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**ASSUMPTION ENGLISH SCHOOL
PRELIMINARY EXAMINATION 2025**

**PHYSICS
6091 / 01**



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LEVEL: Sec 4 Express **DATE:** 3 September 2025

CLASS: Sec 4/1 **DURATION:** 1 hour

Additional Materials provided: 1 sheet of OAS paper

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your NAME and INDEX NUMBER at the top of this page and on the OAS paper. Shade your index number on the OAS paper.

There are 40 questions in this section. Answer all questions. For each question, there are four possible answers A, B, C and D.

Choose the one you consider correct and record your choice in soft or 2B pencil on the OAS paper provided. DO NOT fold or bend the OAS paper.

At the end of the examination, hand in your OAS paper and question booklet separately.

This Question Paper consists of 17 printed pages including this page.
[Turn over

MULTIPLE-CHOICE QUESTIONS (40 marks)
Answer all questions on the OAS paper provided.

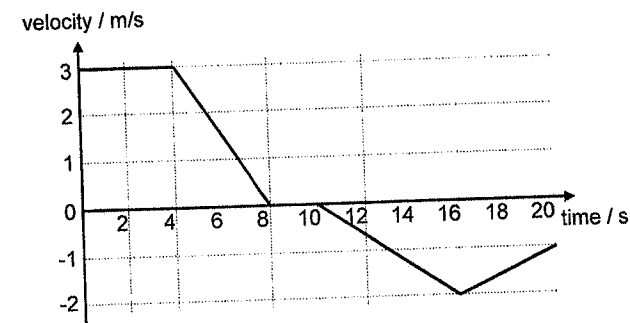
- 1 Which list of SI units contains base units only?

A ampere, kilogram, hour, volt
B ampere, kilogram, kilometre, second
C kelvin, metre, mole, second
D kelvin, metre, second, volt

- 2 Which instruments are best used to determine the density of a small metal ball?

A digital caliper, measuring cylinder
B electronic balance, measuring cylinder
C measuring tape, beaker
D micrometer screw gauge, electronic balance

- 3 The diagram shows the velocity-time graph of an object.



Which statement must be correct?

- A The greatest rate of change of velocity is 0.33 m/s^2 .
- B The object moves in the opposite direction at $t = 8 \text{ s}$.
- C The object stops moving at two different parts of the motion.
- D The total distance travelled by the object is 30 m.

- 4 An object falls through a vacuum.

Which row correctly describes the acceleration and the velocity of the object?

	acceleration	velocity
A	constant	constant
B	constant	increasing
C	increasing	constant
D	increasing	increasing

- 5 An astronaut initially weighs 800 N on Earth. He travels to the Moon and does some physical work daily. He weighs 120 N on the Moon after a month.

The gravitational field strength on the Moon is 1.6 N/kg.
The gravitational field strength on Earth is 10 N/kg.

How much mass is lost by the astronaut?

- A 0 kg B 5.0 kg
C 8.0 kg D 12 kg

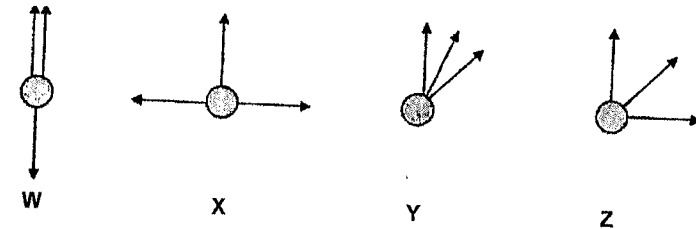
- 6 A rocket of mass 3.2×10^6 kg has an upward thrust of 4.5×10^3 kN when leaving Earth's surface.

The gravitational field strength is 10 N/kg.

What is the initial acceleration of the rocket?

- A 0.99 m/s^2 B 4.1 m/s^2
C 10 m/s^2 D 13 m/s^2

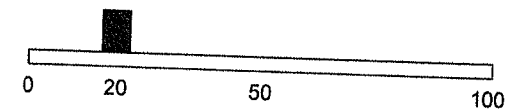
- 7 Three forces of the same magnitude act simultaneously on an object.



Which pair of vector diagrams show the same resultant force?

- A W and X
B W and Y
C X and Z
D Y and Z

- 8 A uniform metre rule has a weight of 30 N. A 15 N box is placed at the 20 cm mark. The metre rule can be balanced on a pivot.

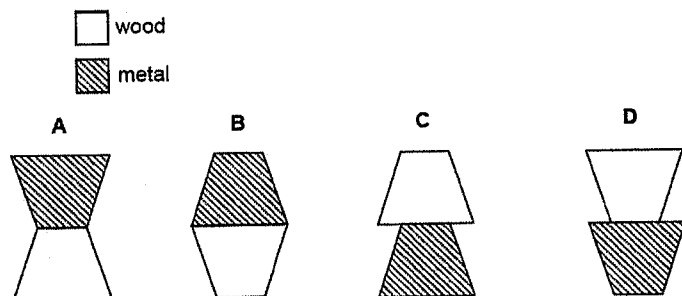


At which mark should the pivot be placed?

- A 10 cm B 30 cm
C 40 cm D 60 cm

- 9 A student tries out different ways of stacking two containers. One container is made of wood, and the other is made of metal. The dimensions of the containers are identical.

Which arrangement has the greatest stability?



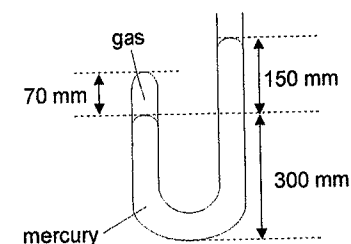
- 10 A child stands on snow wearing snowshoes. The mass of the child is 40 kg and his two feet have a total area of 0.018 m^2 .

The mass of the snowshoes is 2.0 kg and have a total area of 0.50 m^2 in contact with the snow.

The gravitational field strength is 10 N/kg . What is the pressure exerted on the snow?

- A 77 Pa B 800 Pa
C 810 Pa D 840 Pa

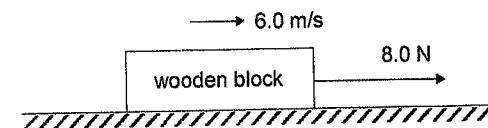
- 11 The diagram shows a gas trapped in the left arm of a manometer containing mercury.



Given that the atmospheric pressure is 760 mm Hg, what is the pressure of the trapped gas?

- A 70 mm Hg B 150 mm Hg
C 840 mm Hg D 910 mm Hg

- 12 A block of wood is pulled along a horizontal bench at a speed of 6.0 m/s by a force of 8.0 N.



How much work is done due to the frictional force in 5.0 s?

- A 40 J B 48 J
C 240 J D 480 J

- 13 Which energy resource is correctly described?

	energy resource	renewable	availability
A	biofuels	yes	at all times
B	nuclear	no	irregular
C	solar radiation	yes	at all times
D	wind	no	irregular

- 14 The total energy incident in 1.0 s on a group of solar panels is 120 J/m².
720 J of energy is transferred in 1.0 s by the solar panels to be stored in a battery.

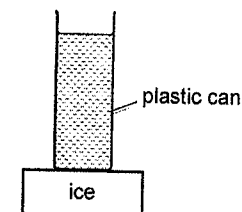
If the efficiency of the system is 17%, what is the total surface area of the panels?

- A 6.0 m² B 7.0 m²
C 11 m² D 35 m²
- 15 Which statement best explains why substances in gaseous state are less dense than when they are in liquid or solid states?
- A Particles in gaseous state are in random and continuous motion.
B Particles in gaseous state expand more than when they are in liquid or solid state.
C Particles in gaseous state have smaller mass than when they are at liquid or solid state.
D Spaces between particles in gaseous state are larger than when they are in liquid state or solid state.
- 16 Smoke particles in a sealed container are illuminated by a beam of light. Under a microscope, the smoke particles are observed to move randomly.
What causes this motion?
- A atomic vibrations within the smoke particles
B collisions between smoke particles
C collisions of smoke particles with rapidly moving air molecules
D smoke particles gain energy from the beam of light

- 17 Which description of a dull black surface is correct?

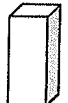
- A good emitter and good absorber of radiation
B good emitter and poor absorber of radiation
C poor emitter and good absorber of radiation
D poor emitter and poor absorber of radiation

- 18 A tall plastic can contains water at room temperature. The can is placed on top of a big block of ice.

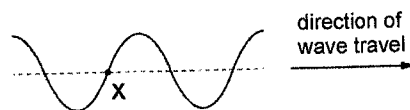


What is/are the main process(es) that cool(s) the water at the top of the can?

- A conduction
B conduction and convection
C convection
D convection and radiation
- 19 Which statement describes what happens when wax solidifies?
- A There is a transfer of energy and a change in temperature.
B There is a transfer of energy but no change in temperature.
C There is no transfer of energy and no change in temperature.
D There is no transfer of energy but there is a change in temperature.
- 20 Different amounts of energy Q are supplied to copper blocks of different masses.
Which block experiences the greatest temperature change?

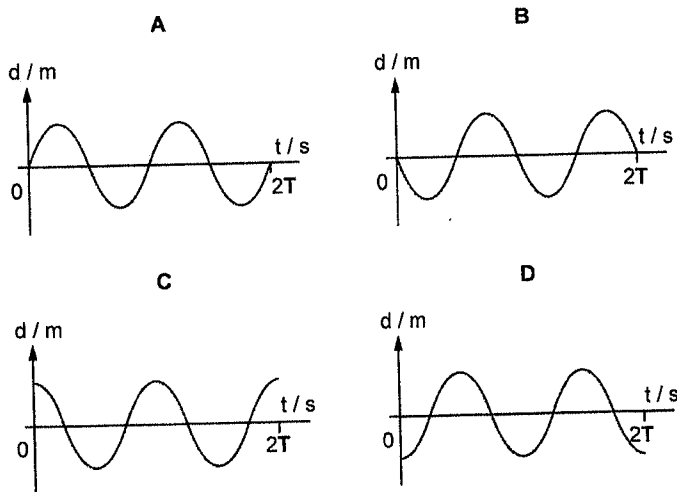
A	B	C	D
			
1.0 kg	2.0 kg	1.0 kg	2.0 kg
$Q = 150 \text{ J}$	$Q = 150 \text{ J}$	$Q = 300 \text{ J}$	$Q = 300 \text{ J}$

- 21 A transverse wave travels along a rope from left to right. The diagram shows the rope at time $t = 0$ s. The period of the wave is T .



One particle of the rope is labelled X.

Which graph shows the variation with time of the displacement of particle X between $t = 0$ s and $t = 2T$?



- 22 A man who is standing at a point O between two parallel walls, fires a starting pistol. He hears the first echo after 0.60 s and another one after 0.80 s.



The speed of sound in air is v . What is the distance between the two walls?

- | | | | |
|---|--------|---|--------|
| A | $0.3v$ | B | $0.4v$ |
| C | $0.7v$ | D | $1.4v$ |

- 23 It is known that the energy E of an electromagnetic wave and its frequency f is related by the product:

$$E = hf$$

where h is a constant.

Which region of the electromagnetic spectrum has the highest energy?

- A gamma rays
B infrared radiation
C radio waves
D ultraviolet radiation

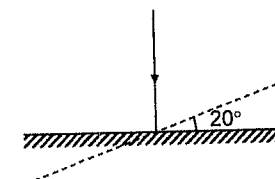
- 24 A student makes four statements about infrared waves.

- 1 They can be seen by the human eye.
- 2 They travel at 3×10^8 km/s in air.
- 3 They are transverse waves.
- 4 They can be used in intruder alarms.

Which statement(s) is/are correct for infrared waves?

- A 1 and 3 only
B 2 only
C 3 and 4 only
D 2, 3 and 4

- 25 A ray strikes a plane mirror perpendicularly as shown in the diagram below.



If the mirror is then turned by 20° , what is the new angle between the incident ray and the reflected ray?

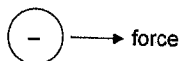
- | | | | |
|---|------------|---|------------|
| A | 0° | B | 20° |
| C | 40° | D | 80° |

- 26 A student makes use of a lens as a magnifying glass.

Which row shows the object distance from the lens and the characteristics of the image formed?

	object distance	characteristics of image
A	less than focal length	real and inverted
B	less than focal length	virtual and upright
C	more than focal length	real and upright
D	more than focal length	virtual and inverted

- 27 A stationary negative charge in an electric field experiences an electric force in the direction shown.

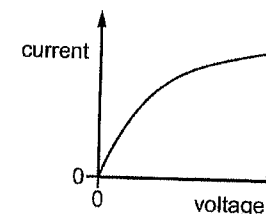


What is the direction of the electric field?

- A horizontally to the left
 B horizontally to the right
 C into the page
 D out of the page
- 28 A plastic rod is rubbed with cloth. The rod becomes positively charged.
- What happens to the plastic rod and what is the charge on the cloth?

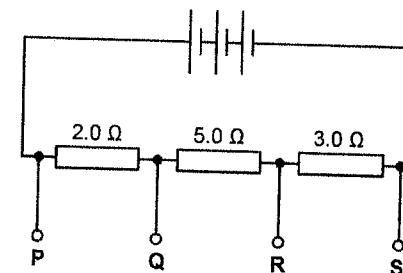
	plastic rod	charge on cloth
A	gains electrons	negative
B	gains electrons	positive
C	loses electrons	negative
D	loses electrons	positive

- 29 The graph shows the current-voltage characteristics of a filament lamp.



Which statement describes how the resistance of the lamp changes as the voltage increases?

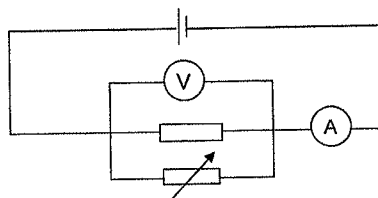
- A The resistance decreases at a decreasing rate.
 B The resistance decreases to zero.
 C The resistance increases at an increasing rate.
 D The resistance remains constant.
- 30 The diagram shows a circuit with a 5.0 V power supply, three resistors and four output terminals P, Q, R and S.



Between which pair of terminals is there a potential difference of 3.5 V?

- A PQ
 B PR
 C QS
 D RS

- 31 In the circuit shown, what will happen when the resistance of the variable resistor is increased?



	voltmeter	ammeter
A	decrease	decrease
B	decrease	increase
C	increase	increase
D	no change	decrease

- 32 The power rating of a refrigerator is 1500 W when connected to power source of 240 V.

It costs \$0.35 for 1 kWh of electrical energy.

How much will it cost to keep the refrigerator running for 1 week?

- | | | | |
|---|---------|---|---------|
| A | \$3.68 | B | \$2.19 |
| C | \$12.60 | D | \$88.20 |

- 33 The case of an electric fan is earthed. The plug to the fan contains a 5 A fuse. There is a current of 4 A when the fan works normally.

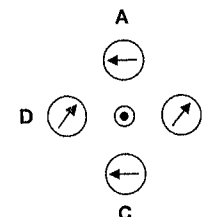
The cable to the fan becomes so worn that the live wire makes electrical contact with the metal case.

The switch is opened. What happens at the moment when the live wire touches the metal case?

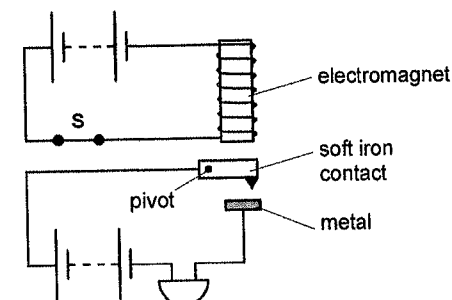
- A Current flows to the earth wire but the fuse is unaffected.
 B The fuse melts and current stops flowing.
 C The metal case becomes very hot and may cause a fire.
 D The metal case is at high potential but there is no current flow.

- 34 A wire perpendicular to the page carries an electric current out of the page. There are four compasses near the wire.

Which compass correctly shows the direction of the magnetic field caused by the current?



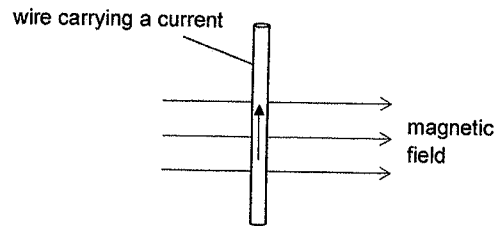
- 35 The diagram shows an alarm system in which switch S is closed. The top circuit is arranged so that the electromagnet is positioned over the soft iron contact.



What happens when switch S is opened?

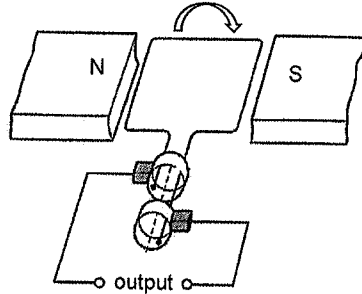
	iron contact	bell
A	drops	rings
B	drops	stops ringing
C	moves up	rings
D	moves up	stops ringing

- 36 The diagram shows a wire carrying a current in a magnetic field.



What is the direction of the force on the wire?

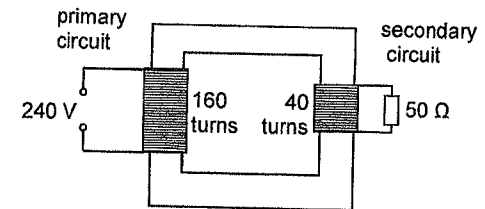
- A left to right
 - B right to left
 - C into the page
 - D out of the page
- 37 The simple a.c. generator consists of a rectangular coil of wire placed in between two magnetic poles. The coil is rotated in the direction as shown in the diagram.



What can be said of the induced electromotive force when the coil is in this position?

- A maximum, due to greatest rate of change to magnetic field
- B maximum, due to smallest rate of change to magnetic field
- C zero, due to greatest rate of change to magnetic field
- D zero, due to smallest rate of change to magnetic field

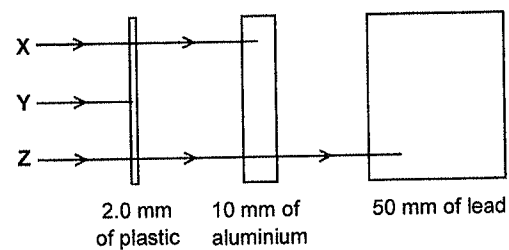
- 38 The diagram shows an ideal transformer connected to a $50\ \Omega$ resistor.



What is the current in the primary circuit?

- | | |
|----------|---------|
| A 0.30 A | B 1.2 A |
| C 1.5 A | D 4.8 A |
- 39 Which is **not** the correct procedure if a person is contaminated with radioactive substance?
- A leave the contaminated area
 - B remove the contaminated clothing
 - C use dry cloth to wipe exposed skin
 - D wash exposed skin with soap and water

40 The diagram shows the paths of three different types of radiation, X, Y and Z.



What are X, Y and Z?

	X	Y	Z
A	α -particles	β -particles	γ -rays
B	β -particles	α -particles	γ -rays
C	β -particles	γ -rays	α -particles
D	γ -rays	α -particles	β -particles

- End of Paper -

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
C	B	D	B	B	B	A	C	C	D
Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
D	C	A	D	D	C	A	A	B	C
Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
B	C	A	C	C	B	A	C	C	B
Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
D	D	D	A	A	C	A	A	C	B

Candidate Name	Form Class	Index Number
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**ANG MO KIO SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2025
SECONDARY FOUR EXPRESS**

**PHYSICS
Paper 1**

**6091(Revised)/01
3 September 2025
1 hour**

Setter: Ms Michelle Ong

Candidates answer on the OTAS Paper.

Additional Materials: OTAS Paper

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Write your Name, Class and Index Number in the spaces provided.

Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

There are **forty** questions on this paper. Answer **all** questions.

For each question there are four possible answers **A, B, C** and **D**.

Choose the one you consider correct and record your choice in soft pencil on the OTAS.

Read the instructions on the OTAS very carefully.

Each correct answer will score one mark. No marks will be deducted for a wrong answer.
Any rough working should be done in this booklet.

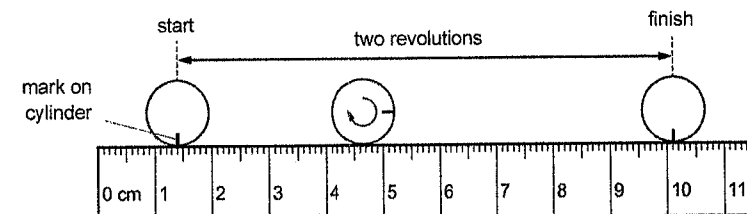
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **18** pages and **0** blank page.

1 What is the order of magnitude of the diameter of an atom?

- A 10^{-7} cm
- B 10^{-7} mm
- C 10^{-7} nm
- D 10^{-7} μ m

2 A small cylinder is rolled along a ruler and completes two revolutions.



The circumference is the distance around the outside of a circle.

What is the circumference of the cylinder?

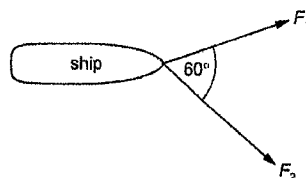
- A 4.4 cm
- B 5.2 cm
- C 8.7 cm
- D 10.1 cm

3 Which option lists only vector qualities?

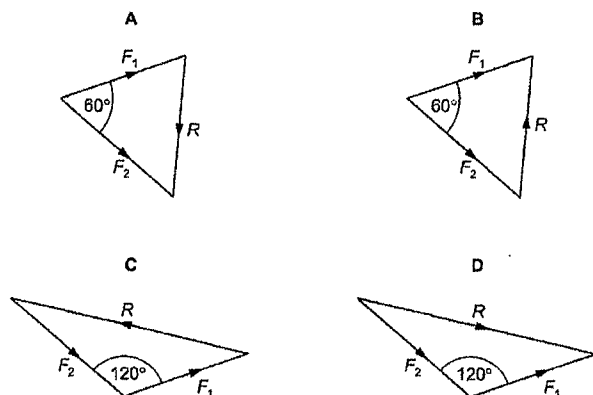
- A energy, mass and force
- B energy, mass and power
- C velocity, force and acceleration
- D velocity, power and acceleration

[Turn Over

- 4 A ship is pulled by two boats. The boats exert forces F_1 and F_2 on the ship, as shown.



Which vector diagram shows the resultant force R acting on the ship?



- 5 An object is thrown vertically upwards with an initial velocity of 10 m/s and it takes 1.0 s to reach the top. Ignoring effects of air resistance, what are the velocity and acceleration values at the top of the motion?

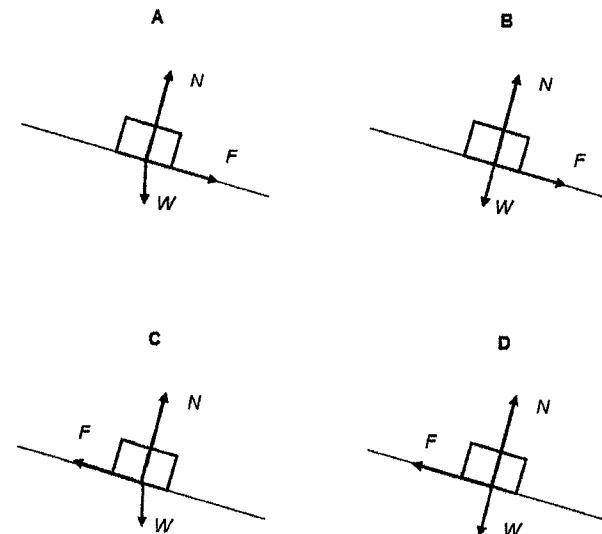
	velocity / m/s	acceleration / m/s ²
A	0	0
B	0	10
C	10	0
D	10	10

- 6 When his parachute is fully opened, a parachutist falls towards the ground at constant speed. Under these conditions, which statement is correct?

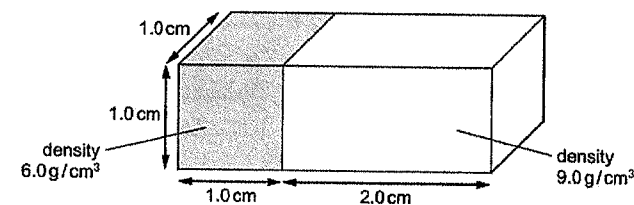
- A There are no forces acting on the parachutist.
- B The upward force on the parachute is equal to the weight of the parachutist.
- C The upward force on the parachute is greater than the weight of the parachutist.
- D The upward force on the parachute is less than the weight of the parachutist.

- 7 A block of wood is at rest on a sloping ramp. The force acting on the block are the weight W of the block, the friction F between the block and the ramp and the normal force N exerted by the ramp.

Which free-body diagram is correct?



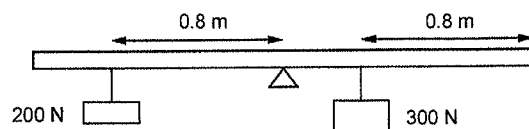
- 8 Two blocks are joined together.



One block has a density of 6.0 g/cm³ and the other has a density of 9.0 g/cm³. What is the overall density of the two blocks when they are melted together?

- A 7.0 g/cm³
- B 7.5 g/cm³
- C 8.0 g/cm³
- D 15 g/cm³

- 9 A rigid uniform bar of length 2.4 m is pivoted horizontally at its midpoint.

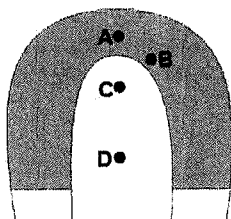


Weights are hung from two points on the bar as shown in the diagram. To maintain equilibrium, a force is applied to the bar.

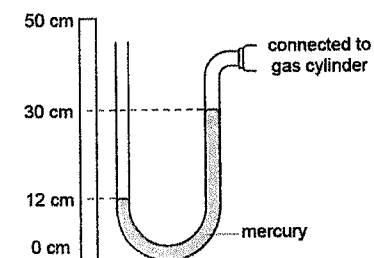
What is the moment of this force and its direction?

	moment / Nm	direction
A	40	clockwise
B	40	anticlockwise
C	80	clockwise
D	80	anticlockwise

- 10 Where is the most likely center of gravity of the horseshoe magnet below?



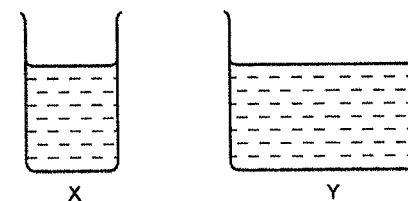
- 11 A mercury manometer is connected to a gas cylinder. The atmospheric pressure is equal to 76 cm of mercury (Hg).



What is the pressure in the gas cylinder?

- A 18 cmHg
B 30 cmHg
C 58 cmHg
D 94 cmHg

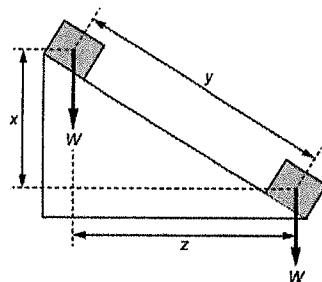
- 12 Two vessels X and Y are filled to the same level with the same liquid. The area of the base of X is less than that of Y.



Which row correctly compares the force and pressure on the base of the vessels?

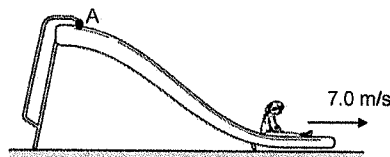
	force	pressure
A	same	same
B	same	X is greater
C	Y is greater	same
D	Y is greater	X is greater

- 13 A heavy box of weight W slides down a frictionless slope.



What is the work done by the weight W in moving from top to bottom?

- A Wy
 B Wx
 C $W(x+z)$
 D $W(y-z)$
- 14 A child of mass 30 kg slides down from the top of a smooth slide. Her initial speed is 0.65 m/s at point A. Her speed at the bottom of the slide is 7.0 m/s. The gravitational field strength g is 10 N/kg.



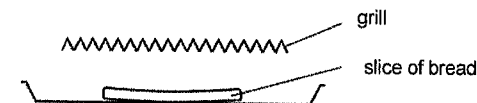
What is the height of the slide?

- A 0.65 m
 B 2.43 m
 C 2.45 m
 D 6.35 m

- 15 Smoke particles in air are illuminated by a beam of light and viewed through a microscope. The smoke particles undergo jerky random motion. What causes this motion?

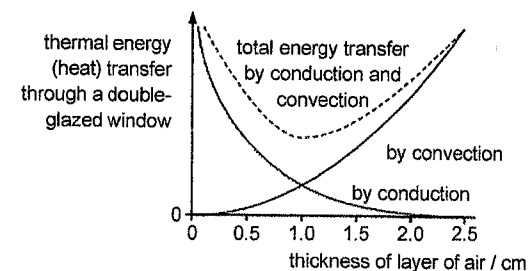
- A atomic vibrations within the smoke particles
 B collisions between the smoke particles
 C impacts of fast-moving air molecules
 D the energy of the beam of light

- 16 A slice of bread is placed under a red-hot electric grill to make toast.



What are all possible process(es) in which the thermal energy reaches the bread?

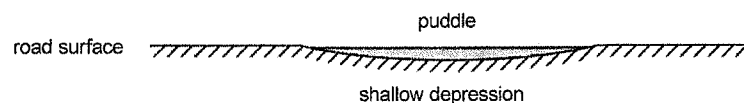
- A radiation only
 B convection and radiation
 C conduction and radiation
 D conduction, convection and radiation
- 17 A double-glazed window has two sheets of glass separated by a layer of air.



Thermal energy is transferred through the layer of air by conduction and convection. The amount of conduction and convection varies with the thickness of the layer of air, as shown in the graph. Which thickness of air is the most ideal for the window?

- A 1.0 cm
 B 1.5 cm
 C 2.0 cm
 D 2.5 cm

- 18 The diagram shows a cross-section through a rainwater puddle formed in a shallow depression in a road surface.



Over a period of time, the air temperature, wind speed and wind direction all remain constant.

What happens to the rate of evaporation of water from the puddle?

- A It decreases, because the surface area decreases.
 - B It increases, because the puddle gets shallower.
 - C It increases, because the surface area decreases.
 - D It remains constant.
- 19 A 2.0 kW kettle containing boiling liquid is placed on a balance. It is left there and continues to boil for 4 minutes. The balance reading changes by 0.50 kg.

What is the specific latent heat of vaporisation of the liquid?

- A 960 J/kg
 - B 16 000 J/kg
 - C 240 000 J/kg
 - D 960 000 J/kg
- 20 The energy required to change liquid water into water vapour at the same temperature is called latent heat of vaporisation.

What does this energy do?

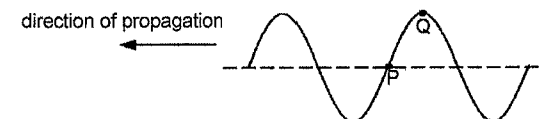
- A It increases the average separation of the water molecules.
- B It increases the average speed of the water molecules.
- C It raises the temperature of the air near the water.
- D It splits the water molecules into their separate atoms.

- 21 A heater of the same power rating is used to heat 3 different liquids X, Y and Z. The results are shown below.

liquid	mass of liquid / g	increase in temperature after 5.0 minutes / °C
X	100	15
Y	200	12
Z	180	10

Which of the following correctly compares specific heat capacities c_x , c_y and c_z of liquids X, Y and Z respectively?

- A $c_x > c_y > c_z$
 - B $c_x > c_z > c_y$
 - C $c_z > c_y > c_x$
 - D $c_y > c_x > c_z$
- 22 The diagram shows a transverse wave on a rope. The wave is travelling from right to left. At the instant shown, the points P and Q on the rope have zero displacement and maximum displacement respectively.



Which row describes the direction of motion of the points P and Q at this instant?

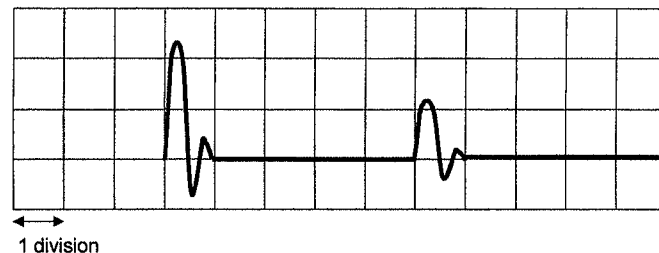
	point P	point Q
A	downwards	downwards
B	upwards	upwards
C	upwards	downwards
D	downwards	upwards

- 23 Infra-red rays and X-rays are both part of the electromagnetic spectrum.

Which statement is correct?

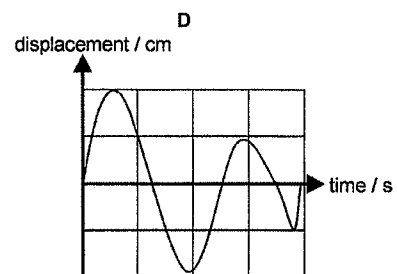
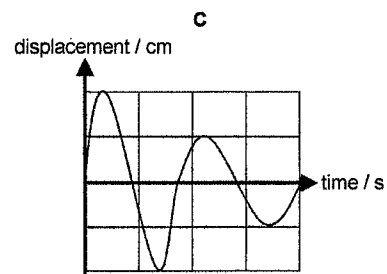
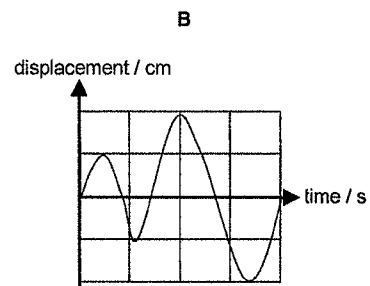
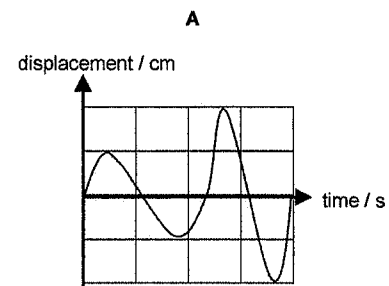
- A They have the same frequency.
- B They need a medium to propagate.
- C They travel at the same speed in vacuum.
- D They can be deflected by an electric field.

- 24 The diagram shows a cathode-ray oscilloscope screen measuring sound signal and its echo. Each division is set at 20 ms and speed of sound in air is 300 m/s.

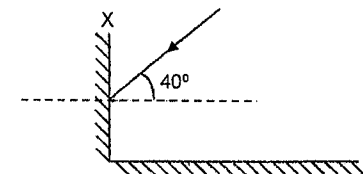


What is the distance between the source of sound and the surface where the sound was reflected?

- A 12 m
B 15 m
C 24 m
D 30 m
- 25 Which displacement-time graph correctly describes the waveform of sound increasing both loudness and pitch?

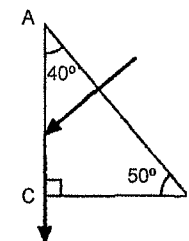


- 26 The diagram shows two plane mirrors placed perpendicular to each other.



What is the angle of reflection at mirror Y?

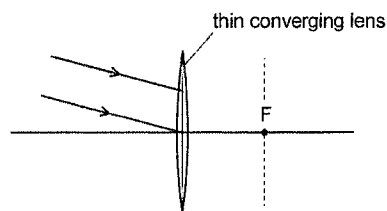
- A 40°
B 50°
C 80°
D 100°
- 27 The diagram shows a ray of light entering a glass prism at the surface AB and travelling along the surface AC.



What is the refractive index of the glass prism?

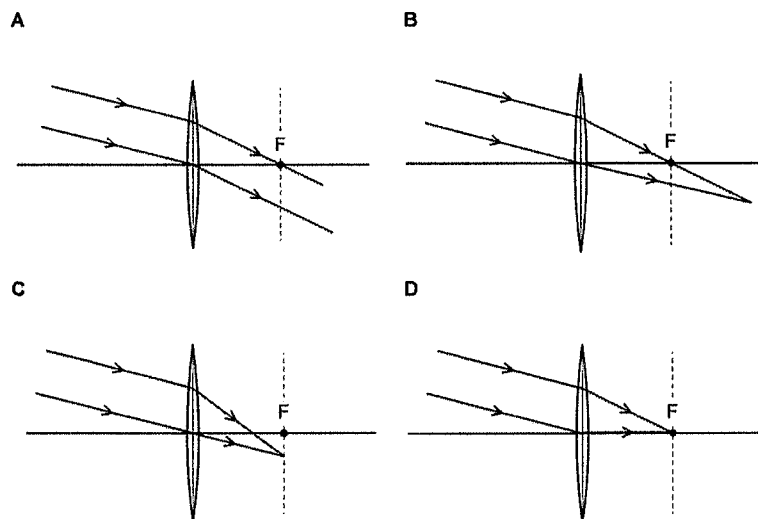
- A 1.19
B 1.31
C 1.50
D 1.56

- 28 A parallel beam of light is incident on a thin converging lens.



F is one focal point of the lens.

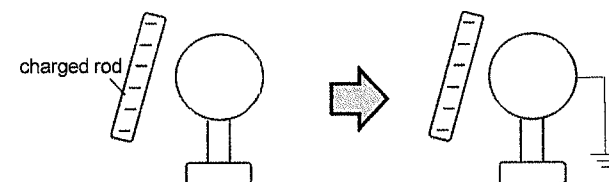
Which ray diagram shows the light after it passed through the lens?



- 29 In an experiment on static electricity, the following procedures are done in sequence on a neutral conducting sphere mounted on an insulating stand.

Procedure 1: Bring a negatively charged rod near the neutral conducting sphere

Procedure 2: Connect the conducting sphere to the Earth



Procedure 1

Procedure 2

Which row describes the movement of charges in the conducting sphere during each procedure?

	procedure 1	procedure 2
A	negative charges attracted and moved to the left	negative charges flow from the Earth to the sphere
B	negative charges repelled and moved to the right	negative charges flow from the sphere to the Earth
C	positive charges attracted and moved to the left	positive charges flow from the sphere to the Earth
D	positive charges repelled and moved to the right	no movement of charges

- 30 A conductor XY has a potential difference of 12 V between its ends. There is a current of 3.0 A in XY.



Which statement is correct?

- A** Electrons flow from X to Y.
- B** The resistance of the conductor is 3 Ω .
- C** The charge per second in the conductor is 12 C.
- D** The power dissipated in the conductor is 36 W.

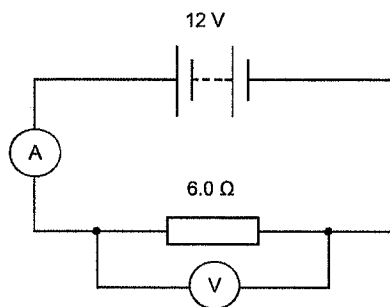
- 31 A copper wire has a resistance of $2.0\ \Omega$.

A second copper wire is twice as long as the first wire, and its diameter is twice the diameter of the first wire.

What is the resistance of the second wire?

- A $1.0\ \Omega$
- B $2.0\ \Omega$
- C $8.0\ \Omega$
- D $16\ \Omega$

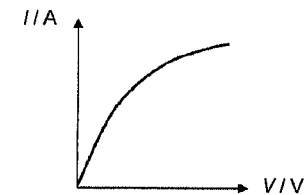
- 32 In the circuit shown, the ammeter reads $2.0\ \text{A}$ and the voltmeter reads $12\ \text{V}$.



How much energy is transferred by the resistor in 10 seconds?

- A $2.4\ \text{J}$
- B $14\ \text{J}$
- C $240\ \text{J}$
- D $1440\ \text{J}$

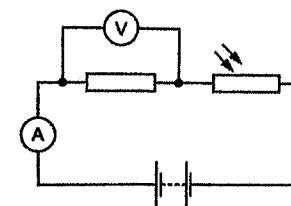
- 33 The graph shows the I - V characteristics of a certain conductor.



Which statement about this conductor is true?

- A Its resistance is zero when the potential difference across it increases.
- B Its resistance decreases when the current flowing through it increases.
- C Its resistance increases when the current flowing through it increases.
- D Its resistance remains constant when the current flowing through it increases.

- 34 A resistor and a light-dependent resistor (LDR) are connected in series with a battery, as shown.



When very bright light is shone on the LDR, the readings on both the ammeter and the voltmeter change.

How do the readings change?

	reading on ammeter	reading on voltmeter
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

- 35 A current of 4 A flows in the live wire of a socket when the appliance is functioning normally.

Which statement is true?

- A A current of 4 A flows in the earth wire.
- B A current of 4 A flows in the neutral wire.
- C A current of less than 4 A flows in the earth wire.
- D A current of less than 4 A flows in the neutral wire.

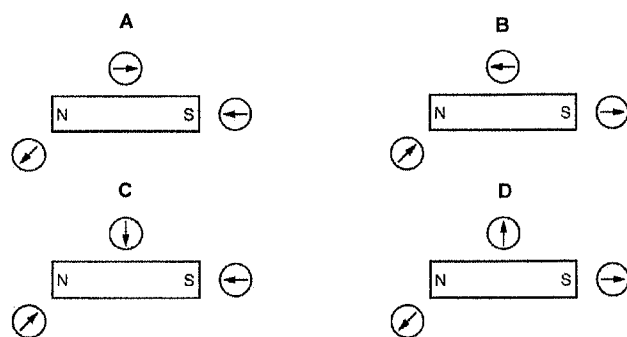
- 36 A heater is marked 240 V, 1.2 kW.

Which fuse rating is suitable for the heater?

- A 5 A
- B 7 A
- C 12 A
- D 20 A

- 37 A student uses three small plotting compasses to investigate the magnetic field around a bar magnet.

Which diagram shows the directions in which the compass needles point?

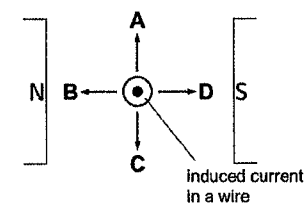


- 38 A transformer is used to step down an input voltage of 240 V for use with a doorbell that is rated at 6 V, 2 A.

Which transformer should be used for this application?

	primary coil	secondary coil
A	1680	84
B	42	1680
C	4560	114
D	228	4560

- 39 The diagram shows an induced current flowing through a wire between the poles of a magnet. What is the direction of the force applied on the wire?



- 40 A neutron is used to probe a uranium-235 atom to undergo nuclear fission.

Which of the following is the correct possible nuclide equation?

- A ${}_0^1n + {}_{92}^{235}\text{U} \rightarrow {}_{56}^{144}\text{Ba} + {}_{36}^{90}\text{Kr} + 2{}_0^1n$
- B ${}_0^1n + {}_{92}^{235}\text{U} \rightarrow {}_{56}^{142}\text{Ba} + {}_{36}^{91}\text{Kr} + 2{}_0^1n$
- C ${}_0^1n + {}_{92}^{235}\text{U} \rightarrow {}_{55}^{144}\text{Ba} + {}_{36}^{90}\text{Kr} + {}_0^1n$
- D ${}_0^1n + {}_{92}^{235}\text{U} \rightarrow {}_{56}^{146}\text{Ba} + {}_{37}^{90}\text{Kr} + 2{}_0^1n$

End of Paper

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Answers for Paper 1

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
B	A	C	D	B	B	C	C	A	C
Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
C	C	B	B	B	C	A	A	D	A
Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
B	C	C	B	A	B	D	C	B	D
Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
A	C	C	D	B	B	A	C	A	A

Name: Index no.: Class:.....

**Bukit Batok Secondary School****GCE O LEVEL PRELIMINARY EXAMINATIONS 2025****SECONDARY 4 EXPRESS****PHYSICS**

Paper 1 Multiple Choice

6091/01**3 September 2025****1 Hour****1000 – 1100 h**

Additional Materials: Multiple Choice Answer Sheet (OAS)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, index number and class in the spaces provided at the top of this page.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.Choose the **one** you consider correct and record your choice in **soft pencil** on the OAS.

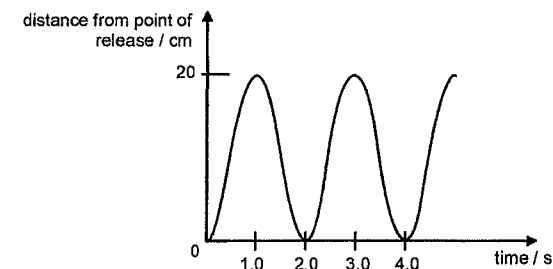
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

This Question paper consists of **20** printed pages including this cover page.

- 1 The bob of a simple pendulum is pulled to one side and released. The motion during the swing is shown on the graph below.



What is the period of the pendulum?

- A** 1.0 s
B 2.0 s
C 3.0 s
D 4.0 s

- 2 What is the correct order of magnitude for the diameter of the Earth and for the diameter of an atom?

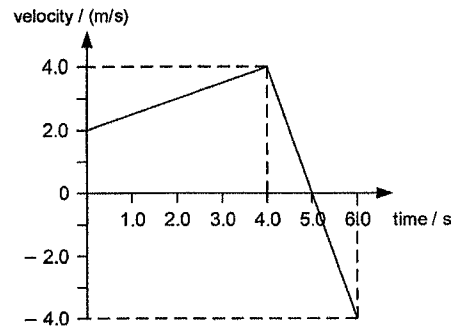
	diameter of Earth	diameter of atom
A	10 Mm	0.1 nm
B	10 Mm	0.1 μm
C	10 Gm	0.1 nm
D	10 Gm	0.1 μm

- 3 At $t = 0$ s, a train travels north at a velocity of 30 m/s along a straight horizontal track.

At time $t = 5.0$ s, its velocity starts to change and its acceleration is constant at -1.5 m/s^2 .How is the train moving at $t = 20$ s?

- A** travelling south with increasing speed
B travelling north with decreasing speed
C travelling south with decreasing speed
D travelling north with increasing speed

- 4 The diagram shows the velocity against time graph for the motion of a body.



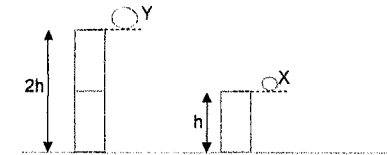
What is the displacement in the first 6.0s?

- A 12 m
B 14 m
C 16 m
D 20 m
- 5 A car of mass 1000 kg is travelling down a steep hill. The brakes fail and the driver uses a horizontal sand-filled safety road to stop the car. The car enters the sand at a speed of 10 m/s and it experiences a net stopping force of 2500 N.

How far does the car travel in the sand before coming to rest?

- A 2.5 m
B 4.0 m
C 20 m
D 40 m

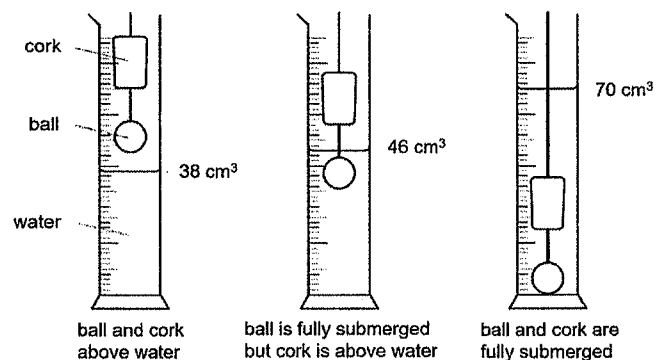
- 6 An object X of mass m is released from a height h . Above object X, another object Y of mass $2m$ is released from a height $2h$ simultaneously.



If both objects fall freely, which statement is correct?

- A The distance between them decreases and Y overtakes X.
B The distance between them increases as X falls faster.
C The distance between them remains constant.
D The velocities of both objects are constant.
- 7 When a block of wood of mass 2.0 kg is pushed along the horizontal flat surface of a bench, the friction measured is 4.0 N.
- Which statement describes the motion of the block when it is pushed along the same bench with a force of 10 N?
- A The block moves with a velocity of 3.0 m/s.
B The block moves with a velocity of 5.0 m/s.
C The block moves with an acceleration of 3.0 m/s².
D The block moves with an acceleration of 5.0 m/s².

- 8 A metal ball is attached to a cork and is lowered into a measuring cylinder.



The mass of the cork is 3.8 g.

What is the density of the cork?

- A 0.10 g/cm³
 B 0.12 g/cm³
 C 0.16 g/cm³
 D 6.32 g/cm³

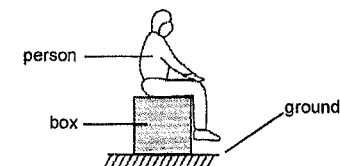
- 9 An object that has a mass of 15 kg on the Earth is taken to the Moon.

The gravitational field strength on the Earth is 10 N/kg and that on the Moon is 1.6 N/kg.

What are the mass and the weight of the object on the Moon?

	mass / kg	weight / N
A	15	24
B	15	150
C	24	15
D	150	24

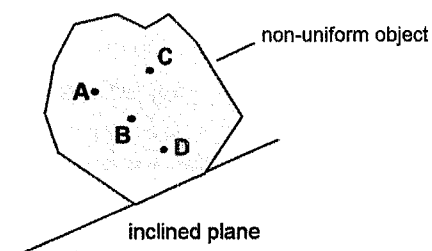
- 10 The figure below shows a person sitting on a box that rests on the ground.



Which pair of forces are related by Newton's Third Law of Motion?

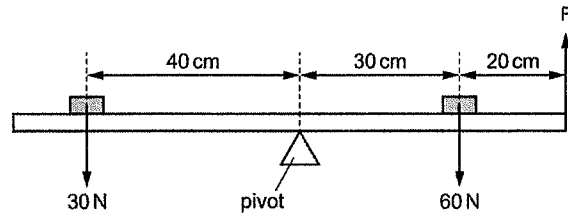
- A The weight of the box and the normal force from the ground on the box.
 B The weight of the man and the normal force from the box supporting the man.
 C The weight of the man and the contact force on the box by the man.
 D The weight of the man and the force of man on Earth.

- 11 A non-uniform object is placed on an inclined plane. The object is just about to topple.



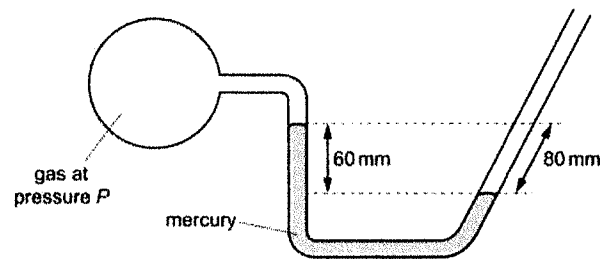
Which position is the centre of gravity?

- 12 A light, uniform beam is pivoted at its centre. Two weights are placed on the beam in the positions shown and the beam is balanced by an upward force F .



What is the magnitude of F ?

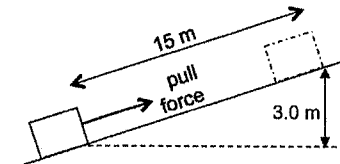
- A 6.1 N
B 12 N
C 30 N
D 60 N
- 13 The diagram shows a mercury manometer. The tube is open to the atmosphere on the right-hand side. The left-hand side is connected to a container containing a gas at pressure P . Atmospheric pressure on its own supports a column of mercury of height 756 mm.



What is the gas pressure P ?

- A 676 mm mercury
B 696 mm mercury
C 816 mm mercury
D 836 mm mercury

- 14 An object of mass 20 kg is pulled up a slope of 15 m. The object is raised by a vertical height raised of 3.0 m. The frictional force between the object and the slope is 30 N.



What is the minimum work done by the pulling force?

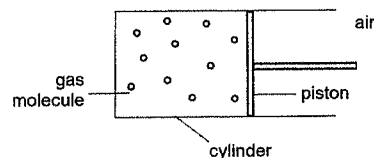
- A 150 J
B 450 J
C 510 J
D 1100 J
- 15 A heavy lifting machine lifts a mass of 120 kg through a vertical height of 50 m. It uses 80 kJ of energy.

The gravitational field strength is 10 N/kg.

What is the efficiency of the machine?

- A 25 %
B 33 %
C 75 %
D 100 %

- 16 Gas inside a sealed cylinder is heated slowly to a higher temperature.



What are the changes to the speed of the gas molecules and the rate of collision with the piston as temperature increases?

	speed of molecules	rate of collision
A	greater	greater
B	greater	reduced
C	greater	same
D	same	greater

- 17 A beaker of water is heated up and its temperature increases from 30 °C to 54 °C.

Which statement correctly describes the changes of the water molecules when the temperature is increased?

- 13
- A Both the kinetic and potential energy of the water molecules increase at the same time.
 - B Only the kinetic energy of the water molecules has increased.
 - C Only the potential energy of the water molecules has increased.
 - D The kinetic energy of the water molecules increases initially until a certain temperature before the potential energy of the water molecules starts to increase.

- 18 Which scenario will **not** produce convection current in a container filled with water at room temperature of 30 °C?

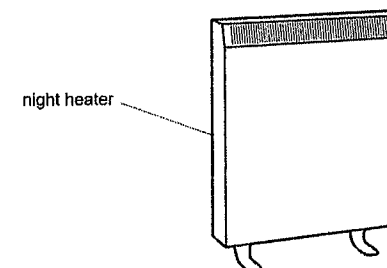
- A dropping a piece of very hot metal into the water
- B floating many pieces of ice on the water
- C lighting a candle beneath the container
- D placing a 300 W lighted bulb just above the water surface

- 19 A piece of ordinary kitchen aluminum foil is used to wrap around food to be cooked in a barbecue fire. The foil has a shiny side and a dull side.

Which side should be on the outside and why?

- A The dull side should be on the outside because it is a better emitter of thermal radiation.
- B The dull side should be on the outside because it absorbs thermal radiation better.
- C The shiny side should be on the outside because it is a better thermal conductor.
- D The shiny side should be on the outside because it is a better absorber of thermal radiation.

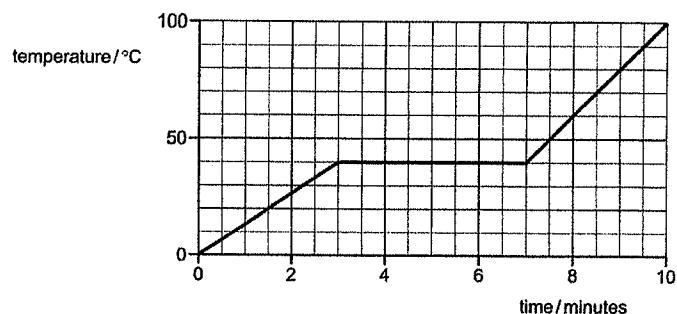
- 20 In many cold countries, a night storage heater is used to heat up rooms. It contains a large block of material that is heated electrically during the night to store heat in the blocks for use in the day. During the day the block cools down, releasing thermal energy into the room.



Which heat capacity and night-time temperature increase will cause the most energy to be stored by the block?

	heat capacity of the block	night-time temperature increase
A	large	large
B	large	small
C	small	large
D	small	small

- 21 The graph shows how the temperature for a sample of candle wax changes when it is heated.

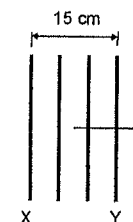


The mass of the wax is 200 g. Thermal energy is supplied to the wax at a constant rate of 12 000 J per minute.

What is the specific latent heat of fusion of the wax?

- A 180 J/g
 B 240 J/g
 C 480 J/g
 D 600 J/g
- 22 Which statement about boiling and evaporation is correct?
- A Boiling only occurs at the surface of a liquid.
 B Bubbles are not formed in the liquid during boiling.
 C Evaporation is not affected by the surface area of the liquid.
 D Evaporation occurs at any temperature of the liquid.

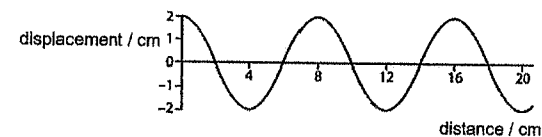
- 23 The figure below shows a water wave travelling in a ripple tank. The wave travels from X to Y in 5.0 s



What is the frequency of the water wave?

- A 0.60 Hz
 B 3.0 Hz
 C 15 Hz
 D 75 Hz

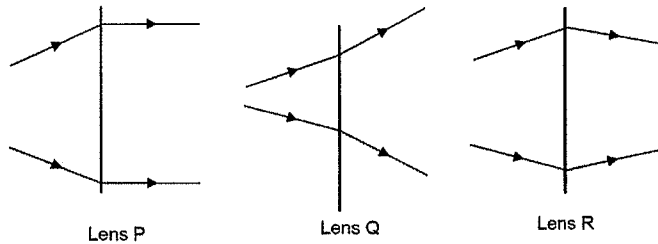
- 24 The displacement against distance graph below shows a water wave travelling at 2.8 m/s.



What is the period of this wave?

- A 0.029 s
 B 2.9 s
 C 8.0 s
 D 35 s

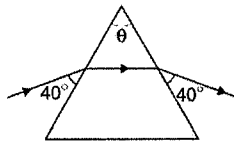
- 25 Rays of light pass through three lenses.



Which len(s) is/are **not** a converging lens?

- A Lens Q only
- B Lens R only
- C Lens P and Q
- D Lens Q and R

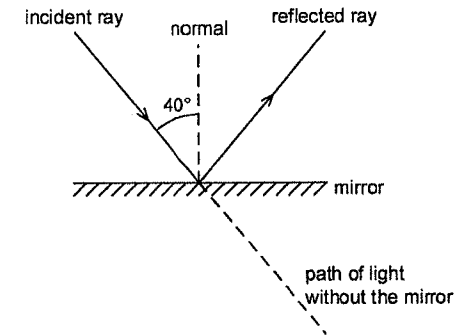
- 26 A light ray passes through a triangular glass prism of refractive index 1.5.



What is angle θ ?

- A 51°
- B 53°
- C 56°
- D 61°

- 27 A mirror is placed in the path of a ray of light.



Through which angle does the direction of the ray of light change?

- A 40°
- B 80°
- C 100°
- D 140°

- 28 A student stands 50 m from a wall and knocks two wooden blocks together. When the frequency of the knocking is 3 knocks per second, the echo of a knock is heard at the instant of the next one.

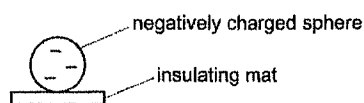
What is the speed of sound calculated using these measurements?

- A 150 m/s
- B 200 m/s
- C 300 m/s
- D 350 m/s

- 29 Which of the following shows the correct arrangement of electromagnetic waves in **decreasing** order of wavelength?

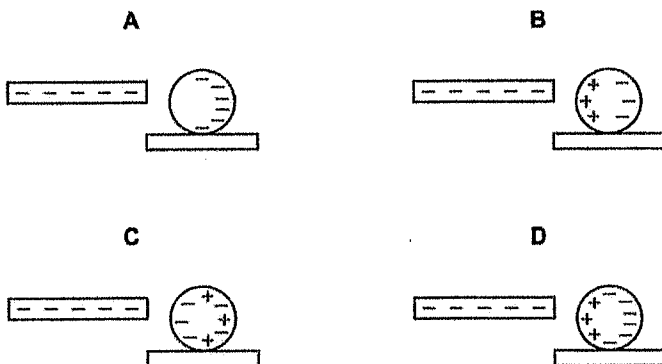
- A radio wave, infra-red, X-ray, microwave
- B radio wave, microwave, infra-red, X-ray
- C infra-red, X-ray, microwave, radio wave
- D X-ray, infra-red, microwave, radio wave

- 30 A negatively charged copper sphere rests on an insulating mat.



A negatively charged polythene rod is brought near to the copper sphere.

Which diagram (A, B, C or D) best shows the distribution of charge on the sphere?

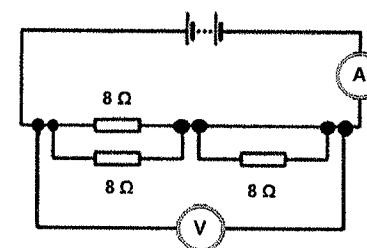


- 31 A charge of 60 C passes through a resistor in 120 s. In 1.0 s, the energy transferred in the resistor is 5.0 J.

What is the potential difference across the resistor?

- A 5.0 V
B 10 V
C 12 V
D 24 V

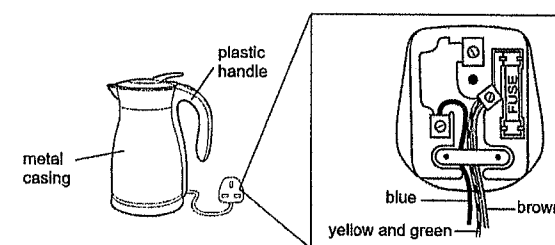
- 32 Three $8\ \Omega$ resistors are connected as shown in the diagram.



What is the voltmeter reading when the ammeter reading is 2.0 A?

- A 2.0 V
B 6.0 V
C 8.0 V
D 24 V

- 33 An electric kettle has a plastic handle and metal casing. The 3-pin plug of the electric kettle is wrongly wired and a magnified view is as shown. The colour of each wire is indicated in the diagram.



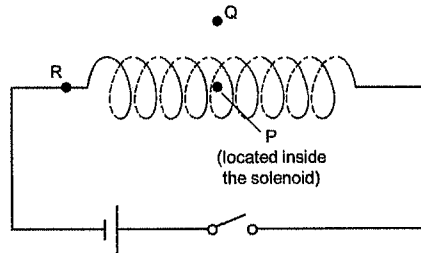
What would be the effect of this wrong wiring?

- A The electric kettle does not work.
B The electric kettle overheats.
C The fuse in the plug blows.
D The metal casing becomes live.

34 Which statement best describes an example of induced magnetism?

- A A bar magnet attracts a piece of soft iron.
- B A bar magnet loses its magnetism if it is repeatedly dropped.
- C A bar magnet, swinging freely, comes to rest pointing in North-South direction.
- D Two North poles repel each other but a North pole attracts a South pole.

35 A solenoid is connected to a cell and three compasses, P, Q and R, are placed around the solenoid as shown below.



When the switch is closed, which row shows the direction in which the compass needles point to?

	P	Q	R
A	→	←	→
B	←	→	←
C	←	←	→
D	→	→	←

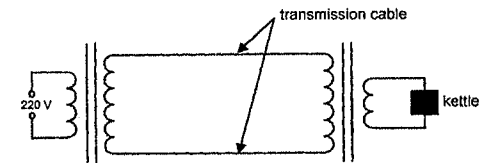
36 A negatively-charged particle is entering a uniform magnetic field perpendicularly.



What will happen to the charged particle?

- A experience a force into the paper
- B experience a force out of the paper
- C experience a force to the bottom of the paper
- D experience a force to the top of the paper

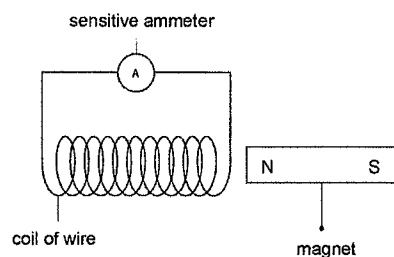
37 A kettle rated 110 V, 2.0 kW is operated by the following circuit, which consists of a step-up and then a step-down transformer. The ratio of the turns of the step-up transformer is 1:10.



What is the ratio of the turns of the step-down transformer?

- A 5 : 1
- B 20 : 1
- C 1 : 5
- D 1 : 20

- 38 The diagram shows a coil of wire that is connected to a sensitive ammeter and a bar magnet.



Which of the following does **not** cause a reading on the ammeter?

- A moving both the coil and the magnet away from each other at the same speed
- B moving both the coil and the magnet to the left at the same speed
- C moving both the coil and the magnet towards each other at the same speed
- D rotating the magnet 180° clockwise such that the south pole is closer to the coil

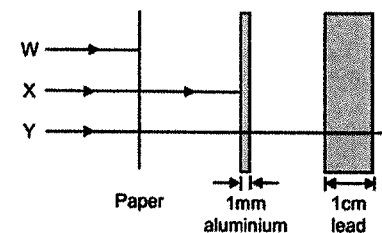
- 39 The background count rate measured by a radiation counter is 40 counts per minute (cpm). With the counter close to a radioactive source, the counter reading is 960 cpm.

Given that the half-life of the source is 20 minutes, what is the counter reading one hour later?

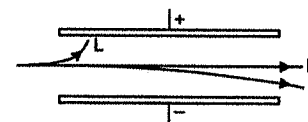
- A 115 cpm
- B 120 cpm
- C 155 cpm
- D 160 cpm

- 40 The following show different behaviours of α -particles, β -particles and gamma radiation.

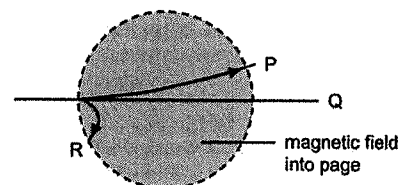
- They are absorbed to different extents in solids.



- They behave differently in an electric field.



- They behave differently in a magnetic field.



Which three labels in the figures above refer to the same kind of radiation?

- A W, L, P
- B X, L, R
- C Y, M, P
- D Y, N, Q

--- End of Paper ---

Question	Suggested Answer	Suggested explanation
1	B	$T = 3.0 \text{ s} - 1.0 \text{ s} = 2.0 \text{ s}$ Look for the smallest repeated pattern.
2	A	Radius of earth = 6500 km, so the diameter of earth is 13000 km Diameter of atom is in nanometres
3	B	Acceleration is negative means it is slowing down. In the duration of 15 s (5 to 20 s), the speed dropped by 22.5 m/s. It is still travelling North but with decreasing speed.
4	A	Displacement = area (0 to 5 s) – area (5 to 6 s) $= \frac{1}{2}(4.0)(2.0 + 4.0) + \frac{1}{2}(1.0)(4.0) - \frac{1}{2}(1.0)(4.0)$ $= 12 \text{ m}$
5	C	Constant deceleration implies F_{net} (net force) = ma (where a is negative) $2500 = (1000)(\text{deceleration})$ deceleration = 2.5 m/s^2 Time taken to stop = $10/2.5 = 4.0 \text{ s}$ Distance travelled = area under graph = $\frac{1}{2}(4.0)(10) = 20 \text{ m}$
6	C	Both objects experience the same acceleration due to free fall and the same initial velocity (from rest). Gain in distance per second is the same for both.
7	C	$F = ma$ $10 - 4 = (2)(a)$ $a = 3.0 \text{ m/s}^2$
8	C	Volume of the cork = $70 - 46 = 24 \text{ cm}^3$ Density = mass / volume = $3.8 / 24 = 0.16 \text{ g/cm}^3$
9	A	$W = mg = 15(1.6) = 24 \text{ N}$ Same mass of 15 kg (regardless of location)
10	D	Factual recall. Earth on Man downwards and then Man pulls on Earth upwards.
11	B	Weight (from the C.G.) acts vertically down and directly through the pivot.
12	B	$M_{\text{cw}} = M_{\text{acw}}$ $(60)(30) = (30)(40) + (50)(F)$ $F = 12 \text{ N}$
13	B	$756 - 60 = 696 \text{ mm Hg}$
14	D	GPE + work done against friction $= (20)(10)(3.0) + (30)(15) = 1050 \text{ J}$
15	C	Efficiency = gain in GPE / total input $= (120)(10)(50) / 80000 = 0.75 = 75\%$
16	A	At higher temperature, the speed of molecules increases and the rate of collision against inner walls increases.
17	A	Factual recall. Both KE and PE increases when temperature increases. PE increases as intermolecular spacing increases. KE depends on temperature.
18	D	Heating at bottom, cooling at top
19	B	We want to absorb thermal radiation (infrared radiation) faster to cook the food faster
20	A	$Q = C \Delta \theta$
21	B	$Q = mL = Pt$ $12000(4) = (200)(L)$ $L = 240 \text{ J/g}$
22	D	Factual recall. Evaporation occurs over a range of temperatures.
23	A	3 complete waves in 5.0 s (note that one sine curve is one wave) In 1 s, wave 0.60 waves $\rightarrow 0.60 \text{ Hz}$

Question	Suggested Answer	Suggested explanation
24	A	Wavelength = 8 cm and speed = 28 m/s = 2800 cm/s $T = 8 / 2800 = 0.0029 \text{ s}$
25	A	Q is diverging lens since the light rays diverge more or the rays converge less after passing through Q
26	D	Angle of refraction in the prism $= \sin^{-1}(\sin 50 / 1.5) = 30.7$ $\text{Theta} = 180 - (90 - 30.7) - (90 - 30.7) = 61.4^\circ$
27	C	$180 - 40 - 40 = 100^\circ$ Without mirror, light ray goes straight (angle = 180°)
28	C	Time for echo = $1/3 \text{ s} = 0.3333 \text{ s}$ Speed = total distance / total time $= (50 + 50) / 0.3333 = 300 \text{ m/s}$
29	B	Factual recall
30	D	Factual recall. A is not correct because we do not increase the number of negative charges from 3 to 6. D is correct because the net charge is still 3 negative charges.
31	B	$V = W / Q = (5.0 \times 120) / 60 = 10 \text{ V}$
32	C	1 A passes through each 8 Ω resistor in parallel $V = IR = (1.0)(8) = 8.0 \text{ V}$
33	D	Factual recall. Live wire is connected to earth wire which is in turn connected to metal casing.
34	A	Factual recall. Magnet attracts magnetic material.
35	B	Right hand grip rule. R is next to North pole of electromagnet. P points to the left inside the solenoid electromagnet. Q points to the right.
36	C	Fleming's left hand rule. Reverse the direction of the electron before using FLHR. Left thumb: direction of resultant force on electrons Index finger: direction of magnetic field lines (external) Middle finger: direction of conventional current (opposite of electron flow)
37	B	Stepped up voltage = $10 \times 220 = 2200 \text{ V}$ Stepped down voltage = 110 V $2200 / 110 = \text{Primary voltage} : \text{Secondary Voltage} = 20 : 1$
38	B	No relative motion between coil and magnet leads to no change in magnetic flux linked to coil
39	C	$960 - 40 = 920 = \text{real cpm of sample}$ $920 \text{ cpm} \rightarrow 460 \rightarrow 230 \rightarrow 115 \text{ cpm}$ Counter reading = $115 + 40 = 155 \text{ cpm}$
40	B	Y: gamma ray M: gamma ray Q: gamma ray W: alpha particle N: alpha particle P: alpha particle X: beta particle L: beta particle R: beta particle

Name	Class	Index Number
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BROADRICK SECONDARY SCHOOL **SECONDARY 4 G3** **PRELIMINARY EXAMINATION 2025**

PHYSICS

Paper 1 Multiple Choice

6091

September 2025
1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST.

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and index number on the Answer sheet (OTAS) in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

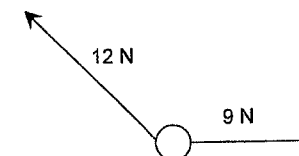
The use of an approved scientific calculator is expected, where appropriate.

For Examiner's Use
40

1 What is the unit of work done expressed in base units?

- A kg m s^2 B $(\text{kg m}^2) / \text{s}^2$ C $\text{kg} / (\text{m s}^2)$ D $\text{kg} / (\text{m}^2 \text{s}^2)$

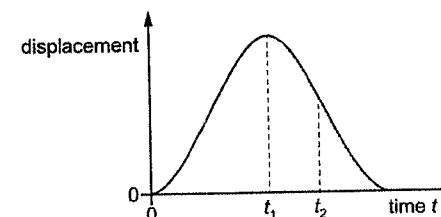
2 The diagram shows two forces acting on a small sphere. The angle between the two forces is more than 90° .



Which is a possible resultant force acting on the small sphere?

- A 3 N B 11 N C 21 N D 24 N

3 A train sets off from a station at time $t = 0$. The graph shows how the displacement of the train varies with time.



Which statement about the movement of the train between time t_1 and t_2 is correct?

- A Its velocity is decreasing and it is moving away from the station.
 B Its velocity is decreasing and it is moving towards the station.
 C Its velocity is increasing and it is moving away from the station.
 D Its velocity is increasing and it is moving towards the station.

- 4 Water is added to a measuring cylinder containing 100 cm^3 of liquid paraffin. The density of paraffin is 0.80 g / cm^3 and that of the water is 1.0 g / cm^3 .

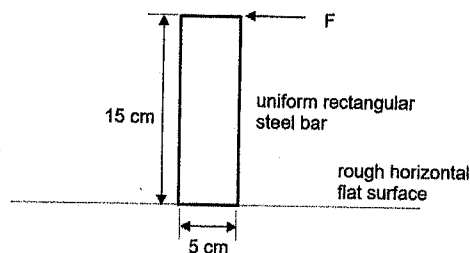
As the water is added, the level of the paraffin rises to 150 cm^3 . The paraffin and water do not mix.

What is the final total mass of liquid in the measuring cylinder?

- A 130 g B 140 g C 167 g D 175 g
- 5 A student places a cup on a table cloth on top of a table top. When he pulls the table cloth quickly, the cup stays on the table without falling off.

Which of the following is the best explanation?

- A The atmospheric pressure keeps the cup from falling off.
 B The cup makes a tight seal with the table due to difference in pressure.
 C The mass of the cup keeps it in position due to inertia.
 D The weight of the cup is more than the weight of the table cloth.
- 6 The diagram shows a uniform rectangular steel bar placed on a rough horizontal flat surface. A horizontal force F acts on the top end of the steel bar. The steel bar weighs 30 N . The steel bar is in equilibrium.



Which of the following formulae can be used to calculate force F ?

- A $30 \times (5 + 2) = F \times (15)$
 B $30 \times (5) = F \times (15)$
 C $(30 \times 10) \times (5 + 2) = F \times (15)$
 D $(30 \times 10) \times (5) = F \times (15 + 2)$

- 7 The table below gives the height of the centre of gravity above the base and the base area of several cuboids.

cuboid	height of centre of gravity	base area
P	4 cm	5 cm^2
Q	4 cm	10 cm^2
R	6 cm	5 cm^2
S	6 cm	10 cm^2

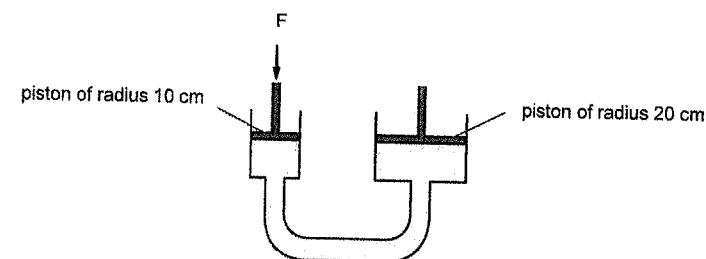
Which of the following statements is true?

- A P has the greatest stability while R has the least stability.
 B Q has the greatest stability while R has the least stability.
 C R has the greatest stability while Q has the least stability.
 D R has the greatest stability while S has the least stability.
- 8 An electric motor is required to lift an object of weight 600 N up a vertical height of 100 m in 2 minutes.

What will be the electrical power required if the overall efficiency of the motor is 80%?

- A 400 W B 625 W C 24 000 W D 37 500 W

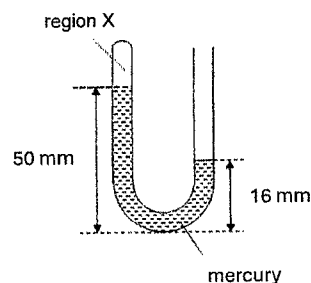
- 9 When a force, F , is applied to the smaller piston of a hydraulic press, as shown, the small piston moves down by a distance, D .



How far upwards will the larger piston move?

- A $D/4$ B $D/2$ C $2D$ D $4D$

- 10 The diagram shows a U-tube filled with mercury. The left arm is sealed, and the right arm is exposed. There is some trapped air in region X. The atmospheric pressure is 760 mmHg.



What is the pressure of the trapped air in region X?

- A 726 mmHg
B 744 mmHg
C 776 mmHg
D 794 mmHg
- 11 A fixed mass of gas is trapped in a syringe. The volume of the syringe is slowly reduced, compressing the gas without changing the temperature.
- Why does the pressure exerted on the walls of the syringe change?
- A The gas particles collide with the walls of the syringe with more force.
B The gas particles have greater average kinetic energy.
C The gas particles collide with each other more often.
D The gas particles collide with the walls of the syringe more often.
- 12 In an experiment to demonstrate Brownian motion, a brightly illuminated cell containing smoke particles is viewed under a microscope. The illuminated smoke particles are seen to move randomly.
- Which statement explains this?
- A The smoke particles are bombarded continually by air particles.
B The smoke particles are moved about by convection currents.
C The smoke particles are shaken by the vibrations of the molecules.
D The smoke particles are supplied with energy by the light illuminating them.

- 13 A heater is designed to radiate thermal energy.

Which change to the design decreases the thermal energy emitted by radiation?

- A a darker coloured surface
B a higher surface temperature
C a larger surface area
D a shinier surface

- 14 When a liquid evaporates, some molecules escape.

What is the effect on the kinetic energy of the molecules in the liquid and from where do the molecules escape?

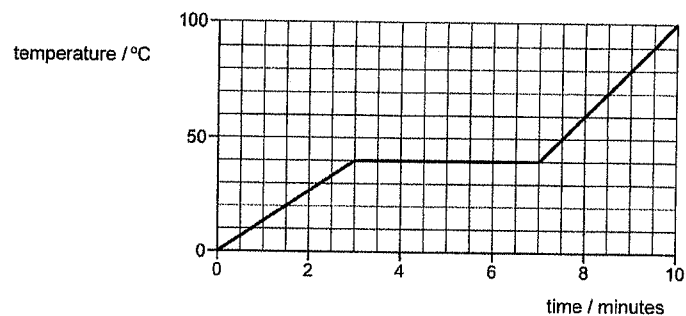
	kinetic energy of molecules in the liquid	molecules escape from
A	decreases	everywhere within the liquid
B	decreases	the surface only
C	increases	everywhere within the liquid
D	increases	the surface only

- 15 A block of copper is at room temperature.

Which row describes a smaller block of copper at the same temperature?

	internal energy	heat capacity	specific heat capacity
A	less	less	same
B	less	same	less
C	same	less	same
D	same	same	same

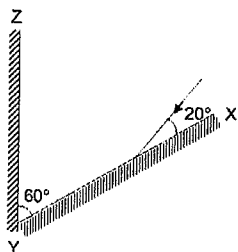
- 16 The graph shows how the temperature of a sample of wax changes with time as it is heated.



The mass of the wax is 200 g.
Thermal energy is supplied to the wax at a constant rate of 12 000 J / min.

What is the specific latent heat of fusion of the wax?

- A 180 J / g B 240 J / g C 480 J / g D 600 J / g
- 17 A ray of light is incident at an angle of 20° to a mirror XY. Another mirror YZ is arranged at an angle of 60° to XY as shown in the diagram below.

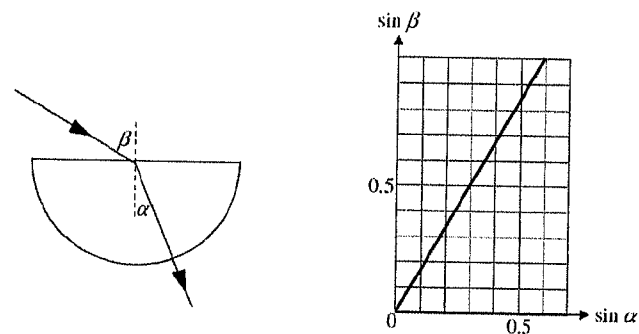


After reflection from XY, the ray is incident on YZ.

What is the angle of incidence of the ray at the mirror YZ?

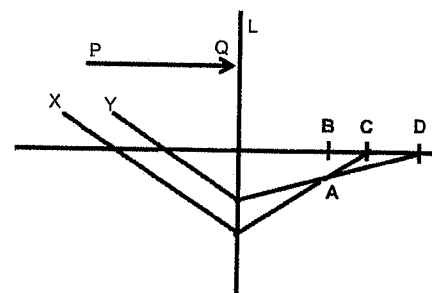
- A 0° B 10° C 30° D 60°

- 18 A light beam is incident into a semi-circular glass block and refracted out as shown. A graph of $\sin \beta$ against $\sin \alpha$ is plotted as shown.



What is the critical angle of the glass?

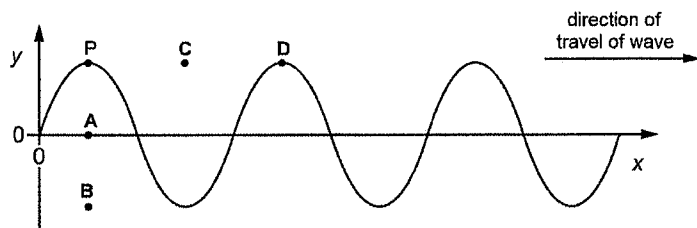
- A 30.0° B 36.9° C 44.4° D 53.1°
- 19 The diagram shows two incoming parallel rays of light X and Y, which pass through a converging lens, L.



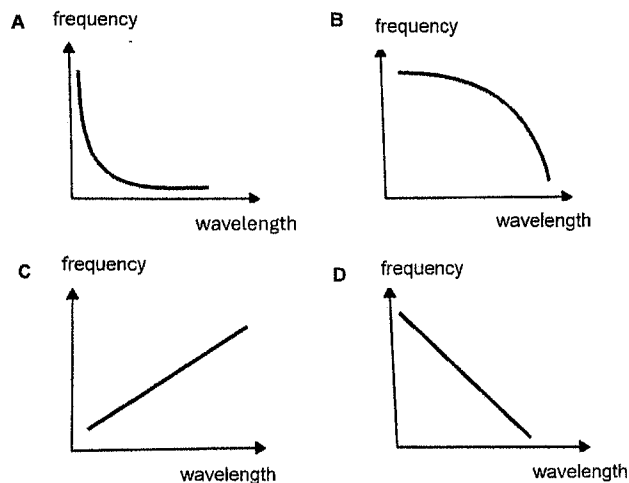
Which point will ray PQ pass through after passing through the lens?

- 20 The graph shows how the displacement y of a transverse wave on a rope varies with distance x at time $t = 0$. The wave has a frequency of 0.5 Hz. A point P is marked on the rope with its original position shown.

What is the position of P at time $t = 1$ s?



- 21 Which graph shows the relationship between the frequency and the wavelength of the electromagnetic waves?

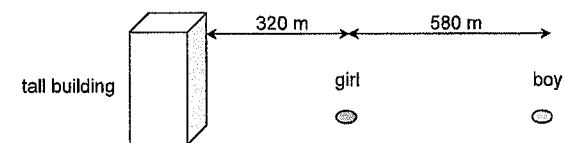


- 22 The diagram shows the main sections of the electromagnetic spectrum in order of increasing frequency. Some of the sections are labelled. The section P has a frequency just below that of visible light.

radio waves		P	visible light			gamma rays
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Which application uses the section P?

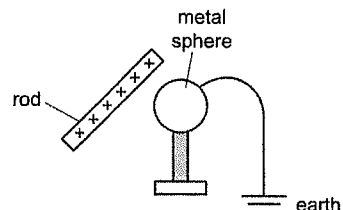
- A radio
B suntanning bed
C satellite television
D television remote controller
- 23 A girl standing 320 m in front of a tall building fires a shot with a starting pistol. A boy, standing 580 m behind her, hears two bangs 2 s apart.



From this information, what is the speed of sound in air?

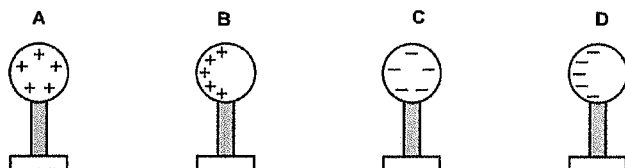
- A 300 m / s B 310 m / s C 320 m / s D 330 m / s
- 24 Two notes of different loudness but same pitch are played on a musical instrument. Which of the following statements is true?
- A The two sound waves produced will have different amplitudes and different frequency.
B The two sound waves produced will have different amplitudes and the same frequency.
C The two sound waves produced will have the same amplitude and different frequency.
D The two sound waves produced will have the same amplitude and the same frequency.

- 25 A positively charged rod is held close to an insulated metal sphere. The sphere is earthed as shown.



The earth connection is removed and then the rod is removed.

Which diagram shows the charges on the sphere after the rod is removed?



- 26 A lightning bolt is created when there is a potential difference of $2 \times 10^6 \text{ V}$ between the clouds and the ground. During the discharge of the lightning bolt, $2 \times 10^{10} \text{ J}$ of energy is released in 0.1 s.

How much current flows through the lightning bolt?

- A $1 \times 10^{-5} \text{ A}$ B $1 \times 10^{-4} \text{ A}$ C $1 \times 10^4 \text{ A}$ D $1 \times 10^5 \text{ A}$

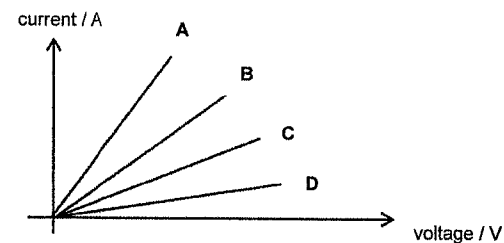
- 27 Four resistance wires (A, B, C and D) are made from the same material. The wires are connected in parallel across a battery.

Which wire will have the highest current flowing through it?

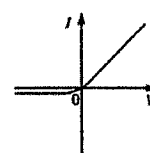
	length of filament	cross-sectional area of filament
A	L	A
B	2L	A
C	L	2A
D	2L	2A

- 28 The graph shows the current-voltage relationships of four different types of ohmic conductors all of the same length. All four conductors are connected in parallel and a battery is connected across them.

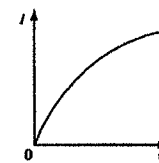
Which of the conductors will allow the smallest amount of charge to pass through it at any one time?



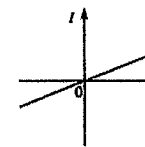
- 29 Graphs X, Y and Z show how the current varies with potential difference for three electrical components.



graph X



graph Y

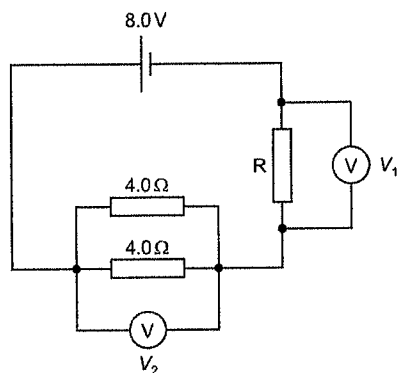


graph Z

Which electrical component does each graph represent?

	graph X	graph Y	graph Z
A	filament lamp	semiconductor diode	metallic conductor
B	metallic conductor	semiconductor diode	filament lamp
C	semiconductor diode	filament lamp	metallic conductor
D	semiconductor diode	metallic conductor	filament lamp

- 30 A cell with an e.m.f of 8.0 V is connected to some resistors.

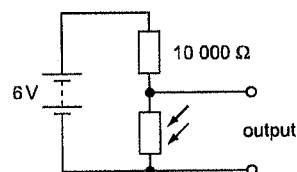


The voltmeter readings V_1 and V_2 show the same reading of 4.0 V.

What is the resistance of resistor R?

- A 0.5 Ω B 2.0 Ω C 4.0 Ω D 8.0 Ω

- 31 A potential divider consists of an LDR and a resistor connected to a 6 V battery.



What should be the resistance of the LDR for the output to be 3 V?

- A 0 Ω
B between 0 and 10 000 Ω
C 10 000 Ω
D more than 10 000 Ω

- 32 A 3-pin plug is working under normal condition. The brown wire carries a current of 4 A when the appliances is switched on.

What would be the current in the blue and yellow-green wires?

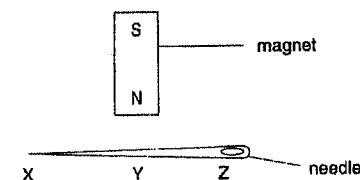
	blue wire	yellow-green wire
A	0 A	4 A
B	2 A	2 A
C	4 A	0 A
D	4 A	4 A

- 33 An electric hotplate is rated at 1500 W and an oven is rated at 2000 W. Over the duration of one day, the hotplate is switched on for a total of 1.0 hour and the oven is switched on for 4.0 hours. The cost of electricity is 29 cents per kWh.

What is the cost of using the electric hotplate and oven in one day?

- A \$2.32 B \$2.76 C \$3.44 D \$5.08

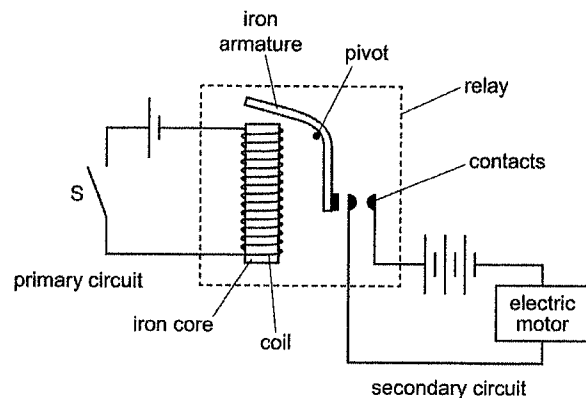
- 34 The diagram shows a magnet being used to pick up a steel needle. The North pole of the magnet is close to the centre Y of the needle.



What are the poles induced in the needle at X, Y and Z?

	pole induced at X	pole induced at Y	pole induced at Z
A	N	N	N
B	N	S	N
C	S	N	S
D	S	S	S

- 35 The diagram shows a relay used to switch on an electric motor.



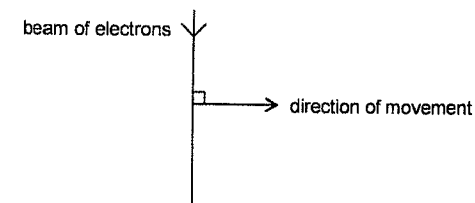
A student makes five statements to explain how the relay switches on the electric motor. The statements are not in the correct order.

- 1 The current in the coil magnetises the electromagnet.
- 2 The armature closes the contacts.
- 3 The current in the secondary circuit makes the motor turn.
- 4 The electromagnet attracts the iron armature.
- 5 The switch S in the primary circuit is closed.

What is the correct order of the statements?

- A 1 → 5 → 2 → 4 → 3
 B 3 → 2 → 4 → 1 → 5
 C 3 → 4 → 1 → 5 → 2
 D 5 → 1 → 4 → 2 → 3

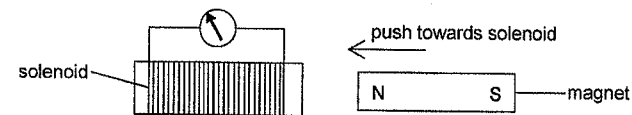
- 36 A beam of electrons travels between the poles of a magnet. The beam starts to move in the direction shown.



Which is the **most** likely direction of the magnetic field?

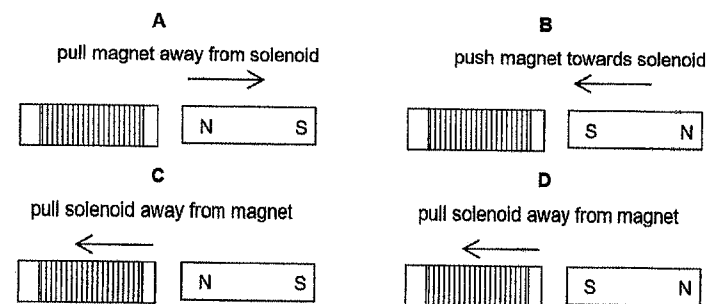
- A to the left
 B to the right
 C into the plane of the paper
 D out of the plane of the paper

- 37 The diagram shows the North pole of a bar magnet being pushed into a solenoid.

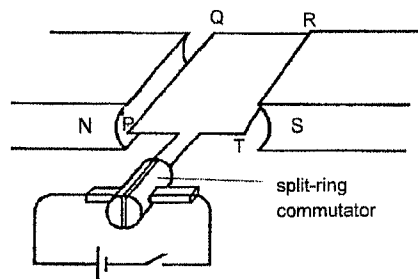


An electromotive force is induced in the solenoid and the galvanometer needle deflects to the left as shown.

Using the same end of the solenoid, which of the following actions will cause the galvanometer needle to deflect in the same direction?



- 38 The diagram shows a simple d.c. electric motor.



When the switch is closed, which of the following statements are correct?

- I A current will flow round the coil in the direction PQRT
- II The coil will rotate in a clockwise direction when viewed from side PT
- III The split-ring commutator reverses the current after every complete cycle.

- A I only B III only C II and III D I and III

- 39 Electrical power is transmitted by cables over long distances at very high voltages.

What are the effects of using a high voltage transmission system?

	power loss in the cables	current in the cables
A	high	high
B	high	low
C	low	high
D	low	low

- 40 Which of the following nuclear reactions is an example of fusion?

- A carbon 14 decaying to nitrogen + an electron
- B two heavy hydrogen nuclei becoming helium + a neutron + energy
- C radioactive radium 226 decaying to radioactive radon 222 + an alpha particle
- D radioactive sodium 24 decaying to stable magnesium 24 + a beta particle

End of paper

Preliminary Examination Physics 6091 – Answers

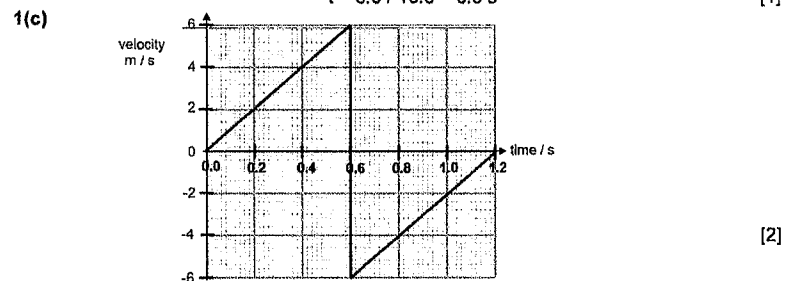
Paper 1

1	2	3	4	5	6	7	8	9	10
B	B	D	A	C	A	B	B	A	A
11	12	13	14	15	16	17	18	19	20
D	A	D	B	A	B	B	B	B	B
21	22	23	24	25	26	27	28	29	30
A	D	C	B	C	D	C	D	C	B
31	32	33	34	35	36	37	38	39	40
C	C	B	B	D	D	D	A	D	B

Paper 2

1(a) Rate of change of velocity [1]

1(b) Acceleration due to gravity = 10.0 m/s^2
 $a = (v - u) / t$
 $10.0 = (6.0 - 0) / t$ [1]
 $t = 6.0 / 10.0 = 0.6 \text{ s}$ [1]



1(d) Height = Area under velocity-time graph
 $= \frac{1}{2} (0.6)(6)$ [1]
 $= 1.8 \text{ m}$ [1]

2(a) mass = Weight / g
 $\text{mass} = 61 / 10 = 6.1 \text{ kg}$ [1]

2(b) Resultant force = mass x acceleration (a)
 $95 - 61 = 6.1 \times a$ [1]
 $a = 34 / 6.1$
 $a = 5.57 \text{ m/s}^2$ [1]



BEATTY SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2025
SECONDARY FOUR EXPRESS / G3

CANDIDATE
NAME

CLASS

REGISTER
NUMBER

PHYSICS

Paper 1

Multiple Choice

Setter:

Mr Fadzrun Adnan

6091/01

29 August 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and register number on the Multiple Choice Answer Sheet provided.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers, **A**, **B**, **C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

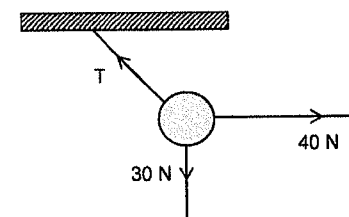
The use of an approved scientific calculator is expected, where appropriate.

- 1 Carbon is an element that can be found in a range of objects – from pencil lead to the largest living animal – the blue whale.

What is the correct order of magnitude for the length of a pencil lead and a blue whale?

	length of pencil lead	length of blue whale
A	0.1 m	0.01 km
B	0.1 m	0.01 Mm
C	0.1 mm	0.01 km
D	0.1 mm	0.01 Mm

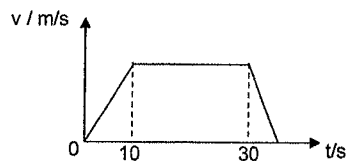
- 2 A pendulum bob of weight 30 N is pulled horizontally to the right by a 40 N force and remains stationary as shown.



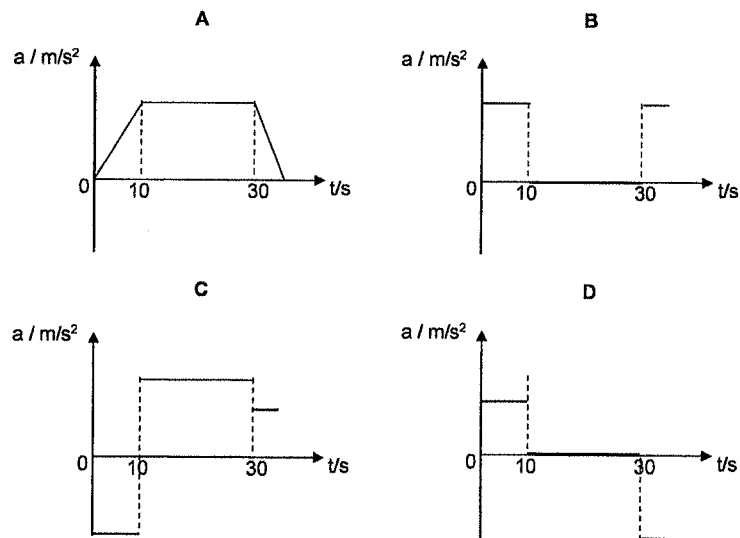
What is the tension T in the string of the pendulum?

- A 20 N
B 50 N
C 60 N
D 70 N

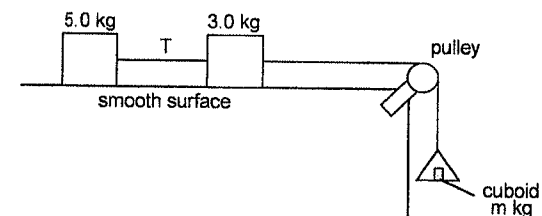
- 3 The motion of a car on a straight and horizontal road can be represented by a velocity-time graph as shown.



Which graph shows how the car's acceleration varies with time?



- 4 The diagram shows two blocks connected by a string on a smooth surface. One of the blocks is connected to another string that passes over a frictionless pulley with a tray attached at the end. A cuboid of mass m is placed on the tray as shown.



If the tray has an acceleration of 5.0 m/s^2 , what is the magnitude of mass m and the tension T in the string? The gravitational field strength is 10 N/kg .

	m / kg	T / N
A	4.0	25
B	4.0	40
C	8.0	25
D	8.0	40

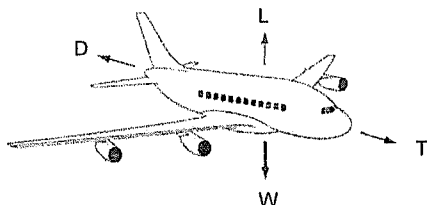
- 5 A cyclist is travelling on a straight road. He stops the bicycle by squeezing the handbrakes.

What changes if he squeezes the handbrakes harder?

- I – braking distance
- II – braking force
- III – reaction time
- IV – work done against friction

- A I and II
- B II and IV
- C III and IV
- D IV only

- 6 During flight, an aircraft experiences four forces acting on it. The four forces are:



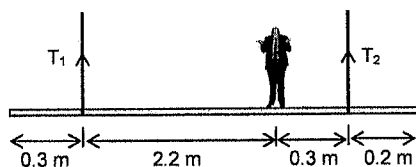
L – lift due to the wings
W – weight of aircraft
T – thrust due to engines
D – drag due to air resistance

The aircraft is descending at a constant rate while decelerating.

Which row about the horizontal and vertical forces is correct?

	horizontal forces	vertical forces
A	$T < D$	$L < W$
B	$T > D$	$L < W$
C	$T < D$	$L = W$
D	$T > D$	$L > W$

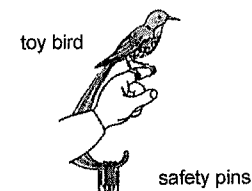
- 7 A man of weight 800 N is standing on a uniform plank of weight 100 N. The plank is suspended horizontally at two points as shown.



What are the tensions T_1 and T_2 in the two ropes?

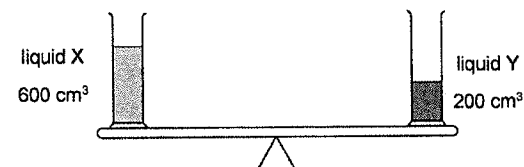
	T_1 / N	T_2 / N
A	148	752
B	156	764
C	704	196
D	750	150

- 8 A student uses safety pins to balance a toy bird on his finger.



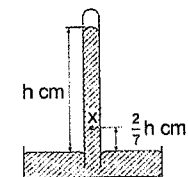
What is the purpose of the safety pins?

- A To increase stability by increasing the weight of the toy bird.
B To lower the centre of gravity of the toy bird above the finger.
C To lower the centre of gravity of the toy bird below the finger.
D To raise the centre of gravity of the toy bird below the finger.
- 9 Two identical measuring cylinders are filled with a different volume of liquids X and Y separately. Each measuring cylinder is then placed on a uniform beam pivoted at its centre. The measuring cylinders are placed at an equal distance away from the pivot as shown.



Which statement about the densities of both liquids is correct?

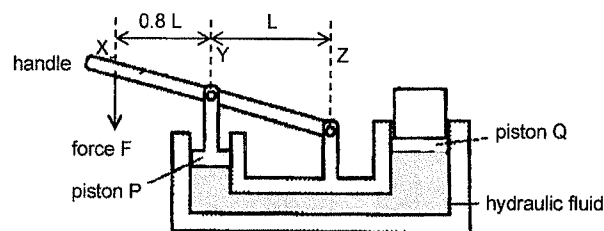
- A The densities of liquid X and liquid Y are the same.
B The density of liquid X is one third the density of liquid Y.
C The density of liquid X is six times the density of liquid Y.
D The density of liquid X is three times the density of liquid Y.
- 10 On a sunny day when the atmospheric pressure is 100 kPa, a mercury barometer has a height of h cm.



What is the pressure at point X in the barometer?

- A 28.6 kPa B 71.4 kPa C 100 kPa D 129 kPa

- 11 A lever is connected to a hydraulic jack at piston P.



The surface area of piston Q in contact with the hydraulic fluid is 10 times that of piston P. The horizontal distances XY and YZ are $0.8L$ and L respectively.

What is the force F exerted at the handle if the load lifted at piston Q is 20 kN ?

- A 1.1 N B 2.5 N C 1100 N D 2500 N

- 12 The table shows information about different energy resources used in electricity generation – how efficient energy is transferred from the resource to electrical output, how much it costs to generate every kWh of energy and how much carbon dioxide (CO_2) is emitted in the process.

resource	energy transfer efficiency	cost per kWh	environmental impact
L	35 %	\$0.05	high CO_2 emission
M	15 %	\$0.15	no CO_2 emission
N	40 %	\$0.08	high CO_2 emission
P	20 %	\$0.12	no CO_2 emission

Which option correctly identifies the energy resources L, M, N and P?

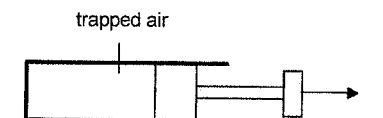
	L	M	N	P
A	coal	solar	natural gas	wind
B	natural gas	wind	coal	solar
C	solar	coal	wind	natural gas
D	wind	solar	natural gas	coal

- 13 Water from a reservoir passes through the turbine of a hydroelectric system at a rate of 1000 kg/s . The reservoir is 500 m above the level of the turbine. The electrical output from the a.c. generator driven by the turbine is 200 A at an electromotive force of 22 kV .

What is the efficiency of the hydroelectric system?

- A 12 % B 24 % C 44 % D 88 %

- 14 A tube with a movable piston is shown below. The piston is pulled outwards very slowly by a constant force F . The temperature of the air remains constant.



Which statement is **not** correct?

- A The air pressure inside the tube increases.
 B The distance between the air particles increases.
 C The force of collision between the air particles and the tube remains the same.
 D The frequency of collision between the air particles and the tube decreases.

- 15 What causes Brownian motion that is observed in smoke particles?

- A collisions between air particles
 B collisions between air and smoke particles
 C convection currents in the air
 D transfer of energy in the kinetic store between smoke particles

- 16 Generally, the solid state of a substance is denser than its liquid state. Ice, however, is less dense than liquid water.

Which statement best explains why ice is less dense than water?

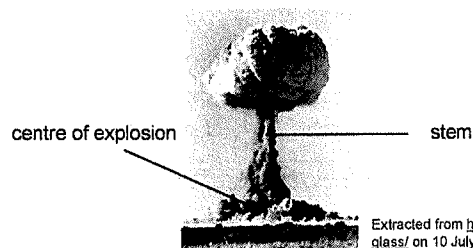
- A Particles in ice are less closely packed.
 B Particles in ice vibrate more vigorously about their fixed positions.
 C Particles in water are less orderly.
 D Particles in water have stronger forces of attraction between them.

- 17 Two pairs of tongs, one made of metal and the other made of wood, are placed for some time in a kitchen at room temperature.

Why does the pair of metal tongs feel cooler to the touch compared to the wooden one?

- A It absorbs infrared radiation from the skin better than the wooden tongs.
 B It conducts heat from our skin better than the wooden tongs.
 C It emits infrared radiation at a faster rate than the wooden tongs.
 D It has a lower temperature than the wooden tongs.

- 18 When a nuclear bomb is detonated, there is an initial outward expansion of extremely hot air. At the centre of the explosion, the hottest gases rise very rapidly to form the stem as shown.

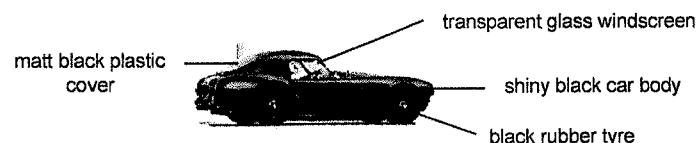


Extracted from <https://museums.victoria.com.au/article/atomic-glass/> on 10 July 2025

After a while, there is an inward and upward rush of cool air towards the stem.

Which statement best explains why there is a rush of cool air from the surrounding?

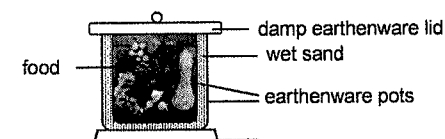
- A Cool air is denser than the hot air.
 B It will enable convection currents to form.
 C Particles of the cool air have lower average kinetic energy than the hot air particles.
 D There is a region of low pressure at the centre of the explosion.
- 19 A shiny black car is parked on a black-surfaced carpark as shown. The car is exposed to the sun for a prolonged period.



Which part of the car will be the hottest and why does it record the highest temperature?

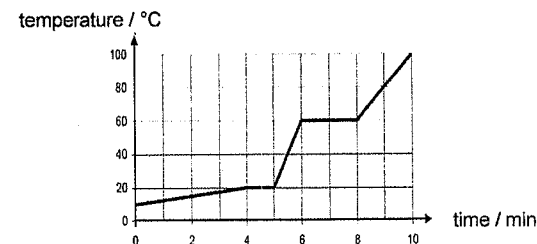
	hottest part	explanation
A	car body	it absorbs the most radiation
B	cover	it emits the most radiation
C	tyre	it conducts heat from the heated ground
D	windscreen	it allows radiation to pass through

- 20 A traditional claypot cooler is a non-electric refrigeration device that can store food at a lower temperature than the surroundings. It typically consists of two earthenware pots, one nested inside the other with wet sand in between as shown.



What enables the food to reach a lower temperature than that of the surrounding air?

- A Convection currents forming above and outside the earthenware pots that removes heat from the food.
 B Evaporation of water from the damp earthenware lid and pots.
 C Large surface area of the earthenware pots absorbing infrared radiation from the food and emitting it out to the surrounding air.
 D Wet sand rapidly conducting heat away from the food.
- 21 A solid substance is heated at a constant rate until it reaches its gaseous state. The graph of its temperature against time is as shown.



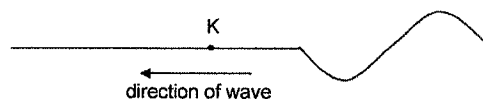
What can be deduced about the substance from the graph?

- A Its specific heat capacity increases with temperature.
 B Its specific heat capacity is smallest when in the liquid state.
 C The specific latent heat of fusion is larger than the specific heat capacity.
 D The specific latent heat of fusion is twice the specific latent heat of vaporisation.
- 22 A liquid H of mass m at 20°C is mixed with a liquid L of mass $4m$ at 80°C . The final temperature of the mixture is 70°C .

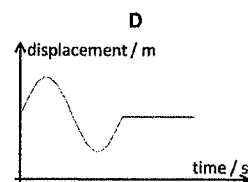
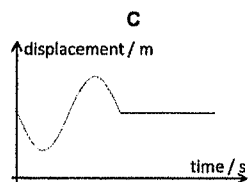
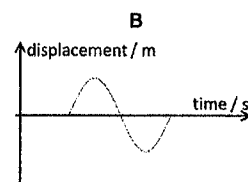
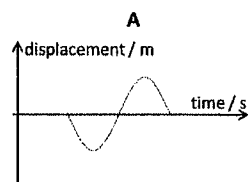
Assuming both liquids are miscible and that there is no transfer of energy to the surroundings, what is the ratio of the specific heat capacity of H to the specific heat capacity of L?

- A 1:5 B 4:5 C 5:1 D 5:4

- 23 The diagram shows a wave travelling on a string towards the left at a particular instance.



Which graph shows the displacement-time graph of point K in the string, beginning from the instance shown?



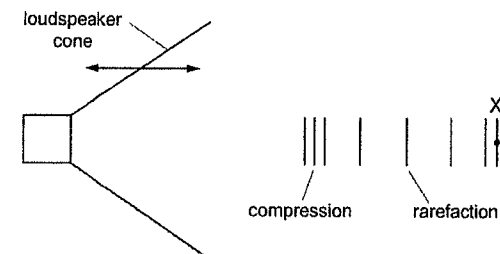
- 24 When a sea wave approaches the shore, its wavelength reduces due to the decrease in the depth of the sea as shown.



How do the frequency and speed of the wave change when the wave approaches the shore?

	frequency	speed
A	decrease	remains the same
B	increase	remains the same
C	remains the same	decrease
D	remains the same	increase

- 25 Compressions and rarefactions are sent out from a loudspeaker cone as it vibrates back and forth. The frequency of the vibration is 500 Hz.



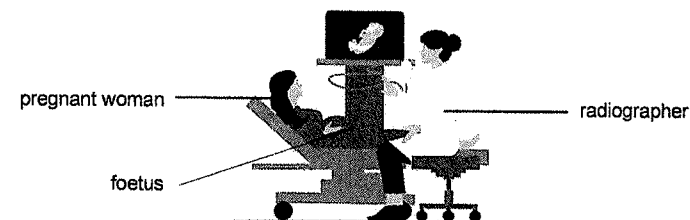
At time t s, point X undergoes a compression.

At what time does point X undergo a rarefaction?

- A** $(t + 0.002)$ s **B** $(t + 0.003)$ s **C** (t^2) s **D** $(2t)$ s

Read the following and answer questions 26 and 27.

A pregnant woman undergoes an ultrasound scan to check on the well-being of her unborn foetus as shown.



- 26 When the radiographer talks, the foetus in the womb will hear her voice differently from how the woman hears it due to the different media in which the sound travels.

How is the voice heard by the foetus different from that heard by the woman?

- A** The radiographer's voice will be louder and at the same pitch.
B The radiographer's voice will be softer and at a higher pitch.
C The radiographer's voice will be softer and at a lower pitch.
D The radiographer's voice will be softer and at the same pitch.

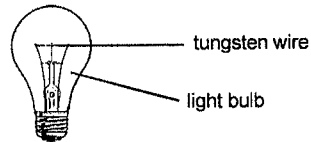
27 Which statement best explains why ultrasound is used in the scan instead of electromagnetic waves?

- A Overexposure to electromagnetic waves can cause ionisation which damages living tissue and harms the foetus.
- B Ultrasound is a longitudinal wave unlike the transverse electromagnetic waves.
- C Ultrasound does not transmit as much energy to the foetus as electromagnetic waves.
- D Ultrasound produces a clearer image of the foetus than electromagnetic waves.

28 Which application of electromagnetic waves is matched correctly?

	electromagnetic wave component	application
A	infrared	laptop wifi signal
B	microwave	television remote control
C	ultraviolet	treatment of raw water
D	X-ray	detection of forged bank notes

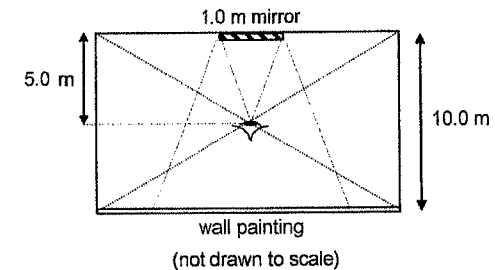
29 When a light bulb is turned on, the current flowing in the tungsten wire causes it to become hot and subsequently glow.



Which part of the electromagnetic spectrum does the light bulb emit?

- A infrared and visible light
- B microwave, infrared and visible light
- C ultraviolet and visible light
- D visible light only

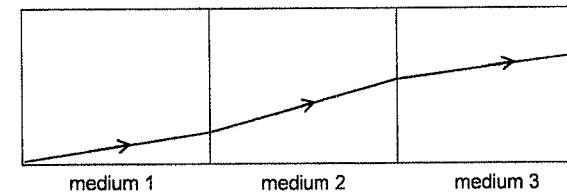
30 A museum visitor stands exactly in the middle of a rectangular chamber and observes a wall painting behind him through a thin mirror of length 1.0 m as shown. The mirror is also placed exactly in the middle of the chamber.



What length of the wall painting can the museum visitor observe?

- A 1.5 m
- B 2.0 m
- C 3.0 m
- D 5.0 m

31 The diagram shows a ray of light travelling through three different media. The light ray in medium 1 is parallel to the light ray in medium 3.



Which row correctly shows the refractive indices of the three media?

	medium 1	medium 2	medium 3
A	1.32	1.25	1.41
B	1.32	1.39	1.25
C	1.39	1.32	1.25
D	1.39	1.32	1.39

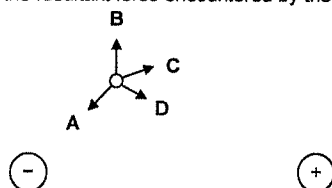
32 An object of height 5.0 cm is placed 30.0 cm in front of a lens of focal length 10.0 cm.

What is the height of the image and how far is it from the lens?

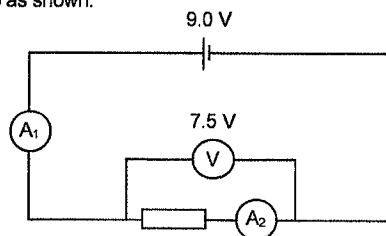
	image height	image distance
A	less than 5.0 cm	less than 30.0 cm
B	exactly 5.0 cm	exactly 30.0 cm
C	more than 5.0 cm	less than 30.0 cm
D	more than 5.0 cm	more than 30.0 cm

- 33 The diagram shows an electron approaching two isolated electric charges.

What is the direction of the resultant force encountered by the electron?



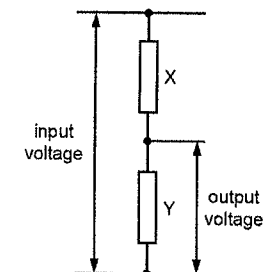
- 34 A circuit is set up as shown.



What are possible values of the current measured in A_1 and A_2 , and why is the potential difference (p.d.) measured across the resistor less than the electromotive force (e.m.f.) across the cell?

	A_1 / A	A_2 / A	reason
A	1.5	1.5	The connecting wires are not tightly secured.
B	1.5	2.5	There was zero error in the voltmeter.
C	2.5	1.5	The ammeter A_2 has significant resistance.
D	2.5	2.5	The connecting wires have significant resistance.

- 35 An electrician creates a potential divider using two resistors, X and Y, as shown. He needs the output voltage across resistor Y to be 40 % of the input voltage.



Which two resistors can he use in this potential divider?

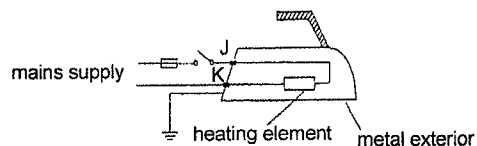
	X	Y
A	4.0Ω	6.0Ω
B	4.0Ω	10Ω
C	6.0Ω	4.0Ω
D	10Ω	4.0Ω

- 36 A lamp is rated 50 W, 240 V.

How will the brightness of the lamp change when it is plugged into a 110 V mains supply?

- A brighter by about 2 times
- B brighter by about 5 times
- C dimmer by about 2 times
- D dimmer by about 5 times

- 37 An electric iron typically has a circuit as shown.

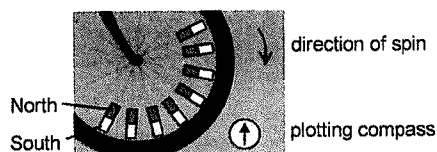


In which situation will the fuse **not** blow when the switch is closed?

- I – The fuse is connected to the wire at K instead of J.
- II – The fuse rating is just above the operating current.
- III – The user touches the metal exterior with wet hands.
- IV – The wire at J touches the metal exterior when the insulation wears out.

- A I and II
- B I and III
- C I, II and III
- D III and IV

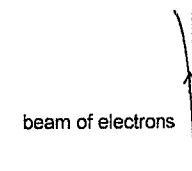
- 38 Small bar magnets are placed on the spokes of a bicycle as shown. A plotting compass is placed near the front wheel of the bicycle.



If the front wheel is spinning clockwise, how will the magnetic needle in the plotting compass behave?

- A It will point away from the centre of the wheel and oscillate according to the speed of the spinning.
- B It will point towards the centre of the wheel and oscillate according to the speed of the spinning.
- C It will rotate anticlockwise continuously.
- D It will rotate clockwise continuously.

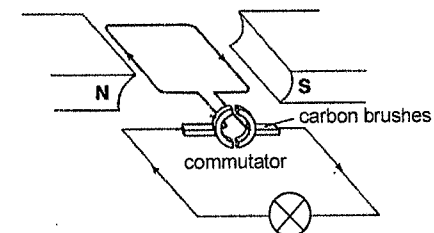
- 39 A beam of electrons travels between the poles of a magnet. The beam starts to bend towards the left.



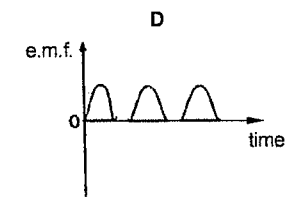
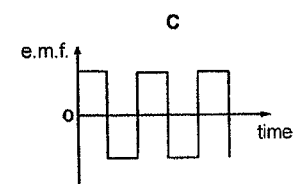
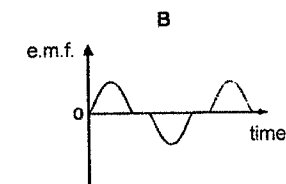
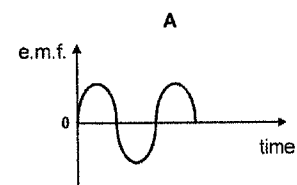
Which is the most likely direction of the magnetic field?

- A into the page
- B out of the page
- C towards the left
- D towards the right

- 40 A student tried replacing the slip rings of an alternating current generator with a split ring commutator as shown.



Which graph shows the electromotive force (e.m.f.) induced in the circuit?





BEATTY SECONDARY SCHOOL
END OF YEAR EXAMINATION 2025
SECONDARY FOUR EXPRESS / G3
PURE PHYSICS 6091
MARK SCHEME

Paper 1
Answers

Qn	Ans
1	A
2	B
3	D
4	C
5	A
6	C
7	A
8	C
9	B
10	B

Qn	Ans
11	C
12	A
13	D
14	A
15	B
16	A
17	B
18	D
19	A
20	B

Qn	Ans
21	B
22	B
23	A
24	C
25	B
26	D
27	A
28	C
29	A
30	C

Qn	Ans
31	D
32	A
33	C
34	D
35	C
36	D
37	C
38	B
39	B
40	D

Name:	Class:	Class Register Number:
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中正中學

CHUNG CHENG HIGH SCHOOL (MAIN)

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PRELIMINARY EXAMINATION 2025
SECONDARY 4

PHYSICS

6091/01

Paper 1 Multiple Choice

3 September 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and register number clearly in the spaces provided at the top of this page.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

This document consists of **15** printed pages and 1 blank page.

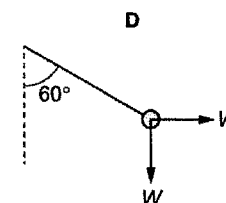
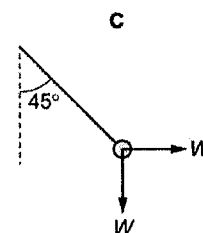
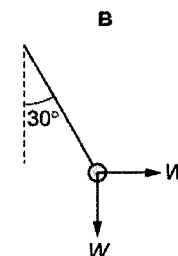
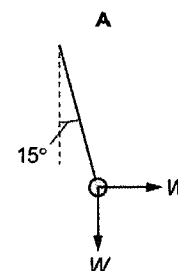
[Turn over

- 1 Which of the following groups of physical quantities consists only of scalars?

- A acceleration, force, velocity
B acceleration, mass, speed
C force, time, velocity
D mass, speed, time

- 2 The bob of a single pendulum is pulled horizontally by a force that is equal to weight W of the bob.

Which diagram shows the angle between the pendulum thread and the vertical?

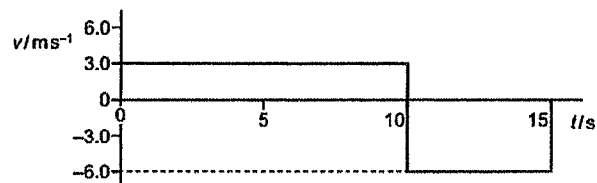


- 3 Two cubes, X and Y, have the same mass, but the length of a side of X is twice that of Y.

What is the value of the ratio $\frac{\text{density of X}}{\text{density of Y}}$?

- A 0.125 B 1.0 C 4.0 D 8.0

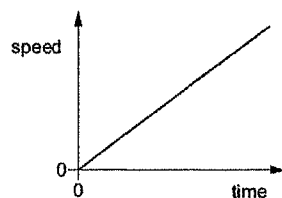
- 4 A radio-controlled toy car travels along a straight line for a time of 15 s. The variation with time t of the velocity v of the car is shown.



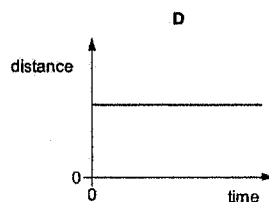
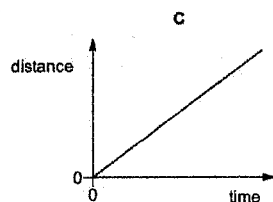
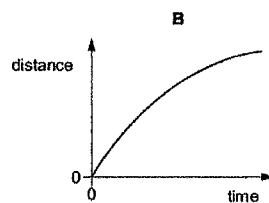
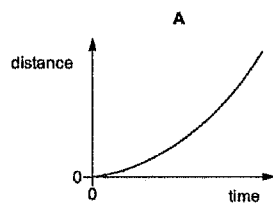
What is the average velocity of the toy car for the journey shown by the graph?

- A -1.5 ms^{-1} B 0.0 ms^{-1} C 2.0 ms^{-1} D 4.0 ms^{-1}

- 5 The speed-time graph represents a short journey.



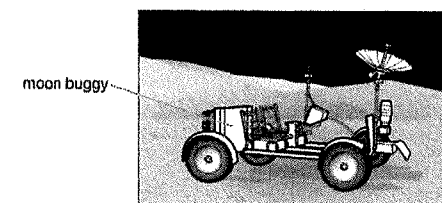
Which distance-time graph represents the same journey?



- 6 Which property of an object determines its resistance to a change from its state of rest or motion?

- A its mass B its shape C its volume D its surface area

- 7 The diagram shows a moon buggy used by astronauts.



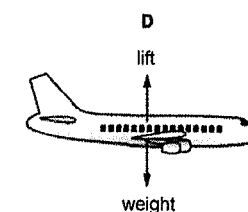
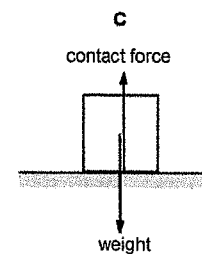
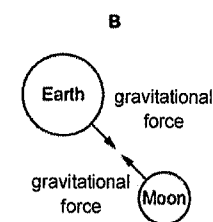
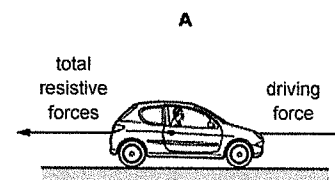
The mass of the moon buggy on the Earth is 210 kg. The gravitational field strength on the Moon is $\frac{1}{6}$ of that on the Earth.

What is the likely weight of the moon buggy on the Moon?

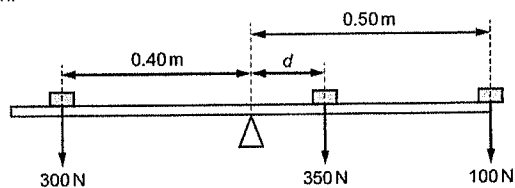
- A 0 N B 35 N C 210 N D 340 N

- 8 Each diagram illustrates a pair of forces of equal magnitude.

Which diagram gives an example of a pair of forces that is described by Newton's third law of motion?



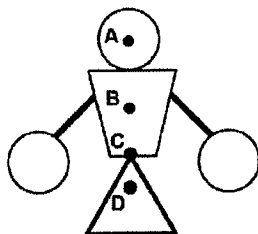
- 9 A uniform beam is pivoted at its centre. The beam is balanced by three weights in the positions shown.



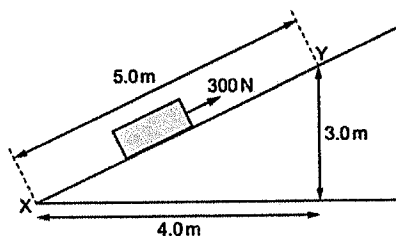
What is the length d ?

- A 0.05 m B 0.10 m C 0.20 m D 0.48 m

- 10 The diagram shows a balancing toy pivoted on a triangular stand. When the toy is tilted slightly, it remains stationary at the new position. Where is the centre of gravity of the balancing toy?



- 11 A 300 N force is applied to a box of weight 400 N to move it up a ramp, as shown in the diagram below.



How much work is done to overcome friction when moving the box from X to Y?

- A 300 J B 900 J C 1200 J D 1500 J

- 12 Which energy source is available constantly over a 24-hour period?

- A natural gas
B solar cells
C tidal
D wind

- 13 A 15 W lamp is turned on for 30 minutes. It wastes 7 000 J of energy.

What is the efficiency of the lamp?

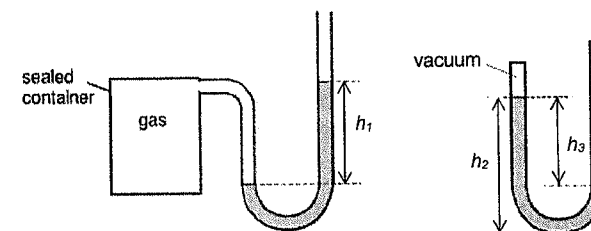
- A 0.26 B 0.35 C 0.59 D 0.74

- 14 The diagram shows 2 manometers containing mercury.

Both are placed in the same room.

The manometer on the left is connected to a sealed container filled with gas.

All measurements are in cm.



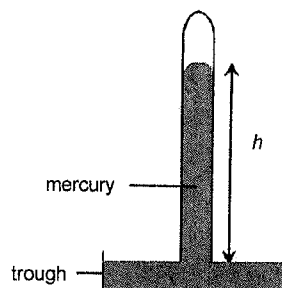
What is the pressure of the gas in cm Hg?

- A $(h_1 + h_2)$
B $(h_1 + h_3)$
C $(h_1 + h_2 - h_3)$
D $(h_2 - h_1)$

[Turn over

- 15 The diagram shows a working barometer.

Which change would not cause the height h of the mercury column to vary?



- A Leakage of air into the tube
 B Change in gravitational field strength
 C Change in temperature
 D Adding mercury to the trough
- 16 When water is freezing, energy from the internal store is transferred out.
 Which of the following statements is correct?
 A The average kinetic energy of the water molecules decreases.
 B The average potential energy of the water molecules decreases.
 C The average size of the water molecules decreases.
 D The average density of the water molecules decreases.
- 17 Heat sinks are installed in electrical appliances to absorb and dissipate heat quickly.
 Which of the following characteristics are suitable for a good heat sink?
 A It has a high heat capacity and small surface area.
 B It has a high heat capacity and large surface area.
 C It has a low heat capacity and small surface area.
 D It has a low heat capacity and large surface area.

- 18 Wiping the body of a patient who has a high fever with a wet towel makes use of the cooling effect of evaporation.

When liquid evaporates, some liquid molecules in the liquid escape.

Which molecules escape?

- A the molecules at the bottom of the liquid with less energy than others
 B the molecules at the bottom of the liquid with more energy than others
 C the molecules at the top with more energy than others
 D the molecules at the top with less energy than others
- 19 A loudspeaker produces a sound that is too soft. The loudspeaker is adjusted so that it produces a louder sound of the same pitch.
 What happens to the amplitude and frequency of the sound when the loudspeaker is adjusted?

	amplitude	frequency
A	becomes greater	stays the same
B	becomes smaller	stays the same
C	stays the same	becomes greater
D	stays the same	becomes smaller

- 20 An observer hears a clap of thunder 3.0 s after seeing the flash of lightning.
 The speed of sound in air is 330 m / s.
 How far from the observer was the lightning?
 A 110 m B 495 m C 990 m D 1980 m

- 21 What are the lowest and highest frequencies of sound that a human being with normal hearing can hear?

	lowest frequency	highest frequency
A	2.0 Hz	2.0 kHz
B	2.0 Hz	20 000 Hz
C	20 Hz	20 kHz
D	20 kHz	20 000 kHz

22 Which of the following shows the correct arrangement of electromagnetic waves in increasing order of wavelength?

- A Radio wave, Infrared, X-ray, Microwave, Gamma ray
- B Radio wave, Microwave, Infrared, X-ray, Gamma ray
- C Gamma ray, Infrared, X-ray, Microwave, Radio wave
- D Gamma ray, X-ray, Infrared, Microwave, Radio wave

23 Which two types of electromagnetic radiation are both used to kill cancerous cells and to detect cracks in metals?

- A Gamma rays and X-rays
- B Microwaves and Ultraviolet radiation
- C Ultraviolet radiation and X-rays
- D Gamma rays and Microwaves

24 Which statement about infrared radiation is correct?

- A Infrared radiation is a longitudinal wave.
- B In a vacuum, infrared radiation travels at the speed of light.
- C Infrared radiation has a higher frequency than ultraviolet radiation.
- D White surfaces are better emitters of infrared radiation than black surfaces.

25 A thin converging lens of focal length 15 cm forms a real, inverted and magnified image of an object at a distance u from the lens.

What are the possible values of u ?

- I. 15 cm
- II. 20 cm
- III. 25 cm
- IV. 30 cm

- A I and II
- B II and III
- C I, II and III
- D III and IV

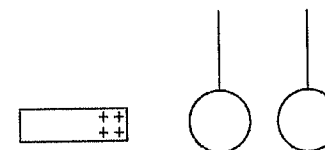
26 Plastic and wool are insulating materials.

Samples of plastic and wool are rubbed together. This causes a transfer of electrons.

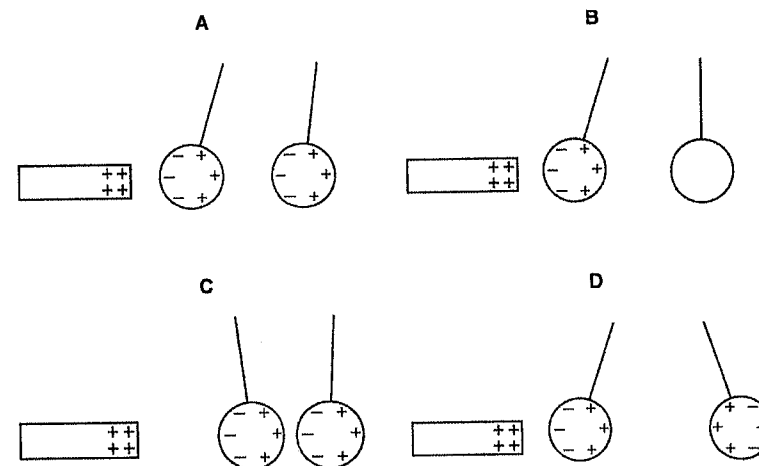
Which row shows the direction of electron transfer and the final charge on both materials?

	plastic	wool	final charge on plastic	final charge on wool
A	gains electrons	loses electrons	neutral	positive
B	gains electrons	loses electrons	negative	positive
C	loses electrons	gains electrons	negative	positive
D	loses electrons	gains electrons	positive	neutral

27 Two uncharged metal spheres, not touching one another, are suspended by means of a cotton thread. A positively charged rod is brought near to the spheres.

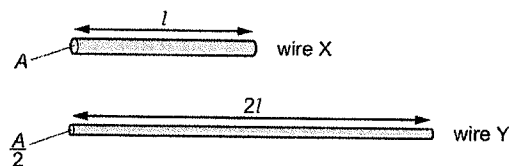


Which diagram shows what happens to the spheres?



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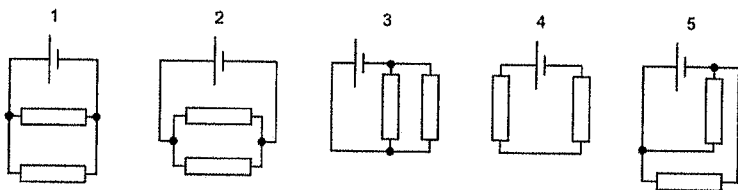
- 28 A copper wire X has resistance R . Another copper wire Y has twice the length and half the cross-sectional area of X.



What is the resistance of Y?

- A $R/2$ B R C $2R$ D $4R$

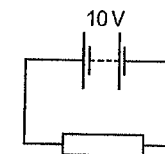
- 29 The diagrams show five electrical circuits. All the resistors are identical.



Which circuits have equal resistance?

- A 1, 2, 3 and 5
B 1, 2, 4 and 5
C 1, 3, 4 and 5
D 2, 3, 4 and 5
- 30 A potential difference of 4.0 V produces a current of 3.0 A in a resistor.
How much energy is transferred to the internal store in 10 s ?
- A 12 J B 30 J C 40 J D 120 J

- 31 A battery of electromotive force (e.m.f.) 10 V is connected to a resistor.

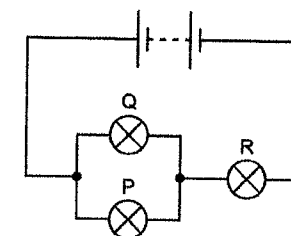


A charge of 2.0 C passes through the resistor.

How much work is done as the charge passes through the resistor?

- A 0.20 J B 2.0 J C 5.0 J D 20 J

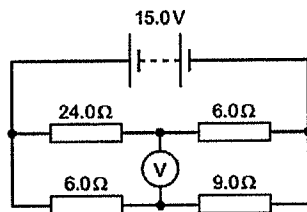
- 32 Three identical filament lamps P, Q and R are connected to a battery of negligible internal resistance, as shown.



The filament wire in lamp Q breaks so that it no longer conducts. What are the changes in the brightness of lamps P and R?

	lamp P	lamp R
A	brighter	brighter
B	brighter	dimmer
C	dimmer	brighter
D	dimmer	dimmer

- 33 A circuit consists of a battery, a high-resistance voltmeter and four fixed resistors, as shown. The battery has an electromotive force (e.m.f.) of 15.0 V and negligible internal resistance.



What is the reading on the voltmeter?

- A 3.0 V B 6.0 V C 9.0 V D 12.0 V

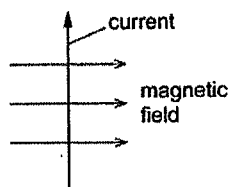
- 34 A 100 W lamp is switched on for five hours each day for three weeks.

The cost of one unit of electricity is \$0.24.

How much does it cost to run the lamp for this time?

- A \$0.36 B \$0.84 C \$2.52 D \$36.00

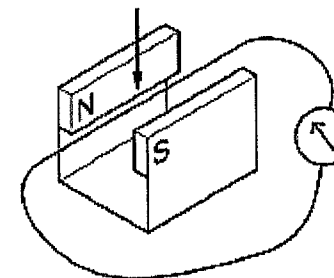
- 35 The diagram shows a wire carrying a current in a magnetic field.



What is the direction of the force on the wire?

- A left to right
B right to left
C into the page
D out of the page

- 36 A wire is moved in a direction perpendicular to the magnetic field.



Three changes are suggested.

1. The speed of the movement of the wire is increased.
2. The strength of the magnetic field is decreased.
3. The direction of the magnetic field is reversed.

Which change(s) increase(s) the electromotive force (e.m.f.) induced in the wire?

- A 1 and 3 B 1 only C 2 and 3 D 3 only

- 37 Electrical power cables transmit electrical energy over large distances using high-voltage, alternating current.

What are the advantages of using a high voltage and of using an alternating current?

	advantage of using a high voltage	advantage of using an alternating current
A	high current is produced in the cable	the resistance of the cable is reduced
B	high current is produced in the cable	the voltage can be changed using a transformer
C	less energy is wasted in the cable	the resistance of the cable is reduced
D	less energy is wasted in the cable	the voltage can be changed using a transformer

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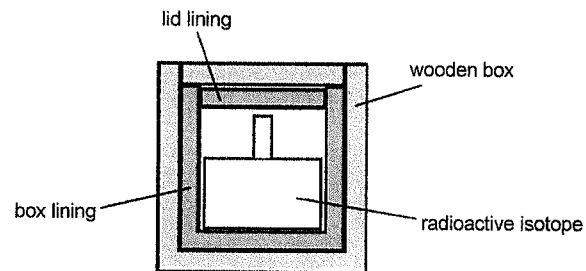
- 38 A nucleus consists of 90 protons and 144 neutrons.

This nucleus emits two beta particles followed by an alpha particle.

Which of the following shows the number of protons and neutrons in the new nuclide formed?

- A 86 protons and 140 neutrons
 - B 86 protons and 142 neutrons
 - C 90 protons and 140 neutrons
 - D 90 protons and 142 neutrons
- 39 Which statement about nuclear fusion is correct?
- A Nuclear fusion occurs at low temperatures.
 - B Nuclear fusion occurs between heavy nuclei.
 - C Nuclear fusion occurs in the formation of many stars.
 - D Nuclear fusion powers most electricity generating power stations.

- 40 Radioactive isotopes that emit alpha-particles, beta-particles and gamma rays are stored in wooden boxes that are lined with a material that prevents most of the radiation from escaping from the box.



Which material is used for the lining of the lid and box?

- A lead
- B copper
- C aluminium
- D iron

[Turn over

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Prelim Physics 6091 2025 P1 Mark Scheme

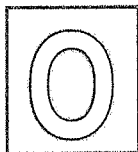
1	2	3	4	5	6	7	8	9	10
D	C	A	B	A	A	D	B	C	C
11	12	13	14	15	16	17	18	19	20
A	A	D	B	D	B	B	C	A	C
21	22	23	24	25	26	27	28	29	30
C	D	A	B	B	B	A	D	A	D
31	32	33	34	35	36	37	38	39	40
D	B	B	C	C	B	D	C	C	A

33



中正中学 义顺

CHUNG CHENG HIGH SCHOOL (YISHUN)



2025 Preliminary Examination
Secondary Four (Express)

CANDIDATE NAME

CLASS

INDEX NUMBER

PHYSICS

6091/01

Paper 1 Multiple Choice

27 August 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and index number in the spaces at the top of this page and on the OTAS provided.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers, **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in soft pencil on the separate OTAS.

Read the instructions on the OTAS very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this question paper.

The use of an approved scientific calculator is expected, where appropriate.

2

1 For which quantity is the magnitude a reasonable estimate?

	quantity	magnitude
A	diameter of an atom	50 μm
B	Earth's gravitational field strength	9.0 N/kg
C	refractive index of glass	0.93
D	wavelength of radio waves	5.0 m

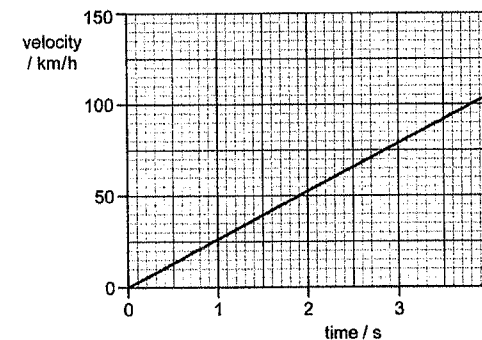
2 Which expression with only SI base units is equivalent to the newton?

- A** J/m **B** kg m/s^2 **C** $\text{kg m}^2/\text{s}$ **D** $\text{kg m}^2/\text{s}^2$

3 Which group of quantities contains only vectors?

- A** acceleration, displacement, speed
B acceleration, gravitational field strength, work done
C displacement, force, velocity
D gravitational field strength, force, power

4 The variation of velocity with time of a car is shown in the diagram.



What is the acceleration of the car?

- A** 190 m/s^2 **B** 53 m/s^2 **C** 26 m/s^2 **D** 7.3 m/s^2

- 5 On Mars, the gravitational field strength is 38% of that on Earth.

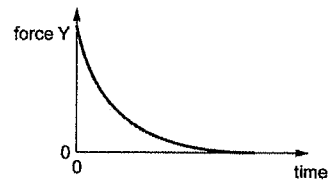
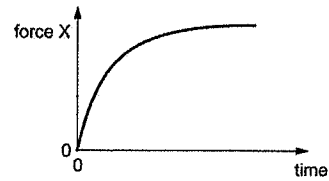
A body has a mass of 2.5 kg and weight of 25 N on Earth.

What are the mass and weight of this body on Mars?

	mass on Mars / kg	weight on Mars / N
A	0.95	9.5
B	0.95	66
C	2.5	9.5
D	2.5	66

- 6 A ball falls from rest through air and eventually reaches terminal velocity.

For this fall, forces X and Y acting on the ball vary with time as shown.

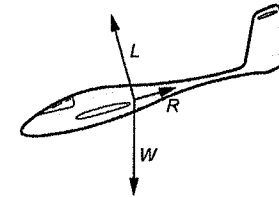


What are forces X and Y?

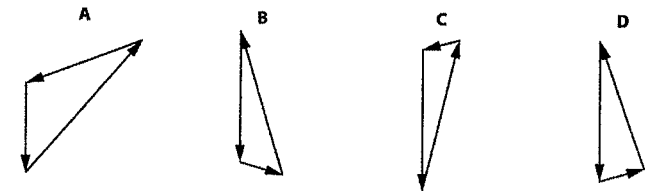
	force X	force Y
A	air resistance	resultant force
B	air resistance	weight
C	resultant force	air resistance
D	resultant force	weight

- 7 A model plane is descending at constant speed at an angle to the horizontal.

The diagram shows the directions of the lift L , air resistance R and weight W acting on the plane.



Which vector diagram could represent the forces acting on the glider?



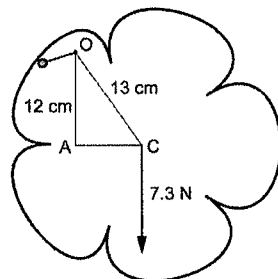
- 8 A book rests on a table.

What is the reaction to the weight of the book?

- A the pull of the book by the Earth
- B the pull of the Earth by the book
- C the push of the book on the table
- D the push of the table on the book

5

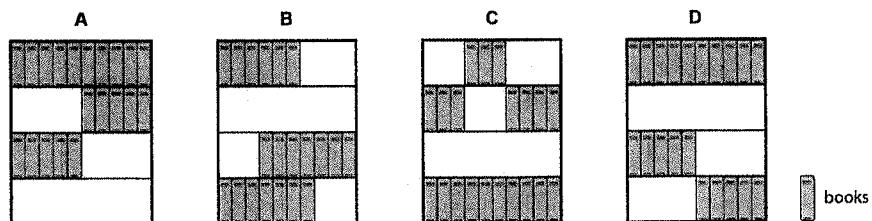
- 9 A piece of cardboard with uniform thickness is freely suspended from point O, where $OC = 13\text{ cm}$.
The weight of the cardboard is 7.3 N and its centre of gravity is at C.



When the lamina is displaced to the position with $OA = 12\text{ cm}$, what is the moment of the force (due to the weight) about point O that causes the lamina to swing?

- A 7.3 Ncm anticlockwise
B 37 Ncm clockwise
C 88 Ncm clockwise
D 95 Ncm anticlockwise

- 10 Similar sets of books are placed in identical bookcases.



Which bookcase is most likely to fall backward if pushed slightly from the front?

6

- 11 A volume of 1.5 m^3 of water is mixed with 0.50 m^3 of alcohol. The density of water is 1000 kg/m^3 and the density of alcohol is 800 kg/m^3 .

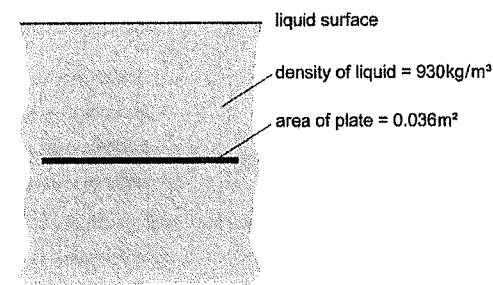
The volume of the mixture is 2.0 m^3 .

What is the density of the mixture?

- A 850 kg/m^3 B 900 kg/m^3 C 940 kg/m^3 D 950 kg/m^3

- 12 A horizontal plate of area 0.036 m^2 is placed beneath the surface of a liquid of density 930 kg/m^3 .

The force acting on the plate due to the pressure of the liquid is 290 N .



The gravitational field strength is 10 N/kg .

The effect of atmospheric pressure is negligible.

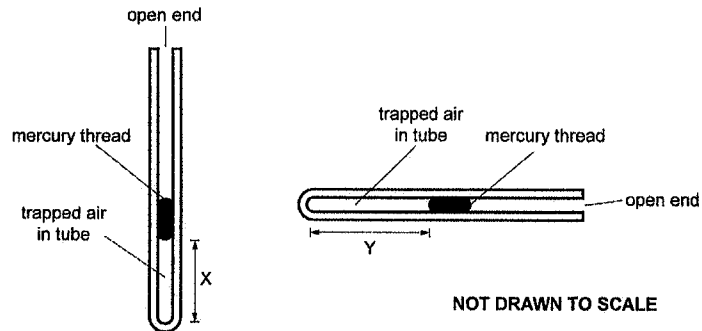
What is the depth of the plate beneath the surface of the liquid?

- A 0.87 m B 1.13 m C 8.7 m D 9.1 m

- 13 A thin tube contains a short thread of mercury, trapping a column of air at one end. The other end of the tube is open to the atmosphere.

When the tube is held vertically, the length of the trapped air column is X .

When the tube is placed horizontally, the length of the trapped air column is Y .



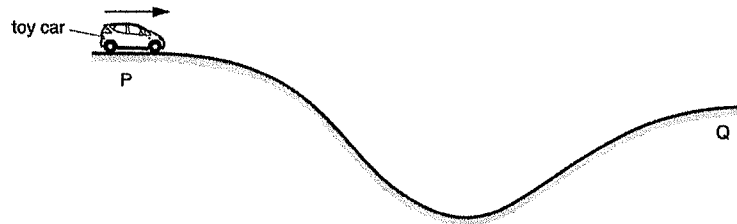
Which statement correctly describes the relationship between lengths X and Y ?

- A X may be greater or smaller than Y , depending on atmospheric pressure.
- B X is always greater than Y , due to increased pressure from the mercury thread.
- C X is always smaller than Y , due to increased pressure from the mercury thread.
- D X is always equal to Y , as atmospheric pressure remains constant.

- 14 A toy car travels from P to Q along a track. P is higher than Q .

At P , the car has 8.0kJ of energy in its kinetic store.

At Q , its gravitational potential store has 35kJ less energy than that at P .

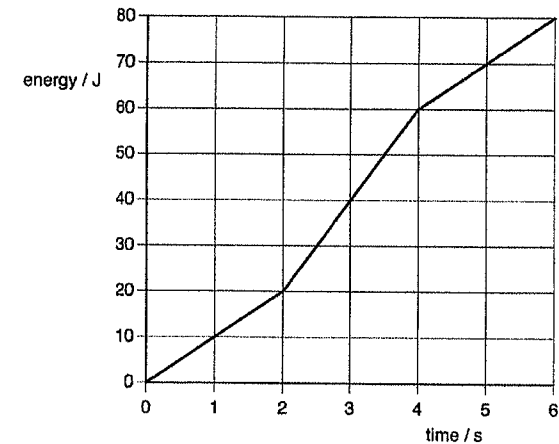


Between P and Q , 10kJ of work is done against friction.

What is the minimum energy in the car's kinetic store at Q ?

- A 33kJ
- B 45kJ
- C 53kJ
- D 65kJ

- 15 An electrical heater is turned on at time zero. The total thermal energy transferred by the heater during the first 6 seconds is shown in the graph.



What is the maximum power output of the heater at any instant during these 6 seconds?

- A 10W
- B 20W
- C 30W
- D 40W

- 16 What are the energy changes in nuclear power production?

- A chemical $\rightarrow$ thermal $\rightarrow$ electrical
- B electrical $\rightarrow$ thermal $\rightarrow$ nuclear
- C nuclear $\rightarrow$ chemical $\rightarrow$ electrical
- D nuclear $\rightarrow$ thermal $\rightarrow$ electrical

- 17 When energy is continuously removed from the thermal store of a substance at a steady rate, its temperature decreases but occasionally remains constant for a period of time.

What is happening to the substance when its temperature remains constant temporarily?

- A The substance is losing thermal energy faster.
- B The substance is undergoing a change in physical state.
- C The substance is experiencing an increase in internal energy.
- D The substance has reached thermal equilibrium with its surroundings.

- 18 Why does the pressure inside a sealed container of gas increase when the gas is heated?
- A The gas molecules collide more frequently with each other.
 - B The gas molecules expand when heated.
 - C The gas molecules move faster and collide with the walls of the container more frequently.
 - D There are more gas molecules present to collide with the walls of the container.

- 19 What is meant by the *internal energy* of an object?

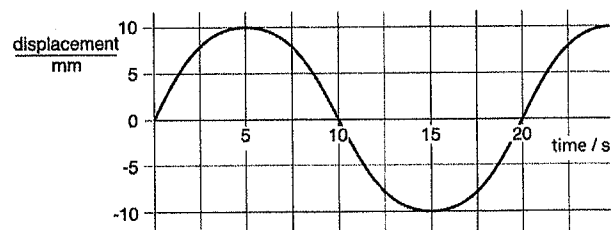
- A The energy related to the object's motion through space.
- B The energy due to the random motion of molecules in the object.
- C The energy arising from the forces of attraction between the molecules.
- D The total of all the kinetic and potential energies of the molecules in the object.

- 20 A 0.10 kg block of copper requires 1160 J of thermal energy to increase its temperature from 10°C to 40°C.

What is the numerical value of the ratio $\frac{\text{specific heat capacity of copper}}{\text{heat capacity of the copper block}}$?

- A $\frac{1}{30}$ B $\frac{1}{10}$ C 10 D 30

- 21 The graph shows how the displacement of a particle in a wave varies with time.



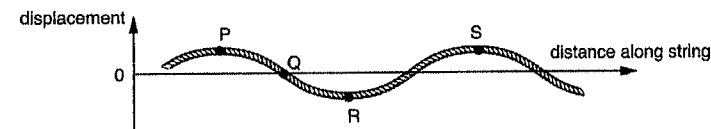
The wave has an amplitude of

- A 10 mm and could be either transverse or longitudinal.
- B 10 mm and must be transverse.
- C 20 mm and could be either transverse or longitudinal.
- D 20 mm and must be transverse.

- 22 The diagram shows the shape of part of a transverse wave travelling along a rope at a particular instant.

P, Q, R and S are four different points on the rope.

The wave is travelling towards the right.



Which statement is correct?

- A P and Q are moving to the right.
- B P and R are moving downward.
- C Q and R are moving upward.
- D Q and S are moving to the left.

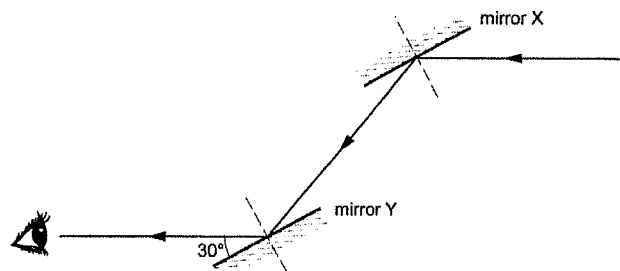
- 23 A radar system sends out a pulse of radio waves which reflects off an aircraft and returns to the receiver after 240 μs.

The speed of radio waves in air is 3.0×10^8 m/s.

What is the distance between the radar and the aircraft?

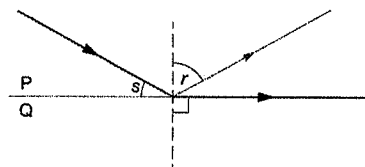
- A 3.6 km B 7.2 km C 36 km D 72 km

- 24 A ray of light is reflected by two parallel plane mirrors X and Y.



Which statement is correct?

- A The angle of incidence at mirror X is 30° .
 B The angle of reflection at mirror X is 60° .
 C The angle of reflection at mirror Y is 30° .
 D The angle of incidence at mirror Y is 120° .
- 25 The diagram shows a ray of light incident on the boundary between two mediums, P and Q. The mediums have different refractive indexes.



Some of the incident light is reflected back into medium P

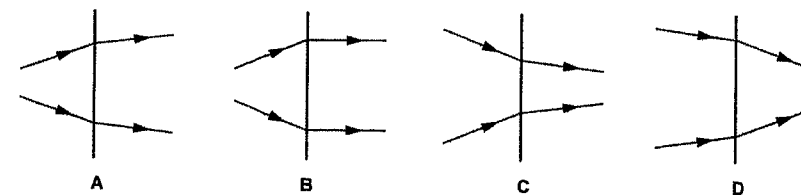
Some light travels exactly along the boundary between the two mediums.

Angle r is greater than angle s .

Which angle is the critical angle, and which medium has the greater refractive index?

	critical angle	medium with greater refractive index
A	r	P
B	r	Q
C	s	P
D	s	Q

- 26 Which diagram show light rays passing through a diverging lens.



- 27 The table shows the wavelengths of five electromagnetic waves.

Which row is correct?

	increasing wavelength →				
A	gamma ray	x-ray	infra-red	microwave	radio wave
B	radio wave	microwave	infra-red	x-ray	gamma ray
C	radio wave	microwave	ultraviolet	infra-red	x-ray
D	x-ray	infra-red	ultraviolet	microwave	radio wave

- 28 When the flash on a camera is used, a charge of 1.2C flows for 0.0025s through the flash lamp.

The average voltage across the flash lamp is 300V .

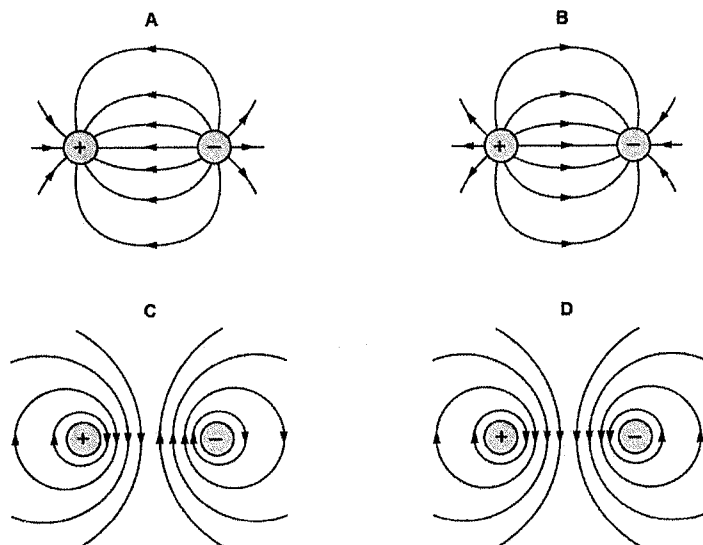
What is the electrical energy and power supplied to the flash lamp?

	energy / J	power / kW
A	300	120
B	300	144
C	360	120
D	360	144

13

29 A positive charge and a negative charge of equal magnitude are placed a short distance apart.

Which diagram best represents the associated electric field?

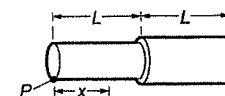


14

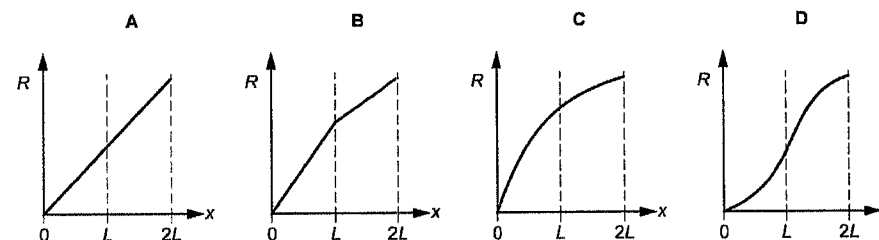
30 A resistor is constructed from two cylindrical metal conductors of identical material.

Each cylinder is of length L and uniform diameter.

The two cylinders are joined end-to-end as shown.



Which graph best shows how the resistance of the resistor varies with distance x from end P?



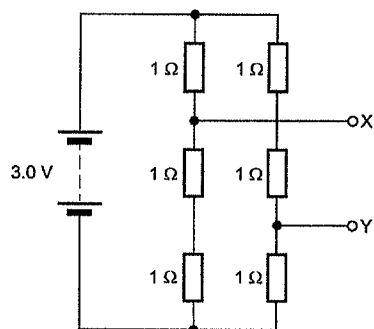
31 Four statements about potential difference and electromotive force are given below:

- 1 It involves converting electrical energy into other forms of energy.
- 2 It involves converting other forms of energy into electrical energy.
- 3 It is the energy per unit charge required to move charge completely around a circuit.
- 4 It is the work done per unit charge by the charge in moving from one point to another.

Which statements describe potential difference, and which describe electromotive force?

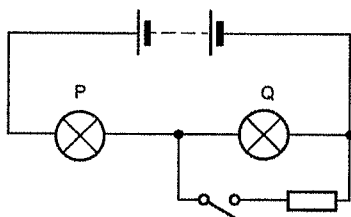
	potential difference	electromotive force
A	1 and 3	2 and 4
B	1 and 4	2 and 3
C	2 and 3	1 and 4
D	2 and 4	1 and 3

32 What is the potential difference between terminals X and Y?



- A 0V B 1.0V C 2.0V D 3.0V

33 Two identical lamps, P and Q, and one resistor are connected in the circuit shown.



Initially, the switch is open and both lamps glow with normal brightness.

What happens to the brightness of lamps P and Q when the switch is closed?

	lamp P	lamp Q
A	brighter	brighter
B	brighter	dimmer
C	dimmer	brighter
D	dimmer	dimmer

34 An electric lamp is marked "230V, 1kW" and is connected to a main circuit with a maximum rating of 30A.

Which fuse rating is most suitable to use in series with the lamp to protect it?

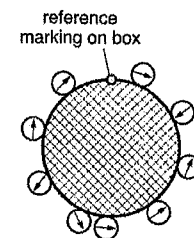
- A 1A B 3A C 7A D 13A

35 Which of the following best describes induced magnetism?

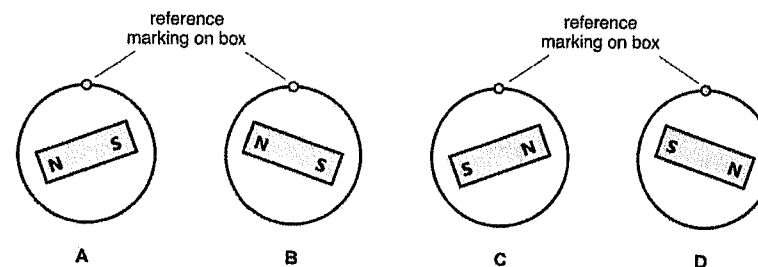
- A A bar magnet attracts a piece of soft iron when placed near to it.
 B A bar magnet loses its magnetism after being repeatedly dropped.
 C A bar magnet aligns itself with the Earth's magnetic field when freely suspended.
 D Two North poles repel each other, while a North pole attracts a South pole.

36 The diagram shows a box containing a hidden bar magnet. A reference marking is made on the surface of the box.

Compasses are placed around the outside of the box, and their needles align as shown in the diagram.

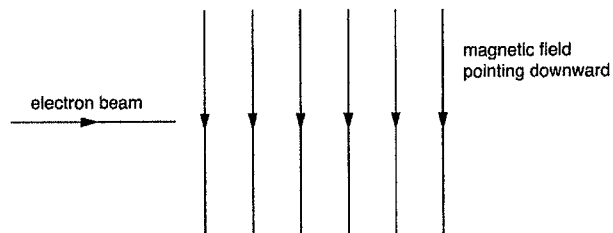


Which diagram best shows the position and orientation of the bar magnet inside the box, relative to the reference mark?



17

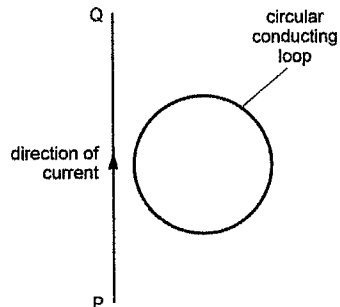
- 37 The diagram shows a beam of electrons about to enter a magnetic field. The direction of the field is downward.



What will be the direction of the deflection, if any, as the beam passes through the field?

- A towards the bottom of the page
- B towards the top of the page
- C into the page
- D out of the page

- 38 A circular conducting loop is placed near a current-carrying straight wire PQ, as shown in the diagram.



Which action will result in an induced current in the circular loop?

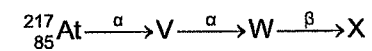
- A Move the circular loop horizontally to the right, increasing its distance from the wire PQ.
- B Move the circular loop vertically downward.
- C Rotate the circular loop anticlockwise around the wire PQ, using the wire as the axis of rotation.
- D Rotate the circular loop clockwise around the wire PQ, using the wire as the axis of rotation.

18

- 39 Which statement about the ionising powers of alpha, beta and gamma radiation is correct?

- A Alpha radiation has the greatest ionising power.
- B Beta radiation has the greatest ionising power.
- C Gamma radiation has the greatest ionising power.
- D Alpha, beta and gamma radiation have equal ionising powers.

- 40 The following represents a sequence of radioactive decays involving two α -particles and one β -particle.



What is nuclide X?

- A ${}_{85}^{213}\text{At}$
- B ${}_{77}^{215}\text{Ir}$
- C ${}_{82}^{209}\text{Pb}$
- D ${}_{81}^{217}\text{Tl}$

End of Paper

MARK SCHEME
2025 END-OF-YEAR
SECONDARY FOUR EXPRESS
PHYSICS 6091

Paper 1 (A1 × 40)

1	2	3	4	5	6	7	8	9	10		
D	B	C	D	C	A	D	B	B	A		
11	12	13	14	15	16	17	18	19	20		
D	A	C	A	B	D	B	C	D	C		
21	22	23	24	25	26	27	28	29	30		
A	C	C	B	A	C	A	D	B	B		
31	32	33	34	35	36	37	38	39	40		
B	B	B	C	A	A	D	A	A	C		[40]

Paper 2

Deduct 1 mark for any mistake in significant figures; however, only 1 mark may be deducted per section in total.

Deduct 1 mark for each wrong or missing unit. If the same unit mistake carries through a question, do not deduct again for it.

Qn	Mark Scheme	Marks	Marks
1	(a) straight line with a constant/uniform slope/gradient.	B1	1
	(b) (i) area under the velocity-time graph when the graph is below x-axis. OR $\frac{1}{2} \times (0.80 - 0.30) \times 5.0$ 1.3 m	B1 A1	2
	(b) (ii) area under the velocity-time graph when the graph is above the x-axis OR	B1	2



CHUA CHU KANG
SECONDARY SCHOOL

O LEVEL PRELIMINARY EXAMINATION 2025
Secondary Four Express

Marks:

40

CANDIDATE
NAME

CLASS

INDEX
NUMBER

PHYSICS

6091/01

Paper 1 Multiple Choice

29 Aug 2025

Additional Materials: Multiple Choice Answer Sheet

1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, index number and class on the Answer Sheet in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

This document consists of 20 printed pages.

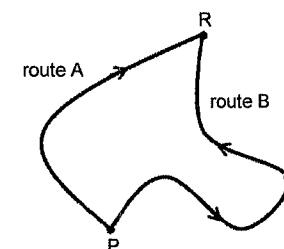
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2

1 Which quantity is not a base quantity?

- A** electric charge
- B** length
- C** mass
- D** temperature

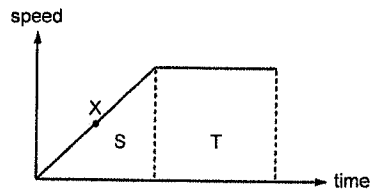
2 Two cars travel from P to R along two routes. One moves along route A while the other along route B. Both cars reach R at the same time.



Which statement about the two cars is correct for the journey from P to R?

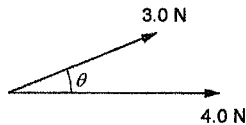
- A** They have the same average speed.
- B** They have the same average velocity.
- C** They have different displacement.
- D** They travel the same distance.

- 3 The graph shows the motion of an object.



Which feature of the graph represents the distance travelled by the object whilst moving at a constant speed?

- A area S
 - B area S + area T
 - C area T
 - D the gradient at point X
- 4 A force of 3.0 N and a force of 4.0 N act at an angle θ to each other on the same object.



The angle θ can vary from 0° to 90° .

What is **not** a possible magnitude of the resultant force?

- A 7.0 N
- B 6.0 N
- C 5.0 N
- D 1.0 N

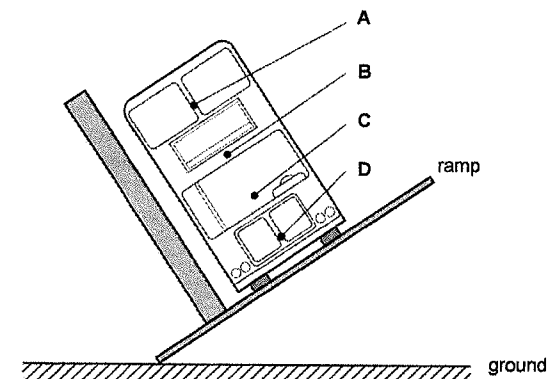
- 5 The weight of a rock on Venus is less than its weight on Earth.

How do the mass of the rock and gravitational field strength on Venus compare with their respective values on Earth?

	mass of rock	gravitational field strength
A	smaller	smaller
B	smaller	zero
C	same	smaller
D	same	same

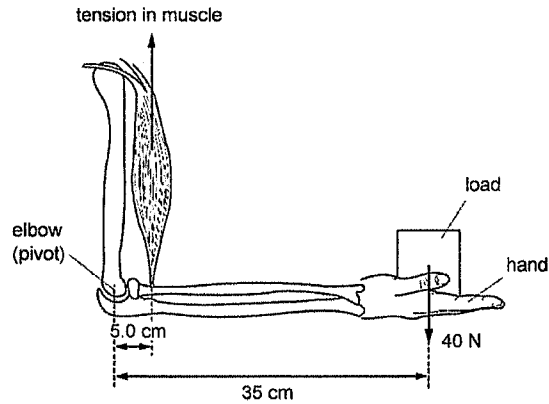
- 6 Which of the following is not an example of an action-reaction pair?
- A A student pulling a bag forward, and the bag pulling the student backwards.
 - B Weight of a book resting on the table, and the normal contact force the table exerts on the book.
 - C Driving wheel of a bicycle exerting friction on the road, and the road exerting friction on the wheel.
 - D Earth pulling a skydiver with gravitational force, and the skydiver pulling Earth with a gravitational force.
- 7 The stability of a bus is tested by tilting it on a ramp. The diagram shows a bus that is just about to topple over.

Where is the centre of gravity of the bus?



5

- 8 The diagram shows the muscle and bones in a person's arm. The hand holds a load of weight 40 N. The elbow acts as a pivot and the tension in the muscle keeps the lower part of the arm horizontal.

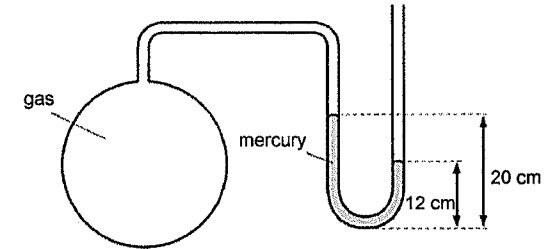


What is the tension in the muscle due to the load?

- A 200 N
B 240 N
C 280 N
D 1 400 N

6

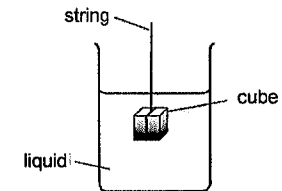
- 9 The diagram shows a mercury manometer used to measure the pressure of gas in a container. Atmospheric pressure is 76 cm of mercury.



What is the pressure of the gas?

- A 56 cm of mercury
B 68 cm of mercury
C 84 cm of mercury
D 96 cm of mercury

- 10 The diagram shows a cube suspended on a string under the surface of a liquid. The cube experiences a pressure caused by the liquid.



What would increase the pressure acting on bottom surface of the cube?

- A using a liquid with a lower density
B lowering the cube deeper into the liquid
C increasing the mass of the cube
D decreasing the bottom surface area of the cube

- 11 Soaring at a height of 226 m, Swissotel has been the site for Asia's most gruelling Vertical Marathon. In 2013, Australia's Mark Bourne won the Men's Open category in a remarkable 6 minutes 51 seconds.

Taking his weight to be 650 N, calculate the power developed by Bourne in his ascent.

- A 23 W
B 36 W
C 360 W
D 23 000 W
- 12 A boy climbs slowly at a constant speed to the top of a small hill.
- What is the main energy transfer taking place as the boy climbs?
- A internal store to kinetic store of energy
B chemical potential store to kinetic store of energy
C kinetic store to gravitational potential store of energy
D chemical potential store to gravitational potential store of energy
- 13 Smoke particles in a transparent box are observed using a microscope. A small point of light is seen to move around as shown.



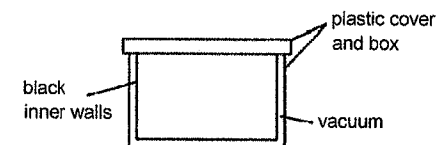
What does this experiment demonstrate about air molecules?

- A They are in continuous random motion.
B They can be seen through a microscope.
C They move more quickly when they are heated.
D They move because of collisions with smoke particles.

- 14 A gas is trapped in a sealed container. The volume of the container is kept constant as the gas is heated.

What happens to the gas particles?

- A They expand.
B They get further apart.
C They move more quickly.
D They collide with the container walls less frequently.
- 15 The diagram shows the cross-section of a plastic container that a manufacturing company has created.



The company claims that the container can keep food warm for a duration that surpasses other brands of container. It offers the following explanations to justify their claims:

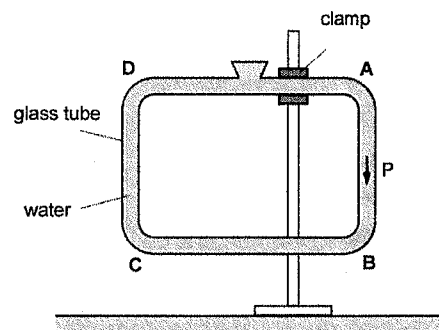
1. The plastic container will reduce heat loss through conduction as plastic is a poor conductor of heat.
2. The black inner walls will absorb heat from the environment to keep food warm since black surfaces are good absorbers of heat.
3. The vacuum between the interior and exterior walls of the container will prevent heat losses to the surroundings through conduction, convection and radiation.

Which of the statement(s) is/are correct?

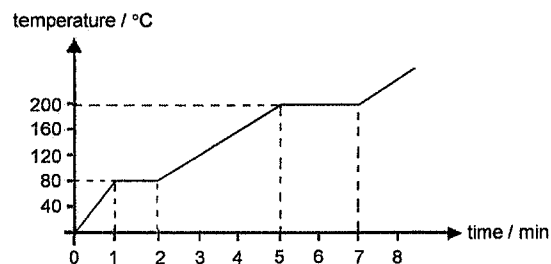
- A 1 only
B 1 and 2 only
C 2 and 3 only
D 1, 2 and 3

- 16 The diagram shows a glass tube filled with water and suspended above a bench. The water is free to circulate around the tube. At point P, there is a convection current moving in a downwards direction.

At which point should an ice pack be placed in order to set up this convection current?



- 17 A substance at solid state is heated by a constant heat source. The graph shows the change of temperature of 2.0 kg of the substance when a 1500 W heater is used.



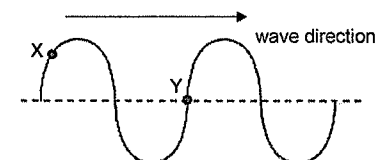
What is the specific latent heat of vapourisation of the substance?

- A 1 500 J/kg
B 3 000 J/kg
C 45 000 J/kg
D 90 000 J/kg

- 18 Which statement describes two properties of boiling that are different from the properties of evaporation?

- A Boiling occurs at all temperature and throughout the liquid.
B Boiling occurs at a specific temperature and throughout the liquid.
C Boiling occurs at all temperature but only on the surface of the liquid.
D Boiling occurs at a specific temperature but only on the surface of the liquid.

- 19 The diagram shows a transverse wave on a rope. The wave is moving to the right and points X and Y are on the rope.

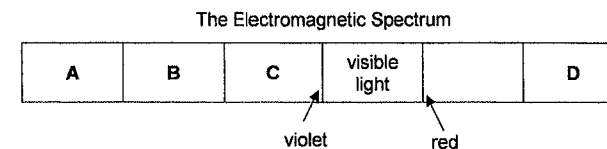


Which of the following describes the direction of motion of the points X and Y at this instant?

	point X	point Y
A	upward	upward
B	downward	downward
C	right	right
D	right	left

- 20 The diagram shows an electromagnetic spectrum. The violet and red ends of the visible spectrum are marked.

Which part of the spectrum can be used to detect counterfeit notes?

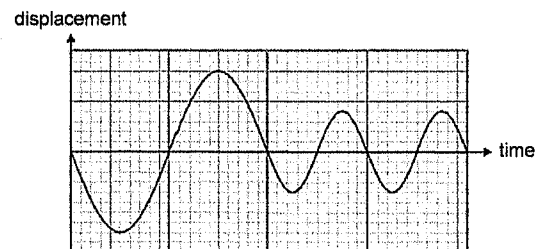


- 21 X-rays are one type of electromagnetic radiation.

Which row is correct for X-rays?

	type of wave	speed of wave in vacuum
A	longitudinal	340 m/s
B	longitudinal	3.0×10^8 m/s
C	transverse	340 m/s
D	transverse	3.0×10^8 m/s

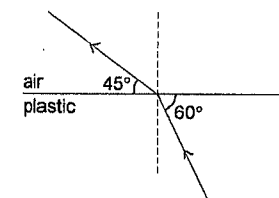
- 22 The displacement-time graph shows how a sound wave changes with time.



Which row shows the change in loudness and pitch of the sound wave?

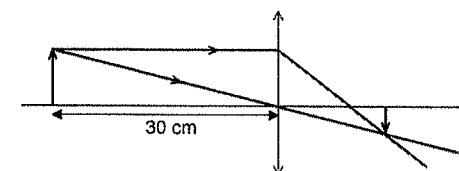
	loudness	pitch
A	decreases	no change
B	decreases	increases
C	increases	decreases
D	increases	increases

- 23 The diagram shows a ray of light moving from plastic into air.



What is the refractive index of plastic?

- A 0.71
B 0.82
C 1.2
D 1.4
- 24 The diagram shows an object placed 30 cm in front of a thin converging lens, which is used to form a real image in a camera.



What is a possible focal length of this lens?

- A 10 cm
B 15 cm
C 30 cm
D 60 cm

- 25 When a plastic rod is rubbed with a dry cloth, the rod gains electrons from the cloth.

What is the final charge on the rod and on the cloth?

	charge on rod	charge on cloth
A	negative	negative
B	negative	positive
C	positive	negative
D	positive	positive

- 26 A student is tasked to charge a metal ball by induction using a strip of polythene. His teacher gives him four cards of instructions.

1

The metal ball is earthed momentarily.

2

The polythene strip is brought up to the ball.

3

The polythene strip is removed.

4

The polythene strip is rubbed with a woollen cloth.

How should the student arrange the order of these cards to perform his task correctly?

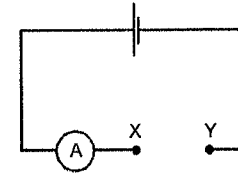
- A 2 → 3 → 4 → 1
 B 2 → 4 → 3 → 1
 C 4 → 1 → 2 → 3
 D 4 → 2 → 1 → 3

- 27 A current of 3.0 A flows through a resistor.

What is the total amount of charges passing through it in 2.0 minutes?

- A 0.025 C
 B 1.5 C
 C 6.0 C
 D 360 C

- 28 The diagram shows an incomplete circuit.

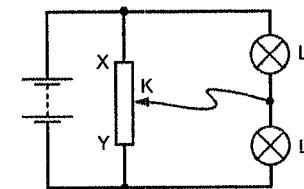


Four wires of different length and thickness are connected in turn between point X and point Y. All four wires are made of the same metal.

Which wire will cause the greatest reading on the ammeter?

- A long and thick wire
 B long and thin wire
 C short and thick wire
 D short and thin wire

- 29 The diagram shows a potential divider circuit with two identical light bulbs L_1 and L_2 .

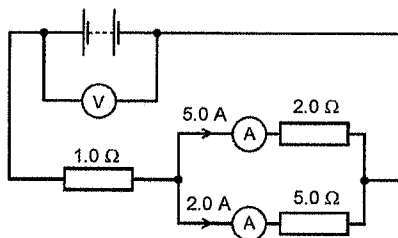


The contact K is halfway between X and Y and the two light bulbs are equally bright.

What will happen to the brightness of L_1 and L_2 when contact K is moved towards X?

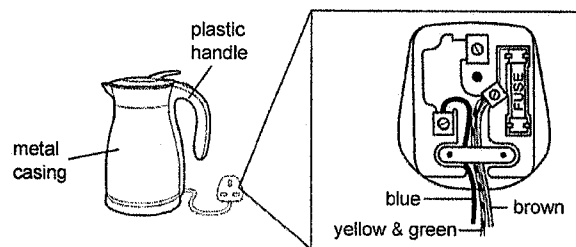
	brightness of L_1	brightness of L_2
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

- 30 The circuit diagram shows a $1.0\ \Omega$ resistor connected in series with a parallel arrangement of a $2.0\ \Omega$ resistor and a $5.0\ \Omega$ resistor. The current readings for the parallel arrangement are shown.



What is the reading on the voltmeter?

- A 1.0 V
B 10 V
C 15 V
D 17 V
- 31 An electric kettle has a plastic handle and a metal casing. The plug of the electric kettle is wrongly wired, and a magnified view is as shown.



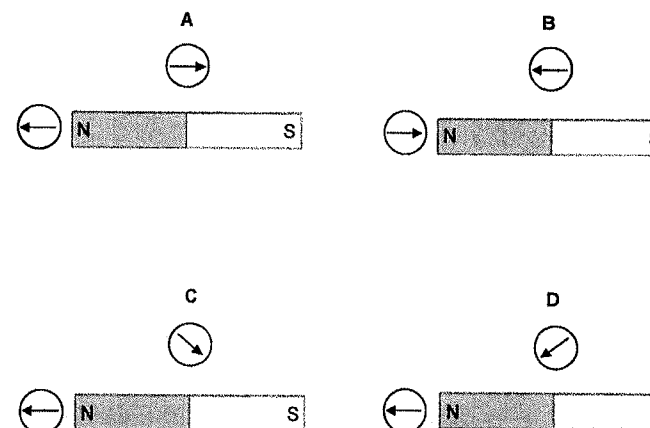
What is the effect of using the plug wired this way?

- A The electric kettle does not work.
B The electric kettle catches fire.
C The fuse in the plug blows.
D The metal casing becomes live.

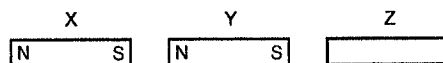
- 32 What is the purpose of a fuse in a circuit and where is it wired?

	purpose	wired
A	to protect the wires from overheating	in the earth wire
B	to protect the wires from overheating	in the live wire
C	to protect the user from electric shock	in the earth wire
D	to protect the user from electric shock	in the live wire

- 33 Which of the following correctly shows the directions of the plotting compasses placed around a bar magnet?



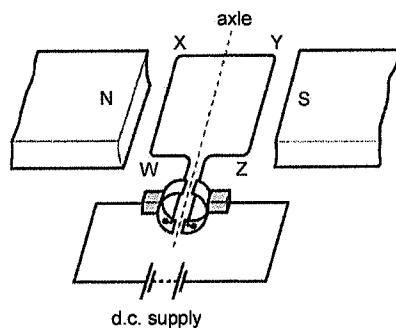
- 34 The diagram shows three bars placed in a line. X and Y are both magnets. Z is a soft iron.



What are the magnetic forces on X and Z due to magnet Y?

	force on X	force on Z
A	attraction	attraction
B	attraction	repulsion
C	repulsion	attraction
D	repulsion	repulsion

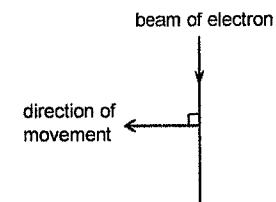
- 35 The diagram shows a simple d.c. motor.



Which statements are correct?

- I A current will flow through the coil in the direction WXYZ.
 II The coil will rotate in a clockwise direction about the axle.
 III The split-ring commutator will reverse the direction of the current every 180°.
- A I and II only
 B I and III only
 C II and III only
 D I, II and III

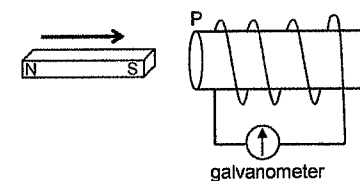
- 36 A beam of electrons travels between the poles of a magnet. The beam starts to move in the direction shown.



Which is the direction of magnetic field?

- A towards left
 B towards right
 C into the paper
 D out of the paper

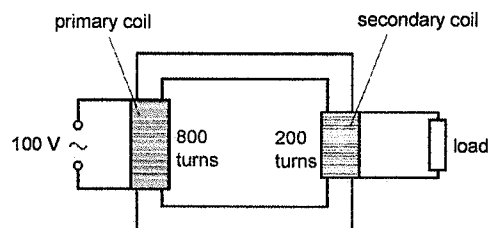
- 37 The diagram shows a permanent magnet approaching a solenoid at a constant speed.



What is the polarity of the solenoid at P and the direction of the deflection in the galvanometer.

	polarity of solenoid at P	direction of the deflection in galvanometer
A	north pole	to the right
B	north pole	to the left
C	south pole	to the right
D	south pole	to the left

- 38 The diagram shows an ideal transformer. An alternating current supply of 100 V is supplied to the primary coil and a current of 0.50 A flows through it.



What is the potential difference across the load and the current flowing through it?

	potential difference / V	current / A
A	50	2.0
B	50	1.0
C	25	2.0
D	25	1.0

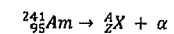
- 39 A neutral atom of an isotope has the nuclide notation ${}_{36}^{84}\text{Kr}$.

Which statement is correct?

- A There are 48 protons in the nucleus of the atom.
- B There are 45 neutrons in the nucleus of the atom.
- C There are 36 electrons in the nucleus of the atom.
- D There are 12 more neutrons than electrons in the atom.

- 40 Americium-241 is a radioactive nuclide used in smoke detectors. It undergoes α -decay to form nuclide X.

This decay may be represented by the equation shown.



What are the values of A and Z?

	A	Z
A	237	93
B	239	91
C	241	94
D	241	96

4E Physics 6091 CCKSS Prelims 2025

Paper 1 Marking Scheme

Question	Answer	Question	Answer	Question	Answer	Question	Answer
1	A	11	C	21	D	31	D
2	B	12	D	22	B	32	B
3	C	13	A	23	D	33	A
4	D	14	C	24	A	34	A
5	C	15	A	25	B	35	B
6	B	16	A	26	D	36	C
7	C	17	D	27	D	37	D
8	C	18	B	28	C	38	C
9	B	19	B	29	B	39	D
10	B	20	C	30	D	40	A

Candidate Name	Class	Register Number
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CHANGKAT CHANGI SECONDARY SCHOOL

Preliminary Examination 2025

Subject : Physics
Paper No. : 6091 / 01
Level : Secondary 4 Express
Date : 3 September 2025
Duration : 1 hour
Setter : Mr. Lee Chin Teck

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your name, class and register number in the spaces at the top of this page.

MULTIPLE CHOICE QUESTIONS [40 MARKS]

Answer all questions. Shade the correct answer in pencil on the OTAS sheet provided.

Use gravitational field strength on Earth, $g = 10 \text{ m/s}^2$ or 10 N/kg for all calculations.

For Examiners' Use	Marks
Paper 1	/ 40
Personal Target	Actual Grade
Parent's / Guardian's signature	

This Question Paper consists of **14** printed pages including the cover page.

[Turn Over]

Answer all the questions. Shade the correct answer in pencil on the OTAS sheet provided.

- 1 A student measures the thickness of a coin using a digital micrometer screw gauge in Fig. 1.1

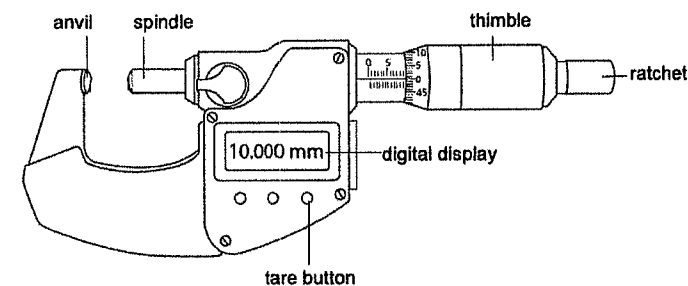


Fig. 1.1

The following steps are carried out.

- Place the coin between the anvil and the spindle.
- Turn the thimble to close the anvil and the spindle.
- Take the reading on the display.
- Close the anvil and spindle. Then, press the tare button to reset the display.
- Turn the ratchet until a "click" is heard.
- Turn the thimble to open the anvil and the spindle.

What is the correct order of the steps?

- A** 4 → 6 → 1 → 2 → 3 → 5
B 4 → 6 → 1 → 2 → 5 → 3
C 6 → 1 → 2 → 5 → 3 → 4
D 6 → 1 → 2 → 5 → 4 → 3

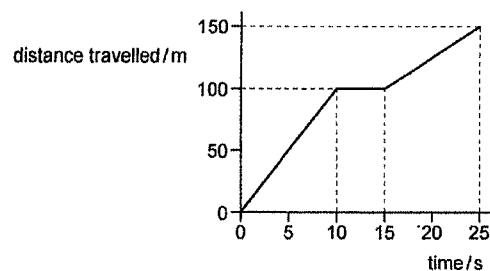
- 2 The resultant force F_R acting on an object is given by, $F_R = ma$, where m is the mass of the object and a is the acceleration of the object.

Which unit is equivalent to the unit for force?

- A** kg m s^2
B $\text{kg m}^2 \text{ s}$
C kg m/s^2
D $\text{kg m}^2/\text{s}^2$

3

- 3 A cyclist takes a ride lasting 25 s and the graph below illustrates the motion of the cyclist as time passes.



Which of the following is an inaccurate description of the motion of the cyclist?

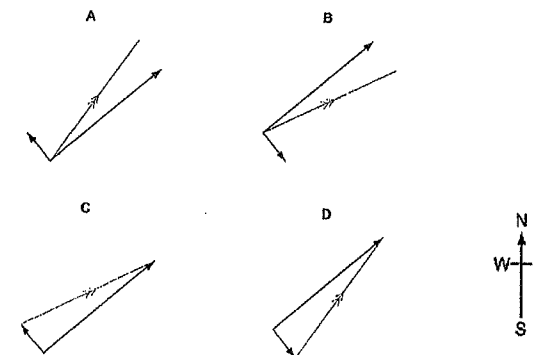
- A The average speed is 21.6 km/h.
 B The cyclist has a slower speed from the 15 to 25 s than when she started from 0 to 5 s.
 C During the period 0-10 s and 15-25 s, the cyclist has zero acceleration.
 D The area under the graph gives the total average distance travelled.
- 4 Two iron balls A and B of the same mass are allowed to fall freely from rest. Ball A falls for 2 seconds while Ball B falls for 4 seconds. If the gravitational acceleration is 10 ms^{-2} , which of the following statements is correct?
- A Ball B falls the same distance as Ball A
 B Ball B falls two times further than Ball A
 C Ball B falls three times further than Ball A
 D Ball B falls four times further than Ball A
- 5 The gravitational field strength of planet Mars is 8 times less than that of Jupiter. An asteroid of mass 200 kg travels from the vicinity of the planet Mars to Jupiter. How do the properties of the asteroid change after it leaves Mars and enters the gravitational field of Jupiter?

	Weight of the asteroid	Velocity of asteroid
A	constant	increasing
B	constant	decreasing
C	increasing	increasing
D	constant	constant

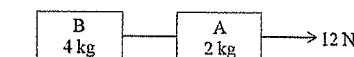
[Turn Over]

4

- 6 Paul was dribbling a soccer ball on the field in a N-E direction when Aaron came from Paul's left to tackle him. Which of the following shows the most accurate resultant direction of the motion of the soccer ball?

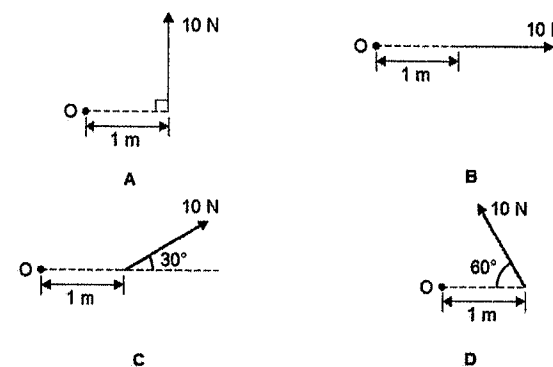


- 7 A force of 12 N acts on block A and block B of mass 2 kg and 4 kg respectively as shown below.

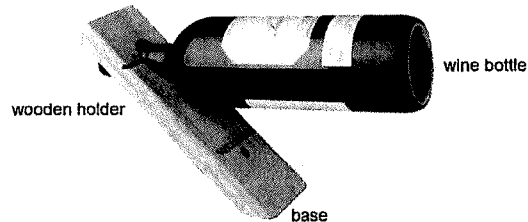


Given that the floor is smooth, what is the tension of the string which is between block A and block B?

- A 2 N B 4 N C 8 N D 12 N
- 8 Which of the following force produces the greatest moment about O?

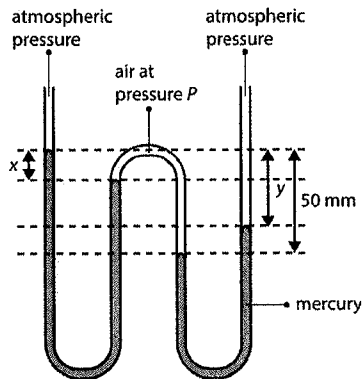


- 9 The diagram below shows a wine bottle placed in a wooden holder. The bottle and the holder are in equilibrium.



Which of the following statements is true about the set-up?

- A The centre of gravity of the bottle is directly above the base of the wooden holder.
 B The centre of gravity of the bottle and that of the wooden holder are at the same point.
 C The centre of gravity of the wooden holder is at the base of the wooden holder.
 D The centre of gravity of the bottle and the wooden holder is directly above the base of the wooden holder.
- 10 The diagram below shows a W-shaped tube containing mercury. Air at pressure P is trapped in the tube. Each of its openings is exposed to the atmosphere pressure. (not drawn to scale)

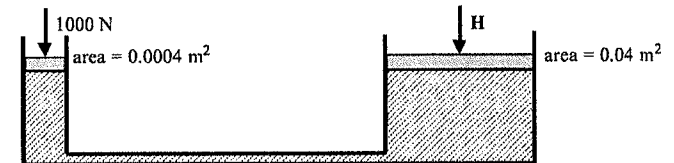


The atmospheric pressure is equal to the pressure that would be exerted by a column of mercury of height 760 mm. Which of the following set of values are correct?

	x / mm	y / mm	Pressure / mm of mercury
A	20	20	780
B	20	30	780
C	30	20	810
D	30	30	790

[Turn Over]

- 11 The hydraulic press below shows a force of 1000 N acting on a small area piston and it can lift a weight at H that is 100 times greater than 1000 N.



Which of the following statements about pressure and forces explain the workings of the hydraulic press?

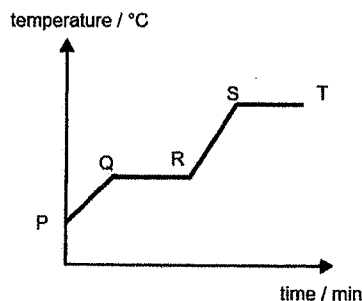
- I Liquid pressure is transmitted equally through the liquid
 II Liquid is compressible and thus pressure is the same
 III Pressure on the small-area piston is equal to the pressure acting on the larger area
 IV The work done by the 1000 N in moving a column of liquid down is equal to pushing up a smaller column of liquid over at H.
- A I and II B I and III C I, III and IV D All of above

- 12 A car is accelerating up Mount Faber, around its meandering road to the hilltop. Which of the following statements best describes the energy conversion by the car engine from the energy in the chemical potential store of the petrol?
- A Energy in the gravitational potential store
 B Energy in the gravitational potential store and in the kinetic store
 C Energy in the kinetic store and work done against friction of the road
 D Energy in the gravitational potential store, energy in the kinetic store and work done against friction of the road.
- 13 A motorized pump raises 0.20 m^3 of water by 5.0 m in 10 minutes. If the efficiency of the pump is 75 %, what is the power input by the motor? Take density of water to be 1000 kg m^{-3} .
- A 12.5 W B 22.2 W C 556 W D 1330 W
- 14 A student investigates the condensation of nitrogen gas at low temperature. Which of the following statements correctly describes the behaviour of the nitrogen gas molecules?
- A The nitrogen molecules contract
 B The nitrogen molecules move freely but at a slower speed
 C The nitrogen molecules occupy a smaller space
 D The nitrogen molecules vibrate about a fixed position
- 15 Which of the following will not affect the rate of energy transfer of a body by radiation?
- A surface area
 B surface material
 C surface temperature
 D colour and texture of a surface

16 During a barbecue, why do we always cook food on top of the charcoal?

- A To increase the rate of energy transfer by conduction
- B To increase the rate of energy transfer by convection
- C To increase the rate of energy transfer by evaporation
- D To increase the rate of energy transfer by radiation

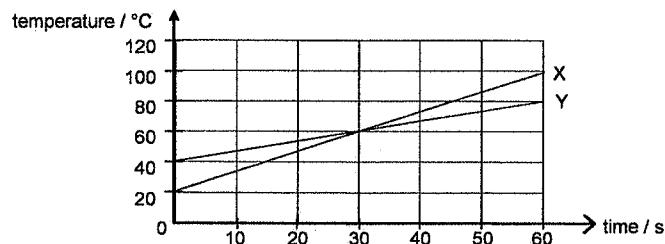
17 A solid substance is placed in a boiling tube and heated steadily. The temperature-time graph of the substance is as shown below.



Which of the following describes accurately the internal energy and/or state of the substance?

- A Both the potential energy and kinetic energy of the molecules increase greatly at PQ
- B The molecules at QR increase in potential energy and overcome intermolecular forces
- C At ST, the substance exists both as a solid and liquid.
- D The total internal energy of the molecules at RS remains constant according to conservation of energy.

18 Two blocks X and Y, which are made of the same metal, are heated by heaters at the same power rating. The variations of temperature with time are given below.

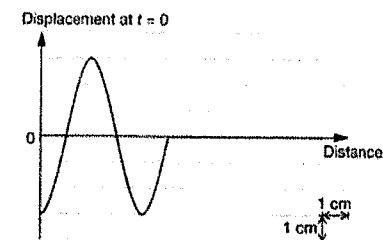


What is the ratio of masses of X to Y?

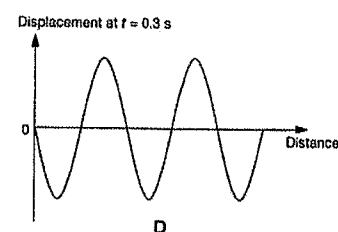
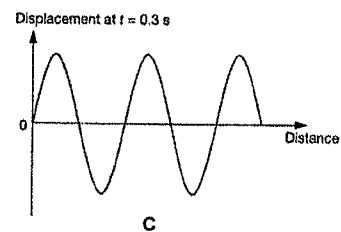
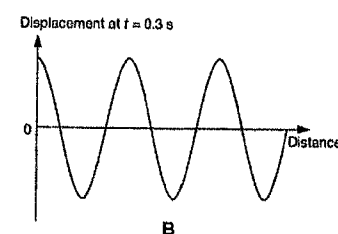
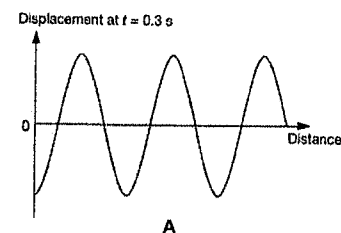
- A 1 : 2
- B 2 : 1
- C 1 : 4
- D 4 : 1

[Turn Over]

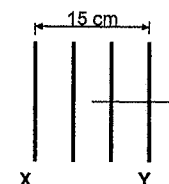
19 The displacement-distance graph of the particles along a travelling transverse wave at $t = 0$ is shown below. The frequency of the wave is 5 Hz.



Which of the following shows the waveform at $t = 0.3$ s?



20 Below shows a water wave travelling in a ripple tank. The wavefront at X travels to Y in 5.0 s.



What is the frequency of the water wave?

- A 0.60 Hz
- B 3.0 Hz
- C 15 Hz
- D 75 Hz

-

What does the speed of sound in air depend on?

- During the Covid-19 pandemic, hospitals employed automated robots that move around the hospital rooms at night to sterilize the equipment as shown below.



48

	EM wave	frequency
A	X-ray	1.18×10^{15} Hz
B	UV ray	1.18×10^{15} Hz
C	Infrared radiation	1.18×10^{13} Hz
D	UV ray	1.18×10^{13} Hz

-

A P and Q **B** P and R **C** Q and R **D** P, Q and R

-

A It moves away from point G towards a point between G and H.
B It moves away from point G towards a point beyond H.
C It remains inverted at point G but becomes bigger.
D It remains inverted at point G but becomes smaller.

-

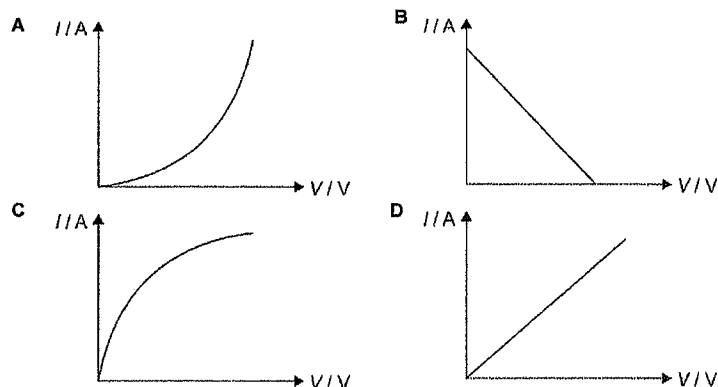
A X and Y will stick to each other as they possess unlike charges
B X and Y will repel each other as they all have excessive positive charges on them
C X and Y will repel each other as they all have excessive negative charges on them
D Nothing will happen as both X and Y are neutral after the earthing

- A** 8 : 1 **B** 4 : 1 **C** 2 : 1 **D** 1 : 1

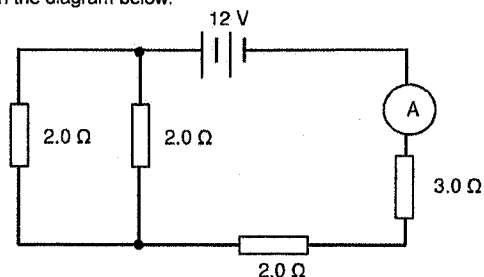
- 28 An accumulator supplies 9600 C in 7200 s to a resistance wire of $18\ \Omega$. What is the work done to move a charge of 1 C through the wire?

A 12.0 J B 21.5 J C 24 J D 230 kJ

- 29 Which of the following I-V graph most likely represents a thermistor?



- 30 A circuit is set up in the diagram below.



What is the ammeter reading of the circuit?

A 0.50 A B 0.67 A C 1.5 A D 2.0 A

- 31 Many domestic hairdryers have no earth wire. Why?

A The casing of the hairdryer is made of metallic material.
 B The current is small
 C The fan prevents the heating coil from becoming too hot
 D The plug is installed with a fuse

- 32 A washing machine has a rating of 240 V and unknown power rating. It was switched on for 2 hours for a particular wash of clothes. The cost of one unit of electricity is \$0.15 and the electricity bill for that wash was \$0.15.

What is the power rating of the washing machine?

A 45 W B 75 W C 500 W D 1000 W

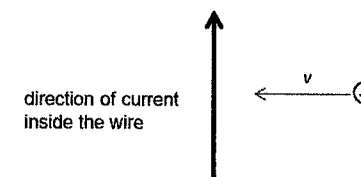
- 33 Which of the following incorrectly describes the characteristics of magnetic field?

A Magnetic field lines are continuous, and they form closed loops
 B Size of the separation between the magnetic field lines indicates the magnetic field strength
 C Direction of the magnetic field line is from the north pole to the south pole
 D Magnetic field lines do not cross each other unless they are within the bar of magnet

- 34 Terry is trying to design a magnetic relay where he can switch on and off a small current to activate a magnetic device to act as a lever to switch on a high-voltage relay. Which material has characteristics that is suitable for his relay?

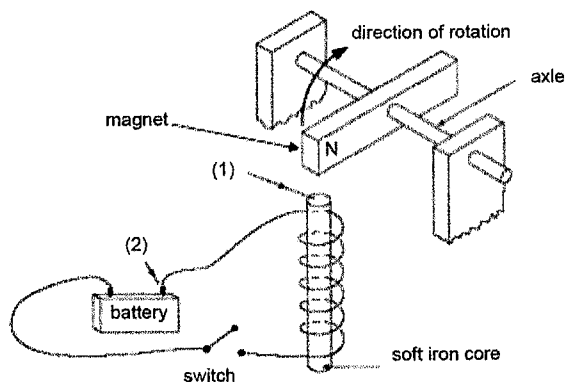
A Steel is suitable as it retains its magnetism to cause a permanent attraction
 B Iron is suitable as it loses its magnetism easily and is a hard magnet
 C Iron is suitable as it gains and loses its magnetism easily
 D Steel is suitable as it is a hard magnet and gains its magnetism slowly

- 35 A positively charged particle is moving at constant velocity and at a right angle towards a straight current-carrying conductor. What happens to the particle as it approaches the conductor?



A It will accelerate towards the wire
 B It will slow down
 C It will be deflected downwards
 D It will be repelled by the wire

- 36 A magnet mounted on an axle is free to spin. When the switch is closed, the magnet spins in the direction shown.



What is the magnetic polarity of the end of the soft iron core marked (1) and the polarity of the battery terminal marked (2)?

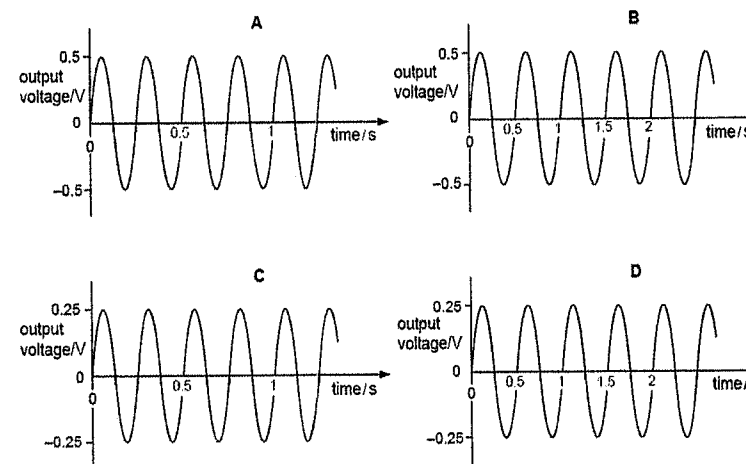
	polarity of soft iron core (1)	polarity of battery (2)
A	North	Negative
B	North	Positive
C	South	Negative
D	South	Positive

- 37 What is the function of the slip ring in an a.c. generator?

- A to ensure the induced current in the coil is transferred to the external circuit
 B to provide the turning effect of coil
 C to reverse the current flowing in the coil in every half-turn
 D to store e.m.f. of the coil

- 38 A girl turns the handle of a small a.c. generator four times each second. The generator produces a maximum output voltage of 0.25 V. She modifies the generator by adding twice the number of coils and now turns it two times each second.

Which of the following shows the output voltage vs time graph of the modified experiment?



- 39 Radioactive dating ^{14}X was used to find the age of a wooden archaeological specimen. Measurements were taken in three situations where the following count rates were obtained.

specimen	count rate
1 g sample of living wood	105 counts per minute
1 g sample of archaeological specimen	35 counts per minute
no sample	25 counts per minute

If the half-life of ^{14}X is known to be 570 years, what was the approximate age of the archaeological specimen?

- A 280 years B 850 years C 1140 years D 1710 years

- 40 The isotope $^{222}_{86}\text{Rn}$ decays in a sequence of emissions to form the isotope $^{206}_{82}\text{Pb}$. It will either emit an α -particle or a β -particle at each stage of the decay sequence.

What is the number of stages in the decay sequence?

- A 20 B 16 C 8 D 4

-- End of paper --

[Turn Over]

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
B	C	D	D	C	B	C	A	D	B
Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
C	D	B	C	B	B	B	A	B	A
Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
C	A	B	C	B	C	A	C	A	D
Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
B	C	D	C	C	A	A	D	D	D

[Turn Over]



CONVENT OF THE HOLY INFANT JESUS SECONDARY
Preliminary Examination in preparation for
the General Certificate of Education Ordinary Level 2025

CANDIDATE
NAME

CLASS

REGISTER
NUMBER

PHYSICS

6091/01

Paper 1 Multiple Choice

03 September 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet (OMR)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and register number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.

Choose the one you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate

2

- 1 A textbook lists the average width of a human hair as 0.0001 m and the distance between the Earth and the Sun as 1.5×10^{11} m.

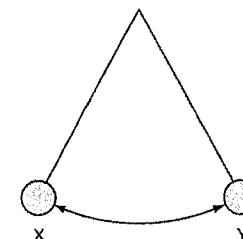
How are these values expressed with prefixes?

	average width of a human hair	distance between the Earth and the Sun
A	1.0×10^{-1} mm	1.5×10^{-1} Tm
B	1.0×10^{-1} mm	1.5×10^{-1} Gm
C	1.0×10^{-1} μ m	1.5×10^{-1} Gm
D	1.0×10^{-1} μ m	1.5×10^{-1} Tm

- 2 What is the unit of pressure expressed in base units?

A kg / ms² B kg / ms C kg² / ms² D kg / m²s²

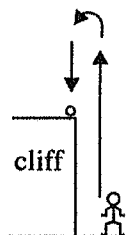
- 3 A pendulum is set in motion and 20 complete swings are timed. The time measured is 30 s.



What is the period and the shortest time t for the pendulum to swing from X to Y?

	period / s	time t / s
A	0.75	0.75
B	0.75	1.5
C	1.5	1.5
D	1.5	0.75

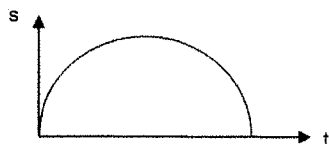
- 4 A robot standing at the bottom of a cliff shoots a ball upwards. The ball drops on top of the cliff after reaching a maximum height of 125 m in 5 s.



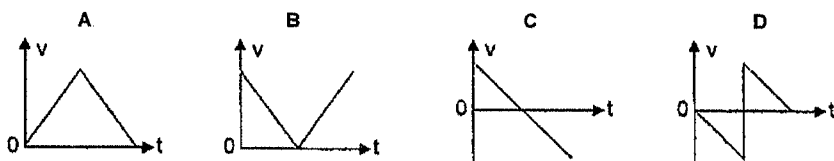
What is the height of the cliff given that the ball reaches the top of the cliff 7 s after the shoot? (Take $g = 10 \text{ m/s}^2$ and the height of the robot to be negligible)

- A 125 m B 115 m C 110 m D 105 m

- 5 The diagram shows the graph of displacement s against time t for a body moving in a straight line.



Which is the graph of speed v against time t for this body?

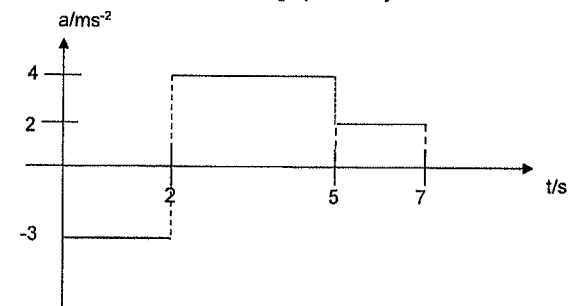


- 6 A bus has a total mass of 12 000 kg. It moves along a horizontal stretch of road at a speed of 10 m/s. It then accelerates, reaching a final speed of 30 m/s after 16 s.

What is the size of the average resultant force acting on the bus when it is accelerating?

- A 7500 N B 9600 N C 15 000 N D 22 500 N

- 7 The graph shows the acceleration-time graph of a toy car.

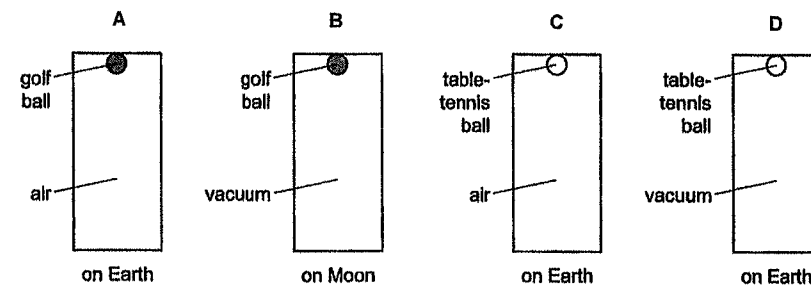


If the toy car starts off with an initial velocity of 10 ms^{-1} , what is its velocity at the 7th second?

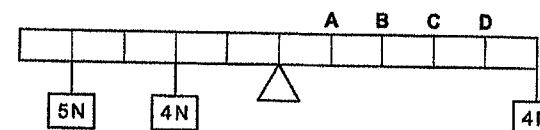
- A -10 ms^{-1} B 10 ms^{-1} C 20 ms^{-1} D 30 ms^{-1}

- 8 The diagrams show four experiments in which a ball falls from the top to the bottom of identical sealed glass tubes.

In which experiment does the ball take the shortest time to reach the bottom of the tube?

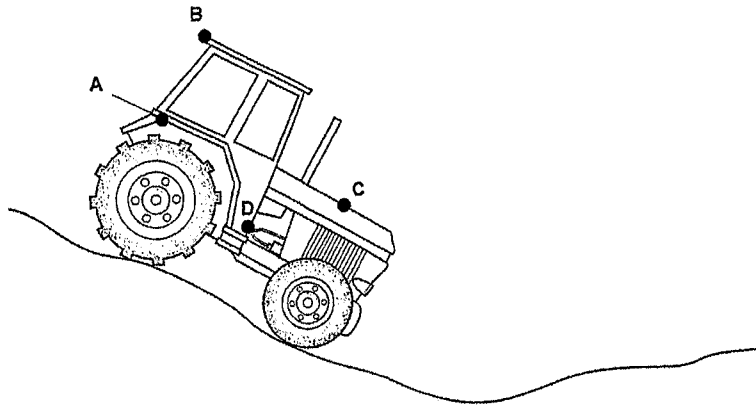


- 9 The diagram shows a uniform beam with three weights hung on it. At which point does a load of 2 N balance the beam?

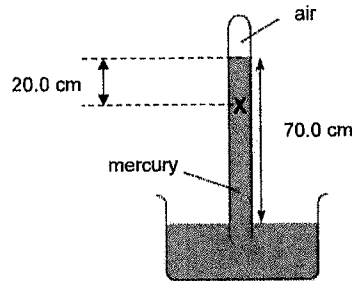


- 10 A tractor is being used on rough ground.

Where should the position of its centre of gravity be for the tractor to topple?



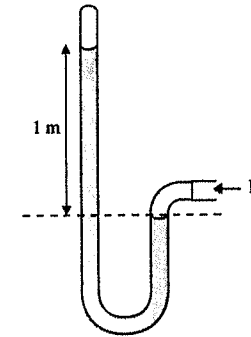
- 11 The diagram shows a barometer containing some air in the space above the mercury column. The height of mercury column is 70.0 cm. X is a point 20.0 cm below the surface of the mercury in the tube. The atmospheric pressure is 76.0 cmHg.



What is the pressure at point X in the mercury?

- A 56.0 cmHg B 50.0 cmHg C 26.0 cmHg D 20.0 cmHg

- 12 A closed tube manometer is connected to an air pump as shown. The manometer is filled with water of density 1000 kg/m^3 and the pressure exerted by the trapped air is 190 kPa.



What is the air pressure caused by the air pump?

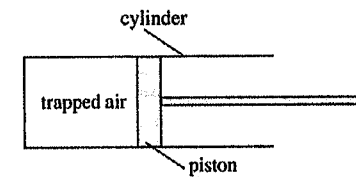
- A 10 kPa B 190 kPa C 200 kPa D 210 kPa

- 13 An electric motor took 20 s to lift a 500 N load through a vertical height of 8.0 m.

If the efficiency of the motor is 40 %, how much is the electric input power to the motor?

- A 80 W B 120 W C 333 W D 500 W

- 14 A gas is trapped in a cylinder with a movable piston as shown. The temperature of the gas is kept constant as the piston is pulled out of the cylinder.



What happens to the gas particles?

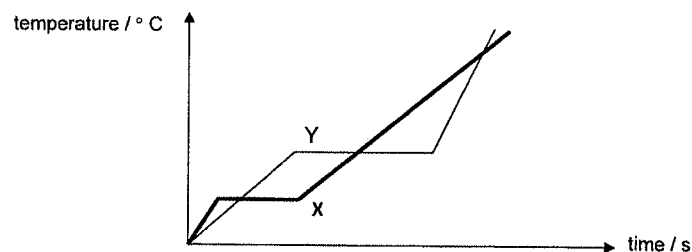
- A They collide with the cylinder walls more frequently.
B They expand.
C They get further apart.
D They move slower.

- 15 Heat capacity is the energy required to raise the temperature of the object by 1°C .

What does this energy do?

- A It increases the internal potential energy of the solid molecules.
- B It increases the vibration among the solid molecules.
- C It increases the average size of the solid molecules.
- D It increases the forces of attraction between the solid molecules.

- 16 Equal masses of two solids X and Y are heated successively in a well-lagged calorimeter. Thermal energy is supplied to both at the same rate. The temperature-time graph for the process is shown.



Which statement below is correct?

- A Solid X has a larger specific heat capacity than solid Y.
- B Liquid X has a smaller specific heat capacity than liquid Y.
- C Solid X has a smaller specific latent heat of fusion than solid Y.
- D Solid X has a smaller specific latent heat of vaporization than solid Y.

- 17 Four bars, all exactly the same size, are each placed with one end in boiling water.

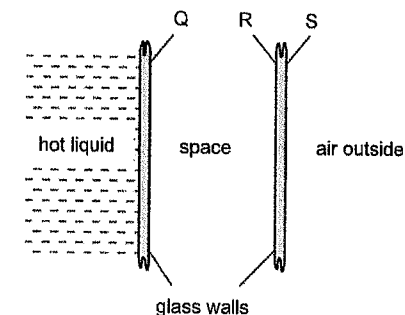
The times taken for the temperature of the other end to increase by 2°C are measured.

material of bar	time for 2°C rise / s
copper	5
aluminium	10
cork	800
styrofoam	1200

To make a large metal tank with the least heat loss, which materials should be used for the tank and its insulation?

	tank	Insulation
A	aluminium	cork
B	aluminium	styrofoam
C	copper	cork
D	copper	styrofoam

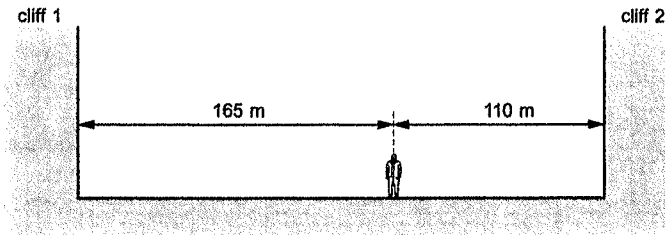
- 18 A student uses a double-walled glass vessel to contain a hot liquid.



Which method reduces the heat loss by radiation?

- A creating a vacuum in the space between the glass walls
- B painting surface Q black
- C painting surface R black
- D painting surface S white

- 19 A man stands between two cliffs and claps his hands once.

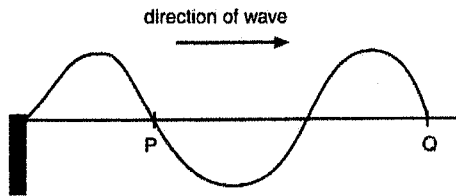


An echo is heard which is closely followed by another.
The speed of sound is 330 m/s.

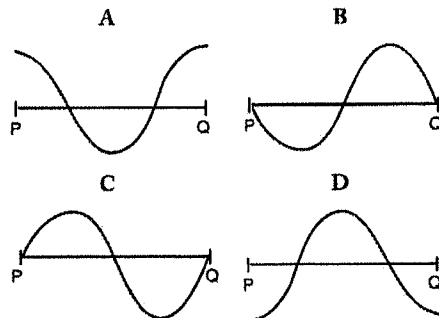
What is the time interval between the two echoes?

- A 0.17 s B 0.33 s C 0.67 s D 0.83 s

- 20 A vibrator generates a travelling wave on a string. The diagram shows the shape of the string at a certain instant.



Which is the correct shape of the string between P and Q after half a period?



- 21 When ultrasound travels from air into water, what happens to its frequency, wavelength and speed?

	frequency	wavelength	speed
A	remains the same	reduced	reduced
B	remains the same	increased	increased
C	remains the same	increased	reduced
D	increased	increased	increased

- 22 The frequency of a note with high pitch is greater than the frequency of a note with low pitch.

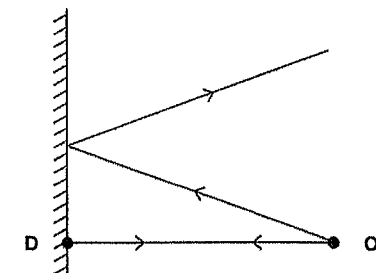
Which statement about the note with high pitch is correct?

- A It has a longer wavelength.
B It has a shorter wavelength.
C It has a greater speed in air.
D It has a slower speed in air.

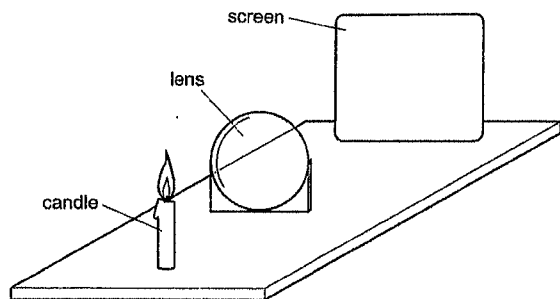
- 23 The diagram shows two divergent rays of light from an object O being reflected from a plane mirror.

At which position will the image be formed?

- A •
B •
C •



- 24 A thin converging lens is used to produce, on a screen, a focused image of a candle.



Various focused images are produced on the screen by moving the lens and the screen backwards and forwards.

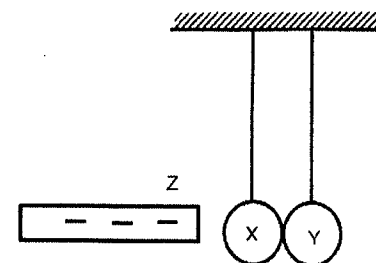
Which statement is **always** correct?

- A The image is at the principal focus (focal point) of the lens.
 B The image is bigger than the object.
 C The image is closer to the lens than the object is.
 D The image is inverted.
- 25 Statements 1 and 2 refer to signals passing through an optical fibre of refractive index 1.5.
- 1 The speed of the signal in the optical fibre is less than 3.0×10^8 m/s.
 2 The angle of incidence of the signals in the optical fibre must be greater than 41.8° .

Which statement(s) is/are correct?

- A neither of the statements
 B both statements 1 and 2
 C statement 1 only
 D statement 2 only

- 26 A negatively charged rod is brought near two neutral spheres X and Y, which are in contact. Y is momentarily earthed and Z is then removed.



What happens to the charge distribution on X and Y?

	X	Y
A	negative	negative
B	negative	positive
C	positive	positive
D	positive	negative

- 27 A battery supplies a current of 0.5 A to a circuit consisting of two identical resistors in series.

If the work required to move the electrical charges through each resistor is 300 J per minute, what is the e.m.f. of the battery?

- A 10 V B 20 V C 75 V D 150 V

- 28 A cell is connected to a resistor.

What is the electromotive force of the cell equal to?

- A the potential difference across the resistor for each unit of current
 B the power produced in the circuit for each unit of charge that passes the resistor
 C the work done in the circuit for each unit of charge that passes the resistor
 D the work done in the circuit for each unit of current

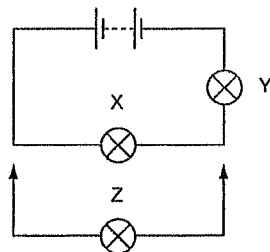
- 29 A resistor with resistance R is made from a length L of resistance wire with a cross-sectional area A .

A second resistor with twice the resistance of the first resistor is made from wire of the same material with a cross-sectional area $2A$.

What is the length of the second resistor?

- A $L/2$ B L C $2L$ D $4L$

- 30 The diagram shows identical lamps X and Y connected in series with a battery. The lamps light with normal brightness.

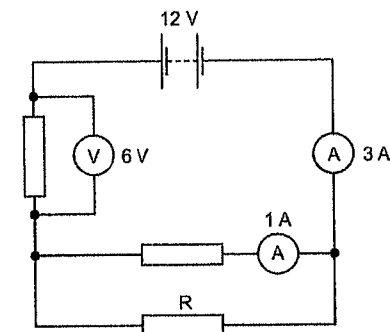


A third identical lamp Z is connected in parallel with lamp X .

What happens to the brightness of lamp Y ?

- A brighter than normal
B normal
C dimmer than normal
D very dim (cannot be seen)

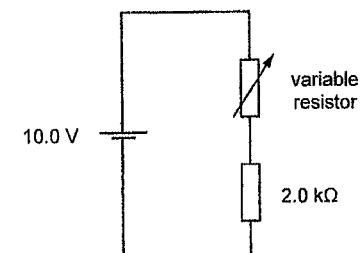
- 31 The circuit diagram shows three different resistors and three meters with their readings.



What is the value of resistor R ?

- A $2\ \Omega$ B $3\ \Omega$ C $4\ \Omega$ D $6\ \Omega$

- 32 A variable resistor is connected in series with a fixed resistor of resistance $2.0\ \text{k}\Omega$ and a $10.0\ \text{V}$ supply.

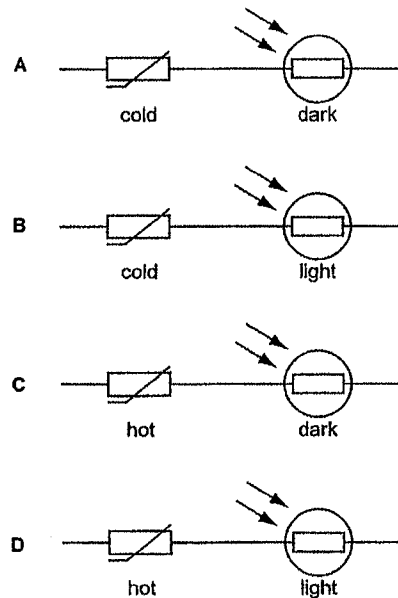


The resistance of the variable resistor can vary from $2.0\ \text{k}\Omega$ to $8.0\ \text{k}\Omega$

What is the range of possible values for the potential difference across the variable resistor?

- A $2.0 - 8.0\ \text{V}$
B $2.0 - 10.0\ \text{V}$
C $5.0 - 8.0\ \text{V}$
D $5.0 - 10.0\ \text{V}$

- 33 A thermistor and a light-dependent resistor are connected in series to a power supply. Which conditions will result in smallest current flowing through them?



- 34 An electric cooker has a hotplate rated at 1500 W and an oven rated at 2000 W.

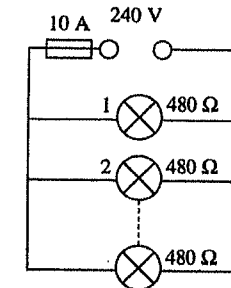
During one day, the hotplate is switched on for a total of 1.0 hour and the oven is switched on for 3.0 hours.

The cost of electricity is 30 cents per kWh.

What is the cost of using the electric cooker for one day?

- A 225 cents B 420 cents C 2250 cents D 225 000 cents

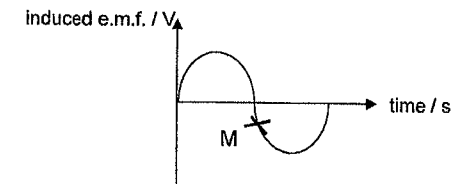
- 35 Lamps are connected in parallel in the circuit as shown. The fuse rating is 10 A and the resistance of each lamp is 480Ω .



What is the maximum number of lamps that can be connected without blowing the fuse?

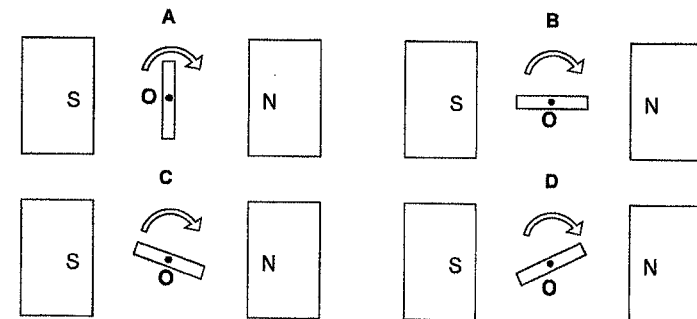
- A 2 B 10 C 19 D 20

- 36 The graph shows how the induced e.m.f. of a simple a.c. generator varies with time.



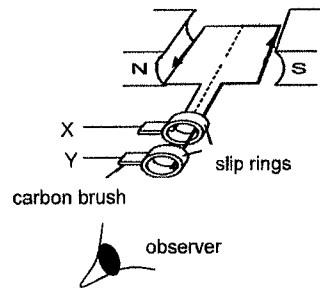
The diagrams below show the front view of the coil of an a.c. generator. The coil is being rotated about an axis through O in a uniform magnetic field.

Which of them shows the position of the coil when the value of the induced emf is at M?



17

- 37 The diagram shows an a.c. generator connected to leads X and Y. The current direction in the coil is as shown.

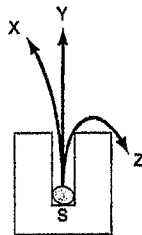


Which row shows the direction of rotation of the coil as seen by an observer and the rule used to obtain the direction of current as shown?

	direction of rotation	rule used
A	clockwise	Fleming's left hand rule
B	clockwise	Fleming's right hand rule
C	anti-clockwise	Fleming's left hand rule
D	anti-clockwise	Fleming's right hand rule

- 38 The diagram shows the emission of alpha, beta and gamma radiations from a source S within a lead block.

There is a strong magnetic field present.

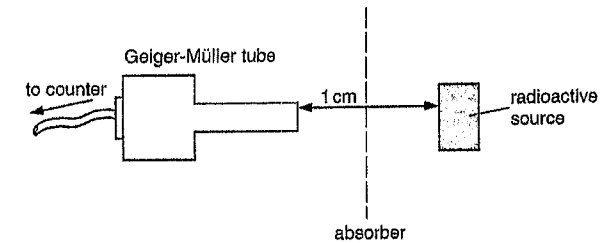


What are the names of the radiation X, Y and Z?

	X	Y	Z
A	alpha	beta	gamma
B	alpha	gamma	beta
C	beta	alpha	gamma
D	beta	gamma	alpha

18

- 39 A student investigates the penetrating power of radiation from a radioactive source.



The table shows her results.

background count	25 counts per minute
count with source only	630 counts per minute
count with source and paper absorber	630 counts per minute
count with source and aluminium absorber 3mm thick	180 counts per minute

The source emits

- A alpha and beta particles.
 B beta particles and gamma rays.
 C beta particles only.
 D gamma rays only.

- 40 Atoms P and Q are isotopes.

How does the composition of neutral atoms of P compare with neutral atoms of Q?

	number of protons	number of neutrons	number of electrons
A	different	different	different
B	different	same	same
C	same	different	same
D	same	same	different

[Turn over



CHIJ SECONDARY (TOA PAYOH)
PRELIMINARY EXAMINATION 2025
SECONDARY 4(EXPRESS)

PHYSICS
6091/01
Paper 1

1	A	11	C	21	B	31	B
2	A	12	C	22	B	32	C
3	D	13	D	23	C	33	A
4	D	14	C	24	D	34	A
5	B	15	B	25	B	35	C
6	C	16	C	26	C	36	D
7	C	17	B	27	B	37	D
8	D	18	D	28	C	38	B
9	D	19	B	29	D	39	B
10	C	20	C	30	A	40	C

Paper 2
6091/02

Qn	Answers	Mark	
1(a)	- Correct curve - Horizontal straight line towards t_2	1 1	
1(b)	A gravitational field is a region where a mass experiences a force due to gravity (gravitational attraction).	1	
1(c)(i)	$W = mg$ $W = 65 \times 3.0 = 195 \text{ N}$	1	
1(c)(ii)	Resultant force = $500 - 195 = 305 \text{ N}$	1	
1(c)(iii)	$F = ma$ $305 = 65 \times a$ $a = 4.69 \text{ m/s}^2$	1	

55



COMPASSVALE SECONDARY SCHOOL
Secondary Four Express
Preliminary Examination 2025

NAME

CENTRE NUMBER CLASS INDEX NUMBER

PHYSICS

6091/01

Paper 1 Multiple Choice

20 August 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name and index number on the Answer Sheet in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions. For each question, there are four possible answers **A, B, C** and **D**. Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

This document consists of 18 printed pages.

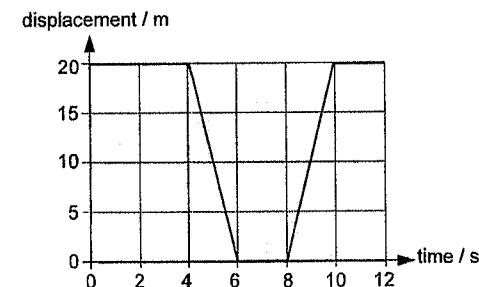
Set by: Mr Ng JJ

[Turn over

1 Which pair contains two vector quantities?

- A charge and work
- B pressure and velocity
- C speed and temperature
- D weight and acceleration

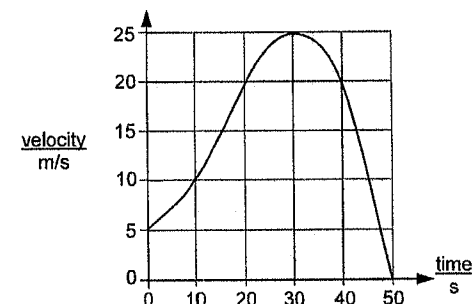
2 The graph shows how the displacement of a lift changes with time.



What is the average speed of the lift?

- A 1.7 m/s
- B 3.3 m/s
- C 5.0 m/s
- D 10 m/s

3 The diagram shows the velocity-time graph of a car.

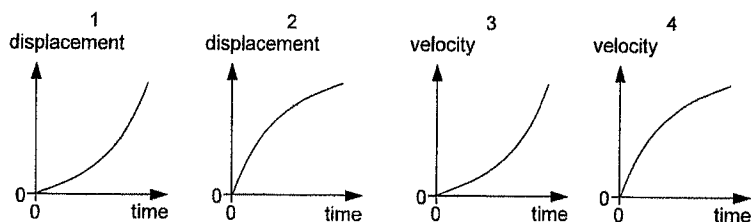


What is the acceleration of the car at 30 s?

- A 0 m/s²
- B 0.50 m/s²
- C 0.67 m/s²
- D 0.83 m/s²

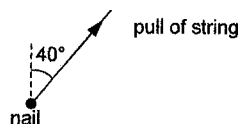
- 4 A ball is dropped from the top of a tall cliff. As the ball falls, air resistance has a noticeable effect on its motion.

Graphs 1 and 2 are displacement-time graphs. Graphs 3 and 4 are velocity-time graphs.



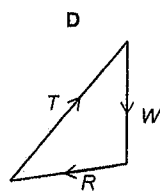
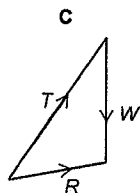
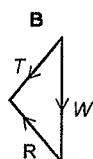
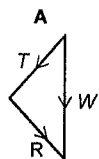
Which graphs describe the motion of this ball?

- A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4
- 5 A heavy nail is fixed firmly to a wall. It is pulled by a string at 40° to the vertical. The nail does not move.



Three forces act on the nail: its weight W , the tension T in the string and the force R exerted by the wall.

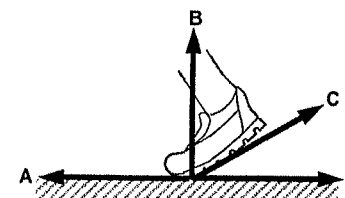
Which diagram, drawn to scale represents the three forces?



[Turn over

- 6 The diagram shows a runner's shoe at the start of a race.

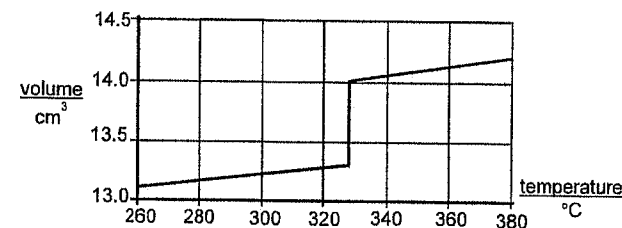
Which arrow indicates the direction of the force of friction acting on the runner's shoe?



- 7 What is a gravitational field?

- A a region where a force experiences a gravitational attraction due to its mass
B a region where a gravitational attraction produces a mass due to its force
C a region where a mass experiences a force due to gravitational attraction
D a region where a mass experiences a gravitational attraction due to its charge

- 8 The graph shows how the volume of a sample of solid X changes with temperature as it is heated.



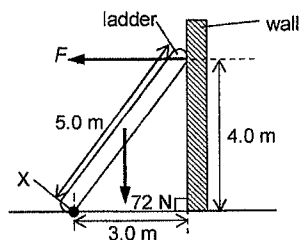
The mass of the sample of solid X is 160 g.

What is the density of the liquid X at 328°C ?

- A 12.0 g/cm^3 B 11.7 g/cm^3 C 11.4 g/cm^3 D 11.1 g/cm^3

- 9 A uniform ladder of length 5.0 m rests against a wall as shown.

The weight of the ladder is 72 N. The friction between the wall and the top of the ladder is negligible.



The top of the ladder is 4.0 m from above the ground. The bottom of the ladder is 3.0 m from the wall

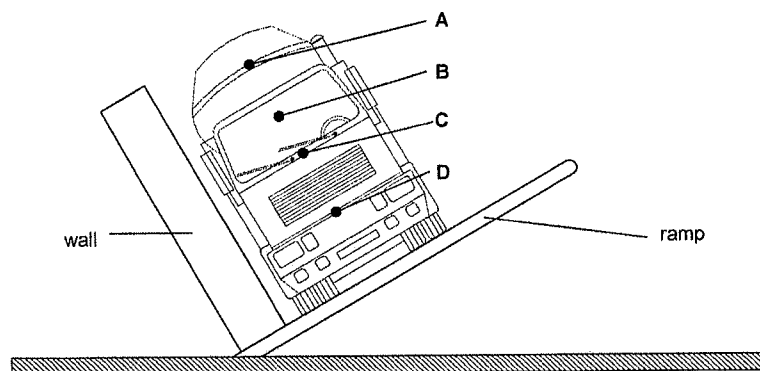
Taking moments about X, what is the force F between the wall and the top of the ladder?

- A 27 N B 36 N C 45 N D 54 N

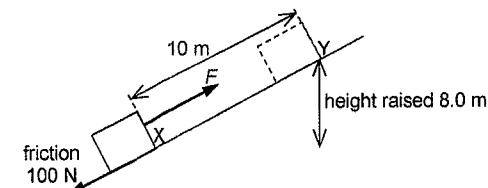
- 10 The stability of a truck is tested by tilting it on a ramp.

The diagram shows a truck that is just about to topple over.

Where is the centre of gravity of the truck?



- 11 A box of mass 5.0 kg is pulled up a slope from X to Y at a constant speed of 4.0 m/s.



The frictional force between the object and the slope is 100 N and the gravitational field strength is 10 N/kg.

What is the total work done by force F ?

- A 400 J B 1000 J C 1400 J D 1440 J

- 12 The engine of a car of mass, m can deliver an amount of power, P .

What is the minimum time in which the car can accelerate from rest to a speed, v ?

- A $\frac{mv}{P}$ B $\frac{P}{mv}$ C $\frac{2P}{mv^2}$ D $\frac{mv^2}{2P}$

- 13 A window in an aeroplane has an area of 0.16 m².

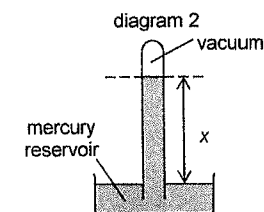
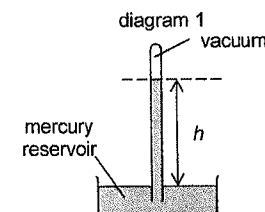
The pressure inside the aeroplane is 80 kPa and the pressure outside is 50 kPa.

What is the value of the resultant force acting on the window due to these pressures?

- A 4800 N B 8000 N C 12 800 N D 20 800 N

- 14 Diagram 1 shows a tube sealed at one end and partly immersed in mercury. The tube has a diameter of d . The top of the mercury in the tube is a height h above the mercury reservoir.

Diagram 2 shows a similar arrangement with a tube that has a diameter of $2d$.



What is the relationship between h and x ?

- A $x = 0.25 h$ B $x = 0.50 h$ C $x = h$ D $x = 2h$

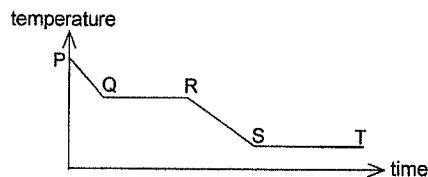
- 15 Smoke particles in air are illuminated by a beam of light and viewed through a microscope.

The particles undergo jerky random motion due to

- A the energy from the beam of light.
 - B impact of fast-moving air molecules.
 - C collisions between the smoke particles.
 - D atomic vibrations within the smoke particles.
- 16 200 g of water at 100 °C is turned into steam at 100 °C in 300 seconds using an electric heater. The specific latent heat of vaporisation of water is 2250 J/g.

What is the average power of the electric heater?

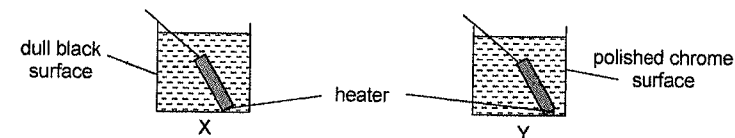
- A $\frac{2250}{300 \times 200}$ W
 - B $\frac{2250 \times 200}{300}$ W
 - C $\frac{2250 \times 300}{200}$ W
 - D 2250 x 200 x 300 W
- 17 The graph shows how the temperature changes for a sample of hot liquid wax that is allowed to cool.



What happens to the kinetic energy and the potential energy of the molecules during QR?

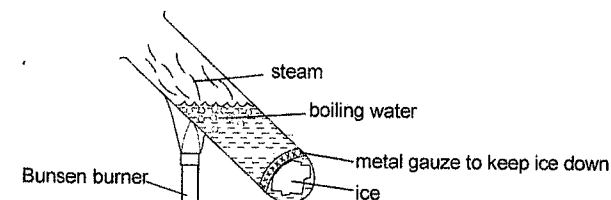
	kinetic energy	potential energy
A	decrease	decrease
B	decrease	stays the same
C	stays the same	decrease
D	stays the same	stays the same

- 18 Two copper cans X and Y with outer surfaces of different textures are filled with the same amount of water at room temperature and heated by heaters of the same power.



Which statement is correct?

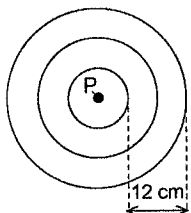
- A Water in both cans take the same length of time to boil because the texture of outer surface will not affect the rate of energy absorbed by water.
 - B Water in can X boils faster because dull surface is a good absorber.
 - C Water in can X boils faster because dull black surface is a better insulator.
 - D Water in can Y boils faster because polished chrome surface is a poor radiator.
- 19 An experiment is carried out as shown in the diagram.



The ice takes a long time to melt, even though the water at the top of the tube is boiling because

- A energy is removed from the water as steam.
- B ice is a poor thermal conductor.
- C the gauze prevents energy transfer to the ice.
- D water is a poor thermal conductor.

- 20 In a ripple tank, a dipper moves up and down at point P to produce circular water waves.

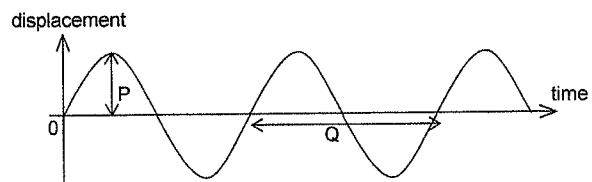


The diagram shows the position of the wave crests after 2.0 s. The distance between the wave crests is 12 cm.

What is the speed and the frequency of the wave?

	speed / cm s ⁻¹	frequency / Hz
A	9.0	1.5
B	9.0	0.67
C	4.0	1.5
D	4.0	0.67

- 21 The diagram shows a graph of wave motion.



Which quantities are represented by P and by Q?

	P	Q
A	amplitude	period
B	amplitude	wavelength
C	half the amplitude	period
D	half the amplitude	wavelength

- 22 Which row shows the correct order for the speed of sound in air, steel and water?

	slowest	→	fastest
A	air	water	steel
B	air	steel	water
C	steel	water	air
D	steel	air	water

- 23 Below are three statements about the application of electromagnetic radiation and their corresponding properties.

electromagnetic radiation	application	property
gamma rays	medical treatment	high penetrating power and energy
infra-red radiation	sunbeds	high thermal energy
microwaves	satellite tv	can pass through cloud cover

How many of these statements are correct?

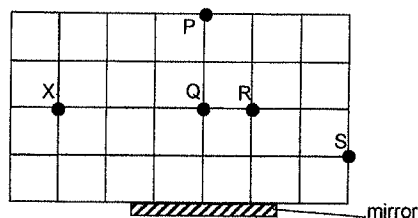
- A zero B one C two D three

- 24 The wavelength of X-rays is roughly the size of an atom.

What is the estimated wavelength and frequency of X-rays?

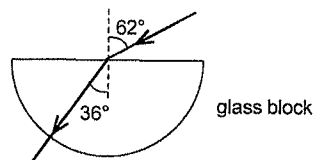
	estimated wavelength	estimated frequency / Hz
A	0.1 μm	3.3 × 10 ⁸
B	0.1 μm	3.0 × 10 ¹⁴
C	0.1 nm	3.3 × 10 ¹¹
D	0.1 nm	3.0 × 10 ¹⁸

- 25 The diagram shows the positions of an observer and four pins P, Q, R and S.



Which of the pins will the observer at position X be able to see in the mirror?

- A P and Q B P, Q and R C Q and R D Q, R and S
- 26 Light in a vacuum strikes a semi-circular glass block at an angle of incidence of 62° .

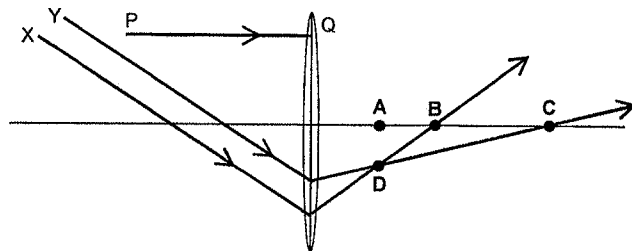


In the glass block, the angle of refraction is 36°

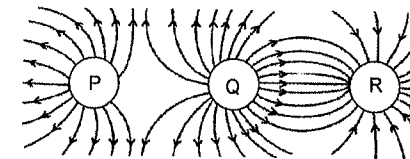
What is the speed of light in the glass block?

- A 1.7×10^8 m/s B 2.0×10^8 m/s C 3.0×10^8 m/s D 4.5×10^8 m/s
- 27 Two parallel light rays X and Y pass through a thin converging lens.

Which point will light ray PQ pass through after it passes through the lens?



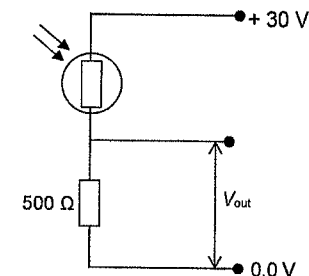
- 28 The electric field of three charged spheres is as shown.



Which of the following correctly describes the charges of spheres P, Q and R?

	P	Q	R
A	negative	negative	positive
B	negative	positive	positive
C	positive	negative	negative
D	positive	positive	negative

- 29 The diagram shows a potential divider circuit formed by a light dependent resistor (LDR) and a 500Ω resistor connected to a 30 V power supply.



The resistance of the LDR is 1000Ω in the dark but drops to 100Ω in bright light.

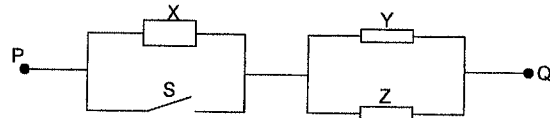
What is the corresponding change in output voltage V_{out} ?

- A a rise from 10 V to 25 V
 B a rise from 5.0 V to 20 V
 C a fall from 25 V to 10 V
 D a fall from 20 V to 5.0 V

- 30 Three resistors X, Y and Z are connected in a circuit. The resistance of X is $40\ \Omega$.

All three resistors are made from the same material and have the same length.

The cross-sectional area of X is twice the cross-sectional area of Y and Z.

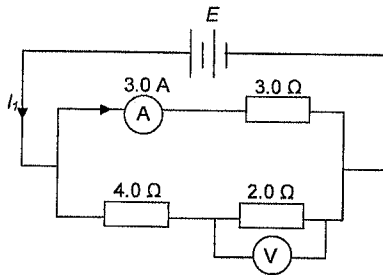


What is the effective resistance of the circuit between P and Q when switch S is closed?

- A $10\ \Omega$ B $40\ \Omega$ C $50\ \Omega$ D $80\ \Omega$

- 31 A circuit consists of a battery of electromotive force (e.m.f) E connected across an arrangement of $2.0\ \Omega$, $3.0\ \Omega$ and $4.0\ \Omega$ resistors.

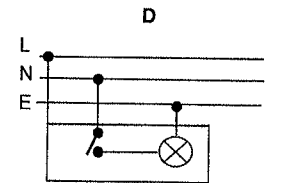
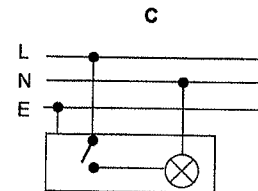
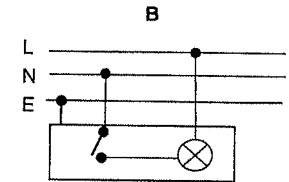
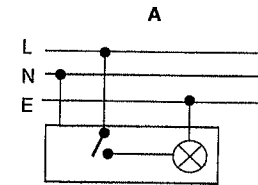
The current in the $3.0\ \Omega$ resistor is $3.0\ \text{A}$ and the current in the wire leading from the battery is I_1 . A voltmeter is used to measure the potential difference V across the $2.0\ \Omega$ resistor.



What are the values of E , I_1 and V ?

	E / V	I_1 / A	V / V
A	9.0	4.5	3.0
B	9.0	3.0	6.0
C	18	4.5	6.0
D	18	6.0	12

- 32 Which diagram shows the correct connections for a switch and lamp in a lighting circuit?



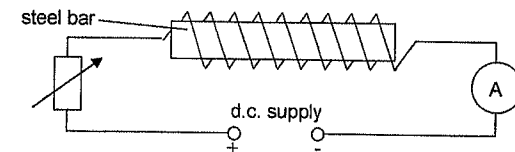
- 33 A man decides to replace six $100\ \text{W}$ light bulbs with six $60\ \text{W}$ light bulbs.

The bulbs are used for 5.0 hours each day and the cost of electricity is $\$0.30$ cents per kWh.

What is the weekly saving from replacing the light bulbs?

- A $\$0.36$ B $\$2.52$ C $\$3.60$ D $\$25.20$

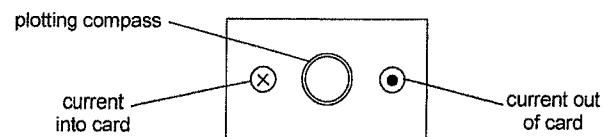
- 34 The diagram shows how a steel bar can be magnetised.



Which statement describes how the steel bar can be **demagnetised**?

- A Reverse the d.c. supply and gradually decrease the current in the circuit.
 B Reverse the d.c. supply and gradually increase the current in the circuit.
 C Use an a.c. supply and gradually decrease the current in the circuit.
 D Use an a.c. supply and gradually increase the current in the circuit.

- 35 Two vertical wires pass at right angles through a piece of card. There is a large current in each of the wires in the direction shown when viewed from the top of the card.

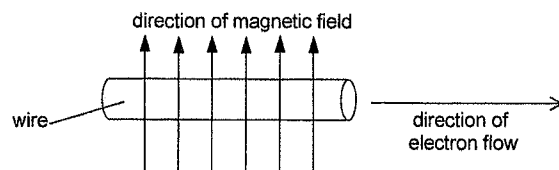


A plotting compass is placed on the card.

Which diagram shows the direction in which the needle of the plotting compass points?



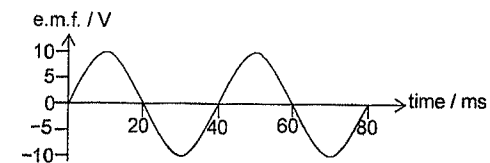
- 36 A current-carrying wire is placed in a magnetic field. The direction of electron flow is shown.



What is the direction of the force on the wire?

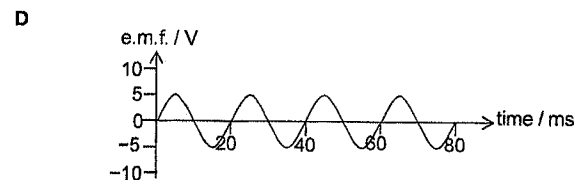
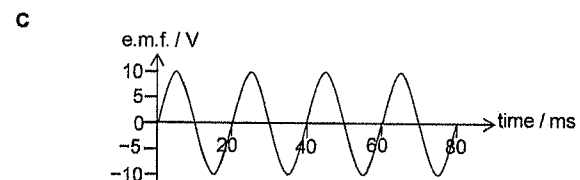
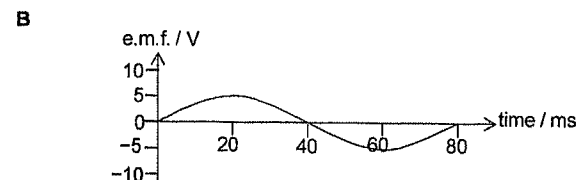
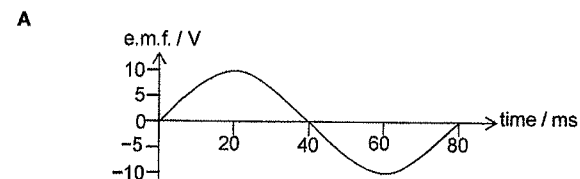
- A in the opposite direction to the magnetic field
- B in the same direction as the magnetic field
- C into the paper
- D out of the paper

- 37 A simple a.c. generator produces an alternating e.m.f. as shown.



The speed of the generator is halved.

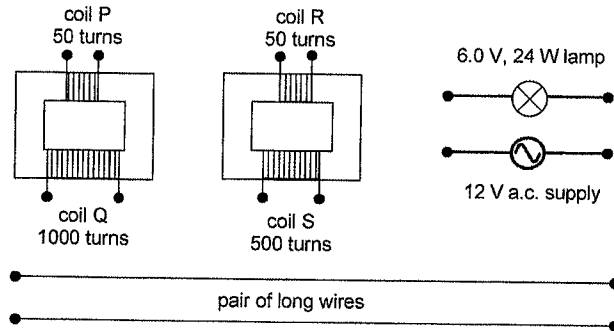
Which graph shows best represents the new output?



- 38 A demonstration of power transmission using transformers is set up from the following equipment: a 12 V a.c. supply, a pair of long wires for the power transmission lines, a 6.0 V 24 W lamp and two transformers.

One transformer has a coil P with 50 turns and a coil Q with 1000 turns.

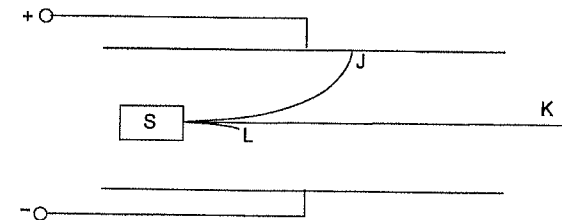
The other transformer has a coil R of 50 turns and a coil S with 500 turns.



Which arrangement gives a satisfactory demonstration in which the lamp lights at normal brightness?

	coils connected to		
	a.c. supply	power transmission line	lamp
A	P	Q and R	S
B	P	Q and S	R
C	R	S and P	Q
D	R	S and Q	P

- 40 The diagram shows the paths of three emissions, J, K and L from a radioactive source S when the source is placed in a strong electric field.



Which row shows the correct nature of each emission?

	J	K	L
A	α particles	β particles	γ radiation
B	α particles	γ radiation	β particles
C	β particles	α particles	γ radiation
D	β particles	γ radiation	α particles

- 39 Which nuclear reaction is an example of fission?

- A two heavy hydrogen nuclei becoming helium + a neutron + energy
- B radioactive radium-226 decaying to radioactive radon-222 + an alpha particle
- C radioactive sodium-24 decaying to stable magnesium-24 + beta particle
- D uranium-235 + a neutron becoming barium-144 + krypton-90 + two neutrons + energy

2025 Sec 4 Express Preliminary Examinations Answers

Paper 1 MCQ [40 marks]

1	2	3	4	5	6	7	8	9	10
D	B	A	B	D	A	C	C	A	C

11	12	13	14	15	16	17	18	19	20
C	D	A	C	B	B	C	D	D	A

21	22	23	24	25	26	27	28	29	30
A	A	C	D	D	B	A	D	A	B

31	32	33	34	35	36	37	38	39	40
A	C	B	C	B	C	B	D	D	D

Paper 2 Section A [60 marks]

- 1 (a) The gradient of the (velocity-time) graph which shows acceleration of the ball is constant 1
[accept equivalent statements, i.e. (graph is) a straight line/linear or not curved]
- (b) time = 0.20 s 1
- (c) (i) constant acceleration (of 10 m/s²), ball moving downwards 1
(ii) constant deceleration (of 10 m/s²), ball moving upwards 1
- (d) height = area under v-t graph
= $\frac{1}{2} (-3.0 + -1.0) (0.80 - 0.60)$ M1
= 0.40 m A1
[6]
- 2 (a) (upward) force / pull of space capsule on the Earth 1
- (b) The (downward force of) weight of capsule is equal and opposite to (upward force of) air resistance. (Since the forces acting on the capsule are balanced, the capsule will descend at constant velocity by Newton's first law.) 1
- (c) (i) When parachutes are fully opened, the air resistance acting on the capsule increases and becomes larger than the weight of the capsule. 1
This causes the resultant force acting on the capsule to be negative (or upwards while the capsule is moving downwards). By Newton's second law, the capsule will decelerate since $F_{\text{net}} = ma$ 1
- (ii) $F_{\text{net}} = ma$
W – total resistive forces = 9600 x -45 [1 m for W, 1m for F_{net}] M1
(9600 x 10) – total resistive forces = -432000 M1
total resistive forces = 96000 + 432000
= 528000 N $\approx$ 530000N (to 2 sf) A1
[7]



COMMONWEALTH SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2025
SECONDARY 4 EXPRESS PHYSICS

Name: _____ () Class: _____

Physics 6091/01
Paper 1 Multiple Choice 29 August 2025
Additional Materials: Multiple Choice Answer Sheet 1130 h – 1230h
1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, index number and class on the Answer Sheet in the spaces.

There are **forty** questions in this paper. Answer **all** questions. For each question there are four possible answers, **A, B, C** and **D**.
Choose the **one** you consider correct and record your answer in **soft pencil** on the separate answer sheet.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected, where appropriate.

Name of setter: Ms Vino

This booklet consists of 21 printed pages including the cover page.

[Turn over

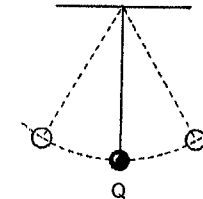
2

- 1 The approximate diameter of the earth is 1.3×10^7 m and the diameter of a nitrogen atom is 1.5×10^{-10} m.

How are these values expressed with prefixes?

	diameter of the Earth	diameter of nitrogen atom
A	1.3×10^{-2} Mm	1.5×10^{-1} μ m
B	1.3×10^{-2} Gm	1.5×10^{-1} μ m
C	1.3×10^{-2} Mm	1.5×10^{-1} nm
D	1.3×10^{-2} Gm	1.5×10^{-1} nm

- 2 A student sets a pendulum bob in motion and started timing as it swung past Q as shown in the diagram.

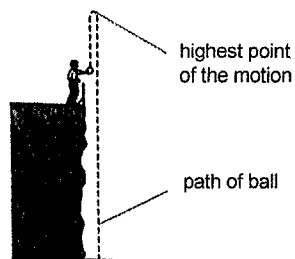


The bob swung past Q twenty times before the student stopped his timing. He recorded the timing as T s.

What is the period of the pendulum bob?

- A (T + 10) s
B (T + 20) s
C (T + 40) s
D T s
- 3 A motorist traveling at 20 m/s approached a traffic light. When he was 25 m from the stop-line, the traffic light turned amber and he stepped on the brakes immediately.
If the car decelerated uniformly at 10 m/s^2 to rest, how far away is the stationary car from the stop-line?
- A 0 m
B 5 m
C 20 m
D 45 m

- 4 A student stands near the edge of a cliff. He throws a ball upwards, as shown in the diagram.

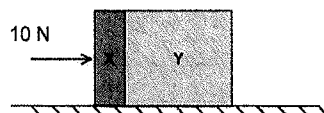


The ball rises vertically a short distance and then falls. Air resistance is negligible.

Which row describes the magnitude and the direction of the acceleration a of the ball as the ball moves upward and at the highest point of motion respectively?

	as the ball moves upwards	at the highest point of motion
A	$a = 10 \text{ m/s}^2$, downwards	$a = 10 \text{ m/s}^2$, downwards
B	$a = 10 \text{ m/s}^2$, upwards	$a = 0 \text{ m/s}^2$
C	$a = 10 \text{ m/s}^2$, upwards	$a = 10 \text{ m/s}^2$, downwards
D	$a = 10 \text{ m/s}^2$, downwards	$a = 0 \text{ m/s}^2$

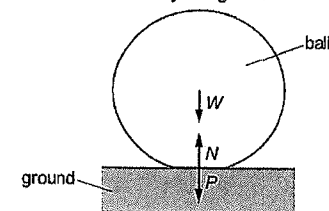
- 5 Two blocks, X and Y, of masses 1 kg and 4 kg respectively, are accelerated along a smooth horizontal surface by a 10 N force applied to block X as shown.



What is the magnitude of the force exerted on block Y by block X during this acceleration?

- A 2 N
B 3 N
C 8 N
D 13 N

- 6 A ball is dropped onto horizontal ground and bounces vertically upwards. When the ball is in contact with the ground, the following forces are present:
- the weight W of the ball
 - the contact force P exerted on the ground by the ball
 - the contact force N exerted on the ball by the ground.

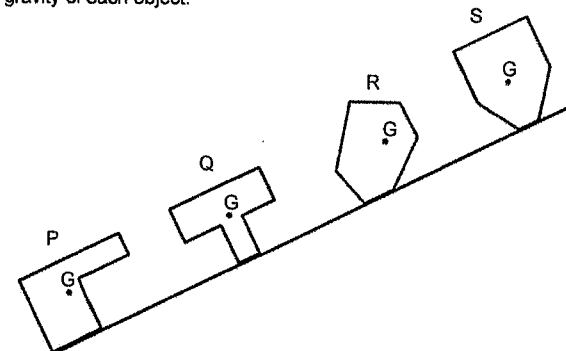


At a particular instant, the ball is in contact with the ground and the ball is momentarily stationary.

At this instant, which relationship is correct?

- A $N = P$
B $N = W$
C $N = W + P$
D $W = P$

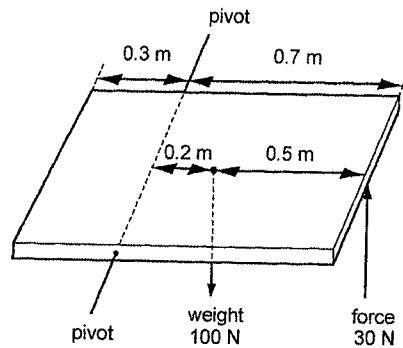
- 7 Four objects, P, Q, R and S, of different shapes are placed on a slope. G represents the centre of gravity of each object.



Which of these objects will topple?

- A P, Q and R
B Q, R and S
C Q and R
D Q and S

- 8 A pivoted window, weighing 100 N, is opened with a force of 30 N.



What is the magnitude of the resultant moment about the pivot?

- A 1 N m B 5 N m C 35 N m D 41 N m

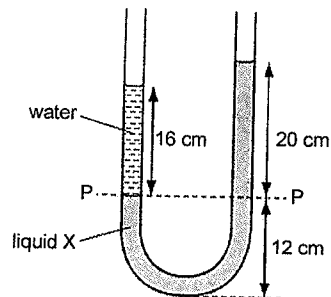
- 9 Paper is sold in packets labelled 80 g/m².

This means that a sheet of paper of area 10 000 cm² has a mass of 80 g. The thickness of each sheet is 0.11 mm.

What is the density of the paper?

- A 0.0073 g/cm³ B 0.088 g/cm³ C 0.73 g/cm³ D 0.88 g/cm³

- 10 A manometer contains water and a liquid X. The two liquids do not mix.

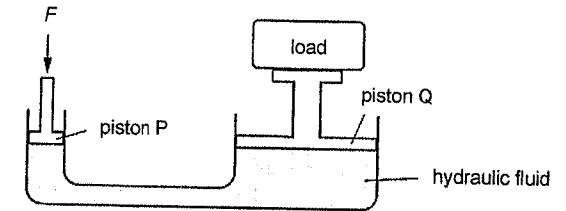


The height at level P is 12 cm. The density of water is 1000 kg/m³.

What is the density of liquid X?

- A 500 kg/m³ B 800 kg/m³ C 1250 kg/m³ D 2000 kg/m³

- 11 A hydraulic lift can be used to lift a load of mass 2000 kg by applying a force F to a piston P.

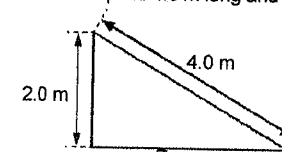


The cross-sectional area of piston P is 50 cm² and the cross-sectional area of piston Q is 500 cm². The gravitational field strength g is 10 N/kg.

What is the value of the force F ?

- A 200 N B 2000 N C 5000 N D 50000 N

- 12 A box is initially at rest at the top of a rough slope. The box slides down the slope. The weight of the box is 20 N. The slope is 4.0 m long and 2.0 m high.

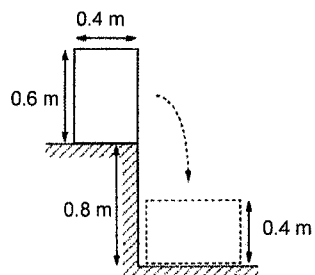


The box does 10 J of work against friction as it slides down the slope.

What is the speed of the box as it reaches the bottom of the slope?

- A 5.4 m/s B 6.3 m/s C 7.1 m/s D 9.5 m/s

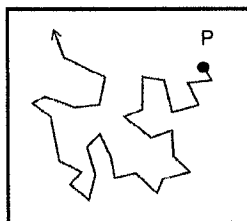
- 13 A uniform solid block has weight 200 N, width 0.4 m and height 0.6 m. The block rests on a step of depth 0.8 m as shown in the diagram.



The block is knocked over the edge of the step and rotates through 90° before coming to rest with the 0.6 m side horizontal on the ground. The gravitational field strength, g is 10 N/kg.

What is the change to the energy in the gravitational potential store of the block?

- A 100 J B 140 J C 180 J D 220 J
- 14 The diagram shows a smoke particle P seen moving randomly when suspended in air under a microscope.



Which statement explains why P moves randomly?

- A Air molecules are much larger than P.
 B Air molecules collide with P from different directions.
 C P is lighter than the air molecules.
 D P is much larger than air molecules.

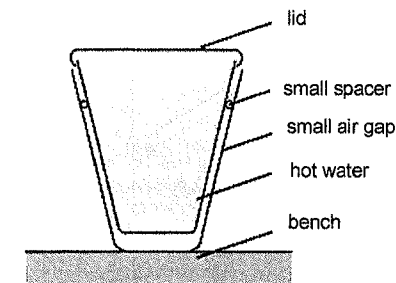
- 15 A kettle as shown below is brought over a fire to boil water.



Which of the following features will allow the water to be boiled slowly?

	inner surface	outer surface	texture
A	white	black	smooth
B	white	white	smooth
C	black	black	rough
D	black	white	rough

- 16 Two styrofoam cups are stacked together. Hot water is poured into the inner cup and a lid is placed on top of the inner cup as shown in the diagram.



A small spacer allows for a small air gap between the two cups.

Which statement is correct?

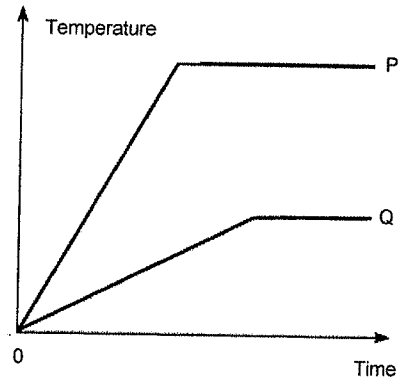
- A Heat loss by radiation is prevented by the small air gap.
 B No heat passes through the sides of both the inner cup and the outer cup.
 C The bench is heated by convection from the bottom of the outer cup.
 D The lid reduces heat loss by convection.

- 17 A liquid is heated in a container that is open to the atmosphere.

Which statement describes two properties of boiling that are different from the properties of evaporation?

- A Boiling occurs at a specific temperature but only at the surface of the liquid.
- B Boiling occurs at all temperatures but only at the surface of the liquid.
- C Boiling occurs at a specific temperature and throughout the liquid.
- D Boiling occurs at all temperatures and throughout the liquid.

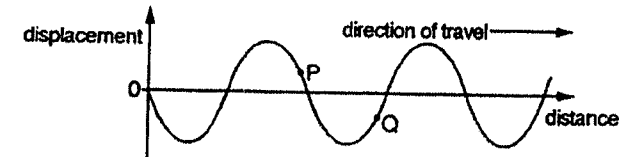
- 18 Identical heaters were used to heat two solids, P and Q, of identical mass. The temperatures of the solids during the heating were recorded and shown in the graph.



Which of the following statements is correct?

- A P has a lower specific heat capacity.
- B P has a lower specific latent heat of fusion.
- C Q has a lower specific heat capacity.
- D Q has a lower specific latent heat of fusion.

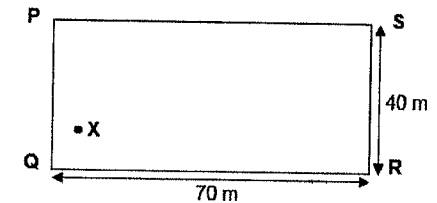
- 19 A transverse wave travels along a rope. The graph shows the variation of displacement with distance along the rope at a certain time. The wave is travelling to the right.



In which direction(s) are P and Q moving at this instance?

	P	Q
A	downwards	downwards
B	right	right
C	upwards	downwards
D	downwards	upwards

- 20 The diagram below shows an enclosed concert hall whose walls are assumed to be perfect reflectors of sound waves.

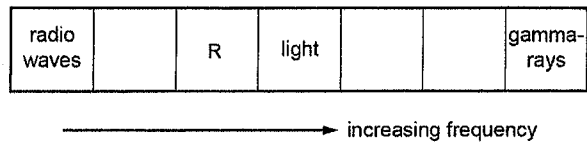


A sound detector is placed at the position X. The detector picks up the first two echoes at 20 ms and 60 ms respectively.

How far is the detector placed away from walls PQ and QR respectively? (Assume the speed of sound in air to be 330 m/s.)

	distance from PQ	distance from QR
A	3.3 m	9.9 m
B	3.3 m	30.1 m
C	6.6 m	19.8 m
D	6.6 m	20.2 m

- 21 The diagram shows the main sections of the electromagnetic spectrum in order of increasing frequency. Some of the sections are labelled.

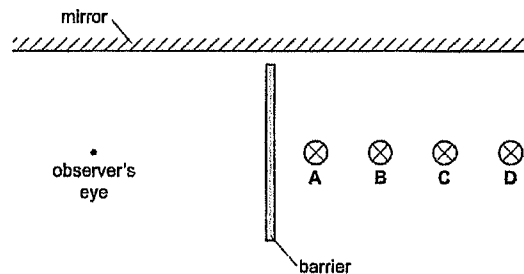


Section R has a frequency just below that of light.

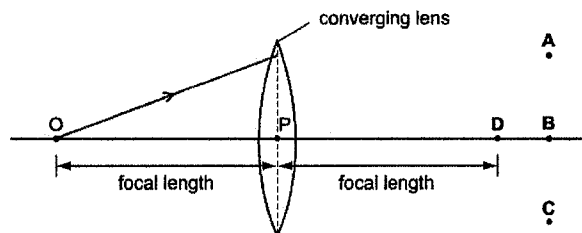
Which application uses the section R?

- A killing cancerous cells
 B satellite television
 C sterilisation
 D television remote control
- 22 The diagram shows a barrier placed at right angles to a plane mirror with four lamps at positions A, B, C, and D.

Which lamp can be seen by the observer?

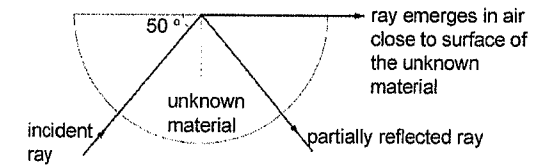


- 23 In the diagram, the distance OP is the focal length of the converging lens. One ray of light from O is shown.



Through which point will this ray pass, after refraction by the lens?

- 24 A ray of monochromatic light passes through a transparent semi-circular block of an unknown material. The path of the ray is shown in the diagram.



What is the refractive index of the unknown material?

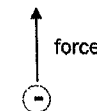
- A 0.64
 B 0.77
 C 1.31
 D 1.56

- 25 A plastic rod is rubbed with a cloth. The rod becomes positively charged.

What happens to the plastic rod and what is the charge on the cloth?

	plastic rod	charge on cloth
A	gains electrons	positive
B	gains protons	positive
C	loses electrons	negative
D	loses protons	negative

- 26 A stationary negative charge in an electric field experiences a force in the direction shown.



What is the direction of the electric field?

- A horizontally to the left
 B horizontally to the right
 C vertically downwards
 D vertically upwards

- 27 Voltage-current readings were obtained for different electrical components.

Which readings are for a 3 V, 0.06 A torch bulb?

A	voltage/V	0	1	2	3
	current/mA	0	6	12	18
B	voltage/V	0	1	2	3
	current/mA	0	25	45	60
C	voltage/V	0	1	2	3
	current/mA	0	20	40	60
D	voltage/V	0	1	2	3
	current/mA	0	10	20	30

- 28 A resistor with resistance R is made from a length L of resistance wire with cross-sectional area A .

A second resistor with resistance $2R$ is made from wire of the same material with a cross-sectional area of $\frac{A}{4}$.

What length of wire is needed for the second resistor?

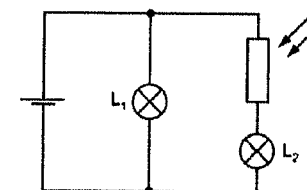
- A $\frac{L}{2}$ B L C $2L$ D $8L$

- 29 Four lamps, each with a rating of 6 V, 3 W are operated at normal brightness.

What is the total energy supplied to the lamps in five seconds?

- A 10 J B 20 J C 40 J D 60 J

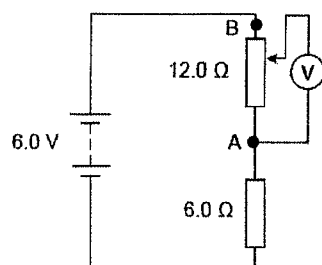
- 30 In the circuit shown, R is a light-dependent resistor connected with two light bulbs, L_1 and L_2 .



What effect does an increase of light intensity on R have on the brightness of L_1 and L_2 ?

	L_1	L_2
A	decreases	decreases
B	decreases	increases
C	stays the same	decreases
D	stays the same	increases

- 31 The diagram shows a circuit with a potential divider connected in series with a fixed resistor $6.0\ \Omega$.



The movable contact of the voltmeter is adjusted between A to B. What are the minimum and maximum readings on the voltmeter?

	minimum voltage / V	maximum voltage / V
A	0	4.0
B	0	6.0
C	2.0	4.0
D	6.0	12.0

- 32 An electrical cable contains three wires: live, neutral and earth. The cable is correctly wired to a plug containing a 3 A fuse. The insulation becomes damaged and bare metal wires show.

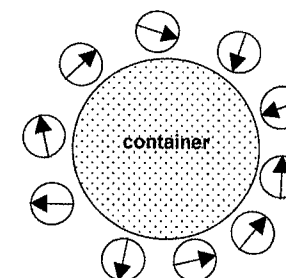
Five possible events can occur.

- A person touches the earth wire.
- A person touches the neutral wire.
- A person touches the live wire.
- The live wire touches the neutral wire.
- The live wire touches the earth wire.

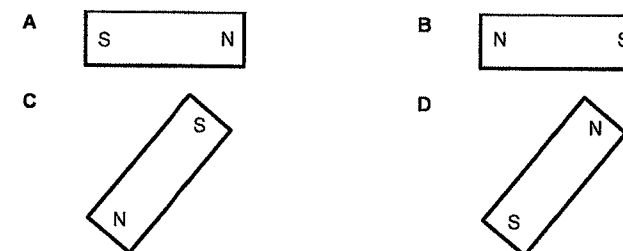
How many of these five events will cause the fuse in the plug to blow?

- A 1 B 2 C 3 D 4

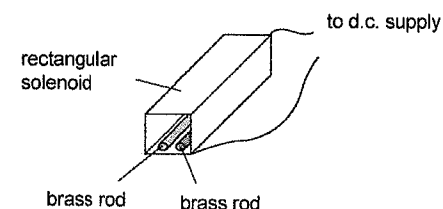
- 33 The diagram shows a circular container which has a bar magnet hidden inside it. Compasses are placed around the outside and their needles point as shown.



Which diagram shows the position of the magnet inside the box?



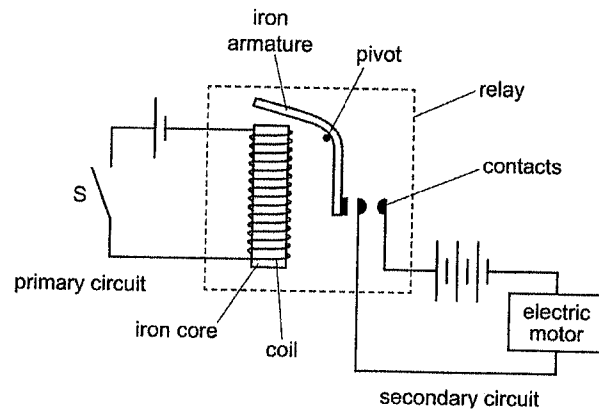
- 34 The diagram shows two brass rods, side by side, at the bottom of a rectangular solenoid. The wires of the rectangular solenoid / coil are insulated.



What happens when a direct current passes through the solenoid?

- A The two rods move towards each other.
 B The two rods move away from each other.
 C The two rods move towards and then away from each other.
 D The two rods remain stationary.

- 35 The diagram shows a device called a relay used to switch on an electric motor. The relay consists of a primary circuit that is used to switch on an electric motor in a secondary circuit.



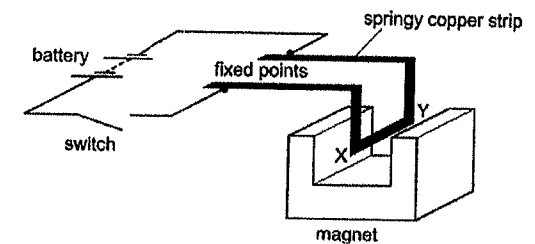
A student makes five statements to explain how the relay switches on the electric motor. The statements are not in the correct order.

1. The current in the coil magnetises the electromagnet.
2. The armature closes the contacts.
3. The switch S in the primary circuit is closed.
4. The current in the secondary circuit makes the motor turn.
5. The electromagnet attracts the iron armature.

What is the correct order of the statements?

- A 1 → 5 → 2 → 4 → 3
 B 2 → 3 → 4 → 1 → 5
 C 3 → 1 → 5 → 2 → 4
 D 5 → 1 → 4 → 2 → 3

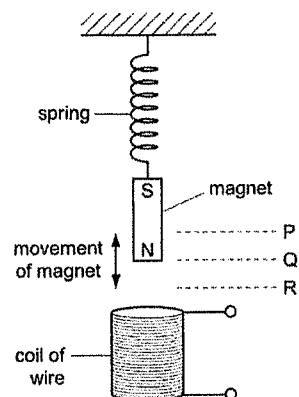
- 36 When the switch is closed in the circuit shown, the wire XY moves up a certain distance. When the switch is opened, XY springs back to its original position.



Which change makes the wire XY move up a smaller distance when the switch is closed?

- A Use a stronger magnet.
 B Connect a resistor in series with the battery.
 C Reverse the terminals of the battery.
 D Reverse the poles of the magnet.

- 37 A magnet moves up and down above a coil of wire.

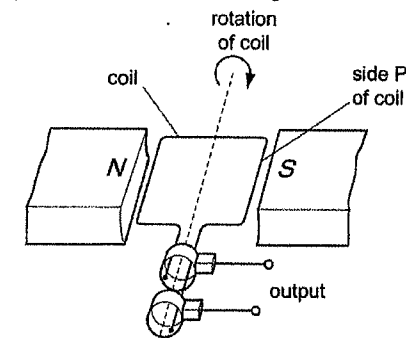


The bottom of the magnet moves up and down between P and R.

Where is the bottom of the magnet when there is no induced electromotive force in the coil?

- A At P and at Q.
- B At P and at R.
- C At Q only.
- D At R only.

- 38 An output voltage is produced as the coil in the diagram rotates.



One side of the coil is labelled P.

During the rotation, when is the output voltage zero?

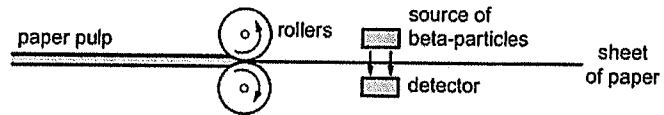
	orientation of coil	position of P
A	horizontal	near the N pole only
B	horizontal	near the N pole or near the S pole
C	vertical	at the top only
D	vertical	at the top or bottom

- 39 A nucleus consists of 90 protons and 144 neutrons. This nucleus emits two beta particles followed by an alpha particle.

Which of the following shows the number of protons and neutrons in the new nuclide formed?

- A 86 protons and 140 neutrons
- B 86 protons and 142 neutrons
- C 90 protons and 140 neutrons
- D 90 protons and 142 neutrons

- 40 The diagram shows how the thickness of paper is measured during manufacture.



Why are beta particles used for this purpose?

- A Alpha particles are all stopped by the paper.
- B Alpha particles make the paper radioactive
- C Gamma radiation is all stopped by the paper
- D Gamma radiation is only produced by sources with a short half-life.

1	D	11	B	21	D	31	A
2	A	12	A	22	C	32	B
3	B	13	C	23	A	33	C
4	A	14	B	24	D	34	D
5	C	15	B	25	C	35	C
6	A	16	D	26	C	36	B
7	D	17	C	27	B	37	B
8	A	18	A	28	A	38	D
9	C	19	C	29	D	39	C
10	B	20	A	30	D	40	A



DUNMAN SECONDARY SCHOOL

CANDIDATE
NAME

CLASS

INDEX
NUMBER

PRELIMINARY EXAMINATION 2025 SECONDARY 4 EXPRESS

PHYSICS

Paper 1 Multiple Choice

6091/01
26 August 2025
1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

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Write your name, class and index number on the Answer Sheet in the spaces provided unless this has been done for you.

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Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

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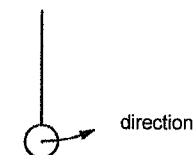
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The use of an approved scientific calculator is expected, where appropriate.

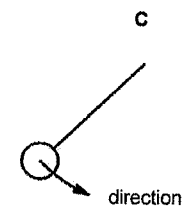
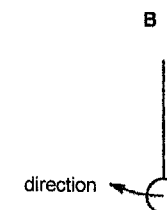
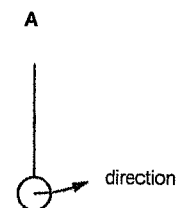
This document consists of 22 printed pages.

2

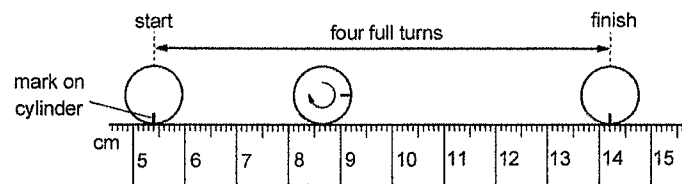
- 1 A pendulum has a period of 2.0 s.
A stopwatch is started when the pendulum is vertical and is moving to the right, as shown in the diagram.



Which diagram shows the position and direction of the pendulum 5.0 s later?

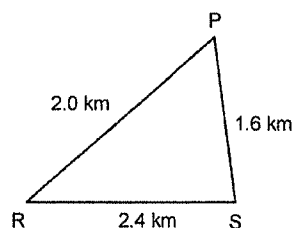


- 2 A small cylinder is rolled along a ruler and completes four full turns as shown in the diagram. The diagram is not drawn to scale.



What is the circumference of the cylinder?

- A 2.2 cm B 4.4 cm C 8.8 cm D 10.2 cm
- 3 A woman runs 2.0 km from P to R in 20 minutes and then rests at R for 10 minutes. She then takes 10 minutes to run 2.4 km from R to S.



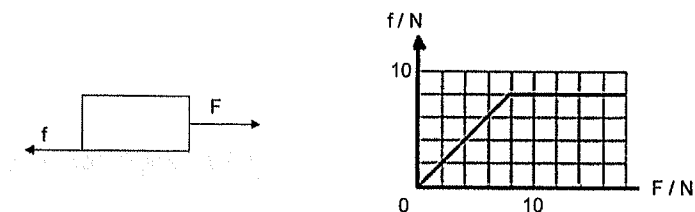
What is her average velocity for the journey from P to S?

- A 0.040 km / minute
B 0.053 km / minute
C 0.090 km / minute
D 0.120 km / minute
- 4 An object falls from rest through air.

Which statement is correct if the object has not reached terminal velocity?

- A Both its velocity and acceleration decrease.
B Its velocity decreases and its acceleration is constant.
C Its velocity increases and its acceleration decreases.
D Its velocity increases and its acceleration is constant.

- 5 A pulling force F , increasing from zero, is applied on a block placed on a rough horizontal surface. A graph of friction f against the pulling force F is plotted as shown.



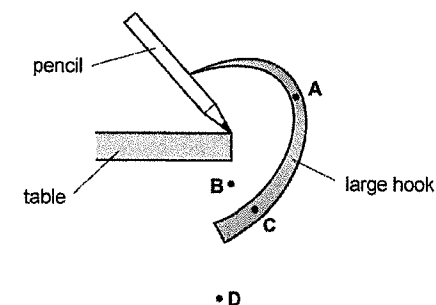
What is the value of F when the block starts to move?

- A 0 N B 2 N C 8 N D 10 N
- 6 The mass of object X is less than the mass of object Y. The objects contain different amounts of matter and have different inertias. Which row is correct?

	less amount of matter	lower inertia
A	X	X
B	X	Y
C	Y	X
D	Y	Y

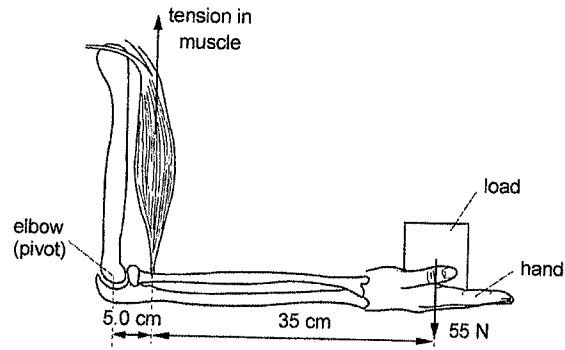
- 7 A large hook sticks into a pencil. The hook and pencil stay balanced on the edge of a table, as shown in the diagram.

Where is the centre of gravity of the hook and pencil?



- 8 The diagram shows a muscle and some bones in a human's arm.

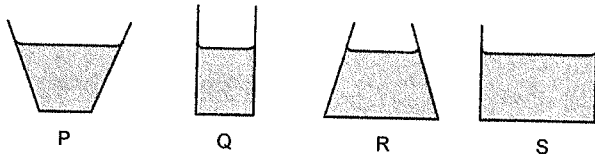
The hand holds a load of weight 55 N. The elbow acts as a pivot and the tension in the muscle keeps the lower part of the arm horizontal.



What is the tension in the muscle due to the load?

- A 280 N B 390 N C 440 N D 2200 N

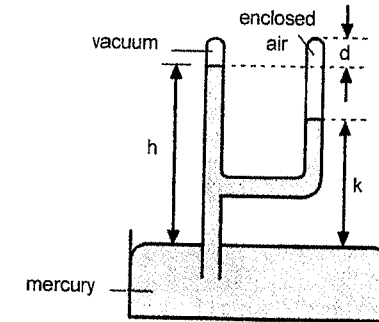
- 9 The diagrams drawn to the same scale, show the vertical sections of a set of circular vessels. Each vessel contains the same depth of water.



Which statement is correct?

- A The water exerts the greatest pressure on the base of vessel P.
 B The water exerts the greatest pressure on the base of vessel S.
 C The water exerts the same force on the base of each vessel.
 D The water exerts the same pressure on the base of each vessel.

- 10 A forked tube contains air in one branch and a vacuum in the other as shown.



What is the pressure of the enclosed air?

- A d cm Hg
 B $(h - d)$ cm Hg
 C $(h - k)$ cm Hg
 D k cm Hg

- 11 A single metal bolt has a mass of 38 g.

Three of such bolts are immersed in a measuring cylinder that contains 30 cm^3 of water. The reading on the measuring cylinder rises to 42 cm^3 .

What is the density of the metal?

- A 0.90 g/cm^3 B 1.3 g/cm^3 C 3.2 g/cm^3 D 9.5 g/cm^3

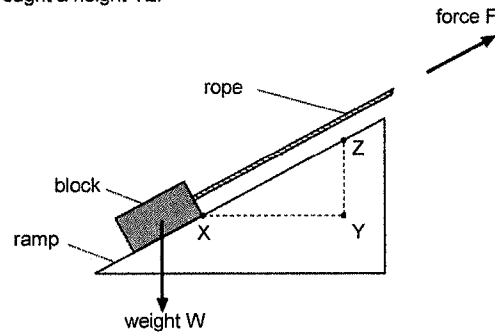
- 12 A rocket of mass M when empty carries a mass M of fuel. The rocket and fuel travel at speed v . The engine of the rocket is fired and all the fuel is expelled until no fuel is left. The speed of the rocket increases to $2v$.

What happens to the kinetic energy of the rocket?

- A It doubles.
 B It halves.
 C It increases by a factor of four.
 D It remains the same.

- 13 The diagram shows a block being pulled up along a ramp by a rope.

The block has weight W and the rope is pulled with force F . The block moves a distance XZ and is raised through a height YZ .

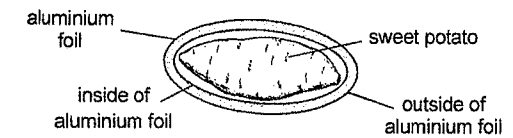


What is the work done on the block by the rope?

- A $F \times XZ$
 - B $F \times YZ$
 - C $W \times XY$
 - D $W \times XZ$
- 14 The size of a balloon increases when it is left under the Sun.
- Why does this happen?
- A The air molecules inside the balloon are bigger when it is heated.
 - B The air molecules inside the balloon move faster when it is heated.
 - C The air molecules inside the balloon move outwards when it is heated.
 - D The number of air molecules inside the balloon increases when it is heated.

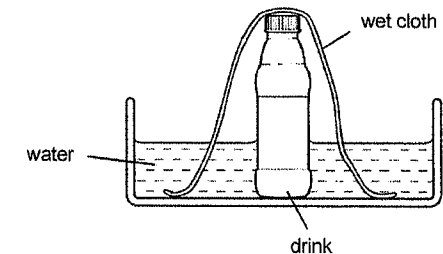
- 15 In aluminium foils, one side is shinier than the other. They are commonly used to wrap sweet potatoes cooked in a barbeque fire.

The diagram shows a sweet potato being wrapped in aluminium foil.



How should the sweet potato be wrapped in the aluminium foil to allow it to be cooked faster when placed in the fire?

- A The dull side should be on the outside because it is a better absorber of radiation.
 - B The dull side should be on the outside because it is a better conductor of heat.
 - C The shiny side should be on the outside because it is a better absorber of radiation.
 - D The shiny side should be on the outside because it is a better conductor of heat.
- 16 On a hot day, a cold drink in a bottle can be kept cool by standing it in a bowl of water and placing a wet cloth over it.



Why will the drink be kept cool?

- A Hot air cannot escape from the bottle.
- B The cloth conducts heat from the bottle into the water.
- C The drink cannot evaporate from the bottle.
- D Water evaporating from the cloth cools the drink.

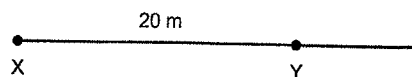
- 17 Two liquids P and Q are placed in two similar polystyrene cups. Initially, both liquids are at the same temperature and have equal masses. They are simultaneously heated by identical immersion heaters.

If liquid P has a lower specific heat capacity, which result(s) will be observed?

- 1 Liquid P will be boiled away before liquid Q does.
- 2 Liquid P will reach its boiling point first.
- 3 The temperature of liquid P will rise more rapidly than liquid Q.

- A 1 only
B 1, 2 and 3
C 2 only
D 3 only

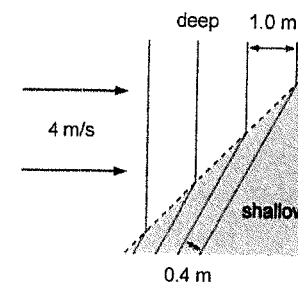
- 18 X and Y are two points 20 m apart on a string. Point X is vibrated 5 times in one second and the first resulting wave reaches Y two seconds later.



What is the period and wavelength of the wave?

	period / s	wavelength / m
A	0.20	2.0
B	0.20	4.0
C	2.5	2.0
D	2.5	4.0

- 19 Refraction occurs when waves travel from deep water to shallow water.



What is the speed of the waves in the shallow water?

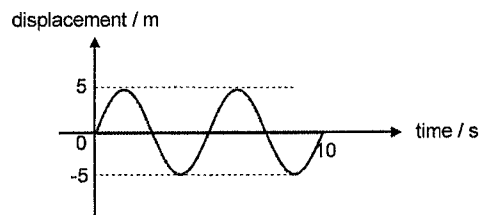
- A 0.4 m/s B 1.2 m/s C 1.6 m/s D 4.0 m/s

- 20 A sonic 'tape measure' is used to measure the length of a room. It measures a time interval of 0.080 s between transmitting a sound pulse and receiving its echo. The speed of sound in air is 330 m/s.

How far is the reflecting wall from the 'tape measure'?

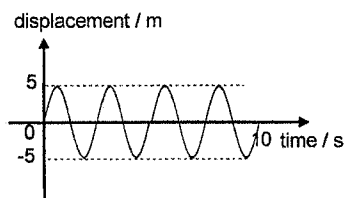
- A 5.5 m B 11 m C 13 m D 26 m

- 21 A musical note is represented on the displacement-time graph below.

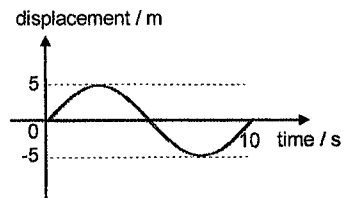


Which displacement-time graph shows another musical note which has twice the loudness and half the pitch of the original musical note?

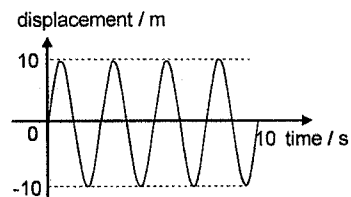
A



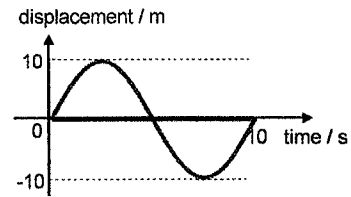
B



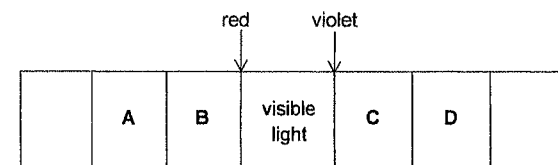
C



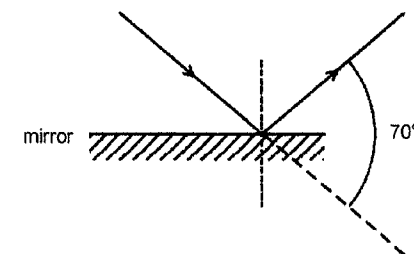
D



- 22 The diagram below shows the electromagnetic spectrum.
Which component can be used to detect counterfeit notes?



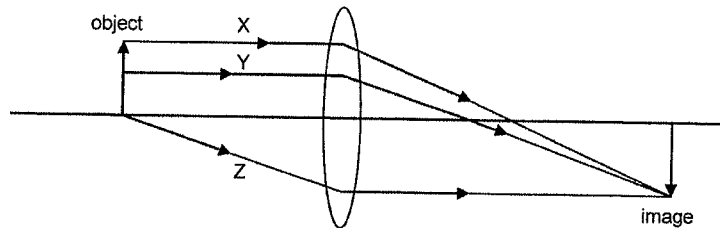
- 23 Light is incident on a mirror and reflected as shown.



What is the angle of incidence and the angle of reflection?

	angle of incidence / °	angle of reflection / °
A	35	35
B	35	55
C	55	55
D	70	70

- 24 Which ray(s) is/are correctly drawn in the diagram below?



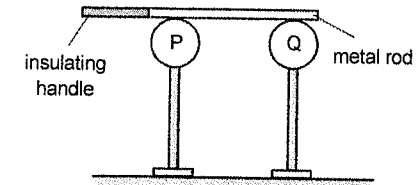
- A ray X only
 B ray Y only
 C rays X and Z only
 D rays X, Y and Z
- 25 An electrostatically charged object will pick up small pieces of paper.

Which object will not pick up any piece of paper?

- A A plastic comb pulled through dry hair.
 B A polythene rod rubbed with a woollen cloth.
 C A rubber balloon rubbed on a nylon shirt.
 D An earthed metal rod rubbed with a duster.

- 26 Two metal spheres are mounted on insulating stands. Sphere P is initially uncharged and sphere Q is initially positively charged.

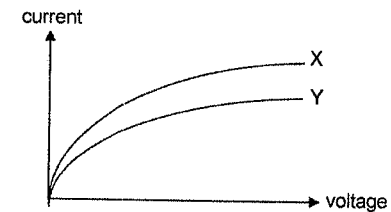
A metal rod, held by an insulating handle, is placed in contact with P and Q as shown.



Which statement correctly describes the charge on the metal spheres when the metal rod is placed in contact with the metal spheres?

	charge on P	charge on Q
A	positive	positive
B	positive	uncharged
C	uncharged	positive
D	uncharged	uncharged

- 27 The graph shows the current - voltage relationship of two filament lamps made of the same type of metal.



Which statement is correct?

- A Both filaments X and Y obey Ohm's law.
 B Filament X is longer and thinner than filament Y.
 C The resistance of both filaments decreases with temperature rise as current increases.
 D The resistance of filament X is smaller than the resistance of filament Y when both are at the same voltage.

28 Why are batteries sometimes made from several identical cells arranged in parallel?

- A The battery has a greater e.m.f. than a single cell on its own.
- B The battery has a lower e.m.f. than a single cell on its own.
- C The battery lasts longer than a single cell on its own.
- D The battery supplies a smaller current than a single cell on its own.

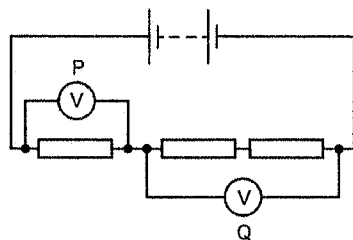
29 A charge of 0.40 C passes through a resistor in 1.0 s.

In 5.0 s, 50 J of work is done by the battery to drive the charges through the resistor.

What is the potential difference across the resistor?

- A 0.020 V B 0.040 V C 25 V D 50 V

30 Three identical resistors are connected in series to a battery.

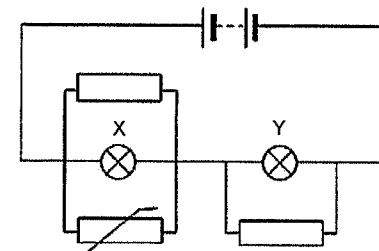


Voltmeter Q reads 10.0 V.

What is the reading on voltmeter P and what is the e.m.f. of the battery?

	reading on P / V	e.m.f. of battery / V
A	5.0	10.0
B	5.0	15.0
C	10.0	10.0
D	10.0	15.0

31 A circuit is set up as shown.



What will happen to the brightness of bulb X and Y if the temperature of the thermistor is increased?

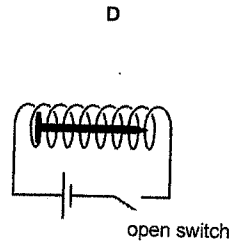
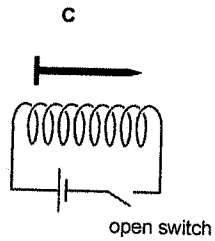
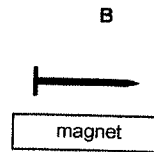
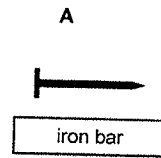
	brightness of bulb X	brightness of bulb Y
A	brighter	brighter
B	brighter	dimmer
C	dimmer	brighter
D	unchanged	unchanged

32 The cable to an electric cooker contains a live wire, a neutral wire and an earth wire.

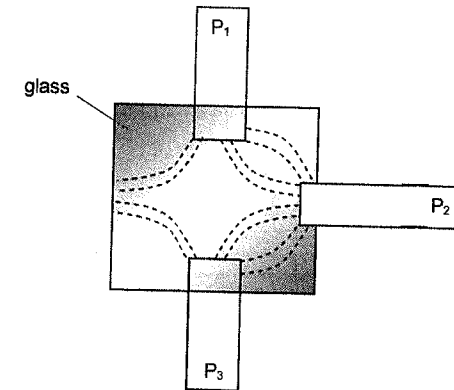
In which wires are the currents the same when the cooker is operating under normal conditions?

- A the live, the neutral and the earth
- B the live and the earth only
- C the neutral and the earth only
- D the neutral and the live only

- 33 The diagrams show an iron nail in four different set-ups. In which diagram will the nail become an induced magnet?



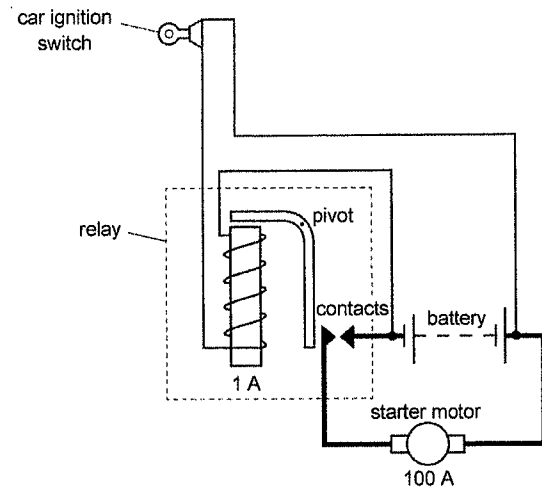
- 34 A piece of thin glass is placed on top of three strong magnets positioned as shown. Iron filings are then sprinkled on the glass and the pattern is produced as shown.



What are the correct poles at P₁, P₂ and P₃?

	P ₁	P ₂	P ₃
A	north	north	north
B	north	south	south
C	south	north	south
D	south	south	north

- 35 The diagram shows a car ignition switch and starter motor.

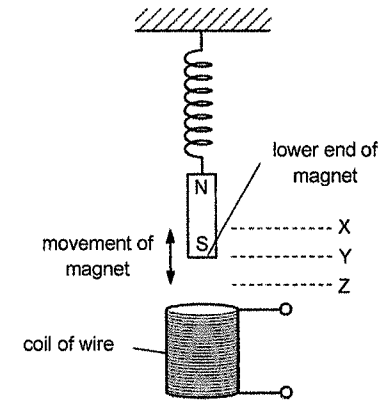


The ignition switch is in a circuit with long, thin wires. The starter motor is in a circuit with short, thick wires.

What is the explanation for the choice of wires?

- A Each circuit needs to contain the same total mass of wire.
- B The ignition switch circuit carries a smaller current than the starter motor circuit.
- C Thicker wires heat up more quickly when the relay is switched on.
- D Thin wires have lower resistances.

- 36 A magnet oscillates vertically above a coil of wire.

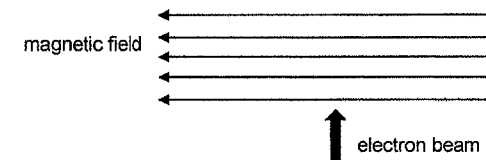


As the lower end of the magnet oscillates between X and Z, a varying e.m.f. is induced across the coil.

When this e.m.f. is 0 V, where could the lower end of the magnet be at?

- A at X or at Y
- B at X or at Z
- C at Y only
- D at Z only

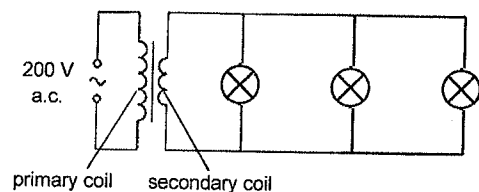
- 37 An electron beam is aimed perpendicularly at a magnetic field. The direction of the magnetic field is from right to left as shown.



In which direction will the electron beam be deflected?

- A into the page
- B out of the page
- C to the bottom right of the page
- D to the top left of the page

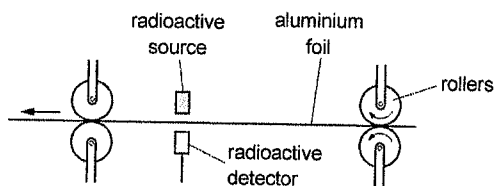
- 38 The diagram shows a transformer with 80 % efficiency.
Each light bulb is rated at '12 V, 24 W' and is operating normally.



What is the current flowing in the primary coil?

- A 0.20 A B 0.45 A C 2.00 A D 2.50 A

- 39 Thin aluminium foil is used in cooking.
The diagram shows a system used to control the thickness of aluminium foil being made in a factory.



What is the most suitable radioactive source for the system?

	source	half-life of source
A	beta	1 hour
B	beta	6 years
C	gamma	1 hour
D	gamma	6 years

- 40 $^{14}_6\text{C}$ is a natural radioactive isotope of carbon and is present in all living things. It has a half-life of 5700 years. The amount of $^{14}_6\text{C}$ in an animal stays constant while the animal is alive and only starts reducing when the animal dies.

How old is a bone that is found to have only 25% of the natural proportion of $^{14}_6\text{C}$ remaining?

- A 5700 years
B 11 400 years
C 17 100 years
D 22 800 years

Paper 1

1	2	3	4	5	6	7	8	9	10
B	A	A	C	C	A	B	C	D	C
11	12	13	14	15	16	17	18	19	20
D	A	A	B	A	D	D	A	C	C
21	22	23	24	25	26	27	28	29	30
D	C	C	A	D	A	D	C	C	B
31	32	33	34	35	36	37	38	39	40
C	D	B	C	B	B	A	B	B	B

Class:	Candidate Name:	Candidate Index Number:
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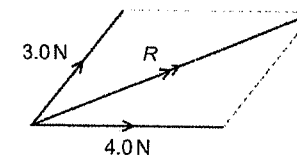
Answer all questions

- 1 The approximate diameter of the earth is 1.3×10^7 m and the diameter of a nitrogen atom is 1.5×10^{-10} m.

How are these values expressed with prefixes?

	diameter of the Earth	diameter of nitrogen atom
A	1.3×10^{-2} Mm	1.5×10^{-1} μ m
B	1.3×10^{-2} Gm	1.5×10^{-1} μ m
C	1.3×10^{-2} Mm	1.5×10^{-1} nm
D	1.3×10^{-2} Gm	1.5×10^{-1} nm

- 2 The diagram shows the resultant R of a 3.0 N force and a 4.0 N force acting at a point.



The angle between the 3.0 N force and the 4.0 N force can be any value from 0° to 90° .

Which value of R is not possible?

- A 4.0 N B 5.0 N C 6.0 N D 7.0 N

- 3 A parachutist jumps from a plane and opens his parachute some time later.



Which of the following is true about the directions of the velocity and acceleration of the parachutist after opening his parachute and before reaching terminal velocity?

	velocity	acceleration
A	downwards	downwards
B	downwards	upwards
C	upwards	downwards
D	upwards	upwards

 EDGEFIELD SECONDARY SCHOOL 2025 PRELIMINARY EXAMINATION Secondary 4 PHYSICS Paper 1 Multiple Choice Additional Materials: OTAS	O Syllabus
	6091/ 01 August 2025 1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

FOR EXAMINER'S USE

TOTAL / **40**

My target grade/mark: _____

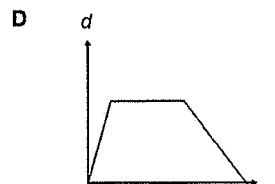
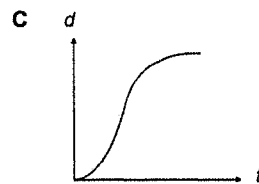
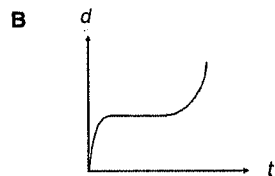
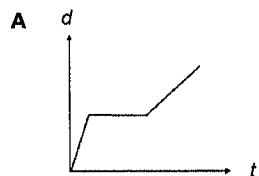
Parent's signature _____

This document consists of 18 printed pages.

- 4 A sphere moves along a smooth rail from P to Q as shown.



Which of the following graphs best represents the variation of the distance d travelled by the sphere with time t ?



- 5 A metal cube has a mass of 15 g. Each side measures 4.0 cm. The density of the metal is 3.0 g/cm³. There is empty space in the middle of the cube.

What is the volume of the empty space?

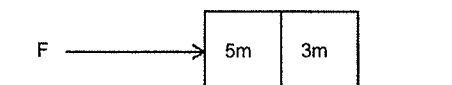
- A 5.0 cm³ B 11 cm³ C 19 cm³ D 59 cm³

- 6 An experiment is carried out by an astronaut on the surface of the Moon. A coin and a feather are dropped at the same instant from the same height.

Which of the following statements is correct?

- A The coin falls faster than the feather, but both take a longer time than if they were falling from the same height on Earth.
 B The coin falls faster than the feather, but both take a shorter time than if they were falling from the same height on Earth.
 C They fall together, taking a longer time than the coin would in falling from the same height on Earth.
 D They fall together, taking a shorter time than the coin would in falling from the same height on Earth.

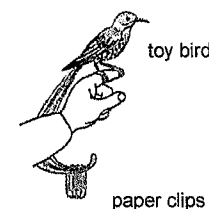
- 7 Two blocks with mass 5m and 3m are pushed along a smooth horizontal surface by an applied force F .



What is the magnitude of the force exerted between the blocks?

- A F B $\frac{2}{8}F$ C $\frac{3}{8}F$ D $\frac{8}{3}F$

- 8 A girl uses paper clips to balance a toy bird on her finger, as shown.



What is the effect of the paper clips?

- A They do not affect the centre of gravity but increase the weight.
 B They help to lower the centre of gravity below her finger.
 C They help to raise the centre of gravity above her finger.
 D They help to raise the centre of gravity to her finger.

- 9 The diagram shows a uniform metal bar of mass 30 kg. A student pulls straight up with a force F at one end Y of the bar so that it pivots about the end X.



When the end Y just comes off the ground, what is the value of the force F ?

- A 15 N B 60 N C 150 N D 240 N

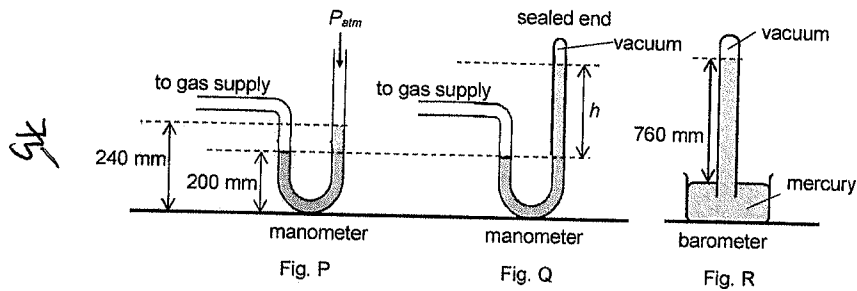
- 10 A fixed mass of gas is heated in a cylinder with a movable piston. The piston is pushed outwards by the gas to maintain a constant pressure in the piston.

Which row about the gas particles is correct?

	frequency of collision with the inner wall of cylinder	average speed
A	decrease	increase
B	decrease	no change
C	increase	increase
D	increase	no change

- 11 The pressure inside a gas cylinder is measured separately using two different mercury manometers as shown in Fig. P and Q. One of the manometers has an open end while the other has a sealed end.

A barometer, as shown in Fig. R, is used to measure the atmospheric pressure at the location of the experiment.



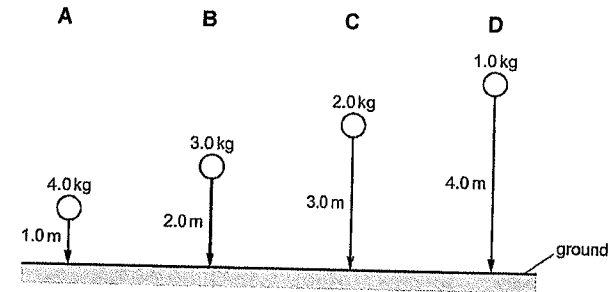
The diagrams are not drawn to scale.

What is the height, h , of the mercury in Fig. Q?

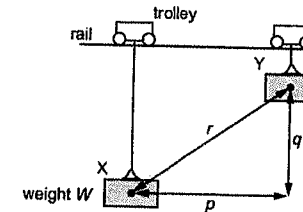
- A 40 mm B 720 mm C 800 mm D 1000 mm

- 12 Four balls with different masses are dropped from the heights shown. Air resistance may be ignored.

Which ball has the smallest average speed?



- 13 A weight W hangs from a trolley that runs along a rail. The trolley moves horizontally through a distance p and simultaneously raises the weight through a height q .

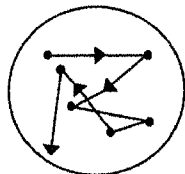


As a result, the weight moves through a distance r from X to Y. It starts and finishes at rest.

How much work is done on the weight during this process?

- A Wp B $W(p + q)$ C Wq D Wr

- 14 Smoke particles in a transparent container are observed under a microscope. A small point of light is seen to move around as shown.

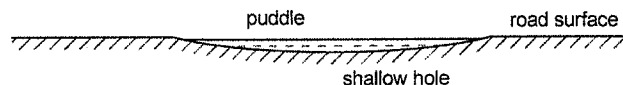


When the temperature in the container is raised, what change can be observed?

- A The small point of light becomes brighter.
 B The small point of light changes direction more frequently.
 C The small point of light increases in size.
 D The small point of light moves slower.
- 15 A substance consists of particles that are close together and moving past each other at random. The average speed of the particles is gradually increasing.

What best describes the substance?

- A a gas being heated
 B a liquid being heated
 C a liquid undergoing solidification
 D a solid being heated
- 16 The diagram shows the cross-sectional area of a shallow puddle of water on a road after rain.

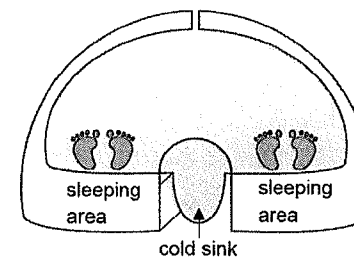


The surrounding temperature and the wind speed remain constant.

Which of the following best explains how the rate of evaporation of the water from the puddle changes?

	rate of evaporation	explanation
A	decreases	depth of puddle decreases
B	decreases	surface area decreases
C	increases	volume of water decreases
D	remains constant	temperature and wind speed do not change

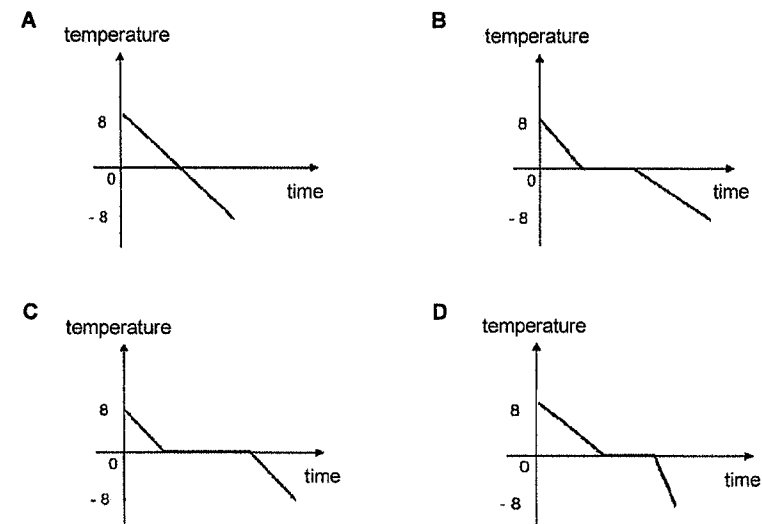
- 17 Eskimos build igloos as temporary shelter in extremely cold places such as the Arctic. The diagram shows a cross-section of an igloo. The entrance is dug deep enough (lower than the sleeping area) to create a cold sink.



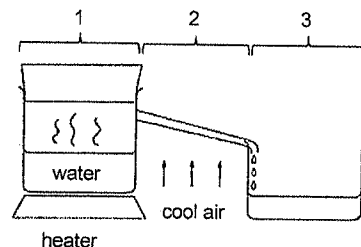
Which of the following statements about the air in the igloo is correct?

- A Cold air is denser and remains in the cold sink.
 B The air in the igloo is heated up by conduction only.
 C The warm air in the igloo is less dense, contracts and rises.
 D Warm air in the cold sink expands, becomes denser and rises out of the cold sink to heat up the rest of the igloo.
- 18 A cup of water at 8°C was cooled to ice at -8°C .

Given that ice has a lower specific heat capacity than water, which of the following cooling curves shows how the temperature changes with time?



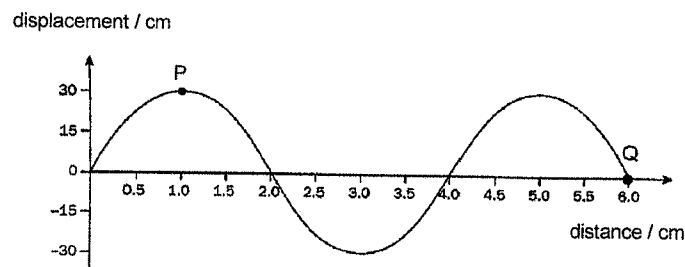
- 19 The diagram below shows a simple water distiller. Water is kept boiling in region 1, completely condensed in region 2 and collected in region 3.



In which region is latent heat of vaporisation absorbed or released by the water?

	absorbed	released
A	1	2
B	1	3
C	2	1
D	3	1

- 20 A transverse wave is represented by the graph below.

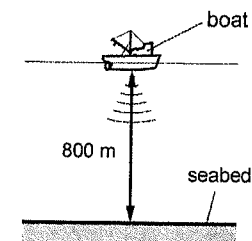


Given that the frequency of the wave is 5.0 Hz, how long does it take for the crest to travel from P to Q?

- A 0.20 s B 0.25 s C 0.30 s D 0.50 s

- 21 A pulse of sound is transmitted vertically downwards from the bottom of a stationary boat. The time taken for its echo to be detected back at the boat is 1.4 s.

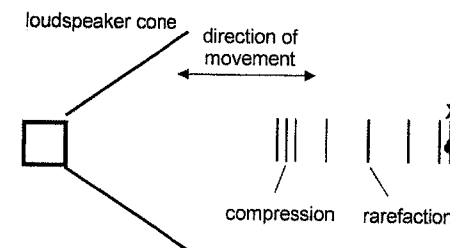
The seabed is 800 m below the boat.



What is the speed of sound in the water?

- A 286 m/s B 571 m/s C 1140 m/s D 2290 m/s

- 22 Compressions and rarefactions are sent out from a loudspeaker cone as it vibrates backwards and forwards. The frequency of vibration is 50 Hz.



Point X is at the centre of a compression.

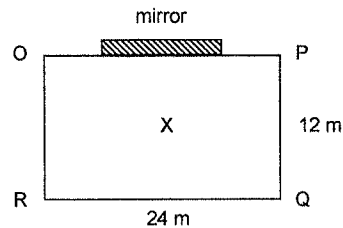
How much time elapses before the next rarefaction arrives at X?

- A 0.010 s B 0.020 s C 25 s D 50 s

- 23 Visible light, X-ray and microwaves are all components of the electromagnetic spectrum.

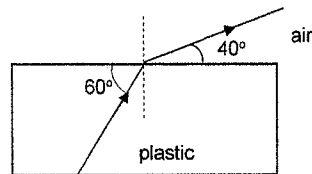
Which of the following statements about the waves is correct?

- A In a vacuum, microwaves travel at the same speed as visible light and have a shorter wavelength.
 B In a vacuum, microwaves travel at the same speed as X-rays and have a shorter wavelength.
 C In a vacuum, X-rays travel at the same speed as visible light and have a shorter wavelength.
 D In a vacuum, X-rays travel faster than visible light and have a shorter wavelength.
- 24 A plane mirror is to be installed in the middle of wall OP in a rectangular room 24 m by 12 m.



What is the minimum width of the plane mirror on wall OP such that a person standing in the middle of the room at X can see the entire wall QR in the mirror?

- A 8 m B 12 m C 16 m D 24 m
- 25 A ray of light travels from plastic to air as shown.



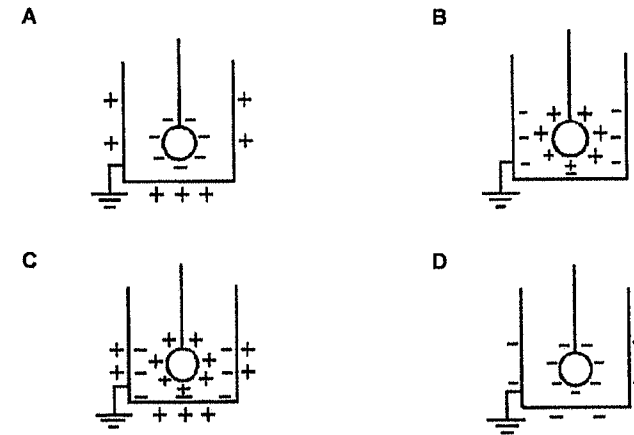
The speed of light in air is 3.0×10^8 m/s.

What is the speed of light in the plastic?

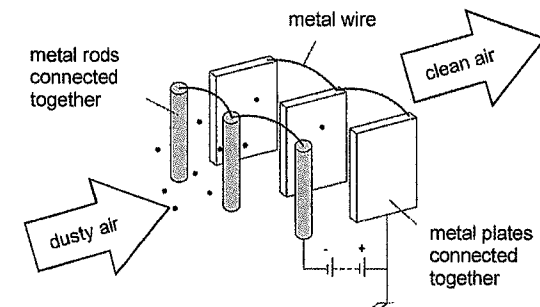
- A 1.5×10^8 m/s
 B 2.0×10^8 m/s
 C 3.0×10^8 m/s
 D 4.5×10^8 m/s

- 26 A charged sphere is suspended by an insulating thread inside a metal can. The outside of the can is earthed.

Which diagram shows the correct resulting charges on the sphere and on the can?



- 27 In an electrostatic precipitator, a fan blows dusty air past several metal rods and metal plates. There is a large potential difference between the metal rods and the metal plates.



How do dust particles get removed in this precipitator?

- A Dust particles gain electrons and get attracted to the metal plates.
 B Dust particles gain protons and move away from the metal plates.
 C Dust particles lose electrons and move away from the metal plates.
 D Dust particles lose protons and get attracted to the metal plates.

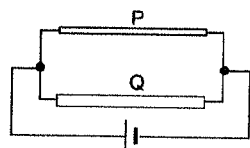
- 28 A 12 V car battery is fully charged. It is connected in series to a lamp labelled "12 V, 24 W". The lamp shines at normal brightness for 8 hours.

What is the magnitude of the charge that passes through the lamp during this time?

- A 960 C B 14 400 C C 57 600 C D 691 200 C

- 29 The diagram shows two wires P and Q, each of the same length and the same material, connected in parallel to a battery.

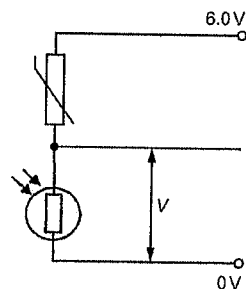
The cross-sectional area of Q is twice that of P.



What fraction of the total current passes through P?

- A $\frac{1}{5}$ B $\frac{1}{4}$ C $\frac{1}{3}$ D $\frac{1}{2}$

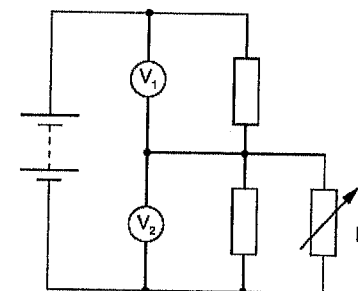
- 30 A potential divider consists of a negative temperature coefficient (NTC) thermistor and a light-dependent resistor (LDR).



Which of the following conditions will give the smallest voltage V across the LDR?

- A cold and bright
B cold and dark
C hot and bright
D hot and dark

- 31 The circuit diagram shows a variable resistor R connected in parallel to the lower half of a potential divider.



The resistance of R increases.

What happens to the voltmeter readings?

	reading on V_1	reading on V_2
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

- 32 Four possible situations are listed below.

- 1 The live wire touches the earth wire.
- 2 The live wire touches the neutral wire.
- 3 The earth wire is touched by a person.
- 4 The fuse is fixed on the neutral wire instead of the live wire.

In which of the following situation(s) would a fuse melt?

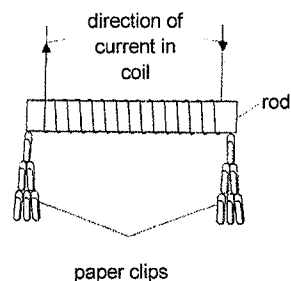
- A 2 only
B 1 and 2 only
C 3 and 4 only
D 1, 2 and 3 only

- 33 A 2.0 kW heater and a 1.0 kW fan are connected in parallel to a 240 V mains supply.

Which of the following fuse ratings should be installed in the household circuit?

- A 10 A B 12 A C 13 A D 30 A

- 34 Four rods are placed, in turn, inside a coil of copper wire.

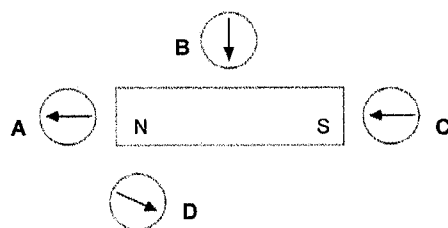


The table below gives the results of the experiment.

Which rod would be the most suitable to use as the core of a coil in a circuit breaker?

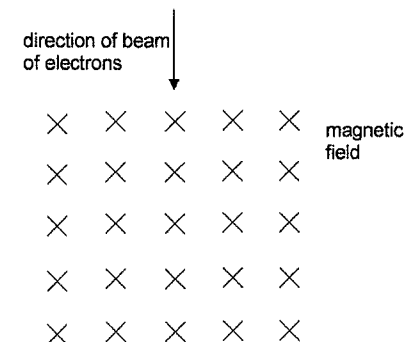
	number of paper clips picked up when there is current in the coil	number of paper clips picked up when there is no current in the coil
A	1	0
B	20	5
C	40	0
D	40	20

- 35 Four compasses are placed around a bar magnet, as shown in the diagram.



Which of the compasses is pointing in the wrong direction?

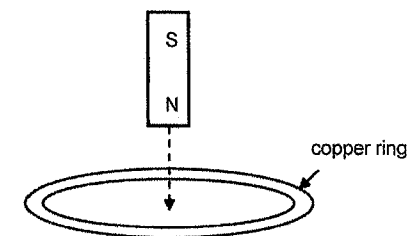
- 36 The diagram shows a beam of electrons entering a magnetic field.



Which of the following describes the movement of the electrons as they enter the magnetic field?

- A The electrons are deflected into the paper.
- B The electrons are deflected out of the paper.
- C The electrons are deflected to the left.
- D The electrons are deflected to the right.

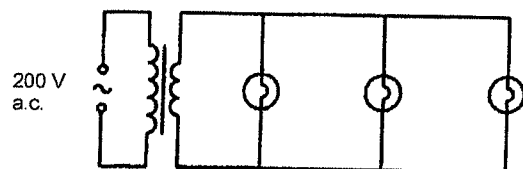
- 37 A magnet is dropped vertically through a copper ring. The induced electromotive force is larger than the weight of the magnet.



Which of the following statements is **incorrect**?

- A A current flows in the ring just after the magnet passes through the ring.
- B A current flows in the ring just before the magnet passes through the ring.
- C The magnet accelerates just after it passes through the ring.
- D The magnet slows down just before it passes through the ring.

- 38 A transformer as shown below is 60% efficient. Each light bulb is "12 V, 24 W" and is working at the rated value.



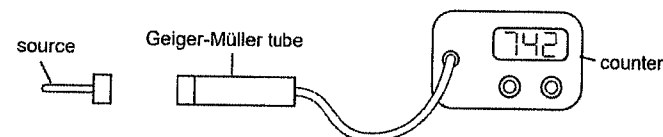
What is the primary current in the circuit?

- A 0.36 A B 0.45 A C 0.60 A D 0.80 A
- 39 The half-life of a certain radioactive element is such that $\frac{7}{8}$ of a given quantity decays in 12 days.

What fraction remains undecayed after 24 days?

- A $\frac{1}{128}$ B $\frac{1}{64}$ C $\frac{1}{32}$ D $\frac{1}{16}$

- 40 A radioactive source is placed 3 cm from a Geiger-Müller tube in air. The average count rate is 742 counts / minute.



Three measurements are taken with sheets of different materials placed between the source and the tube.

The results are recorded in the table as shown below.

material of sheet between source and tube	thin card	aluminium foil	thick lead
average count rate / counts per minute	273	275	68

Which types of radiation does the source emit?

- A alpha and beta only
 B alpha and gamma only
 C alpha, beta and gamma
 D beta and gamma only

End of Paper

1	2	3	4	5	6	7	8	9	10
D	A	B	C	D	C	C	B	C	A
11	12	13	14	15	16	17	18	19	20
C	A	C	B	B	B	A	D	A	B
21	22	23	24	25	26	27	28	29	30
C	A	C	A	B	B	A	C	C	A
31	32	33	34	35	36	37	38	39	40
B	B	C	C	B	C	C	C	B	B

b7



FUHUA SECONDARY SCHOOL
Secondary Four Express
PRELIMINARY EXAMINATION 2025

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PHYSICS

6091/01

Paper 1

DATE 2 September 2025
TIME 0800 – 0900
DURATION 1 hour

Additional Material: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class, index number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on this paper. Answer all questions. For each question, there are four possible answers **A**, **B**, **C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done on this paper.

The use of an approved scientific calculator is expected, where appropriate.

FOR EXAMINER'S USE	PARENT'S SIGNATURE

Setter: Mr Muhammad Khairi Bin Ruslihan **Vetter:** Mr Nicholas Liu

This document consists of 15 printed pages, including this page.

- 1 A pair of digital calipers measures the external diameter of a metal pipe to be 2.780 cm. The internal diameter of the pipe is 2.020 cm. What is the thickness of the wall of the metal pipe?

A 0.280 cm **B** 0.380 cm **C** 0.560 cm **D** 0.760 cm

- 2 The diameter of four spheres W, X, Y and Z are shown in the table below.

object	diameter
W	0.002 mm
X	40 nm
Y	0.00005 Tm
Z	0.25 μ m

Which of the following correctly lists the size of objects in ascending order?

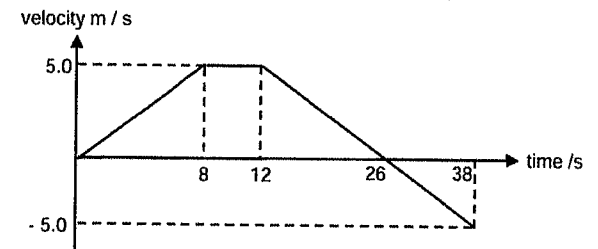
A **W, X, Y, Z**

B X, Z, W, Y

C Z, X, W, Y

D X, Z, Y, W

- 3** The diagram shows the velocity-time graph of a cyclist's journey.



What is the average speed for the cyclist's entire journey?

A 1.0 m/s **B** 1.2 m/s **C** 1.8 m/s **D** 2.8 m/s

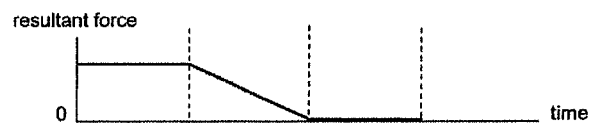
- 4 A feather falls through a vacuum. Which row describes the velocity and acceleration of the object?

	velocity	acceleration
A	constant	constant
B	constant	increasing
C	increasing	constant
D	increasing	increasing

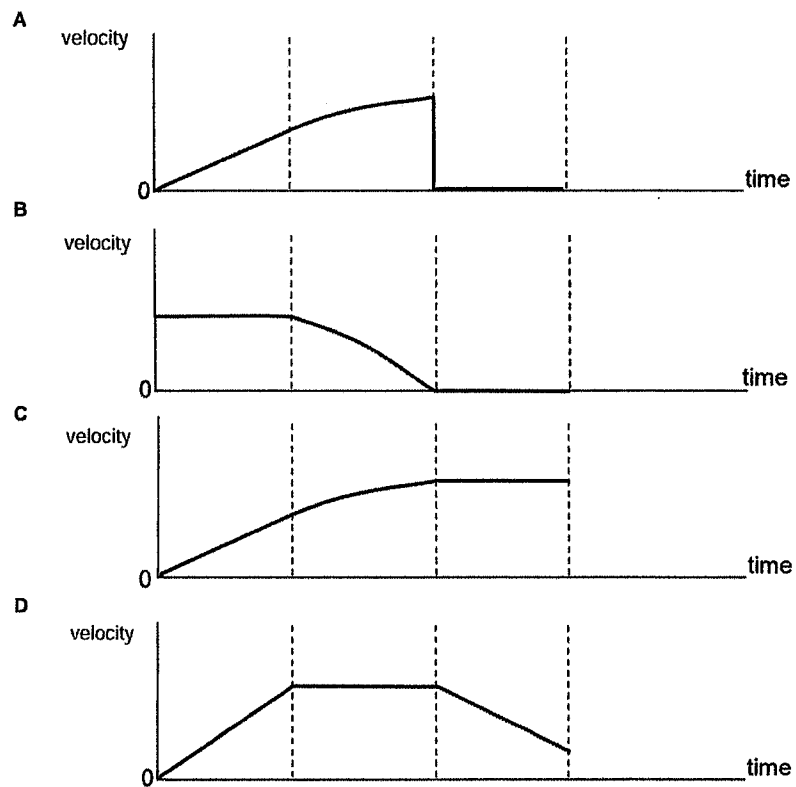
- 5 Two forces act on a stationary object. The magnitudes of the forces are 5.0 N and 12.0 N respectively. Which could be the magnitude of the resultant force acting on the object?

A 6.0 N **B** 8.5 N **C** 17.2 N **D** 19.0 N

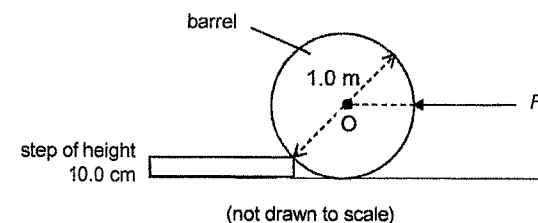
- 6 The graph below shows how the resultant force acting on an object varies with time.



Which graph correctly shows how the velocity of the object varies with time?

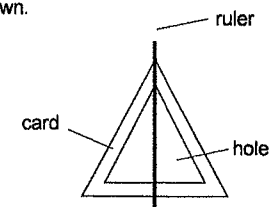


- 7 A barrel of weight 100 N and diameter 1.0 m is rested against a step of height 10.0 cm as shown below. O is the centre of the barrel.

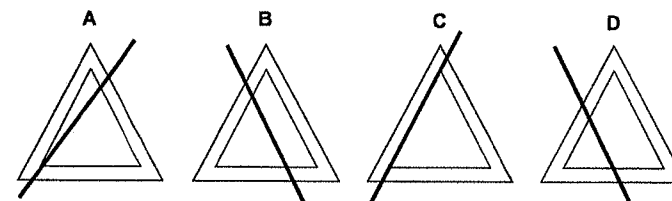


What is the smallest horizontal force F needed to push the barrel over the step?

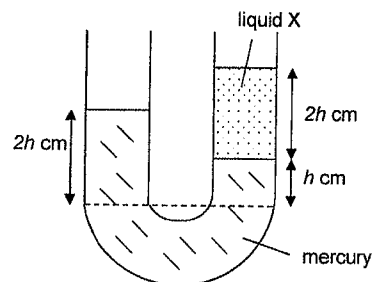
- A 25 N B 40 N C 75 N D 100 N
- 8 A uniform equilateral triangular piece of card with a triangular hole can be balanced on the thin edge of a ruler as shown.



Which diagram also shows the triangular card balanced on the ruler?

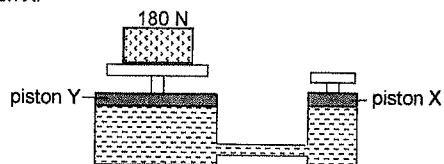


- 9 A U-shaped tube contains mercury and liquid X.



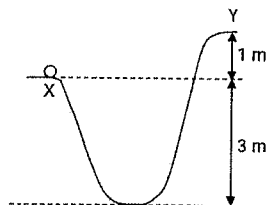
If the density of mercury is $13\,600\text{ kg/m}^3$, what is the density of the liquid X?

- A $6\,800\text{ kg/m}^3$ B $13\,600\text{ kg/m}^3$ C $20\,400\text{ kg/m}^3$ D $27\,200\text{ kg/m}^3$
- 10 The diagram below shows a simple hydraulic jack. The area under piston Y is four times the area under piston X.



If a load of 180 N is being lifted by piston Y, what is the size and direction of the force on piston X?

- A 45 N upwards
B 45 N downwards
C 720 N upwards
D 720 N downwards
- 11 The diagram shows a marble of mass 36 g at the top of a slope at point X. Assume that friction is negligible. The gravitational field strength is 10 N/kg .



What is the minimum energy in the kinetic store of the marble at X such that it can reach point Y?

- A 0.18 J B 0.36 J C 1.08 J D 1.44 J

- 12 A small hydroelectric power station diverts water from a river. Every second, 20 kg of water flows through a pipe and falls through a vertical drop of 15 m. The efficiency of the power station is 60%. The gravitational field strength is 10 N/kg .

What is the power output?

- A 1.8 kW B 18 kW C 3.0 kW D 180 kW

- 13 A substance consists of particles that are close together and moving past each other. The average speed of the particles is gradually decreasing.

Which statement best describes the substance?

- A a solid melting
B a solid being cooled
C a liquid freezing
D a liquid being cooled

- 14 Air is pumped slowly into a car tyre to increase the pressure in the car tyre. The temperature of the air in the car tyre does not change.

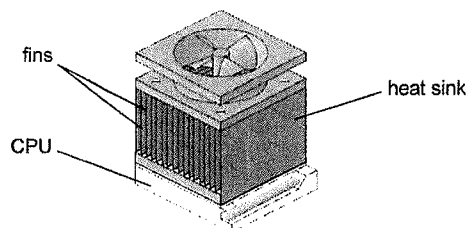
Which row is correct?

	average speed	frequency of collisions with walls
A	increases	decreases
B	increases	increases
C	unchanged	decreases
D	unchanged	increases

- 15 Which statement best explains why the transfer of energy in the internal store via conduction in gases is generally slower than that in solids?

- A Gases have higher densities than solids.
B Gas particles move at greater speed than solid particles.
C The distance between particles in a gas is much further apart than in solids.
D The forces of attraction between gas particles are stronger than in solids.

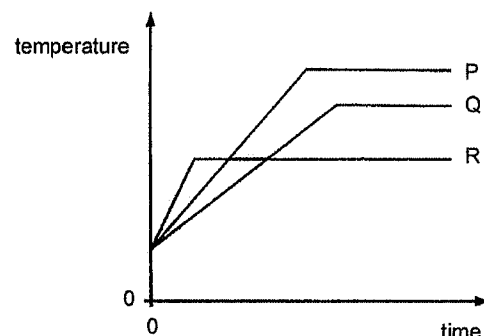
- 16 The figure below shows a heat sink placed on top of a central processing unit (CPU) chip in a computer. The heat sink is painted black and is designed to have many fins.



Energy in the internal store is transferred from the CPU to the heat sink. The heat sink then transfers the energy to the surroundings.

Which statement about the heat sink is correct?

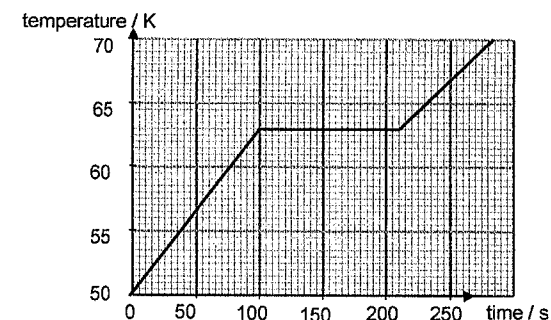
- A It has many fins to reflect radiation from the CPU to the surroundings.
 - B It has many fins to increase the surface area for emission of radiation.
 - C It is painted black because black surfaces are good conductors of heat.
 - D It is painted black because black surfaces are good reflectors of radiation.
- 17 Equal masses of three liquids P, Q and R are heated from room temperature. Each liquid is supplied with heat at the same rate. The graph shows how the temperature of each liquid varies with time after heating starts.



What can be deduced from the graph?

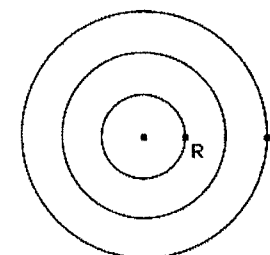
- A P has the highest melting point.
- B Q has the largest specific heat capacity.
- C R gains the least internal energy.
- D R has the smallest specific latent heat of vaporisation.

- 18 A 400 W heater is used to heat 0.40 kg of solid. The temperature-time graph of the substance is shown below.



What is the specific latent heat of fusion of the substance?

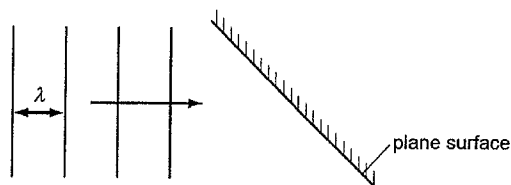
- A 7 690 J / kg
 - B 70 500 J / kg
 - C 100 000 J / kg
 - D 110 000 J / kg
- 19 A pebble is dropped into still water. This causes a disturbance in a form of circular wavefronts travelling outwards with a speed v as shown in the diagram below.



If the wavelength is λ , what is the time taken for the disturbance at R to reach S?

- A $\frac{\lambda}{v}$
- B $\frac{\lambda}{2v}$
- C $\frac{2\lambda}{v}$
- D $\frac{3\lambda}{2v}$

- 20 In an experiment using a ripple tank, plane wavefronts arrive at a plane surface.



Which of the following correctly describes the waves after they are reflected from the surface?

	speed of waves	wavelength, λ
A	faster	shorter
B	slower	longer
C	slower	the same
D	the same	the same

- 21 Which statement is correct?

- A Gamma rays have a longer wavelength than ultra-violet radiation.
- B Infra-red radiation have a lower frequency than radio waves.
- C Microwaves have a longer wavelength than visible light.
- D X-rays have a higher speed in vacuum than visible light.

- 22 When sections of a large metal pipe have been welded together, they are checked to discover whether there are any cracks in the joints.

Which component of the electromagnetic spectrum is used for this purpose?

- A infra-red radiation
- B radiowaves
- C ultra-violet radiation
- D x-rays

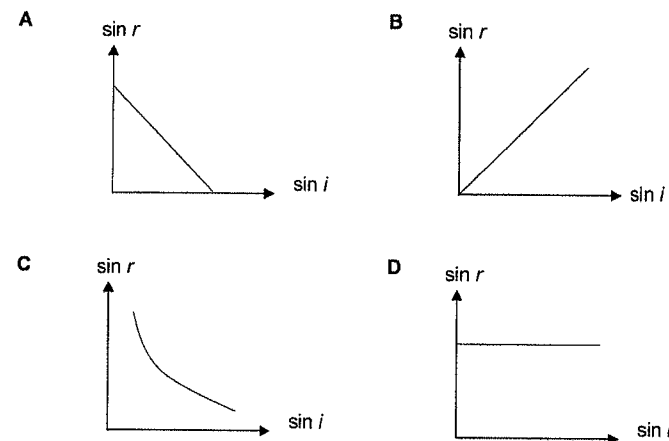
- 23 An object is placed 15.0 cm in front of a converging lens of focal length 10.0 cm.

Which of the following is the characteristic of the image produced by the lens?

- A laterally inverted and magnified
- B real and magnified
- C real and diminished
- D virtual and upright

- 24 A ray of light is refracted in a glass block.

Which graph shows how the sine of the angle of refraction r vary with the sine of the angle of incidence i in the glass block?



- 25 The following negative charge in an electric field experiences an electric force F in the direction shown.



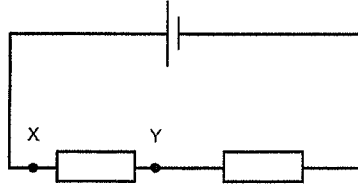
What is the direction of the electric field at the position of the charge?

- A horizontally to the left
 - B horizontally to the right
 - C vertically downwards
 - D vertically upwards
- 26 Cloth X and pipe Y are electrically neutral. Cloth X is used to rub pipe Y to charge the pipe. Cloth X has a greater tendency to lose electrons than Y and hence Y has a negative charge of 2.0 C.

What is the net charge on cloth X?

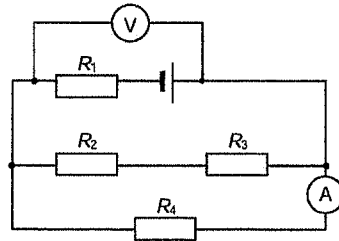
- A negative with a magnitude equal to 2.0 C
- B negative with a magnitude more than 2.0 C
- C positive with a magnitude equal to 2.0 C
- D positive with a magnitude more than 2.0 C

- 27 The diagram shows two resistors connected in series with a cell.



Which of the following describes the potential difference across XY?

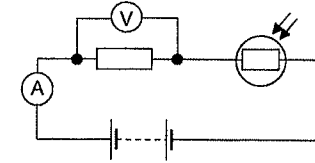
- A the power needed to drive one unit of charge through the cell
 - B the power needed to drive one unit of charge between X and Y
 - C the work done in driving one unit of charge between X and Y
 - D the work done in driving one unit of charge through the cell
- 28 A cloud carrying a charge of 15 C passes all its charge to the earth through a bolt of lightning. The lightning lasts for 0.4 ms. How much electric current is carried by the bolt of lightning?
- A 6.0×10^1 A B 3.75×10^2 A C 6.0×10^4 A D 3.75×10^4 A
- 29 Four resistors of unknown resistances, a voltmeter and an ammeter are connected to a dry cell as shown in the diagram.



The resistance of which resistor can be calculated from the readings of the voltmeter and the ammeter?

- A R_1 B R_2 C R_3 D R_4

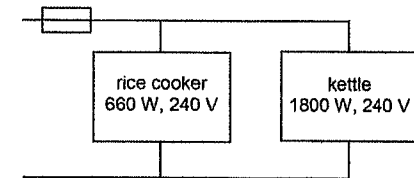
- 30 A resistor and a Light-Dependent Resistor (LDR) are connected in series with a battery as shown.



When the light intensity of the surrounding increases, how do the readings on the ammeter and voltmeter change?

	reading on ammeter	reading on voltmeter
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

- 31 Which statement explains why a switch in an appliance is not connected to the neutral wire but to the live wire instead?
- A closed switches in neutral wire cannot allow current to flow in the appliance.
 - B opened switches in neutral wire cannot cut off current.
 - C opened switches in neutral wire cannot disconnect appliance from high voltage.
 - D opened switches in neutral wire cannot store enough charges to power the appliance.
- 32 A rice cooker and kettle are connected in parallel to a mains supply. A fuse is attached to the live wire.



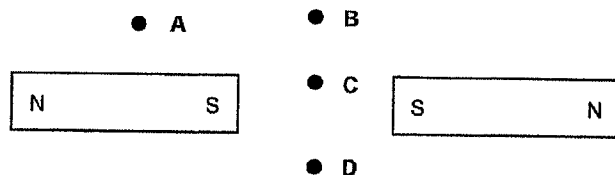
Which of the following is the most suitable fuse rating for the fuse so that both appliances can be used simultaneously?

- A 3 A
- B 5 A
- C 10 A
- D 13 A

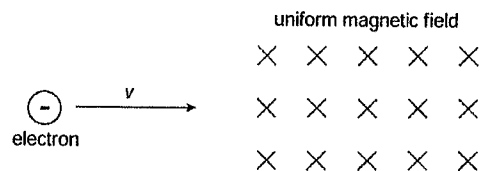
33 Which material is used for the needle of a plotting compass?

- A aluminium B brass C iron D steel

34 Two bar magnets are placed near each other with their poles as shown. A student plots the resultant magnetic field with a compass. At which point does the compass point towards the top of the page?



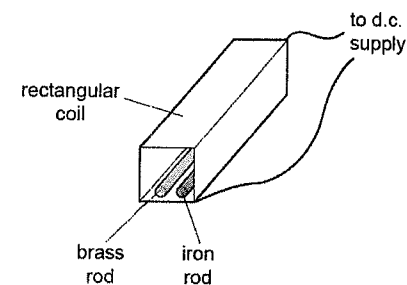
35 The diagram shows an electron moving at a speed v towards a region of uniform magnetic field.



How will the electron be deflected when it enters the magnetic field?

- A into the page
B out of the page
C towards the top of the page
D towards the bottom of the page

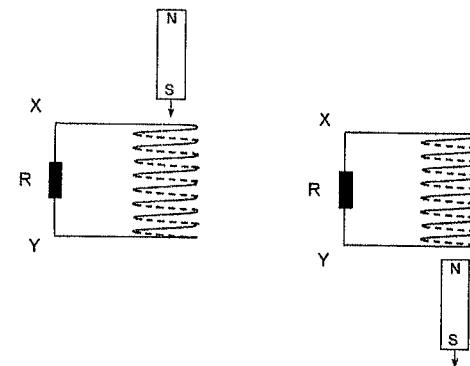
36 The diagram shows a brass rod and an iron rod beside each other at the bottom of a rectangular coil.



What happens when a direct current passes through the coil?

- A Only the brass rod is magnetised.
B Only the iron rod is magnetised.
C The two rods attract each other.
D The two rods repel each other.

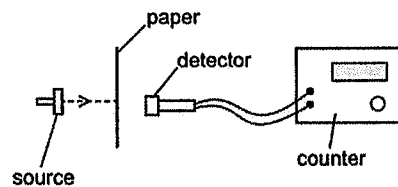
37 A bar magnet is dropped through a coil of wire. The coil is connected to a resistor R. The figure below shows the bar before it enters the coil and after it leaves the coil.



Which row shows the direction of the induced current in the resistor R?

	magnet entering coil	magnet leaving coil
A	X to Y	X to Y
B	X to Y	Y to X
C	Y to X	X to Y
D	Y to X	Y to X

- 38 A transformer converts the transmission voltage of 10800 V to 240 V for use by the residential buildings. The secondary coil of this transformer contains 360 turns. How many turns are there on the primary coil?
- A 8 B 16 C 16200 D 32400
- 39 The reading on a detector placed near a radioactive material is 870 counts per second. The background count rate is 30 counts per second. The half-life of the radioactive material is 34 hours.
- What is the reading on the detector after 68 hours?
- A 210 counts per second
B 240 counts per second
C 420 counts per second
D 840 counts per second
- 40 A thin sheet of paper is placed between a radioactive source and a radiation detector. The count rate falls to a very low reading.



From this result, which type of radiation is the source emitting?

- A α -particles
B β -particles
C γ -rays
D X-rays

End of Paper

FHSS Prelim 2025 Paper 1 MS

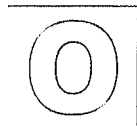
1	2	3	4	5	6	7	8	9	10
B	B	D	C	B	C	C	B	A	B

11	12	13	14	15	16	17	18	19	20
B	A	D	D	C	B	B	D	C	D

21	22	23	24	25	26	27	28	29	30
C	D	B	B	A	C	C	D	D	D

31	32	33	34	35	36	37	38	39	40
C	D	D	D	D	B	C	C	B	A

84



GAN ENG SENG SCHOOL
Preliminary Examination 2025



CANDIDATE
NAME

CLASS

INDEX
NUMBER

PHYSICS

Paper 1 Multiple Choice

6091/01

17 September 2025

1 hour

Sec 4 Express

Additional Materials: OTAS

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, class and index number on the OTAS in the spaces provided unless this has been done for you.

There are **forty** questions in this paper. Answer **all** questions. For each question there are four possible answers **A, B, C, and D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate OTAS.

Read the instructions on the OTAS very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

Total Marks
40

- 1 Which row shows the approximate diameter of an atom and the average diameter of the Earth?

	diameter of an atom	diameter of the Earth
A	0.5 μm	12 Mm
B	0.5 μm	12 Gm
C	0.5 nm	12 Mm
D	0.5 nm	12 Gm

- 2 Amanda studies some equations.

acceleration = change in velocity / time

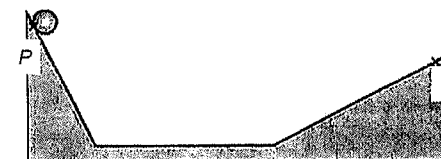
density = mass / volume

pressure = force / area

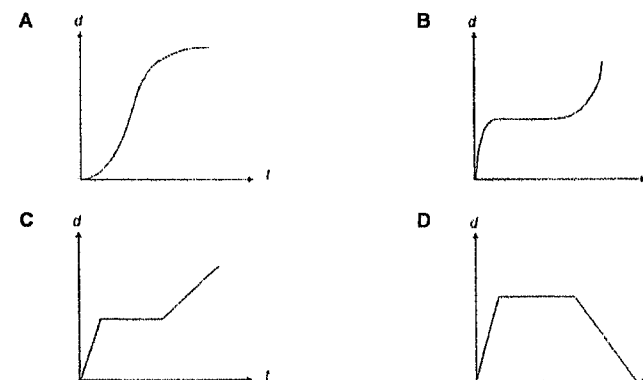
How many different scalar quantities are contained in the equations?

- A** 3 **B** 4 **C** 5 **D** 6

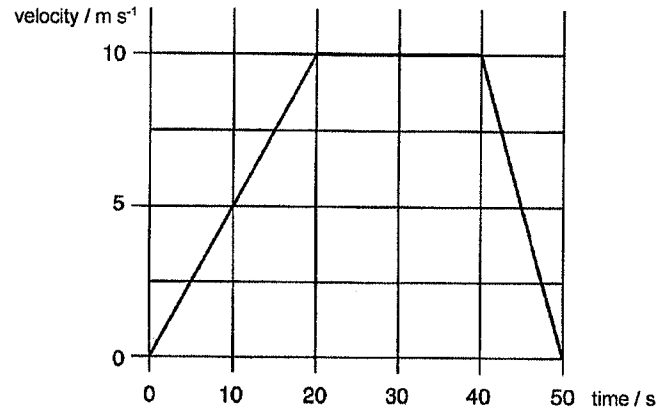
- 3 A sphere runs along a smooth rail from *P* to *Q* as shown.



Which of the following graphs best represents the variation of the distance *d* travelled by the sphere with time *t*?

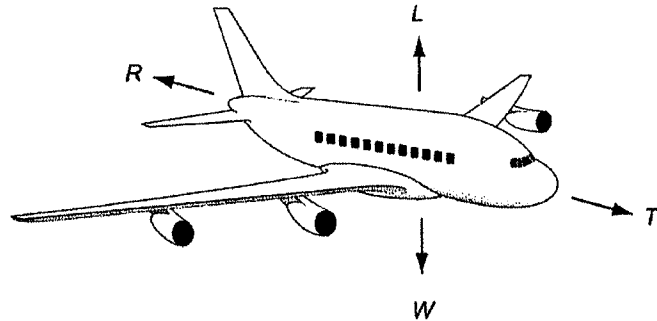


- 4 The graph shows the movement of a car over a period of 50 s.



What was the displacement travelled by the car during the time when it was moving at a uniform deceleration?

- A 50 m B 100 m C 200 m D 350 m
- 5 An aircraft, flying at a constant height, is gaining speed. The four forces acting are lift due to the wings L , air resistance R , thrust due to the engines T and weight W .



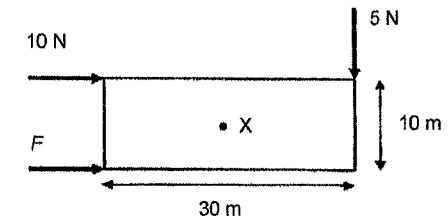
Which row about horizontal and vertical forces is correct?

	horizontal forces	vertical forces
A	$T = R$	$L = W$
B	$T > R$	$L = W$
C	$T > R$	$L > W$
D	$T = R$	$L > W$

- 6 A bus has a total weight of 120 kN. It moves along a horizontal stretch of road at a speed of 10 m/s. It then accelerates, reaching a final speed of 30 m/s after 16 s. What is the size of the average resultant force acting on the bus when it is accelerating?

A 7 500 N B 9 600 N C 15 000 N D 22 500 N

- 7 The diagram shows a uniform rectangular board with three forces, 5 N, 10 N and F , acting at its edges. A pin passes through the centre of gravity of the board at X so that the board is able to rotate freely about X .



What is the value of F so that the board remains in equilibrium?

A 8.3 N B 12 N C 25 N D 40 N

- 8 The diagram shows the side view of Daniel sitting on a chair.

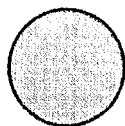


Which of the following will **not** help to prevent the chair from overturning?

- A Daniel leans forward.
 B Increase the base area of the chair.
 C Increase the height of the backrest.
 D Lower the centre of gravity of the chair.

5

- 9 Three objects are cut from the same sheet of aluminium. They have different shapes, but they all have the same height and thickness.



disc



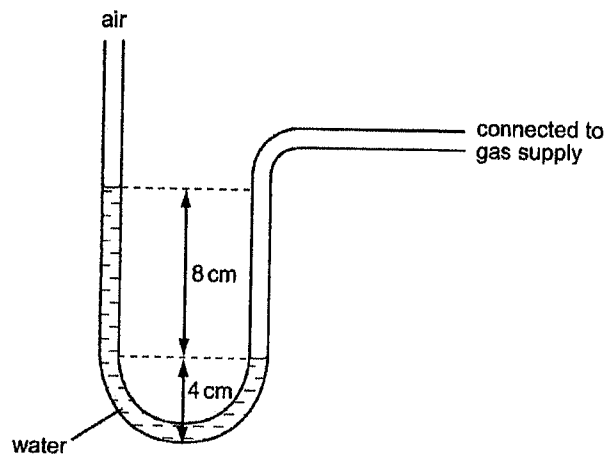
square



L-shape

Which object has the greatest density?

- A disc
B L-shape
C square
D all have the same density
- 10 A manometer is connected to a gas supply.

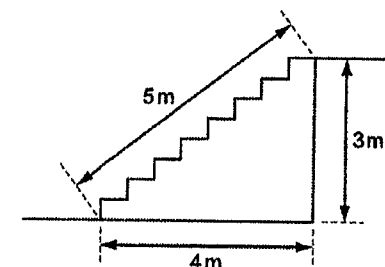


Pressure can be measured in cm of water. What is the pressure of the gas?

- A 8 cm of water less than atmospheric pressure
B 8 cm of water more than atmospheric pressure
C 12 cm of water less than atmospheric pressure
D 12 cm of water more than atmospheric pressure

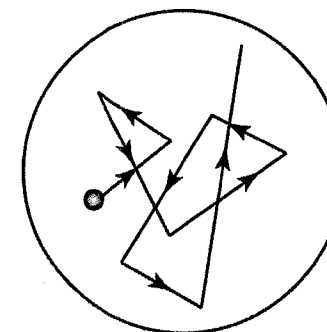
6

- 11 The diagram shows a flight of stairs.



How much useful work is done by Jayden with a mass of 60 kg when climbing the stairs?

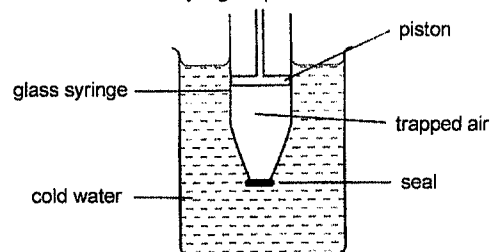
- A 120 J
B 1 800 J
C 2 400 J
D 3 000 J
- 12 In a marathon, Ethan of weight 600 N runs up a slope of height 40 m with constant speed of 4.0 m/s. The length of the run is 600 m. Neglecting friction and air resistance, what is his power output from his muscles?
- A 3.2 W
B 48 W
C 160 W
D 2 400 W
- 13 Smoke particles in a transparent box are observed using a microscope. A small point of light is seen to move around as shown.



What does this experiment demonstrate about air molecules?

- A They are in continuous random motion.
B They can be seen through a microscope.
C They move more quickly when they are heated.
D They move because of collisions with smoke particles.

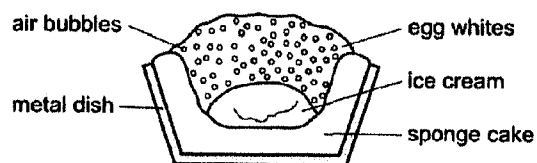
- 14 The outlet of a glass syringe is sealed so that air is trapped below the piston. The piston begins to move down when the syringe is placed in cold water.



How do the speed of the gas molecules and their frequency of collision with the piston compare with their initial values at room temperature when the piston stops moving?

	speed of molecules	frequency of collision
A	decreases	decreases
B	decreases	increases
C	unchanged	decreases
D	unchanged	increases

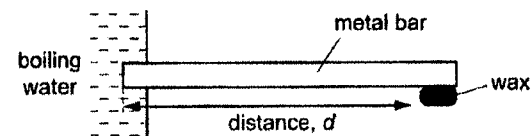
- 15 Alicia makes the dessert 'baked Alaska'.



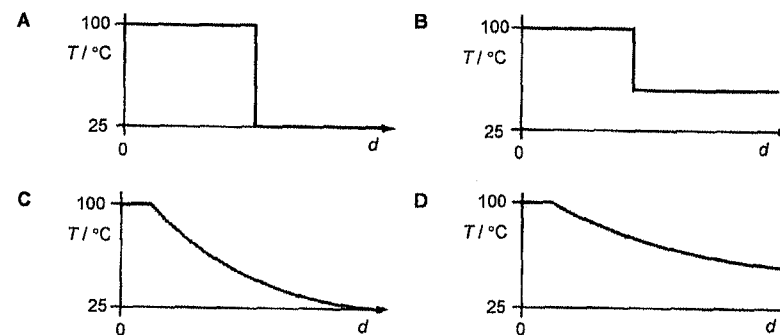
The dessert is placed in a very hot oven until the top of the egg whites turns brown. It is then removed from the oven. Why does the ice cream stay cold?

- A Air is a good conductor of heat and conducts the heat away from the ice cream.
- B Air is a poor conductor of heat and reduces the heat from reaching the ice cream.
- C The metal dish is a good conductor of heat and conducts the heat away from the ice cream.
- D The metal dish is a poor conductor of heat and stops the heat from reaching the ice cream.

- 16 A piece of solid wax is attached at one end of a metal bar at room temperature (25 °C). The other ends of the rod is placed in boiling water.



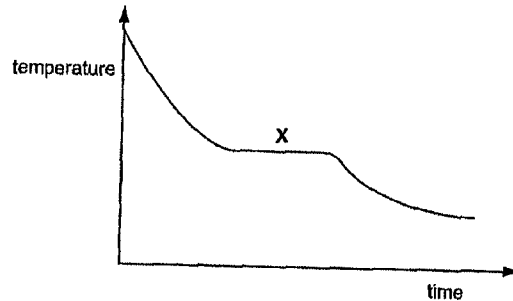
After five minutes, the wax starts to melt. Which graph shows how the temperature T of the bar varies with the distance d along the bar at this time?



- 17 Thermal energy is supplied at the same rate to 100 g of paraffin oil and 100 g of water in identical containers. Why does the temperature of water rise slower?

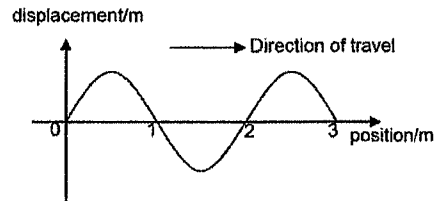
- A The water has a larger specific heat capacity than paraffin oil.
- B The water has a smaller specific heat capacity than paraffin oil.
- C The water is denser than paraffin oil.
- D The water is less dense than paraffin oil.

- 18 A hot stearic acid is carefully poured into a beaker. The graph shows how its temperature changes as it cools towards room temperature.

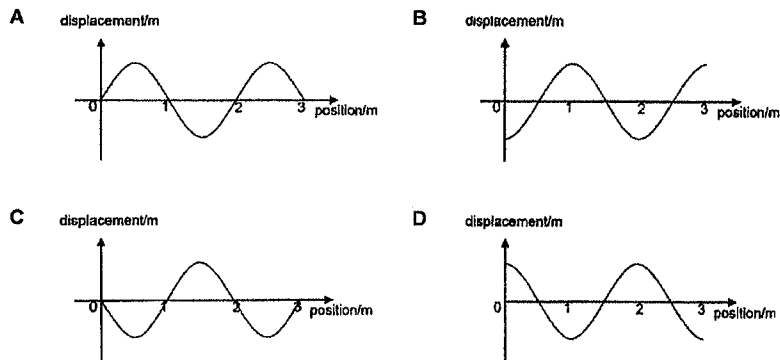


Which process(es) is/are taking place at region X?

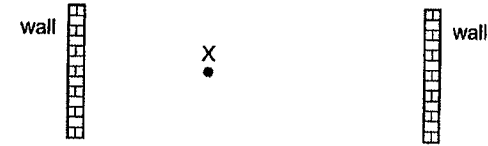
- A boiling and evaporation B condensation only
C evaporation only D freezing and evaporation
- 19 The diagram shows the displacement-position graph of a transverse wave at $t = 0$ s as it travels to the right. The wave has a period T .



Which of the following graphs correctly shows how the transverse wave would look like at $t = 0.75T$?



- 20 Tania who is standing at a point X between two parallel walls (as shown in the diagram) fires a starting pistol.



She hears the first echo after 0.6 s and another after 0.8 s. How long after firing the pistol will she hear the next echo?

- A 1.2 s B 1.4 s C 1.6 s D 2.4 s

- 21 Which statement about X-rays is correct?

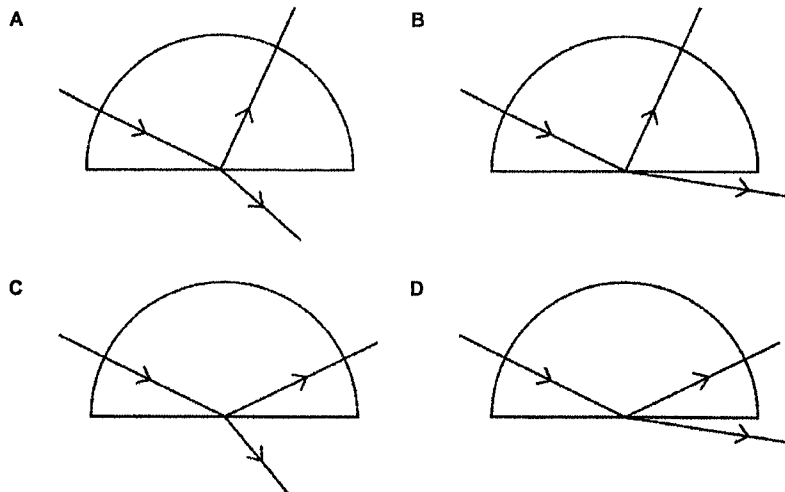
- A They have a higher frequency than visible light and can kill cancer cells.
B They have a lower frequency than visible light and can kill cancer cells.
C They have a higher frequency than visible light and cannot kill cancer cells.
D They have a lower frequency than visible light and cannot kill cancer cells.

- 22 Which of the following statements is **incorrect**?

- A Gamma rays have wavelengths shorter than microwaves and may be used to check welds.
B Infrared rays are emitted by hot objects and can pass through glass.
C Radiowaves have wavelengths longer than X-rays and may be used in television communications.
D Ultraviolet rays may cause sunburn and can produce fluorescence.

- 23 A ray of light enters a semi-circular glass block normal to the curved surface.

Which of the following correctly shows the partial reflection and refraction of the ray?



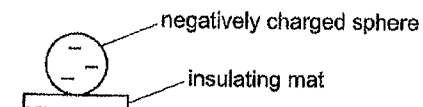
- 24 Jolie uses a thin converging lens to produce a magnified virtual image of a scale she wishes to read accurately. The focal length of the lens is 15 cm. What is a suitable distance between the scale and the lens?

A 10 cm B 15 cm C 25 cm D 30 cm

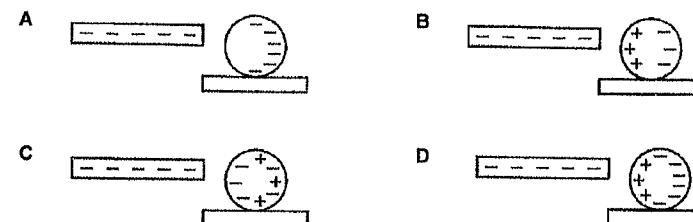
- 25 Three objects, X, Y and Z are metal spheres, each on an insulated stand. Objects X and Y experiences a force of attraction. Objects X and Z experiences a force of attraction. Which set of charges **cannot** be correct?

	charge on X	charge on Y	charge on Z
A	positive	negative	negative
B	positive	negative	positive
C	uncharged	positive	negative
D	uncharged	positive	positive

- 26 A negatively charged steel sphere rests on an insulating mat.



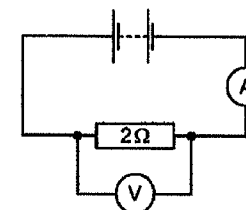
A negatively charged polythene rod is brought near to the steel sphere. Which diagram shows the charge distribution on the sphere?



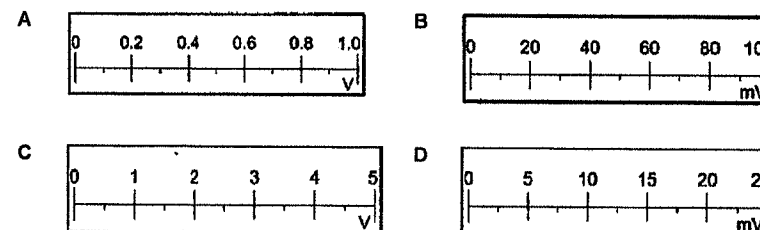
- 27 The resistance of a cylindrical wire P is $60\ \Omega$. A second wire Q is made from the same material. The cross-sectional area of Q is four times that of P. The length of Q is twice the length of P. What is the resistance of Q?

A $30\ \Omega$ B $120\ \Omega$ C $240\ \Omega$ D $480\ \Omega$

- 28 The diagram shows a circuit in which the ammeter reads 190 mA.

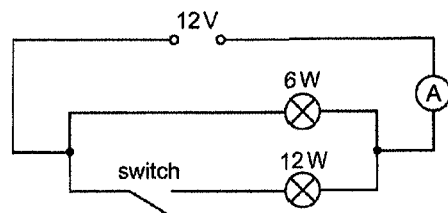


Which voltmeter scale is best to measure the potential difference across the resistor?



13

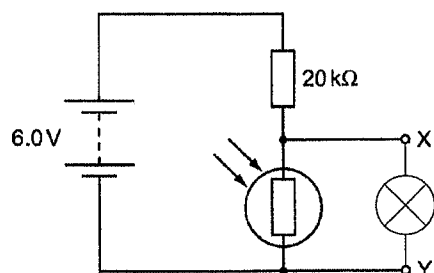
- 29 The diagram shows two lamps in a circuit.



When the switch is open, the ammeter reads 0.5 A. What is the reading when the switch is closed?

- A 0.5 A B 1.0 A C 1.5 A D 2.0 A

- 30 The circuit shows a potential divider that is used to switch on a lamp when it gets dark.



The potential difference across XY is 0.60 V when the lamp is switched on. What is the resistance of the light-dependent resistor when the lamp is switched on?

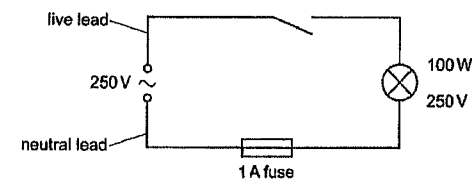
- A 1.8 kΩ B 2.2 kΩ C 160 kΩ D 180 kΩ

- 31 Yong Han replaces three 60 W filament lamps with three 9 W LED lamps. The lamps are used for 4.0 hours each day. How many kWh of energy are saved each week by using the LED lamps instead of the filament lamps?

- A 0.8 B 1.4 C 4.3 D 5.0

14

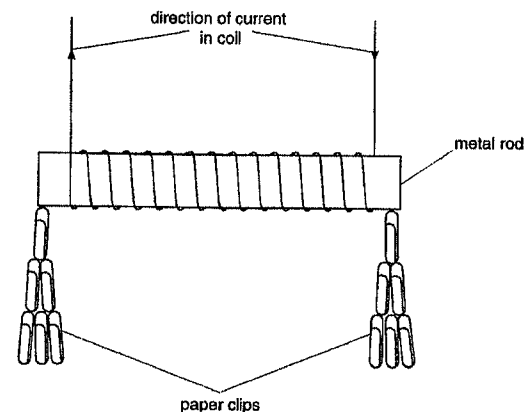
- 32 Ashley suggests setting up the circuit shown in the diagram.



Why is this circuit unsafe?

- A The fuse is in the wrong supply lead.
B The fuse rating is too small.
C The lamp has too small power rating.
D The switch is in the wrong supply lead.

- 33 Four metal rods are placed, in turn, inside a coil of copper wire.



The table below gives the results of the experiment. Which rod would be the most suitable to use for the core of a coil in a circuit breaker?

metal rod	number of paper clips picked up when there is a current in the coil	number of paper clips still attracted when the current is switched off
A	1	0
B	20	2
C	35	0
D	35	30



Geylang Methodist School (Secondary)
Preliminary Examination 2025

PHYSICS

6091/01

Paper 1

Sec 4 Express

Additional materials: Optical Answer Sheet

1 hour

27 August 2025

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, index number and class on the Answer Sheet in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers, **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough work should be done in this booklet.

Gravitational field strength is assumed to be **10 N/kg** unless otherwise specified.

The use of an approved scientific calculator is expected, where appropriate.

This document consists of **18** printed pages and **2** blank pages.

[Turn over

2

GMS(S)/Physics/P1/Prelim/2025/4E

- 1 Which of the following shows the most suitable instruments used for the measurements of these given objects?

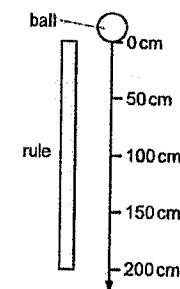
	internal diameter of a test-tube	thickness of a copper wire
A	digital calipers	digital micrometer screw gauge
B	metre rule	digital calipers
C	digital micrometer screw gauge	digital calipers
D	measuring tape	digital micrometer screw gauge

- 2 Which group of quantities consists of only vectors?

- I mass, force, weight
- II weight, energy, acceleration
- III weight, force, displacement

- A III only
- B I and II only
- C II and III only
- D I, II and III

- 3 In a laboratory, a ball is dropped in a vacuum and falls 200 cm.



Which statement describes the acceleration of the ball?

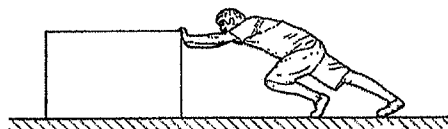
- A It is greater at 10 cm than at 200 cm.
- B It is greatest at 200 cm.
- C It is smaller at 50 cm than at 100 cm.
- D It is the same value at 50 cm as at 150 cm.

- 4 A car travelling at 35 m/s brakes to a sudden stop when a child ran across the zebra crossing. The driver with a mass of 78 kg takes 1.4 seconds to stop completely and exerts a forward force on his safety belt.

What is the reaction force exerted by the safety belt on the driver?

- A 1390 N B 1950 N
C 27300 N D 38200 N

- 5 A man pushes a heavy box along the ground.



A force acts between the man's hands and the box. Another force acts between the man's feet and the ground.

In which direction do these forces act on the man?

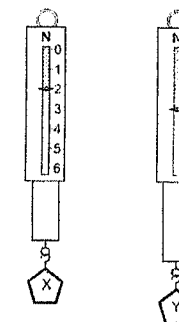
	force on man's hands	force on man's feet
A	towards the left	towards the right
B	towards the left	towards the left
C	towards the right	towards the right
D	towards the right	towards the left

- 6 2000 kg of iron is melted and mixed with 4.0 m³ of molten copper. The density of molten iron and molten copper are 7500 kg/m³ and 9000 kg/m³ respectively.

What is the approximate density of the mixture?

- A 8000 kg/m³ B 8250 kg/m³
C 8350 kg/m³ D 8900 kg/m³

- 7 Two objects X and Y, with identical dimensions, hang on identical spring balances.

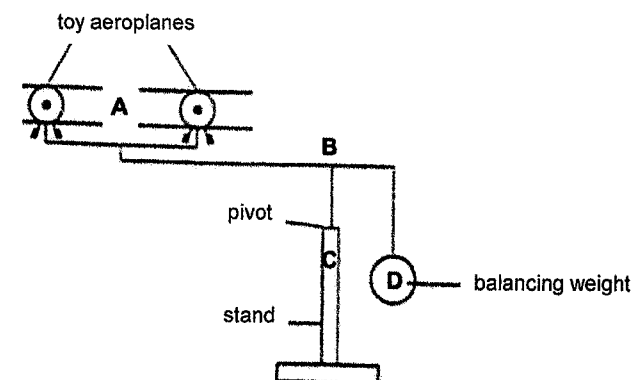


Which statement about X and Y is correct?

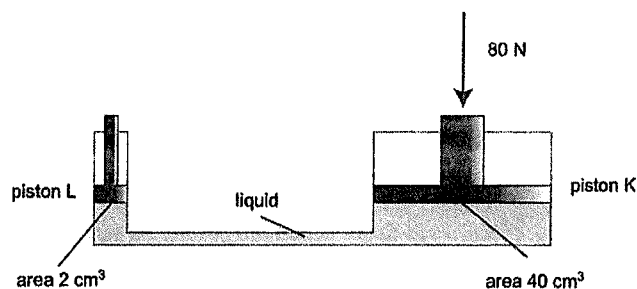
- A The density of X is greater than the density of Y.
B It is not possible to determine the density of X and of Y.
C The density of X is greater than the density of Y.
D It is not possible to determine the density of X and of Y.

- 8 The diagram shows a balancing toy pivoted on a stand. If the toy aeroplanes are tilted slightly, they will return to their original position.

Where is the centre of gravity of the balancing toy?

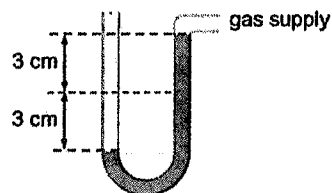


- 9 The diagram shows the cross-section of a hydraulic jack. Piston K is supporting a weight of 80 N. The liquid in the hydraulic jack is not compressible.



Which of the following statements is correct?

- A The force at piston L is 1600 N.
 B Piston K will move a longer distance than piston L.
 C The pressure at piston K and piston L is the same.
 D The pressure at piston K is lower than at piston L.
- 10 The diagram shows the level of mercury in a manometer connected to a gas supply.



What is the pressure of the gas supply?

- A 3 cmHg above atmospheric pressure
 B 3 cmHg below atmospheric pressure
 C 6 cmHg above atmospheric pressure
 D 6 cmHg below atmospheric pressure

- 11 A boy climbs slowly at a constant speed to the top of a small hill.

What is the main energy transfer taking place for the boy as he climbs?

- A internal store to kinetic store
 B chemical potential store to kinetic store
 C kinetic store to gravitational potential store
 D chemical potential store to gravitational potential store

- 12 Smoke particles in a transparent box are observed using a microscope. A small point of light is seen to move around as shown.



What does this experiment demonstrate about air molecules?

- A They move because of collisions with smoke particles.
 B They move because of collisions with smoke particles.
 C They are in continuous random motion.
 D They move more quickly when they are heated.

- 13 The total number of particles and the average kinetic energy of the particles in three bodies, P, Q and R, are given in the table.

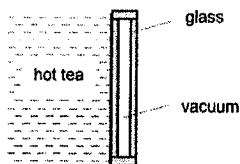
body	total number of particles	average kinetic energy of particles
P	N	E
Q	0.5N	2E
R	2N	E

The temperatures of P, Q and R are denoted by T_P , T_Q and T_R respectively.

Which relationship between T_P , T_Q and T_R is correct?

- A $T_P = T_Q < T_R$
 B $T_P = T_R < T_Q$
 C $T_Q < T_P < T_R$
 D $T_Q < T_P = T_R$

- 14** To contain hot tea, a student uses a double-walled glass vessel that consists of two panes of glass separated by a vacuum.



Which modes of energy transfer are prevented by the vacuum?

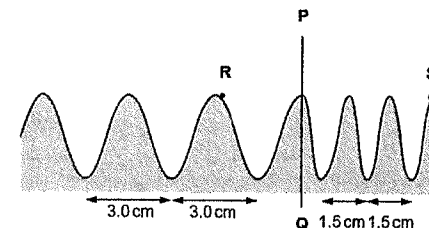
- A** conduction only
B radiation only
C conduction and convection
D conduction and radiation
- 15** When 1800 J of thermal energy is supplied to a liquid of mass m in a container, the temperature of the liquid and the container changes by 10°C . When the mass of the liquid is doubled to $2m$, 3000 J of thermal energy is required to change the temperature of the liquid and container by 10°C .

What is the specific heat capacity of the liquid in $\text{J}/(\text{kg } ^\circ\text{C})$?

- | | | | |
|----------|-----------------|----------|-----------------|
| A | $\frac{60}{m}$ | B | $\frac{120}{m}$ |
| C | $\frac{180}{m}$ | D | $\frac{240}{m}$ |

- 16** Which statement about waves is **correct**?
- A** Both longitudinal waves and transverse waves can travel at the speed of light.
 - B** Both longitudinal waves and transverse waves of similar wavelengths must have similar frequencies.
 - C** Both longitudinal waves and transverse waves can travel in a vacuum.
 - D** Both longitudinal waves and transverse waves can travel in water.

- 17** The diagram shows a water wave in a ripple tank.



The wave has a speed of 0.15 m/s at R.

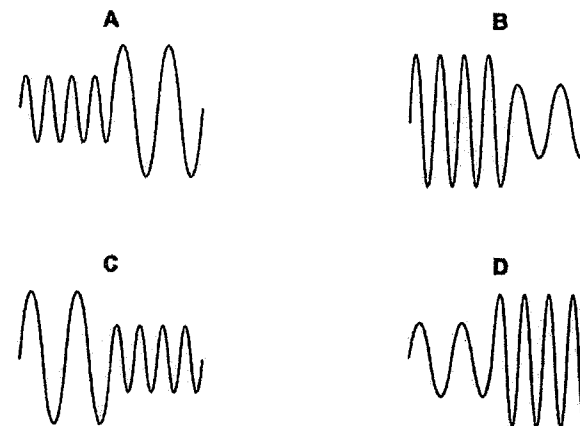
The wave crosses a boundary PQ where the distance between troughs changes from 3.0 cm to 1.5 cm.

What is the velocity of the wave at point S?

- A** 0.075 m/s **B** 0.15 m/s
C 0.30 m/s **D** 0.45 m/s

- 18** Sound waves are displayed as a trace on the screen of an oscilloscope.

Which trace shows a sound that becomes quieter with a lower pitch?

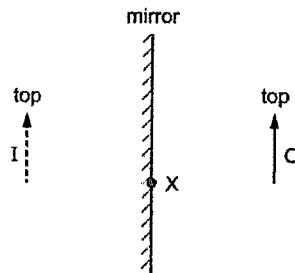


- 19 Ultrasound is used to map the ocean floor. During one survey, the depth of water is 1800 m. An ultrasound pulse is sent from the surface and when it returns to the receiver, another pulse is sent immediately. In any period of 12 s, five pulses are sent down from the surface and received.

What is the speed of the ultrasound in water?

- A** 150 m/s **B** 360 m/s
C 1200 m/s **D** 1500 m/s

- 20** An object O is placed in front of a plane mirror. I is the image formed.

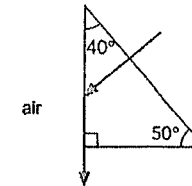


A light ray from the top of the object is incident on the mirror at X.

What happens to this light ray?

- A** It reflects and passes through the bottom of O.
- B** It reflects and passes through the top of O.
- C** It reflects as though it came from the bottom of I.
- D** It reflects as though it came from the top of I.

- 21 A ray of light enters a glass prism normal to the surface and travels along the path as shown.

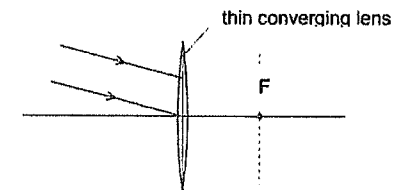


(diagram not drawn to scale)

What is the refractive index of the glass?

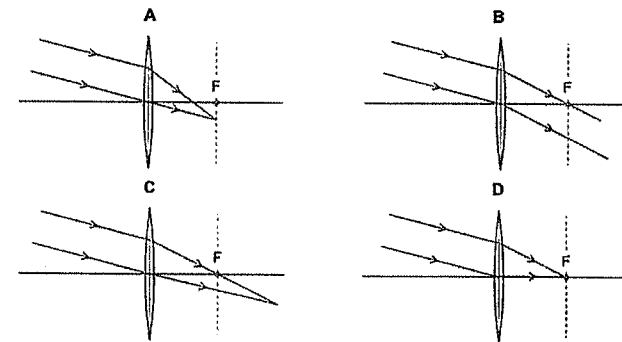
- | | | | |
|----------|-------------|----------|-------------|
| A | 1.31 | B | 1.33 |
| C | 1.50 | D | 1.56 |

- 22** A parallel beam of light is incident on a thin converging lens.



F is one focal point of the lens.

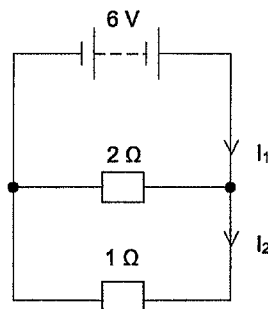
Which ray diagram shows the light after it has passed through the lens?



-

What is the resistance of R?

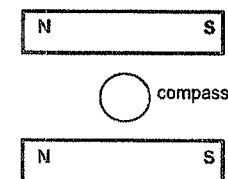
- 30** Two resistors, $2\ \Omega$ and $1\ \Omega$, are connected to a battery with E.M.F. of 6 V in an electrical circuit.



A $I_1 = 2 \text{ A}$ and $I_2 = 2 \text{ A}$ **B** $I_1 = 3 \text{ A}$ and $I_2 = 6 \text{ A}$
C $I_1 = 9 \text{ A}$ and $I_2 = 3 \text{ A}$ **D** $I_1 = 9 \text{ A}$ and $I_2 = 6 \text{ A}$

-

- 32** The diagram shows two identical magnets arranged in parallel to each other. A compass is placed between the two magnets.

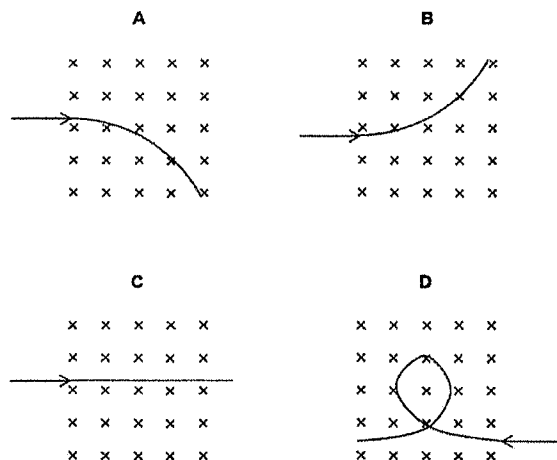


A $\rightarrow$ B $\leftarrow$ C $\downarrow$ D $\uparrow$

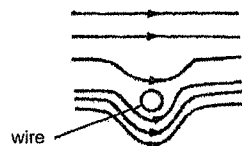
- A** an iron bar in a coil connected to an alternating current
B an iron bar in a coil connected to a direct current
C a steel bar in a coil connected to an alternating current
D a steel bar in a coil connected to a direct current

- 34 An electron moves through a magnetic field that is into the plane of paper.

Which of the following diagrams correctly shows how the electron moves through the field?



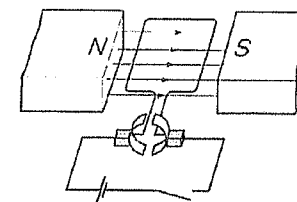
- 35 The diagram below shows the resultant field pattern around a cross-section of a direct-current carrying straight wire placed in a uniform magnetic field.



What is the direction of the current and force acting on the wire?

	current	force
A	into the page	downward
B	out of the page	upward
C	out of the page	downward
D	into the page	upward

- 36 The diagram shows a simple d.c. motor.



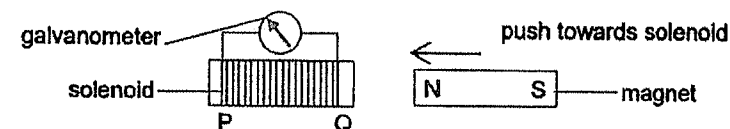
The switch is closed and the coil rotates.

Which change makes the coil rotate in the opposite direction and at a faster rate?

- A increase the number of turns in the coil and increase the current in the coil
 B reverse the direction of the current and remove the split ring commutator
 C reverse the magnetic field and increase the current in the coil
 D reverse both the magnetic field and the direction of current in the coil and increase the current in the coil.

- 37 A student pushes the N-pole of a bar magnet into end Q of a long solenoid.

An electromotive force and hence an induced current is induced in the solenoid and the galvanometer needle deflects to the left as shown.



Which of the following produces a deflection in the same direction?

- A pulling the N-pole out of end Q
 B pulling the S-pole out of end P
 C pushing the N-pole into end P
 D pushing the S-pole into end P

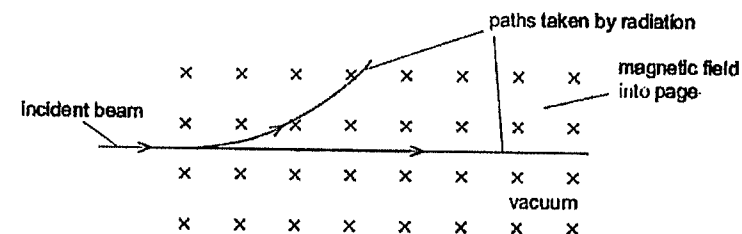
- 38 What happens when a simple a.c. generator doubles the number of turns in its coil?
- A The amplitude of induced e.m.f. is doubled and frequency does not change.
 - B The amplitude of induced e.m.f. is doubled and frequency is halved.
 - C The amplitude of induced e.m.f. is doubled and frequency is doubled.
 - D The amplitude of induced e.m.f. does not change and frequency is doubled.

- 39 The grid shows some nuclides arranged according to the number of protons and the number of neutrons in each of them.

A nucleus of the nuclide ${}^8_3\text{Li}$ decays by emitting β -particle. What is the resulting nuclide?

number of protons	4					A	B	
	3				${}^6_3\text{Li}$	${}^7_3\text{Li}$	${}^8_3\text{Li}$	
	2		${}^3_2\text{He}$	${}^4_2\text{He}$			C	D
	1	${}^1_1\text{H}$	${}^2_1\text{H}$					
		0	1	2	3	4	5	6
		number of neutrons						

- 40 A beam of radiation enters a region in which there is a very strong, uniform magnetic field directed into the page. All the equipment is in a vacuum.



The beam splits and the curved path and the straight path taken by the radiation in the magnetic field are shown on the diagram.

What types of radiation are in the incident beam?

- A β -particles and γ -rays only
- B α -particles and γ -rays only
- C α -particles and β -particles only
- D α -particles, β particles and γ -rays

Answers

4PP Prelim Paper1 2025

1	2	3	4	5	6	7	8	9	10
A	A	D	B	D	D	A	C	C	D
11	12	13	14	15	16	17	18	19	20
D	C	B	C	B	D	A	B	D	D
21	22	23	24	25	26	27	28	29	30
D	A	A	C	A	C	C	C	C	D
31	32	33	34	35	36	37	38	39	40
D	A	D	A	B	C	D	A	A	B



**HILLGROVE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2025
SECONDARY FOUR G3**

CANDIDATE NAME () CLASS -

CENTRE NUMBER S INDEX NUMBER

PHYSICS

6091/01

Paper 1 Multiple Choice

25 Aug 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet

0810 AM to 0910 AM

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and index number on the Answer Sheet in the spaces provided.

DO NOT WRITE ON ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

Setter: Mr Edwin Lim

This document consists of **20** printed pages.

1 Which pair includes a scalar quantity and a vector quantity?

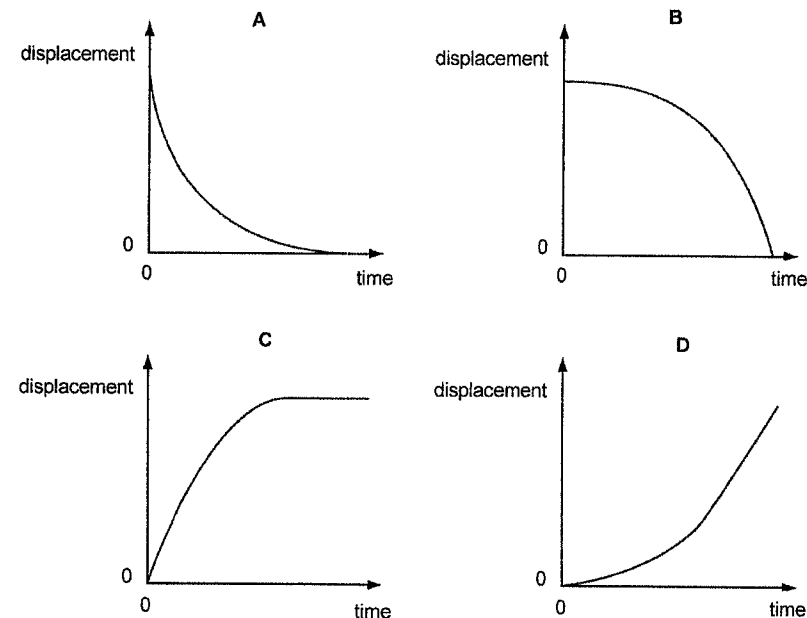
- A acceleration and displacement
- B density and pressure
- C kinetic energy and weight
- D speed and power

2 What is the conversion factor for converting nanoseconds (ns) to milliseconds (ms)?

- A 10^{-6}
- B 10^{-3}
- C 10^6
- D 10^{12}

3 An object is released from rest in air and falls vertically. Its acceleration decreases until it eventually reaches terminal velocity.

Which graph best represents how the displacement of the object varies with time?



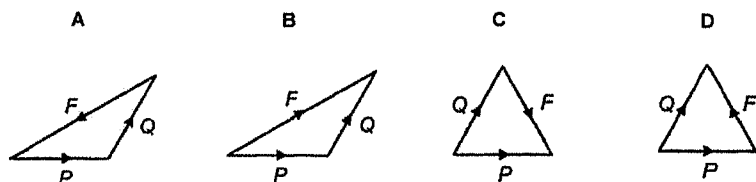
- 4 A car travels with constant acceleration along a straight road. It passes point X with a speed of 10 m/s and point Y with a speed of 28 m/s. Points X and Y are separated by a distance of 150 m. The average speed of the car between X and Y is 20 m/s.

What is the acceleration of the car?

- A 2.4 m/s²
 B 3.7 m/s²
 C 5.1 m/s²
 D 7.5 m/s²

- 5 A body is acted on by two forces, *P* and *Q*. A frictional force *F* holds the body in equilibrium.

Which vector diagram represents the relationship between these forces?



- 6 A crate of mass 5.0 kg moves with constant speed when it is pushed along a rough surface by a force of 8.0 N.

What is the acceleration of the crate when the force is increased to 12 N?

- A 0 m/s²
 B 0.80 m/s²
 C 1.6 m/s²
 D 2.4 m/s²

- 7 A uniform beam has a length of 100 cm. A box is placed at the 20 cm mark. The beam and the box can be balanced on a pivot.



Where is the most likely position of the pivot in order to balance the beam and the box?

- A 20 cm B 35 cm C 50 cm D 70 cm

- 8 Four identical bottles contain different volumes of the same liquid. The density of the liquid is much higher than the density of the container.

Which container is the most stable?



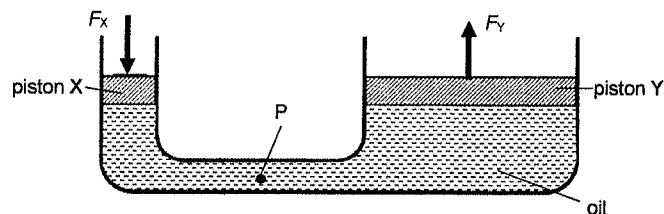
- 9 The density of liquid Q is twice that of liquid R.

In liquid R, the pressure due to the liquid at depth *x* is 4.0 kPa.

What is the depth in liquid Q where the pressure due to the liquid is 7.0 kPa?

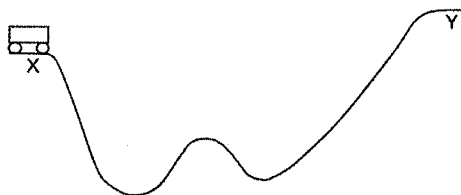
- A 0.29 *x*
 B 0.88 *x*
 C 1.1 *x*
 D 3.5 *x*

- 10 The diagram shows a hydraulic press with two pistons and filled with oil. The area of piston X is smaller than that of piston Y. A force F_X is exerted on piston X which causes a force F_Y on piston Y. P is a point in the oil.



Which statement about the above hydraulic press is correct?

- A F_X is larger than F_Y .
 - B The distance moved by both pistons are equal.
 - C The pressure acting on piston X is greater than that on piston Y.
 - D The pressure at point P is higher than the pressure acting on piston Y.
- 11 A 400 kg cart travels along a track from X to Y as shown in the figure. Its kinetic energy at X is 65 kJ, and that at Y is 15 kJ. The gravitational field strength is 10 N/kg.



What is the vertical height of point Y above point X?

- A 3.8 m
- B 13 m
- C 16 m
- D 20 m

- 12 Two machines each lifts a load, as shown in the table.

	mass of load	height lifted	time taken
machine P	10 kg	6.0 m	3.0 s
machine Q	15 kg	4.0 m	5.0 s

Which statement correctly describes the work done and the power of the machines?

- A Both machines do the same amount of work and have the same power.
 - B Both machines do the same amount of work but P has higher power.
 - C Both machines do the same amount of work but Q has higher power.
 - D Machine P does more work than Q and has higher power than Q.
- 13 A gas is heated uniformly inside a sealed rigid cylinder.
- Which quantity does not change?
- A rate of collisions of molecules with the cylinder wall
 - B average force acting on the gas molecules by the cylinder wall
 - C average distance between the gas molecules
 - D average speed of the gas molecules

- 14 A liquid substance is cooled to its melting point and the substance starts to solidify.

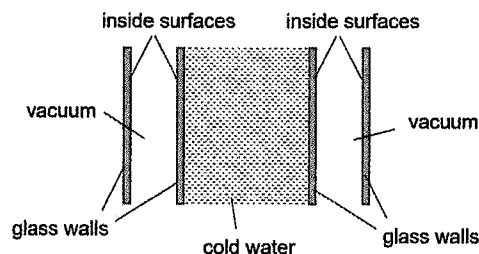
How do the molecules in the solid state compare with the molecules in the liquid state?

- A The average kinetic energy is lower but the intermolecular forces are stronger.
- B The average kinetic energy is lower and the intermolecular forces are weaker.
- C The average kinetic energy is the same but the intermolecular forces are weaker.
- D The average kinetic energy is the same but the intermolecular forces are stronger.

15 Which medium transfers thermal energy mainly by the movement of electrons?

- A air
- B steel
- C water
- D wood

16 The diagram shows part of a vacuum flask. The vacuum flask contains cold water.



Which row correctly describes the colour of the inside surfaces and their function in keeping the water cold?

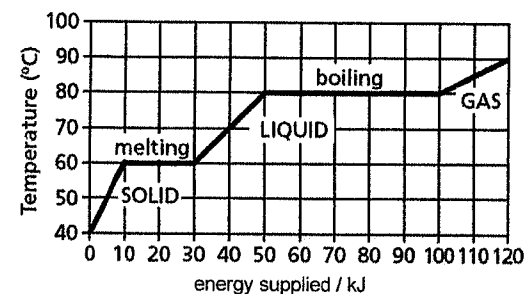
	colour of inside surfaces	function
A	black	good absorber
B	black	good emitter
C	silver	poor absorber
D	silver	poor emitter

17 Water has a higher specific heat capacity than iron. The same amount of energy is given to equal masses of water and iron that are initially at the same temperature.

Which statement is true?

- A The iron has a higher final temperature than the water.
- B The water has a higher final temperature than the iron.
- C The temperature of the iron rises faster than the water but both reach the same final temperature.
- D The temperature of the water rises faster than the iron but both reach the same final temperature.

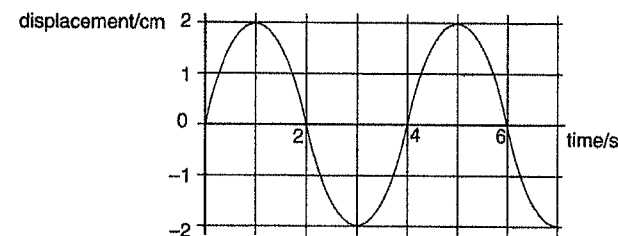
18 The diagram shows the heating curve of a substance of mass 1.2 kg.



What is the ratio of the specific latent heat of vaporisation to the specific latent heat of fusion of the substance?

- A 0.40
- B 2.5
- C 3.3
- D 10

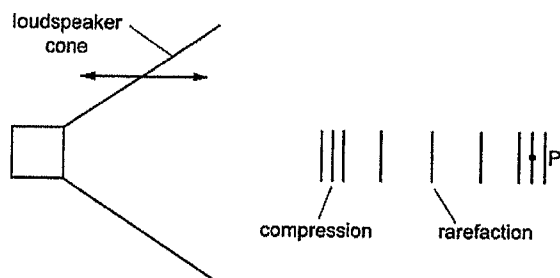
19 The diagram shows the displacement-time graph of a particle in a wave.



Which statement about the wave particle is correct?

- A The amplitude is 2.0 cm and the frequency is 0.25 Hz.
- B The amplitude is 2.0 cm and the frequency is 0.50 Hz.
- C The speed is 0.50 cm/s and the period is 4.0 s.
- D The speed is 0.50 cm/s and the wavelength is 4.0 cm.

- 20 A loudspeaker cone vibrates with a frequency of 80 Hz and produces a series of compressions and rarefactions.

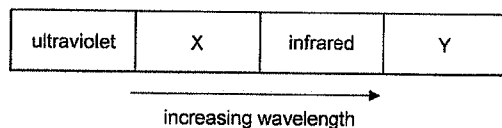


A compression is at point P.

How much time elapses before the next rarefaction arrives at P?

- A 0.0031 s
- B 0.0063 s
- C 0.013 s
- D 0.025 s

- 21 The diagram shows part of the electromagnetic spectrum.



Which statement about X and Y is correct?

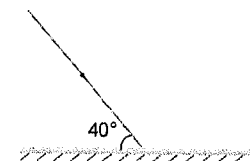
- A X has a higher frequency than Y.
- B X has a lower frequency than Y.
- C X has a higher speed in vacuum than Y.
- D X has a lower speed in vacuum than Y.

- 22 The wavelength of red light emitted by a laser beam is 750 nm in air.

What is the frequency of the red light?

- A 2.50×10^{-15} Hz
- B 225 Hz
- C 1.33×10^8 Hz
- D 4.00×10^{14} Hz

- 23 A ray of light is incident on a horizontal plane mirror, making an angle of 40° with the mirror as shown.

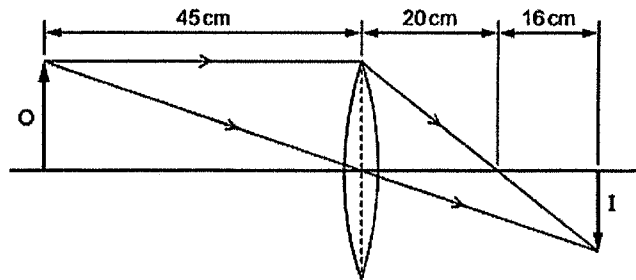


The mirror is tilted through an angle of 15° in the anti-clockwise direction.

What is the angle between the incident ray and the reflected ray?

- A 50°
- B 70°
- C 110°
- D 130°

- 24 The diagram shows how light rays forms an image I of an object O after passing through a convex lens. The diagram is not drawn to scale.

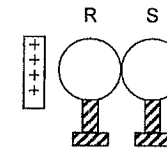


The object O is moved such that the image is now the same size as the object.

What is the distance between the object and the convex lens?

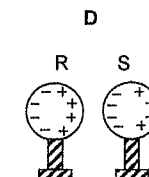
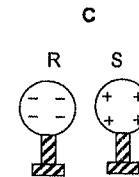
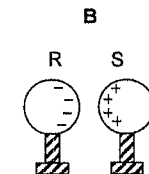
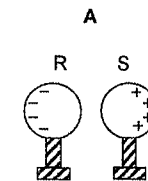
- A 20 cm
- B 36 cm
- C 40 cm
- D 65 cm

- 25 Two conducting spheres R and S are placed together so that they touch one another. A positively charged glass rod is brought near to R.



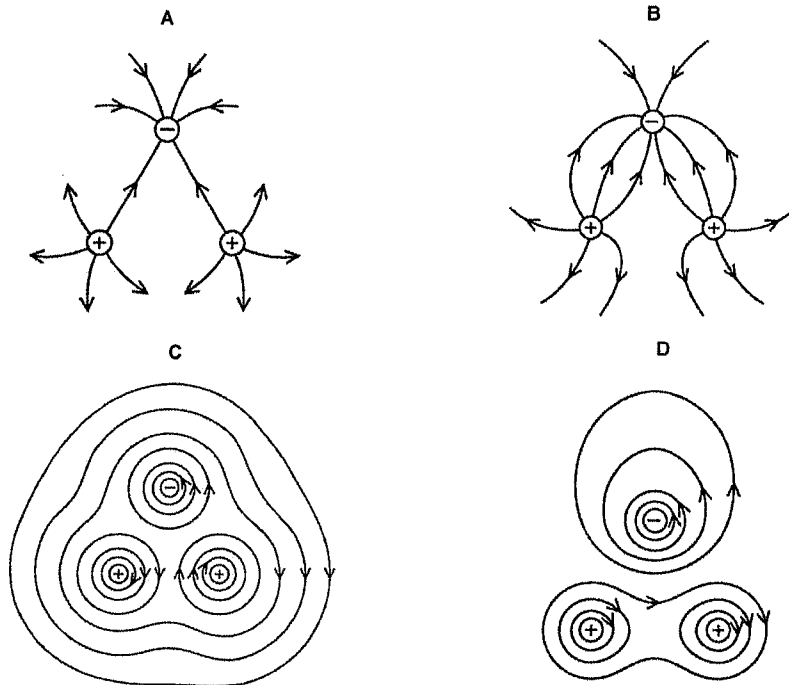
The two spheres are then moved slightly apart with the glass rod still in position. The glass rod is then removed.

Which diagram shows the spheres at the end of the experiment?

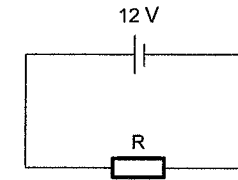


- 26 Two positive charges and one negative charge, all of equal magnitude, are set at the corners of an equilateral triangle.

Which diagram best represents the electric field surrounding the charges?



- 27 The circuit is switched on for some time and the energy dissipated in the resistor R is 2400 J.



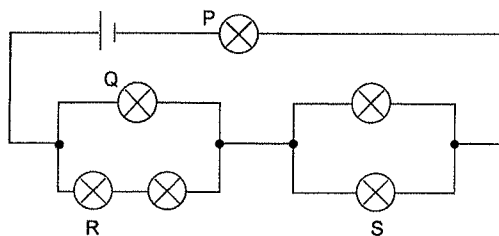
What is the amount of charge that passes through R?

- A 0.0050 C
- B 200 C
- C 2400 C
- D 29000 C

- 28 Which row describes how the resistance of the electrical components varies when the potential difference across each component increases?

	semiconductor diode	filament lamp	metallic conductor
A	constant	decreases	increases
B	increases	constant	decreases
C	decreases	decreases	increases
D	decreases	increases	constant

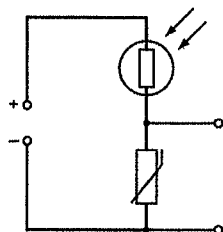
29 Six identical light bulbs are connected as shown in the diagram below.



Which are the dimmest and brightest bulbs?

	dimmest	brightest
A	P	Q
B	Q	R
C	R	P
D	S	P

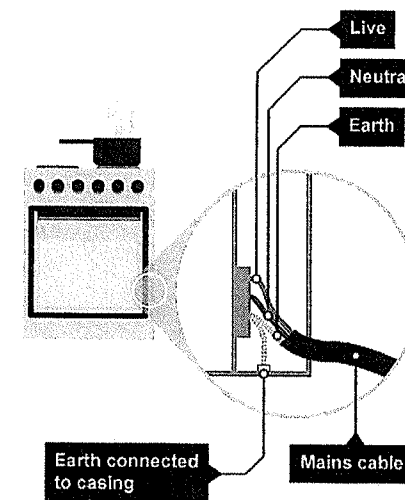
30 A potential divider circuit is formed using a light-dependent resistor (LDR) and a thermistor.



Under which set of conditions will the potential difference across the thermistor have the smallest value?

	illumination	temperature
A	high	high
B	high	low
C	low	high
D	low	low

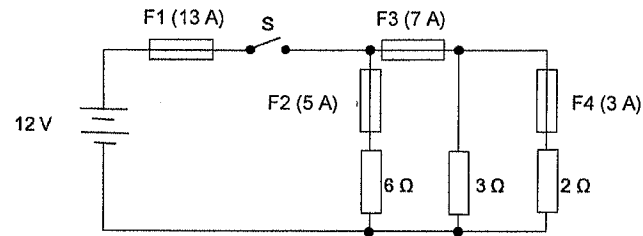
31 The diagram shows the electrical wiring of a 3000 W electric oven connected to a 240 V supply.



What is the current in the three wires when the oven is working normally?

	live	neutral	earth
A	0.080 A	0 A	0 A
B	0.080 A	0.080 A	0.080 A
C	12.5 A	0 A	0 A
D	12.5 A	12.5 A	0 A

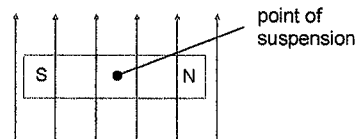
- 32 In the circuit below, there are four fuses F1, F2, F3 and F4 with the respective ratings shown.



When switch S is closed, which fuses blow?

- A F1 and F2
- B F1 and F4
- C F2 and F3
- D F3 and F4

- 33 A bar magnet is freely suspended in a uniform magnetic field. The top view is shown.

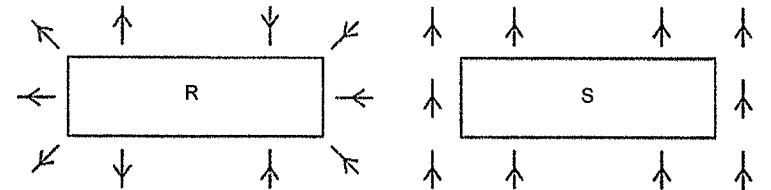
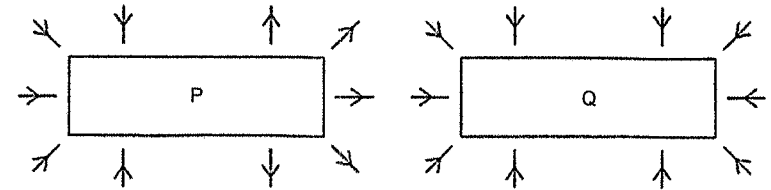


How will the bar magnet move?

- A rotate 90° anti-clockwise
- B rotate 90° clockwise
- C rotate 180° anti-clockwise
- D remains stationary

- 34 Compass needles are placed at different positions near four metal bars P, Q, R and S.

The directions in which the compass needles point are shown below.



Which row correctly describes the metal bars?

	magnet	non-magnetic material
A	P and Q	R and S
B	P and R	Q and S
C	P and R	S
D	P, Q and R	S

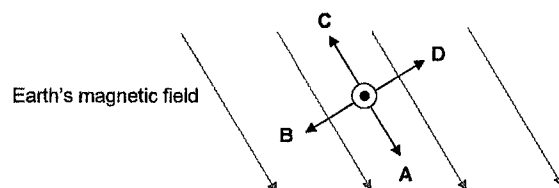
- 35 Two straight parallel wires, X and Y, carry currents of the same size in opposite directions.

What is the direction of the **magnetic field** acting on wire Y due to wire X?

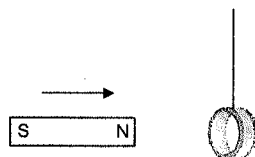


- A downwards
B left
C right
D upwards
- 36 A cable carries current out of the plane of the diagram in Earth's magnetic field.

What is the direction of the force experienced by the cable?



- 37 An strong bar magnet is moved towards a freely suspended copper ring.



What will happen to the copper ring?

- A moves towards the left
B moves towards the right
C remains at rest
D rotates about the vertical axis

- 38 An ideal transformer is connected to a 250 V supply to operate a lamp rated at 100 W and 4.0 A.

What is the ratio of the number of turns in the primary coil to the number of turns in the secondary coil?

- A 0.10
B 1.6
C 10
D 63

- 39 A radioactive nuclide X disintegrates by emitting gamma radiation and a single α particle, forming a daughter nuclide Y.

Which statement is correct?

- A The atomic number of Y is two less than that of X.
B The mass number of Y is two less than that of X.
C X and Y are isotopes of the same element.
D Y has more nucleons than X.

- 40 Two radioactive isotopes P and Q have half-lives of 10 minutes and 15 minutes respectively. A sample initially contains the same number of atoms of each isotope.

After 30 minutes, what is the ratio of the number of atoms of P to the number of atoms of Q?

- A 0.25
B 0.50
C 1.0
D 2.0

Paper 1 Solutions

1	C	6	B	11	B	16	C	21	A	26	B	31	D	36	D
2	A	7	B	12	B	17	A	22	D	27	B	32	D	37	B
3	D	8	C	13	C	18	B	23	B	28	D	33	A	38	C
4	A	9	B	14	D	19	A	24	C	29	C	34	C	39	A
5	A	10	D	15	B	20	B	25	B	30	C	35	D	40	B



HUA YI SECONDARY SCHOOL
PRELIMINARY EXAM 2025

4-G3

NAME

CLASS

INDEX
NUMBER

PHYSICS
PAPER 1

6091/01

29 August 2025
1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue, or correction fluid.

Write your Name, Class, and Index Number on the Answer Sheet in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the one you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

Paper 1

40

This document consists of 15 printed pages and 1 blank page.

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Setter: Mrs Lim Kai Xin

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2

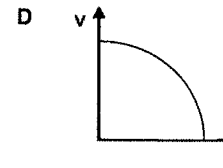
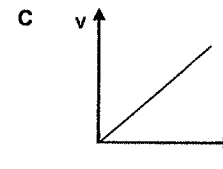
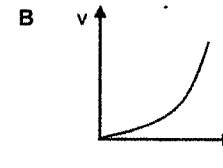
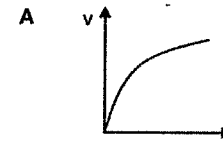
- 1 Pendulum X makes 25 complete oscillations in 10 s. Pendulum Y makes 15 complete oscillations in 15 s. Both pendulums were displaced by a small angle before their oscillations.

Which statement must be true?

- A The angle of swing for pendulum Y is smaller than that of pendulum X.
B The mass of the bob of pendulum Y is smaller than that of pendulum X.
C The period of pendulum Y is shorter than pendulum X.
D The string of pendulum Y is longer than that of pendulum X.

- 2 A marble is dropped off from the top of a cliff. As it falls, it experiences air resistance.

Which graphs describe the motion of the marble?



2025_4-G3_PRELIMS_PHYSICS_PAPER 1

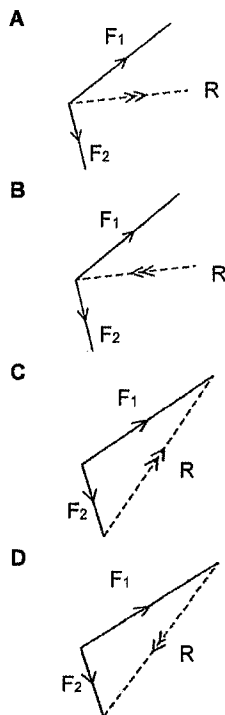
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- 3 The velocity-time graph shows the motion of an object during a period of 30 s.



What is the average velocity of the object during the first 30 s?

- A 10 m/s B 11 m/s C 17 m/s D 18 m/s
- 4 Which diagram shows the magnitude and direction of the resultant R of the two forces F_1 and F_2 ?



- 5 A man with an open parachute falls to Earth at constant speed. The following forces act on the man while he is falling.

P: the upward force of the parachute on the man
Q: the upward force of the man on the Earth
R: the downward force of the Earth on the parachute
S: the downward force of the man on the parachute

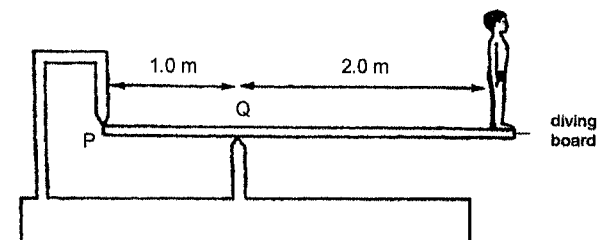
Which two forces are an action-reaction pair?

- A P and Q B P and R C P and S D Q and R
- 6 An astronaut initially weighs 800 N on the Earth. He travels to the Moon and does some physical work daily. He weighs 120 N on the Moon after a month.

The gravitational field strength on the Moon is 1.6 N/kg.
The gravitational field strength on the Earth is 10 N/kg.

How much mass is lost by the astronaut?

- A 0 kg B 5 kg C 20 kg D 68 kg
- 7 The diagram shows a man of mass 50 kg standing at the end of a diving board.

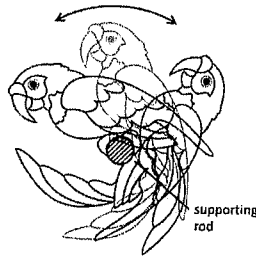


The uniform diving board has a mass of 10 kg. It is 3.0 m long and is pivoted at the points P and Q. The gravitational field strength $g = 10 \text{ N/kg}$.

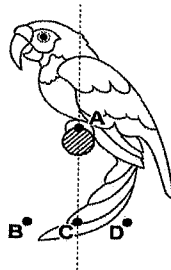
What is the magnitude and direction of the forces at P and Q on the diving board?

	P	Q
A	950 N down	1650 N up
B	1050 N down	1650 N up
C	950 N up	1650 N down
D	1050 N up	1650 N down

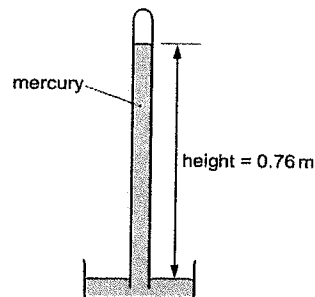
- 8 A parrot shaped toy is designed to oscillate about a supporting rod as shown.



Where should the center of gravity be located so that the toy is the most stable?



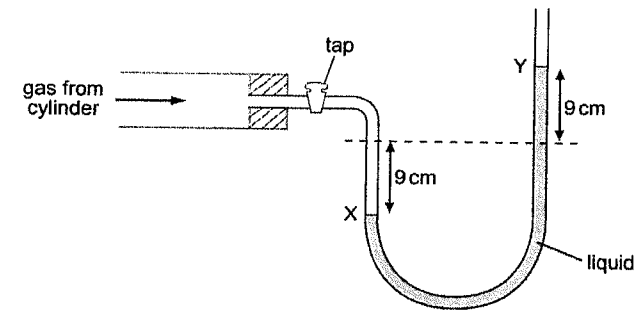
- 9 When the pressure exerted by the atmosphere is 0.10 MPa, the height of the mercury in a barometer is 0.76 m.



What is the pressure exerted by the atmosphere when the height of the mercury in the simple barometer is 0.57 m?

- A 0.025 MPa B 0.075 MPa C 0.10 MPa D 0.13 MPa

- 10 The diagram shows the levels X and Y in a liquid manometer when the gas tap is opened.



What is the height difference of X and Y when a manometer with double the cross-sectional area is being used?

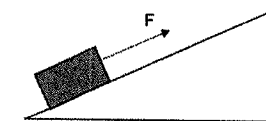
- A 0 cm B 9 cm C 18 cm D 36 cm

- 11 A car of mass 500 kg has an engine with a power output of 6.0 kW. The car takes 10 minutes to travel up a slope of vertical height 500 m. Air resistance and friction are negligible. The gravitational field strength $g = 10 \text{ N/kg}$.

What is the amount of energy in the kinetic store of the car when the car reaches the top of the hill?

- A $1.1 \times 10^6 \text{ J}$
B $2.5 \times 10^6 \text{ J}$
C $3.6 \times 10^6 \text{ J}$
D $6.1 \times 10^6 \text{ J}$

- 12 A box is pulled up with a force F up a rough slope at uniform speed.



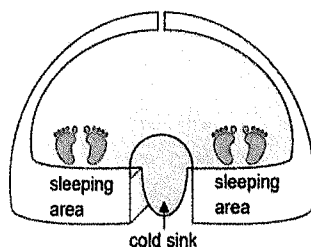
Which statement about the energy stores of the box is **not** correct?

- A Mechanical work is done by the force F on the object as it moves up the slope.
B No energy is transferred to the internal store of the surrounding.
C The gravitational potential store of the box increases as it moves up the slope.
D The kinetic store of the box remains the same as it moves up the slope.

- 13 When fine pollen grains suspended in water are viewed under a microscope, they are seen to be making small erratic movements.

What is the explanation for this observation?

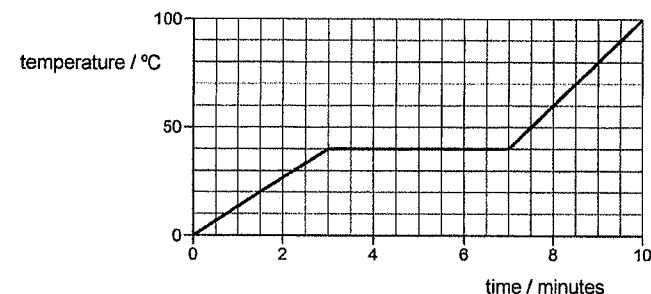
- A The pollen grains are being bombarded by water molecules.
 B The pollen grains are carried by convection current.
 C The pollen grains are colliding with one another.
 D The pollen grains are sliding past one each other in the water.
- 14 Which statement describes the kinetic particle model in liquid during boiling?
- A The average speed of the particles increases.
 B The intermolecular forces of attraction weakens.
 C The internal kinetic energy of the particles increases.
 D The internal potential energy of the particles decreases.
- 15 Inuits build igloos as temporary shelter in extremely cold places such as Arctic. A cross-section of an igloo is shown. The entrance is dug lower than the sleeping area to create a cold sink.



Which statement about the air in the igloo is correct?

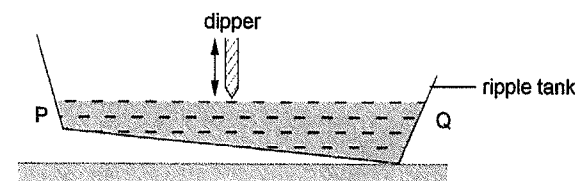
- A Cold air is denser and remains in the cold sink.
 B Cold air in the igloo is heated up by conduction only.
 C Warm air in the cold sink expands, become denser and rises.
 D Warm air in the igloo is less dense, contracts and rises.
- 16 An insulated beaker contains 300 g of water, initially at 30 °C. Steam at 100 °C is introduced into the beaker until the temperature of the mixtures reaches 85 °C.
- The specific heat capacity of water is 4.2 J/(g °C) and the specific latent heat of vaporization of steam is 2260 J/g.
- How much steam is introduced into the beaker?
- A 1.1 g B 29.8 g C 298 g D 1100 g

- 17 The mass of the wax is 200 g. Thermal energy is supplied to the wax at a constant rate of 12 000 J/minute.



What is the specific latent heat of fusion of the wax?

- A 180 J/g B 240 J/g C 480 J/g D 600 J/g
- 18 Which statement about evaporation is **not** correct?
- A Evaporation can only occur in liquid.
 B Evaporation can still happen even if the liquid feels cold.
 C Only the faster-moving particles can escape during evaporation.
 D During evaporation, the temperature of the liquid always stays the same.
- 19 A dipper oscillating at constant frequency is placed at the centre of an inclined ripple tank as shown.



How does the wavelength of the water wave change when it is moving towards the two ends P and Q of the ripple tank?

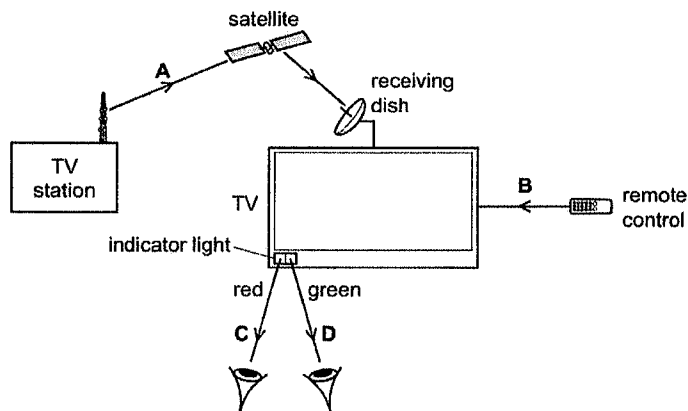
	towards P	towards Q
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	no change	no change

20 In which situation is energy transferred by wave motion?

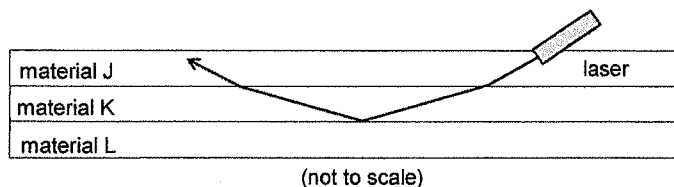
- A A book falling off a table and hitting the ground.
- B A cyclist pedalling and accelerating forward.
- C Heat energy transferred within a pot of water.
- D Sound traveling from a speaker to your ears.

21 A television (TV) station transmits a signal to a television receiving dish. The television has an on / off indicator light. The television is switched on by a remote control which changes the indicator light from red to green.

Which electromagnetic wave used in these actions has the longest wavelength?



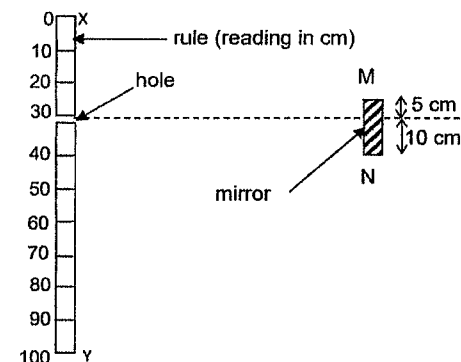
22 A laser shoots a ray of light into a stack of 3 different transparent materials as shown in the diagram.



Which row correctly shows the refractive indices of materials J, K and L?

	material J	material K	material L
A	1.13	1.44	1.52
B	1.13	1.52	1.44
C	1.44	1.13	1.52
D	1.52	1.44	1.13

23 The diagram shows a metre rule XY with a small hole drilled at the 30 cm mark. A plane mirror MN is placed in front of the ruler and is parallel to it.



What is the extent to which an observer can see the meter rule when peeping through the hole at the mirror?

- A 0 cm to 90 cm mark
- B 10 cm to 70 cm mark
- C 20 cm to 50 cm mark
- D 20 cm to 60 cm mark

24 A converging lens has a focal length of 30.0 cm. An object is placed at a distance 35.0 cm from the optical centre of the lens.

What are the characteristics of the image formed?

- A real, inverted and magnified
- B real, upright and same size as the object
- C virtual, inverted and same size as the object
- D virtual, magnified and upright

25 The frequencies of musical note C and note E are 262 Hz and 330 Hz respectively. Four statements are made about note C and E.

- 1 Note E is louder than note C.
- 2 Note E has a higher pitch than note C.
- 3 Note E has a shorter wavelength than note C.
- 4 Note E travels faster than note C.

Which statements are correct?

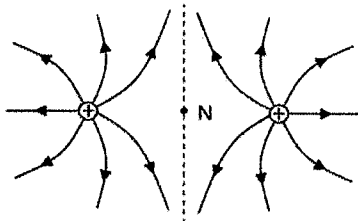
- A 1 and 2
- B 1 and 4
- C 2 and 3
- D 3 and 4

- 26 A man stands in front of a large wall. He claps two pieces of wood together regularly at 0.5 s interval such that the echo of the first clap coincides with the second clap. The speed of sound in air is 340 m/s.

What is the approximate distance between the man and the wall?

- A 85 m B 170 m C 255 m D 340 m

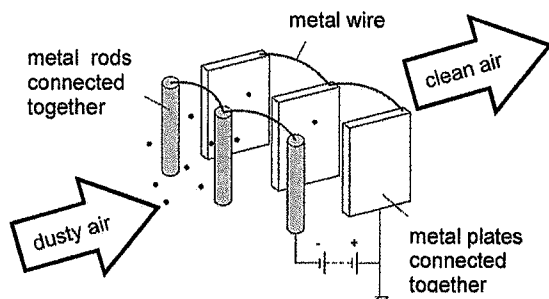
- 27 An electron is placed at the point N in the electric field as shown where point N is the centre of two identical positive charges.



What is the motion of the electron?

- A does not move
B moves downwards
C moves out of paper
D moves upwards

- 28 In an electrostatic precipitator, a fan blows dusty air past several metal rods and metal plates.



How does dust particles get removed in this precipitator?

- A dust particles gain electrons and get attracted to the metal plates
B dust particles gain protons and move away from the metal plates
C dust particles lose electrons and move away from the metal plates
D dust particles lose protons and get attracted to the metal plates

- 29 Voltage-current readings were obtained for different electrical components.

Which readings are for a 3V, 0.06 A filament bulb?

A

voltage / V	0	1	2	3
current / mA	0	6	12	18

B

voltage / V	0	1	2	3
current / mA	0	10	20	30

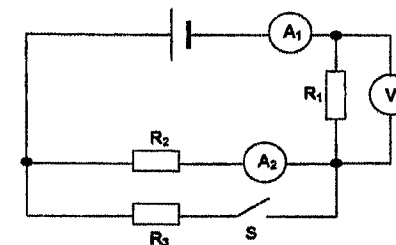
C

voltage / V	0	1	2	3
current / mA	0	20	40	60

D

voltage / V	0	1	2	3
current / mA	0	25	45	60

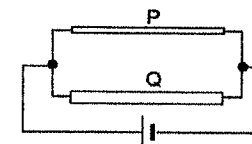
- 30 In the circuit below, R_1 , R_2 and R_3 are three identical resistors.



If the switch S is closed, what will be the changes to the ammeters and voltmeter readings?

	A_1	A_2	V
A	decreases	decreases	increases
B	increases	decreases	decreases
C	increases	decreases	increases
D	increases	increases	decreases

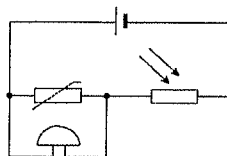
- 31 Two wires P and Q, each of the same length and the same material are connected in parallel to a battery. The cross-sectional area of Q is twice that of P.



What is the ratio of the current passing through P to the total current?

- A 1:5 B 1:4 C 1:3 D 1:2

- 32 The diagram shows a thermistor and a light-dependent resistor (LDR) joined to a circuit with a dry cell. A buzzer is joined to the circuit.



Which conditions will cause the buzzer to sound?

	temperature	light intensity
A	high	high
B	low	high
C	high	low
D	low	low

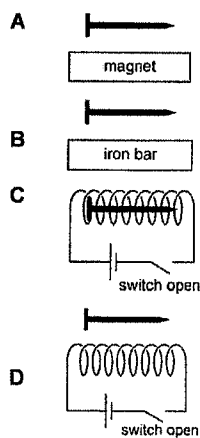
- 33 The cost of electricity is 9.0 ¢/kWh. It takes 0.060 hours and costs 1.2 ¢ to boil the water in a kettle.

What is the power rating of the kettle?

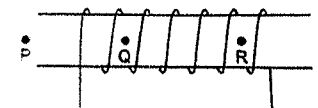
- A 0.45 kW B 0.65 kW C 2.22 kW D 130 kW

- 34 The diagrams show an iron nail in four different situations.

In which diagram will the nail become an induced magnet?



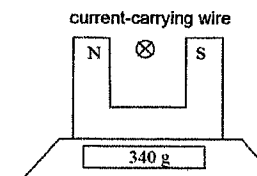
- 35 A steady current is passed through a solenoid. P, Q, R and S are four points on the axis of the solenoid.



Which row indicates a possible direction of the magnetic field due to the current?

	P	Q	R	S
A	→	→	←	←
B	→	→	→	→
C	→	←	→	←
D	→	←	←	→

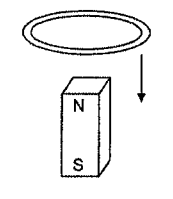
- 36 A current-carrying wire is placed between the poles of the horseshoe magnet. The electronic balance reads 340 g.



Which could be the reading on the electronic balance when the current-carrying wire is removed?

- A 0 g B 330 g C 340 g D 350 g

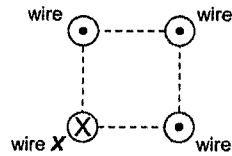
- 37 A copper ring is dropped over a bar magnet from point X to Y.



Which row correctly shows the induced magnetic pole generated in the top part of the ring at point X and Y?

	X	Y
A	north	north
B	north	south
C	south	north
D	south	south

- 38 Four parallel wires each carrying the same current are arranged in a square formation. Wire X experiences a net electromagnetic force.



Which of the following shows the correct direction of the net electromagnetic force?



- 39 A radioactive isotope of sodium has a half-life of 15 h. The table gives data from an experiment to show how the rate of decay of the isotope varies with time. The background count rate has not been subtracted from these data.

time/h	0	10	20	30
count rate counts/s	400	260	170	115

What is the background radiation count rate?

- A 12 counts/s B 15 counts/s C 20 counts/s D 30 counts/s
- 40 Several scientists are working in a laboratory. The scientists are experimenting with sources which emit ionising radiation. Each scientist is given a list of safety rules.

Three of the rules are shown.

- 1 Keep at least 2 m away from the sources.
- 2 Do not stay longer than 4 hours per day in the laboratory.
- 3 Stay behind the lead-lined screen.

Which safety rules are for protection against the effects of ionising radiation?

- A 1 and 2 only B 1 and 3 only C 2 and 3 only D 1, 2 and 3

END OF PAPER

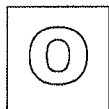
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**HUA YI SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2025
SECONDARY 4E (PHYSICS) 6091
MARK SCHEME**

Q	Answer	Q	Answer	Q	Answer	Q	Answer
1	D	11	A	21	A	31	C
2	A	12	B	22	C	32	B
3	A	13	A	23	C	33	C
4	A	14	B	24	A	34	A
5	C	15	A	25	C	35	B
6	B	16	B	26	A	36	D
7	B	17	A	27	A	37	C
8	C	18	D	28	A	38	D
9	B	19	B	29	D	39	C
10	C	20	D	30	C	40	D

Section A [50 marks]

Qn No.	Answers	Marks
1	(a) Loss of GPE = Gain in KE $mgh = \frac{1}{2}mv^2$ $gh = \frac{1}{2}v^2$ $10(9 - 1.2) = \frac{1}{2}v^2$ $v = 12.5 \text{ m/s}$	M1 A1
	(b) As the diver enters the water, the <u>total upward resistive force increases</u> causing the <u>resultant force and acceleration to decrease</u>. As the <u>diver slows down</u>, the <u>resistive force also decreases</u>.	B1 B1
	(c) $RF = 950 - (78 \times 10) = 170 \text{ N}$ upwards $a = F/m = 170 / 78 = 2.18 \text{ m/s}^2$ direction of acceleration is upwards. [-1] if the acceleration is given as -2.18 m/s^2 as question ask for magnitude.	M1 A1 A1
Total:		[7]
2	(a) Principle of moments state that when an object is in equilibrium, the sum of the clockwise moments about a pivot is equal to the sum of the anticlockwise moments about the same pivot.	B1
	(b) By taking moments about the pivot, sum of anticlockwise moment = sum of clockwise moment $F \times 150 = 70 \times 15$ $F = 7.0 \text{ N}$ [-1] 1 sf	M1 A1
	(c) (i) The metal discs added to the bottom of the chair helps to <u>lower the centre of gravity</u> of the chair. Accept: centre of gravity now falls within base area / now lies directly above the pivot. Reject: center of gravity moves to the left.	B1



JURONGVILLE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2025
Secondary 4 Express



STUDENT
NAME

CLASS

INDEX
NUMBER

PHYSICS

6091/01

Paper 1 Multiple Choice

21 August 2025

Additional Materials: Multiple Choice Answer Sheet

1 hour

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, index number and class in the spaces at the top of this page.

There are **forty** questions on this paper. Answer **ALL** questions. For each question, there are four possible answers, **A, B, C** or **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on separate Answer Sheet.

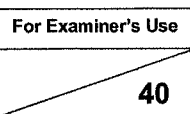
Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

Take acceleration due to gravity on Earth, g , to be 10 m/s^2 unless stated otherwise.



Setter: Mr Raymond Tan

This document consists of 16 printed pages.

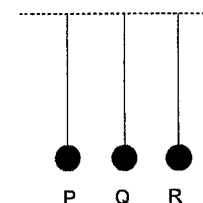
JVSS Prelim 2025

4Exp Physics 6091/01

[Turn over

2

- 1 Three pendulums P, Q and R are set up as shown.



The masses of P, Q and R are 10 g, 20 g and 50 g respectively. The length of the pendulums are the same.

Given that the effect of air resistance is negligible, which is statement that is true?

- A P will oscillate the fastest.
- B R will oscillate the fastest.
- C They will all swing at different periods.
- D They will have the same period.

- 2 Which situation describes an object having a non-uniform acceleration?

- A a ball falling at terminal velocity
- B a lorry moving at constant velocity
- C a suspended pendulum bob swinging from left to right
- D a toy car going down a frictionless ramp

- 3 Which of the following statements concerning the motion of a body are correct?

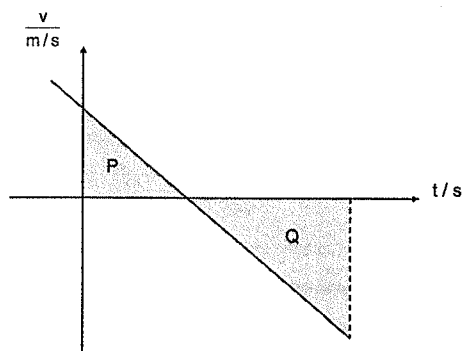
- (i) A body can have zero acceleration but still in motion.
- (ii) A body can have constant velocity but is also accelerating.
- (iii) A body can have constant speed but varying velocity.

- A (i) and (ii) only
- B (i) and (iii) only
- C (ii) and (iii) only
- D (i), (ii) and (iii)

JVSS Prelim 2025

4Exp Physics 6091/01

- 4 A ball is thrown vertically upwards from a cliff-top and it finally lands in the sea below. The velocity-time graph of the fall is shown below.



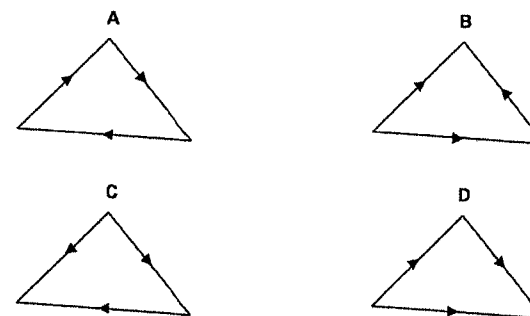
Which of the following gives the height of the cliff above the sea-level?

- A P
B Q
C $P + Q$
D $Q - P$
- 5 Two identical stones are dropped in the vacuum, from different heights at the same instant. The stones accelerate downwards.

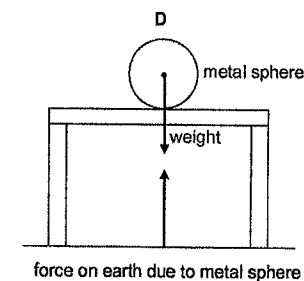
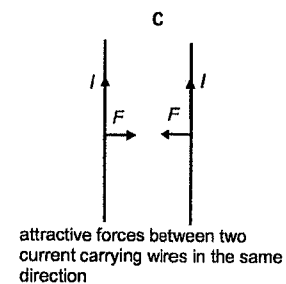
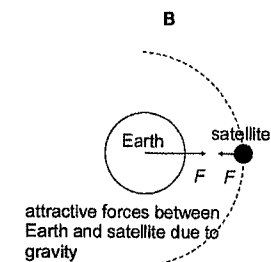
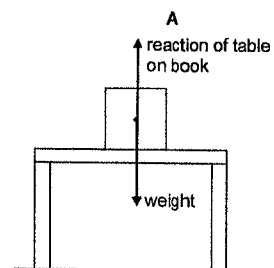
Which of the following describes the distance between them?

- A decrease initially and then stay constant
B keep decreasing until they collide
C keep increasing
D stay constant

- 6 Which of the following shows the correct vector diagram of an object in equilibrium?



- 7 Which of the following pair of forces is **not** an example of action and reaction forces according to Newton's third law of motion?

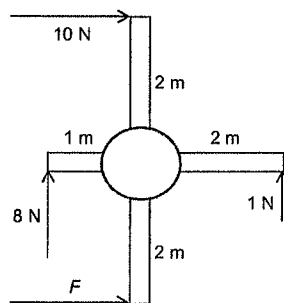


5

8 Which of the following explains why gas has low density?

- A Gas particles are far apart.
- B Gas particles are held in fixed positions.
- C Gas particles have low kinetic energy.
- D Gas particles randomly collide with one another.

9 A windmill is pushed by four external forces as shown.

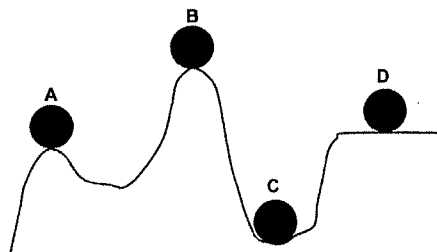


Which is the force F required to prevent the windmill from turning?

- | | |
|---------|--------|
| A -10 N | B 10 N |
| C 13 N | D 17 N |

10 The diagram below shows 4 balls.

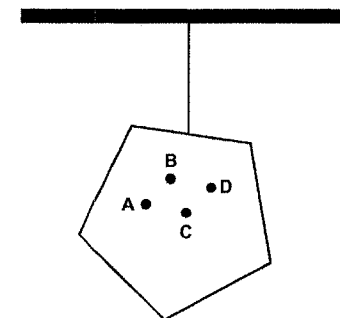
Which ball is in a state of stable equilibrium?



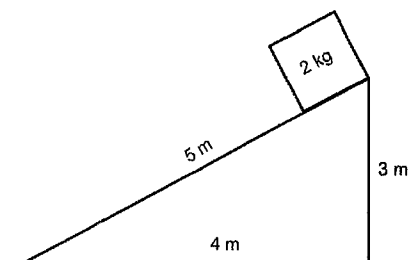
6

11 A kite hangs freely on the branch of a tree as shown.

Which point is possibly the centre of gravity of the kite?



12 A box of mass 2 kg slides down from the top of the ramp with an initial speed of 0 m/s.



Given that the friction along the ramp is 3.2 N, what is the speed of the box when it reaches the foot of the ramp? Take $g = 10 \text{ N/kg}$.

- | | |
|-----------|-----------|
| A 6.6 m/s | B 6.8 m/s |
| C 8.0 m/s | D 9.0 m/s |

13 A girl of weight 450 N runs up a flight of 20 steps in 10.0 s. Each step has a height of 10 cm.

What is the average power developed by the girl?

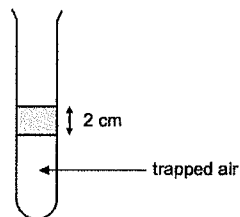
- | | |
|----------|---------|
| A 22.5 W | B 90 W |
| C 225 W | D 900 W |

- 14 Atmospheric pressure is $1.0 \times 10^5 \text{ Pa}$.

What is the total weight of the atmosphere pressing down on a flat horizontal roof with dimensions $2 \text{ m} \times 5 \text{ m}$?

- A $1.0 \times 10^3 \text{ N}$ B $1.0 \times 10^4 \text{ N}$
C $1.0 \times 10^5 \text{ N}$ D $1.0 \times 10^6 \text{ N}$

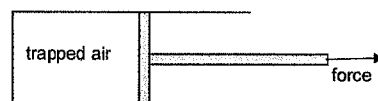
- 15 A 2 cm mercury column is suspended along a glass tube as shown.



Given that the atmospheric pressure is 75 cm Hg, what is the pressure exerted on the trapped air?

- A 0 cm Hg B 73 cm Hg
C 75 cm Hg D 77 cm Hg

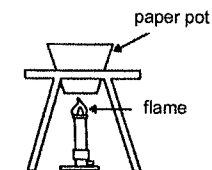
- 16 Air is trapped in the cylinder as shown.



Assuming that there is no friction between the cylinder and the piston, which statement is true when the piston is pulled out by a force as shown?

- A The pressure and volume of the trapped air remain constant.
B The pressure on the trapped air decreases and therefore the volume of the trapped air increases.
C The pressure on the trapped air increases and therefore the volume of the trapped air decreases.
D The pressure on the trapped air increases and therefore the volume of the trapped air increases.

- 17 Some steamboat restaurants serve their food using paper pots, as illustrated in the diagram below.



Which statement explains why the paper pot did **not** catch fire when in contact with the flame?

- I The paper is thick enough to withstand the high temperature of the flame.
II The paper is thin and therefore heat is conducted quickly to the water in the paper pot.
III Water has a boiling point lower than the burning temperature of the paper.

- A I and II only B I and III only
C II and III only D all the above

- 18 Which of the following does **not** affect the rate of radiation?

- A colour of surface
B density of substance
C surface area
D surface temperature

- 19 A man puts one foot on a tiled floor and the other foot on a rug. The rug has been placed on the tiled floor for a long time.



Which statement correctly explains why the floor feels colder than the rug?

- I The floor is at a lower temperature than the rug.
II The floor is a better conductor of heat than the rug.
III The floor has a smaller heat capacity compared to the rug.

- A II only B I and II only
C II and III only D I, II and III

20 Which statement describes the differences between latent heat and specific latent heat?

- A Latent heat is a property of a substance while specific latent heat is a property of an object.
- B Latent heat involves a change in temperature of 1°C while specific latent heat involves no change in temperature.
- C Specific latent heat is a property of a substance while latent heat is a property of an object.
- D Specific latent heat involves a change in temperature of 1°C while latent heat involves no change in temperature.

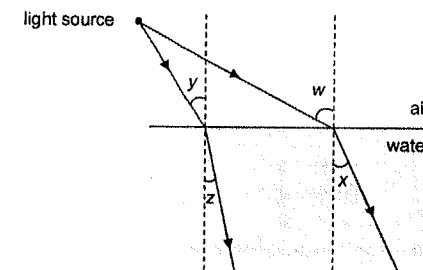
21 Which of the following describes the three waves listed below?

	electromagnetic waves	sound waves	water waves
A	longitudinal	longitudinal	transverse
B	transverse	longitudinal	longitudinal
C	transverse	longitudinal	transverse
D	transverse	transverse	longitudinal

22 Which statement regarding light is **not** true?

- A Light is a transverse wave.
- B Light slows down when it enters an optically denser medium.
- C Light travels at 3.0×10^8 m/s.
- D The frequency of light changes when it refracts.

23 The diagram shows two rays of light entering water.



Which equation is correct?

- A $w = x$
- B $x = z$
- C $\sin w \times \sin z = \sin x \times \sin y$
- D $\frac{\sin w}{\sin x} = \frac{\sin z}{\sin y}$

24 A man runs towards a plane mirror at a constant speed of 2 m/s.

How fast does he see his image running towards him?

- A 2 m/s
- B 4 m/s
- C 6 m/s
- D 8 m/s

25 Which sound is **not** within the audible range?

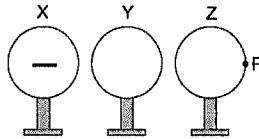
- A 0.9 Hz
- B 90 Hz
- C 9000 Hz
- D 18 000 Hz

26 Which of the following are the properties of electromagnetic waves?

- I All electromagnetic waves can be reflected and refracted.
- II All electromagnetic waves carry charges.
- III All electromagnetic waves carry energy.

- A I and II only
- B I and III only
- C II and III only
- D all the above

- 27 Three conductors are placed close to each other. Conductor X is negatively charged. Both conductor Y and conductor Z are neutral.



What will be the charge in conductor Z after it is being earthed momentarily at point P?

- A cannot be determined B negative
C neutral D positive
- 28 Before paint is being sprayed onto the target, particles are charged by friction at the nozzle area.

Which of the following statements are correct?

- I This method helps to attract the paint to the target.
II This method ensures an even spread of paint on the target.
III This method prevents the paint from attracting positively charged dust.

- A I and II only B I and III only
C II and III only D all the above

- 29 An ammeter shows a reading of 50 mA.

How much electrical charge flows through the ammeter in 10 s?

- A 0.50 C B 5.0 C
C 50 C D 500 C

- 30 A battery drives 20 C of charge round a circuit in 4.0 s. The total work done is 400 J.

What is the electromotive force of the battery?

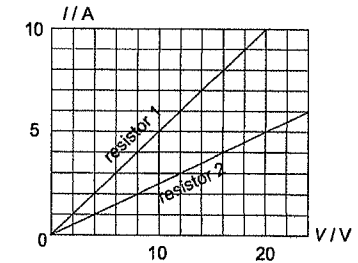
- A 5 V B 20 V
C 100 V D 2000 V

- 31 A 2.0 m long wire with a radius of 1.0 mm has a resistance of 16 Ω .

What is the resistance of the same type of wire which is 4.0 m long and has a radius of 2.0 mm.

- A 4 Ω B 8 Ω
C 16 Ω D 32 Ω

- 32 The I - V graph of resistors 1 and 2 are shown below.



Resistors 1 and 2 are connected in parallel in a circuit. The potential difference across resistor 2 is 20 V.

What is the effective resistance of the circuit?

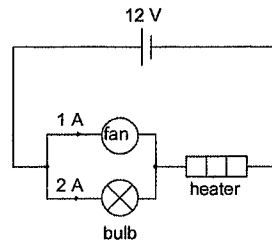
- A 1.3 Ω B 2.3 Ω
C 3.3 Ω D 6.0 Ω

- 33 An electrical heater labelled as "240 V, 120 W" is used in Taiwan where the supplied voltage is 120 V.

What is the power output of the electrical heater when used in Taiwan?

- A 30 W B 60 W
C 120 W D 240 W

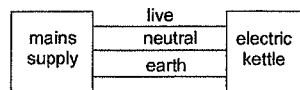
- 34 A heater, a fan and a bulb are connected to a 12 V battery as shown.



The fan with a resistance of R has a potential difference of 6 V across it and a current of 1 A through it. The bulb has a current of 2 A flowing through it.

Which statement is true?

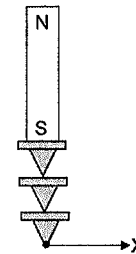
- A The potential difference across the bulb is 6 V and its resistance is $2R$.
 - B The potential difference across the bulb is 6 V and its resistance is $0.5R$.
 - C The potential difference across the heater is 6 V and the current flowing through it is 2 A.
 - D The potential difference across the heater is 12 V and the current flowing through it is 3 A.
- 35 An electrical kettle is connected to the mains supply as shown.



Given that the mains supply has a potential difference of 240 V and a current of 0.5 A flows in the circuit, what are the potential across and current flowing in the neutral wire?

	potential / V	current / A
A	0	0
B	0	0.5
C	240	0
D	240	0.5

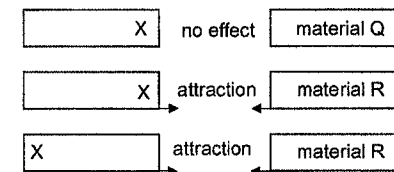
- 36 The diagram below shows a magnet attracting three steel pins.



Which of the following identifies the process that had taken place and polarity at the point, X?

	process	polarity
A	electromagnetic induction	North
B	electromagnetic induction	South
C	magnetic induction	North
D	magnetic induction	South

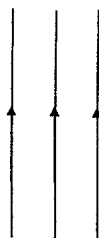
- 37 Magnet P with one end marked X is brought near materials Q and R.



Which of the following correctly identifies the nature of materials Q and R?

	Q	R
A	magnetic	magnet
B	magnetic	magnetic
C	non-magnetic	magnet
D	non-magnetic	magnetic

- 38 Three vertical conducting wires have the same amount of current flowing through them in the direction shown. The distance between the wires are the same.



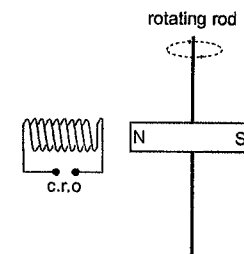
Which of the following describes the resultant electromagnetic force acting on the middle wire?

- A perpendicular to the plane of the paper
 B resultant electromagnetic force is zero
 C to the left
 D to the right
- 39 The ratio of the number of turns in the primary coil to the number of turns in the secondary coil of an ideal transformer is 5 : 1. The primary coil of the transformer is connected to a 250 V d.c. supply.

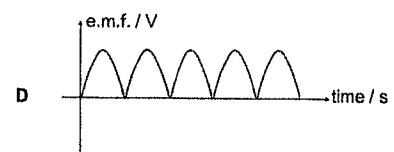
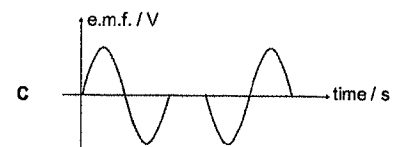
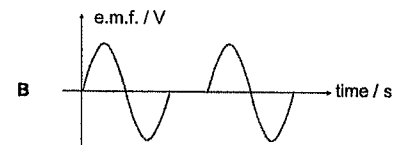
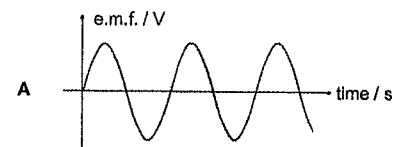
What is the output voltage of the transformer?

- A 0 V B 50 V
 C 250 V D 1250 V

- 40 A bar magnet which is attached to a rotating rod is placed near to a coil. The coil is connected to a cathode ray oscilloscope.



Which of the following shows how the induced e.m.f. in the coil varies with time as shown on the cathode ray oscilloscope?



End of Paper



**Jurongville Secondary School
Science Department 2025
Marking Scheme & Marker's Report**

Assessment: Physics Prelim Paper 1

Level: 4 Exp

Paper 1

Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans
1	D	2	C	3	B	4	D	5	D	6	A	7	A	8	A	9	C	10	C
11	C	12	A	13	B	14	D	15	D	16	B	17	C	18	B	19	A	20	C
21	C	22	D	23	C	24	B	25	A	26	B	27	D	28	A	29	A	30	B
31	B	32	A	33	A	34	B	35	B	36	D	37	D	38	B	39	A	40	A

[Turn Over



KUO CHUAN PRESBYTERIAN SECONDARY SCHOOL

2025 PRELIMINARY EXAMINATION

Secondary 4 Express

NAME

CLASS

REG. NO

PHYSICS

6091/01

Paper 1 Multiple Choice

26 August 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet

Setter: Mr. Jeremy See

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, class and register number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

This document consists of 17 printed pages and 1 blank page.

[Turn Over]

2

- 1 What is the order of magnitude of the diameter of the Earth?
A 1×10^3 m B 1×10^7 m C 1×10^9 m D 1×10^{12} m
- 2 What is the unit of force expressed in base units?
A $(\text{kg m}) / \text{s}^2$ B $\text{kg} / (\text{m s})$ C $\text{kg} / (\text{m s}^2)$ D $(\text{kg m}) / \text{s}^2$
- 3 Two stones of different weight fall at the same time from the same height towards the floor.
Air resistance may be ignored.

Which row describes and explain how the stones hit the floor?

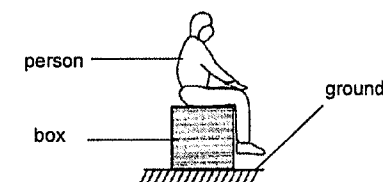
	how the stones hit the floor	explanation
A	both stones hit the floor at the same time	acceleration of free fall is constant
B	both stones hit the floor at the same time	they fall at constant speed
C	the heavier stone hits the floor first	acceleration increases with weight
D	the heavier stone hits the floor first	speed increases with weight

- 4 An aircraft is moving at 60 m/s in a northerly direction when a cross-wind from the east starts to blow. The speed of the wind is 13 m/s.

What is the resultant magnitude of the aircraft's velocity when the wind is blowing?

- A 47 m/s B 59 m/s C 61 m/s D 73 m/s

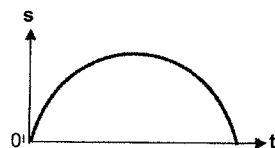
- 5 The figure below shows a person sitting on a box that rests on the ground.



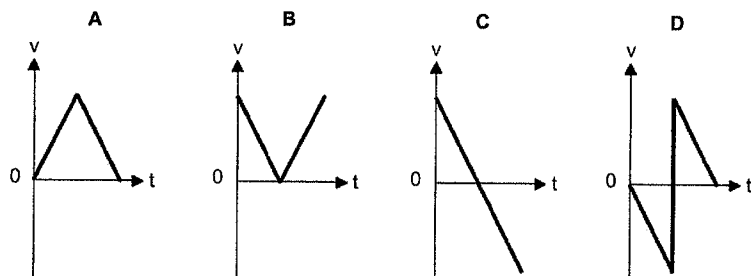
Which of the following action-reaction pairs is correct?

- A The weight of the box and the normal force from the ground on the box.
B The weight of the man and the normal force from the box supporting the man.
C The weight of the man and the contact force on the box by the man.
D The weight of the man and the force of man on Earth.

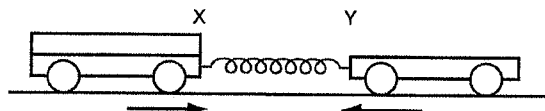
- 6 The diagram shows a graph of displacement s against time t for an object moving in a straight line.



Which graph of velocity v against t correctly represents the motion of the object?



- 7 Trolley X and trolley Y are joined by a stretched spring. Trolley X has twice the mass of trolley Y.



When the trolleys are released, the acceleration of X is 2.0 m/s^2 to the right.

What is the initial acceleration of trolley Y to the left?

- A 1.0 m/s^2 B 2.0 m/s^2 C 3.0 m/s^2 D 4.0 m/s^2

- 8 A sphere P, made of steel, has a weight of 10 N on Earth.

Another sphere Q, also made of steel, has a weight of 10 N on Mars.

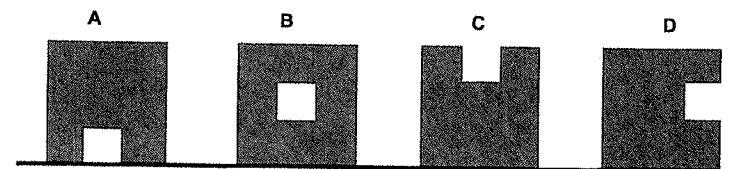
The gravitational field strength on Earth is greater than the gravitational field strength on Mars.

Which statement is correct?

- A On Earth, the weight of sphere Q is less than 10 N .
 B On Mars, the weight of sphere P is the same as the weight of sphere Q.
 C The mass of sphere P is less than the mass of sphere Q.
 D The mass of sphere P is the same as the mass of sphere Q.

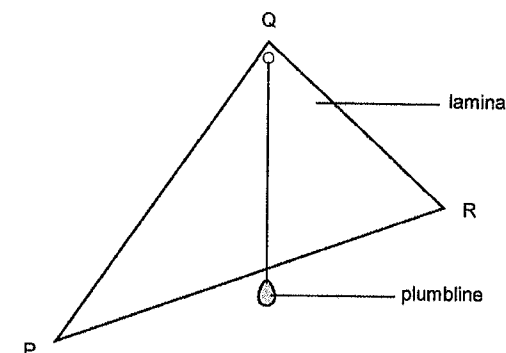
- 9 The diagram show four objects with equal mass.

Which object is most stable?



- 10 A student finds the centre of gravity of a triangular lamina PQR.

He drills a small hole at Q. He suspends the lamina from a pin through the hole at Q so that the lamina swings freely. He attaches a plumbline onto the pin and traces the line of the plumbline onto the lamina.

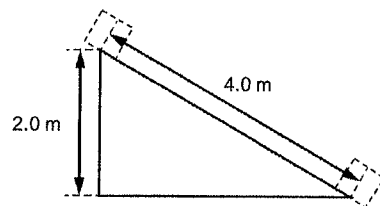


To determine the location of the centre of gravity, the student then repeats the experiment but with one change.

What is the change?

- A He repeats with a heavier weight on the plumb-line.
 B He repeats with a longer plumb-line.
 C He suspends the lamina from a pin through a hole at R.
 D He suspends the lamina from the hole at Q, with R on the left and P on the right.

- 11 A box, initially at rest, slides 4.0 m down a rough surface.
The weight of the box is 20 N. The slope is 4.0 m long and 2.0 m high.
The gravitational field strength on Earth is 10 N/kg.



A constant force of friction of 3.0 N acts against the box as it slides down the slope.

What is the speed of the box as it reaches the bottom of the slope?

- A 3.5 m/s B 5.3 m/s C 6.3 m/s D 8.9 m/s

- 12 The engine of a motor vehicle develops a large power.

Which statement is correct?

- A The driving force acting on the vehicle must be large.
B The engine must have a very large volume.
C The engine must transfer a large amount of energy every second.
D The vehicle must be very fast.

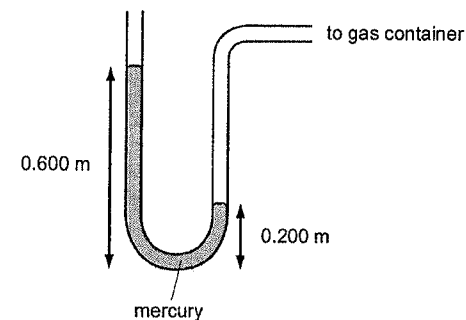
- 13 A heavy table has six legs. The cross-sectional area of each leg is X.

The legs of the table make marks in a carpet. These marks become deeper with increased pressure.

What modification could be made to the table to reduce the depth of the marks in the carpet?

- A using three legs, each of an area smaller than X
B using four legs, each of an area that is the same as X
C using six legs, each of an area smaller than X
D using eight legs, each of an area that is the same as X

- 14 The diagram shows a mercury manometer connected to a gas container.



The density of mercury is 13 600 kg/m³. The gravitational field strength g is 10 N/kg.

What is the pressure difference between the gas in the container and the atmosphere?

- A 40 800 Pa B 54 400 Pa C 81 600 Pa D 108 800 Pa

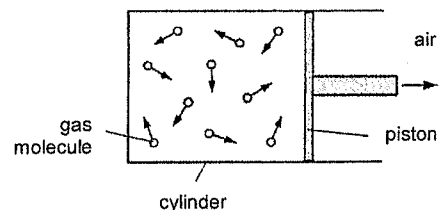
- 15 Pollen grains are placed in a transparent illuminated box and water is added.

The pollen grains are seen to move randomly on the surface of the water when viewed with a microscope.

What is the cause of the random motion of the pollen grains?

- A The pollen grains absorb light and this increase their kinetic energies.
B The pollen grains are moving randomly because they have internal energies.
C The pollen grains are moving randomly because they collide with the water molecules.
D The pollen grains are moving due to convection currents caused by the water being heated by the light.

- 16 Gas inside a cylinder is heated slowly to a higher temperature. The pressure inside the cylinder remains constant as the piston moves outwards.



How do the speed of the gas molecules and their rate of collision with the piston compare with their initial values at the lower temperature?

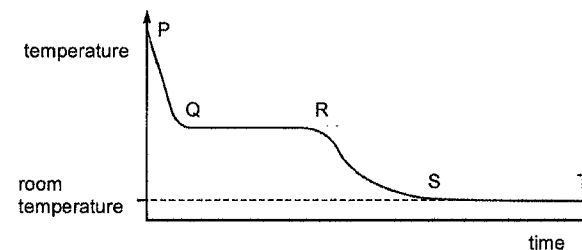
	speed of molecules	rate of collision
A	greater	greater
B	greater	reduced
C	greater	same
D	same	greater

- 17 A metal can is filled with hot water and sealed tightly. The metal can is placed inside a polystyrene box so that the hot water would cool down slowly.

Which statement describes the processes of transfer of energy out of the internal store of the water?

- A by conduction then convection
- B by conduction then radiation
- C by evaporation then convection
- D by evaporation then radiation

- 18 A hot liquid is allowed to cool. The graph shows the cooling curve.



In which part of the curve is latent heat released?

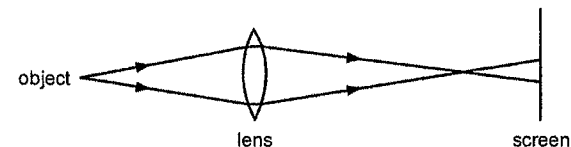
- A PQ
- B QR
- C RS
- D ST

- 19 A ray of light passes from glass to air. In glass, the speed of light is 1.8×10^8 m/s.

What is the critical angle for light passing from glass to air?

- A 32°
- B 37°
- C 41°
- D 47°

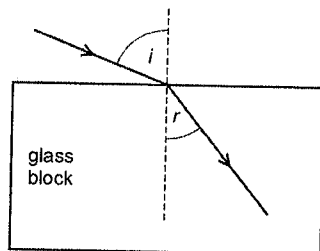
- 20 The setup produces a blurred image on the screen.



Which statement describes how a sharp image can be seen on the screen?

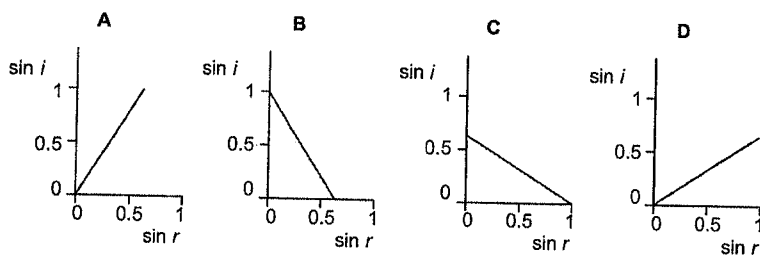
- A by moving the object away from the lens and screen
- B by moving the screen away from the lens and object
- C by using a brighter object at the same position
- D by using a lens of longer focal length at the same position

- 21 A ray of light enters a glass block at an angle of incidence i , producing an angle of refraction r in the glass.



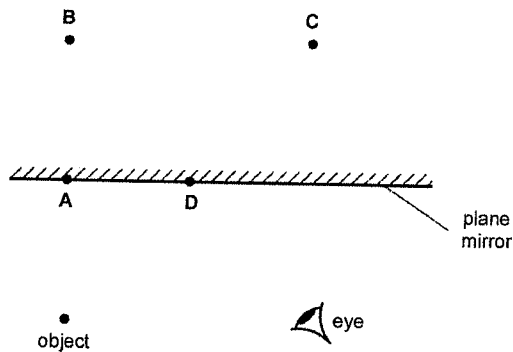
Different values of i and r are measured, and a graph of $\sin i$ against $\sin r$ is drawn.

Which graph is correct?



- 22 The diagram shows an object in front of a plane mirror.

At which labelled position is the image of the object formed?



- 23 A student writes down some facts about two transverse waves.

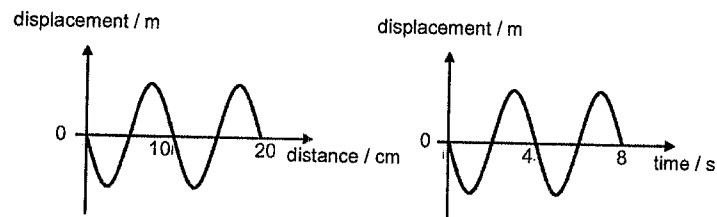
Wave 1 has a frequency f and a velocity v .

Wave 2 has four times the frequency of wave 1 and is travelling at a velocity of $2v$.

What is the wavelength of wave 2 in terms of f and v ?

- A $\frac{2f}{v}$ B $8fv$ C $\frac{2v}{f}$ D $\frac{v}{2f}$

- 24 The graphs shows the variations in the displacement of a transverse wave with distance and time.



Which row correctly describes the wavelength and frequency of the wave?

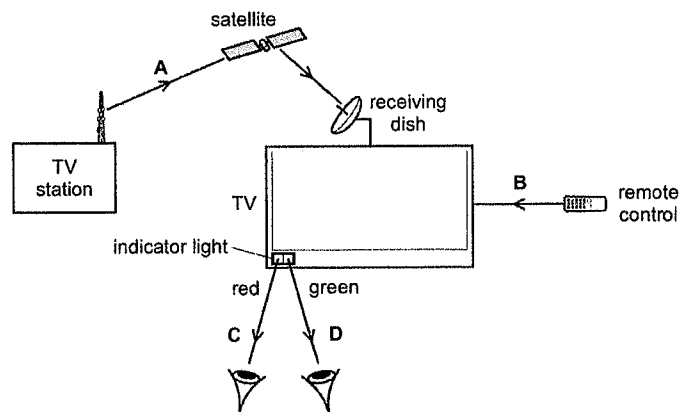
	wavelength / cm	frequency / Hz
A	5.0	0.25
B	5.0	4.0
C	10	0.25
D	10	4.0

- 25 The diagram shows a television (TV) station transmitting a signal to a television receiving dish.

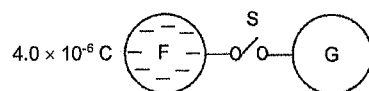
The television has an on / off indicator light.

The television is switched on by a remote control which changes the indicator light from red to green.

Which component of the electromagnetic spectrum used here has the longest wavelength?



- 26 F and G are two identical conducting spheres. F carries a negative charge of $4.0 \times 10^{-6} \text{ C}$ and G is uncharged. The two spheres are linked by a switch S and conducting wires. The charges flow for 1 ms for F and G to have the same amount of negative charge.



What is the average current in the wire when switch S is closed?

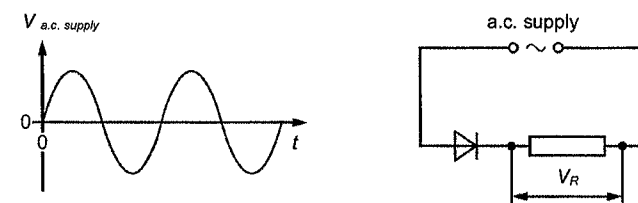
- A $2.0 \times 10^{-3} \text{ A}$ B $2.0 \times 10^{-9} \text{ A}$ C $4.0 \times 10^{-3} \text{ A}$ D $4.0 \times 10^{-9} \text{ A}$
- 27 Which statement explains why a bird can stand on an overhead high-voltage transmission line without suffering any harm?
- A Both feet are at the same voltage.
 B Its body has a very high resistance.
 C Its feet are very good insulators.
 D The spaces between its feathers act as insulators.

- 28 The table describes four different resistance wires. They are all made from the same metal.

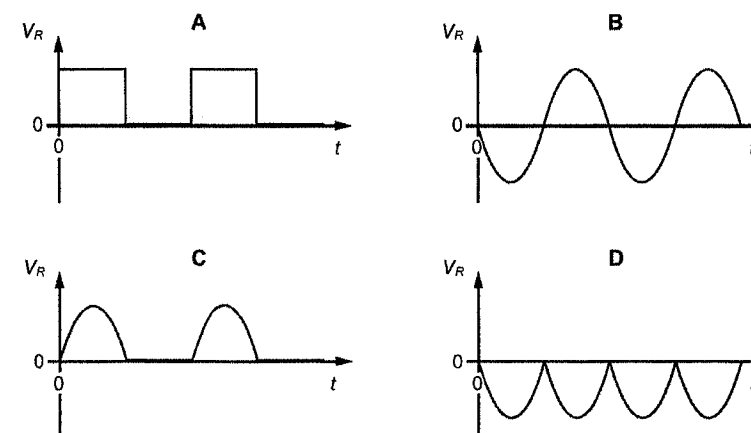
Which wire has the smallest resistance?

	length of wire / m	diameter of wire / mm
A	2.0	1.0
B	2.0	1.5
C	3.0	1.0
D	3.0	1.5

- 29 An alternating (a.c.) supply is connected to a diode and a resistor in series.

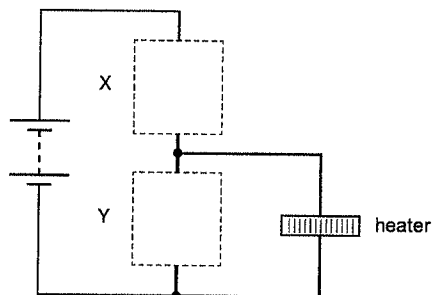


Which graph shows how the potential difference V_R across the resistor varies with time t ?



- 30 The diagram shows a circuit used to switch on a heater when the temperature drops below a certain value.

The heater turns on when its potential difference is above a certain value.



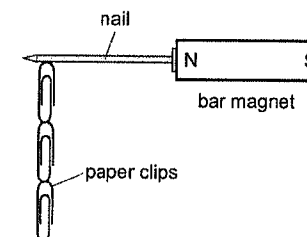
Which row shows the components that should be connected at X and at Y?

	X	Y
A		
B		
C		
D		

- 31 What causes the fuse to blow in a mains electrical circuit?

- A a person touches the live wire
- B a person touches the neutral wire
- C the live wire touches the earth wire
- D the neutral wire touches the earth wire

- 32 Four nails, A, B, C and D, are tested to find which makes the strongest permanent magnet.

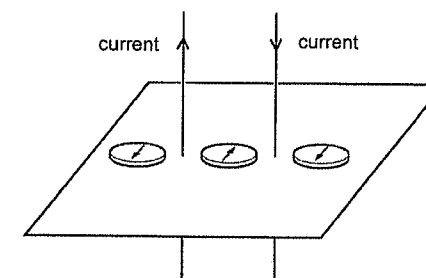


One of the nails is placed against a bar magnet and the number of paper clips which the nail can support is recorded. The bar magnet is then removed and the number of paper clips remaining attached to the nail is recorded. Each nail is tested in turn.

Which nail becomes the strongest permanent magnet?

nail	number of paper clips attached to the nail	
	bar magnet present	bar magnet removed
A	2	0
B	2	1
C	4	3
D	5	2

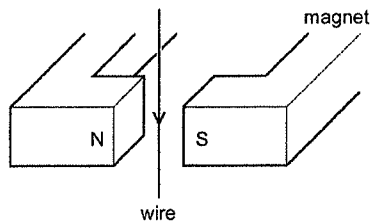
- 33 Two parallel wires carry currents in opposite directions. Three plotting compasses are placed in the positions shown.



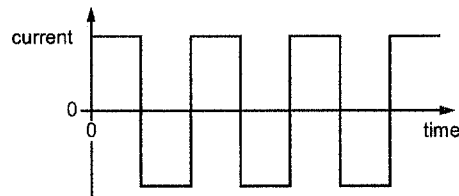
The currents in both wires are reversed. How many compass needles change directions? (Ignore the effect of the Earth's magnetic field.)

- A 0
- B 1
- C 2
- D 3

- 34 The diagram shows a wire between two poles of a magnet.



The current in the wire repeatedly changes between a constant value in one direction and a constant value in the opposite direction, as shown in the graph.



What is the effect on the wire?

- A The force on the wire alternates between one direction and the opposite direction.
 B The force on the wire is constant in size and direction.
 C There is no force acting on the wire at any time.
 D There is only a force on the wire when the current reverses.
- 35 A transformer has 5500 turns on the primary coil and 500 turns on the secondary coil.
- The output of the secondary coil is 110 V a.c and is connected to a heater. The transformer is 100% efficient.

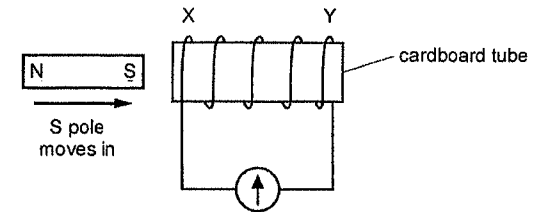
The heater produces a power of 132 W.

What is the current in the primary coil?

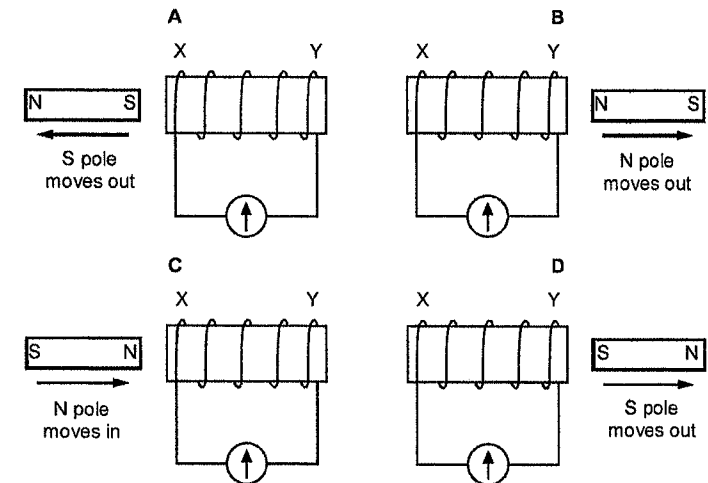
- A 0.11 A B 0.12 A C 1.2 A D 13.2 A

- 36 A coil XY is wound around a cardboard tube.

When the S pole of a magnet is pushed into the coil XY, the galvanometer deflects to the left.



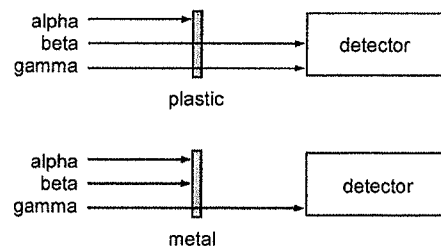
What other movement of the magnet will produce a deflection to the left?



- 37 Which row correctly describes an example of radioactive decay?

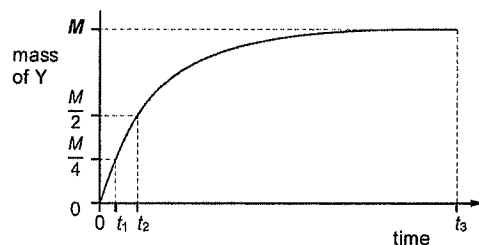
	original nucleus	emission	change or no change of element
A	stable	γ	change of element
B	unstable	α	change of element
C	unstable	α	no change of element
D	unstable	β	no change of element

- 38 The diagram shows the radioactive emissions that pass through a piece of plastic and a piece of metal of the same thickness.



Which type of radioactive emission can be distinguished between the plastic and the metal?

- A alpha, beta and gamma
 B alpha only
 C beta only
 D gamma only
- 39 An unstable isotope X decays to the stable isotope Y. The graph shows how the mass of Y present in a sample varies with time.



Which time interval gives the half-life of X?

- A $t_2 - t_1$ B $t_3 - t_2$ C t_2 D $\frac{t_3}{2}$
- 40 Which row describes nuclear fission and nuclear fusion?

	fission	fusion
A	produces larger nuclei	is the energy source of a star
B	produces larger nuclei	releases energy in a power station
C	produces smaller nuclei	is the energy source of a star
D	produces smaller nuclei	releases energy in a power station

END OF PAPER

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Answers Key to 2025 Physics P1P2 (6091/01/02) KCPSS Prelim Exam

PAPER 1

Q1	B	Q11	B	Q21	A	Q31	C
Q2	A	Q12	C	Q22	B	Q32	C
Q3	A	Q13	D	Q23	D	Q33	D
Q4	C	Q14	B	Q24	C	Q34	A
Q5	D	Q15	C	Q25	A	Q35	A
Q6	C	Q16	B	Q26	A	Q36	D
Q7	D	Q17	B	Q27	A	Q37	B
Q8	C	Q18	B	Q28	B	Q38	C
Q9	C	Q19	B	Q29	C	Q39	C
Q10	C	Q20	D	Q30	B	Q40	C

116

- 1 Which row gives reasonable estimates for the mass and the speed of an adult running?

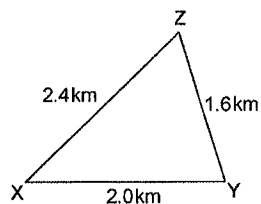
	mass / kg	speed / m/s
A	6×10^0	5×10^1
B	6×10^1	5×10^0
C	6×10^1	5×10^1
D	6×10^2	5×10^0

- 2 The acceleration of a toy car of mass 1.0 kg is 2.0 m/s^2 .

What is meant by the term *acceleration*?

- A The car travels 2.0 metres in one second.
 B The car will speed up by 2.0 metres per second every second.
 C The maximum speed of the car is 2.0 metres per second.
 D The force acting on the toy car of mass 1.0 kg is 2.0 Newton.

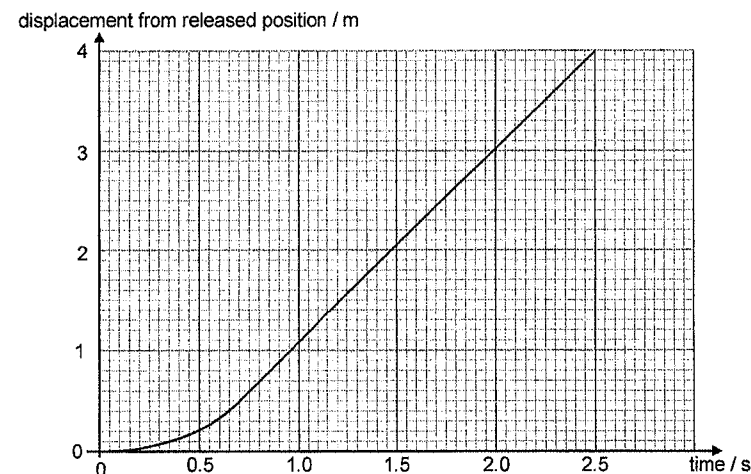
- 3 A girl runs 2.0 km from X to Y in 20 minutes and then rests at Y for 10 minutes. She then takes 10 minutes to run 1.6 km from Y to Z.



What is the magnitude of her average velocity for the journey from X to Z?

- A 0.060 km/minute
 B 0.080 km/minute
 C 0.090 km/minute
 D 0.130 km/minute

- 4 The graph shows how the displacement of an object from its released position changes with time.



What is the terminal velocity of the object?

- A 1.0 m/s B 1.3 m/s C 1.6 m/s D 2.0 m/s

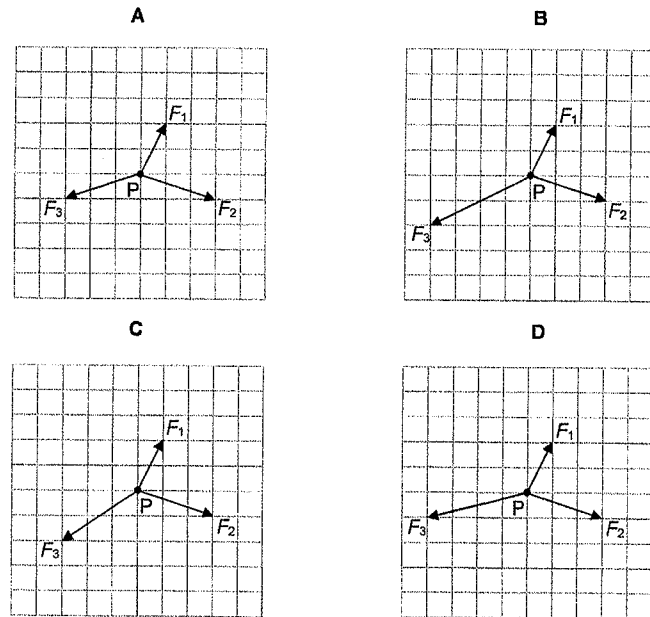
- 5 Four of the gravitational forces that act between bodies in the Solar System are described.

- P the force on the Moon due to the Earth
 Q the force on the Earth due to the Sun
 R the force on the Earth due to the Moon
 S the force on the Moon due to the Sun

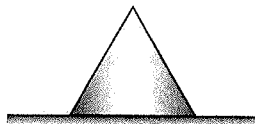
Which two forces are a Newton's third law pair (action and reaction)?

- A P and Q B P and R C Q and S D R and S

- 6 In each of the diagrams, there are three forces, F_1 , F_2 and F_3 acting on a particle P. In which diagram is particle P in equilibrium?



- 7 A metal cone with a circular base is placed on a flat surface as shown in the diagram.



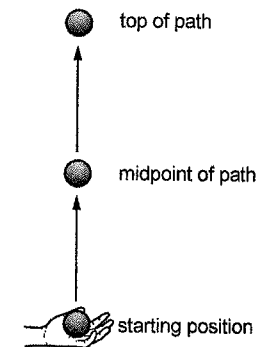
Which factors affect the stability of the cone?

- A its weight only
- B the diameter of its base and the position of its centre of gravity
- C the diameter of its base only
- D the position of its centre of gravity only

- 8 Objects with different weights are placed on a rigid, horizontal surface. Which row shows the correct pressure acting on the surface?

	weight / N	area in contact / m^2	pressure / N/m^2
A	10	0.1	1
B	20	0.2	0.01
C	30	0.1	300
D	40	0.2	8

- 9 A ball is thrown vertically upwards into the air. It rises to the top of its path before beginning to fall vertically downwards.



Assume that the energy in gravitational potential store of the ball is zero at its starting position.

Which statement about the ball is **not** correct?

- A As it rises, the energy in its kinetic store is transferred to its gravitational potential store.
 - B At the midpoint of its path, the energy in its gravitational potential store is equal to the initial energy in its kinetic store.
 - C At the top of its path, the energy in its kinetic store is zero.
 - D At the top of its path, its total energy is less than its initial total energy.
- 10 What is the average power output of a laser that can deliver 0.20 J of energy in 10 ns?
- A 2 nW
 - B 20 mW
 - C 200 kW
 - D 20 MW

- 11 Some energy sources are reliably available at all times, and some are not. Which row shows three sources all in their correct columns?

	available at all times	not available at all times
A	geothermal	nuclear, solar
B	geothermal, nuclear	solar
C	solar, nuclear	geothermal
D	solar	nuclear, geothermal

- 12 In an experiment to demonstrate Brownian motion, a transparent container is filled with smoke particles suspended in air.

What can be seen when the contents of the container are strongly illuminated and viewed through a microscope?

- A molecules in random motion
 B molecules vibrating regularly
 C smoke particles in random motion
 D smoke particles vibrating regularly

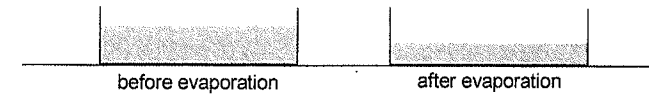
- 13 Thermal energy is added to a substance which may be a solid, a liquid or a gas. What quantity of the substance must increase at the end of the energy transfer?

- A its internal energy
 B its temperature
 C the average kinetic energy of the molecules
 D the average potential energy of the molecules

- 14 Which of the following statements concerning thermal energy transfer between two objects is **incorrect**?

- A No thermal energy transfer by conduction occurs between two objects if the space between the two objects is a vacuum.
 B No thermal energy transfer by convection occurs between two objects if the space between the two objects is a vacuum.
 C No thermal energy transfer by radiation occurs between two objects if the space between the two objects is a vacuum.
 D No net thermal energy transfer occurs between two objects if the temperature difference between the two objects is zero.

- 15 Some of the liquid in a dish evaporates, as shown in the diagrams.



Which molecules leave the liquid and which molecules in the liquid have greater average energy in its kinetic store?

	molecules that leave have	molecules in the liquid have greater average energy in its kinetic store
A	high energy	before evaporation
B	high energy	after evaporation
C	low energy	before evaporation
D	low energy	after evaporation

- 16 Which two quantities must be known in order to calculate the energy needed to vaporise a certain quantity of liquid?

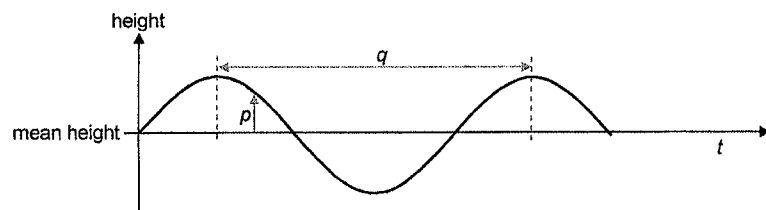
	quantity 1	quantity 2
A	boiling point	specific heat capacity of liquid
B	boiling point	specific latent heat of liquid
C	mass	specific heat capacity of liquid
D	mass	specific latent heat of liquid

- 17 In the electromagnetic spectrum shown, which quantity increases from left to right?

Radio waves	Microwaves	Infra-red radiation	Visible light	Ultraviolet radiation	X rays	Gamma rays
-------------	------------	---------------------	---------------	-----------------------	--------	------------

- A amplitude
 B frequency
 C velocity
 D wavelength

- 18 The graph shows how the height of the water surface at a point in a harbour varies with time t as waves pass the point.



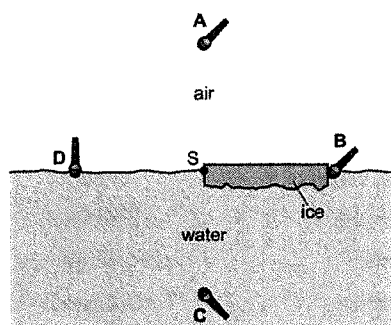
What are p and q ?

	p	q
A	displacement	period
B	displacement	wavelength
C	amplitude	period
D	amplitude	wavelength

- 19 A block of ice floats on water as shown in the figure.

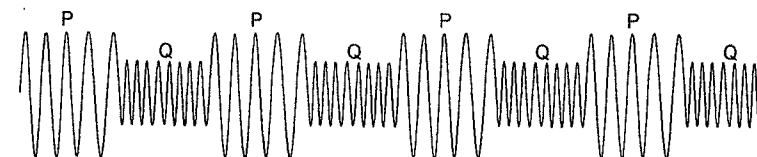
A source of sound S is positioned at the edge of the ice block. Four microphones are placed equal distances from S .

Which microphone detects the sound from S first?



- 20 A police car sounds its siren when travelling to an emergency. The siren produces two different sounds P and Q, which are emitted alternately.

The diagram represents the sound waves emitted by the siren.



Which of the two sounds P and Q is softer and which has the lower pitch?

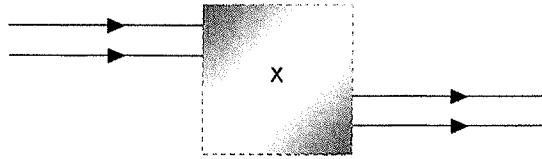
	softer sound	sound of lower pitch
A	P	P
B	P	Q
C	Q	P
D	Q	Q

- 21 A glass surface **cannot** form an image of an object by reflection.

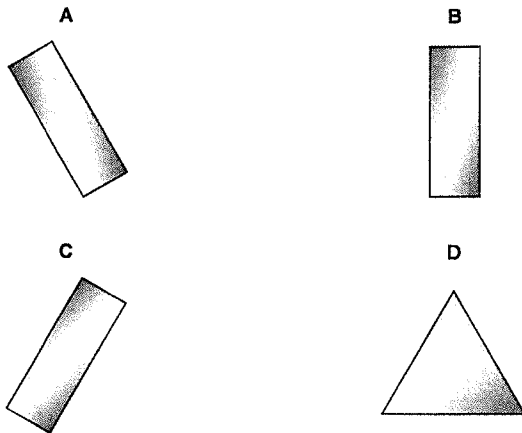
Which of the following statements best explains this?

- A light from the object is absorbed by the glass surface.
- B light from the object is reflected randomly in different directions by the glass surface.
- C light from the object passes through the glass surface without reflection.
- D the laws of reflection are not obeyed in the reflection by a glass surface.

- 22 A parallel beam of light is refracted by a transparent object placed on X. The refracted beam remains parallel but displaced downward.

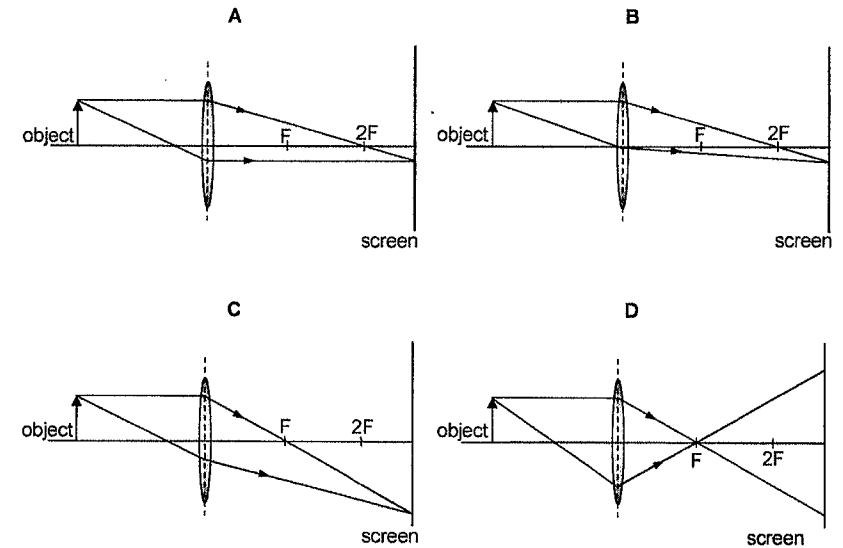


Which of the following is likely to be the transparent object placed on X?



- 23 Which diagram shows how an image of an object is formed on a screen by a converging lens?

F is the focal point of the lens.



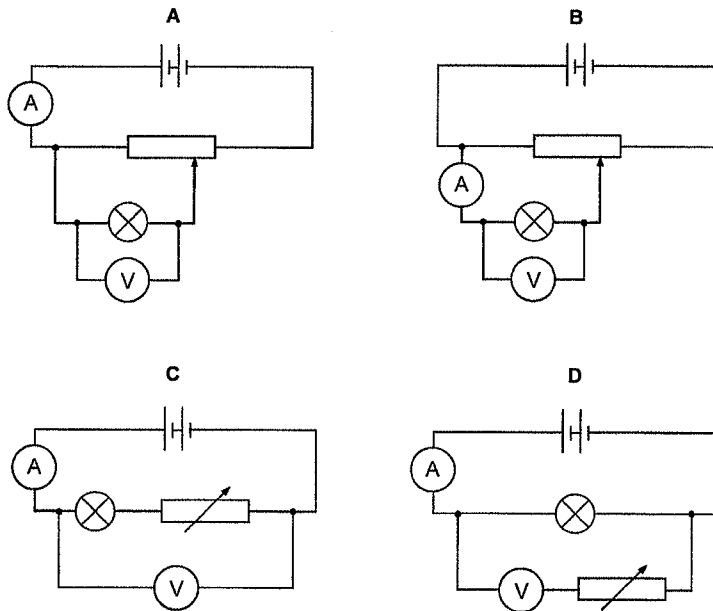
- 24 A lightning bolt transfers 6.0 C of charge from a cloud to the ground in 2.0 ms. What is the average current during this event?

- A $1.2 \times 10^{-2} \text{ A}$
 B $3.0 \times 10^2 \text{ A}$
 C $3.0 \times 10^3 \text{ A}$
 D $1.2 \times 10^4 \text{ A}$

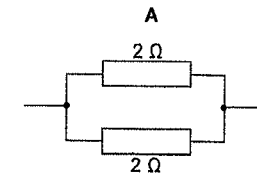
- 25 An iron wire has length 8.0 m and diameter 0.50 mm. The wire has resistance R . A second iron wire has length 2.0 m and diameter 1.0 mm. What is the resistance of the second wire?

A $\frac{1}{16}R$ B $\frac{1}{8}R$ C $\frac{1}{2}R$ D R

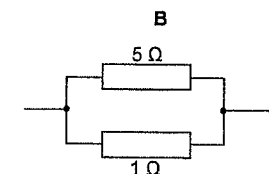
- 26 An experiment is set up to investigate how the current in a filament lamp changes with the potential difference across it. Which circuit is correct?



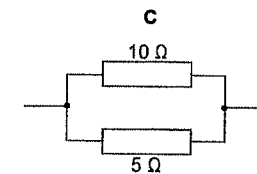
- 27 A student connects various resistors in parallel pairs. Underneath each diagram is a statement about the total resistance of each pair of resistors. Which statement is correct?



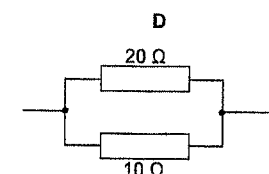
The total resistance is 4 Ω



The total resistance is between 4 Ω and 5 Ω

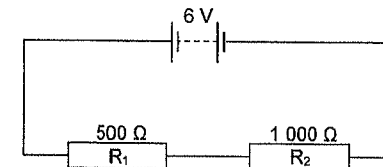


The total resistance is less than 5 Ω



The total resistance is more 20 Ω

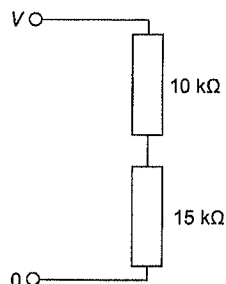
- 28 The diagram shows a 6 V battery connected in series to two resistors R_1 and R_2 . R_1 has a resistance of 500 Ω and R_2 has a resistance of 1 000 Ω .



- A third resistor with a resistance of 500 Ω is placed in parallel across R_2 . Which statement about the new circuit is correct?

A The current through R_2 is larger than before.
 B The current through the battery is smaller than before.
 C The potential difference (p.d.) across R_1 is larger than before.
 D The p.d. across R_2 is now greater than the p.d. across R_1 .

- 29 A potential divider circuit is set up by connecting two resistors in series as shown. The potential difference across the circuit is V .



What is the potential difference across the 10 kΩ resistor?

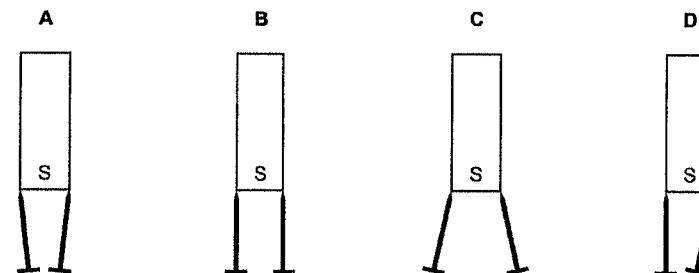
- A $\frac{10}{25} V$
 B $\frac{15}{25} V$
 C $\frac{10}{15} V$
 D $\frac{15}{10} V$

- 30 A heater has a rating of '220 V, 4 000 W'. The heater is working at its rated value.

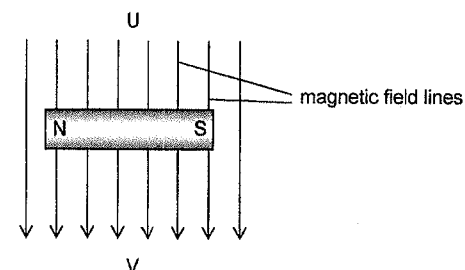
Which of the following statements is **incorrect**?

- A 4 000 J of energy is transferred electrically to thermal energy for every coulomb of charge passing through the heater.
 B The heater transfers 2.4×10^6 J of energy electrically every minute.
 C The heater draws a current of 18.2 A.
 D The resistance of the heater is 12.1 Ω.

- 31 Two soft pins are suspended from the S pole of a bar magnet. Which diagram shows the correct behaviour of the pins?



- 32 A freely suspended magnet is held perpendicular to a uniform magnetic field as shown. The magnet is viewed from above.

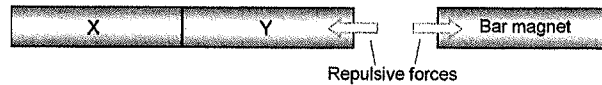


view from above

What happens to the magnet when it is released?

- A It turns through 90° anticlockwise and then moves towards V.
 B It turns through 90° anticlockwise and then stops moving.
 C It turns through 90° clockwise and then move towards U.
 D It turns through 90° clockwise and then stops moving.

- 33 Two metal bars X and Y attract each other and stick together end to end as shown in the figure.



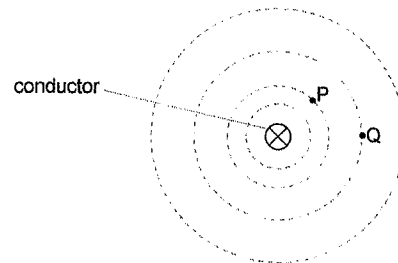
When a bar magnet is brought near Y, repulsive forces act between them.

Which of the following may describe the nature of X and Y?

- (1) Both X and Y are bar magnets.
- (2) X is an iron bar and Y is a bar magnet.
- (3) X is a bar magnet and Y is an iron bar.

- A (1) and (2) only
- B (1) and (3) only
- C (2) and (3) only
- D (1), (2) and (3)

- 34 The diagram shows the shape of the magnetic field lines near a current-carrying conductor.

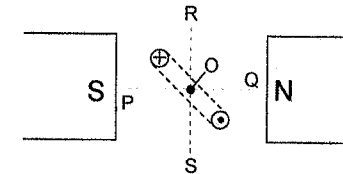


The current in the conductor is into the plane of the diagram.

Which row correctly states the direction of the field lines and compares the strengths of the field at points P and Q?

	direction of field lines	the field is weaker at
A	clockwise	P
B	clockwise	Q
C	anticlockwise	P
D	anticlockwise	Q

- 35 The figure shows the plan view of a current carrying rectangular coil placed in a uniform magnetic field. The coil is free to rotate about O, and the direction of the current in the coil is constant.

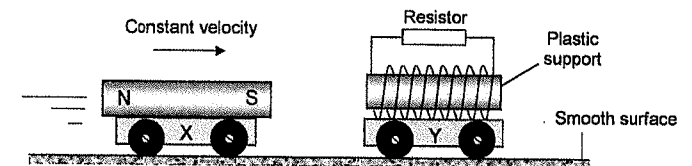


Which of the following correctly describes the motion of the coil?

- A The coil rotates anti-clockwise continuously.
- B The coil rotates clockwise continuously.
- C The coil oscillates about PQ.
- D The coil oscillates about RS.

- 36 Trolley X with a bar magnet fixed on it and trolley Y with a solenoid fixed on it are placed on a smooth horizontal surface. The solenoid is made with a insulated wire coiled around a plastic support.

Trolley X is then set in motion at constant velocity towards stationary trolley Y as shown in the figure.



Which of the following statements correctly describes the subsequent motions of the two trolleys?

- A X accelerates to the right and Y accelerates to the left.
- B X accelerates to the left and Y accelerates to the right.
- C X continues moving with constant velocity and Y accelerates to the right.
- D X decelerates and Y accelerates to the right.

- 37 Electric power cables transfer energy electrically over large distances using high-voltage, alternating current.

Which are the advantages of using a high voltage and of using an alternating current?

	advantage of using high voltage	advantage of using an alternating current
A	high current is produced in the cable	the resistance of the cable is reduced
B	high current is produced in the cable	the voltage can be changed using a transformer
C	less energy is wasted in the cable	the resistance of the cable is reduced
D	less energy is wasted in the cable	the voltage can be changed using a transformer

- 38 An isotope of radon is radioactive. It decays by emitting an α -particle.

What happens to the nucleus of a radon atom during the emission of the α -particle?

- A It becomes the nucleus of a different isotope of radon with fewer neutrons.
 B It becomes the nucleus of a different isotope of radon with more neutrons.
 C It becomes the nucleus of an element with a higher proton number.
 D It becomes the nucleus of an element with a lower proton number.

- 39 The emissions from a radioactive source pass through a sheet of lead that is 10 mm thick.

Which type of radiation is emitted from the source and how is the radiation affected by an electric field?

	type of radiation	effect of electric field on radiation
A	α	radiation deflected
B	α	radiation not deflected
C	γ	radiation deflected
D	γ	radiation not deflected

- 40 Nuclear fusion is one source of energy.

What is nuclear fusion?

- A the decay of a radioactive nucleus
 B the joining together of two nuclei to make a larger nucleus
 C the melting of an unstable nucleus
 D the splitting of a nucleus into two lighter nuclei

End of Paper

1	2	3	4	5	6	7	8	9	10
B	B	A	D	B	D	B	C	B	D
11	12	13	14	15	16	17	18	19	20
A	C	A	C	A	D	B	A	B	C
21	22	23	24	25	26	27	28	29	30
B	C	C	C	A	B	C	C	A	A
31	32	33	34	35	36	37	38	39	40
C	B	D	B	D	D	D	D	D	B

Class/ Index Number	Centre Number/ 'O' Level Index Number	Name
/	/	



新加坡海星中学
MARIS STELLA HIGH SCHOOL
PRELIMINARY EXAMINATION
SECONDARY FOUR

PHYSICS

Paper 1 Multiple Choice

6091/01
3 September 2025
1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your class, index number, Centre number, O level index number and name in the spaces at the top of this page.

There are **forty** questions on this paper. Answer **all** questions. For each question, there are four possible answers **A, B, C** and **D**. Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this question booklet. The use of an approved scientific calculator is expected, where appropriate.

The total marks for this paper is 40.

At the end of the examination, hand in the following separately:

- (1) Multiple Choice Answer Sheet
- (2) Question Paper

- 1 Max Planck's equation of radiation states that the energy, E , of electromagnetic waves is equal to the product of Planck's constant, h and the frequency, f of the electromagnetic wave. The equation is $E=hf$.

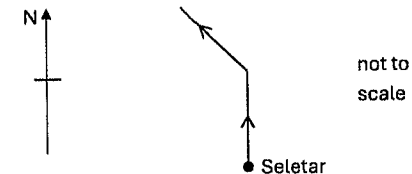
What is the unit of Planck's constant, h , expressed as SI **base** units?

- A J / Hz
- B $\text{m s}^2 / \text{kg}^3$
- C $\text{kg m}^2 / \text{s}$
- D $\text{kg m}^3 / \text{s}^2$

- 2 An air-traffic control centre at Seletar looks after aircraft within a 400 km radius of Singapore.

A small aircraft, flying due north at 300 km/h, passes over Seletar at 12:00pm. It carries enough fuel for another 550 km of flying.

At 12:30pm, air traffic control instructs the pilot to turn through 45° onto a north-westerly bearing. The aircraft continues at 300 km/h until 1:30pm.

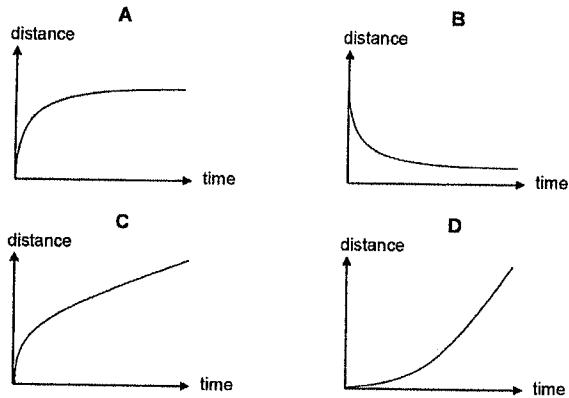


At 1:30pm the aircraft is still 150 km from its destination.

What is the location of the aircraft and which action is required?

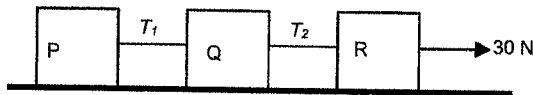
	location of aircraft	action required
A	outside Seletar's air-traffic control space	carry on to destination
B	outside Seletar's air-traffic control space	make an emergency landing before getting to destination due to insufficient fuel
C	within Seletar's air-traffic control space	carry on to destination
D	within Seletar's air-traffic control space	make an emergency landing before getting to destination due to insufficient fuel

- 3 Which of the following distance-time graphs best describes a skydiver jumping off a plane till reaching terminal velocity?



- 4 At the top of a cliff of height 100 m, a girl throws a rock upwards with a velocity of 15 m/s. How much time later will the rock hit the bottom of the cliff? Ignore the effects of air resistance and take acceleration due to gravity as $g = 10 \text{ m/s}^2$.
- A 6.2 s B 6.8 s
C 7.5 s D 8.2 s

- 5 P, Q and R are three identical blocks resting on a smooth surface as shown below. The blocks are joined by strings with tensions T_1 and T_2 when a force of 30 N is applied at one end as shown in the diagram below.

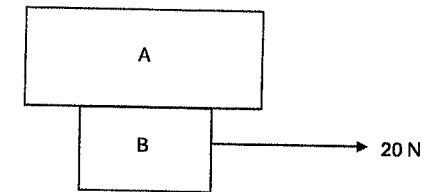


What are the tensions T_1 , and T_2 in the strings?

	T_1	T_2
A	15 N	15 N
B	30 N	30 N
C	10 N	20 N
D	10 N	15 N

[Turn over

- 6 Two objects, A (mass 6.0 kg) and B (mass 4.0 kg), are stacked one on top of the other as shown.

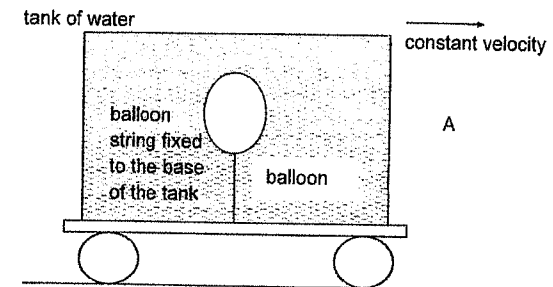


B is pulled by a horizontal force of 20 N and all surfaces are frictionless.

What is the acceleration of A?

- A 0 m/s^2
B 2.0 m/s^2
C 3.3 m/s^2
D 5.0 m/s^2

- 7 A sealed tank filled to the brim with water is mounted on wheels. A balloon is fixed at the base of the tank. The tank is initially moving at a constant velocity.

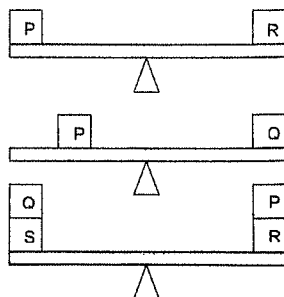


Which statement correctly describes the motion of the balloon when the tank starts to slow down?

- A The balloon will move backward.
B The balloon will move forward.
C The balloon will remain in its original position.
D The balloon will start to oscillate back and forth.

5

- 8 Four cubes P, Q, R and S are used to balance a uniform beam pivoted about its mid-point. They have the same volume but different masses.

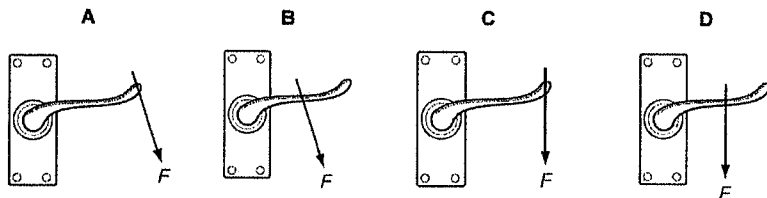


Which cube is the heaviest?

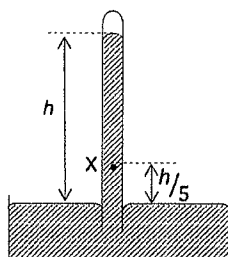
- A P B Q C R D S

- 9 The diagrams show a force of magnitude F being applied to the same door handle.

Which diagram shows the greatest moment?



- 10 The diagram shows a mercury barometer.

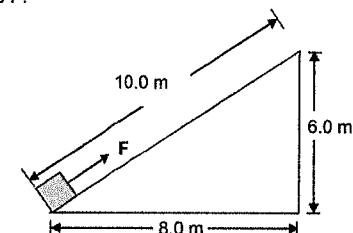


Given that the height of the mercury barometer is h when the atmospheric pressure is 100 000 Pa, what is the pressure at point X?

- A 20 000 Pa B 80 000 Pa
C 120 000 Pa D 180 000 Pa

6

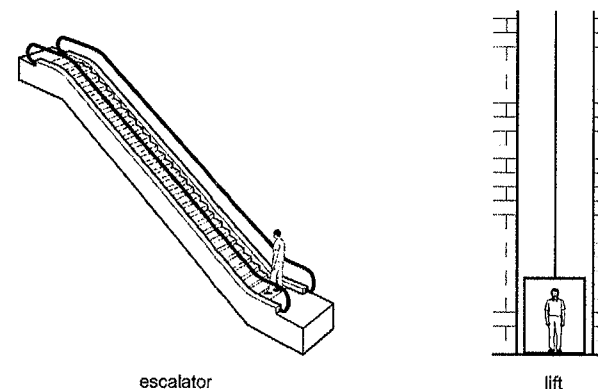
- 11 The figure below shows a box of mass 6.0 kg being dragged to the top of a slope at a constant speed by a constant force F .



Given that the total work done against friction is 160 J and the gravitational field strength is 10 N/kg, what is the value of force F ?

- A 16 N B 20 N C 52 N D 60 N

- 12 A man can either take an escalator or a lift to travel up between two floors in a hotel.



The escalator takes 20 seconds to carry the man between the two floors. The useful work done against gravity is W . The useful power developed is P . The lift takes 30 seconds to carry the same man between the same two floors.

How much useful work against gravity is done by the lift, and how much useful power is developed by the lift?

	useful work done against gravity by lift	useful power developed by lift
A	more than W	less than P
B	more than W	P
C	W	less than P
D	W	P

[Turn over]

- 13 When a hot gas is left to cool, its internal energy decreases.

What causes this?

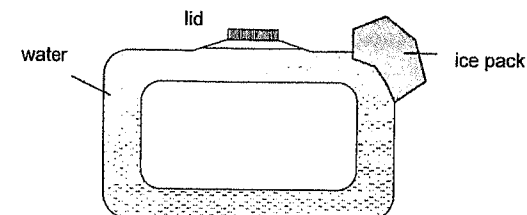
- A a decrease in the kinetic energy of the gas particles
- B a decrease in the gravitational potential energy of the gas particles
- C an increase in the average speed of the gas particles
- D an increase in the average distance of separation of the gas particles

- 14 An experiment is carried out to investigate the rate of transfer of internal energy by conduction and radiation through different mediums – mercury, vacuum and wood.

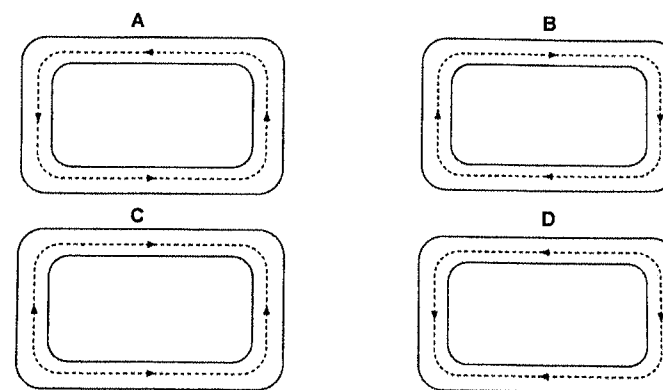
Which mediums show the greatest rate of transfer of internal energy by conduction and radiation?

	conduction	radiation
A	mercury	vacuum
B	vacuum	mercury
C	vacuum	wood
D	wood	vacuum

- 15 A student filled an upright ring-shaped container completely with warm water. He then placed a pack of ice at a corner of the container.



Which is a correct illustration of the convection current that was set up?



- 16 Two different liquids, P and Q with the same mass and initial temperature, are heated by the same heat source. Liquid P reaches a temperature of 80°C faster than liquid Q.

This shows that

- A liquid P has a higher specific heat capacity than liquid Q.
- B liquid P has a lower specific heat capacity than liquid Q.
- C liquid P has a higher specific heat of vapourisation than liquid Q.
- D liquid P has a lower specific heat of vapourisation than liquid Q.

- 17 A wave in the sea collides with a cliff.

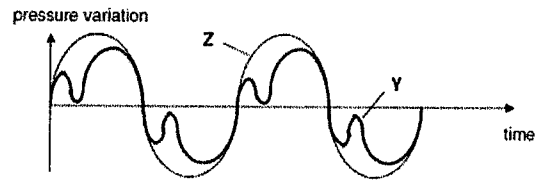
A crest of the wave hits the cliff once every 6.0 s.

The horizontal distance between a crest and the adjacent trough of the wave is 4.5 m.

What is the speed of the wave?

- A 0.67 m / s
- B 0.75 m / s
- C 1.3 m / s
- D 1.5 m / s

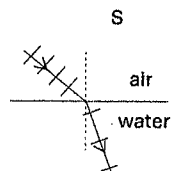
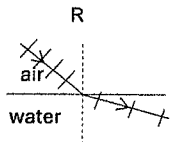
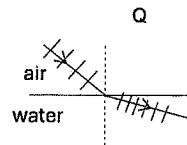
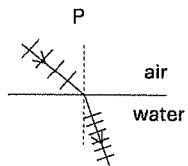
- 18 The figure below shows two waveforms produced by a flute (Y) and tuning fork (Z) played by two students.



How do the loudness and pitch of the sound from the tuning fork Z compare to that of the flute Y?

- A The loudness of Y is lower but its pitch is the same as Z.
- B Both Y and Z have the same loudness and pitch.
- C The loudness of Y is higher but its pitch is lower than Z.
- D The loudness of Y is the lower but its pitch is higher than Z.

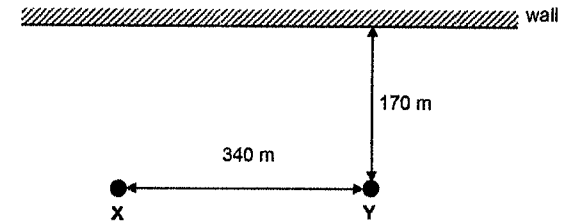
- 19 The diagrams below show the waves travelling from air to water. The wave direction and wavefronts along the wave are also shown in each diagram.



Which of the diagrams above correctly represent light and sound waves as it travels from air to water?

	light wave	sound wave
A	P	Q
B	S	Q
C	P	R
D	S	R

- 20 The diagram shows two persons (X and Y) standing 340 m apart and 170 m away from the wall.



When person X fires a gun, person Y hears the gunshot twice.

Given that the speed of sound in air is 340 m/s, what is the time interval between the two gunshot sounds heard by person Y?

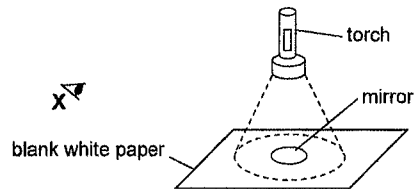
- A 0.41 s
- B 0.50 s
- C 0.62 s
- D 1.24 s

- 21 What is one of the uses of ultrasound?

- A cleaning jewellery
- B fluorescent tubes
- C optical fibres
- D sunbeds

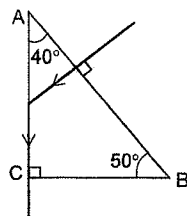
- 22 One night, Chester switched off all the lights in his room and placed a large piece of blank white paper onto his table.

He placed a small mirror, with its reflecting surface facing upwards, at the centre of the paper. Chester then shined a torch directly above the mirror as shown in the diagram below.



What would Chester see if he looks at the setup at position X?

- A The mirror appears brighter than the paper as most of the light rays undergo regular reflection into his eyes.
 - B The mirror appears brighter than the paper as most of the light rays undergo diffused reflection into his eyes.
 - C The paper appears brighter than the mirror as most of the light rays undergo regular reflection into his eyes.
 - D The paper appears brighter than the mirror as most of the light rays undergo diffused reflection into his eyes.
- 23 The diagram shows a ray of light entering a glass prism at the surface AB and travelling along the surface AC.



What is the refractive index of the glass prism?

- A 1.31 B 1.42 C 1.50 D 1.56

- 24 Applications use different components of the electromagnetic spectrum.

Which shows correct applications for X-rays, ultraviolet light and microwaves?

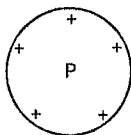
	X-rays	ultraviolet light	microwaves
A	mobile phone	fluorescent tube	intruder alarm
B	killing cancerous cells	sterilising surgical instruments	satellite television
C	medical imaging	television controller	sunbed
D	sterilising surgical instruments	television controller	detecting cracks in metal

- 25 An electrically charged plastic ball is dropped from rest.

Which types of fields are caused by the ball?

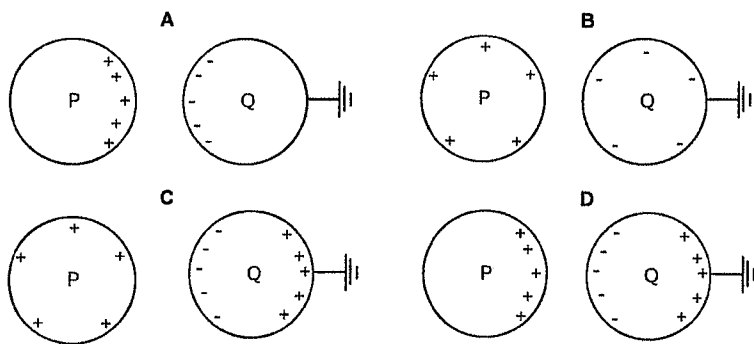
- A gravitational and magnetic only
- B electric and gravitational only
- C electric and magnetic only
- D electric, gravitational and magnetic

- 26 A metal sphere P has a positive charge distribution as shown.



A similar sphere Q, connected to an earthing wire, is brought close to P.

Which diagram best shows the final distribution of charge between the two spheres?



- 27 A student touches the body of a car that has become charged during its journey.

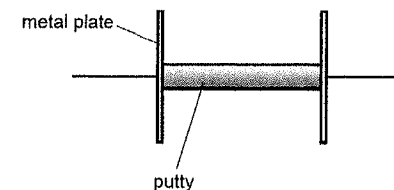
A current of 10 mA passes through him for 20 ms.

How much charge flows through him?

- A 2.0×10^{-4} C B 0.50 C C 2.0 C D 200 C

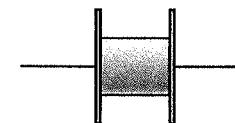
- 28 Conducting putty is a soft material which can easily be made into different shapes. It conducts electricity.

50 g of conducting putty is placed between two metal plates as shown.



With the putty arranged like this, it has a resistance of 8Ω .

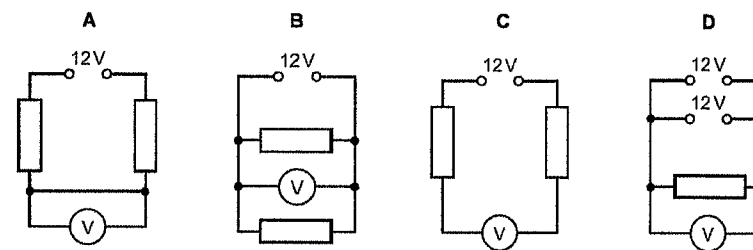
The plates are now squeezed together so that the distance between them is halved.



What is the resistance of the putty now?

- A 2Ω B 4Ω C 8Ω D 16Ω

- 29 In which circuit does the voltmeter not read 12 V?



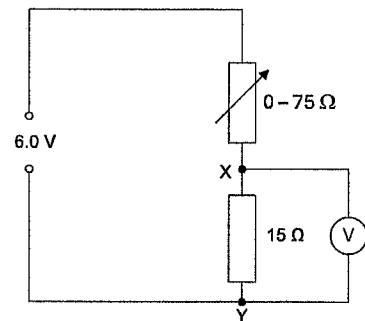
- 30 When the flash on a camera is used, a charge of 1.5 C flows for 0.0030 s through the flash lamp.

The average voltage across the flash lamp is 3600 V.

What is the energy supplied electrically to the flash lamp and what is the average power supplied?

	energy / J	power / W
A	2400	7.2
B	2400	800 000
C	5400	16.2
D	5400	1.8×10^6

- 31 The diagram shows two resistors in a circuit with a power supply and a voltmeter.



What is the range of voltages that can be obtained between points X and Y?

- A 0.0 V to 1.0 V
 B 0.0 V to 6.0 V
 C 1.0 V to 3.0 V
 D 1.0 V to 6.0 V

- 32 At a construction site, a metal scaffolding is firmly embedded in the damp ground. A builder holds a mains-operated electric drill in one hand, and the metal scaffolding with the other hand.

The power cable of the drill is damaged such that parts of the exposed cable enters the metal casing of the drill, where an earth wire is connected.

Which of the following could happen?

- A A current could pass through the builder and electrocute him.
 B A current in the scaffolding could heat him up and burn him.
 C The large current could blow the fuse.
 D The large current could make the motor spin too quickly.

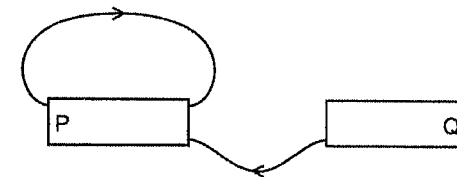
- 33 A 240 V mains circuit contains eight 60 W lamps in parallel.

At the time when the lamps are switched on, the filaments are cold and the current is four times as large as the final steady current in the circuit.

What is the initial current supplied by the mains?

- A 0.25 A B 1.0 A C 2.0 A D 8.0 A

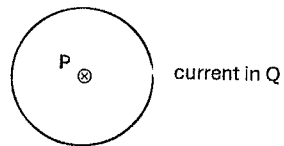
- 34 The diagram shows two magnetic field lines of the magnetic field around two bar magnets.



Which row shows the magnetic poles at end P and end Q of the two magnets?

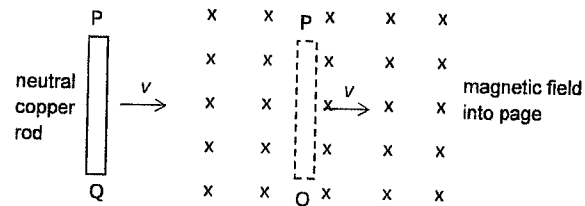
	P	Q
A	N	N
B	N	S
C	S	N
D	S	S

- 35 A long straight wire P is placed along the axis of a flat circular coil Q. The wire and the coil each carry a current as shown.



What can be deduced about the force acting on each part of Q due to the current in P?

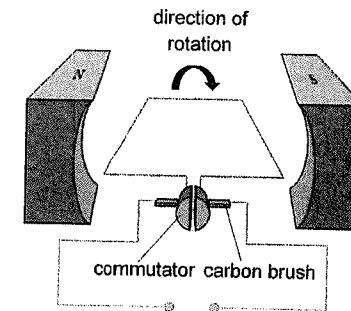
- A The force is away from P.
 B The force is towards P.
 C The force is perpendicular to the plane in the diagram.
 D There is no force in any direction.
- 36 The diagram below shows an electrically neutral copper rod moving at speed v into a magnetic field. The direction of the field is into the page. P and Q are the ends of the copper rod.



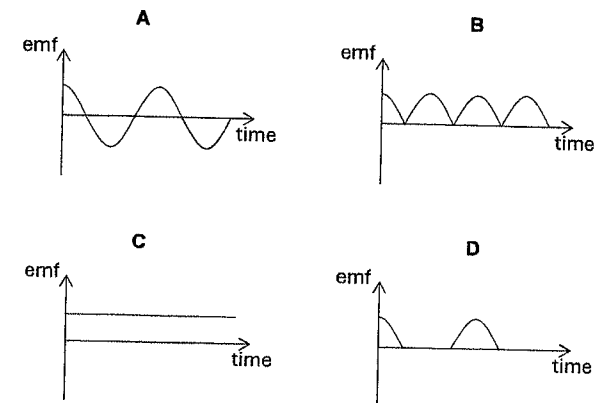
Which of the following options best describes the net charge found at P and Q when the rod is moving and is completely inside the magnetic field?

	P	Q
A	positive	positive
B	negative	positive
C	neutral	neutral
D	positive	negative

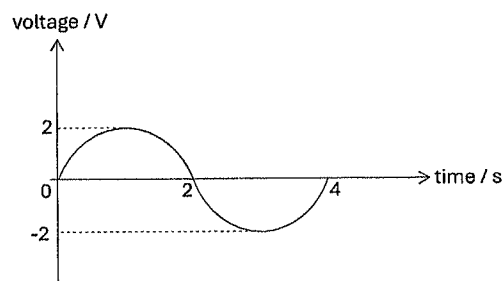
- 37 The figure shows an electrical generator, which consists of a rotating coil between a pair of permanent magnets.



Which of the following graphs shows the variation of e.m.f. produced by the generator?



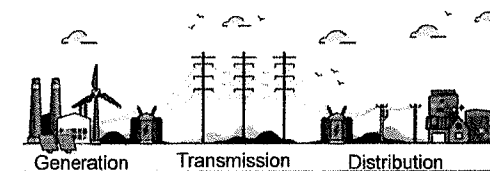
- 38 A simple a.c. generator produces a voltage which varies with time as shown in the graph below.



Which of the following reflects how the correct voltage varies with time when the generator rotates at half the original speed?

	maximum voltage / V	frequency / Hz
A	1	0.13
B	1	0.50
C	4	0.13
D	4	0.50

- 39 Long-distance power transmission occurs at high alternating voltages.



The following are reasons suggested to explain why high alternating voltages are used.

reason	
1	Alternating voltages can be stepped up or down efficiently by transformers.
2	For a given transmission power, the current will be reduced if a high voltage is adopted.
3	The power loss in the transmission cables will be reduced if a high voltage is adopted.

Which of the above reasons are correct?

- A both reasons 1 & 2
 B both reasons 1 & 3
 C both reasons 2 & 3
 D all the given reasons

- 40 A radioisotope has a half-life of 18 hours.

At 9:00 am on 1 May, a sample was prepared which contained 4.00 mg of the radioisotope.

At what time will the mass of the radioisotope remaining be 0.50 mg?

- A 3:00 am on 2 May
 B 3:00 pm on 3 May
 C 9:00 am on 4 May
 D 9:00 pm on 7 May

- End of paper -

2025 MSHS 6091 Physics
Prelim Exam Solutions

PAPER 1

1	2	3	4	5	6	7	8	9	10
C	B	D	A	C	A	A	D	A	B

11	12	13	14	15	16	17	18	19	20
C	C	A	A	B	B	D	A	C	A

21	22	23	24	25	26	27	28	29	30
A	A	D	B	D	A	A	A	A	D

31	32	33	34	35	36	37	38	39	40
D	C	D	B	D	D	B	A	D	B

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Name: _____ () Class: _____



MONTFORT SECONDARY SCHOOL

PRELIMINARY EXAMINATION

SECONDARY 4 EXPRESS

PHYSICS

6091/ 01

Paper 1 Multiple Choice

29 August 2025 (Friday)

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, paper clips, glue or correction fluid.

Write your name, Class and index number on the Answer Sheet in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C and D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet provided.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

Take $g = 10 \text{ m/s}^2$ or 10 N/kg unless otherwise stated.

This document consists of **19** printed pages and **1** blank page

Setter: Ernest Yu

1 What is the conversion factor for converting nanohertz (nHz) to gigahertz (GHz)?

- A 10^{-9} B 10^{-12} C 10^{-15} D 10^{-18}

2 Which of the following shows the most suitable instruments used for the measurements of these given objects?

	internal diameter of a test-tube	thickness of a copper wire
A	digital calipers	digital micrometer screw gauge
B	metre rule	digital calipers
C	digital micrometer screw gauge	digital calipers
D	measuring tape	digital micrometer screw gauge

3 A student examines three equations:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

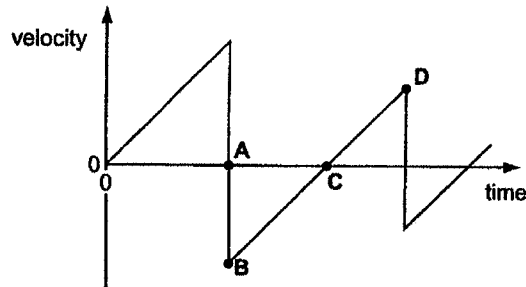
$$\text{work done} = \text{force} \times \text{displacement}$$

$$\text{acceleration} = \frac{\text{change of velocity}}{\text{time taken}}$$

How many different vector quantities can be found in these equations?

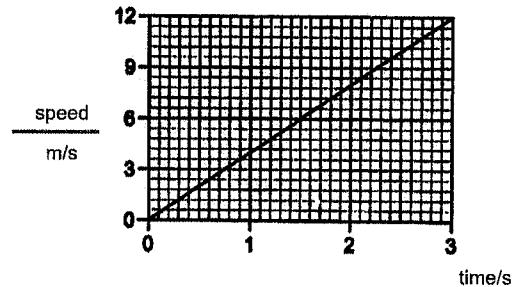
- A 2 B 3 C 4 D 5

- 4 A ball is released from rest above a horizontal surface. The graph shows how the velocity of the bouncing ball varies with time.



At which point on the graph does the ball reach its maximum height after the first bounce?

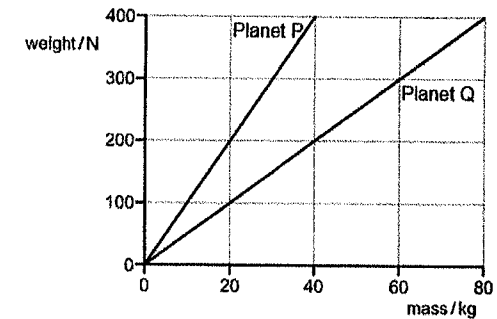
- 5 The graph shows how the speed of a car changes from rest.



What is the average speed of the car during the first 3 s?

- A 4 m/s B 6 m/s C 18 m/s D 36 m/s

- 6 The diagram shows how weight varies with mass on planets P and Q.



An object of weight 400 N on planet P is taken to planet Q.

Which of the following is correct?

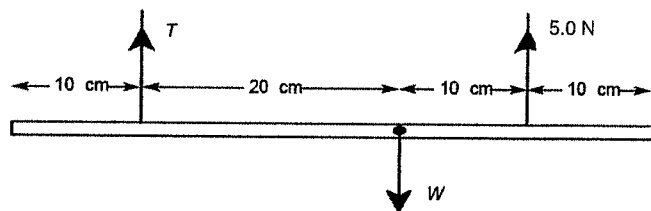
- A The density of the object is higher on planet Q.
 B The gravitational field strength on planet P is lower than that on planet Q.
 C The mass of the object on planet Q is 80 kg.
 D The weight of the object on planet Q is 200 N.

- 7 A force of 20 N pushes an object of mass 5.0 kg along a rough horizontal surface where the frictional force is 5.0 N.

What is the acceleration of the object?

- A 1.0 m/s² B 2.0 m/s² C 3.0 m/s² D 4.0 m/s²

- 8 A non-uniform rod of unknown weight W is suspended by two strings as shown in the diagram. The tension in one of the strings is 5.0 N.

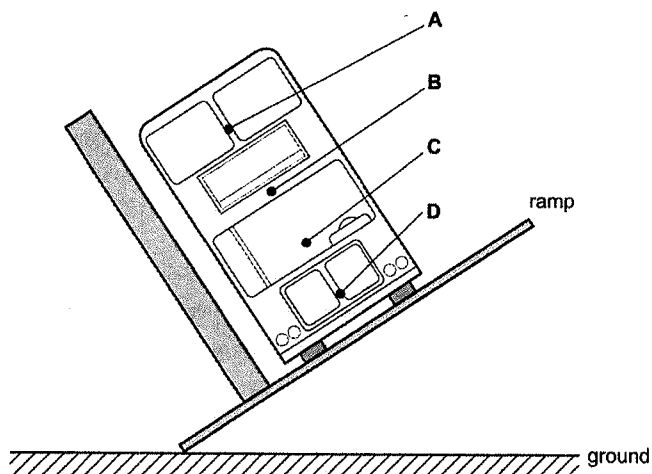


What is the tension T in the other string?

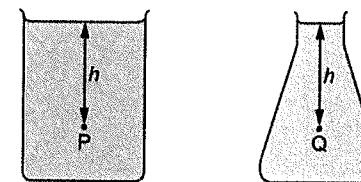
- A 2.5 N B 5.0 N C 7.5 N D 12.5 N

- 9 The stability of a bus is tested by tilting it on a ramp. The diagram shows a bus that is just about to topple over.

Where is the centre of gravity of the bus?



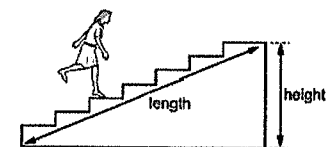
- 10 Two glass containers filled with different liquids are placed next to each other. Point P is a distance h below the surface of the liquid in one container. Point Q is a distance h below the surface of the liquid in the other container.



Why is the pressure at P different from the pressure at Q ?

- A The atmospheric pressure is different at P .
 B The densities of the liquids are different.
 C The gravitational field strength is different at P .
 D The shapes of the containers are different.

- 11 A student runs up a flight of stairs.



Which information is not needed to calculate the rate at which the student is doing work against gravity?

- A the height of the flight of stairs
 B the length of the flight of stairs
 C the time taken to run up the stairs
 D the weight of the student

- 12 A parachutist has opened his parachute and is falling to Earth at constant speed. What is the overall energy store conversion taking place as he falls?

A kinetic store $\rightarrow$ internal store
 B kinetic store $\rightarrow$ gravitational potential store
 C gravitational potential store $\rightarrow$ internal store
 D gravitational potential store $\rightarrow$ kinetic store

- 13 Some solar panels have a total area of 12 m^2 . Each 1.0 m^2 of the panels receives 0.85 kJ of energy from the Sun in 1.0 s . The efficiency of the panels is 16% .

How much power do they produce?

A 1.6 kW B 2.2 kW C 64 kW D 160 kW

- 14 A gas in a sealed cylinder is heated.

Which quantity does not increase as the gas is heated?

A the average number of gas molecules hitting the cylinder walls per second
 B the average kinetic energy of the gas molecules
 C the average speed of the gas molecules
 D the average distance between the gas molecules

- 15 Containers X and Y are filled with equal amount of hot water. The temperature of the water is measured with a thermometer 10 minutes later. It is observed that the water in container X has a much lower temperature than container Y.

Below are some statements to explain the observation.

1. Container X has a lid and container Y is not covered.
2. Container X is black in colour and container Y is white in colour.
3. Container X has a larger surface area and container Y has a smaller surface area.

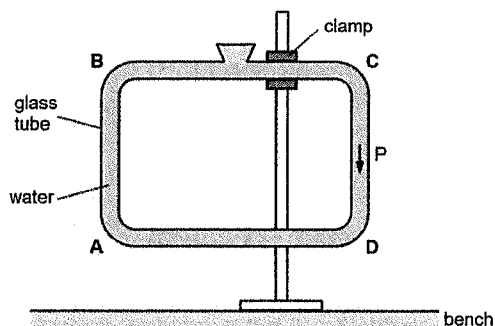
Which statements are correct?

A 1 and 2 only B 1 and 3 only
 C 2 and 3 only D 1, 2 and 3

- 16 It is more dangerous to expose our skin to 50 g of steam at 100°C than to 50 g of water at 100°C because

A steam conducts heat faster than water.
 B steam is a better radiator of heat.
 C steam moves at a greater speed than water.
 D steam releases more energy than water when it condenses.

- 17 The diagram shows a glass tube filled with water and suspended above a bench. The water is free to circulate around the tube. At point P, there is a convection current moving in a downwards direction.



At which points are the tube heated or cooled to cause this convection current?

- A Heating at A and heating at D
 B Cooling at B and heating at D
 C Heating at C and cooling at B
 D Heating at A and cooling at C
- 18 A thin sheet of material is shiny and white. It is used to wrap around an athlete who has ran a race.
- What is the effect of the sheet being shiny and white rather than dull and black?
- A It reflects less radiation from the athlete and the athlete cools down more quickly.
 B It reflects less radiation from the athlete and the athlete cools down more slowly.
 C It reflects more radiation from the athlete and the athlete cools down more quickly.
 D It reflects more radiation from the athlete and the athlete cools down more slowly.

- 19 The temperature of a body increases by 1°C .

Which other quantity also increases?

- A heat capacity
 B internal energy
 C latent heat
 D specific heat capacity

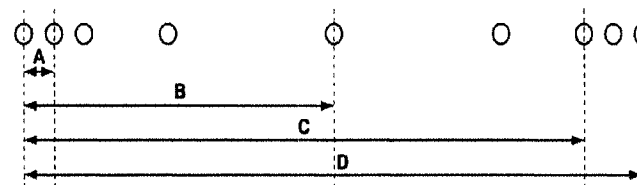
- 20 The figure below shows a water wave travelling in a ripple tank. The wavefront at X travels to Y in 5.0 s.



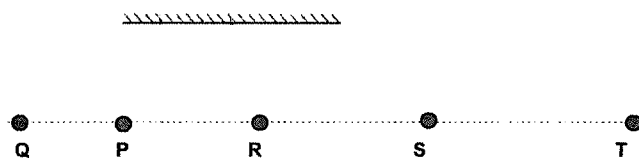
What is the frequency of the water wave?

- A 0.60 Hz B 3.0 Hz C 15 Hz D 75 Hz

- 21 A sound wave passes through air. The diagram represents the arrangement of air molecules at one instant. Which distance is the wavelength of the sound wave?



- 22 The diagram shows 4 students, **Q**, **R**, **S** and **T** standing equal distance from the mirror. Student **P** looks through the mirror to observe the images of the 4 students.



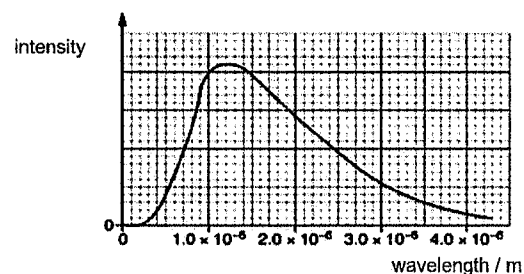
Whose image(s) can student P see through the mirror ?

- A R only
 B R and S only
 C Q, R and S only
 D Q, R, S and T
- 23 In the electromagnetic spectrum shown below, which quantity increases from left to right?

Radio waves	Microwaves	Infra-red radiation	Visible light	Ultraviolet radiation	X rays	Gamma rays
-------------	------------	---------------------	---------------	-----------------------	--------	------------

- A amplitude B frequency C velocity D wavelength

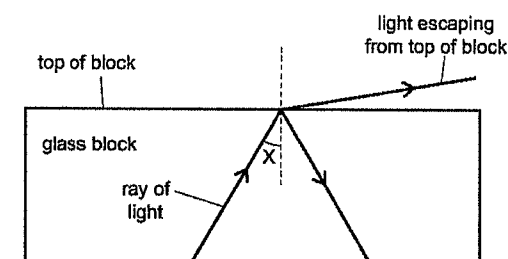
- 24 A star emits electromagnetic radiation over a range of wavelengths. The diagram shows how the intensity of the radiation from the star varies with wavelength.



What is the frequency of the brightest radiation emitted from the star?

- A 7.0×10^{13} Hz B 1.0×10^{14} Hz C 2.5×10^{14} Hz D 1.5×10^{15} Hz

- 25 A scientist tries to direct a ray of light in a glass block so that no light escapes from the top of the block. However, some light still manages to escape from the glass block.

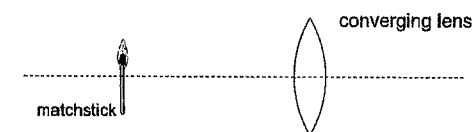


The scientist changes angle **X** and completely stops the light from escaping through the top of the block.

Which row in the table describes the change to angle **X** and the name of the effect produced?

	change to angle X	name of effect produced
A	decrease	refraction
B	decrease	total internal reflection
C	increase	refraction
D	increase	total internal reflection

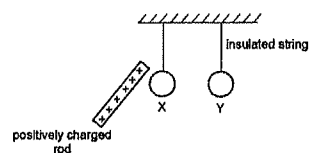
- 26 A lighted matchstick is placed 15 cm from the centre of a converging lens with a focal length of 10 cm.



How should the matchstick move in order to form an inverted image of the matchstick with the exact same size on the other side of the lens?

- A 5 cm to the right B 5 cm to the left
 C 10 cm to the right D 15 cm to the right

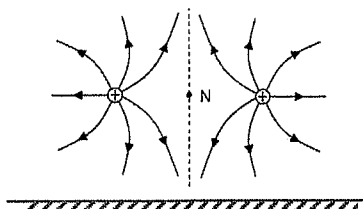
- 27 The diagram shows a positively-charged rod placed near two metal spheres X and Y, insulated and hung by non-conducting strings. Both spheres are initially uncharged.



What would be the charges on both spheres after sphere X is earthed and the positively rod is removed?

	sphere X	sphere Y
A	negative	positive
B	negative	uncharged
C	positive	positive
D	positive	uncharged

- 28 An electron is placed at the point N in the electric field as shown below where point N is the centre of two identical positive charges.



What is the motion of the electron?

- A moves out of the plane of paper
 B moves downwards
 C moves upwards
 D does not move

- 29 The current in an electric motor is 2.0 A. It transfers 20 J of energy in 5.0 s.

What is the potential difference (p.d.) across the motor?

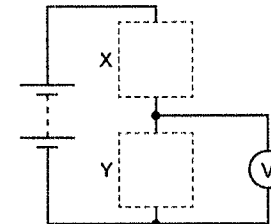
- A 0.50 V B 2.0 V C 8.0 V D 50 V

- 30 A wire has a resistance of 8.0 Ω . A second wire of the same material has twice the length and half the area.

What is the resistance of the second wire?

- A 4.0 Ω B 8.0 Ω C 16 Ω D 32 Ω

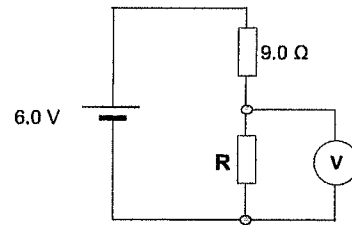
- 31 The circuit shown can be completed by inserting components at X and at Y. The completed circuit is a potential divider in which the potential difference across component Y increases when the brightness increases.



Which row shows the components X and Y?

	X	Y
A	light-dependent resistor	resistor
B	resistor	light-dependent resistor
C	resistor	thermistor
D	thermistor	resistor

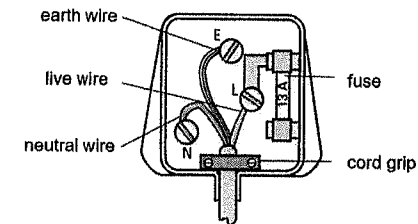
- 32 In the potential divider circuit shown below, the voltmeter reads 1.5 V.



What is the value of resistance R?

- A 1.5 Ω
 B 3.0 Ω
 C 12.0 Ω
 D 27.0 Ω
- 33 In the three-pin plug of a heater, a fuse is connected at the live wire but not at the neutral wire.
 Which of the following statement correctly explains the above statement?
- A The neutral wire is always at a voltage lower than that of the live wire.
 B The live wire carries a larger current than the neutral wire.
 C If the fuse in the neutral wire is blown, the heater still works.
 D The live wire is at a higher potential than that of the neutral wire.

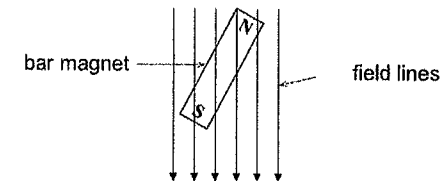
- 34 The diagram shows an electrical plug of a 1500 W electric kettle connected to a 240 V supply.



What is the current in the three wires when the kettle is working normally?

	live wire / A	neutral wire / A	earth wire / A
A	0	0	6.25
B	6.25	0	0
C	6.25	6.25	0
D	6.25	6.25	6.25

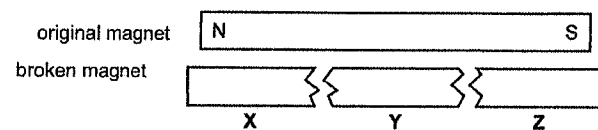
- 35 The diagram shows a bar magnet in a magnetic field.



When the magnet is released, how will it move?

- A rotate clockwise
 B remain stationary
 C move to the top of the page
 D move to the bottom of the page

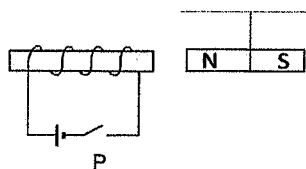
- 36 A bar magnet is broken into three parts X, Y and Z.



Which of the following is correct?

- A
- B
- C
- D

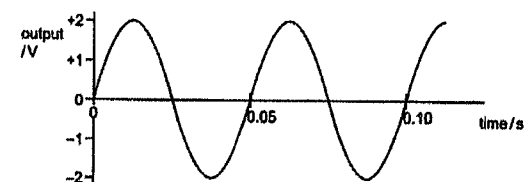
- 37 The diagram shows a fixed solenoid near a permanent magnet hung free to move.



What happens to the magnet when switch P is closed?

- A attracted to the solenoid
- B repelled by the solenoid
- C remains at rest
- D swings back and forth

- 38 The graph shows the output of an a.c. generator. The coil in the generator rotates 20 times in one second.



Which graph shows the output when the coil rotates 10 times in one second?

- A
- B
- C
- D

- 39 The grid shows some nuclides arranged according to the number of protons and the number of neutrons in each of them.

A nucleus of the nuclide ${}^8_3\text{Li}$ decays by emitting a β -particle.

What is the resulting nuclide?

Numbers of protons	4					A	B	
	3				${}^6_3\text{Li}$	${}^7_3\text{Li}$	${}^8_3\text{Li}$	
	2		${}^3_2\text{He}$	${}^4_2\text{He}$			C	D
	1	${}^1_1\text{H}$	${}^2_1\text{H}$					
		0	1	2	3	4	5	6
		Numbers of neutrons						

- 40 Alpha, beta and gamma radiations have various depths of penetration in matter and different charges.

Which row best summarises the penetration and charge of each radiation?

	alpha	beta	gamma
A	absorbed by a sheet of card negative charge	absorbed by several mm of aluminium no charge	not fully absorbed by several cm of lead no charge
B	absorbed by a sheet of card negative charge	absorbed by several mm of aluminium positive charge	not fully absorbed by several cm of lead no charge
C	absorbed by a sheet of card positive charge	absorbed by several mm of aluminium negative charge	not fully absorbed by several cm of lead no charge
D	absorbed by several mm of aluminium positive charge	not fully absorbed by several cm of lead negative charge	absorbed by a sheet of card no charge

END OF PAPER

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MONTFORT SECONDARY SCHOOL

Preliminary Examination 2025

Secondary

4 Express (G3)

PHYSICS

6091/ 01

MARKING SCHEME

Paper 1

1	D	11	B	21	C	31	A
2	A	12	C	22	B	32	B
3	C	13	A	23	B	33	D
4	C	14	D	24	C	34	C
5	B	15	C	25	D	35	A
6	D	16	D	26	B	36	D
7	C	17	D	27	B	37	A
8	A	18	D	28	B	38	A
9	C	19	B	29	B	39	A
10	B	20	A	30	B	40	C

133

Name: Register no: Class:



NGEE ANN SECONDARY SCHOOL



SECONDARY 4 PRELIMINARY EXAMINATION

PHYSICS

6091/01

PAPER 1

03 September 2025

1 hour

Additional Materials: Optical Answer Sheet (OAS)

Instructions to Candidates

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and index number at the top of this cover page.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C and D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Optical Answer Sheet (OAS).

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected, where appropriate.

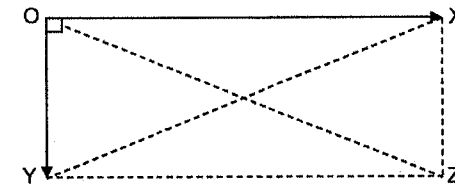
Checked by student: Date:

This document consists of **18** printed pages and **0** blank page.

1 Which physical quantity is a base quantity?

- A energy
- B velocity
- C current
- D charge

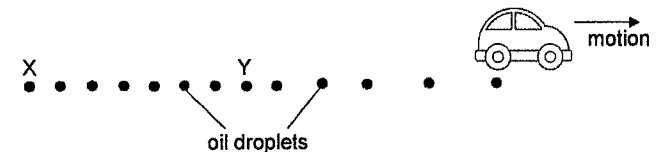
2 The diagram below shows two forces, OX and OY acting at point O.



Which of the following force is required to balance the two forces?

- A XY
- B ZO
- C YX
- D OZ

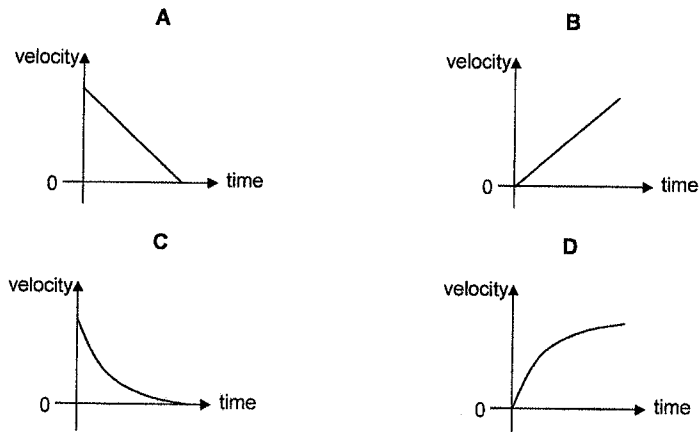
3 The diagram shows oil droplets leaking from a moving car and forming a pattern on the road surface. The frequency of the leakage is two oil droplets for every second.



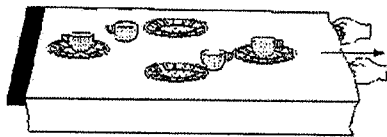
Which row shows the correct length of time that corresponds to the distance between X and Y and the description of the motion of the car?

	time / s	motion
A	3.5	decreasing speed
B	3.5	increasing speed
C	4.0	decreasing speed
D	4.0	increasing speed

- 4 Which of the following velocity-time graphs shows an object experiencing decreasing acceleration?



- 5 The diagram shows some utensils resting on top of a tablecloth. The tablecloth is jerked swiftly off the table to the right.



Which statement best explains the subsequent observation?

- A The utensils move together with the tablecloth due to inertia.
 B The utensils remain at their positions due to the pull of gravity.
 C The utensils remain at their positions due to inertia.
 D The utensils move together with the tablecloth due to friction.

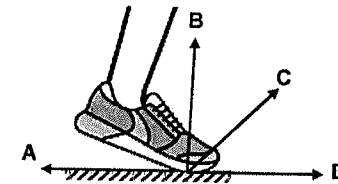
- 6 A small submarine of mass 1000 kg sinks in water with a uniform speed of 2.0 m/s. The gravitational field strength is 10 N/kg.

What is the resultant force exerted on submarine as it sinks?

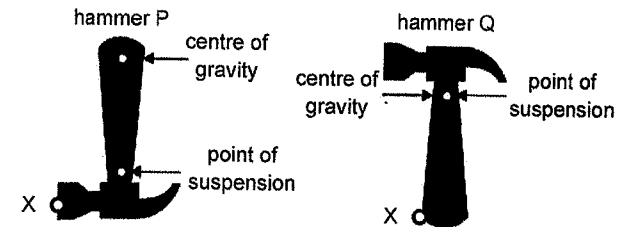
- A 0 N B 500 N C 2000 N D 10 000 N

- 7 The diagram shows a runner's shoe at the start of a race.

Which arrow indicates the direction of the frictional force acting on the runner's shoe?



- 8 Two hammers are suspended in equilibrium as shown in the diagram below.

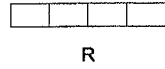


A small force is then applied to the left at point X on both hammers, causing the hammers to be displaced slightly to the left and then released.

What will happen to the hammers at the next instant?

	hammer P	hammer Q
A	rotate in clockwise direction	rotate in anti-clockwise direction
B	rotate in clockwise direction	does not rotate
C	rotate in anti-clockwise direction	rotate in anti-clockwise direction
D	rotate in anti-clockwise direction	rotate in clockwise direction

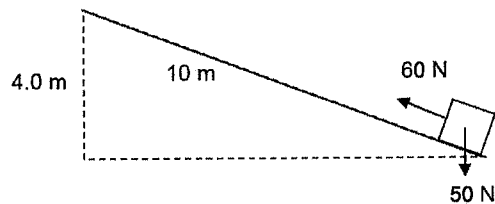
- 9 Four identical boxes are placed on the ground in three different arrangements, P, Q and R.



Which of the following shows a possible set of pressures exerted by the boxes on the ground?

	P	Q	R
A	400 Pa	200 Pa	100 Pa
B	300 Pa	200 Pa	100 Pa
C	100 Pa	200 Pa	300 Pa
D	100 Pa	200 Pa	400 Pa

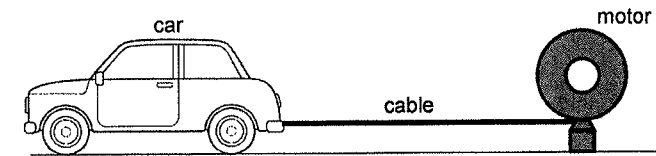
- 10 A box of weight 50 N is being pulled from the bottom to the top of a ramp by a 60 N force at constant velocity. The ramp is 10 m long and its top is 4.0 m high.



What is the magnitude of the friction along the ramp?

- A 0 N B 10 N C 40 N D 60 N

- 11 The diagram shows a motor being used to pull a car towards it. The car is stationary initially and has a mass of 1000 kg.



The power input of the motor is 200 W.

After the motor is switched on for 20 s, the car reaches a speed of 2.0 m/s.

What is the efficiency of the motor?

- A 10% B 20% C 25% D 50%

- 12 A fixed mass of gas is trapped in a rigid metal cylinder.



The metal cylinder is heated and the temperature of the gas increases.

What happens to the internal potential and kinetic energy of gas particles?

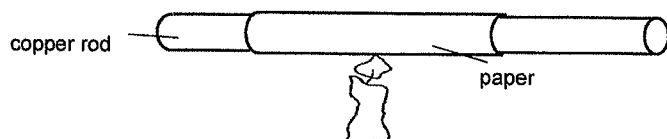
	internal potential energy	internal kinetic energy
A	increases	increases
B	no change	increases
C	increases	no change
D	decreases	increases

- 13 Pollen grains are suspended in a liquid and are illuminated strongly.

Which statement explains why the pollen grains are observed to be in continuous random motion?

- A Liquid molecules collide with the pollen grains.
- B Pollen grains collide with each other.
- C Convection currents occur in the liquid.
- D Air molecules colliding with the pollen grains.

- 14 The diagram shows a piece of paper wrapped tightly around a copper rod and placed above a candle flame. It was observed that the paper did **not** catch fire even when it was placed above the flame for some time.



Which of the following statements provides the best explanation?

- A The flame from the candle is too weak to heat up the paper.
- B The paper is a poor thermal conductor and transfers energy to the cold end.
- C The paper is a poor absorber of radiation and transfer energy quickly to the rod.
- D The copper is a good thermal conductor and transfers energy to the cold ends.

- 15 An ice-making machine extracts energy at a rate of 500 W.

The specific latent heat of fusion of ice is 300 kJ/kg.

How long does it take to freeze 20 g of water at 0 °C?

- A 12 s
- B 33 s
- C 120 s
- D 330 s

- 16 The rate of evaporation of a liquid is increased by

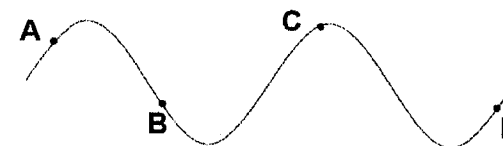
- I increasing its temperature.
- II increasing the pressure over the liquid.
- III blowing the air over its surface.
- IV decreasing its surface area exposed to surrounding.

Which statements are correct?

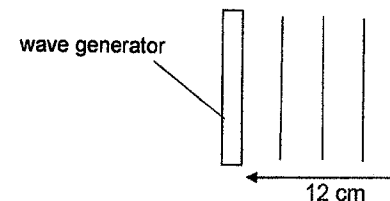
- A I and III only
- B III and IV only
- C I, II and III only
- D I, III and IV only

- 17 The diagram below shows a wave motion at an instant. The wave is traveling to the right.

Which particle is moving upward at this instant?



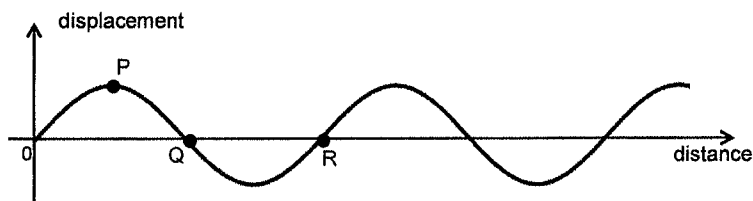
- 18 The diagram shows wavefronts produced by a wave generator. The wave generator makes 5 oscillations in one second.



What is the speed of the wave?

- A 2.4 cm/s
- B 15 cm/s
- C 20 cm/s
- D 60 cm/s

- 19 The diagram shows the displacement-distance graph of a sound wave. P, Q and R are points along the sound wave. Point Q corresponds to a compression region.



Which row is likely to be true about the pressure of each point?

	P	Q	R
A	equal to atmospheric pressure	above atmospheric pressure	below atmospheric pressure
B	equal to atmospheric pressure	above atmospheric pressure	above atmospheric pressure
C	above atmospheric pressure	below atmospheric pressure	below atmospheric pressure
D	above atmospheric pressure	equal to atmospheric pressure	equal to atmospheric pressure

- 20 Which row gives the speed of sound in air, in water and in steel?

	speed in air m/s	speed in water m/s	speed in steel m/s
A	330	1500	6000
B	330	6000	1500
C	6000	330	1500
D	6000	1500	330

- 21 Which of the following sound is an example of ultrasound?

- A Sound with a very low loudness.
 B Sound with a frequency of 10 kHz.
 C Sound with a very high amplitude.
 D Sound with particles moving with a period of 5.0 μ s.

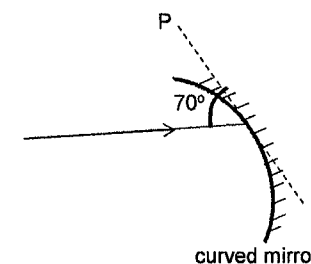
- 22 The diagram shows a contactless payment system which involves the consumers tapping their credit cards or debit cards on the card reader to make their payment. In the process, a particular electromagnetic wave will be sent between the card and the card reader.



What is likely to be this electromagnetic wave?

- A radio wave
 B infrared radiation
 C ultraviolet radiation
 D X-ray

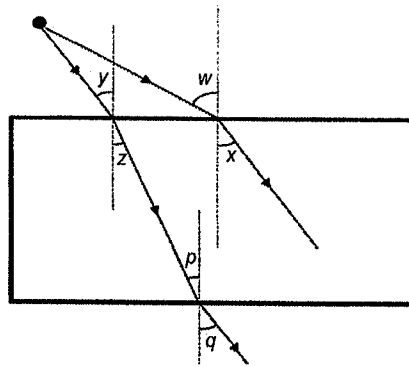
- 23 The diagram shows a light ray incident on a curved mirror. PQ is a tangent line that touches the curved mirror.



Which row is correct?

	PQ is normal for this ray	the angle of incidence is 70°
A	true	true
B	true	false
C	false	true
D	false	false

- 24 The diagram shows two rays of light entering a glass block.



A student wrote down four equations:

I $\frac{w}{x} = \frac{y}{z}$

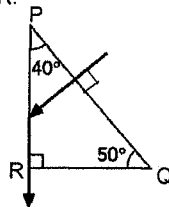
III $\frac{\sin y}{\sin z} = \frac{\sin p}{\sin q}$

II $\frac{\sin w}{\sin x} = \frac{\sin q}{\sin p}$

IV $\frac{\sin x}{\sin w} = \frac{\sin z}{\sin y}$

Which equations are correct?

- A I and II only
 B I and III only
 C II and IV only
 D III and IV only
- 25 The diagram shows a ray of light entering a glass prism perpendicularly to surface PQ and travels along the path PR.



What is the refractive index of the glass?

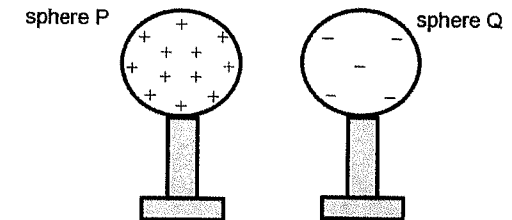
- A 1.40 B 1.46 C 1.50 D 1.56

- 26 An object O is placed 3 cm away from a converging lens of focal length 6 cm.

What type of image is produced?

- A real, upright and diminished
 B real, inverted and magnified
 C virtual, upright and magnified
 D virtual, inverted and diminished

- 27 Two charged conducting spheres, P and Q, mounted on insulating stands. Sphere P is positively charged and sphere Q is negatively charged. Sphere P has more excess charges than sphere Q.

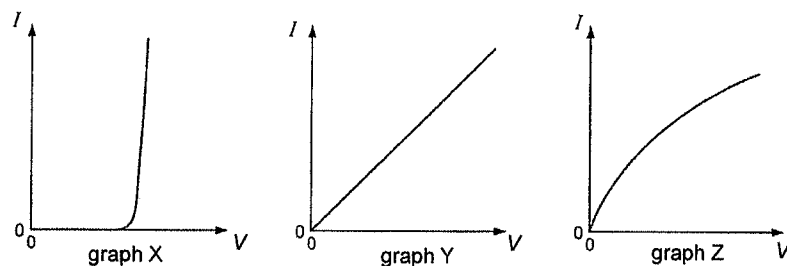


Both spheres P and Q are first moved to touch each other and then moved apart.

What is the final state of charge in spheres P and Q?

	sphere P	sphere Q
A	positively charged	neutral
B	positively charged	positively charged
C	neutral	neutral
D	neutral	positively charged

- 28 Graphs X, Y and Z show the variation of potential difference V with the current I for three circuit components.



The components are a metal wire at constant temperature, a semiconductor diode and a filament lamp.

Which row correctly identifies these graphs?

	metal wire at constant temperature	semiconductor diode	filament lamp
A	X	Z	Y
B	Y	X	Z
C	Y	Z	X
D	Z	X	Y

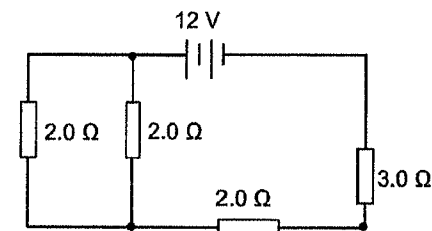
- 29 The dimensions of three copper wires are given.

Wire	length / m	cross-sectional area / mm ²
X	4.0	2.0
Y	5.0	1.0
Z	8.0	6.0

Which row shows the resistance of the wires in ascending order?

- A X, Y, Z
B X, Z, Y
C Y, X, Z
D Z, X, Y

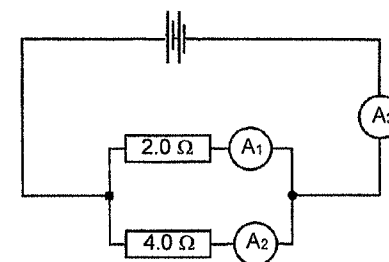
- 30 An electrical circuit with four resistors is set up.



What is the effective resistance of the circuit?

- A 0.55 Ω B 0.83 Ω C 6.0 Ω D 9.0 Ω

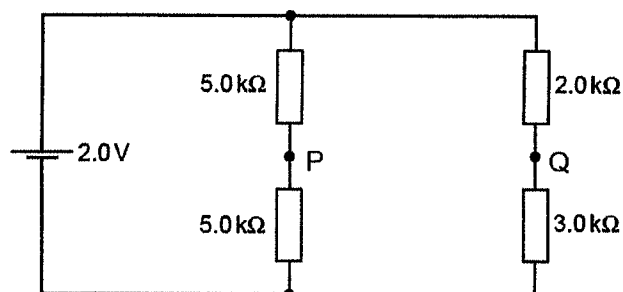
- 31 In the circuit shown, the cells and ammeters all have negligible resistance.



Which row shows a possible set of readings for the ammeters?

	reading on A ₁ / A	reading on A ₂ / A	reading on A ₃ / A
A	2.0	4.0	0
B	4.0	2.0	0
C	2.0	4.0	6.0
D	4.0	2.0	6.0

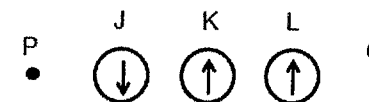
- 32 A cell with a voltage supply of 2.0 V is connected to a network of resistors shown.



What is the potential difference across P and Q?

- A 0.20 V B 0.50 V C 0.80 V D 1.0 V
- 33 Which of the following fuse rating shown is most appropriate for a fuse meant for a device rated "240 V, 720 W"?
- A 2 A B 3 A C 5 A D 10 A
- 34 Which of the following conditions is **not** considered a hazard to the user?
- A Placement of the switch of the circuit along the live wire.
 B Exposed wires due to damaged insulation.
 C Handling electrical appliances in damp conditions.
 D Placement of the fuse along the neutral wire.
- 35 Which action is used to demagnetise a magnet?
- A Earthing the magnet.
 B Spraying water onto the magnet.
 C Place the magnet inside a coil in which there is a direct current and then slowly remove the magnet out of the coil.
 D Place the magnet inside a coil in which there is an alternating current and then slowly remove the magnet out of the coil.

- 36 A student knows that 2 wires, P and Q, are carrying a 2 A current and a 1 A current but he does not know which wire is carrying which current.

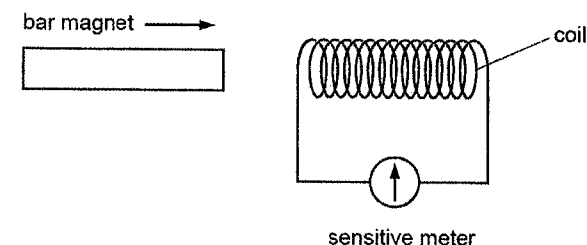


He arranges 3 magnetic compasses, J, K and L between the wires P and Q such that the compass marked K is at the mid-point between the 2 wires.

What is the direction of the currents in P and Q and which wire carries more current?

	current direction in P and Q	wire with a larger current
A	same direction	P
B	same direction	Q
C	opposite direction	P
D	opposite direction	Q

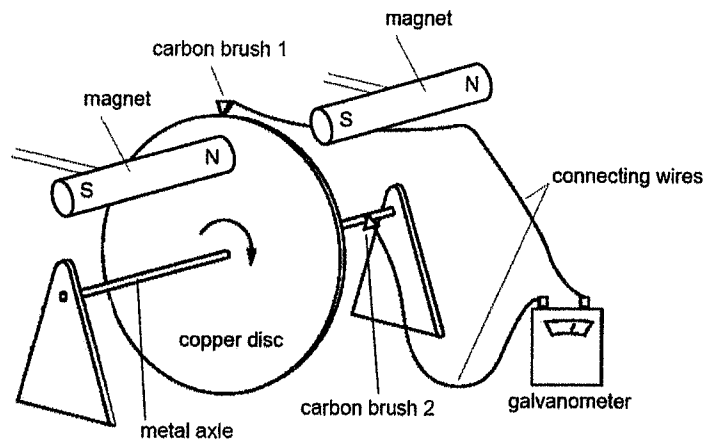
- 37 A bar magnet is pushed into one end of a long coil connected to a sensitive meter.



Which of the following affects the magnitude of the deflection of the meter?

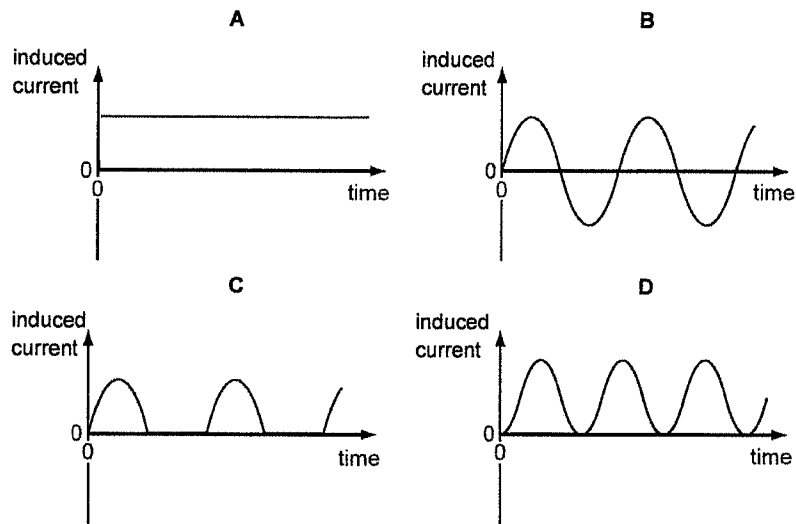
- A the direction in which the coil is wound
 B the number of turns in the long coil
 C which end of the coil that the bar magnet is pushed into
 D which pole of the magnet enters first

- 38 The diagram shows a slotted copper disc driven to spin clockwise at constant speed and placed between the poles of two permanent magnets.

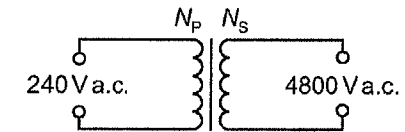


An induced current flows through the galvanometer.

Which graph shows the relationship of the induced current with time?



- 39 A transformer is needed to convert an alternating current supply of 240 V into 4800 V.



Which pair of coils would be suitable for this transformer?

	number of turns on primary coil N_P	number of turns on secondary coil N_S
A	50	1000
B	240	48 000
C	480	24
D	2000	100

- 40 An atomic nucleus emits a β -particle.

What change does this cause to the proton and nucleon number of the nucleus?

	proton number	nucleon number
A	- 1	0
B	- 1	+ 1
C	+ 1	0
D	+ 1	+ 1

END OF PAPER

1	C	6	A	11	D	16	A	21	D	26	C	31	D	36	B
2	B	7	D	12	B	17	B	22	A	27	B	32	A	37	B
3	B	8	B	13	A	18	B	23	D	28	B	33	C	38	A
4	D	9	A	14	D	19	A	24	C	29	D	34	A	39	A
5	C	10	C	15	A	20	A	25	D	30	C	35	D	40	C



NAVAL BASE SECONDARY SCHOOL
PRELIMINARY EXAMINATION, 2025

4E

Name: _____ () Class: _____

PHYSICS

6091/01

Setter: Ms Janessa Chang

29 August 2025

Additional Materials: Multiple Choice Answer Sheet

1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, index number and class on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on this paper. Answer all questions. For each question there are four possible answers A, B, C and D. Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this paper.

The use of an approved scientific calculator is expected, where appropriate.

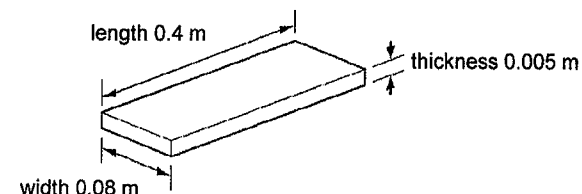
- 1 The SI unit for pressure is Pascal and the symbol is Pa.

Which option shows the equivalent base unit for pressure?

- A kg m s^2
B kg m / s^2
C $\text{kg m}^3 / \text{s}^2$
D $\text{kg / (m s}^2)$

- 2 A manufacturer measures accurately the dimensions of a wooden floor tile.

The approximate dimensions of the tile are shown.

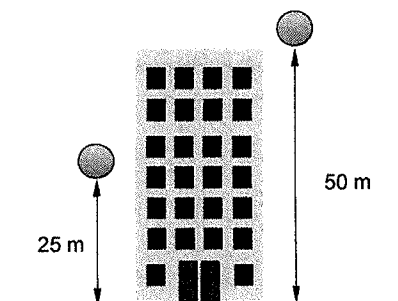


Which shows the best combination of instruments to measure the respective dimensions?

	length	width	thickness
A	meter rule	digital calipers	digital micrometer
B	meter rule	digital micrometer	digital calipers
C	digital calipers	meter rule	digital micrometer
D	digital micrometer	meter rule	digital calipers

3

- 3 Two similar balls are released from a 50 m tall building at the same time.

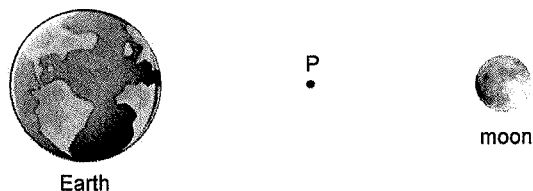


One drops from the top while the other from mid-level. Air resistance is negligible.

Which quantity is the same for both balls?

- A acceleration
- B average speed
- C final velocity
- D time of travel

- 4 The diagram shows a point P midway between the centre of the Earth and the centre of the Moon.



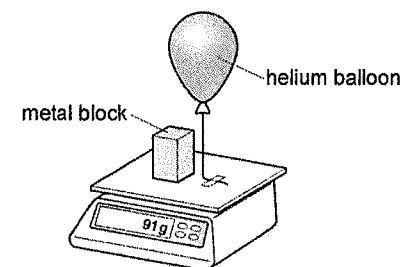
A spacecraft is at point P, travelling from the Earth to the Moon.

Which statement is true?

- A The net gravitational field strength at point P is zero.
- B The net gravitational field strength at point P is to the left.
- C The net gravitational field strength at point P is to the right.
- D There is no gravitational field at point P.

4

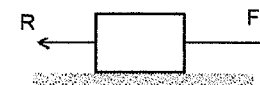
- 5 A helium balloon is tied to an electronic balance. A metal block of mass 100 g is placed on the balance. The reading on the balance is 91 g.



Which statement can be deduced from this experiment?

- A The balloon exerts an upward force of 9.0 N on the top-pan of the balance.
- B The balloon has a mass of - 9.0 g.
- C The balloon has a weight of 0.09 N.
- D The resultant downward force on the electronic balance is 0.91 N.

- 6 Two forces F and R act on a block as it moves towards the right. Force R increases over time while force F remains constant.

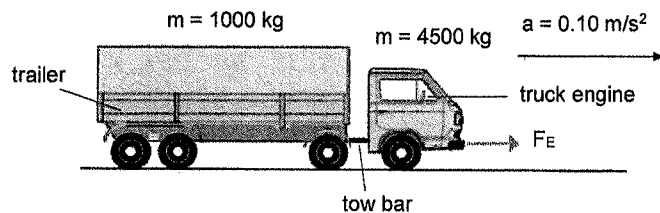


Which statement best describes the motion of the block when forces F and R become equal in magnitude?

- A The block accelerates.
- B The block continues to move towards the right.
- C The block moves in the opposite direction.
- D The block stops moving.

[Turn over

- 7 A truck engine of mass 4500 kg pulls a trailer of mass 1000 kg along a level track with an acceleration of 0.10 m/s^2 . The truck engine is connected to the trailer via a tow bar.

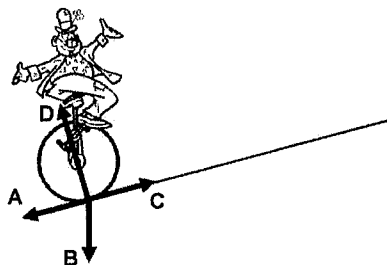


Given that the resistive force acting on the truck engine is 10 N per 1000 kg and the resistive force acting on the trailer is 5 N per 1000 kg.

What is the forward thrust F_E exerted by the engine and the tension in the tow bar?

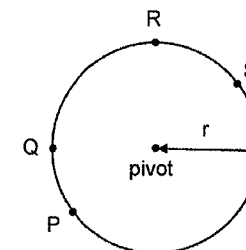
	F_E	tension
A	550 N	0 N
B	550 N	105 N
C	600 N	0 N
D	600 N	105 N

- 8 A clown riding a unicycle is accelerating up an inclined plane as shown in the diagram. A frictional force from the ground acts on the wheel.



In which direction is the action-reaction pair to the frictional force?

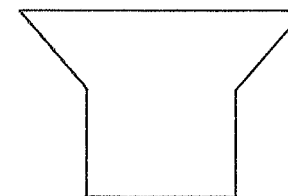
- 9 The diagram shows a uniform disc with radius r pivoted at its centre so that it stays at rest in a vertical plane.



In which position will a piece of plasticine attached to the disc generate the greatest turning effect about the pivot?

- A P
B Q
C R
D S

- 10 The diagram shows a hollow container.



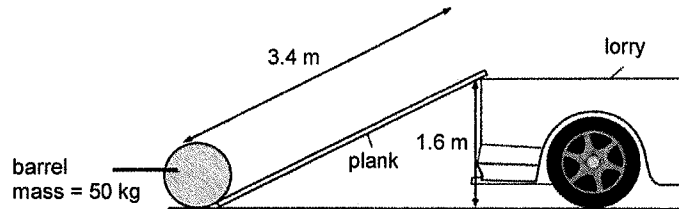
A student suggested 4 modifications to make the container more stable.

- 1 Fully fill the container with water.
- 2 Position the container upside down.
- 3 Add an additional weight on its top surface.
- 4 Fill the bottom half of the container with water.

Which modification(s) would make the container more stable?

- A 1 and 2 only
B 1 and 3 only
C 2, 3 and 4 only
D 2 and 4 only

- 11 A barrel of mass 50 kg is loaded onto the back of a lorry 1.6 m high by pushing it up a smooth plank 3.4 m long. The gravitational field strength, $g = 10 \text{ N/kg}$.



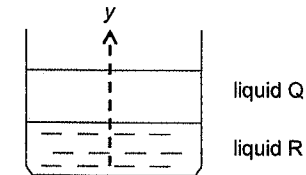
What is the minimum work done on the barrel?

- A 80 J
 B 170 J
 C 800 J
 D 1700 J
- 12 Electrical power of 3000 W is supplied to a motor to lift a weight of 100 N at a speed of 20 m/s for 5.0 s.

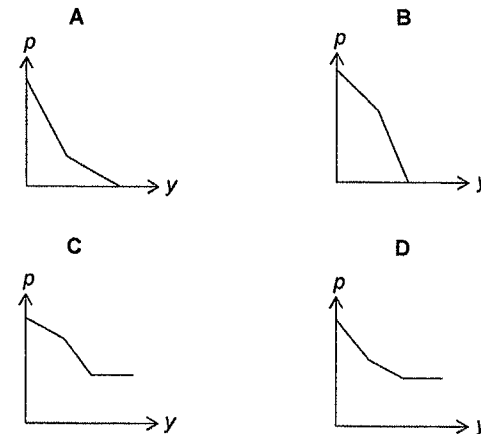
What is the efficiency of the motor?

- A 7%
 B 33%
 C 67%
 D 130%

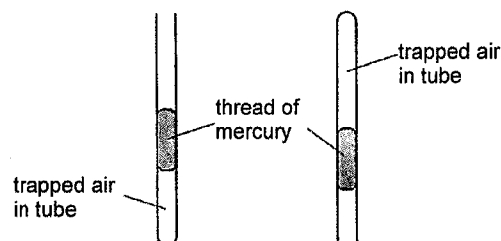
- 13 A tall container which is opened to the atmosphere contains a layer of liquid Q, floating on liquid R. Liquid R has a density which is twice as great as that of liquid Q.



Which graph shows how the pressure p , at a point varies with its height y , above the base of the container?



- 14 A thin tube contains a thread of mercury which traps air at the end of the tube. The other end of the tube is open to the atmosphere. When the tube is turned upside down, the volume of the trapped air increases.



Which statement explains this?

- A The air gets hotter when the tube is turned upside down.
- B The atmosphere pushes less when it acts upwards on the mercury.
- C The pressure in the trapped air is reduced.
- D The trapped air molecules hit the mercury harder when travelling downwards.

- 15 As air is sucked from a straw out of a sealed packet drink, the packet shrinks in volume.

Which statement best explains why the packet drink shrinks in volume?

- A The collision of air molecules with the internal surface area of packet drink has decreased.
- B The kinetic energy of the air molecules in the packet drink decreased.
- C The air molecules are in continuous random motion.
- D The air molecules move more quickly when they are heated.

- 16 In an experiment involving smoke particles in air, heavy particles settle quickly but very small particles remain suspended for long periods of time.

Which statement explains why the very small smoke particles do not settle?

- A Air pressure has a greater effect on very small smoke particles.
- B The Earth's gravitational field does not act on very small smoke particles.
- C Molecular bombardment by air molecules keeps the very small smoke particles suspended.
- D The small smoke particles have the same density as the air.

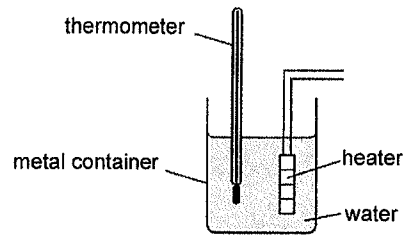
- 17 The diagram shows two metal spheres of different radii in thermal contact in vacuum.



Given that the spheres are at the same temperature, which statement must be correct?

- A Both spheres radiate energy at the same rate.
- B Each sphere has the same energy in its internal store.
- C The larger sphere has a greater average energy in its internal store per atom than the smaller sphere.
- D There is no net transfer of energy by heating between the spheres.

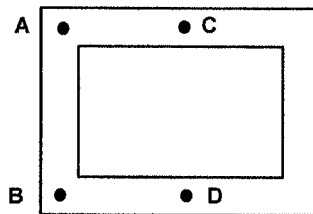
- 18 The diagram shows a set of apparatus used to determine the specific heat capacity of water.



Which option increases the rate at which energy is transferred to the surroundings?

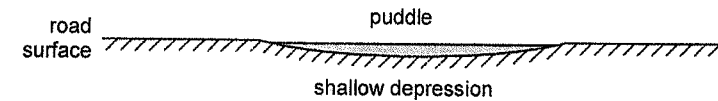
- A painting the outer surface of the container black
 B placing a lid on the container
 C placing the apparatus in a vacuum chamber
 D wrapping the container with felt

- 19 A heating element is to be placed in a narrow-sealed tube of liquid.



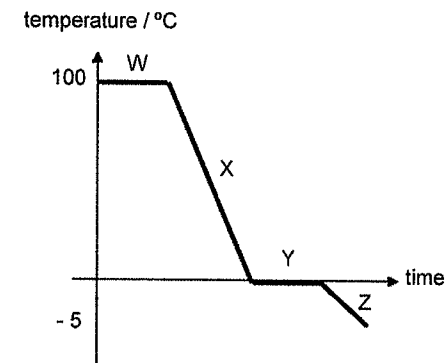
Which would be the best position, A, B, C or D, to place the heating element in order to obtain the best circulation of the liquid throughout the tube?

- 20 The diagram shows a cross-section through a rain-water puddle formed in a shallow depression in a road surface. Over a period of time, the air temperature, wind speed and wind direction all remain constant.



What happens to the rate of evaporation of water from the puddle?

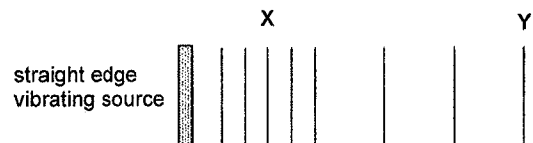
- A It decreases because the surface area decreases.
 B It increases because the puddle gets shallower.
 C It increases because water molecules have more energy to escape.
 D It remains constant because surrounding physical conditions remain constant.
- 21 A substance is allowed to cool in an enclosed space. The graph shows the temperature of the substance plotted against time.



In which regions is the substance losing latent heat?

- A W, X, Y and Z
 B W and Y only
 C X and Y only
 D X and Z only

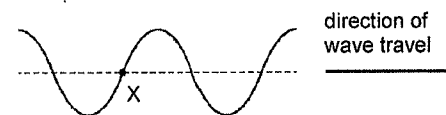
- 22 The plane wavefronts of a water wave formed by a straight edge vibrator are shown.



Which statement about the water wave as it moves from region X to region Y is correct?

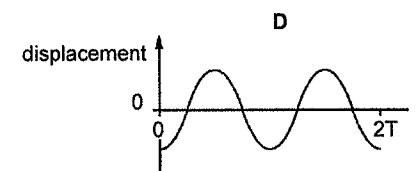
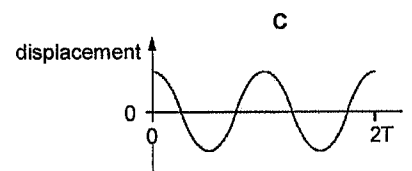
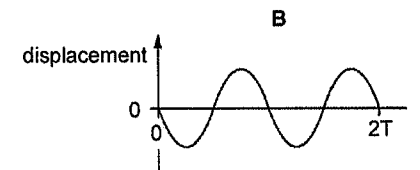
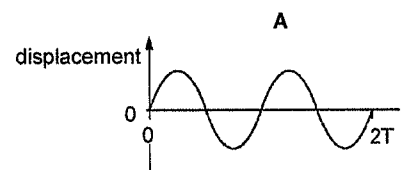
- A The depth of the water is decreasing.
- B The frequency of the waves is increasing.
- C The period of the waves is decreasing.
- D The speed of the waves is increasing.

- 23 A transverse wave travels along a rope. The diagram shows the rope at time $t = 0$.

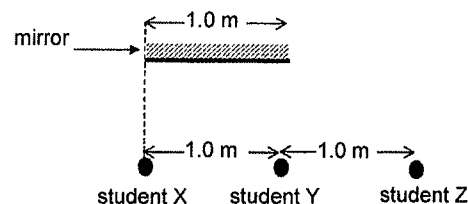


The wave is travelling from left to right. The period of the wave is T . One particle of the rope is labelled X.

Which graph shows the variation with time of the displacement of particle X between $t = 0$ and $t = 2T$?



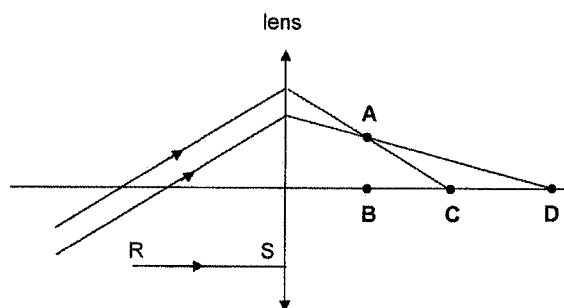
- 24 Three students, X, Y and Z, stand 1.0 m apart in front of a plane mirror that is 1.0 m long.



Student X stands in line with one edge.

How many students can see the images of the other two?

- A 0
B 1
C 2
D 3
- 25 The diagram shows two parallel rays of light passing through a converging lens.



Through which point will the light ray RS pass after passing through the lens?

- 26 The diagram shows part of the electromagnetic spectrum.

infrared	P	Q	X-rays
----------	---	---	--------

Three statements about the spectrum are shown:

- 1 Q can be deflected by an electric field.
- 2 The frequency of P is smaller than that of Q.
- 3 The speed of P in a vacuum is smaller than that of Q.

Which statement(s) is/are is true?

- A 1 only
B 1 and 2 only
C 2 only
D 2 and 3 only
- 27 Which option shows the correct applications for ultraviolet light, infrared radiation and X-rays?

	ultraviolet light	infrared radiation	X-ray
A	mobile phone	satellite television	intruder alarm
B	killing cancerous cells	sunbed	satellite television
C	killing cancerous cells	television controller	medical imaging
D	sterilising medical equipment	television controller	detecting cracks in metal

- 28 Two sounds X and Y are produced by loudspeakers. The amplitude and frequency of each sound wave are given in the table.

	amplitude / mm	frequency / Hz
X	2.0	235
Y	1.3	475

How does sound Y compare to sound X?

- A Y is softer and has a higher pitch.
 B Y is softer and has a lower pitch.
 C Y is louder and has a higher pitch.
 D Y is louder and has a lower pitch.

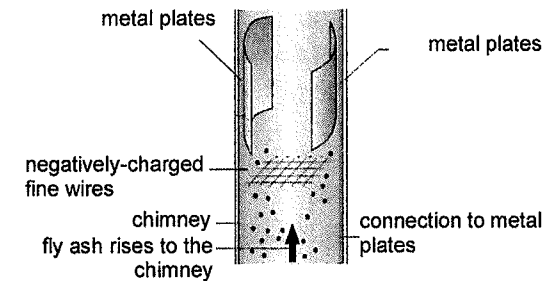
- 29 A pupil charged a metal ball by induction using a strip of polythene. She uses the following steps but not in the following order.

- 1 the metal ball is earthed momentarily
 2 the polythene strip is brought up to the ball
 3 the polythene strip is removed
 4 the polythene strip is rubbed with a woolen cloth

To charge the ball correctly, in which order should she carry out the steps?

- A $2 \rightarrow 3 \rightarrow 4 \rightarrow 1$
 B $2 \rightarrow 4 \rightarrow 3 \rightarrow 1$
 C $4 \rightarrow 1 \rightarrow 2 \rightarrow 3$
 D $4 \rightarrow 2 \rightarrow 1 \rightarrow 3$

- 30 Electrostatic precipitators are installed in power stations to remove fly ash produced. Fly ash is a mixture of smoke and dust particles which can pollute the environment.



Which option incorrectly describes how the electrostatic precipitator removes fly ash?

- A On passing through the negatively-charged wires, the fly ash is charged negatively.
 B The fly ash is charged before passing through the metal plates.
 C The metal plates can be either both positively charged or both earthed to attract the fly ash.
 D The fly ash leaves the chimney with no charge.

- 31 In an electrostatics experiment, two plastic rods X and Y are rubbed with a cloth. After which, rod X is repelled from rod Y when brought near.

Which option shows the possible charge on the three items after rubbing?

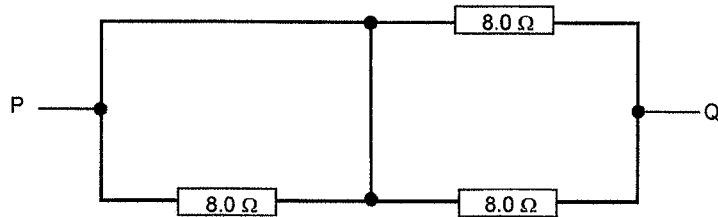
	rod X	rod Y	cloth
A	positive	positive	positive
B	positive	negative	positive
C	negative	negative	positive
D	negative	positive	negative

- 32 A lightbulb has a voltage rating of 12 V. An electron has a charge of 1.6×10^{-19} C.

How much electrical energy is converted to light energy when an electron moves across the lightbulb?

- A 1.33×10^{-20} J
- B 1.92×10^{-18} J
- C 7.50×10^{19} J
- D 1.32×10^{20} J

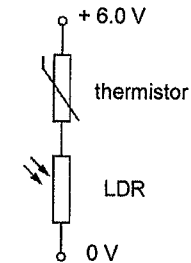
- 33 Three resistors are connected between terminals P and Q as shown.



What is the effective resistance between P and Q?

- A 4.0Ω
- B 5.3Ω
- C 12Ω
- D 16Ω

- 34 A thermistor and a light-dependent resistor (LDR) are connected in series. A potential difference (p.d.) of 6.0 V is applied across them as shown.

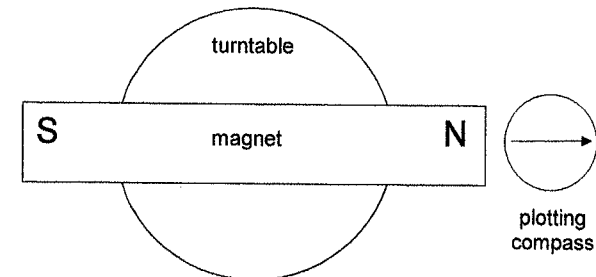


The thermistor has a resistance of 6000Ω in a cold room and 1000Ω in a warm room. The LDR has a resistance of 2000Ω in dim light and 500Ω in bright light.

When is the p.d. across the LDR equal to 2.0 V?

- A in a cold room with bright light
- B in a cold room with dim light
- C in a warm room with bright light
- D in a warm room with dim light

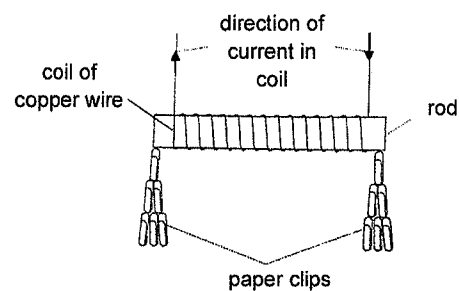
- 35 The figure shows a bar magnet resting on a turntable. A plotting compass is placed in front of the magnet as shown.



What happens to the compass needle when the turntable rotates anticlockwise?

- A does not move
- B oscillates
- C rotates anticlockwise
- D rotates clockwise

- 36 Four rods, A, B, C and D are placed, in turn, inside a coil of copper wire.

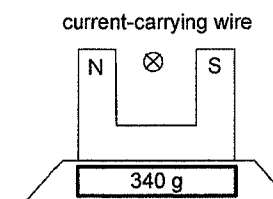


The table shown gives the results of the experiment.

Which rod would be the most suitable to use as the core of a coil in a circuit breaker?

	number of paper clips picked up when there is current in the coil	number of paper clips picked up when there is no current in the coil
A	1	0
B	20	5
C	40	0
D	40	20

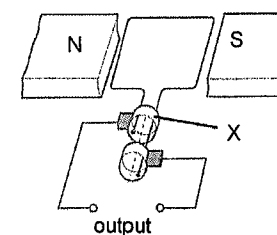
- 37 A current-carrying wire is placed between the poles of the horseshoe magnet as shown. The electronic balance reads 340 g.



Which could be the reading on the electronic balance when the current-carrying wire is removed?

- A 0 g
- B 330 g
- C 340 g
- D 350 g

- 38 The diagram shows a simple a.c. generator.

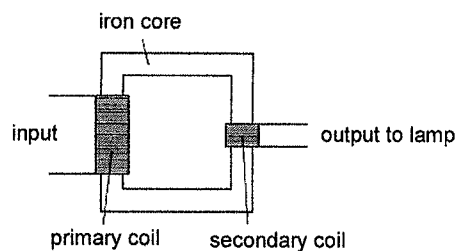


What is component X and how does one increase the magnitude of induced e.m.f. of the a.c. generator?

	component X	increase magnitude of induced e.m.f.
A	slip rings	use thicker wires
B	slip rings	use thinner wires
C	split ring commutator	use thicker wires
D	split ring commutator	use thinner wires

- 39 An ideal step-down transformer has a turns ratio of 5. The secondary coil is connected to a lamp rated at 3.0 V, 0.50 A.

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Which row states the correct input current and input voltage for the lamp to be lit at normal brightness?

	magnitude of input current / A	input voltage / V
A	0.10	15
B	2.50	0.60
C	0.10	15
D	2.50	0.60

- 40 Which statement about nuclear fission or fusion is correct?

- A During fission, hydrogen converts into helium and releases energy.
- B During fission, uranium converts into daughter products and releases energy.
- C During fusion, helium converts into hydrogen and releases energy.
- D During fusion, uranium converts into daughter products and releases energy.

End of Paper

[Turn over

Draft 1

**NBSS Science Department
Secondary 4 Express Pure Physics
Preliminary Examination 2025**

Mark Scheme

Paper 1 (40 marks)

1	2	3	4	5	6	7	8	9	10
D	A	A	B	D	B	D	A	B	D
11	12	13	14	15	16	17	18	19	20
C	C	A	C	A	C	D	A	B	A
21	22	23	24	25	26	27	28	29	30
B	D	B	B	B	C	D	A	D	D
31	32	33	34	35	36	37	38	39	40
C	B	A	C	D	C	B	A	A	B

Total number of A	Total number of B	Total number of C	Total number of D
11	11	8	10

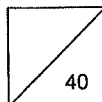
Paper 2

Section A (70 marks)

No	Answer	Marks
1a		B1 for each correct portion



NORTH VISTA SECONDARY SCHOOL
Preliminary Examination 2025
Secondary 4 Express



CANDIDATE
NAME

CLASS

INDEX
NUMBER

PHYSICS

6091/01

02 September 2025

Paper 1 Multiple Choice

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction tape/fluid.

Write your full name, register number and class on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this question paper.
The use of an approved scientific calculator is expected, where appropriate.

1 Which quantity is a vector?

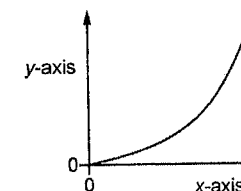
- A distance
- B force
- C mass
- D work done

2 A student determines the circumference of a football.

Which instrument is used to measure directly the circumference of the football?

- A digital calipers
- B digital micrometer screw gauge
- C metre rule
- D measuring tape

3 A car is at rest by a red traffic light. When the light changes to green, the car starts moving. The graph represents the motion of the car.



The car has a constant acceleration.

Which quantity is plotted on the x-axis and which quantity is plotted on the y-axis?

	x-axis	y-axis
A	distance	time
B	speed	time
C	time	distance
D	time	speed

4 The gravitational field strength on Earth is 9.8N/kg.

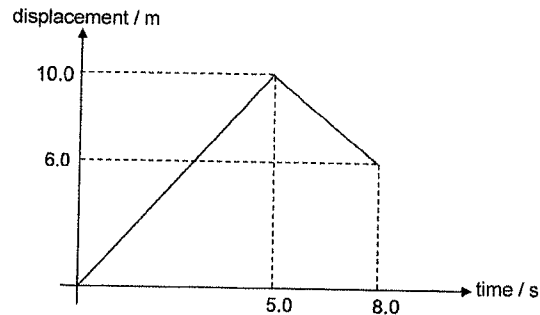
The gravitational field strength on Mars is 3.7N/kg.

The difference between the weight of an object on Earth and the weight of the same object on Mars is 25N.

What is the mass of the object?

- A 1.9kg
- B 2.6kg
- C 4.1kg
- D 6.8kg

- 5 The diagram shows how the displacement of a car varies with time.



What is the average speed of the car?

- A 0.75m/s B 1.25m/s C 1.75m/s D 2.0m/s

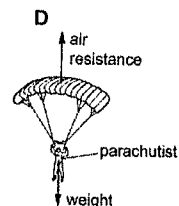
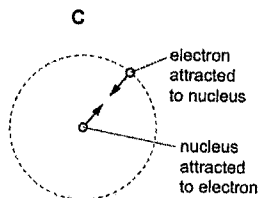
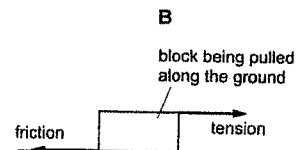
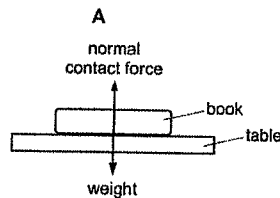
- 6 A parachutist falling at a steady speed opens his parachute.

Which row is correct for the direction of the resultant force and the direction of the acceleration of the parachutist just after his parachute opens?

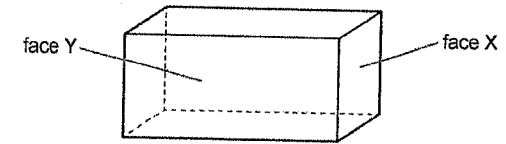
	resultant force direction	acceleration direction
A	downwards	downwards
B	downwards	upwards
C	upwards	downwards
D	upwards	upwards

- 7 Each diagram shows two forces that are equal in magnitude.

Which diagram shows two forces that are a Newton's third law pair of forces?



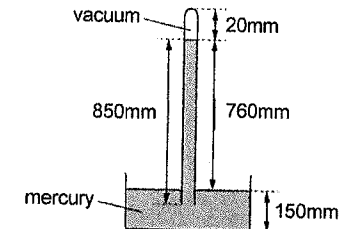
- 8 The centre of gravity of a solid rectangular block is at its centre. A small heavy weight is available.



In which arrangement is the centre of gravity the lowest?

- A with face X on a table
 B with face Y on a table
 C with face X on a table and the heavy weight attached centrally on top of the block
 D with face Y on a table and the heavy weight attached centrally on top of the block

- 9 The diagram shows an instrument that is used to measure the atmospheric pressure.



The density of mercury is $1.4 \times 10^4 \text{ kg/m}^3$. The gravitational field strength is 10 N/kg .

What is the atmospheric pressure?

- A 21kPa B 106kPa C 109kPa D 119kPa

- 10 A car of mass 1000kg is travelling down a steep hill. The brakes fail and the driver uses a horizontal sand-filled safety road to stop the car.

The car enters the sand at a speed of 10m/s and experiences a constant stopping force of 2500N.

How far does the car travel in the sand before coming to rest?

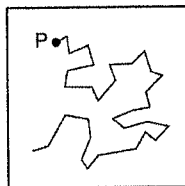
- A 2.0m B 4.0m C 20m D 40m

- 11 The input power to a lamp is 6.0W. The lamp wastes 2.7J of energy in 3.0s.

What is the efficiency of the lamp?

- A 15% B 45% C 55% D 85%

- 12 A smoke particle P is seen to move randomly when suspended in air as illustrated.



Which statement explains why P moves randomly?

- A Air molecules are smaller than P.
- B Air molecules are much larger than P.
- C Air molecules hit P from different directions.
- D Air molecules vibrate about a fixed position.

- 13 A student on a camping expedition cools a sealed bottle of water which is currently at the same temperature as the surrounding air.

Which method cools the water at the greatest rate?

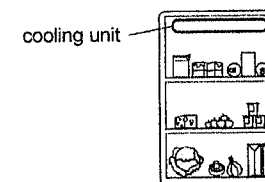
- A Wrap the bottle in dry, white paper and put it in a sunny place.
- B Wrap the bottle in aluminium foil and place it in a shady place.
- C Wrap the bottle in foam and put it in a breeze.
- D Wrap the bottle in wet paper and put it in a breeze.

- 14 A solid X is in thermal equilibrium with a solid Y. Solid Y is at the same temperature as solid Z. The three solids are made of different materials and have different masses.

Which statement is true?

- A Y is not in thermal equilibrium with Z.
- B Y and Z have the same total internal energy.
- C X and Y have the same specific heat capacity.
- D There is no net transfer of energy when X is placed in thermal contact with Z.

- 15 The diagram shows the inside of a refrigerator.

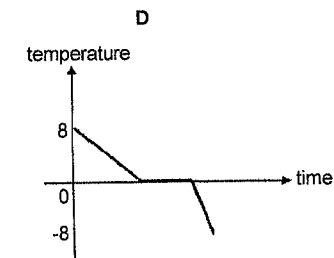
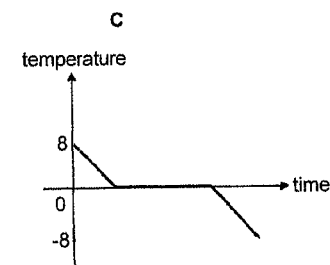
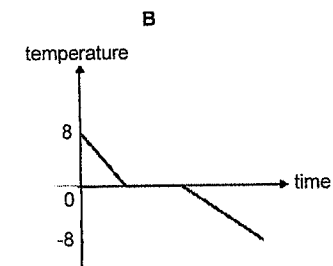
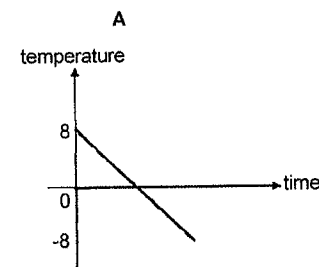


When the refrigerator is first switched on, what happens to the air near the cooling unit?

	the molecules of this air	the density of this air
A	become smaller	decreases
B	become smaller	increases
C	move closer together	decreases
D	move closer together	increases

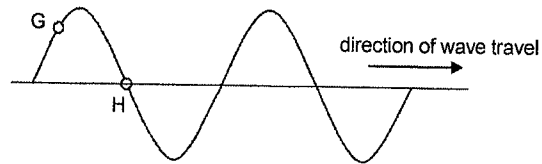
- 16 A cup of water at 8°C was cooled to ice at -8°C .

Given that ice has a lower specific heat capacity than water, which cooling curve shows how the temperature changes with time?



- 17 The diagram shows a wave with two points G and H marked.

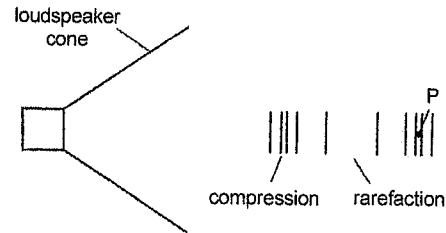
The wave is moving in the direction shown.



What happens to the frequency and direction of vibration of particle G and particle H as the wave moves to the right?

	frequency	direction of vibration of particle G	direction of vibration of particle H
A	constant	upwards	downwards
B	constant	downwards	upwards
C	increases	upwards	downwards
D	increases	downwards	upwards

- 18 Compressions and rarefactions propagate out from a loudspeaker cone as it vibrates backwards and forwards. The frequency of the vibration is 5.0 Hz.



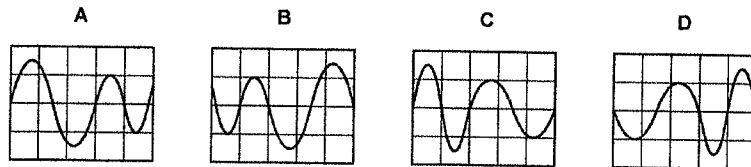
Point P is at the centre of a compression.

How much time elapses before the next rarefaction arrives at P?

- A 0.10s B 0.20s C 0.40s D 5.0s

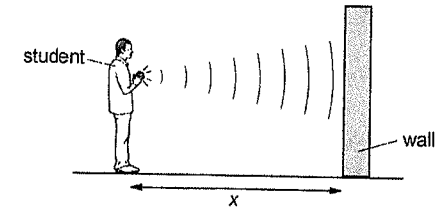
- 19 Four sound waves are displayed on the screen of a cathode-ray oscilloscope.

Which sound wave gets louder and has a pitch that decreases?



- 20 A student claps his hands in front of a wall and hears the echoes. He claps at the same moment as he hears the echo of the previous clap.

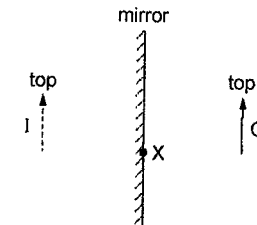
Another student starts a stopwatch on the first clap and stops it on the eleventh clap. The reading on the stopwatch is 9.4 s and the speed of sound is 320 m/s.



What is the distance x between the student and the wall?

- A 140m B 150m C 270m D 300m

- 21 An object O is placed in front of a plane mirror. I is the image formed.



A ray from the top of the object is incident on the mirror at X.

What happens to this ray?

- A It reflects and passes through the bottom of O.
 B It reflects and passes through the top of O.
 C It reflects as though it came from the bottom of I.
 D It reflects as though it came from the top of I.

- 22 The diagram shows some of the waves in the electromagnetic spectrum arranged in order of increasing frequency. One of the waves is labelled X.

radio waves		X	light			gamma rays
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Which application uses the wave X?

- A cancerous cells destruction
 B RFID tagging
 C satellite television
 D thermal imaging

- 23 Plastic and wool are insulating materials.

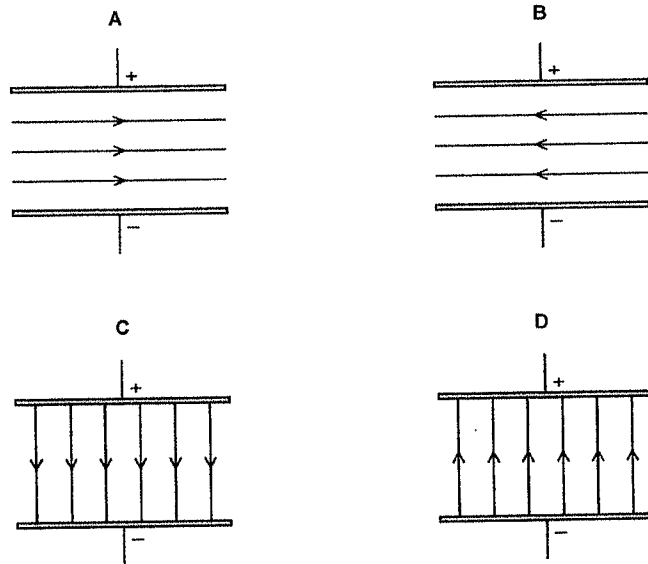
Samples of plastic and wool are rubbed together. This causes a transfer of electrons.

Which row shows the direction of electron transfer and the final charge on both materials?

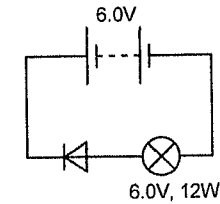
	plastic	wool	final charge on plastic	final charge on wool
A	gains electrons	loses electrons	neutral	positive
B	gains electrons	loses electrons	negative	positive
C	loses electrons	gains electrons	negative	positive
D	loses electrons	gains electrons	positive	neutral

- 24 Two parallel, conducting plates are charged. The charge on the upper plate is positive. The charge on the lower plate is equal in size but negative.

Which diagram shows the pattern and the direction of the electric field between the two plates?

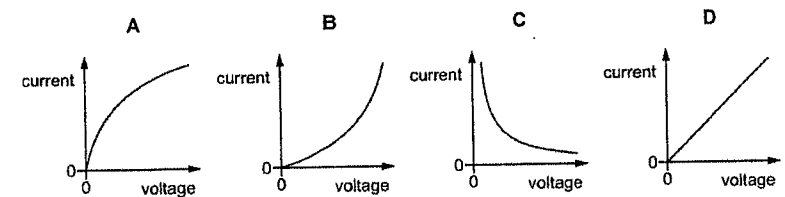


- 25 A student sets up the circuit shown. The lamp does not light up.



What makes the lamp light up?

- A changing the supply to a 12V battery
 B inserting a fuse
 C reversing the battery connections
 D reversing the connections to the lamp
- 26 In which example is the current 1.0A?
- A a 2.5Ω lamp with input power 0.10W
 B a charge of 0.10C passes through a resistor in 100ms
 C a resistor of resistance 0.50Ω with a potential difference of 2.0V across it
 D two resistors with a current of 0.50A connected in series
- 27 A wire of length 0.50m and cross-sectional area $1.0 \times 10^{-6}\text{m}^2$ has a resistance of 0.75 Ω .
 Another wire of the same material has a length of 2.0m and a cross-sectional area of $0.50 \times 10^{-6}\text{m}^2$.
- What is the resistance of the longer wire?
- A 0.094 Ω B 0.38 Ω C 1.5 Ω D 6.0 Ω
- 28 Which graph shows the relationship between current and voltage for a filament lamp?



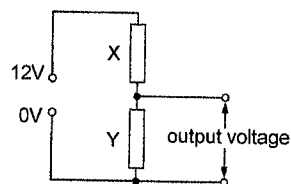
- 29 Two identical resistors are connected first in series and then in parallel.

The two resistors in series are connected to a power supply and the current is I_s . The parallel combination is connected to the same power supply and the current supplied is I_p .

What is the ratio $\frac{I_s}{I_p}$?

- A 0.25 B 0.50 C 2.0 D 4.0

- 30 A potential divider uses a power supply of voltage 12V. The resistors X and Y initially have equal resistances.



The resistance of X is halved.

What is the change in the output voltage?

- A -3.0V B -2.0V C +2.0V D +3.0V

- 31 A metal kettle is plugged into a mains socket. The plug contains a suitable fuse.

The kettle's cable is damaged and the fuse blows.

Why does the fuse blow?

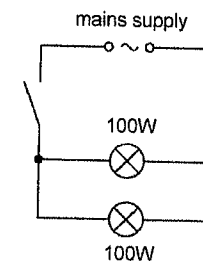
- A The bare earth wire in the cable touches the bare live wire.
 B The bare neutral wire in the cable touches the bare earth wire.
 C The live wire breaks without touching any other wire.
 D The metal casing of the kettle touches the bare earth wire.

- 32 A mains electric circuit is fitted with a circuit breaker rather than a fuse.

Where is the circuit breaker connected and what happens when the current is too large?

	a circuit breaker is connected in	when the current is too large
A	live wire	a thin wire melts and breaks the circuit
B	live wire	an electromagnet opens a switch
C	neutral wire	a thin wire melts and breaks the circuit
D	neutral wire	an electromagnet opens a switch

- 33 Two 100W lamps are connected in parallel to the mains supply, as shown.



How much energy is transferred by the mains when the switch is closed for 36 minutes?

- A 0.030kWh B 0.12kWh C 1.8kWh D 7.2kWh

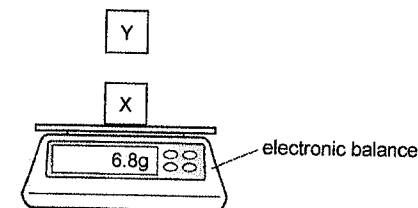
- 34 Three students make comments about appliances with double insulation.

Student P: Appliances with double insulation do not need an earth wire.
 Student Q: Circuits of appliances with double insulation do not contain fuses.
 Student R: Double insulation protects the user of the appliance from an electric shock.

Which students are correct?

- A P and Q
 B P and R
 C Q and R
 D P, Q and R

- 35 Object X is on an electronic balance. Object Y is held above object X as shown.

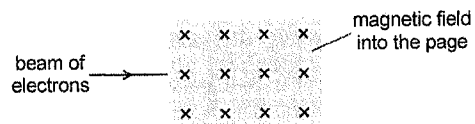


The reading on the balance increases when Y is moved closer to X.

Why does this happen?

- A X and Y are both magnets.
 B X and Y are both made of iron.
 C Y is made of iron and X is a magnet.
 D Y is a magnet and X is made of iron.

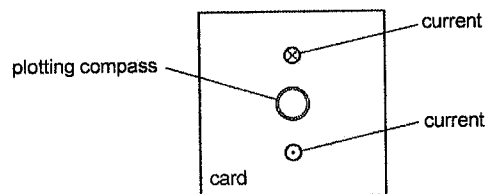
- 36 The diagram shows a beam of electrons about to enter a magnetic field. The magnetic field is directed into the page.



What is the direction of the deflection of the electrons as they enter the magnetic field?

- A into the page
B out of the page
C up the page
D down the page

- 37 Two vertical wires pass at right-angles through a piece of card. There is a large current in each wire in the direction shown.

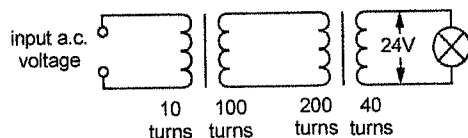


A plotting compass is placed on the card.

Which diagram shows the direction in which the needle of the plotting compass points?



- 38 The diagram shows the circuit for a model power line with two transformers and a lamp at the output.



What is the input voltage?

- A 0.12V B 6.0V C 12V D 96V

- 39 The half-life of a radioactive isotope is 2.5 minutes.

This isotope is the only radioactive isotope in a radioactive sample.

Between time $t = 0$ and $t = 7.5$ minutes, the mass of this isotope in the sample decreases by $70\mu\text{g}$.

What is the mass of this isotope at $t = 0$?

- A $75\mu\text{g}$ B $80\mu\text{g}$ C $210\mu\text{g}$ D $560\mu\text{g}$

- 40 A radioactive isotope of sodium has a half-life of 15 hours.

The table gives data from an experiment to show how the rate of decay of the isotope varies with time.

The background count rate has not been subtracted from these data.

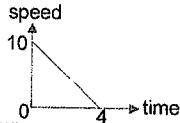
time / hours	0	10	20	30
$\frac{\text{count rate}}{\text{counts / s}}$	400	260	170	115

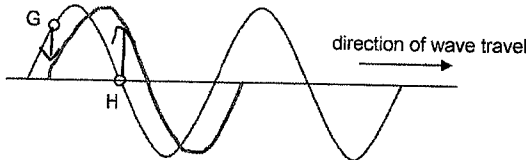
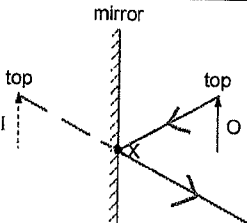
What is the background radiation count rate?

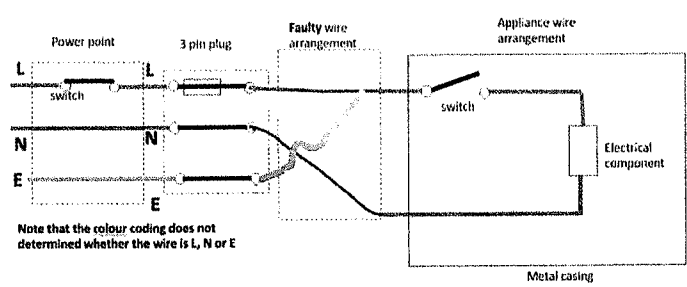
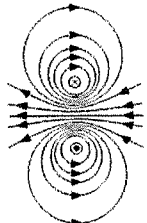
- A 12 counts / s
B 15 counts / s
C 20 counts / s
D 30 counts / s

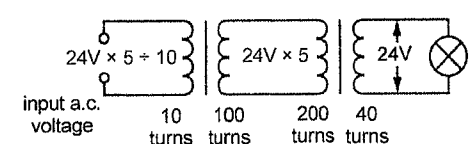
End of Paper

Answers

1	B	Work done is energy transferred from one store to another: scalar quantity. Force is a vector quantity.
2	D	Only measuring tape is flexible to measure the circumference directly. Digital calipers measure its diameter.
3	C	Constant acceleration = speed increases (gradient of distance-time graph increases) at a constant rate. Answer cannot be D as that will mean increasing acceleration.
4	C	Difference between weight = $(m \times 9.8) - (m \times 3.7) = 25$ $m = 4.1 \text{ kg}$
5	C	Average speed = total distance travelled / total time = $(10+4)/8 = 1.75 \text{ m/s}$
6	D	When parachute opens, parachutist continues to move down to the ground, air resistance is much larger than its weight, hence direction of resultant force (up) is acting opposite to direction of motion (down). Direction of acceleration follows direction of resultant force, i.e. up (against its direction of motion - down), hence, parachutist decelerates.
7	C	Only this option is an action-reaction pair. As forces are equal in magnitude but acting on two different bodies.
8	B	Option D is incorrect as CG is raised from the middle position when a heavy weight is attached on top of the block.
9	B	$P_{\text{atm}} = h\rho g = (760/1000) \times 1.4 \times 10^4 \times 10 = 106\,400 \text{ Pa} = 106 \text{ kPa}$
10	C	Work done by stopping force = Transfer of energy in kinetic store $F \times d = \frac{1}{2} mv^2$ $2500 \times d = \frac{1}{2} \times 1000 \times 10^2$ $d = 20 \text{ m}$ OR Braking force = md , $2500 = 1000d$, $d = 2.5 \text{ m/s}^2$ $a = (v-u)/t$ $-2.5 = (0-10)/t$, $t = 4.0 \text{ s}$ distance = area under graph = $\frac{1}{2} \times 4.0 \times 10 = 20 \text{ m}$ 
11	D	efficiency = (useful output power / input power) $\times 100$ $= (6.0 - 2.7/3) / 6.0 \times 100 = 85\%$
12	C	Diagram shows Brownian motion – is the random and continuous motion of smoke particles in air. This is caused by air molecules colliding onto the smoke particles at different directions and with forces of different magnitude.
13	D	Option A: Sunny place, bottle of water at room temperature will absorb heat. Option B: Aluminium foil, shiny surface is a poor emitter of heat. Option C: Foam, a poor conductor of heat Option D: As water in the wet paper evaporates, it removes heat away from the bottle of water. In the presence of breeze, the rate of evaporation increases.
14	D	Option A: Y and Z are the same temperature; hence, they are in thermal equilibrium. Option B: Y and Z, though they are in thermal equilibrium, do not mean they have the same internal energy unless they have the same total number of particles. Y and Z have different masses; hence, they have different total internal energy. But average KE PER particle is the same as they are at the same temperature. Option C: X and Y are made of different materials; hence they have different specific heat capacity. Option D: X and Z are at the same temperature. Hence, no net transfer of energy.
15	D	When the air is cooled, it contracts, thus volume decreases (molecules move closer together). Density = mass / volume, mass constant, density increases.
16	D	During freezing, temperature remains constant at 0°C . Since ice has a lower specific heat capacity than water, for the same drop in temperature, ice requires a shorter time. Hence, gradient of graph for ice is steeper.
17	B	Frequency of source did not change (no mention in question). Hence, frequency of vibration of particles remains constant.

		
18	A	Period of longitudinal wave = $1/f = 1/5.0 = 0.20 \text{ s}$ One period = C to R to C, hence from C to R, it will be 0.10 s (half a period).
19	B	Loudness increases $\rightarrow$ amplitude increases Pitch decreases $\rightarrow$ frequency decreases (less waves in one second) / larger T
20	B	2 claps $\rightarrow$ sound travels to and fro 1 time 11 claps $\rightarrow$ sound travels to and fro 10 times Time taken for sound to travel to and fro once = $9.4/10 = 0.94 \text{ s}$ $2x = \text{speed} \times \text{time} = 320 \times 0.94$ $x = 150 \text{ m}$ OR 1 st clap $\rightarrow 0x$ (sound waves start to travel) 2 nd clap $\rightarrow 2x$ (sound waves have travelled distance of $2x$) 3 rd clap $\rightarrow 4x$ (sound waves have travelled distance of $4x$) 11 th clap $\rightarrow 20x$ (sound waves have travelled distance of $20x$) $20x = \text{speed} \times \text{time} = 320 \times 9.4$ $x = 150 \text{ m}$
21	D	
22	D	Thermal imaging – infrared radiation (X) Killing cancerous cells – gamma rays RFID tags – radio waves Satellite television – microwaves
23	B	Plastic gains electrons, hence, it has excess negative charges (net negative charge). Wool loses electrons, hence it has excess positive charges (net positive charge).
24	C	Direction of electric field is from + to -.
25	C	Diode is in reversed biased mode. Hence, reversing the battery connections will make the diode become forward biased and current can flow. Option A (if battery's connection is reversed), the voltage across bulb will be smaller than 6 V , lower than its rating of 6 V . Hence bulb will be dimmer.
26	B	Option A: $P = I^2 R$, $0.10 = I^2 \times 2.5$, $I = 0.20 \text{ A}$ Option B: $I = Q/t = 0.10 / (100 \times 10^{-3}) = 1.0 \text{ A}$ Option C: $I = V/R = 2.0 / 0.50 = 4.0 \text{ A}$ Option D: Current is only 0.50 A , in a series circuit, current in all resistors are the same.
27	D	$R = \rho l/A = 0.75 \Omega$ Length is increased by 4 times, area is halved. Hence, the new resistance = $0.75 \times 4 \times 2 = 6.0 \Omega$
28	A	For a filament lamp, (TIRI), as current increases, temperature increases, resistance of lamp increases. Ratio of I to V gives reciprocal of R . Hence ratio of I to V decreases.

29	A	$I_s / I_p = (V / 2R) / [V / (1/R + 1/R)^{-1}] = (V / 2R) / (2V / R) = 1/4 = 0.25$
30	C	Initial output voltage across Y = 6.0V New output voltage across Y = $\frac{R}{R+0.5R} \times 12 = 8V$ Change in output voltage = final voltage – initial voltage = 8 – 6 = +2.0V
31	A	 When the bare earth wire touches the bare live wire, it creates a short circuit, and a very large current flows through the fuse. The fuse will blow. Option B: When bare neutral wire touches the bare earth wire, there is no short circuit, hence, no excessive current flow.
32	B	Circuit breaker / fuse is always placed in the live wire. For circuit breaker, excessive current magnetises an electromagnet strongly. It attracts an iron armature due to induction and causes contacts to break.
33	B	$E = P \times t = (100+100)/1000 \text{ kW} \times 36/60 \text{ hr} = 0.12 \text{ kWh}$
34	B	Student Q is wrong as appliances with double insulation still contain a 2-pin plug and there is a fuse in the plug.
35	A	Option A: Both are magnets with like poles facing each other. Repulsion occurs and a downward force is exerted on X, leading to an increase in the reading. Option B: Iron is a magnetic material. No attraction or repulsion. Option C and D: Attraction due to induction by a magnet. Hence, a smaller downward force is exerted on the balance.
36	D	Using FLHR Index finger pointing into the page (magnetic field), middle finger pointing to the left (conventional current), hence thumb points down the page (force).
37	C	 Applying Right Hand Grip Rule X – current into page o – current out of page Needle of compass will point in the direction of the field (left)
38	C	At 2 nd transformer: $\frac{N_s}{N_p} = \frac{V_s}{V_p}, \frac{40}{200} = \frac{24}{V_p}, V_p = 120V$ At 1 st transformer:

		$\frac{N_s}{N_p} = \frac{V_s}{V_p}, \frac{100}{10} = \frac{120}{V_p}, V_p = 12V$ OR 
39	B	Number of half-life at 7.5 min = 7.5/2.5 = 3 Let x be the original mass of sample. Mass of sample remaining at 7.5 min = $x + 2 + 2 + 2 = \frac{x}{8}$ Mass of sample decayed = $x - \frac{x}{8} = \frac{7x}{8} = 70\mu\text{g}$ $x = 80\mu\text{g}$
40	C	Number of half-life at 30 hrs = 30/15 = 2 Let the background count rate be x. Initial count rate (without background radiation) = 400 - x Count rate at 30 hrs = (400 - x) + 2 + 2 = (400 - x)/4 According to table, count rate at 30 hrs (without background radiation) = 115 - x Therefore, $\frac{400 - x}{4} = 115 - x$ Solving: $x = 20 \text{ counts/s}$ OR Number of half-life at 30 hrs = 30/15 = 2 Initial count rate (without background radiation) = c Amount of isotope decayed after 2 half-life = $\frac{3}{4}c$ Amount of isotope decayed after 2 half-life (from the table) = 400 - 115 = 285 $\frac{3}{4}c = 285, c = 380$ Background radiation = 400 - 380 = 20 counts/s

Name: Register/Index Number: Class:

PRESBYTERIAN HIGH SCHOOL



PHYSICS

6091/1

Paper 1 Multiple Choice

2 September 2025

Tuesday

1 hour

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2025 SECONDARY FOUR EXPRESS PRELIMINARY EXAMINATION

INSTRUCTIONS TO CANDIDATES:

DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, class and register number on the Answer Sheet in the spaces provided.

There are forty questions on this paper. Answer all questions. For each question there are four possible answers, A, B, C and D.

Choose the one you consider correct and record your choice in soft pencil on the separate Answer Sheet.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

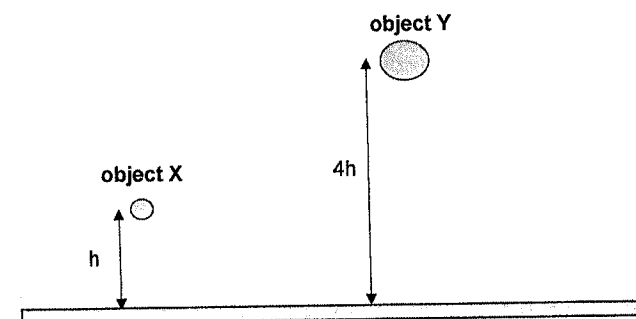
This document consists of 21 printed pages.

- 1 A light year is the distance light travels in 1 year (365 days).

Which of the following is the nearest estimate of 1 light year?

- A 10 000 km
- B 10 000 Mm
- C 10 000 Gm
- D 10 000 Tm

- 2 An object X of mass m is released from a height h . Above object X, another object Y of mass $4m$ is released from a height $4h$ simultaneously.



Neglecting effect of air resistance. If both objects fall freely, which statement is true?

- A The distance between them decreases and Y overtakes X.
- B The distance between them remains constant.
- C The distance between them increases as X falls faster.
- D The velocities of both objects are constant.

- 3 When a horizontal force of 8.0 N is applied to a wooden block of mass 5.0 kg on a horizontal surface, the block moves with a constant velocity.

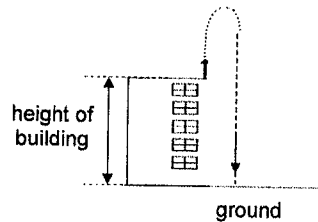
If the force is increased to 15 N, what is the acceleration of the block?

- A 0.8 m/s^2
- B 1.4 m/s^2
- C 1.6 m/s^2
- D 3.0 m/s^2

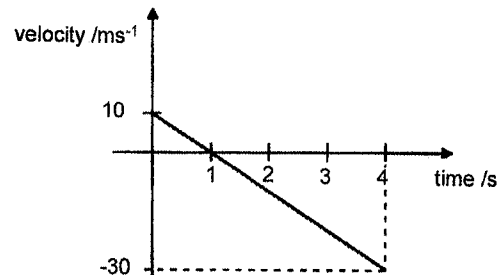
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3

- 4 A stone is thrown up vertically from the top of a building and reaches the ground after 4 seconds.



The graph below shows the change in velocity of the stone from 0 to 4 s.



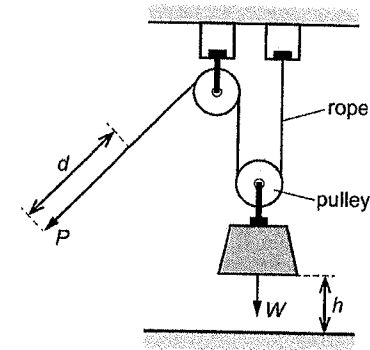
Assuming the effect of air resistance is negligible, what is the height of the building?

- A 50 m
B 45 m
C 40 m
D 35 m
- 5 A motor drives a pump that raises 200 kg of water up by 5.0 m in 10 minutes. If the efficiency of the pump is 75 %, what is the power input by the motor?
- A 12.5 W
B 22 W
C 556 W
D 1330 W

4

- 6 A worker pulls a rope with a force P through a distance d in the direction of the force as shown.

This causes a block of weight W to move vertically upwards through a height h .



How much work is done by the worker?

- A Pd
B Ph
C $(P + W)h$
D $(P + W)d$
- 7 A car of mass 1000 kg is travelling down a steep hill. The brakes fail and the driver uses a horizontal sand-filled safety road to stop the car.

The car enters the sand at a speed of 10 m/s and experiences a constant stopping force of 2500 N.

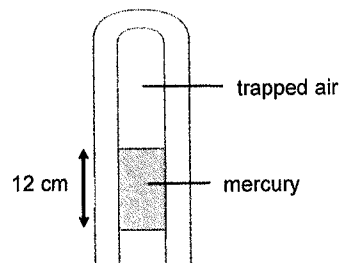
How far does the car travel in the sand before coming to rest?

- A 2.0 m
B 4.0 m
C 20 m
D 40 m

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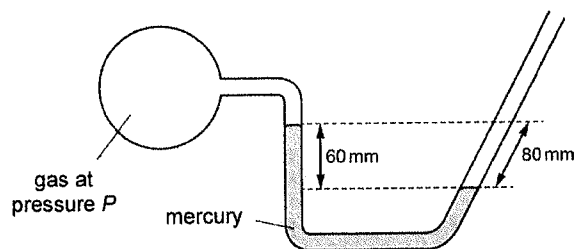
- 8 The diagram shows a column of air enclosed in a narrow capillary tube by a thread of mercury 12 cm in length. The bottom portion of the mercury thread is exposed to atmospheric pressure.



What is the pressure of the trapped air, given that atmospheric pressure is 76 cm Hg?

- A 0 cm Hg
B 64 cm Hg
C 76 cm Hg
D 88 cm Hg
- 9 The diagram shows a mercury manometer. The tube is open to the atmosphere on the right-hand side.

The left-hand side is connected to a container containing a gas at pressure P .

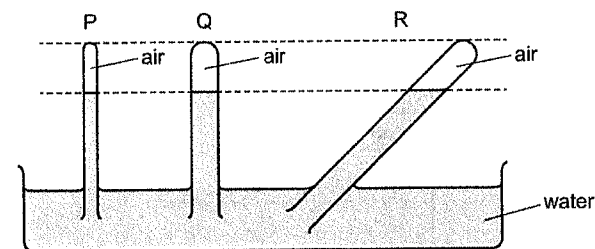


Atmospheric pressure on its own supports a column of mercury of height 756 mm.

Which height of column does pressure P on its own support?

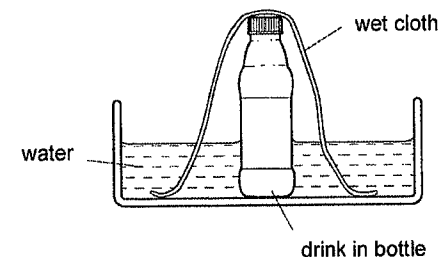
- A 836 mm of mercury
B 816 mm of mercury
C 696 mm of mercury
D 676 mm of mercury

- 10 The diagram shows three tubes P, Q and R. Each tube contains air trapped by a water column.



Which statement is correct?

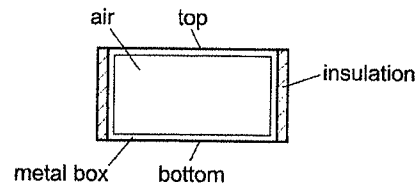
- A The pressure of the trapped air is equal in tubes P, Q and R.
B The pressure of the trapped air is greatest in tube Q.
C The pressure of the trapped air is greatest in tube R.
D The pressure of the trapped air is greatest in tube P.
- 11 On a hot day, the drink in a bottle can be kept cool by standing the bottle in a bowl of water and placing a wet cloth over it.



Why is the drink kept cool?

- A Hot air cannot escape from the bottle.
B The cloth conducts heat from the bottle into the water.
C The drink cannot evaporate from the bottle.
D Water evaporating from the cloth cools the drink.

- 12 A sealed metal box contains a fixed mass of air. The sides of the box are insulated.



A scientist investigates the thermal conductivity of air. She measures how quickly thermal energy passes between the top and bottom of the box.

Which row gives the correct procedure and conclusion?

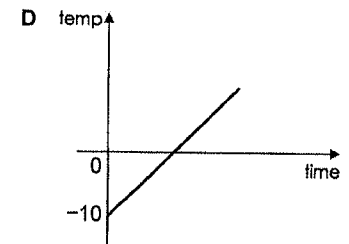
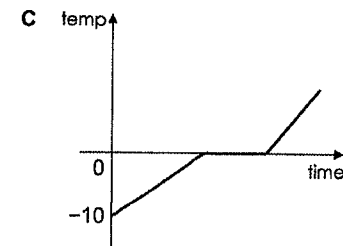
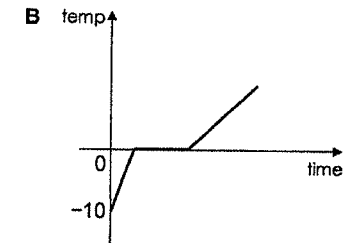
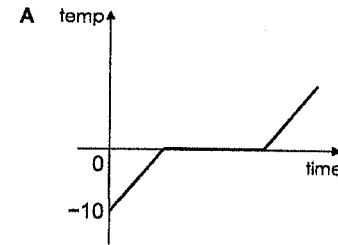
	procedure	conclusion
A	heat bottom surface	air is a good thermal conductor
B	heat bottom surface	air is a poor thermal conductor
C	heat top surface	air is a good thermal conductor
D	heat top surface	air is a poor thermal conductor

- 13 The characteristic of certain cooking pots is that when they are removed from the source of heat, the contents in the pots may continue to boil for some time.

What may be the reason for this?

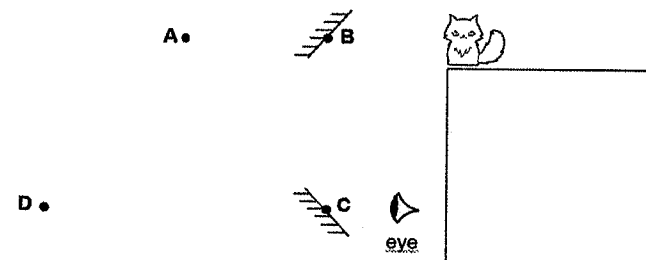
- A The material of the pot has high specific heat capacity.
- B The material of the pot has low specific heat capacity.
- C The material of the pot is a good thermal conductor.
- D The material of the pot has high specific latent heat of vaporisation.

- 14 A block of ice at -10°C was heated. Given that ice has a lower specific heat capacity as compared to water, which one of the following correctly illustrates the heating curve?



- 15 The diagram shows a cat being viewed using two mirrors by an observer.

At which position is the image of the cat located?

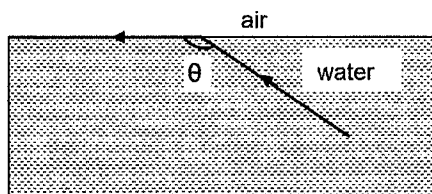


- 16 A ray of light is incident on a horizontal plane mirror, as shown. The light is reflected straight back the way it came.



The mirror is tilted through an angle of 10° .
What is the angle now, between the incident ray and the reflected ray?

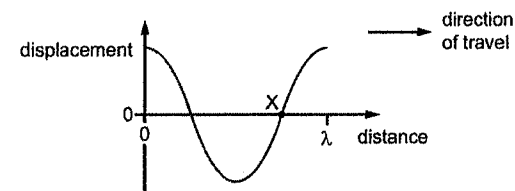
- A 5°
B 10°
C 15°
D 20°
- 17 The diagram shows the path of a ray of light as it strikes the water-to-air boundary.



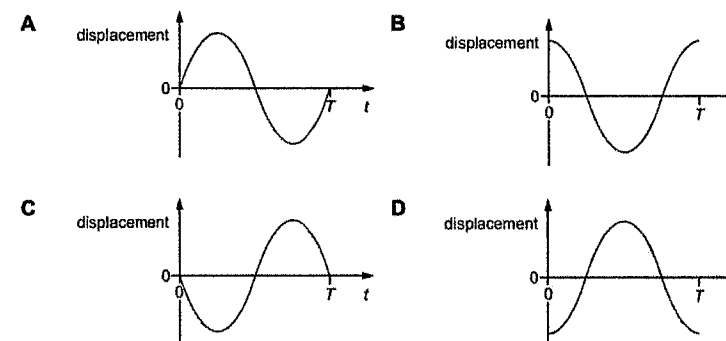
If the speed of light in water is 2.3×10^8 m/s and its speed in air is 3.0×10^8 m/s, what is the value of angle θ ?

- A 100°
B 120°
C 130°
D 140°

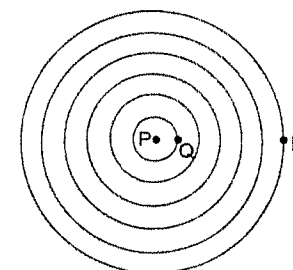
- 18 A transverse wave on a rope has wavelength λ and period T . The graph shows the variation of the displacement of the particles of the rope with distance in the direction of travel of the wave at time $t = 0$.



A particle X is labelled on the graph.
Which graph shows the variation of the displacement of particle X with time t ?



- 19 The diagram shows the top view of some water waves produced from point P.



The waves have a speed of 0.40 m/s and take 2.0 s to travel from point Q to R.

What is the wavelength of the wave?

- A 0.16 m B 0.20 m C 0.40 m D 0.80 m

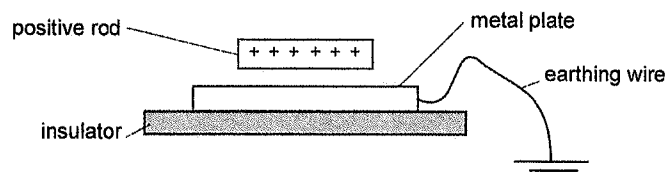
- 20 A student stands at a distance d from the base of a tall cliff. He claps together two pieces of wood and measures the time that elapses before he hears the echo. He conducts the experiment five times and obtains these results.

0.72 s 0.80 s 0.7 s 0.8 s 0.7 s

The speed of sound is 320 m/s.

What is the distance d ?

- A 120 m B 240 m C 480 m D 600 m
- 21 Which list shows regions of the electromagnetic spectrum in order of increasing frequency?
- A X-ray $\rightarrow$ ultraviolet $\rightarrow$ visible light $\rightarrow$ infrared
 B X-ray $\rightarrow$ infrared $\rightarrow$ visible light $\rightarrow$ ultraviolet
 C infrared $\rightarrow$ visible light $\rightarrow$ ultraviolet $\rightarrow$ X-ray
 D ultraviolet $\rightarrow$ visible light $\rightarrow$ infrared $\rightarrow$ X-ray
- 22 A positively charged plastic rod is placed just above a thick metal plate. The metal plate rests on an insulator and is connected to the earth by a wire.



A student disconnects the earthing wire and then removes the positively charged rod. The experiment is repeated.

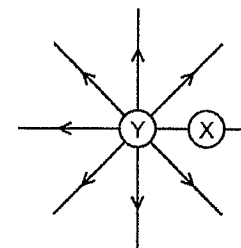
This time the student removes the positively charged rod and then removes the earthing wire.

Which statement is correct?

- A The metal plate becomes more negatively charged when the experiment is repeated.
 B The metal plate becomes positively charged when the experiment is repeated.
 C The metal plate becomes neutral when the experiment is repeated.
 D There is no change in the excess charge on the metal plate when the experiment is repeated.

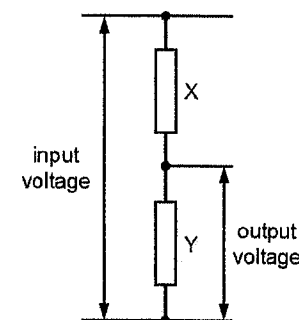
- 23 Object X is stationary and negatively charged. It experiences a force due to the field produced by object Y.

The arrows show the direction of the field produced by Y.



Which statement about the direction of the force on X is correct?

- A It is towards the right because it is in an electric field.
 B It is towards the left because it is in an electric field.
 C It is towards the right because it is in a magnetic field.
 D It is towards the left because it is in a magnetic field.
- 24 An engineer uses the potential divider shown in the diagram. He needs the output voltage to be 10% of the input voltage.



Which pair of values could he use for the two resistors X and Y?

	X / Ω	Y / Ω
A	1.0	9.0
B	1.0	10.0
C	9.0	1.0
D	10.0	1.0

- 25 The resistance of a piece of wire, of length 1 m and diameter 0.3 mm, is R .

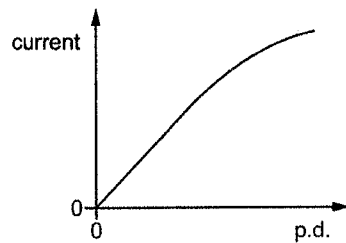
Another piece of wire, made of the same metal, is 2 m longer than the first wire. Its diameter is 50% that of the first wire.

What is the resistance of the second piece of wire?

- A $4R$
B $6R$
C $8R$
D $12R$

- 26 The graph shows the relationship between the current in a circuit component and the potential difference (p.d.) across it.

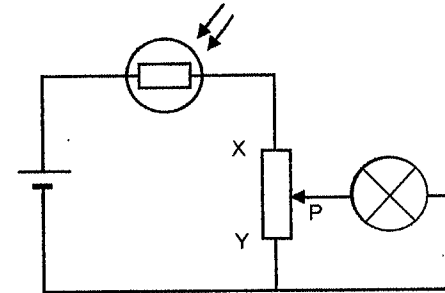
The graph has a straight section and a curved section.



What happens to the resistance of the component in these two sections as the current increases?

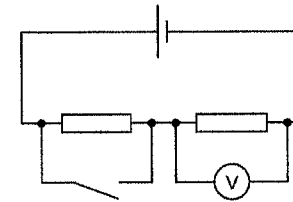
	straight section	curved section
A	resistance increases	resistance decreases
B	resistance increases	resistance increases
C	no change in resistance	resistance decreases
D	no change in resistance	resistance increases

- 27 In the circuit shown below, under what conditions will the light bulb become brighter?



- A Light is incident on the LDR and P is moved to X.
B Light is incident on the LDR and P is moved to Y.
C The LDR is covered and P is moved to X.
D The LDR is covered and P is moved to Y.

- 28 The diagram shows a circuit containing a cell, two resistors, a switch and a voltmeter.



When the switch is open the voltmeter reads 1.5 V.
When the switch is closed the voltmeter reads 2.0 V.

What is the electromotive force (e.m.f.) of the cell?

- A 0.5 V B 1.5 V C 2.0 V D 3.5 V

- 29 A 240 V mains circuit contains eight identical lamps connected in parallel. Each lamp is rated at 60 W when operating normally at 240 V.

When the lamps are first switched on, their filaments are cold, and the resistance of each filament is four times smaller than its resistance during normal operation.

What is the approximate current supplied by the mains immediately after the lamps are switched on?

- A 0.25 A
- B 1.0 A
- C 2.0 A
- D 8.0 A

- 30 When the flash on a camera is used, a charge of 1.5 C flows for 0.0030 s through the flash lamp.

The average voltage across the flash lamp is 3600 V.

What is the electrical energy supplied to the flash lamp and what is the average power supplied?

	energy / J	power / W
A	2400	7.2
B	2400	800 000
C	5400	16.2
D	5400	1.8×10^6

- 31 A desk lamp should have a 3 A fuse fitted, but a 13 A fuse has been fitted by mistake.

The lamp is **not** faulty. The lamp is switched on.

What happens?

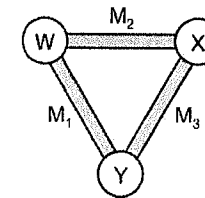
- A The fuse blows.
- B The fuse does **not** blow but the lamp does **not** light.
- C The lamp draws too much current and the supply cables melt.
- D The lamp lights normally.

- 32 A kettle is connected to a 230 V supply and draws a current of 9.6 A. It is switched on for 3.5 minutes each day. The cost of one kilowatt-hour (kWh) of electrical energy is \$0.24.

What is the total cost of using the kettle for 30 days?

- A \$ 6.63
- B \$ 2.64
- C \$ 0.93
- D \$ 0.06

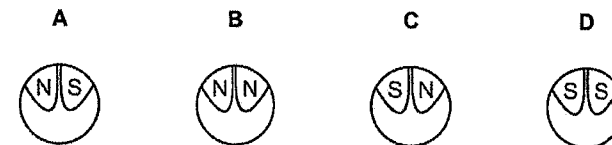
- 33 Magnets M1, M2 and M3 are joined by iron balls W, X and Y as shown.



Magnetic poles are induced in the iron balls W and X as shown.

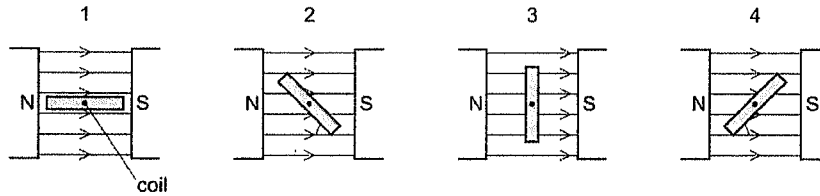


Which diagram shows the poles induced in ball Y?



- 34 Four positions of a current-carrying coil in a magnetic field, as in a d.c. motor, are shown.

In diagrams 2 and 4, the coil is at an angle of 45° to the field lines.

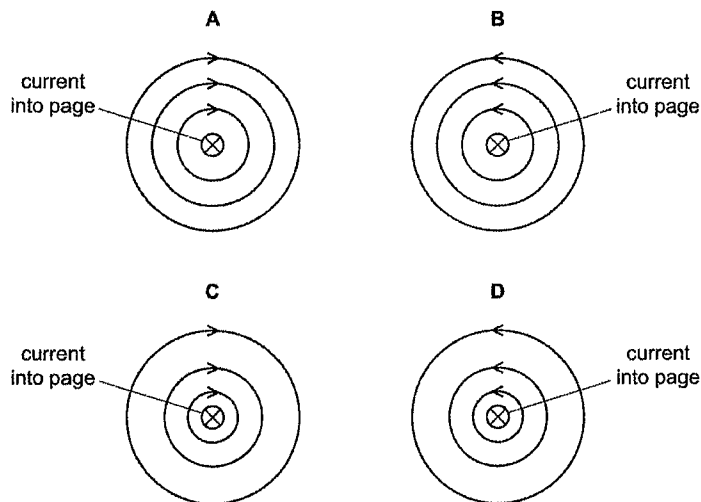


Which row is correct?

	turning effect of the forces in positions 1 and 3	turning effect of the forces in positions 2 and 4
A	different	different
B	different	same
C	same	different
D	same	same

- 35 An electric current in a wire is into the page.

Which diagram shows the shape and direction of the magnetic field around the wire?



[Turn over

- 36 Diagram 1 shows a coil of wire P between the poles of a magnet. The ends of coil P are connected to a battery by slip rings.

Diagram 2 shows a coil of wire Q between the poles of a different magnet. The ends of coil Q are connected to a battery by a split-ring commutator.

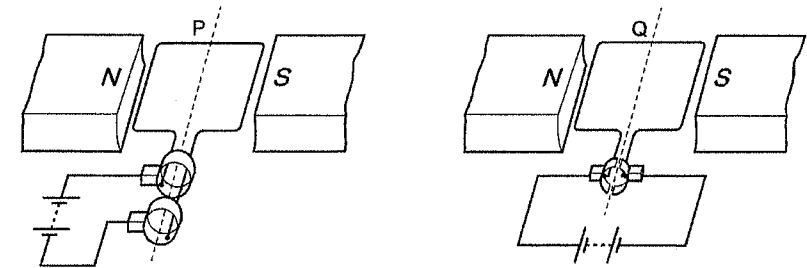


diagram 1

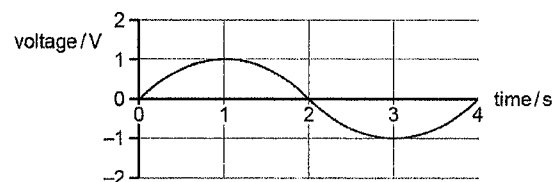
diagram 2

What happens to coils P and Q?

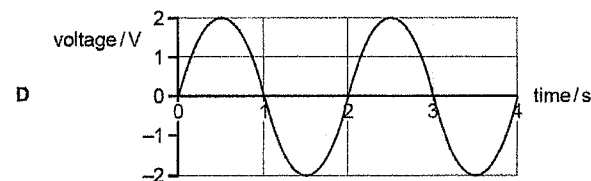
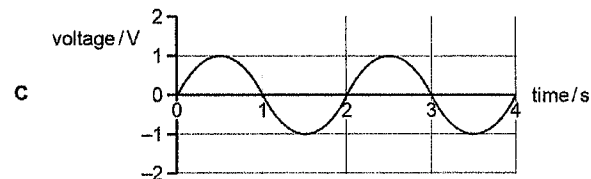
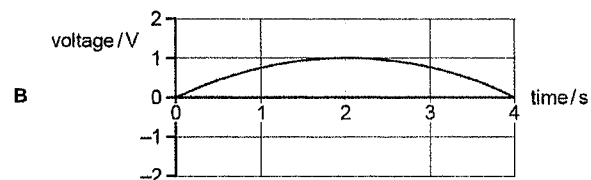
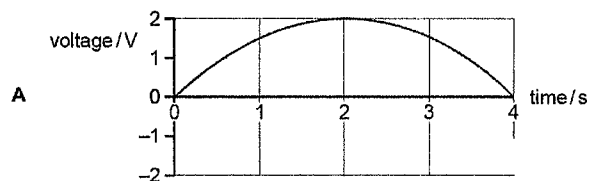
	coil P	coil Q
A	continuously turns anticlockwise	makes one quarter turn anticlockwise then stops
B	continuously turns clockwise	makes one quarter turn clockwise then stops
C	makes one quarter turn anticlockwise then stops	continuously turns anticlockwise
D	makes one quarter turn clockwise then stops	continuously turns clockwise

[Turn over

- 37 A simple a.c. generator produces a voltage that varies with time as shown.

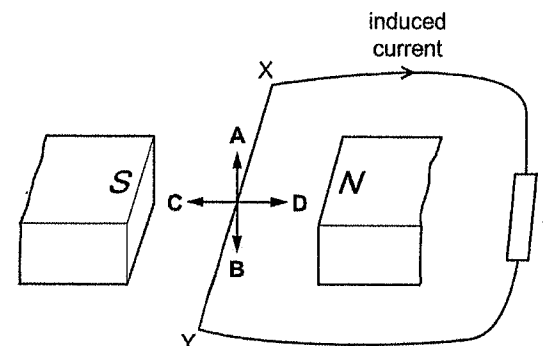


Which graph shows how the voltage varies with time when the generator rotates at twice the original speed?



- 38 A wire XY is connected to a resistor R. The wire is moved in the magnetic field between two magnetic poles.

In which direction must the wire be moved so that the induced current is in the direction shown?



- 39 A radioactive isotope of sodium has a half-life of 15 h.

The table gives data from an experiment to show how the rate of decay of the isotope varies with time.

The background count rate has not been subtracted from these data.

time / h	0	10	20	30
count rate counts / s	400	260	170	115

What is the background radiation count rate?

- A 12 counts/s
B 15 counts/s
C 20 counts/s
D 30 counts/s

- 40 An isotope of lead, $^{212}_{82}\text{Pb}$, is radioactive. After three decays, two beta-particles and an alpha-particle have been emitted. Another radioactive isotope of lead is formed.

What is the mass number (nucleon number) of the new isotope of lead?

- A 200
B 208
C 212
D 216

1870

PRESBYTERIAN HIGH SCHOOL
SCIENCE DEPARTMENT
MARKSCHEME

Subject: Physics

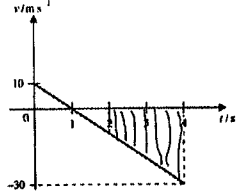
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Level: Sec 4 Express

Test: PrelimExam

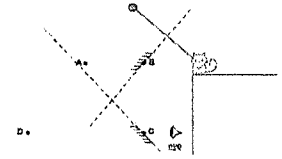
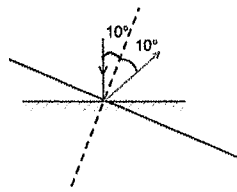
Year: 2025

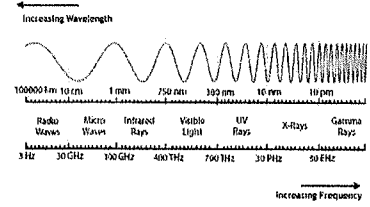
Answers to Paper 1: MCQ

1	D	Distance = speed $\times$ time $= 3 \times 10^8 (24 \text{ h} \times 365 \text{ days} \times 3600 \text{ s})$ $= 9.5 \times 10^{15}$
2	B	All objects will fall at the same rate if there is no air resistance.
3	B	Constant speed: acceleration = 0 m/s^2 Friction = applied force = 8 N F _{applied} – friction = ma $15 - 8 = (5)a$ $a = 7/5 = 1.4 \text{ m/s}^2$
4	C	 height of building = shaded area $= \frac{1}{2} (2) (30 + 10)$ $= 40 \text{ m}$
5	B	Useful power output = $(200)(10)(5) / (10 \times 60)$ $= 16.7 \text{ W}$ Power input = $16.7 / 0.75 = 22 \text{ W}$
6	A	W.D = Force $\times$ distance parallel to the force
7	C	K.E = WD $\frac{1}{2} mv^2 = F \times \text{distance}$

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8	B	$P_{\text{air}} + 12 \text{ cm Hg} = P_{\text{atm}}$ $P_{\text{air}} = 76 \text{ cm Hg} - 12 \text{ cm Hg}$ $= 64 \text{ cm Hg}$
9	C	$P_{\text{atm}} - P_{\text{gas}} = 60 \text{ mm Hg}$ $P_{\text{gas}} = 756 \text{ mm Hg} - 60 \text{ mm Hg}$ $= 696 \text{ mm Hg}$
10	A	The pressure of the trapped air is equal in tubes P, Q and R as all the three tube have the same height of mercury column and also have same pressure.
11	D	Evaporation cause cooling.
12	D	Heat the top surface to show air is poor thermal conductor
13	A	A material with high specific heat capacity can store a large amount of thermal energy without a large increase in temperature. When the pot is removed from the heat source, it still holds a significant amount of thermal energy, which continues to transfer to the contents and keeps them boiling for some time.
14	B	Since ice has a lower specific heat capacity compared to water, its temperature increases at a faster rate than that of water.
15	D	
16	D	
17	D	refractive index of water, $n = \frac{\text{speed of light in air}}{\text{speed of light in water}}$ $= \frac{3.0 \times 10^8}{2.3 \times 10^8} = 1.3$ $c = \sin^{-1}\left(\frac{1}{n}\right) = \sin^{-1}\left(\frac{1}{1.3}\right) = 50^\circ$ $\theta = 50^\circ + 90^\circ = 140^\circ$
18	C	Particle X is at zero displacement at time = 0 s. Particle is moving downward at time = 0 s.

19	A	$v = \frac{\text{distance}}{\text{time}}$ $0.40 = \frac{5\lambda}{2.0}$ $5\lambda = 0.80$ $\lambda = 0.8 / 5 = \underline{0.16 \text{ m}}$
20	A	Average time = $(0.72 + 0.80 + 0.7 + 0.8 + 0.7) / 5$ $= 0.744 \text{ s}$ $\text{Speed} = \frac{\text{distance}}{\text{time}} = \frac{2d}{0.744}$ $2d = 320 \times 0.744$ $d = 120 \text{ m}$
21	C	Electromagnetic Spectrum 
22	C	As the charged rod is removed before the earth wire, the excess charges will discharge through the earth wire.
23	B	Object X is negatively charged and object Y is positively charged. X will be attracted to Y as unlike charges attract.
24	C	Ratio of resistance X to Y = 9 : 1 $\frac{R_X}{R_Y} = \frac{9}{1}$
25	D	$A_1 = A$ $A_2 = (0.5)^2 A = 0.25 A$

		$\frac{R_2}{R_1} = \left(\frac{L_2}{A_2}\right) : \left(\frac{L_1}{A_1}\right)$ $\frac{R_2}{R} = \left(\frac{3}{0.25A}\right) : \left(\frac{1}{A}\right)$ $R_2 = 12R$
26	D	For the straight section, ratio of I/V is constant, so resistance R is constant For the curved section, ratio of I/V decreases, so resistance R will increase
27	A	Light intensity $\uparrow$, resistance of LDR $\downarrow$, p.d across LDR $\downarrow$ Therefore p.d across lamp $\uparrow$
28	C	When switch is closed, voltmeter measure the e.m.f
29	D	In normal operation, current through each lamp = $60/240 = 0.25 \text{ A}$ When lamps are first switched on, current through each lamp = 1.0 A Total current supplied = 8.0 A
30	D	voltage = $\frac{\text{energy}}{\text{charge}}$ energy = $3600 \times 1.5 = 5400 \text{ J}$ Power = energy / time = $5400 / 0.003 = 1.8 \times 10^6 \text{ W}$
31	D	The lamp is not faulty so it will lit normally.
32	C	Power = $VI = (230)(9.6) = 2208 \text{ W}$ Cost = $2.208 \text{ kW} \times 3.5/60 \times 30 \times \$0.24 = \$ 0.93$
33	B	Induced magnetism will have opposite polarity
34	B	The perpendicular distance between the magnetic forces in position 1 and 3 are different. The perpendicular distance between the magnetic forces in position 2 and 4 are the same.
35	C	The magnetic field is weaker when it is further away from the current.
36	C	Using Fleming left hand rule the direction of the force acting on the coil to determine whether it will turn clockwise or anticlockwise. The DC motor in diagram 1 cannot turn continuously as it do not have a split ring commutator.
37	D	speed of rotation of the coil steadily is doubled, the amplitude and the frequency of the induced e.m.f will also double.

38	B	Using Fleming left rule and Lenz law to determine the answer.
39	C	$(400 - BR) / 4 = 115 - BR$ $BR = 20 \text{ counts/s}$
40	B	$212 - 4 = 208$

END OF PAPER

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Paya Lebar Methodist Girls' School (Secondary)
Preliminary Examination 2025
Secondary 4 Express / G3

CANDIDATE NAME		CLASS		CLASS INDEX NUMBER	
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CENTRE NUMBER		INDEX NUMBER			
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PHYSICS

6091/01

Paper 1 Multiple Choice

1 September 2025

Additional Materials: Multiple Choice Answer Sheet

1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Write your name, class, class index number on the separate Answer Sheet.

Do not use staples, paper clips, glue or correction fluid.

There are **forty** questions on this paper. Answer all questions. For each question there are four possible answers **A**, **B**, **C** and **D**.

Choose the **one** you consider correct and record your choice in soft pencil on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

This document consists of **18** printed pages.

[Turn over]

2

1 What is the approximate diameter of the Earth?

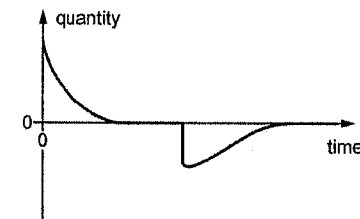
- A** 6400 m **B** 1.3×10^7 m **C** 6.4×10^7 m **D** 1300 km

2 A student intends to measure accurately the diameter of a wire and the internal diameter of a pipe.

What are the most appropriate instruments for the student to use to make these measurements?

	wire	pipe
A	calipers	micrometer
B	compass	micrometer
C	calipers	calipers
D	micrometer	calipers

3 The graph shows how a physical quantity varies with time.

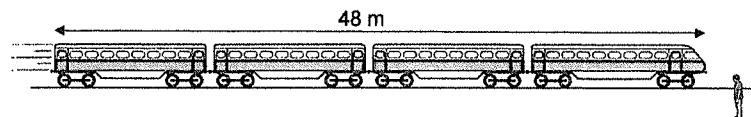


Which event could best be represented by the graph?

- A** the acceleration of a firework rising to a maximum speed
B the speed of a rock as it is dropped from a tall height in air and hits the ground
C the acceleration of a skydiver leaving an aircraft, falling, opening a parachute and falling towards the ground
D the velocity of an asteroid from outer-space as it hits the atmosphere of the Earth and slow down towards the ground

3

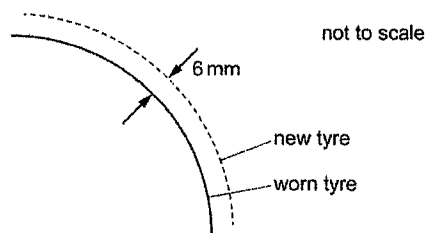
- 4 A man stands next to a railway track. As the head of the train passes the man, it decelerates uniformly.



The entire length of the train is 48 m. The train comes to a complete halt when the tail of the train just passes the man. The duration needed for the train to stop is 8.0 s. Calculate its deceleration.

- A 0.75 m/s² B 0.80 m/s² C 1.5 m/s² D 6.0 m/s²

- 5 The speed shown on a car's speedometer is proportional to the rate of rotation of the tyres. A car has new tyres of diameter 600 mm. The speedometer is accurately calibrated for this diameter. The tyres wear with time and 6 mm of material being removed from the outer surface as shown.



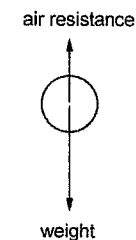
Which statement is correct about the speed shown on the speedometer after this wear has taken place?

- A The speed shown is the same as the actual speed of the car.
 B The speed shown is lower than the actual speed of the car.
 C The speed shown is higher than the actual speed of the car.
 D The speed shown has nothing to do with the diameter of the tyres.

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4

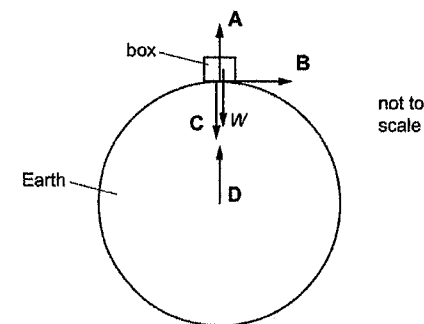
- 6 The diagram shows the vertical forces acting on a ball as it falls vertically through the air. The ball does not reach terminal velocity.



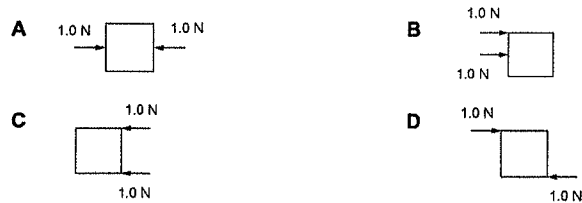
Which row describes what happens to the resultant force on the ball and what happens to the acceleration of the ball as it falls through the air?

	resultant force	acceleration
A	increases	decreases
B	decreases	decreases
C	decreases	increases
D	increases	increases

- 7 A box rests on the Earth, as shown. Newton's third law describes how forces of the same type act in pairs. One of the forces of a pair is the weight W of the box. Which arrow represents the other force of this pair?



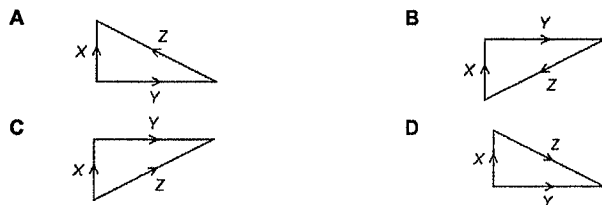
- 8 Four objects each have two forces acting on them. Which object is in equilibrium?



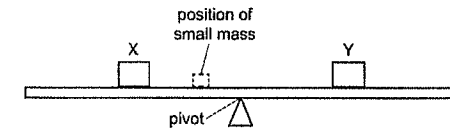
- 9 An object of mass 2.0 kg is taken from the Earth, where the gravitational field strength is 9.8 N/kg. The same object is taken to the Moon, where the gravitational field strength is 1.6 N/kg. Which row is correct?

	weight on Earth / N	weight on Moon / N
A	20	3.2
B	19.6	3.2
C	0.20	0.16
D	98	16

- 10 Which vector diagram correctly shows the force Z as the third force to balance forces X and Y?



- 11 A uniform beam is pivoted at the centre and two identical masses, X and Y, are placed so that the beam balances. A smaller mass is then added at the position shown.

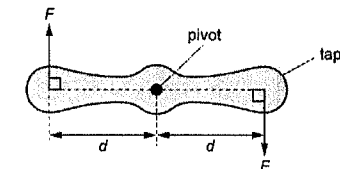


How can the masses be positioned so the beam balances again?

- A move Y towards the pivot
 B move the small mass away from the pivot
 C move X away from the pivot
 D move X towards the pivot
- 12 Three parallel forces act on an object. As a result of these forces, the object is in equilibrium. Which statement must **always** be correct for these forces?

- A They do not all act along the same line.
 B They all act along the same line.
 C They do not all have the same magnitude.
 D They all have the same magnitude.

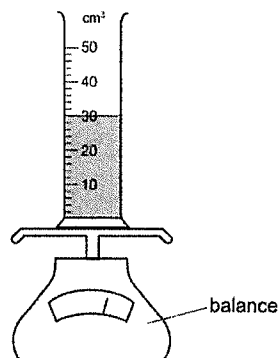
- 13 Two equal forces, F , are applied to a tap as shown.



What is the total moment about the pivot?

- A Fd B $2Fd$ C $\frac{1}{2}Fd$ D zero

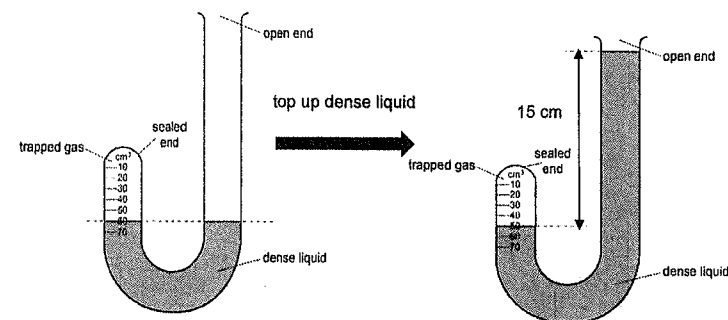
- 14 A measuring cylinder contains 30 cm^3 of a liquid.



Additional liquid is added until the liquid level reaches the 50 cm^3 mark.
The reading on the balance increases by 30 g.
What is the density of the liquid?

- A 0.60 g/cm^3 B 1.0 g/cm^3 C 1.5 g/cm^3 D 1.7 g/cm^3
- 15 The density of sea water is 1030 kg/m^3 . Given that the atmospheric pressure is $101\,000 \text{ Pa}$, calculate the depth in sea water such that the total pressure at that point equal to $513\,000 \text{ Pa}$? [Take $g = 10 \text{ N/kg}$]
- A 9.8 m B 40 m C 49.8 m D 59.6 m

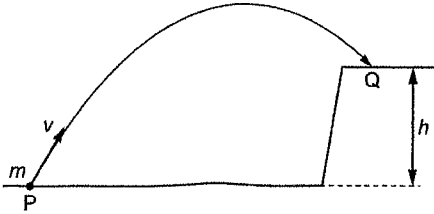
- 16 The diagram shows gas trapped in the sealed end of a tube by a dense liquid. This liquid has a density of $12\,000 \text{ kg/m}^3$ and atmospheric pressure is $100\,000 \text{ Pa}$



Additional dense liquid is added to the tube such that the right side of the tube has an additional height of 15 cm. Calculate the increase in pressure of the trapped gas. [Take $g = 10 \text{ N/kg}$]

- A $180\,000 \text{ Pa}$ B $118\,000 \text{ Pa}$ C $72\,000 \text{ Pa}$ D $18\,000 \text{ Pa}$
- 17 A grasshopper of mass 0.12 g jumps vertically. It uses its back legs over a time of 0.020 s to jump, leaving the ground with a velocity of 3.0 m s^{-1} . What is the average power developed by the legs of the grasshopper?
- A $1.8 \times 10^{-2} \text{ W}$ B $2.7 \times 10^{-2} \text{ W}$ C 27 W D 180 W

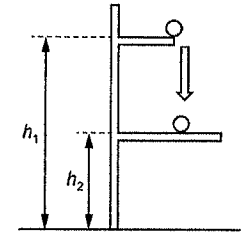
- 18 The diagram shows an object of mass m being projected with speed v from a point P to a point Q on top of a cliff height h . The object does work W against air resistance as it travels from P to Q.



What is the energy in the kinetic store of the object when it reaches point Q?

- A $\frac{1}{2}mv^2 + mgh - W$
 B $mgh - W$
 C $\frac{1}{2}mv^2 - mgh - W$
 D $mgh + W$
- 19 Which of the energy sources is not renewable?
- A nuclear energy
 B biomass energy
 C geothermal energy
 D solar energy

- 20 An object of mass m falls from a higher shelf to a lower shelf.

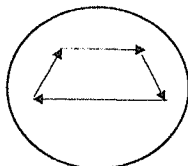


How much gravitational potential energy does the object lose?

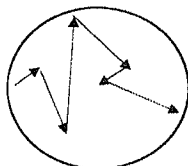
- A $(\frac{m}{g})h_1$ B $mg(h_1 - h_2)$ C $(\frac{m}{g})(h_1 - h_2)$ D mgh_2
- 21 The diagram shows part of a hose used by a firefighter. Water flows through the hose.
-
- cross-section area = $y \text{ cm}^2$ nozzle cross-section area = 12 cm^2
 flow speed = 6.0 m/s flow speed = 1.0 m/s
- The cross-section area of the wider part is 12 cm^2 while the narrower part is $y \text{ cm}^2$. Using the concept of physical property of liquid, calculate y .
- A 12 B 6.0 C 4.0 D 2.0

- 22 Which of the following gives the correct motion of a pollen grain suspended in water?

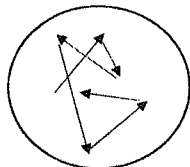
A



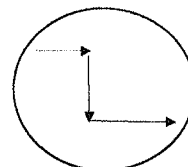
B



C



D



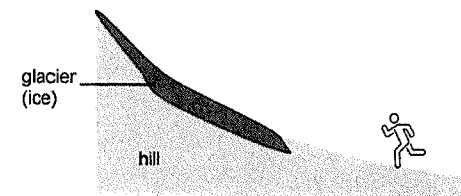
- 23 During evaporation of a liquid, the particles nearer to the surface of liquid escape. This causes the temperature of the liquid to change. Which row describes the temperature change and the change in the average kinetic energy of the remaining particles in the liquid?

	temperature change	change in the average KE of remaining particles
A	increase	no change
B	decrease	no change
C	increase	decrease
D	decrease	decrease

- 24 Object A and object B are in thermal contact with each other. Object A has an internal energy of 150 kJ while object B has an internal energy of 135 kJ. Which of the following statements about heat transfer is correct?

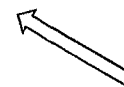
- A There is insufficient evidence to conclude how heat will transfer.
 B Heat will transfer from A to B as A has a higher internal energy.
 C Heat will transfer from B to A as B has a lower internal energy.
 D There is equal amount of heat transfer between A and B.

- 25 A man runs up a slope with a glacier (ice -sheets) as shown below.



He experiences a breeze as he runs uphill. Which diagram shows the correct direction of the breeze experienced by the man.

A



B



C



D



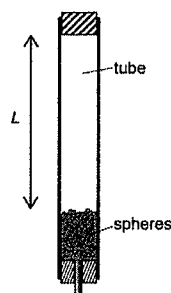
- 26 Four cups A, B, C and D contain hot coffee. Which cup keeps the coffee warm the longest?

	outside surface of the cup	top of the cup
A	white	covered with a lid
B	black	no lid
C	white	no lid
D	black	covered with a lid

- 27 Water in a beaker gains thermal energy at a rate of 3000 W. The water is at its boiling point. The specific latent heat of vaporisation of water is 2260 J /g. How long does it take for 250 g of the water to vaporise?

A 12 s B 18.8 s C 33 s D 188 s

- 28 An insulated tube is filled with a large number n of lead spheres, each of mass m . The tube is inverted s times so that the spheres completely fall through an average distance L each time.



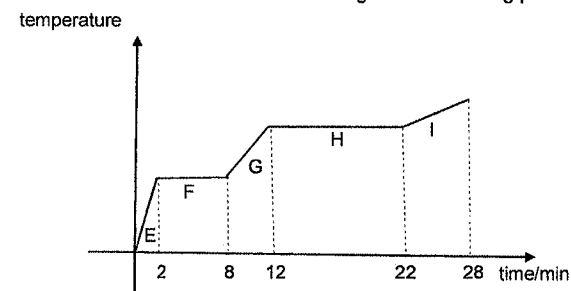
The temperature of the spheres is measured before and after the inversions and the resultant change in temperature is ΔT .

What is the specific heat capacity of lead? [Take g as acceleration due to gravity]

A $\frac{ngL}{ms\Delta T}$ B $\frac{sL}{n\Delta T}$ C $\frac{sgL}{\Delta T}$ D $\frac{nL}{gs\Delta T}$

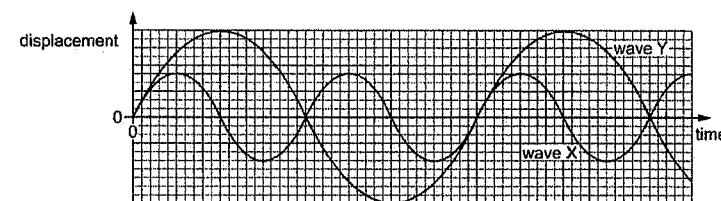
- 29 The temperature-time graph of a certain substance which was originally a solid is shown below. Thermal energy was supplied to it at a **constant rate** until the substance became a liquid and eventually a vapour. The processes that occur are E, F, G, H and I as labelled in the graph.

The mass of the substance remains constant throughout the heating process.



Which of the following statements is true?

- A During process H, the substance is melting.
 B The specific heat capacity of the substance in solid state is the least.
 C The latent heat of fusion is larger than the latent heat of vaporisation.
 D The latent heat of vaporisation is the least among all processes.
- 30 The graph shows the variation with time of the displacement of two separate waves X and Y.



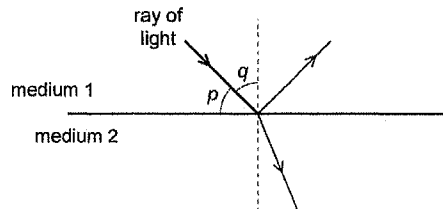
Wave X has frequency f and amplitude A . What is the frequency and what is the amplitude of wave Y?

	frequency	amplitude
A	$\frac{1}{2} f$	$2A$
B	$2f$	$2A$
C	f	$\frac{1}{2} A$
D	$4f$	A

- 31 Which part of the electromagnetic spectrum is used by a remote controller for a television?

A sonar waves
B red light
C infrared waves
D ultraviolet waves

- 32 The diagram shows a ray of light in medium 1 is incident on a glass block. Some of the light is refracted into medium 2 and some of the light is reflected. Two angles, p and q , are marked on the diagram.



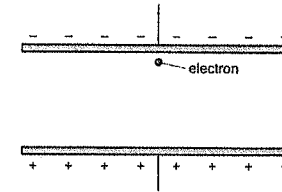
Which row gives the angle of incidence and states whether total internal reflection occurs?

	angle of incidence	total internal reflection
A	p	no
B	q	no
C	p	yes
D	q	yes

- 33 The speed of light in air is 3.0×10^8 m/s.
The critical angle for light in a transparent plastic material placed in air is 37° .
What is the speed of light in the plastic material?

A 5.0×10^8 m/s
B 4.7×10^8 m/s
C 2.4×10^8 m/s
D 1.8×10^8 m/s

- 34 An electron is situated in a vacuum between two charged plates, as shown. It is so light that you can ignore the gravitational force acting on the electron.



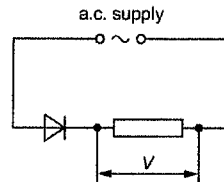
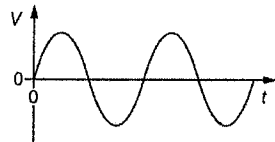
Which statement describes the motion of the electron correctly?

- A The electron accelerates uniformly towards the positively charged plate.
B The electron stays at rest.
C The electron moves with constant velocity towards the positively charged plate.
D The electron undergoes increasing acceleration towards the positively charged plate.

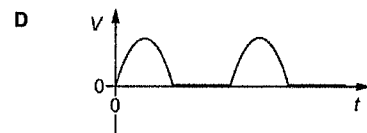
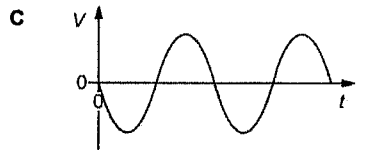
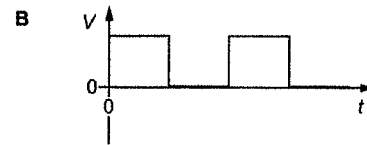
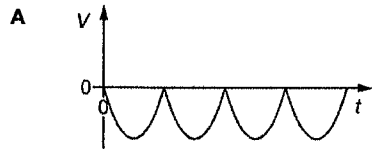
- 35 Four wires are made of the same (pure) metal. The cross-sectional areas, lengths and the temperatures of the wires are shown. Which wire has the largest resistance?

	cross-section area	length	Temperature
A	A	L	T
B	$A/2$	L	$T/2$
C	A	$2L$	$3T$
D	$2A$	$2L$	$T/2$

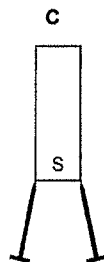
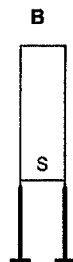
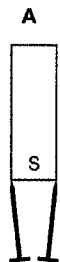
- 36 An alternating (a.c.) supply is connected to a diode and a resistor in series.



Which graph shows how the potential difference V across the resistor varies with time t ?



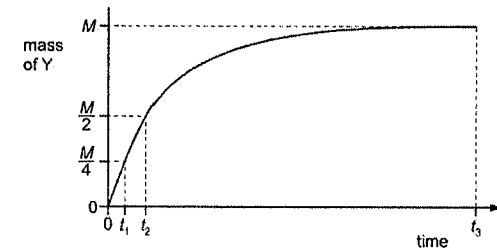
- 37 Two soft-iron pins are suspended from the S pole of a bar magnet. Which diagram shows how the pins are positioned?



- 38 Two transformers, P and Q, each have 2000 turns on their primary coils and 1000 turns on their secondary coils. Both transformers are 100% efficient. The secondary coil of transformer P is connected to the primary coil of transformer Q. Q provides a motor with a current of 0.2 A. What is the current being supplied to the primary of transformer P?

A 0.80 A **B** 0.05 A **C** 0.40 A **D** 0.10 A

- 39 Radioisotope X decays to the stable isotope Y. The graph shows how the mass of Y present in a sample varies with time.



Which time interval gives the half-life of X?

A $t_2 - t_1$ **B** $t_3 - t_2$ **C** $\frac{1}{2} t_3$ **D** t_2

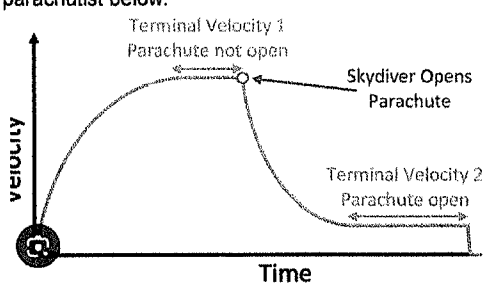
- 40 A nucleus of element X is represented as ${}^{56}_{26}\text{X}$. Which is an isotope of element X?

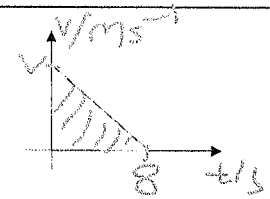
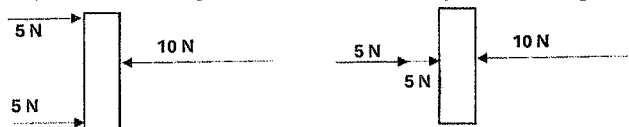
A ${}^{57}_{26}\text{X}$ **B** ${}^{56}_{22}\text{X}$ **C** ${}^{56}_{24}\text{X}$ **D** ${}^{16}_{26}\text{X}$

The End

Answer Key

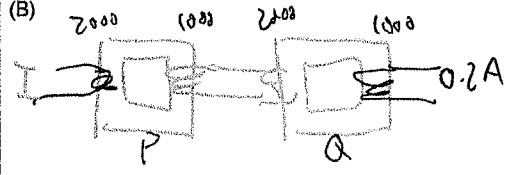
1	2	3	4	5	6	7	8	9	10
B	D	C	C	C	B	D	A	B	B
11	12	13	14	15	16	17	18	19	20
D	C	B	C	B	D	B	C	A	B
21	22	23	24	25	26	27	28	29	30
D	C	D	A	B	A	D	C	B	A
31	32	33	34	35	36	37	38	39	40
C	B	D	A	C	D	C	B	D	A

1	Radius of earth = 6400 km = 6.4×10^6 m Diameter = $2 \times 6.4 \times 10^6$ m = 1.28×10^7 m (B)
2	Micrometer is better than calipers to measure thickness of wire. Inner jaws of calipers are needed to measure internal diameter of pipes (D)
3	Option A – Not possible as firework reaching max speed will have acceleration greater or equals zero. It wont change direction. Option B – Not possible as speed is always greater or equals zero. There should be no negative speed. Option D – Not possible as the velocity of an asteroid hitting earth should always be towards earth and should not change direction/sign. C – correct answer Use gradient = acceleration to sketch acceleration time graph based on velocity time graph of parachutist below: 

4	 Area under graph = 48 m $48 = \frac{1}{2} \times 8 \times V$ $V = 12 \text{ m/s}$ $a = (0-12)/8$ $= -1.5 \text{ m/s}^2$ (C)
5	For the same rate of rotation and hence same speed displayed at the speedometer, a worn wheel has less circumference compared to a new wheel. So a worn wheel actually cover less distance per unit time. This means the displayed speed is higher than its actual speed. (C)
6	(B) As speed of ball increases, air resistance acting upward increases too. Thus, net force (Weight – air resistance) decreases. By $F_{\text{net}} = ma$, as F_{net} decreases, acceleration decreases.
7	(D) Action-reaction pairs act on different objects.
8	(A) An object in equilibrium must have net force zero and net moment zero.
9	(B) Apply $w = mg$
10	(B) 3 forces in equilibrium must form a closed triangle.
11	(D) Move X closer to pivot to reduce anticlockwise moment. This will offset the additional anticlockwise moment due to the small mass.
12	(C) One of the necessary conditions for equilibrium is that net force must be zero. If three forces are parallel and they are of the same size, they will never have a vector sum of zero. Thus, the three parallel forces MUST NEVER be of the same size for equilibrium to occur. 3 forces parallel but not along the same line 3 forces parallel and along same line 
13	(A) Total clockwise moment = $F(d) + F(d)$ $= 2Fd$

14	(C) Added mass = 30g Volume = 50-30 = 20 cm ³ Density = M/V = 30/20 = 1.5 g/cm ³
15	(B) Pressure due to liquid = $h\rho g$ = 513 000 – 101 000 $h \times 1030 \times 10 = 412000$ $h = 40$ m
16	(D) Increase in pressure of trap gas = Final pressure – initial pressure = $(P_{\text{atm}} + h\rho g) - P_{\text{atm}}$ = $h\rho g$ = $0.15 \times 12\,000 \times 10$ = 18 000 Pa
17	(B) $P = WD/t$ = $\frac{1}{2}mv^2/t$ = $0.5 \times (0.12/1000) \times (3^2)/0.02$ = 2.7×10^{-2} W
18	(C) Total energy at P = Total energy at Q + W.D against air resistance $\frac{1}{2}mv^2 = KE \text{ at } Q + mgh + W$ $KE \text{ at } Q = \frac{1}{2}mv^2 - mgh - W$
19	(A) Nuclear is not renewable
20	(B) Application of $mg\Delta h$
21	(D) Water is incompressible So cross section x length = volume $6y = 12 \times 1$ $y = 2$
22	(C) Particles movement should be completely random. This means their movement should not be predictable and there should be no preferred "drift" direction.
23	(D)
24	(A) Internal energy = total KE of particles + total PE of particles. Heat transfer only occur when there is a difference in temperature. Temperature of an object is a measure of average KE of all particles. Thus, there is insufficient evidence as we cannot find average KE of particles in object A & B.

25	(B) The glacier (ice) cools the air around it, the air becomes denser and sink along the slope.
26	(A) White surface reduces heat loss via radiation. Having a lid reduces heat loss via convection and evaporation
27	(D) $Q = mL$ $Pt = mL$ $(3000)t = 250 \times 2260$ $t = 188$ s
28	(C) GPE of 1 trip = $(nm)gL$ Total GPE = $(nm)gL$ s GPE = $Mc\Delta T = (nm)c\Delta T$ $c = (nm)gL \text{ s} / (nm)c\Delta T$ = $\frac{sgL}{\Delta T}$
29	(B) Since power transferred is constant and $E = pt$, the longer the duration, the greater the amount of heat transferred. Since heating up the substance in solid state takes the least time, specific heat capacity for solid state must be the least. Recall that the smaller the specific heat capacity, the larger the change in temperature per unit time (gradient) $pt = mc\Delta T$ Make temp the subject, $\Delta T = \left(\frac{p}{m}\right)\frac{1}{c}t$ Gradient is $\left(\frac{p}{m}\right)\frac{1}{c}$, since p/m is fixed, a smaller c will lead to a larger gradient.
30	(A) Y has double the amplitude Y has double the period which means $\frac{1}{2}$ the frequency
31	(C) Infra red is use for remote control
32	(B)

33	(D) $n = 1/\sin(C)$ $= 1/\sin(37^\circ)$ $1/\sin(37^\circ) = c/v$ $v = (3 \times 10^8) \times \sin(37^\circ)$ $= 1.8 \times 10^8 \text{ m/s}$
34	(A) Electric field is uniform inside parallel plate. Thus, electric force acting on electron is a constant. By $F_{\text{net}} = ma$, the acceleration is uniform/constant.
35	(C) $R \sim L/A$ Option B and C has the same ratio of L/A . However, C has a higher temperature, causing its resistivity to increase as it is a metal. So C has higher resistance.
36	(D) Diode will block the negative voltage as it is in the reverse bias direction.
37	(C) The nails have induced like poles facing each other. So they must repel.
38	(B)  Let current at pri coil of P be I . Current at sec coil of P will be $2I$ as voltage is halved while power is conserved. Current at pri coil of Q is the same as $2I$ (series connection) Current at sec coil of Q will be $4I$ as voltage is further halved too. $4I = 0.20 \text{ A} \rightarrow I = 0.05 \text{ A}$
39	(D) $t=0$ to $t=t_2$, mass of X decreases from M to $M/2$, indicating half the sample is lost and hence the time taken must be half life.
40	(A) Proton number must remain at 26 to be the same element. Isotopes are nuclides of the same element.



PASIR RIS CREST SECONDARY SCHOOL
Preliminary Examination
Secondary Four Express

CANDIDATE NAME

CLASS / INDEX NUMBER

Physics

Paper 1

6091/01
22 August 2025
1 hour

Additional Materials: Multiple-Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your candidate name, class and index number on all the work you hand in.
Do not use staples, paper clips, glue or correction fluid.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the one you consider correct and record your choice in **soft pencil** on the separate answer sheet.

The use of an approved scientific calculator is expected, where appropriate.

Read the instructions on the answer sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

At the end of the examination, hand in the Answer Sheet and this booklet separately.

The total number marks for this paper is 40.

For Examiner's Use
40
Parent's Signature

1 What is the unit of work done expressed in base units?

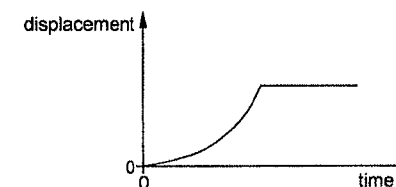
- A (kg m) / s B (kg m²) / s
C (kg² m²) / s D (kg m²) / s²

2 The distance from the earth to the sun is 1.5×10^{11} m and the width of a pollen grain is 2.0×10^{-4} m.

How are these values expressed with prefixes?

	distance from the earth to the sun	width of a pollen grain
A	1.5×10^2 Tm	2.0×10^{-1} mm
B	1.5×10^2 Gm	2.0×10^{-1} mm
C	1.5×10^2 Tm	2.0×10^{-1} cm
D	1.5×10^2 Gm	2.0×10^{-1} cm

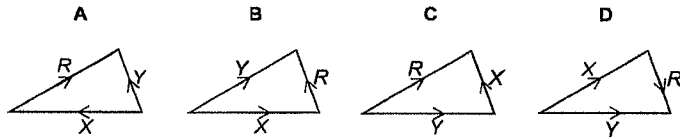
3 The diagram shows how the displacement of a car varies with time as it moves from rest from a traffic junction.



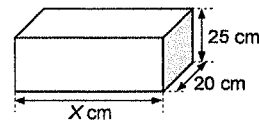
Which statement about a part of the car's motion is correct?

- A The car travels at constant velocity.
B The car has deceleration.
C The car has acceleration.
D The car reverses in direction.

- 4 Which diagram shows two forces X and Y acting together to produce a resultant force R ?



- 5 Which statement about gravitational field strength is correct?
- A Gravitational field strength is the weight of the object.
- B Gravitational field strength is the gravitational field per unit mass placed at that point.
- C Gravitational field strength is the gravitational force per unit area placed at that point.
- D Gravitational field strength is the gravitational force per unit mass placed at that point.
- 6 A copper sphere of density 9000 kg/m^3 and mass 180 kg is melted and moulded to form a uniform block with dimensions as shown in the diagram.



What is the value of X ?

- A 30 B 40
C 50 D 100

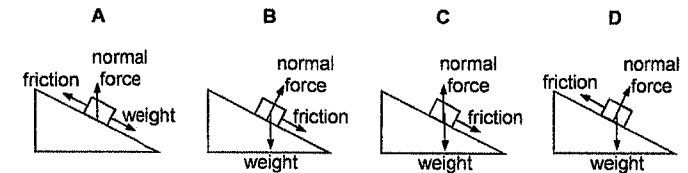
- 7 A ball falls vertically downwards from a tall cliff. As it falls, it achieves terminal velocity.

Which of the following statements about the air resistance acting against the ball is correct.

- A The air resistance is constant throughout the fall.
- B The air resistance increases and then becomes constant.
- C The air resistance decreases and then becomes constant.
- D The air resistance decreases and then increases.

- 8 A block of wood rests on a rough slope.

Which free-body diagram shows the directions of the forces acting on the block?



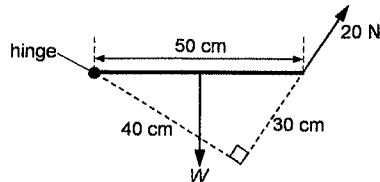
- 9 A force of 20 N acts against an object that is moving at a speed of 12 m/s . No other force acts on the object. The object is brought to rest in 3.0 s .

What is the mass of the object?

- A 1.6 kg B 2.6 kg
C 4.0 kg D 5.0 kg

5

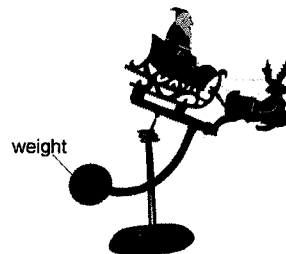
- 10 A uniform rod of weight W is hinged at one end. The rod is 50 cm in length. It is kept in equilibrium by applying a force of 20 N as shown.



What is the weight W of the rod ?

- A 12 N B 16 N
C 24 N D 32 N

- 11 A balancing toy is oscillating continuously. The toy has a large weight near the bottom. The diagram shows one instant during the toy's oscillation.

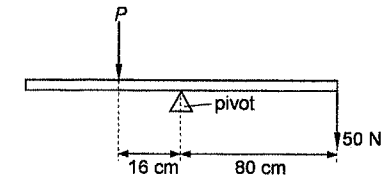


Which statement about the toy's oscillation is correct?

- A The weight of the toy produces an anticlockwise moment about the pivot.
B The normal force at the pivot produces an anticlockwise moment about the pivot.
C The friction between the pivot and the base causes the toy to turn in an anticlockwise direction.
D The centre of gravity of the toy is at the weight.

6

- 12 A uniform beam is pivoted at its middle and is kept balanced by two forces acting on it.

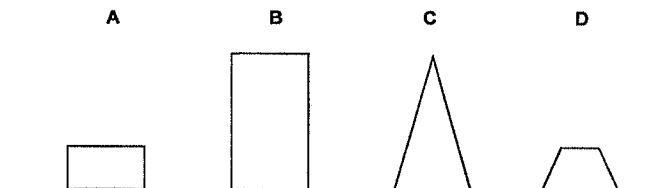


What is the upward force that the pivot exerts on the beam?

- A 50 N B 250 N
C 300 N D 350 N

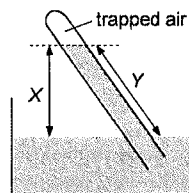
- 13 The diagram shows four uniform objects of equal mass.

Which object is least stable?



7

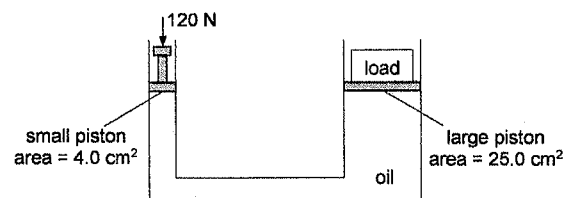
- 14 The diagram shows a barometer with some air trapped at the top. P is the pressure of the trapped air.



The liquid in the barometer has a density ρ and the gravitational field strength is g .

Which expression equals the atmospheric pressure?

- A $X\rho g$ B $X\rho g + P$ C $Y\rho g$ D $Y\rho g + P$
- 15 In a hydraulic press, the small piston is pushed down with a force of 120 N.
- Neglecting the weight of the pistons and the effects of friction, what is the distance moved by the load if the small piston moves down by a distance of 30.0 cm?



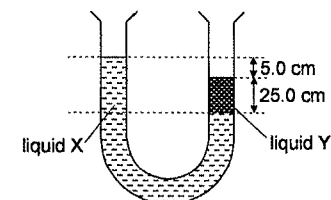
- A 4.8 cm B 187.5 cm
C 750 cm D 3000 cm

[Turn over

8

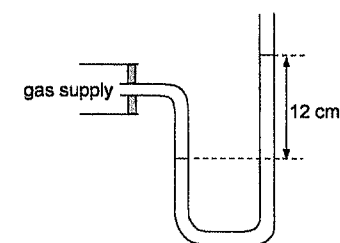
- 16 Two liquids X and Y are poured into a U-shaped tube. The density of liquid X is 0.75 g/cm^3 . Atmospheric pressure is $101\,000 \text{ Pa}$ and gravitational field strength g is 10 N/kg .

What is the density of liquid Y?



- A 0.15 g/cm^3 B 0.63 g/cm^3
C 0.90 g/cm^3 D 1.20 g/cm^3
- 17 A manometer is connected to a gas supply. The manometer is filled with mercury of density $13\,600 \text{ kg/m}^3$. Atmospheric pressure is $110\,000 \text{ Pa}$ and gravitational field strength g is 10 N/kg .

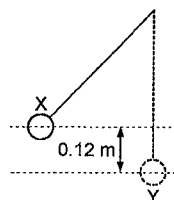
What is the pressure of the gas supply?



- A 0.81 cmHg B 12 cmHg
C 12.8 cmHg D 93 cmHg

9

- 18 A pendulum bob is released from rest at point X. X is 0.12 m above Y. Y is the lowest point of the oscillation. Ignore the effects of friction.



What is the speed of the bob at Y?

- A 0.12 m/s B 1.2 m/s
C 1.5 m/s D 10 m/s
- 19 An F1 car has a mass of 900 kg and accelerates from rest to a speed of 26 m/s in 3.0 s. Ignore the effects of friction.

What is the minimum power of the engine of the F1 car?

- A 300 W B 7800 W
C 23 000 W D 101 000 W

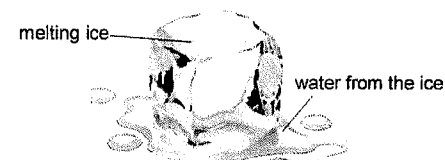
- 20 The pressure of a gas in a container is reduced by cooling the gas at constant volume.

Which row describes the effect on the collisions of the gas molecules with the walls of the container?

	force of collision of each gas particle	frequency of collision of each gas particle
A	harder	more frequent
B	harder	less frequent
C	less hard	more frequent
D	less hard	less frequent

10

- 21 A block of ice melts as energy is transferred to the ice from the surroundings.



While the ice is melting, the temperature of the water from the ice is at the melting point of the ice.

How do the molecules of the liquid water compare with the molecules of ice?

- A Their average internal energy is greater and the force between them is smaller.
B Their average internal energy is smaller and the force between them is smaller.
C Their average internal energy is smaller and the force between them is same.
D Their average internal energy is the same and the force between them is the same.

- 22 Pollen grains suspended in water are observed to be moving when viewed under a microscope.

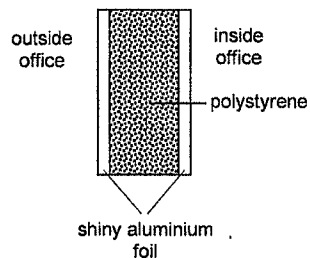
Which statement explains this observation?

- A Convection current occur in the water.
B Water molecules bombard the pollen grains.
C Pollen grains gain energy from the surrounding air and begin vibrating.
D Pollen grains bombard the water molecules.

[Turn over

11

- 23 The diagram shows a type of building board used as an office wall. The outside of the office is much warmer than the inside of the office.

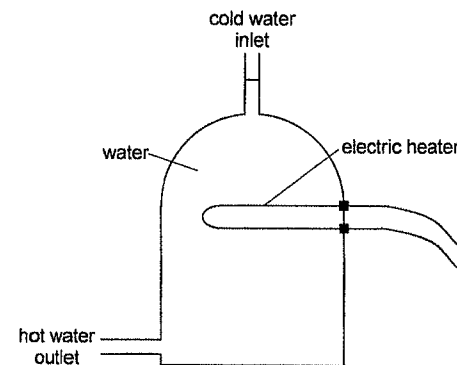


Which row shows why this building board provides good insulation from the hot weather outside the office?

	polystyrene	shiny aluminium foil
A	good conductor of energy	good absorber and emitter of radiation
B	poor conductor of energy	good absorber and emitter of radiation
C	good conductor of energy	poor absorber and emitter of radiation
D	poor conductor of energy	poor absorber and emitter of radiation

12

- 24 A student designs a hot water tank, as shown in the diagram. There are errors in his design.



Which of the statements describes one of the errors in design?

- A The electric heater must be placed lower to allow energy to be transferred by radiation to all the water.
- B The hot water outlet and cold water inlet are in the wrong positions because hot water molecules are bigger than cold water molecules.
- C The electric heater must be placed lower to allow energy to be transferred by conduction to all the water.
- D The hot water outlet and cold water inlet are in the wrong positions because cold water is more dense than hot water.
- 25 A 250 W heater is immersed in a filter funnel of crushed ice. When the heater is switched on, the mass of water collected from the melting ice in 5 minutes is 200 g.

What is the specific latent heat of fusion of ice?

- A 6.25 J/kg B 375 J/kg
- C 6250 J/kg D 375 000 J/kg

[Turn over

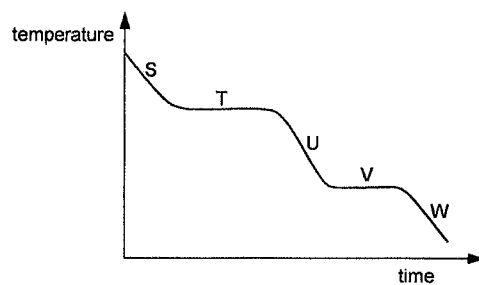
13

- 26 Equal masses of alcohol and mercury are heated to 60 °C and then allowed to cool.

Which statement explains why the mercury cools faster than the alcohol?

- A Mercury has a higher boiling point than alcohol.
- B Mercury has a lower specific heat capacity than alcohol.
- C Mercury has a lower specific latent heat than alcohol.
- D Mercury transfers energy to the surroundings by convection better than alcohol.

- 27 The graph shows how the temperature of a substance varies with time. The substance is initially in the gaseous state.



At which two points on the graph does the kinetic energy of the substance remain the same?

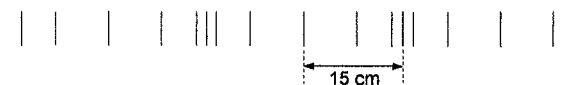
- A S and T
- B T and U
- C T and V
- D V and W

14

- 28 Which row gives an example of a transverse wave and of a longitudinal wave?

	transverse wave	longitudinal wave
A	ultrasound	infrared
B	infrared	ultraviolet
C	ultraviolet	X-rays
D	X-rays	ultrasound

- 29 A longitudinal wave travels along a spring. The diagram represents the position of the coils of the spring at one particular time.



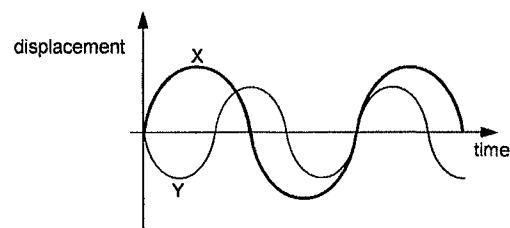
A point on the spring moves backwards and forwards to its maximum displacement between two positions that are 4.0 cm apart.

Which row describes the wave?

	wavelength / cm	amplitude / cm
A	30	4.0
B	30	2.0
C	15	4.0
D	15	2.0

15

- 30 A signal generator produces two sounds X and Y. The displacement-time graph for these two sounds are shown in the diagram.



Which statement about the two sounds is correct?

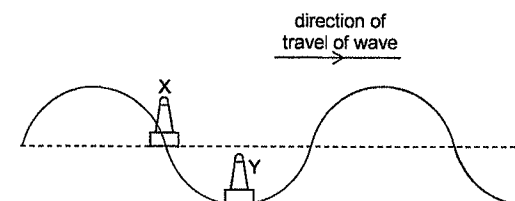
- A X is louder than Y and X has a lower pitch than Y.
 B X is louder than Y and X has a higher pitch than Y.
 C X is softer than Y and X has a lower pitch than Y.
 D X is softer than Y and X has a higher pitch than Y.
- 31 A man stands at a distance from a large, flat cliff. He claps his hands once and hears an echo from the cliff. He then claps at regular intervals until each clap is made just as he hears the echo from the previous clap. His frequency of clapping is 0.25 Hz and the speed of sound through air is 330 m/s.

What is the man's distance from the cliff?

- A 165 m B 330 m
 C 660 m D 990 m

16

- 32 The diagram shows two buoys X and Y at one particular time as a wave moves across the ocean water from left to right.



Which row describes the movement of the buoys during the next complete cycle of the wave?

	buoy X	buoy Y
A	rises then falls then rises	rises then falls
B	rises then falls	rises then falls
C	falls then rises then falls	rises only
D	falls then rises then falls	rises then falls

- 33 A wave moves across the surface of water in a ripple tank. In 4.0 s, a wavefront moves a distance of 120 cm. The wavelength of the wave is 5.0 cm.

What is the frequency of the wave?

- A 3.0 Hz B 6.0 Hz
 C 24 Hz D 40 Hz

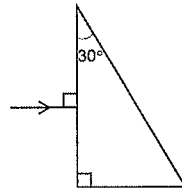
- 34 Which statement about ultraviolet radiation is correct?

- A It has a higher frequency than X-rays and is non-ionising.
 B It has a lower frequency than X-rays and is non-ionising.
 C It has a higher frequency than X-rays and is ionising.
 D It has a lower frequency than X-rays and is ionising.

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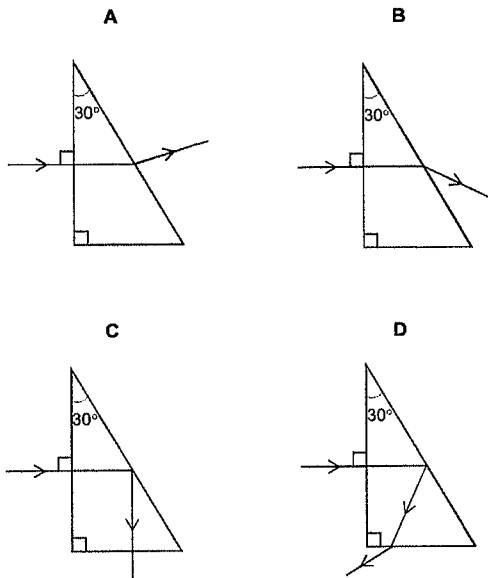
17

- 35 Light is shone perpendicularly onto the surface of a transparent glass prism in the shape of a right-angle triangle, as shown in the diagram.



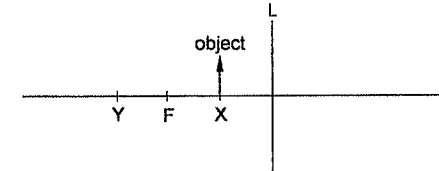
The critical angle of the prism glass is 42° .

Which diagram shows the path of the light ray until it emerges from the prism?



18

- 36 An object is placed at position X in front of a thin converging lens L. Point F is the focal point of the lens, as shown. The diagram is drawn to scale.

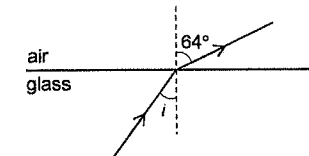


The object is then moved to position Y.

Which row describes the image formed with the object placed at position X and at position Y?

	image with object at X	image with object at Y
A	inverted and magnified	upright and magnified
B	upright and magnified	upright and diminished
C	upright and magnified	inverted and diminished
D	upright and magnified	inverted and magnified

- 37 The diagram shows light travelling from glass to air and striking the boundary with angle of incidence i . The angle of refraction in air is 64° .



The critical angle of the glass is 39° .

What is the angle of incidence i ?

- A 32° B 34°
C 39° D 40°

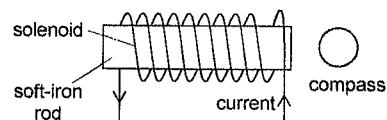
[Turn over

- 38 It costs \$0.22 for 1 kWh of electrical energy.

How much will it cost to run a 120 W speaker for 15 hours?

- A \$0.40 B \$1.80
C \$396 D \$1427

- 39 A compass is placed near the end of a soft-iron rod placed within a solenoid. A large current flows in the solenoid as shown. The needle of the compass is not shown.



Which direction of the compass needle is correct?

- A $\uparrow$ B $\downarrow$
C $\leftarrow$ D $\rightarrow$

- 40 Which of the following statements about soft and hard magnetic materials is correct?

- A Soft magnetic materials have stronger induced magnetism compared to hard magnetic materials.
B Soft magnetic materials retain magnetism longer than hard magnetic materials.
C Soft magnetic materials are harder to magnetise than hard magnetic materials.
D An example of a soft magnetic material is iron and an example of a hard magnetic material is nickel.

End of Paper 1

Paper 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
D	B	C	C	D	B	B	D	D	D	A	C	B	B	A	C	D	C	D	D
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
A	B	D	D	D	B	C	D	B	A	C	A	B	D	B	D	B	A	C	A



Pasir Ris Secondary School

Name	Class	Register Number
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SECONDARY 4 EXPRESS PRELIMINARY EXAMINATION 2025

PHYSICS

6091/01

Paper 1 Multiple Choice

2 September 2025

Tuesday 0800 – 0900

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid or tape.

There are **forty** questions in this section. Answer **all** questions. For each question there are four possible answers, **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

The use of an approved scientific calculator is expected, where appropriate.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

This document consists of **16** printed pages, including this cover page.

[Turn over

2

- 1 The wavelength of X-ray is about 10 times longer than the diameter of an atom.

What is the wavelength of X-ray in air?

- A 3×10^{-24} m B 3×10^{-17} m C 3×10^{-12} m D 3×10^{-9} m

- 2 Which row shows the most suitable instruments used for the measurements of these given objects?

	diameter of a coin	thickness of a copper wire
A	digital calipers	digital micrometer screw gauge
B	metre rule	digital calipers
C	digital micrometer screw gauge	digital calipers
D	measuring tape	digital micrometer screw gauge

- 3 What is the unit of force expressed in base units?

- A $\text{kg m}^2 / \text{s}^2$ B $\text{kg m} / \text{s}^2$ C J / m D Pa / m^2

- 4 Which description is **not** correct?

- A Acceleration can be determined from the gradient of a velocity–time graph.
B Acceleration is the rate of change of velocity.
C Displacement can be determined from the area under a velocity–time graph.
D Velocity is the rate of change of distance.

- 5 The table shows the displacement of a car during a 10 s period of its journey.

time / s	0	2	4	6	8	10
displacement / m	+16	+12	+8	+4	0	–4

How is the car moving during its journey?

- A moving with constant deceleration
B moving with constant velocity
C moving with decreasing velocity
D moving with non-uniform acceleration

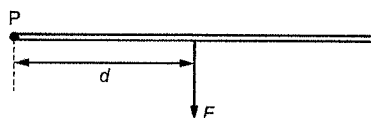
- 6 Which property of an object determines its resistance to a change from its state of rest or motion?

- A its mass
B its shape
C its surface area
D its volume

- 7 Which row contains two correct descriptions about the mass and the weight of an object?

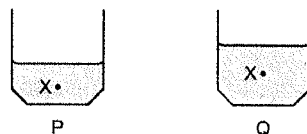
	mass of an object	weight of an object
A	measured using a measuring cylinder	measured using a balance
B	gravitational force exerted on the object	quantity of matter in the object
C	measured in newtons	measured in kilograms
D	not affected by gravitational field strength	affected by gravitational field strength

- 8 The diagram shows a force F acting at 90° to a bar at a distance d from the point P.



Which pair of changes causes the greatest increase in the moment of the force F about the point P?

- A changing the angle between force F and the bar to 45° and halving d
 B changing the angle between force F and the bar to 45° and doubling d
 C doubling F and halving d
 D doubling F and doubling d
- 9 Two identical containers, P and Q, are partly filled with different quantities of sand. The position of the centre of gravity for each container is labelled X.

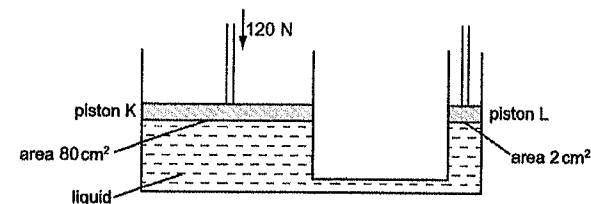


Which container is more stable and what is the reason why it is more stable?

- A P is more stable because it has a lower centre of gravity.
 B P is more stable because it has a smaller mass.
 C Q is more stable because it has a greater mass.
 D Q is more stable because it has a higher centre of gravity.

[Turn Over

- 10 The system shown in the diagram contains a liquid.



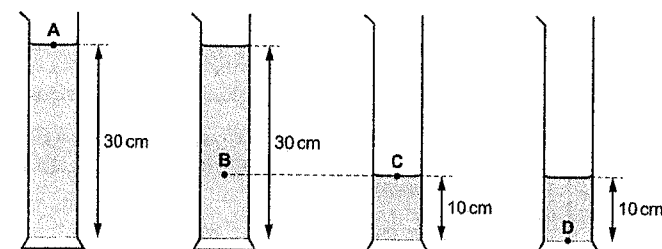
A downward force of 120 N is exerted on the piston K and the liquid is displaced by 0.4 cm.

What will be the upward force exerted on piston L and the distance moved by piston L?

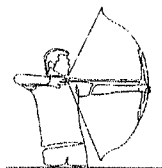
	upwards force on piston L / N	distance moved by piston L / cm
A	4800	0.01
B	3.0	16.0
C	3.0	0.01
D	4800	16.0

- 11 Four measuring cylinders are filled with the same liquid to the heights shown.

At which position is the pressure the greatest?



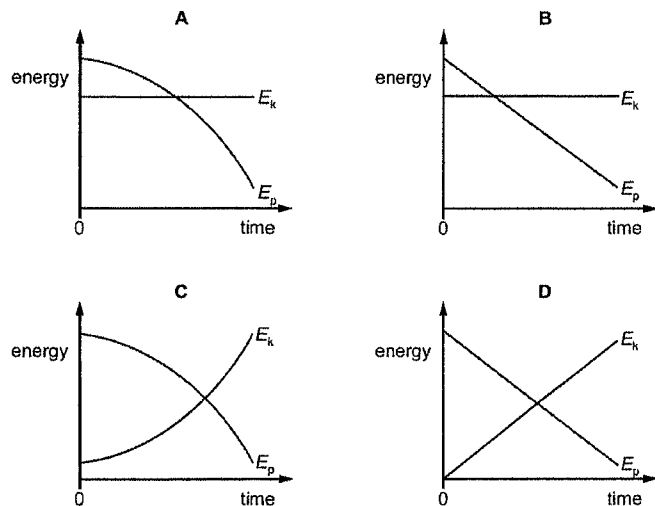
- 12 An arrow was released from a bow by a man.



What is the principal energy change taking place in the bow when the arrow was released?

- A elastic potential store to internal store of energy
 B elastic potential store to kinetic store of energy
 C kinetic store to gravitational potential store of energy
 D gravitational potential store to internal store of energy
- 13 A steel ball is falling at constant speed in oil.

Which graph shows the variation with time of the energy in the gravitational potential store E_p and the energy in the kinetic store E_k of the ball?



[Turn Over

- 14 A man of mass 65 kg runs up a flight of stairs 20 m high in 50 seconds. The gravitational field strength g is 10 N/kg.

What is the power of the man?

- A 0.65 W B 26 W C 260 W D 650 000 W

- 15 According to the kinetic theory, matter is made up of very small particles in a constant state of motion.

Which row best describes the particle behaviour in the gas state?

	arrangement of particles	motion of particles
A	orderly	move randomly at high speed
B	randomly	vibrate and slide over each other
C	disorderly	vibrate around a fixed position
D	randomly	move randomly at high speed

- 16 A liquid is heated.

Which statement is **incorrect**?

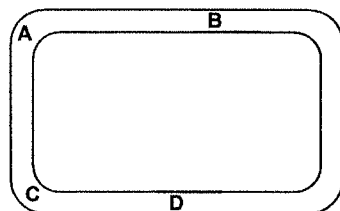
- A The liquid molecules expand.
 B The liquid molecules gain energy.
 C The liquid molecules move further apart.
 D The liquid molecules move faster.

- 17 Two objects are in thermal contact and are at different temperatures. What is/are affected by the temperatures of the two objects?

- I The direction of energy transfer between the objects.
 II The amount of energy in the internal store of each object.
 III The process by which energy is transferred between the objects.

- A I only
 B II only
 C I and II only
 D I, II, and III

- 18 A heating element is to be positioned in a narrow sealed tube of a liquid.



Which would be the best position, A, B, C or D, to place the heating element in order to obtain the best circulation of the liquid throughout the tube?

- 19 The characteristic of certain cooking pots is that when they are removed from the source of heat, the contents in the pots may continue to boil for some time.

What may be the reason for this?

- A The material of the pot has high specific heat capacity.
- B The material of the pot has low specific heat capacity.
- C The pot is made of a very poor thermal conductor
- D The pot is made of a poor radiator of infrared radiation

- 20 Molecules leave a boiling liquid to form vapour. The vapour and the liquid have the same temperature.

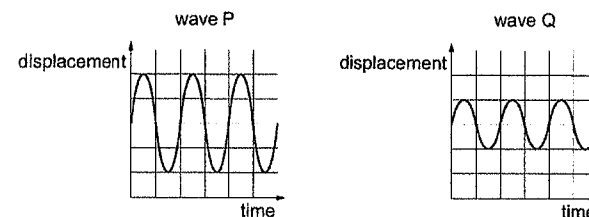
What is the change in the average internal potential energy and the change in the average internal kinetic energy of these molecules when they leave the boiling liquid to form vapour?

	average internal potential energy	average internal kinetic energy
A	increases	increases
B	decreases	stays constant
C	stays constant	increases
D	increases	stays constant

- 21 What is a wavefront?

- A A line joining all nearby points that are in phase.
- B A line joining crests and troughs.
- C The first wave produced by a source.
- D The transfer of energy by oscillation.

- 22 The diagrams represent two different sound waves. The scales of both sets of axes are the same.



How do the pitch and the loudness of P compare with the pitch and the loudness of Q?

	pitch of P	loudness of P
A	greater than Q	same as Q
B	lesser than Q	greater than Q
C	same as Q	greater than Q
D	same as Q	lesser than Q

- 23 Which statement is true about gamma rays?

- A Gamma rays travel at the highest speed in any medium.
- B Only gamma rays are used to kill cancer cells in radiation therapy.
- C Gamma rays are the only electromagnetic waves that have ionising effect.
- D Gamma rays have the highest frequency in the electromagnetic spectrum.

- 24 Which components of the electromagnetic spectrum are used to communicate from a remote controller to a television set and from the Earth to a satellite?

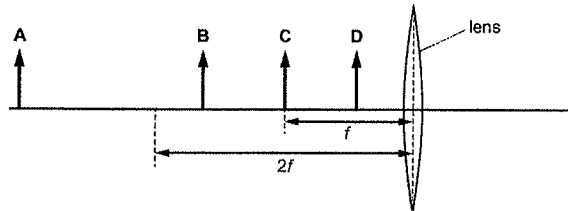
	remote controller to TV set	the Earth to a satellite
A	infrared	microwave
B	infrared	radio wave
C	light	microwave
D	light	radio wave

- 25 A ray of ultraviolet light strikes the surface of a glass block and slows down to 1.8×10^8 m/s.

What is the refractive index of the glass block to ultraviolet light?

- A 0.60
- B 1.7
- C 1.8
- D 5.4

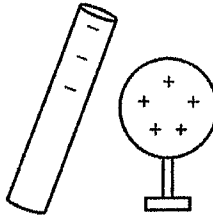
- 26 An object is placed in front of a converging lens. The lens has a focal length f .
The lens produces a real, diminished image of the object.
In which labelled position is the object placed?



- 27 A balloon becomes positively charged when it is rubbed with wool.
What causes the balloon to be charged?

- A diffusion
B induction
C transfer of negative charges
D transfer of positive charges

- 28 A negatively-charged rod is brought near a positively-charged sphere as shown.



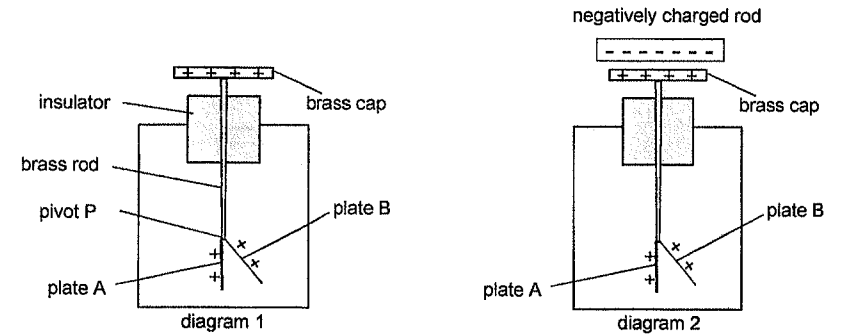
The sphere is then earthed with the rod still in place.

What happens to the charge on the objects?

	rod	sphere
A	more negative	more positive
B	no change	less positive
C	less positive	more positive
D	no change	more positive

- 29 An electroscope is used to determine the presence of charges. Plate A is fixed in position, but plate B can swing freely about pivot P.

Diagram 1 shows that initially, the electroscope is charged positively. Both plates A and B are not touching each other.



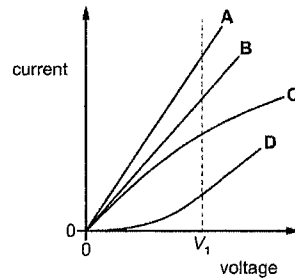
A negatively charged rod is then placed near the brass cap of the electroscope, as shown in diagram 2.

Which statement explains what happens to plate B?

- A Plate B swings further away from plate A because more positive charges are repelled downwards from the cap, causing both plates to be more positively charged.
B Plate B swings further away from plate A because negative charges are repelled downwards from the cap, causing both plates to become negatively charged.
C Plate B swings less from plate A because negative charges are repelled downwards from the cap, causing both plates to be less positively charged.
D Plate B swings less from plate A because positive charges are attracted upwards to the cap, causing both plates to be less positively charged.

- 30 The I - V characteristics for four components, A, B, C and D, are shown.

Which component has the greatest resistance when the potential difference across it is V_1 ?

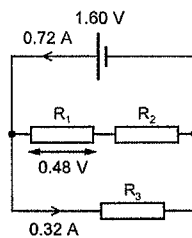


- 31 The current in a filament lamp is increased.

Which statement about the lamp is correct?

- A The brightness of the lamp decreases.
- B The potential difference across the filament decreases.
- C The resistance of the filament decreases.
- D The temperature of the filament increases.

- 32 The diagram shows a circuit consisting of a cell and three resistors R_1 , R_2 and R_3 .

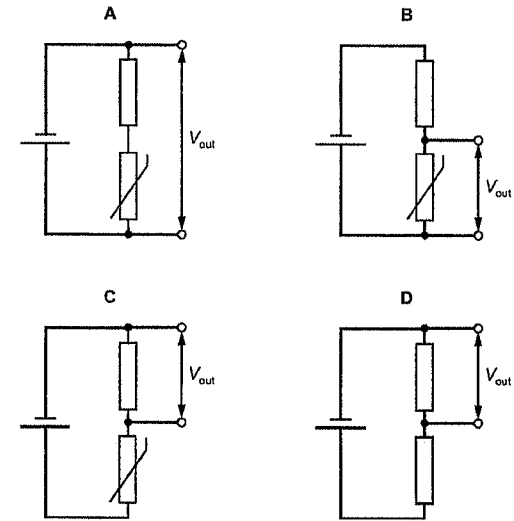


The cell has electromotive force (e.m.f.) 1.60 V. The current in the cell is 0.72 A. The potential difference across R_1 is 0.48 V. The current in R_3 is 0.32 A.

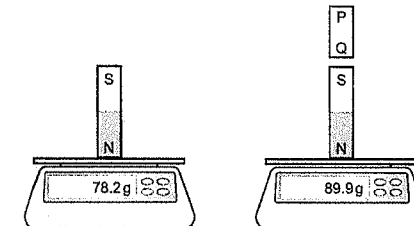
What is the resistance of R_2 ?

- A 0.67Ω
- B 1.2Ω
- C 1.5Ω
- D 2.8Ω

- 33 Which circuit results in output voltage V_{out} increasing with increasing temperature?



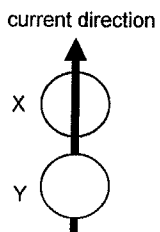
- 34 The diagram shows what happens when a bar PQ is brought near to a permanent magnet which is standing on a balance.



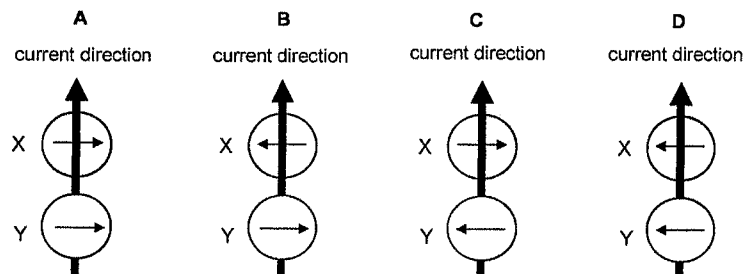
What could bar PQ be?

- A an iron bar or a permanent magnet with P a N pole
- B an iron bar or a permanent magnet with Q a N pole
- C an iron bar only
- D a permanent magnet only

- 35 Plotting compasses X and Y are placed below and on top of a current-carrying wire respectively, as shown in the diagram.



Which diagram shows the possible directions of the compass needles?



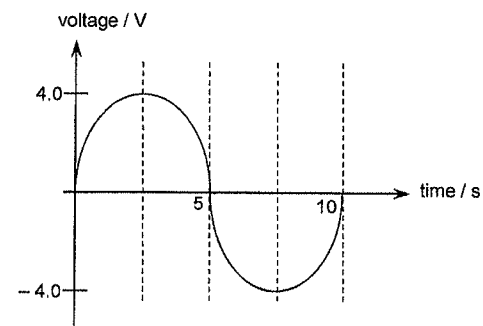
- 36 Two straight parallel wires, X and Y, carry current of the same magnitude in opposite directions.

What is the direction of the magnetic force acting on wire Y?



- A $\uparrow$ B $\downarrow$ C $\rightarrow$ D $\leftarrow$

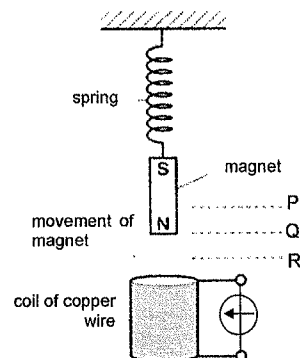
- 37 A simple a.c. generator produces a voltage that varies with time as shown.



How will the period and the peak induced voltage change if the speed of rotation of the coil in the generator is doubled?

	period of wave / s	maximum voltage / V
A	5.0	4.0
B	5.0	8.0
C	10	8.0
D	20	8.0

- 38 The diagram shows a magnet moving up and down (between P and R) above a coil of copper wire.



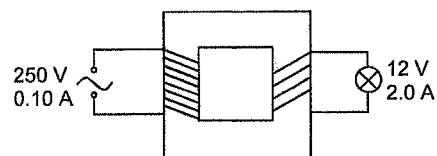
Which statements are true?

- (i) An induced alternating current is formed in the coil as the magnet moves up and down.
- (ii) When the N-pole of the magnet is at P or R, the galvanometer does not show any deflection.
- (iii) The galvanometer will show the highest deflection when the magnet passes Q.

- A** (i) and (ii) only **B** (ii) and (iii) only
C (i) and (iii) only **D** (i), (ii) and (iii)

- 39 A transformer is used to operate a 12 V lamp from a 250 V mains supply. The mains current is 0.10 A and the current flowing through the lamp is 2.0 A.

What is the efficiency of the transformer?

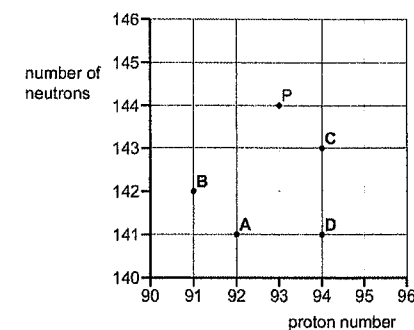


- A** 4.0% **B** 5.0% **C** 96% **D** 104%

- 40 Nucleus P has 144 neutrons and 93 protons. Nucleus P is unstable and undergoes α -decay to form nucleus Q. Nucleus Q then undergoes β^- -decay to form nucleus R.

Nucleus P is represented by point P on the graph.

Which point on the graph represents nucleus R?



-End of Paper-

Answers to 2025 4E PHYSICS PRELIM PAPER 2

1	2	3	4	5	6	7	8	9	10
D	A	B	D	B	A	D	D	A	B
11	12	13	14	15	16	17	18	19	20
B	B	B	C	D	A	C	C	A	D
21	22	23	24	25	26	27	28	29	30
A	C	D	A	B	A	C	D	C	D
31	32	33	34	35	36	37	38	39	40
D	D	C	D	B	C	B	D	C	A

Qn	Answer	Marks
1a	Scalar quantities are quantities with only magnitude but no direction however vector quantities have both magnitude and direction.	B1
1bi	$A = F / m$ $= 27\,000 / 1500$ $= 18 \text{ m/s}^2$	B1
1bi	$A = (V - u) / t$ $-18 \times 1.5 = 0 - u$ $u = 27 \text{ m/s}$	M1 A1

173

Candidate Name _____

Class Register No.

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PEIRCE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2025
SECONDARY FOUR EXPRESS

PHYSICS

Paper 1 Multiple Choice

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and register number in the spaces provided at the top of this page and on the Answer Sheet.

There are **forty** questions on this paper. Answer **all** questions. For each question, there are four possible answers, A, B, C and D.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

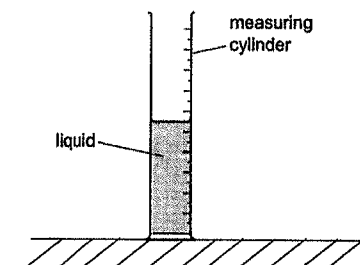
Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

6091/01
29 August 2025
1 hour

2

- 1 The diagram shows liquid in a measuring cylinder.



Using only the measuring cylinder and knowing only the density of the liquid, what can be determined?

- A the cross-sectional area of the measuring cylinder
- B the height of liquid in the measuring cylinder
- C the mass of liquid in the measuring cylinder
- D the pressure on the base of the measuring cylinder

- 2 The velocity of a moving object is given by

- A the area below a displacement-time graph
- B the area below a velocity-time graph
- C the gradient of a displacement-time graph
- D the gradient of a velocity-time graph

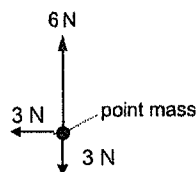
- 3 A stone falling through the air has reached terminal velocity.

Which row shows the acceleration and the velocity of the stone?

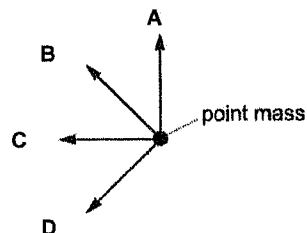
	acceleration of the stone	velocity of the stone
A	zero	constant
B	zero	increasing
C	10 m/s ²	constant
D	10 m/s ²	increasing

3

- 4 The labelled arrows in the diagram represent the directions and sizes of the forces acting on a stationary point mass.

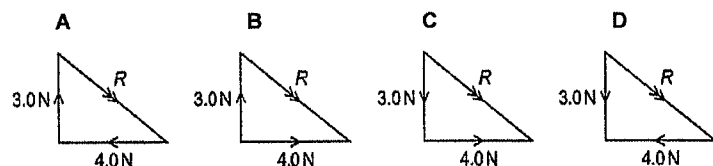


In which direction does the point mass accelerate?

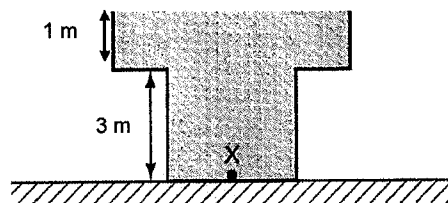


- 5 Forces of 3.0 N and 4.0 N act at right angles to each other.

Which forces produce a resultant force R in the direction shown?



- 6 A container is completely filled with a liquid of density 800 kg/m^3 , as shown. The gravitational field strength is 10 N/kg .



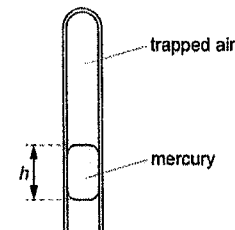
What is the pressure due to the liquid at point X?

- A 2 400 Pa B 3 200 Pa C 24 000 Pa D 32 000 Pa

4

- 7 A test tube, sealed at one end, is held vertically with the closed end at the top. It contains a thread of mercury which traps a column of air. The other end of the tube is open to the atmosphere.

The pressure due to a thread of mercury of height h is $0.2 \times 10^5 \text{ Pa}$ and the atmospheric pressure is $1.0 \times 10^5 \text{ Pa}$.



What is the pressure of the trapped air?

- A $0.2 \times 10^5 \text{ Pa}$ B $0.8 \times 10^5 \text{ Pa}$ C $1.0 \times 10^5 \text{ Pa}$ D $1.2 \times 10^5 \text{ Pa}$
- 8 A rocket of total mass M is travelling at a speed v . After the fuel is used up, the mass of the rocket decreases to $0.5 M$ and its speed increases to $2 v$.
- How does the energy in the kinetic store of the rocket change?
- A It halves.
B It remains the same.
C It doubles.
D It increases by a factor of 4.
- 9 An electric lift is used to raise an object with weight 20 N through a vertical height of 4.0 m in 2.0 s . The efficiency of the motor is 40% .
- What is the power wasted by the lift?
- A 16 W B 24 W C 40 W D 96 W
- 10 Water at 0°C contracts as it is heated to 4°C .

Three students make statements about water at these temperatures.

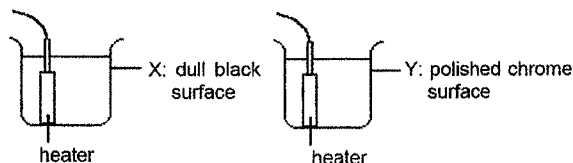
student 1 Convection does not occur in water between 0°C and 4°C .
student 2 As water heats up from 0°C to 4°C , its density decreases.
student 3 Water at 3°C sinks in water at 1°C .

Which student(s) is/are correct?

- A 1 only B 2 and 3 C 2 only D 3 only

5

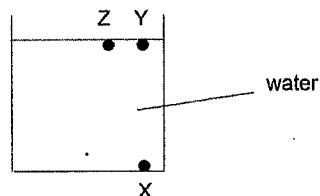
- 11 The diagram shows two copper cans, X and Y, with surfaces made of different textures and colours. Both cans are of the same size, filled with the same amount of water at room temperature, and heated by heaters of the same power.



Which of the following statements is correct?

- A Water in X boils faster because the outer dull black surface is a good absorber of radiation.
 B Water in X boils faster because the outer dull black surface is a poor emitter of radiation.
 C Water in Y boils faster because the outer polished chrome surface is a poor absorber of radiation.
 D Water in Y boils faster because the outer polished chrome surface is a poor emitter of radiation.

- 12 The diagram shows a beaker of water.



Which action of heating/cooling would set up a convection current in the water?

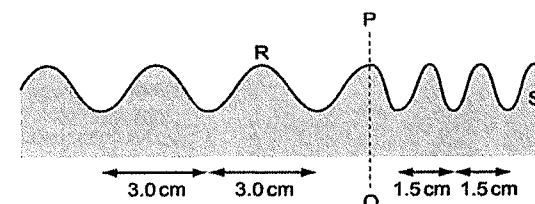
- A cooling at X B cooling at Y C heating at Y D heating at Z
- 13 Equal masses of oil and water are heated to 90°C and then allowed to cool in the same surrounding conditions.

Which statement clearly explains why the oil cools faster than the water?

- A Oil has a higher boiling point than water.
 B Oil has a lower melting point than water.
 C Oil has a higher specific heat capacity than water.
 D Oil has a lower specific heat capacity than water.

6

- 14 The diagram shows a water wave in a ripple tank.



The wave has a speed of 12 cm/s at R. The wave crosses a boundary PQ where the depth changes. The distance between the crests drops from 3.0 cm to 1.5 cm .

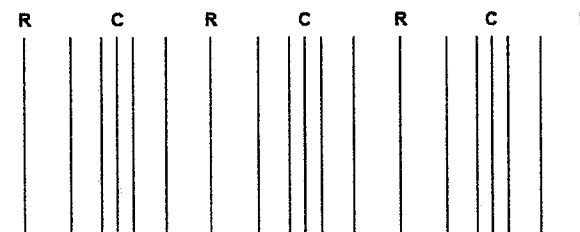
What is the speed of the wave at S?

- A 3.0 cm/s B 6.0 cm/s C 12 cm/s D 24 cm/s

- 15 For a transverse wave, what is a wavefront?

- A a line joining all points on the same crest of a wave
 B a line showing the displacement of a wave
 C the energy content of a wave
 D the first part of a wave to reach a point

- 16 A wave in a solid is presented by a series of lines. The diagram shows the compressions C and rarefactions R at one instant in time.



Which statement is most likely to be correct?

- A The wave transfers particles from the left to the right of the diagram.
 B The direction of travel of the wave is parallel to the lines.
 C The density in a compression C is lower than that in a rarefaction R.
 D The wave transfers energy from the left to the right of the diagram.

- 17 A ship emits a set of sound waves lasting 0.5 s. The waves have a frequency of 3600 Hz.

How many complete waves does the set of sound waves contain?

- A 1800 B 3600 C 7200 D 18000

- 18 An observer hears a clap of thunder 1.0 s after seeing the flash of lightning.

The speeds of sound and light are 320 m/s and 3.0×10^8 m/s respectively.

How far from the observer is the lightning?

- A slightly less than 320 m
B slightly more than 320 m
C slightly less than 3×10^8 m
D slightly more than 3×10^8 m

- 19 Visible light, X-ray and microwaves are components of the electromagnetic spectrum.

Which of the following statements about these three components is correct?

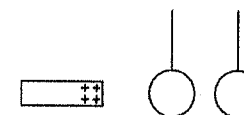
- A In a vacuum, microwaves travel faster than visible light and have a shorter wavelength.
B In a vacuum, microwaves travel at the same speed as visible light and have a shorter wavelength.
C In a vacuum, X-rays travel faster than visible light and have a shorter wavelength.
D In a vacuum, X-rays travel at the same speed as visible light and have a shorter wavelength.

- 20 A thin converging lens has a focal length of 10 cm. An object is placed at four different distances in front of the lens.

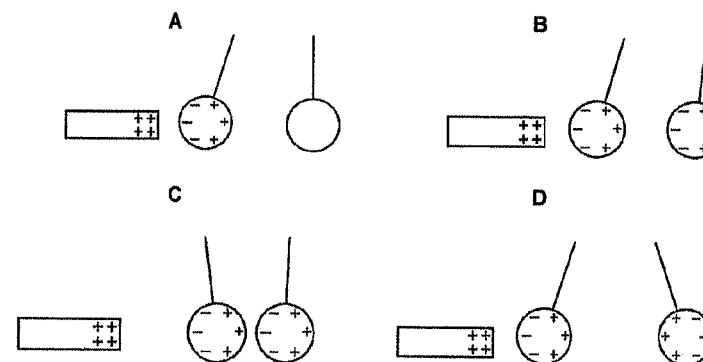
How far from the lens is the object when the image produced is real and magnified?

- A 5 cm B 15 cm C 20 cm D 25 cm

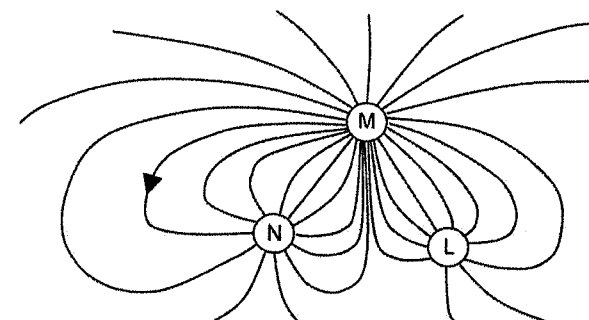
- 21 Two uncharged metal spheres, not touching one another, are suspended by means of a cotton thread.



A positively charged rod is brought near to the spheres. Which diagram shows what happens to the spheres?



- 22 The diagram shows the electric field patterns of three charged particles M, N and L. The direction of one of the field lines is indicated below.

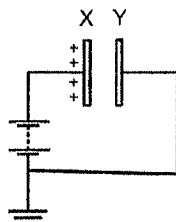


Which statement is correct?

- A M is negatively charged.
B There is attraction between N and L.
C There is repulsion between M and N.
D Field lines around L will point towards L.

9

- 23 A positively charged metal plate X is connected to the earth through a battery. A second metal plate Y, which is initially uncharged, is connected to the earth as shown in diagram.



What happens as Y is brought closer to X?

- A Electrons flow from Y to earth.
 B Electrons flow from earth to Y.
 C Positive charges flow from Y to earth.
 D Positive charges flow from earth to Y.
- 24 A heating element has a potential difference of 15 V when 100 C flows through it.

What is the electrical energy dissipated by the heater?

- A 0.15 J B 6.67 J C 8.0 J D 1500 J

- 25 A copper wire X with cross-sectional area A and length l has resistance R .

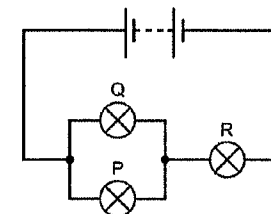
Another copper wire Y has twice the length and half the cross-sectional area of X.

What is the resistance of Y?

- A $\frac{1}{2}R$ B R C $2R$ D $4R$

10

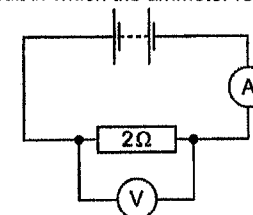
- 26 Three identical filament lamps, P, Q and R, are switched on in the circuit as shown.



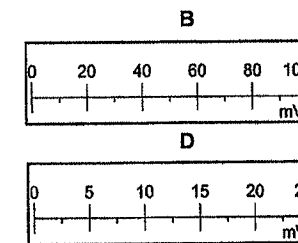
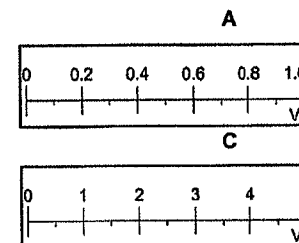
What are the changes in the brightness of lamps P and R, when lamp Q blows?

	lamp P	lamp R
A	brighter	brighter
B	brighter	dimmer
C	dimmer	brighter
D	dimmer	dimmer

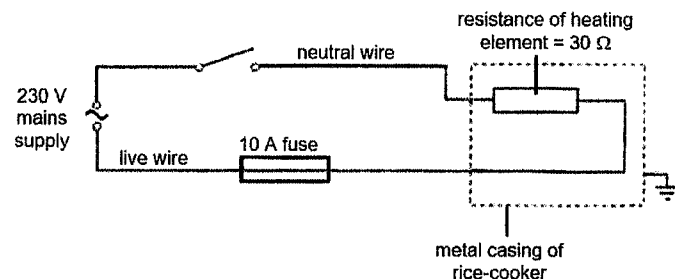
- 27 The diagram shows a circuit in which the ammeter reads 180 mA.



Which voltmeter scale is best to measure the potential difference across the resistor?



- 28 The diagram below shows the circuit formed when a rice-cooker is plugged into a mains socket.

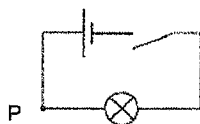


What is the fault in this arrangement?

- A The earth wire is missing.
 B The fuse rating is too low.
 C The resistance of the heating element is too high.
 D The switch is connected wrongly to the wrong wire.
- 29 An electrical cable contains three wires: live, neutral and earth. The cable is correctly wired to a plug which contains a 5 A fuse. The insulation outside all the three wires are damaged and bare wires are exposed.

Which event will cause the fuse in the plug to blow?

- A A person touches the earth wire.
 B A person touches the live wire.
 C The live wire touches the neutral wire.
 D The neutral wire touches the earth wire.
- 30 A circuit diagram of a lamp as shown.

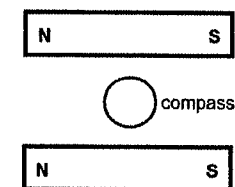


The lamp is switched on for 5.0 minutes and the current in the circuit is 2.0 A.

How much charge passes through point P in the circuit and in which direction do the electrons flow in the circuit?

	charge / C	direction of electron flow
A	10.0	anticlockwise
B	10.0	clockwise
C	600	anticlockwise
D	600	clockwise

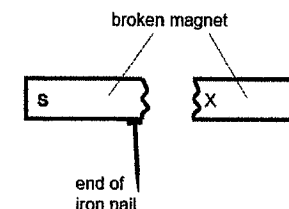
- 31 The diagram shows two identical magnets arranged in parallel to each other. A compass is placed between the two magnets.



What should be the direction of the needle of the compass?



- 32 The diagram shows a bar magnet broken at its centre. An iron nail is placed at one end of the broken magnet.



Which row is correct?

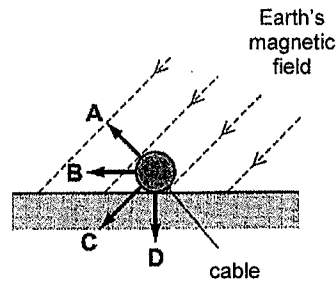
	pole at the end of iron nail	movement of end of iron nail
A	north	attracted to X
B	north	repelled from X
C	south	attracted to X
D	south	repelled from X

- 33 Which is the most effective method of demagnetising a bar magnet?

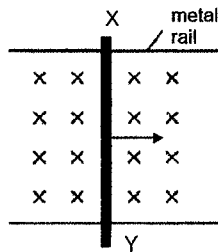
- A placing the magnet in a solenoid carrying a large alternating current and gradually decreasing the current
 B placing the magnet in a solenoid carrying a large direct current and gradually decreasing the current
 C placing the magnet in a solenoid that produces a magnetic field in the opposite direction to the magnet
 D placing the magnet next to an identical bar magnet with its poles in the opposite direction

- 34 The diagram shows the cross section of a cable lying on the ground. There is a direct current in the cable. The Earth's magnetic field is in the direction shown.

Which arrow gives a possible direction for the magnetic force on the cable?



- 35 In the diagram below, a metal rod XY is moved in the direction shown by the arrow along a metal rail in a magnetic field. An induced voltage is set up across XY.



Which statement is correct?

- A An induced current flows from X to Y.
 B An induced current flows from Y to X.
 C An induced current flows from Y to X and then reverses direction.
 D No current is induced.
- 36 What can be done to reduce heating in a transformer without changing the output?
- A Increase the number of turns on each side of the transformer proportionally.
 B Replace the iron core with a steel core.
 C Replace copper wires with iron wires.
 D Use a laminated iron core instead of a solid iron core.

- 37 The input voltage to an ideal transformer in a power station is 3000 V.

The input coil has 5.0 A current and 30 turns. The output voltage of the transformer is 120 000 V.

How many turns are on the output coil and what is the current in the output coil?

	turns on output coil	current in the output coil / A
A	1200	8.0
B	1200	0.125
C	12	0.125
D	12	8.0

- 38 Which of the following shows correctly the use of radioactivity and the type of radiation it uses?

	use of radioactivity	type of radiation it uses
A	household fire (smoke) alarm	gamma
B	gauging thickness of cardboard	beta
C	carbon dating	gamma
D	sterilization of medical equipment	alpha

- 39 A nucleus is represented by ${}_{91}^{230}\text{Z}$. It emits an α particle followed by a β particle.

What is the resulting daughter nucleus?

- A ${}_{88}^{226}\text{A}$ B ${}_{89}^{230}\text{B}$ C ${}_{90}^{226}\text{C}$ D ${}_{91}^{230}\text{Z}$

- 40 Which statement about α -particles and β -particles is correct?

- A α -particles are less ionizing than β -particles.
 B α -particles are more penetrating than β -particles.
 C α -particles have greater mass than β -particles.
 D α -particles have the same charge as β -particles.

End of Paper 1

1	2	3	4	5	6	7	8	9	10
C	C	A	B	C	D	B	C	B	D
11	12	13	14	15	16	17	18	19	20
D	D	D	B	A	D	A	B	D	B
21	22	23	24	25	26	27	28	29	30
B	D	B	D	D	B	A	D	C	D
31	32	33	34	35	36	37	38	39	40
A	A	A	A	B	D	B	B	C	C

NAME:	CLASS:	INDEX NO:
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QUEENSWAY SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2025
SECONDARY 4 EXPRESS

Parent's Signature:

PHYSICS

6091/01

Paper 1 Multiple Choice

2 September 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and index number on the Answer Sheet in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions. For each question, there are four possible answers, **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

2

1 Which of the following are scalar quantities?

- I pressure
- II friction
- III density

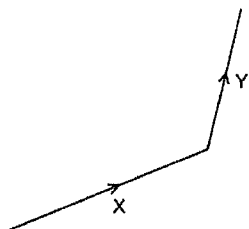
- A I, II and III
- B I and II only
- C I and III only
- D II and III only

2 What is the factor for converting kilometres (km) to millimetres (mm)?

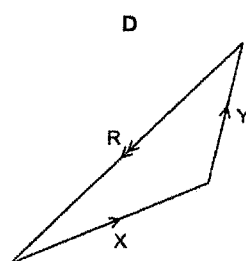
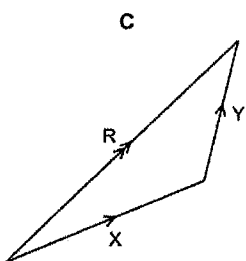
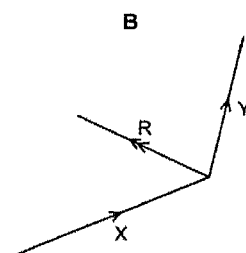
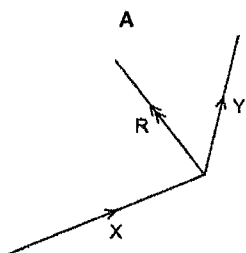
- A 10^{-3}
- B 10^3
- C 10^6
- D 10^{12}

3

- 3 Two forces X and Y act as shown.

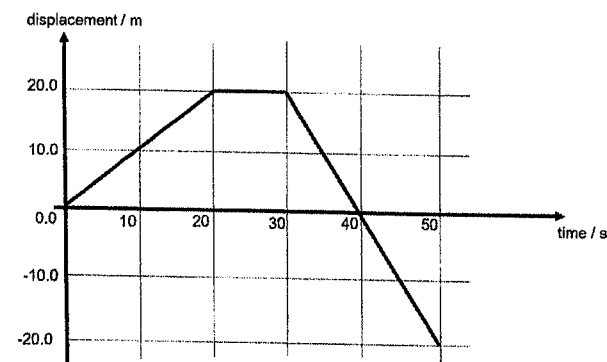


Which diagram shows the resultant force R of X and Y?



4

- 4 The diagram shows the displacement-time graph of a car traveling on a straight, horizontal road.



What is the total distance travelled by the car in 50 s?

- A 0 m B 40 m C 60 m D 600 m

- 5 Two identical balls are dropped vertically from different levels of a building. Ignoring air resistance, ball A takes twice the time than ball B to reach the ground.

What is the ratio of the acceleration of ball A to ball B?

- A 1:1
B 1:2
C 2:1
D 4:1

5

- 6 An object of mass 50 kg is falling vertically downwards in the Earth's atmosphere. The air resistance acting on the object is 200 N.

In which direction does the force of air resistance act on the object and what is the acceleration of the object?

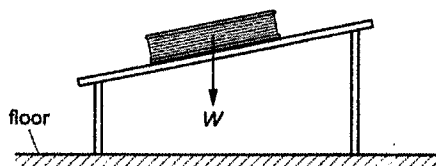
	direction of air resistance	acceleration
A	downward	6 m/s ²
B	downward	14 m/s ²
C	upward	6 m/s ²
D	upward	14 m/s ²

- 7 A body resists changes to its motion.

Which property of a body is responsible for this?

- A density
B gravitational force
C mass
D weight

- 8 A large book is placed on a sloping table. The weight W of the book is due to the Earth's gravitational pull on the book.

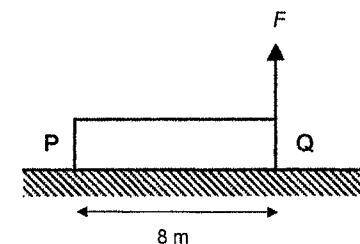


Which force forms a Newton's third law action-reaction pair with W ?

- A The friction f acting on the book.
B The gravitational force of the table pushing on the book.
C The gravitational pull on the Earth by the book.
D The normal reaction force N acting on the book by the table.

6

- 9 A uniform metal slab has mass 50 kg and length 8 m. A man lifts edge Q vertically up with a force F such that the bar pivots at edge P.

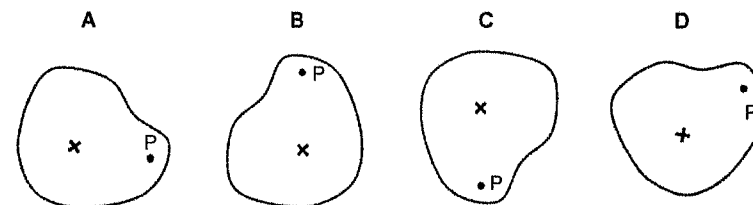


What is the magnitude of force F to just lift edge Q off the floor?

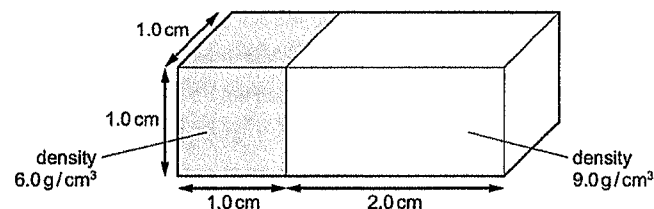
- A 12.5 N B 62.5 N C 125 N D 250 N

- 10 An irregularly shaped cardboard is pivoted at point P and allowed to rotate freely in a vertical plane. The centre of gravity of the cardboard is represented with a 'x'.

Which of the following would be the final resting position of the cardboard after rotating about point P?



- 11 Two blocks of different densities are joined together as shown in the diagram below.

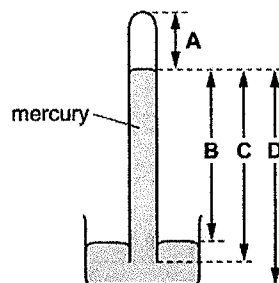


One block has a density of 6.0 g/cm^3 and the other has a density of 9.0 g/cm^3 .

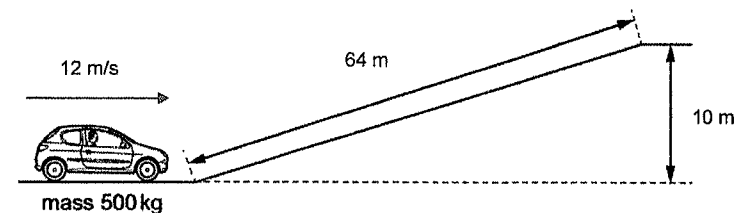
What is the overall density of the two blocks joined together?

- A 7.5 g/cm^3
 - B 8.0 g/cm^3
 - C 12 g/cm^3
 - D 18 g/cm^3
- 12 The diagram shows a simple mercury barometer.

Which labelled length is measured when finding atmospheric pressure?



- 13 The diagram shows a small car of mass 500 kg approaching a slope with an initial speed of 12 m/s . It moves up the slope with a constant acceleration of 2.0 m/s^2 until it reaches the top of the slope. The car takes 4.0 s to reach the top of the slope.



The gravitational field strength g is 10 N/kg .

Ignoring friction, how much work is done by the engine in moving the car up the slope?

- A $14\,000 \text{ J}$
 - B $50\,000 \text{ J}$
 - C $64\,000 \text{ J}$
 - D $114\,000 \text{ J}$
- 14 A 5.0 W lamp is switched on for 15 minutes. It transfers 1500 J to the internal store (thermal) of the surroundings.

What is the efficiency of the lamp?

- A 33 %
- B 43 %
- C 67 %
- D 70 %

- 15 As air is sucked from a straw out of a sealed packet drink, the packet shrinks in volume.

Which of the following best explains why the packet drink shrinks in volume?

- A The air molecules are in continuous random motion.
- B The air molecules shrink in size.
- C The frequency of collision of air molecules with the internal surface area of the packet drink has decreased.
- D The kinetic energy of the air molecules in the packet drink has decreased and the frequency of collisions of the air molecules and packet wall has decreased.

- 16 A beaker of liquid is heated at the bottom corner to form a convection current.

An explanation of the convection current contains four statements.

- 1 Liquid expands.
- 2 Less dense liquid rises and cold liquid moves in to replace it.
- 3 The density of liquid decreases.
- 4 The liquid at the bottom becomes warmer.

What is the correct order of these statements?

- A 4 → 1 → 2 → 3
- B 4 → 1 → 3 → 2
- C 4 → 2 → 3 → 1
- D 4 → 3 → 2 → 1

- 17 A consultant for a cookware manufacturer wishes to make a cooking pan that will have two features:

- i absorb energy from a flame as quickly as possible, and
- ii has a cooking surface that remains hot for a long period of time.

Which pan would be recommended?

- A pan with black outer and inner surface
- B pan with black outer surface and shiny inner surface
- C pan with shiny outer and inner surface
- D pan with shiny outer surface and black inner surface

- 18 Which of the following defines latent heat?

- A the thermal energy absorbed or emitted by a unit mass during a change of state without a temperature change
- B the thermal energy absorbed or emitted by a unit mass per unit temperature change
- C the thermal energy absorbed or emitted during a change of state without a temperature change
- D the thermal energy absorbed or emitted during a unit temperature change

- 19 Which changes of state occur because of the addition of thermal energy?

- A boiling and melting
- B boiling and solidification
- C condensation and melting
- D condensation and solidification

- 20 A heat shield is used to prevent the interior of a spacecraft from reaching very high temperatures while passing through Mars' atmosphere.

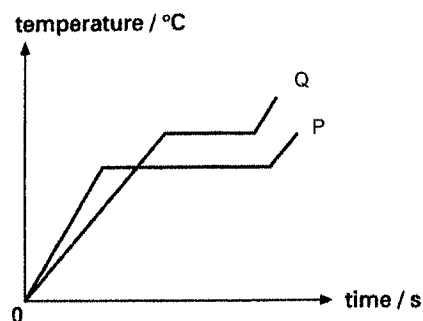
Which of the following thermal properties should the heat shield have to achieve this?

- 1 good thermal conductor
- 2 high melting point
- 3 high specific heat capacity

- A 1 and 2 only
- B 1 only
- C 2 and 3 only
- D 2 only

- 21 Equal masses of solids P and Q are heated by the same heater.

The graph shows the variation of temperature of the solids with time during heating.



Which of the following are correct?

- 1 The melting point of Q is higher than P.
- 2 The specific heat capacity of Q is higher than P.
- 3 The specific latent heat of fusion of Q is higher than P.

- A 1, 2 and 3
 B 1 and 2 only
 C 1 and 3 only
 D 2 and 3 only

- 22 Which statement about transverse waves is correct?

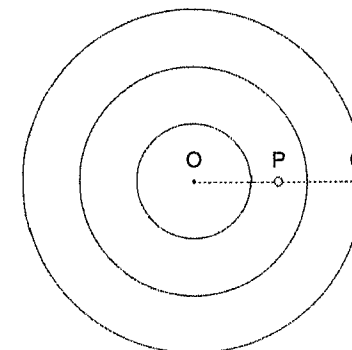
- A The direction of wave travel and energy transfer is perpendicular to each other.
 B The speed of the wave can be measured from the speed of a wavefront travelling forward.
 C The wave requires a medium so that particles can vibrate and form a wave.
 D The wave will cause particles to move from one end of the wave to the other.

- 23 A series of circular wavefronts are produced in a pond.

The diagram shows the positions of two particles, P and Q, in the wave at a particular time.

Point P lies on the trough of the wave and point Q on the crest of the wave.

The speed of the water waves is 15 cm/s and the time taken for any particle in the wave to travel from a crest to a trough is 0.10 s.



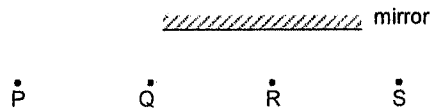
What is the horizontal distance between P and Q?

- A 0.15 cm
 B 1.5 cm
 C 3.0 cm
 D 4.5 cm

- 24 Which wave is part of the electromagnetic spectrum?

	speed / ms ⁻¹	type
A	330	longitudinal
B	330	transverse
C	3.0×10^8	longitudinal
D	3.0×10^8	transverse

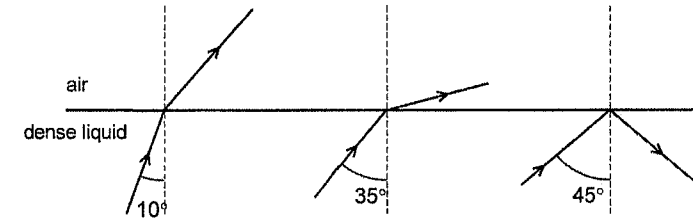
- 25 Four students, P, Q, R and S, are standing in front of a plane mirror.



How many students is Q able to see in the mirror?

- A one
B two
C three
D none of the above

- 26 Three rays of light are incident on the boundary between a dense liquid and air. The angles of incidence are different. (diagrams not drawn to scale)



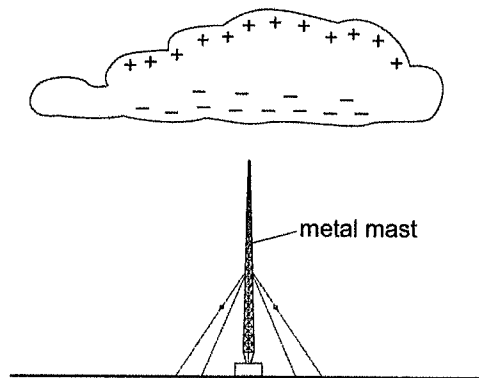
What is a possible critical angle of light in the dense liquid?

- A 5°
B 20°
C 40°
D 50°

- 27 What always experiences a force when placed in an electric field?

- A a magnet
B a piece of wood
C a solenoid
D an electric charge

- 28 The base of a cloud is negatively charged. The cloud is over a metal mast as shown in the diagram below.



Which row correctly describes the charge induced at the top of the mast and how it is produced?

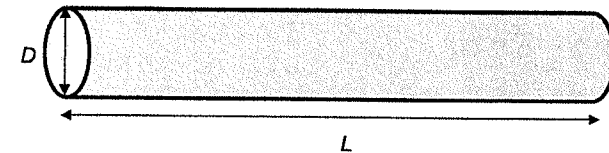
	charge at top of mast	charge at the top of the mast produced by
A	negative	electrons moving to the top of the mast
B	negative	protons moving to the bottom of the mast
C	positive	electrons moving to the bottom of the mast
D	positive	protons moving to the top of the mast

- 29 A 12 V car battery is fully charged. It is connected in series to a lamp labelled 12 V, 24 W. The lamp shines at normal brightness for 8 hours.

What is the magnitude of the charge that passes through the lamp in this time?

- A 960 C
- B 14 400 C
- C 57 600 C
- D 691 200 C

- 30 A resistance wire of length L and diameter D has a resistance R .

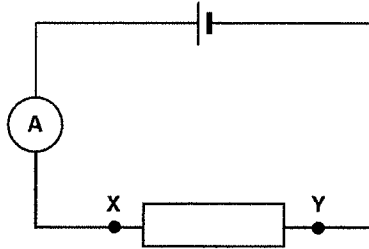


Which change will cause the resistance of the wire to increase four times?

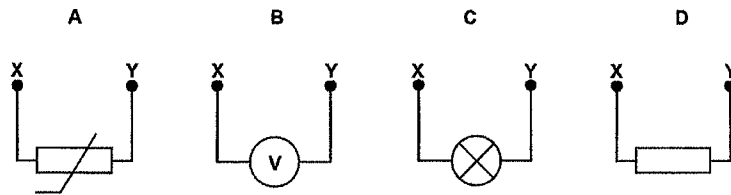
- A decrease the diameter to $0.5D$ and keep the length unchanged
- B decrease the diameter to $0.5D$ and decrease the length to $0.5L$
- C increase the diameter to $2D$ and decrease the length to $0.5L$
- D increase the diameter to $2D$ and increase the length to $4L$

17

- 31 The diagram shows a simple electrical circuit.

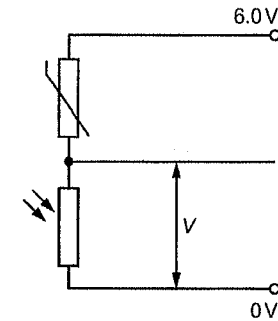


Which electrical component, when added across X and Y, in parallel to the resistor, will not change the ammeter reading?



18

- 32 A potential divider consists of a Negative Temperature Coefficient (NTC) thermistor and a light-dependent resistor (LDR).



Which of the following conditions will give the smallest voltage V across the LDR?

- A cold and bright
- B cold and dark
- C hot and bright
- D hot and dark

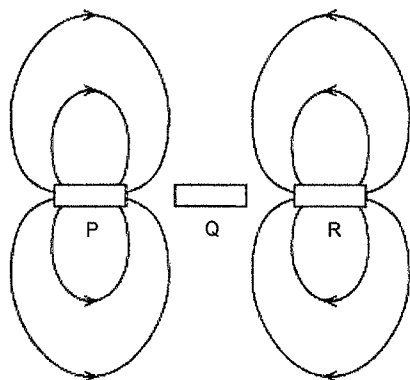
- 33 What is the purpose of a circuit breaker and where is it wired?

	purpose	wired
A	to protect the wires and appliance from overheating	in the earth wire
B	to protect the wires and appliance from overheating	in the live wire
C	to protect the user from electric shock	in the earth wire
D	to protect the user from electric shock	in the live wire

- 34 A heating coil is marked 240 V, 1000 W. A plug is fitted with a 13 A fuse.
What is the maximum number of heating coils that can be connected to the plug?

A 1 B 2 C 3 D 4

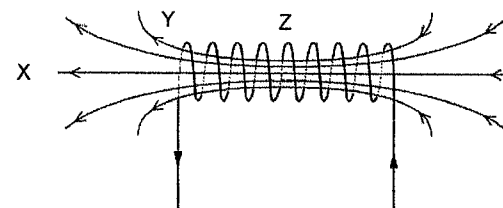
- 35 The diagram shows the magnetic fields around three objects, P, Q and R, placed close to each other.



Which row shows the nature of each of the objects?

	P	Q	R
A	S N	copper rod	N S
B	N S	copper rod	S N
C	N S	iron rod	N S
D	S N	iron rod	S N

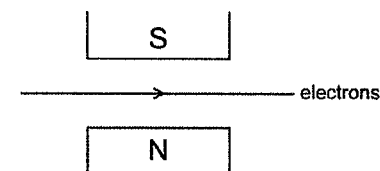
- 36 The diagram shows the magnetic field pattern of a current in a solenoid.



When the current in the solenoid is increased, where is the increase in the magnetic field strength of the solenoid?

- A at X and Y only
B at X, Y and Z
C at Y and Z only
D at Z only

- 37 A beam of electrons travels through a vacuum. The beam passes between the poles of a magnet as shown.

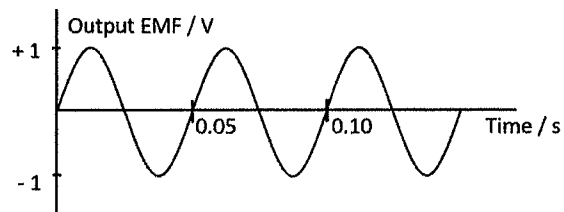


What is the direction of the magnetic field and the direction the electron beam will be deflected?

	direction of magnetic field	direction of deflection of electron beam
A	↑	⊙
B	↑	⊗
C	↓	⊙
D	↓	⊗

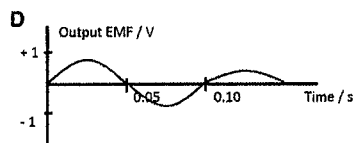
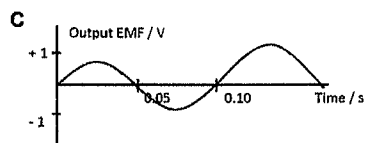
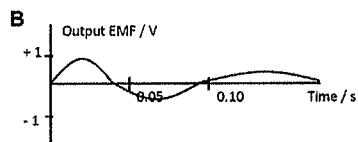
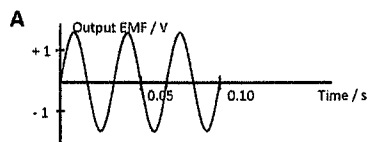
21

- 38 The graph shows the output of an a.c. generator. The coil in the generator rotates 20 times in one second.



The speed of rotation of the coil steadily decreases.

Which graph shows how the output changes from the instant where the speed of rotation of the coil starts to decrease?



- 39 A neutral atom of an isotope has the nuclide notation $^{84}_{36}\text{Kr}$.

Which statement is correct?

- A There are 12 more neutrons than electrons in the atom.
- B There are 36 electrons in the nucleus of the atom.
- C There are 45 neutrons in the nucleus of the atom.
- D There are 48 protons in the nucleus of the atom.

22

- 40 The table below shows the count rate of a radioactive substance over two weeks.

number of weeks	0	1	2
count rate	5400	4500	2700

What is the count rate at the end of six weeks?

- A 0
- B 50
- C 675
- D 900

Queensway Secondary School

Secondary 4 Prelim Examinations 2025

6091/01 Marking Scheme

Q1	C	Q11	B	Q21	B	Q31	B
Q2	C	Q12	B	Q22	B	Q32	A
Q3	C	Q13	D	Q23	D	Q33	B
Q4	C	Q14	C	Q24	D	Q34	C
Q5	A	Q15	C	Q25	B	Q35	B
Q6	C	Q16	B	Q26	C	Q36	B
Q7	C	Q17	B	Q27	D	Q37	B
Q8	C	Q18	C	Q28	C	Q38	B
Q9	D	Q19	A	Q29	C	Q39	A
Q10	B	Q20	C	Q30	A	Q40	C

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**REGENT SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2025
SECONDARY FOUR (EXPRESS)**

NAME: _____

INDEX NUMBER: _____

CLASS: _____

SETTER: MDM NOR RASIDAH

PHYSICS

6091/01

Paper 1 Multiple Choice

28 August 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and index number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C and D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

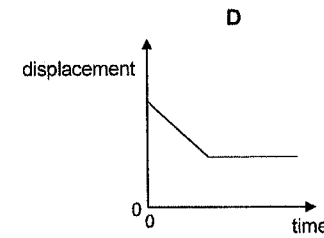
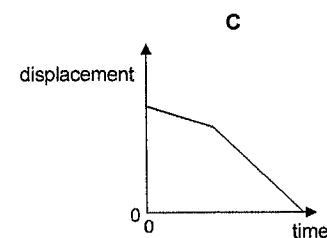
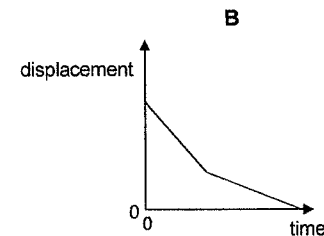
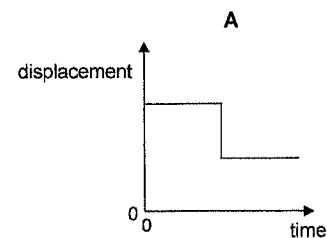
40	TARGET
PARENT'S SIGNATURE	

- 1 What are the orders of magnitude for the diameter of the Earth and the diameter of an atom?

	diameter of the Earth	diameter of an atom
A	10 Gm	0.1 μm
B	10 Gm	0.1 nm
C	10 Mm	0.1 μm
D	10 Mm	0.1 nm

- 2 A parachutist falls at a constant speed. He then opens his parachute and continues to fall to Earth at a lower, constant speed.

Which diagram shows how the displacement of the parachutist varies with time?

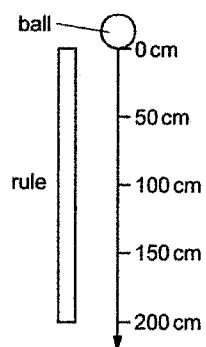


- 3 A cyclist rides at a speed of 4 m/s. He applies the brakes. The bicycle decelerates uniformly and stops in 6 m.

How long does the cyclist take to stop?

- A 0.67 s
- B 2.5 s
- C 3.0 s
- D 6.0 s

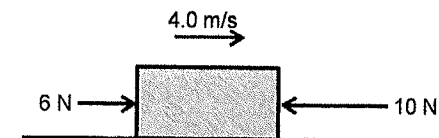
- 4 In a laboratory, a ball is dropped in a vacuum and falls 200 cm.



Which statement describes the acceleration of the ball?

- A It is greater at 10 cm than at 200 cm.
- B It is greatest at 200 cm.
- C It is smaller at 50 cm than at 100 cm.
- D It is the same value at 50 cm as at 150 cm.

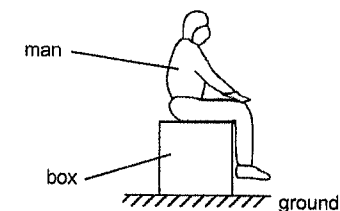
- 5 A block moves horizontally at a constant speed of 4.0 m/s. A 6 N and a 10 N force is applied simultaneously on the block as shown below.



What happens to the motion of the block immediately after the forces are applied?

- A The block continues to move at 4.0 m/s.
- B The block changes direction immediately.
- C The block decelerates immediately.
- D The block stops immediately.

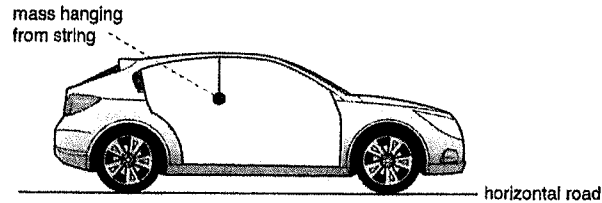
- 6 The diagram below shows a man sitting on a box that rests on the ground.



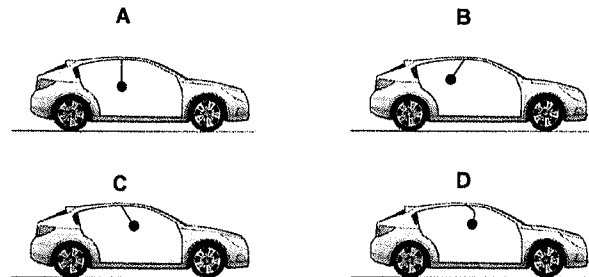
Which action-reaction pair is correct?

- A The weight of the box and the normal force from the ground on the box.
- B The weight of the man and the gravitational force of man on Earth.
- C The weight of the man and the normal force from the box supporting the man.
- D The weight of the man and the weight of the box.

- 7 A man hung a mass to the ceiling of his car using a thin string.
The diagram shows the ball when the car is at rest.



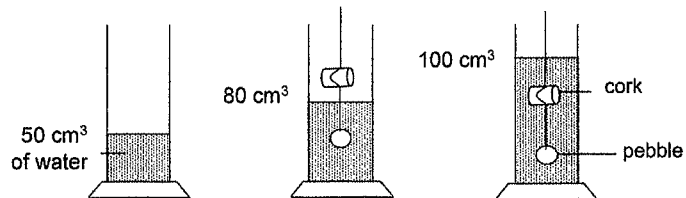
What will be the position of the ball when his car starts moving to the right?



- 8 A student placed 50 cm^3 of water in a measuring cylinder. He then lowered a string with a pendulum bob and a piece of cork tied to it.

The reading of the measuring cylinder at each stage is shown in the diagrams below.

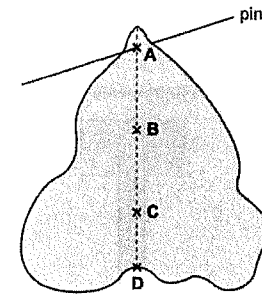
The mass of the pendulum bob and the cork are 80.0 g and 2.5 g respectively.



What is the density of the cork?

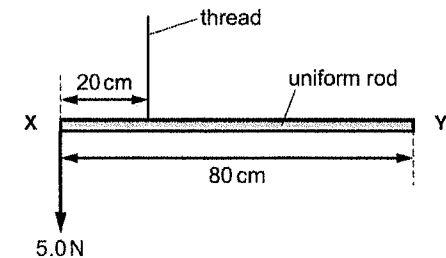
- | | | | |
|---|------------------------|---|------------------------|
| A | 0.13 g/cm^3 | C | 0.050 g/cm^3 |
| B | 0.031 g/cm^3 | D | 1.0 g/cm^3 |

- 9 A piece of uniform card is suspended from a horizontal pin.
Which point is its centre of mass?



- 10 A uniform rod XY of weight 2.0 N has a length of 80 cm .

The rod is suspended by a thread 20 cm from end X. A weight of 5.0 N is suspended from end X.



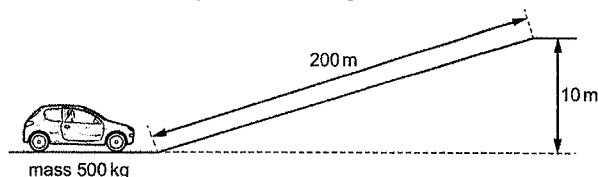
A student hangs a 6.0 N weight on the rod so that it is in equilibrium.

What is the distance of the 6.0 N weight from end X?

- A 6.0 cm
B 10 cm
C 26 cm
D 30 cm

- 11 The diagram shows a small car with a mass of 500 kg approaching a hill. It moves up the hill with constant speed and reaches the top in 5.0 s.

The gravitational field strength, g is 10 N / kg .



Ignoring friction, what is the power needed in moving the car up the hill?

- A $1.0 \times 10^3 \text{ W}$
 B $1.0 \times 10^4 \text{ W}$
 C $5.0 \times 10^4 \text{ W}$
 D $2.0 \times 10^5 \text{ W}$
- 12 A horizontal force pulls a box along a horizontal surface.

The box gains 30 J of kinetic energy, and 10 J of thermal energy is produced by the friction between the box and the surface.

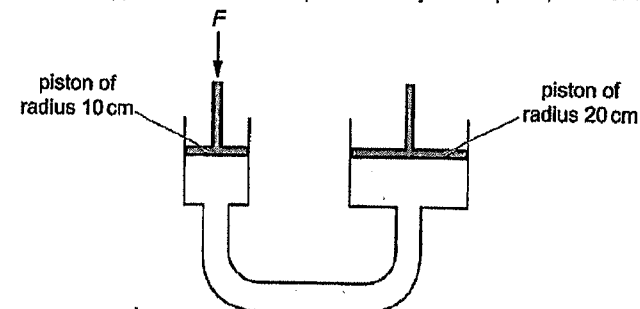
How much work is done by the force?

- A 10 J
 B 20 J
 C 30 J
 D 40 J
- 13 Energy resources are used to produce electricity.

Which resource is non-renewable?

- A biofuel
 B nuclear fuel
 C geothermal
 D wind

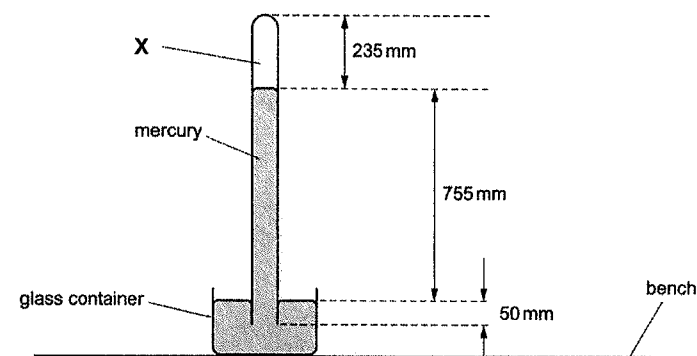
- 14 A force F is applied to the smaller piston of a hydraulic press, as shown.



What is the upward force that acts on the larger piston?

- A $\frac{F}{4}$
 B $\frac{F}{2}$
 C $2F$
 D $4F$

- 15 The diagram below shows a mercury barometer. X is a vacuum.



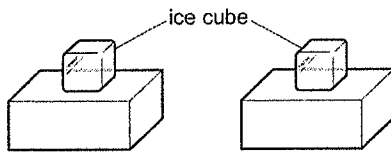
What is the atmospheric pressure indicated by the barometer?

- A 50 mm Hg
 B 705 mm Hg
 C 755 mm Hg
 D 990 mm Hg

- 16 When fine pollen grains suspended in water are viewed from under a microscope, they are seen to make small, erratic movements.

What is the reason for the observation made?

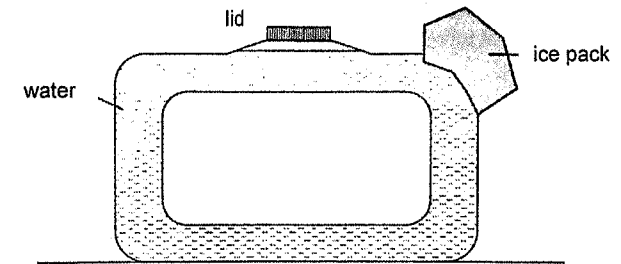
- A They are being dragged by convection currents in the water.
 B They are being hit by water molecules.
 C They are moving and colliding with one another.
 D They have kinetic energy therefore they move around on their own.
- 17 Two identical ice cubes are placed on two different blocks. The blocks are left next to each other on a table in a laboratory.



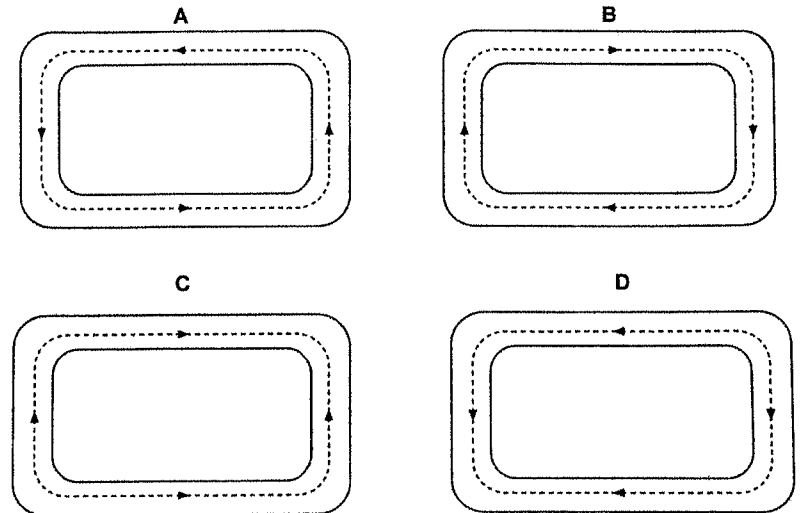
Which material and colour of the block will cause the ice cube to melt first?

	material	colour
A	metal	black
B	metal	silver
C	plastic	black
D	plastic	silver

- 18 A student filled a container completely with warm water. He set up a convection current by placing a pack of ice at a corner of the container as shown in the diagram below.



Which of the following shows the correct direction of convection current that was set up?



- 19 Water in a beaker gains thermal energy at a rate of 3000 W. The water is at its boiling point.

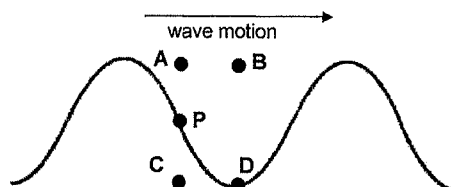
The specific latent heat of vaporisation of water is 2260 J / g.

How long does it take for 250 g of the water to vaporise?

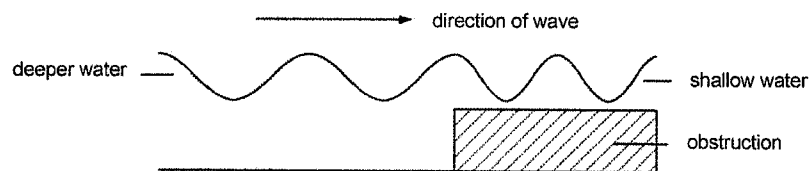
- A 12 s
- B 188 s
- C 332 s
- D 750 s

- 20 A ripple tank produces one wave in every 0.4 s. The cross-section of the water wave with a cork at P is shown in the diagram. The wave is moving to the right.

Where is the position of the cork after 0.1 second?



- 21 The diagram shows a wave moving into shallow water.



What happens as the wave moves to the right?

- A Both the frequency and the speed of the wave decrease.
- B Both the frequency and the speed of the wave increase.
- C The frequency of the wave increases but the speed remains constant.
- D The speed of the wave decreases but the frequency remains constant.

- 22 Which of the following statements is false?

- A Radio wave and ultra sound has the same speed in vacuum.
- B Infra-red radiation is given off by a toaster to heat up the bread.
- C High ionizing electromagnetic waves is deliberately used in some circumstances to cause damage to cells in the human body.
- D Ultra violet plays a crucial role in the body's production of vitamin D.

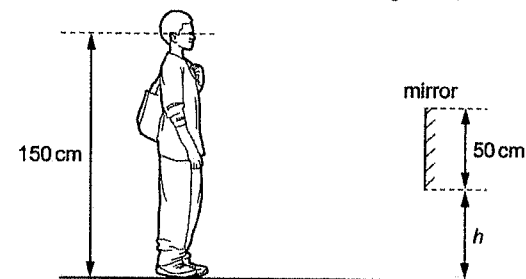
- 23 A microwave wave has a wavelength of 5 mm.

What is the frequency of the wave when it is travelling through vacuum?

- A 1.5×10^6 Hz
- B 6.0×10^5 Hz
- C 6.0×10^{10} Hz
- D 1.5×10^{11} Hz

- 24 A shop owner places a 50 cm mirror on the wall so that customers can look at their shoes. The bottom of the mirror is at height, h , from the ground.

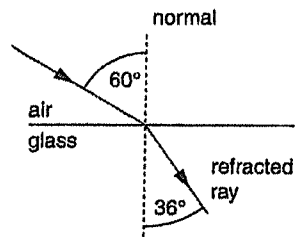
A customer, whose eyes are 150 cm above the ground, looks into the mirror.



What is the maximum height of h which will allow the customer to see the image of his shoes in the mirror?

- A 25 cm
- B 50 cm
- C 75 cm
- D 150 cm

- 25 Light strikes the surface of a glass at an angle of incidence of 60° .



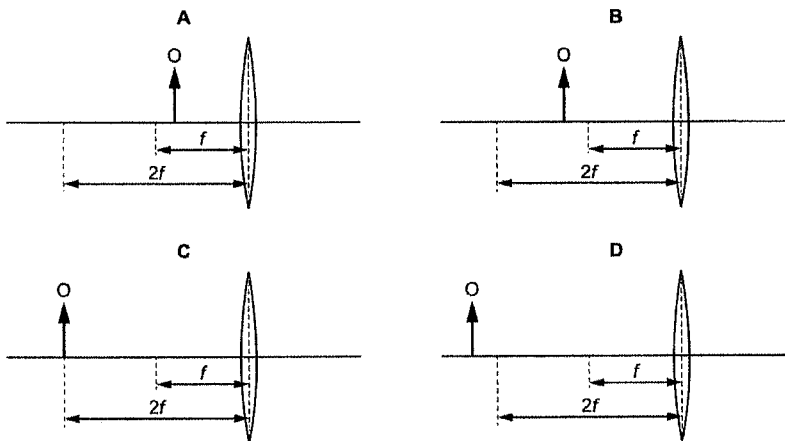
In the glass, the angle of refraction is 36° .

What is the speed of light in glass?

- A 1.8×10^8 m/s
- B 2.0×10^8 m/s
- C 3.0×10^8 m/s
- D 4.5×10^8 m/s

- 26 A converging lens with a focal length f , produces an image of an object O.

Which position of the object produces a virtual image?

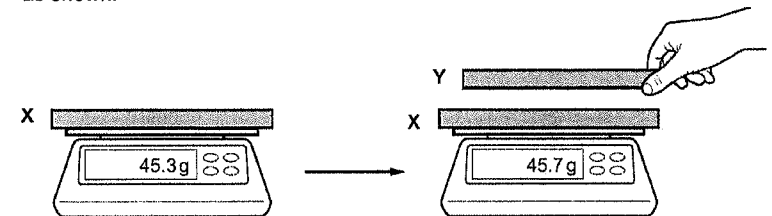


- 27 A polythene rod becomes negatively charged when it is rubbed with a cloth.

Which statement explains this?

- A The rod gains electrons.
- B The rod loses electrons.
- C The cloth gains protons.
- D The cloth loses protons.

- 28 A charged rod X is placed on a balance and another rod Y is brought close to it, as shown.

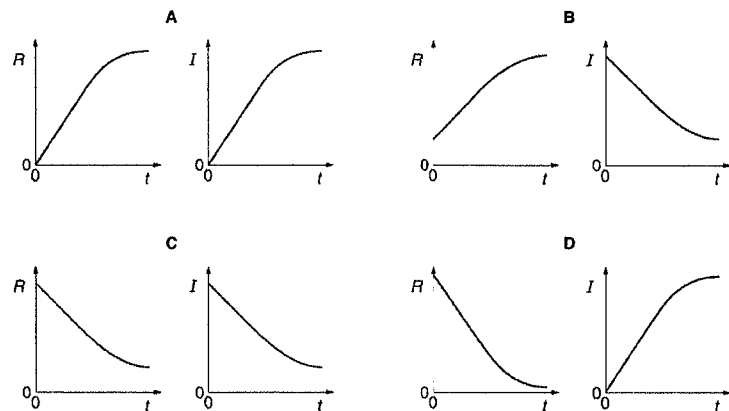


Which combination of charges would cause the change in the balance reading shown?

	X	Y
A	negative	negative
B	negative	no charge
C	negative	positive
D	positive	no charge

- 29 A filament lamp is switched on. After some time, the resistance of the filament lamp changes.

Which pair of graphs show how the resistance R of the filament and the current I in the lamp vary with time t after the lamp is switched on?



- 30 During a lightning strike, there is a current of 3×10^5 A between a charged cloud and Earth for 5×10^{-3} s.

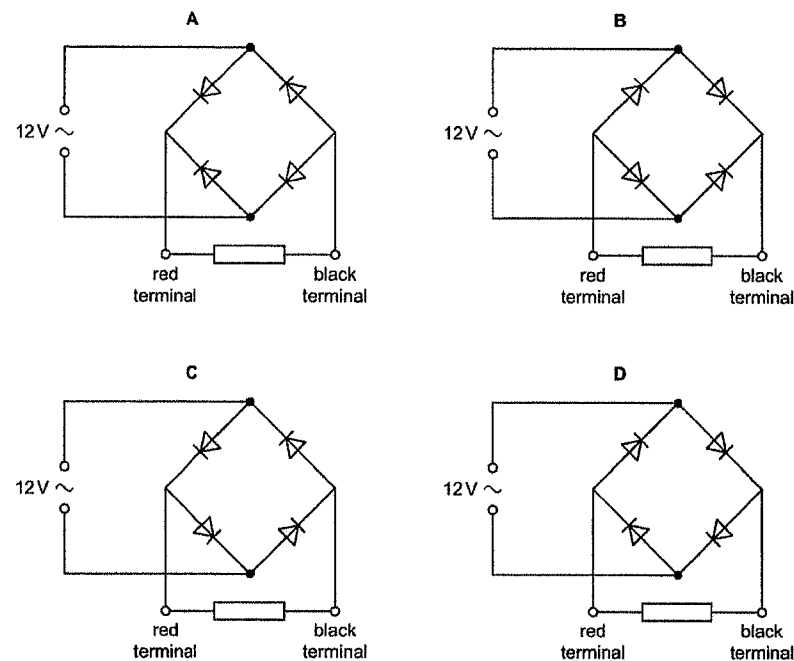
It releases 4.5×10^8 J of energy.

What is the potential difference (p.d.) between the cloud and the Earth?

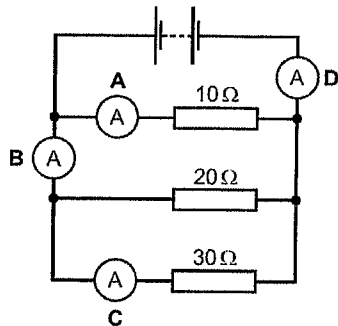
- A 0.30 MV
- B 7.5 MV
- C 300 MV
- D 680 MV

- 31 The four circuits shown each contain four diodes.

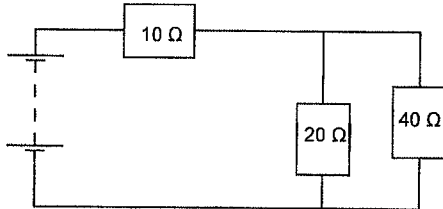
In which circuit is the direction of the current in the resistor always flowing from the red terminal to the black terminal?



- 32 A circuit contains four ammeters and three resistors with different values. Which ammeter shows the largest reading?



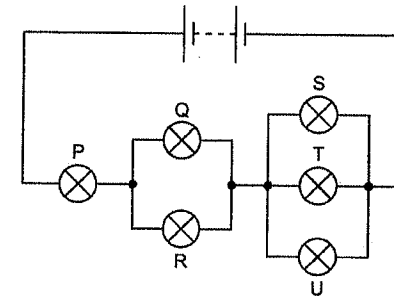
- 33 A circuit is set up as shown in the diagram.



Which statement about the potential difference across the 20 Ω resistor is correct?

- A It is equal to the potential difference across the 10 Ω resistor
- B It is twice the potential difference across the 10 Ω resistor
- C It is equal to the potential difference across the 40 Ω resistor
- D It is half the potential difference across the 40 Ω resistor

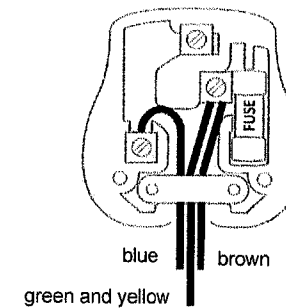
- 34 The diagram shows a circuit of six identical lamps connected to a battery.



Which lamps are brightest?

- A P only
- B Q and R only
- C S, T and U only
- D P, Q, R, S, T and U are equally bright

- 35 The plug of the toaster is wrongly wired as shown.



What will happen when the plug is used as shown?

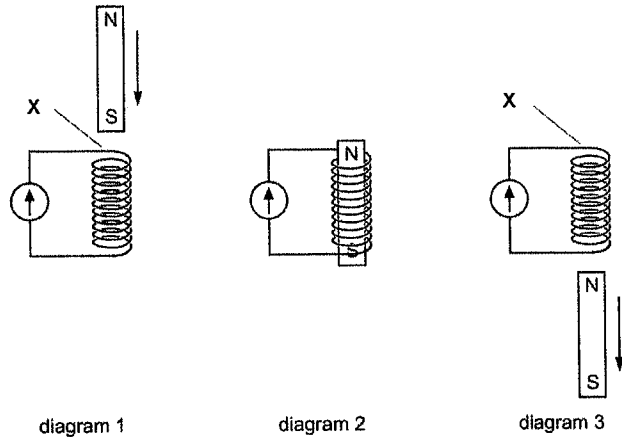
- A The fuse in the plug melts.
- B The toaster continues to work.
- C The toaster continues to work but the casing becomes live.
- D The toaster does not work.

- 36 An oven is labelled 240 V, 4 000 W. A bakery uses the oven for 8 hours every day. The cost of electricity is \$0.30 for 1 kWh.

What is the cost of using the oven for 30 days?

- A \$9.60
B \$17.30
C \$230
D \$288

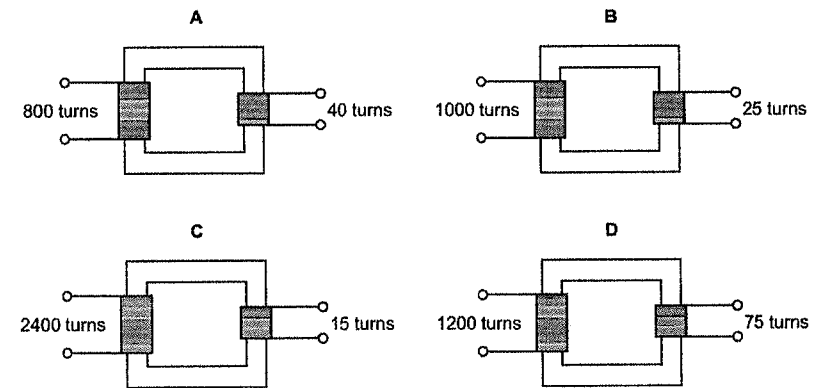
- 37 A magnet is dropped vertically through a solenoid. This induces magnetic poles at both ends of the solenoid.



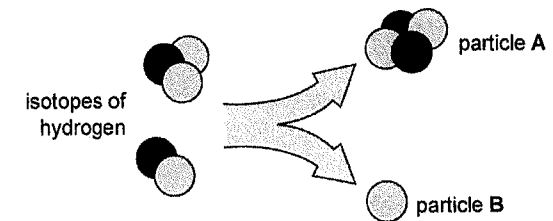
Which magnetic poles are induced at position X in diagram 1 and diagram 3?

	diagram 1	diagram 3
A	N pole	N pole
B	N pole	S pole
C	S pole	N pole
D	S pole	S pole

- 38 Which transformer can change a 240 V a.c. input into a 15 V a.c. output?



- 39 The diagram below shows a fusion reaction.

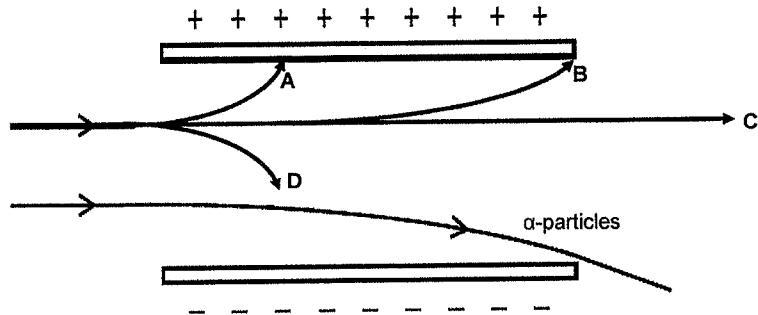


What are particle A and particle B?

	particle A	particle B
A	helium nucleus	electron
B	helium nucleus	neutron
C	hydrogen nucleus	electron
D	hydrogen nucleus	neutron

- 40 The diagram shows the path followed by α -particles as they pass between two charged plates.

Which of the following show the path of the Beta particles?



End of Paper

Paper 1

1	D
2	B
3	C
4	D
5	C
6	B
7	B
8	A
9	C
10	D

11	B
12	D
13	B
14	D
15	C
16	B
17	A
18	B
19	B
20	A

21	D
22	A
23	C
24	C
25	B
26	A
27	A
28	A
29	B
30	A

31	A
32	D
33	C
34	A
35	C
36	D
37	C
38	D
39	B
40	A

061



SINGAPORE CHINESE GIRLS' SCHOOL
PRELIMINARY EXAMINATION 2025
SECONDARY FOUR

CANDIDATE NAME

CLASS	4		
CENTRE NUMBER			

REGISTER NUMBER		
INDEX NUMBER		

PHYSICS

6091/1

Paper 1 Multiple Choice

28 August 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and index number on the Question Paper and Answer Sheet in the spaces provided.

There are **forty** questions in this paper. Answer **all** questions. For each question, there are four possible answers **A, B, C, D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected, where appropriate.
Take $g = 10 \text{ ms}^{-2}$ or 10 Nkg^{-1} unless specified otherwise.

This question paper consists of 19 printed pages and 1 blank page.

2

- 1 For which measurement would a micrometer screw gauge be most suitable for accurate measurement?

A diameter of an atom
B diameter of a wire
C length of this page
D length of a pencil

- 2 A metal ball is attached to a cork with a string and lowered into a measuring cylinder of water until the ball is fully submerged while the cork remains above the water, as shown in Fig. 2.1. The string is then lowered further so that both the ball and the cork are fully submerged, as shown in Fig. 2.2.

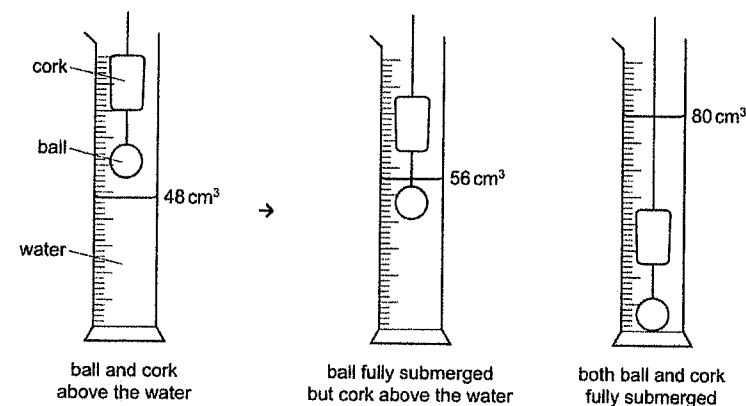


Fig. 2.1

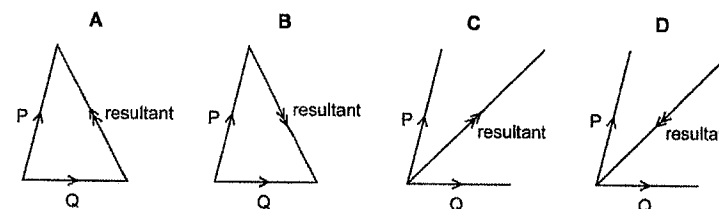
Fig. 2.2

The mass of the cork is 4.8 g.

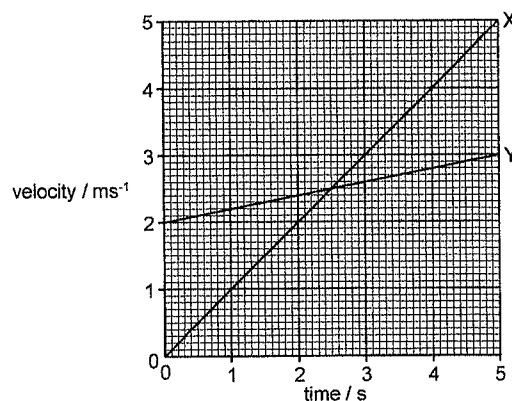
What is the likely density of the cork?

A 0.15 g/cm^3 B 0.20 g/cm^3 C 0.60 g/cm^3 D 5.0 g/cm^3

- 3 Two forces P and Q act on an object. Which diagram shows the resultant of these two forces?

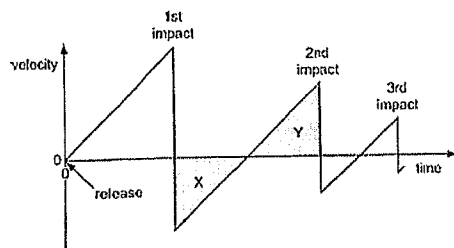


- 4 The figure below shows the velocity-time graphs of two vehicles X and Y. The accelerations and distances travelled by the two vehicles over the 5 s period can be estimated from the graphs.



Which statement is correct?

- A The accelerations of X and Y are the same at 2.5 s.
 B The acceleration of Y is greater than that of X.
 C The distance travelled by X is greater than that travelled by Y in the 5 s period.
 D The distances travelled by X and Y in the 5 s period are the same.
- 5 A ball is released from rest above a horizontal surface. The graph below shows the variation of its velocity with time.



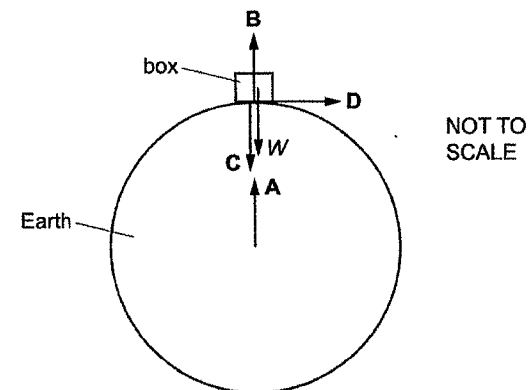
Why are areas X and Y equal?

- A For one impact, the speed at which the ball hits the surface equals the speed at which it leaves the surface.
 B The ball rises and falls through the same distance between impacts.
 C The ball's acceleration is the same during its upward and downward motion.
 D The speed at which the ball leaves the surface after an impact is equal to the speed at which it returns to the surface for the next impact.

- 6 A box rests on the Earth, as shown in the diagram below.

Newton's third law describes how forces of the same type act in pairs.

If the weight W of the box is one of the forces, which arrow represents the other force in this pair?



- 7 An object is accelerating under the influence of a force, F_1 , on a frictionless surface, as shown in Fig. 7.1. A while later, an opposing force, F_2 , of the same magnitude acts on it, as shown in Fig. 7.2.



Fig. 7.1

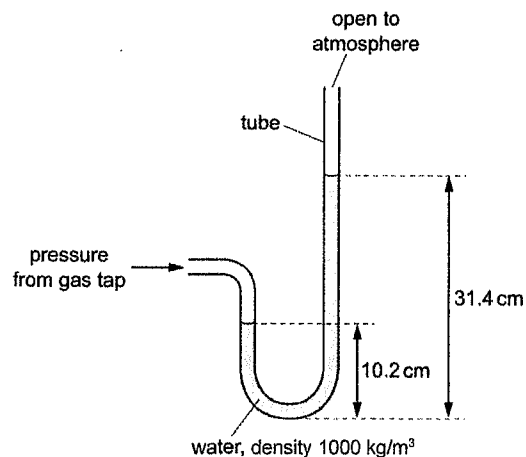


Fig. 7.2

Which statement correctly describes the object's motion immediately after the opposing force acts on it?

- A The object will slow down.
 B The object will move at constant velocity.
 C The object will move in the opposite direction.
 D The object will come to rest.

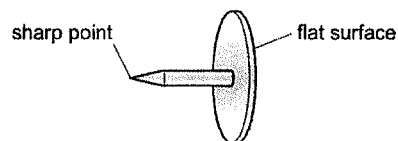
- 8 One end of a U-shaped tube is connected to a gas tap, with its other end open to the atmosphere, as shown in the diagram. It contains water of density 1000 kg/m^3 and the heights of the water columns on both sides are indicated. The atmospheric pressure is 101 kPa .



What is the pressure of the gas from the gas tap?

- A 99 kPa B 100 kPa C 102 kPa D 103 kPa

- 9 The diagram shows a drawing pin (thumb tack) with a sharp point at one end and a flat surface at the other end.



The pin is pushed into a wooden board.

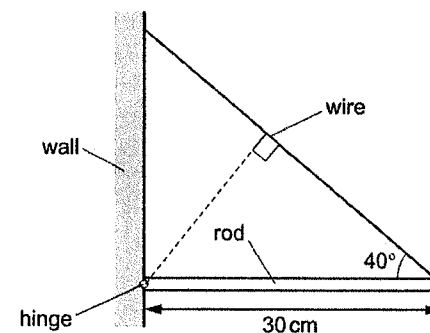
How do the pressure and the force at the sharp point compare with the pressure and the force on the flat surface?

	force at the sharp point	pressure at the sharp point
A	greater than on the flat surface	greater than on the flat surface
B	greater than on the flat surface	less than on the flat surface
C	the same as on the flat surface	greater than on the flat surface
D	the same as on the flat surface	less than on the flat surface

- 10 A student states 'If an object is in equilibrium, the sum of clockwise moments about point X is equal to the sum of anticlockwise moments about point Y.'

Under which condition would this statement be correct?

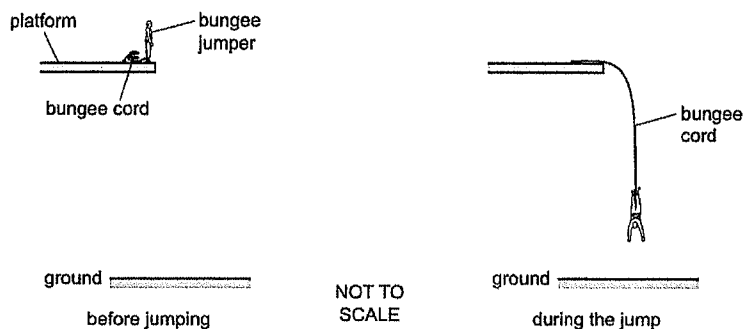
- A Either X or Y is the centre of gravity of the object.
 B Either X or Y is the pivot of the object.
 C X and Y are at opposite ends of the object.
 D X and Y are the same point on the object.
- 11 The diagram shows a uniform rod of length 30 cm and weight 5.2 N attached to a wall by a hinge at one end. The other end of the rod is supported by a wire so that the rod is horizontal and in equilibrium. The wire is at an angle of 40° to the horizontal.



What is the tension in the wire?

- A 3.4 N B 4.0 N C 6.8 N D 8.1 N
- 12 Car X is travelling at half the speed of car Y. Car X has twice the mass of car Y. Which statement is correct?
- A Car X has half the kinetic energy of car Y.
 B Car X has one quarter of the kinetic energy of car Y.
 C Car X has twice the kinetic energy of car Y.
 D The two cars have the same kinetic energy.

- 13 A bungee jumper jumps from a platform and is decelerated by an elastic bungee cord, as shown in the diagram.



As the jumper falls, his initial energy in the gravitational potential store is transferred to his kinetic store and the elastic potential store of the cord.

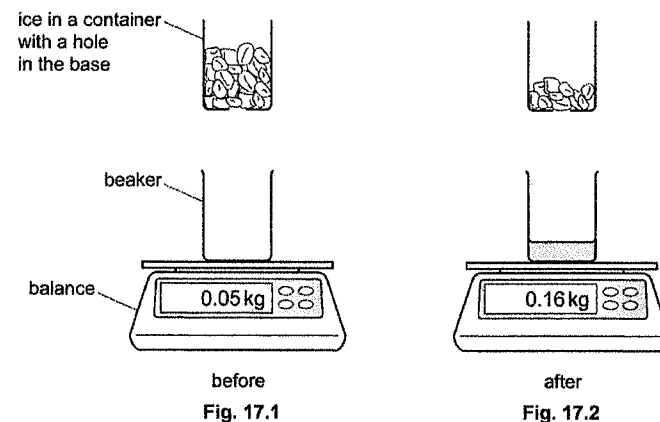
At which part of the jump is energy in all three stores non-zero?

- A on the platform before the jump
 B on the way down before the cord starts to extend
 C on the way down as he decelerates
 D at the bottom of the jump when he is momentarily stationary
- 14 A hydroelectric power station uses energy in the gravitational potential store of water to generate electrical energy.
- In a particular power station, the mass of water flowing per unit time is $1.5 \times 10^5 \text{ kgs}^{-1}$. The water falls through a vertical height of 120 m. The electrical power generated is 100 MW.
- What is the efficiency of the power station?
- A 5.6% B 43% C 56% D 76%
- 15 The specific heat capacity of solid P is greater than that of solid Q.
- What does this statement mean?
- A Less energy is needed to raise the temperature of a unit mass of solid P by 1°C than that of solid Q.
 B Less energy is needed to melt a unit mass of solid P than a unit mass of solid Q.
 C More energy is needed to raise the temperature of a unit mass of solid P by 1°C than that of solid Q.
 D More energy is needed to melt a unit mass of solid P than a unit mass of solid Q.

- 16 A student splashes water onto her face. Here are three statements about the effects.
- P The water uses energy to evaporate.
 Q The water gains energy from the student.
 R The face of the student cools.

Which statements are correct?

- A P and Q only B P and R only C Q and R only D P, Q and R
- 17 A student placed a number of ice cubes in a container with a hole in the base. He left them to melt so that the water dripped into a beaker placed on a balance. The student recorded the initial mass of the beaker as shown in Fig. 17.1 and the final mass of the beaker and water as shown in Fig. 17.2 after five minutes.

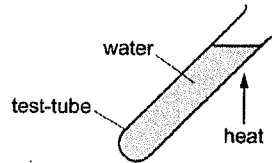


The specific latent heat of fusion for water is 334 J/g .

How much energy was absorbed from the surroundings in order to melt the ice?

- A 37 J B 53 J C 37 000 J D 53 000 J
- 18 One end of a copper rod is placed in hot water. Thermal energy travels along the rod, making the other end warmer.
- What is the behaviour of the copper at an atomic level that accounts for most of the transfer of thermal energy from one end to the other?
- A Atoms at the hot end gain kinetic energy and move towards the other end.
 B Atoms at the hot end expand, colliding with other atoms and transferring energy.
 C Free electrons at the hot end gain energy and move towards the other end, colliding with atoms along the rod.
 D Free electrons at the hot end gain energy from the hot water and move directly to the other end.

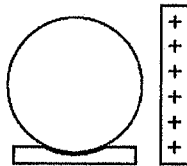
- 19 A glass test-tube containing water is heated at the top, as shown in the diagram. The water at the top boils, but the water at the bottom remains cold.



Which row explains why the water at the bottom of the test-tube remains cold?

	glass	water
A	good thermal conductor	good thermal conductor
B	good thermal conductor	poor thermal conductor
C	poor thermal conductor	good thermal conductor
D	poor thermal conductor	poor thermal conductor

- 20 The diagram shows an uncharged metal sphere placed on an insulating support. A positively charged rod is brought close to the sphere, but does not touch it.



How do the charges in the sphere move and what is now the charge on the sphere?

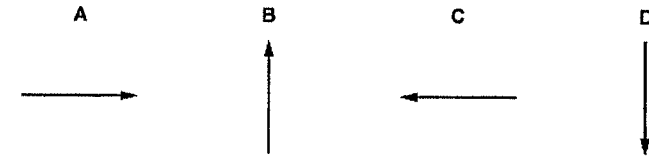
	movement on charges	charge on sphere
A	positive charges move to the left of the sphere	positive
B	positive charges move to the left of the sphere	neutral
C	negative charges (electrons) move to the right of the sphere	positive
D	negative charges (electrons) move to the right of the sphere	neutral

- 21 P is a point near to charge X, as shown in the diagram.

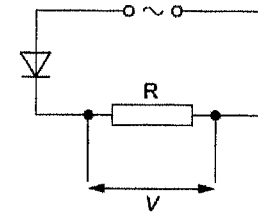


When a negatively charged test charge is placed at point P, it experiences a force of repulsion directed radially away from X.

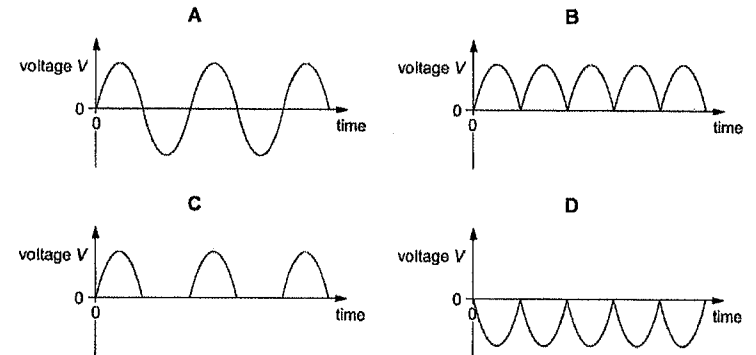
Which arrow correctly shows the direction of the electric field at point P due to the charge X?



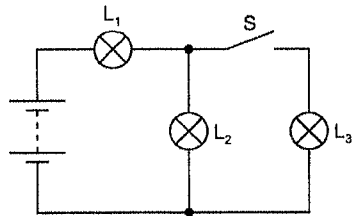
- 22 The diagram shows an alternating current (a.c.) power supply connected in series with a resistor R and a diode.



Which graph shows how the voltage V across the resistor R varies with time?



- 23 Three identical lamps L_1 , L_2 and L_3 are connected to a battery with negligible internal resistance, as shown in the diagram.

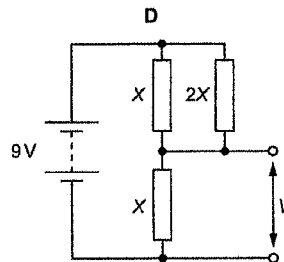
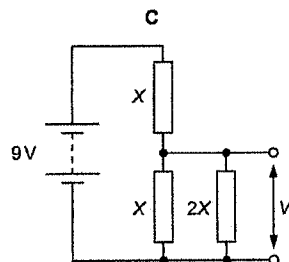
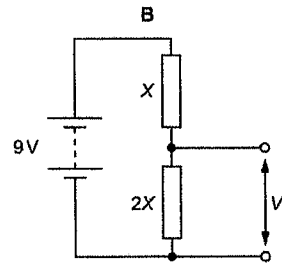
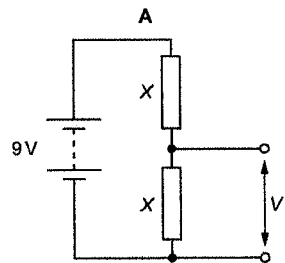


What happens to the brightness of lamps L_1 and L_2 when the switch S is closed?

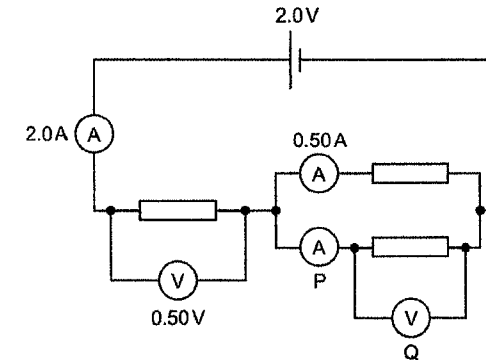
	lamp L_1	lamp L_2
A	brighter	brighter
B	brighter	dimmer
C	dimmer	brighter
D	dimmer	dimmer

- 24 Four potential divider circuits each consist of a battery of electromotive force 9 V and negligible internal resistance connected to a combination of resistors. Each resistor in the circuits has a resistance of either X or $2X$.

Which circuit diagram has the largest output voltage V ?



- 25 The diagram shows a circuit containing a cell of electromotive force (e.m.f.) 2.0 V , three resistors, three ammeters and two voltmeters. One ammeter is labelled P and one voltmeter is labelled Q . The readings on the other two ammeters and the other voltmeter are shown.



What are the readings on ammeter P and voltmeter Q ?

	reading on P / A	reading on Q / V
A	1.5	1.5
B	1.5	2.5
C	2.5	1.5
D	2.5	2.5

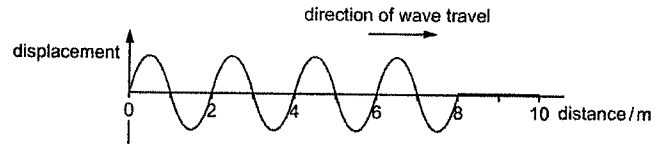
- 26 Some sources of electromagnetic waves are listed.

- 1 a radio wave transmitter
- 2 a source of X-rays
- 3 a 30 mm wavelength radar transmitter
- 4 a light-emitting diode that emits red light

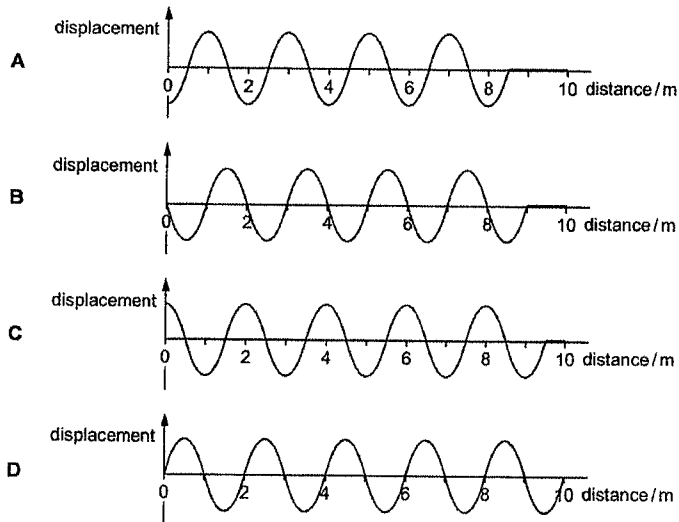
Which list gives the sources in order of increasing wavelength, from left to right, of the waves they emit?

- A $1 \rightarrow 3 \rightarrow 4 \rightarrow 2$
 B $2 \rightarrow 4 \rightarrow 1 \rightarrow 3$
 C $2 \rightarrow 4 \rightarrow 3 \rightarrow 1$
 D $3 \rightarrow 1 \rightarrow 4 \rightarrow 2$

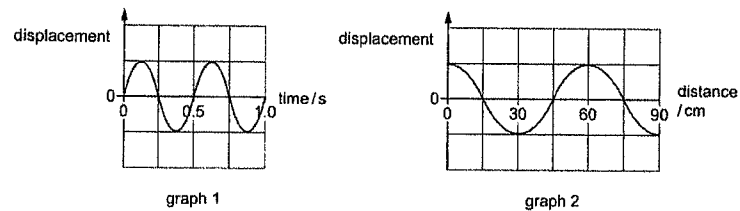
- 27 A transverse wave is travelling along a rope. The frequency of the wave is 2.0 Hz. The graph below shows the variation of the displacement of the wave with distance at time $t = 0$ s.



Which diagram shows the position of the wave at time $t = 0.5$ s?



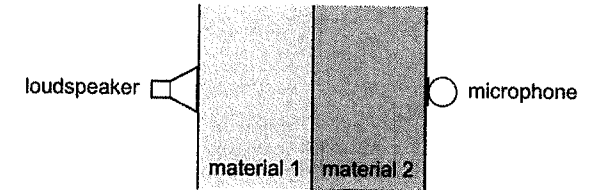
- 28 The two graphs below represent the same wave. Graph 1 shows the variation of the displacement with time at a particular distance. Graph 2 shows the variation of the displacement with distance at one instant.



What is the speed of the wave?

- A 22.5 cm s^{-1} B 30.0 cm s^{-1} C 90.0 cm s^{-1} D 120 cm s^{-1}

- 29 The sound from a loudspeaker must pass through two materials to reach a microphone, as shown in the diagram below.



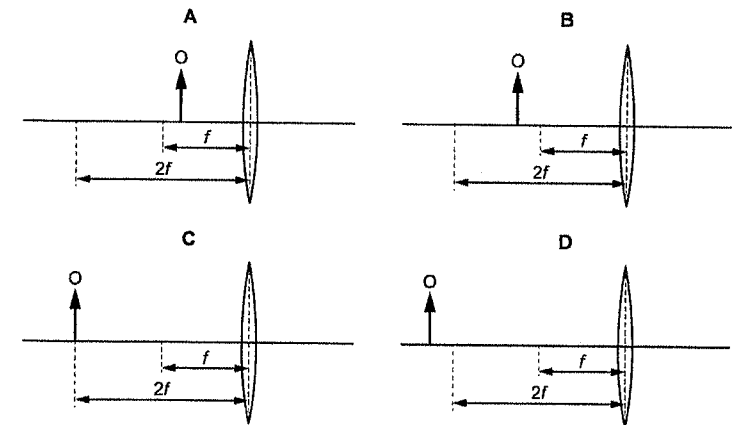
Which combination of materials gives the shortest time for the sound to reach the microphone?

	material 1	material 2
A	air	hydrogen
B	air	water
C	copper	aluminium
D	water	oil

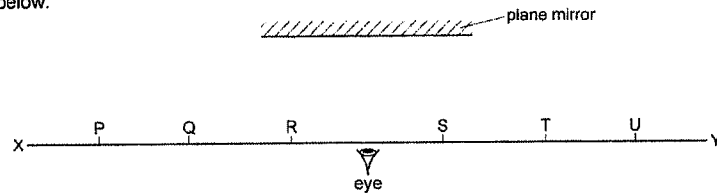
- 30 A converging lens produces an image of an object O.

The focal length of the lens is f .

At which position the object must be placed for the lens to produce a real, enlarged image?



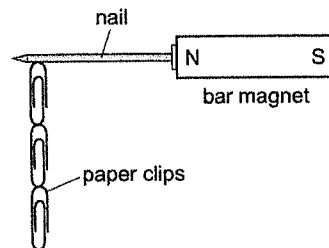
- 31 A student uses one eye to look at images in a plane mirror, as shown in the diagram below.



Objects are placed on the line XY.

Which objects will produce images that can be seen by the eye?

- A P, Q, R, S, T and U
 B Q, R, S and T only
 C P and U only
 D R and S only
- 32 Four nails A, B, C and D are tested to find which makes the strongest permanent magnet. One of the nails is placed against a bar magnet, as shown in the diagram below. The number of paper clips which the nail can support is recorded.



The bar magnet is then removed and the number of paper clips remaining attached to the nail is recorded. Each nail is tested individually.

Which nail becomes the strongest permanent magnet?

	number of paper clips attached to the nail	
	bar magnet present	bar magnet removed
A	2	0
B	2	1
C	4	3
D	5	2

- 33 A steel bar is placed in an East-West direction for it to be demagnetised. No other magnet is nearby.

Which method is not suitable for demagnetising the steel bar?

- A hammering the bar
 B heating the bar to a very high temperature
 C slowly taking the bar out of a coil that carries an alternating current
 D slowly taking the bar out of a coil that carries a direct current
- 34 Diagram 1 shows a coil of wire P between the poles of a magnet. The ends of coil P are connected to a battery using slip rings. Diagram 2 shows a coil of wire Q between the poles of a different magnet. The ends of coil Q are connected to a battery using a split-ring commutator.

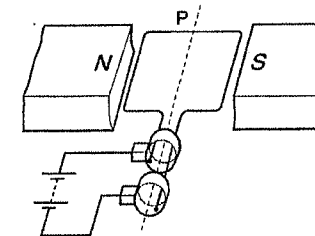


diagram 1

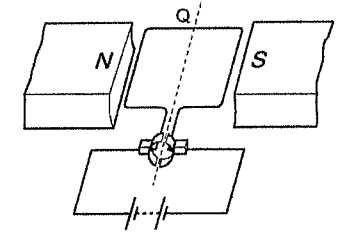
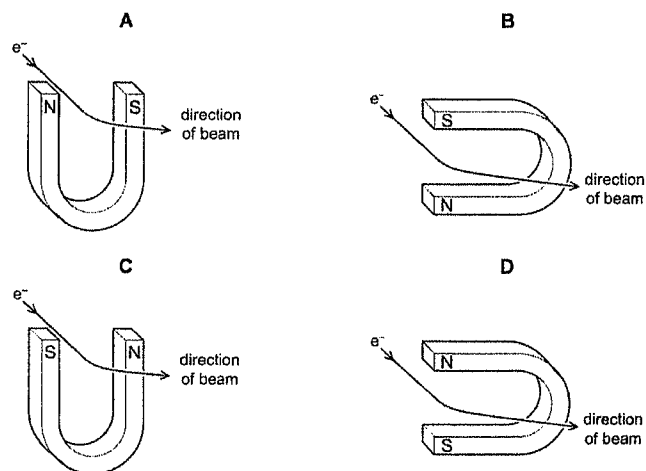


diagram 2

What happens to coils P and Q?

	coil P	coil Q
A	continuously turns anticlockwise	makes one quarter turn anticlockwise then stops
B	continuously turns clockwise	makes one quarter turn clockwise then stops
C	makes one quarter turn anticlockwise then stops	continuously turns anticlockwise
D	makes one quarter turn clockwise then stops	continuously turns clockwise

- 35 A beam of electrons is passed through the magnetic field of a magnet. How must the magnet be positioned to deflect the beam in the direction shown?



- 36 A magnet is dropped vertically through a solenoid, as shown in the diagrams below. This induces magnetic poles at both ends of the solenoid.

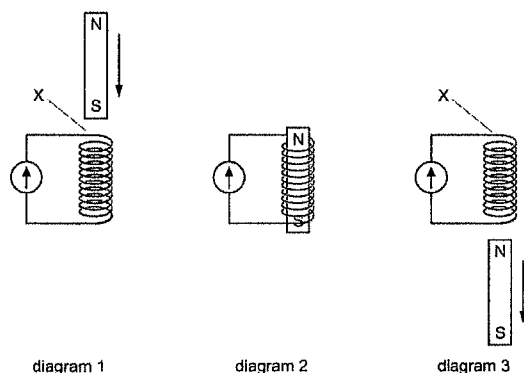


diagram 1

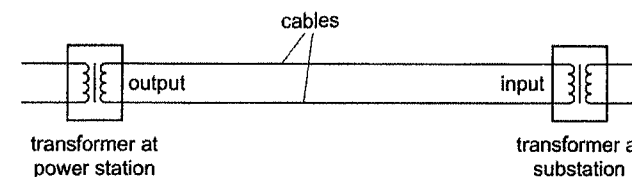
diagram 2

diagram 3

Which magnetic poles are induced at position X in diagram 1 and diagram 3?

	diagram 1	diagram 3
A	N pole	N pole
B	N pole	S pole
C	S pole	N pole
D	S pole	S pole

- 37 Cables transmit electrical power from the output of the transformer at a power station to the input of the transformer at a substation, as shown in the diagram.



The power at the output of the transformer at the power station is 400 MW. Which situation delivers the most power to the input of the transformer at the substation?

	potential difference at power station transformer output / kV	diameter of cables
A	200	large
B	200	small
C	400	large
D	400	small

- 38 Four students are asked to comment on the processes of nuclear fission and nuclear fusion.

Their comments are recorded in the table.

Which row is correct?

	fission	fusion
A	energy is absorbed	a large unstable nucleus splits
B	energy is released	two light nuclei join
C	a large unstable nuclei splits	energy is absorbed
D	two light nuclei join	energy is absorbed

- 39 Which statement about all three types of radioactive emissions is correct?

- A They are all completely absorbed by a thin aluminium sheet.
- B They are all deflected by electric fields.
- C They are all deflected by magnetic fields.
- D They all cause ionisation of gases.

- 40 A teacher holds a radioactive source near a detector.

The reading on the detector is 320 counts/min.

The detector is switched on again after the source has been removed and it shows a reading of 20 counts/min.

What is the counts/min solely due to the source and why is there a reading on the detector when there is no radioactive source present?

	counts/min due to the source	reason for reading with no source
A	300	zero error on detector
B	300	background radiation
C	340	zero error on detector
D	340	background radiation

END OF PAPER

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**2025 PRELIMINARY EXAMINATION
SUGGESTED ANSWER SCHEME**

PAPER 1 (40 marks)

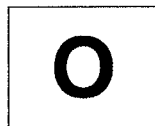
Qn	Ans	Explanation
1	B	Options C and D are not in the range of the micrometer screw gauge. Diameter of an atom is measured using an electron microscope
2	B	Density of cork = $(4.8 \text{ g}) / (80 - 56) \text{ cm}^3 = 0.20 \text{ g/cm}^3$
3	C	Resultant force should originate from the same point as the two component forces. D is wrong as it acts in the opposite direction to the resultant force.
4	D	Area under v-t graph for X = area under v-t graph for Y in 5 s.
5	B	X and Y represents the area - X is the height reached after rebounding, Y is the same height dropped just before impact
6	A	Earth exerts an attractive force (weight - action) on box ; Box exerts an equal but opposite force (reaction) on Earth.
7	B	Two opposing forces of the same magnitude produces a zero resultant force and since the object is already in motion, it will continue in its state of motion at a constant velocity
8	D	Pressure of gas = $101 \text{ kPa} + (0.212 \times 10 \times 1000) \text{ Pa}$ = 103120 Pa = 103 kPa (3 s.f.)
9	C	Force is the same at the sharp point. Due to the small area of the sharp point, pressure (force/area) will be greater than on the flat surface which has a larger area.
10	D	Moment must be taken about the same point (i.e. pivot) for an object in equilibrium
11	B	Tension in wire $\times 30 \text{ cm} \sin 40^\circ = 5.2 \text{ N} \times 15 \text{ cm}$ Tension in wire = 4.044 N = 4.0 N (2 s.f.)
12	A	$KE_y = \frac{1}{2} (m_v)(v_v)^2$; $KE_x = \frac{1}{2} (2m_v)(v_v/2)^2 = (m_v v_v^2)/4 = \frac{1}{2} KE_y$
13	C	A – KE is zero ; B – EPE is zero ; D – KE is zero
14	C	Efficiency = $(100 \times 10^6 \text{ W}) / (1.5 \times 10^5 \text{ kg s}^{-1} \times 10 \text{ N/kg} \times 120 \text{ m}) \times 100\%$ = 55.5% = 56% (2 s.f.)
15	C	Specific heat capacity definition

Qn	Ans	Explanation
16	D	P speaks of the bombardment of molecules at the surface by molecules below; Thermal energy is supplied to the water molecules by the body as it is at a higher temperature ; the drawing of thermal energy from the face cools the face
17	C	$Q = (0.11 \times 1000 \text{ g}) \times 334 \text{ J/g}$ = 36740 J = 37000 J (2 s.f.)
18	C	Atoms are not mobile and cannot expand. Electrons will have collision with atoms as they move to the cooler end of the rod.
19	D	Glass is poor thermal conductor as it does not transfer thermal energy quickly from the heated end ; convection is confined at the top and water is a poor thermal conductor
20	D	In electrostatic induction, only negative charges (electrons) are mobile. By the conservation of charge, the amount of negative charge induced is equal to the amount of positive charges hence the sphere is neutral even during electrostatic induction.
21	C	The direction of the electric field is the direction a (free) positive charge will move when placed at P. Since X is negatively charged, the positive charge will move from P to X, hence the direction.
22	C	Diode allows current to flow in one direction. It will cut off the negative half of the a.c.
23	B	Both lamps were at same brightness before closing switch. After closing, total resistance dropped leading to a higher current. L_1 has a larger current compared to L_2 . So L_1 becomes brighter while L_2 dims.
24	B	Applying potential divider equation A: $V_{\text{output}} = 4.5 \text{ V}$; B: $V_{\text{output}} = \frac{2X}{3X} 9.0 \text{ V} = 6.0 \text{ V}$; C: $V_{\text{output}} = \frac{2X/3}{5X/3} 9.0 \text{ V} = 3.6 \text{ V}$; D: $V_{\text{output}} = 9.0 \text{ V} - \frac{2X/3}{5X/3} 9.0 \text{ V} = 5.4 \text{ V}$
25	A	$V_Q = (2.0 - 0.5) \text{ V}$; $I_P = (2.0 \text{ A} - 0.5 \text{ A}) = 1.5 \text{ A}$
26	C	Radio wave has the longest wavelength
27	D	$v = 2.0 \text{ Hz} \times 2 \text{ m} = 4.0 \text{ ms}^{-1}$. At $t = 0.5 \text{ s}$, the distance moved by the waveform is 2.0 m (1 wavelength)
28	D	$v = (1/0.5) (60 \text{ cm}) = 120 \text{ cm s}^{-1}$
29	C	Speed of sound through solid is the highest.
30	B	Only for object distance $f < u < 2f$ can a real enlarged image.

Qn	Ans	Explanation
31	B	By ray construction, Image of Q and T can still be seen by the eye at E.
32	C	C still attracts the most number of clips(3) after the magnet is removed
33	D	Actions describes in A, B and C disturbs the magnetic domains and cause the little magnets in the domains to disorientate. Passing a direct current will align the domains inside the steel bar and it will become a permanent magnet.
34	C	Applying Fleming's LHR. No rotation for diagram 1 as there is a restoring force when the coil reaches the vertical
35	B	A -electron beam deflected to the bottom of page. (Fleming's LHR) C – electron beam deflected to top of page D – electron beam to the left of page.
36	C	Diagram 1 : X is an induced S-pole when the magnet approaches. As the N-pole recedes away from the coil, a S-pole is induced at the bottom of the coil. Hence X will be a N-pole (Lenz's law)
37	C	Output will be high voltage low current to minimize power loss. Since power loss = I^2R , resistance of cables will be small when cross sectional area is large.
38	B	Both processes result in energy release.
39	D	Gamma radiation pass through aluminium and is not deflected by magnetic and electric fields
40	B	Background radiation accounts for the 20 counts per min



SWISS COTTAGE SECONDARY SCHOOL
SECONDARY FOUR
PRELIMINARY EXAMINATION



Name

Form Class
Register Number

Form Class

4	S	
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PHYSICS

6091/01

Wednesday 3 September 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and register number on the Answer Sheet in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers

A, B, C and D.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

Electronic calculator may be used.

2

- 1 Interstellar distance is usually measured in light-year. One light year is the distance light travels in one year.

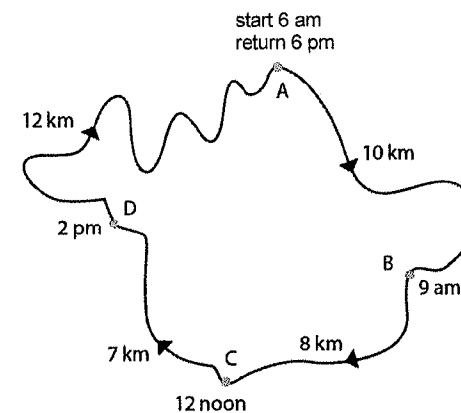
What is the order of magnitude of one light-year?

- A 10^8 m B 10^{13} m C 10^{15} m D 10^{17} m

- 2 Which expression contains only SI base units?

- A $\text{kg m}^2/(\text{s}^2 \text{V})$
B N/kg
C Ns/C
D $\text{kg m}^2/(\text{s}^3 \text{A})$

- 3 A cyclist started cycling from point A at 6 am and went past three other checkpoints B, C and D, before returning to point A at 6 pm. The distances between checkpoints are shown in the route below.



What is the average velocity of the cyclist for the whole journey?

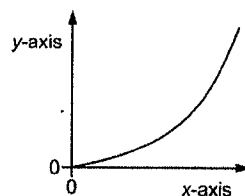
- A 0 m/s B 0.84 m/s C 3.1 m/s D 11 m/s

This document consists of 18 printed pages.

[Turn over

3

- 4 A car is at rest by a red traffic light. When the light changes to green, the car starts moving. The graph represents the motion of the car.

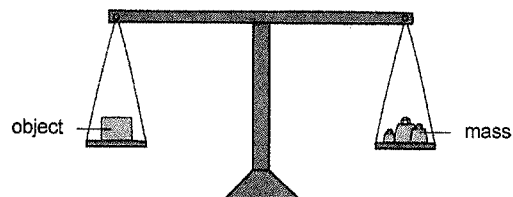


The car has a constant acceleration.

Which quantity is plotted on the x-axis and which quantity is plotted on the y-axis?

	x-axis	y-axis
A	distance	time
B	speed	time
C	time	distance
D	time	speed

- 5 A beam balance is used to determine the mass of an object.



The table shows the various mass combinations placed on the right pan of the balance.

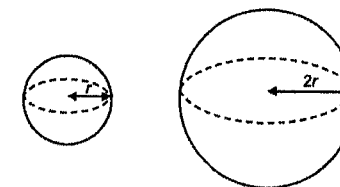
masses on the right pan	effect on the beam balance
100 g, 100 g, 20g, 5 g, 2 g	rotates slightly clockwise
200 g, 10 g, 10 g, 5 g	rotates slightly anticlockwise

What is the most likely mass of the object?

- A 220 g B 225 g C 226 g D 230 g

4

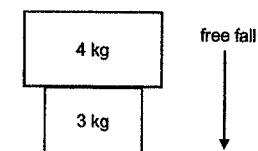
- 6 Two spheres are made of the same material. One sphere has a radius that is twice that of another sphere.



What is the ratio of the mass of the small sphere to the large sphere?

- A 1:1 B 1:2 C 1:3 D 1:8

- 7 Two separate concrete blocks fall from a building under construction at the same time. Both blocks undergo free fall.



What is the magnitude of the force acting on the 3 kg block due to the 4 kg block?

- A 0 N
B 30 N
C 40 N
D 70 N

- 8 Two students X and Y were standing in a bus travelling at constant velocity.

To avoid hitting a child running across the road, the bus driver stepped on the brakes immediately to stop the bus. The bus came to a stop in 2 s.

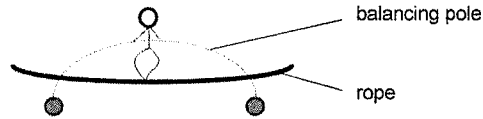
Student X was heavier than student Y.

Which statement about the motion of the students right after the brake was applied is correct?

- A Both X and Y were thrown backward in the opposite direction of the bus's initial velocity.
B Both X and Y were thrown forward in the same direction of the bus's initial velocity.
C Only X was thrown backward in the opposite direction of the bus's initial velocity.
D Only X was thrown forward in the same direction of the bus's initial velocity.

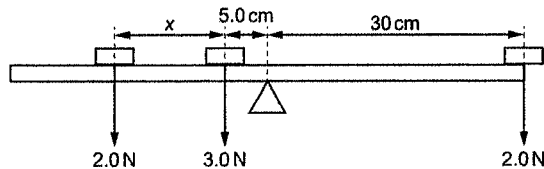
5

- 9 A toy consists of a man holding on to two heavy spheres attached at the end of a light balancing pole. The toy is placed on a tight rope. The toy man is able to return upright when tilted slightly.



Which statement about the combined centre of gravity of the toy man and its balancing pole explains why the toy man is able to balance itself without falling on the rope?

- A It is above the rope but below the waist of the toy man.
 B It is at the point where the feet of the toy man in contact with the rope.
 C It is below the rope and lower than the two spheres.
 D It is below the rope but higher than the two spheres.
- 10 A uniform beam is pivoted at its centre and balanced by three weights as shown.



What is distance x ?

- A 17.5 cm B 22.5 cm C 35.0 cm D 37.5 cm
- 11 A whale swims at a depth of 8.0 m below the surface of the water in the ocean.

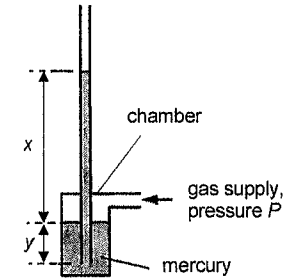
Atmospheric pressure is 1.0×10^5 Pa.
 The density of the sea water is 1025 kg/m^3 .

What is the pressure exerted by the sea water on the whale?

- A 1.8×10^4 Pa
 B 8.2×10^4 Pa
 C 1.1×10^5 Pa
 D 1.8×10^5 Pa

6

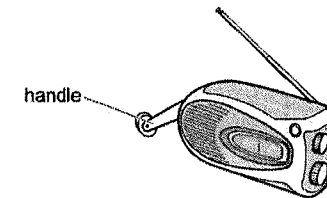
- 12 An open tube stands, with one end in mercury, in a chamber that is connected to a gas supply. The pressure of the gas is P metres of mercury. The atmospheric pressure is h metres of mercury.



The open tube is then replaced with another open tube that is twice larger in diameter but same length. If x and y are measured in metres, what is the pressure P in metres of mercury?

- A $x + h$ B $2(x + h)$ C $2x$ D $2x + y$

- 13 A wind-up radio is used in areas where mains electricity is not available.



A person winds a spring in the radio using the handle. When the spring unwinds, it makes a small coil rotate in a magnetic field.

Which energy transfer is **not** useful for this radio?

- A energy in elastic potential store to energy in the kinetic store
 B energy in the kinetic store to energy in the internal store
 C energy in the chemical potential store to energy in the elastic potential store
 D energy in the kinetic store to the energy in the gravitational potential store

- 14 A rocket is launched vertically upwards by a constant force from its engines.

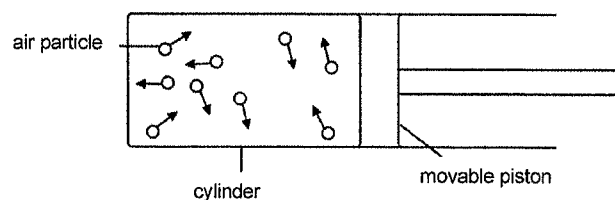
The data for the launch is shown.

weight of rocket	1.9 MN
average air resistance	0.10 MN
force from engine	3.5 MN

How much of the work done on the rocket is used to increase its speed in the first 100 m?

- A 150 MJ B 170 MJ C 350 MJ D 550 MJ

- 15 Air is trapped inside a cylinder by a movable piston. The air inside the cylinder is heated for a short duration. When the heat source is removed, the piston continues to move outward for a short while and stops moving.



When the piston stops moving outward, what happens to the speed of the air particles and their rate of collision with the piston compared to when the piston is still moving after heat source is removed?

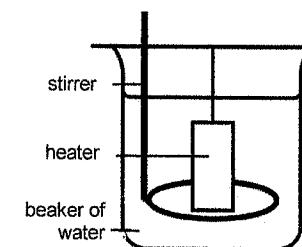
	speed of air particles	rate of collision
A	increases	decreases
B	increases	increases
C	increases	stays constant
D	stays constant	increases decreases

- 16 Expanded polystyrene is often used to make Styrofoam container for storing ice cream.

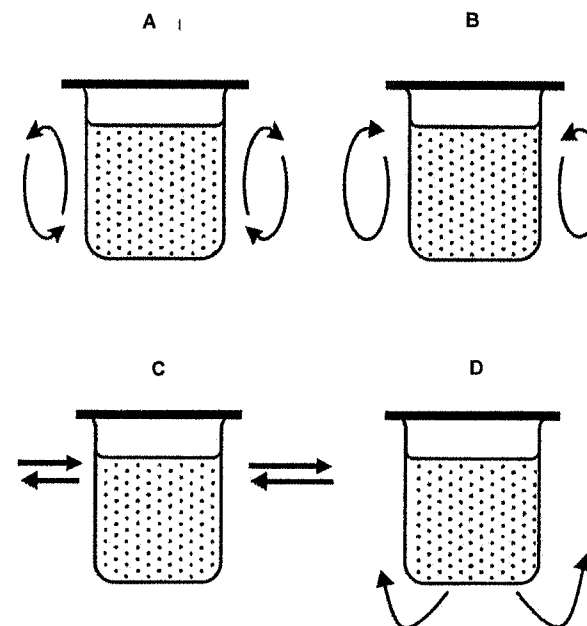
How does the trapped air in expanded polystyrene reduce heat transfer?

- A conduction only.
B conduction and convection.
C conduction, convection and radiation.
D radiation only.

- 17 A beaker of water is heated by an electrical heater as shown below.



Which diagram best illustrates the convection current outside the beaker?



- 18 In colder climates, tropical crops can be grown in greenhouses.

Why do glass panels in a greenhouse help to increase the temperature inside the greenhouse?

- A Glass absorbs sunlight and prevents any radiation from entering the greenhouse.
- B Glass allows sunlight to enter but prevents infrared radiation from escaping.
- C Glass reduces heat transfer from the air inside greenhouse to the outside air.
- D Glass traps air particles, reducing conduction and convection.

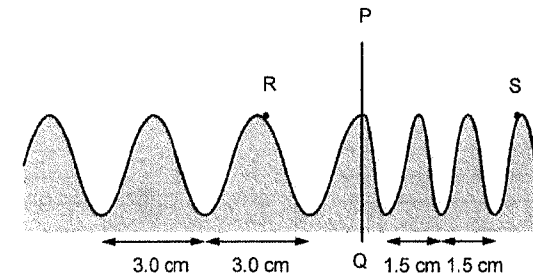
- 19 Which waves are longitudinal?

- A sound waves in water
- B ultraviolet waves in air
- C waves on the surface of water
- D X-rays in a vacuum

- 20 Which row gives the velocity and wavelength of an ultrasound wave?

	velocity / ms ⁻¹	wavelength / cm
A	330	6.6
B	890	89
C	1500	6.0
D	4000	25

- 21 The diagram shows a water wave in a ripple tank.



The wave has a speed of 0.20 m/s at R.

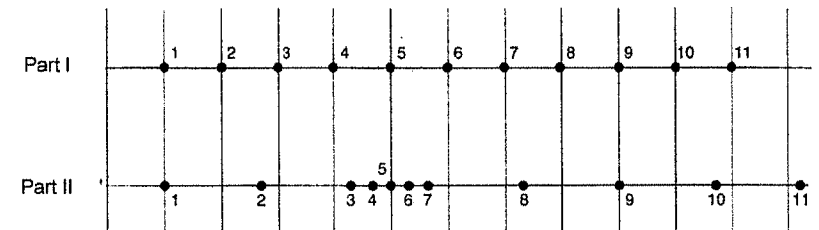
The wave crosses a boundary PQ where the distance between consecutive troughs changes from 3.0 cm to 1.5 cm.

What is the speed of the wave at point S?

- A 0.10 m/s
- B 0.20 m/s
- C 0.40 m/s
- D 0.60 m/s

- 22 A longitudinal wave is travelling in a long slinky spring. Particles 1 to 11 of the spring are at their equilibrium positions as shown in Part I.

Part II shows the positions of the particles at a particular instant when the wave is travelling along the spring. The figure is drawn to scale.



What is the amplitude and the wavelength of the longitudinal wave?

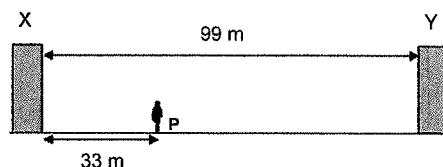
	amplitude / cm	wavelength / cm
A	0.5	4.7
B	1.0	9.2
C	1.5	9.2
D	2.0	4.7

- 23 When a guitar string is plucked harder, which of the following concerning the notes produced will change?

1. frequency
2. loudness
3. quality
4. velocity of sound wave

- A 1 only
 B 1, 2 and 3 only
 C 2 only
 D 2 and 4 only

- 24 Two large vertical walls, X and Y, are 99 m apart. A student, standing at point P which is 33 m away from wall X claps her hands together once. The speed of sound in air is 330 m/s.

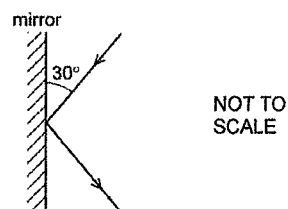


She hears multiple echoes of her clap.

How long does it take for her to hear the third echo?

- A 0.10 s
 B 0.20 s
 C 0.30 s
 D 0.60 s

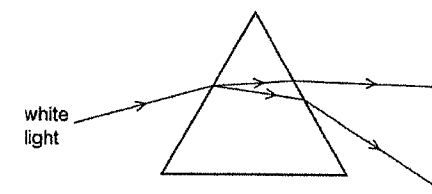
- 25 The diagram shows a ray of light incident on a plane mirror.



What is the angle of reflection?

- A 30° B 60° C 90° D 120°

- 26 A beam of white light is incident on a glass prism.



X and Y are the two ends of the visible spectrum.

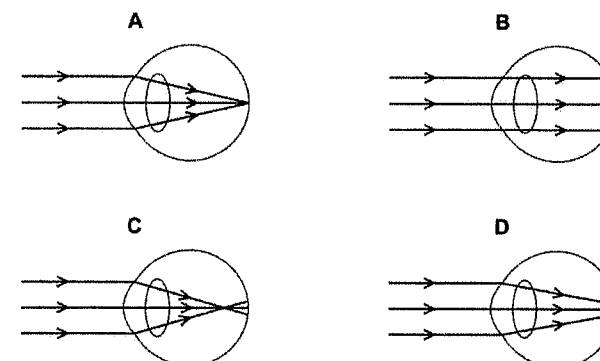
Which statement is correct?

- A All the light travels at the same speed in the prism.
 B The light at X has a lower frequency than the light at Y.
 C The light at X refracts more as it leaves the prism than the light at Y.
 D The white light refracts away from the normal as it enters the prism.

- 27 In which situation is reflection the main effect?

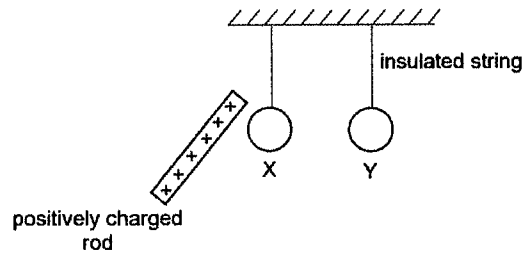
- A A coin at the bottom of a pool appears shallower than it really is.
 B A projector lens forms an image of a slide on a screen.
 C A straw appears bent when placed in a glass of water.
 D An image of yourself can be seen when you look at a shiny metal spoon.

- 28 Which diagram shows how light from a distant object forms an image in a normal eye?



13

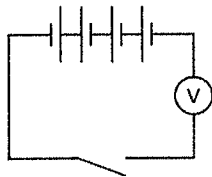
- 29 The diagram shows a positively charged rod brought near two metal spheres X and Y. The metal spheres are held by insulated string, and they are initially uncharged.



What would be the charges on both spheres after sphere X is earthed momentarily?

	sphere X	sphere Y
A	negative	positive
B	negative	uncharged
C	positive	positive
D	positive	uncharged

- 30 Four 1.5 V cells are connected with a voltmeter in a circuit as shown.



The switch is closed.

What is the reading on the voltmeter?

- A 0 V B 1.5 V C 3.0 V D 4.5 V

14

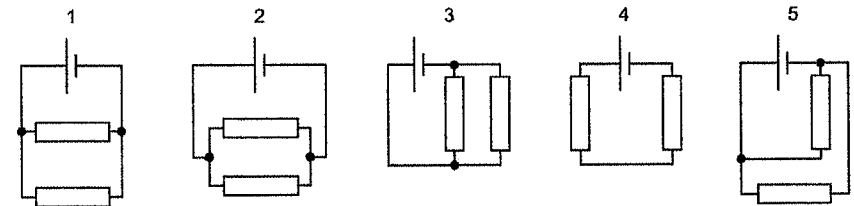
- 31 A copper wire has a resistance of 2.0Ω .

A second copper wire is twice as long as the first wire and its diameter is half the diameter of the first wire.

What is the resistance of the second copper wire?

- A 1.0Ω B 2.0Ω C 4.0Ω D 16Ω

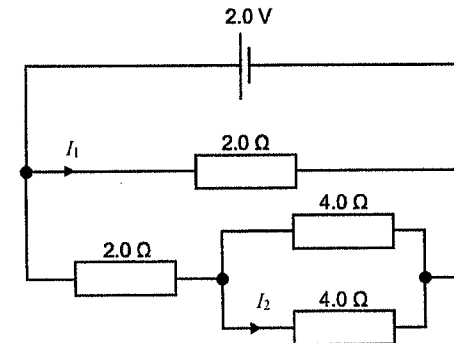
- 32 The diagrams show five electrical circuits. All of the resistors shown are identical.



Which circuits have equal resistance?

- A 1, 2, 3 and 5
B 1, 2, 4 and 5
C 1, 3, 4 and 5
D 2, 3, 4 and 5

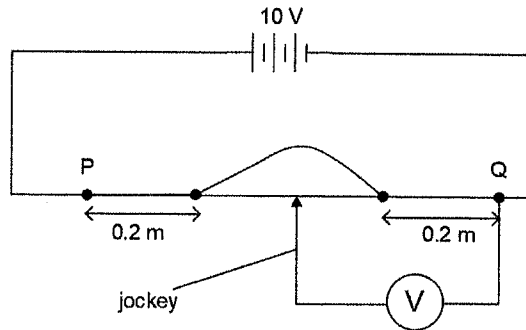
- 33 A cell of voltage of 2.0 V is connected to a network of resistors as shown.



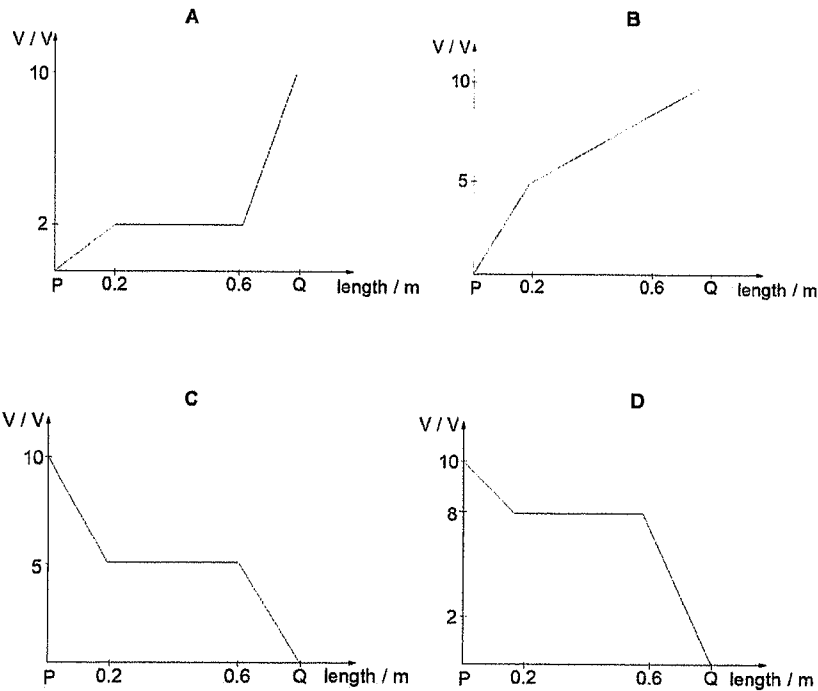
What is the ratio of I_1 to I_2 ?

- A 0.25 B 0.5 C 1 D 4

- 34 The diagram shows a voltmeter connected to Q and a jockey. A connecting wire is connected in parallel with part of a resistance wire PQ, which is 0.8 m long.



Which graph shows the voltage variation along the resistance wire PQ as the jockey moves from P to Q?



- 35 How many kilowatt-hours of energy are used by a 1000 W heater connected to a 240 V supply for 90 minutes?

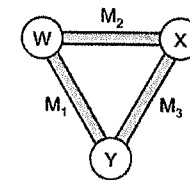
A 0.90 kWh B 1.5 kWh C 360 kWh D 21600 kWh

- 36 Many household appliances are earthed via the mains plug.

Why is earthing considered necessary?

- A Built up static charges need to travel to the Earth.
B Earthing prevents the fuse from blowing.
C Earthing protects user when a fault causes the appliance to become live.
D Earth wire is needed a spare conductor.

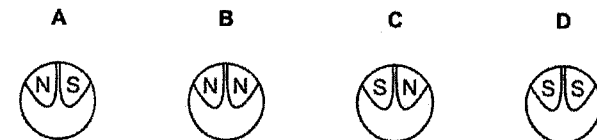
- 37 Magnets M_1 , M_2 and M_3 are joined by iron balls W, X and Y as shown.



Magnetic poles are induced in the iron balls W and X as shown.

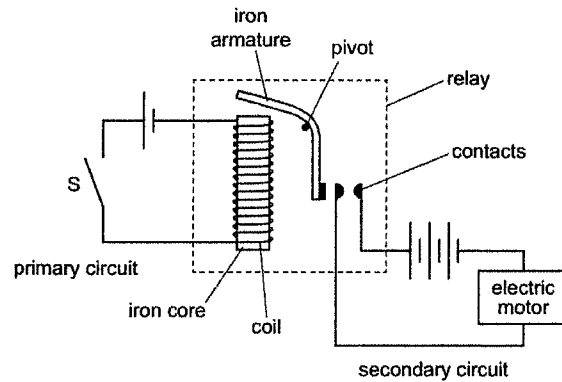


Which diagram shows the poles induced in ball Y?



17

- 38 The diagram shows a relay used to switch on an electric motor.



A student makes four statements to explain how the relay switches on the electric motor when the switch S is closed.

The statements are not in the correct order.

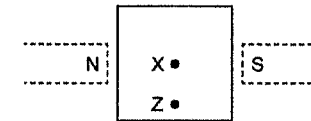
1. The current in the coil magnetises the iron core to become an electromagnet.
2. The armature closes the contacts.
3. The current in the secondary circuit makes the motor turn.
4. The electromagnet attracts the iron armature.

What is the correct order of the statements?

- A 1 → 4 → 2 → 3
 B 1 → 2 → 4 → 3
 C 3 → 2 → 4 → 1
 D 3 → 4 → 1 → 2

18

- 39 A narrow beam of radiation from a radioactive source is detected and travels out of the page through the point X.



The poles of a magnet are then placed on either side of the beam. Radiation is now detected both at X and at Z.

Which types of radiation are present in the beam?

- A alpha and beta radiation
 B alpha and gamma radiation
 C alpha, beta and gamma radiation
 D beta and gamma radiation

- 40 Which source is the least likely to contribute to background radiation detected in a typical environment?

- A cosmic rays originating from outer space
 B radioactive gases like radon seeping from underground rocks
 C radiation from medical imaging procedures like X-rays
 D the electromagnetic fields generated by household electrical wiring

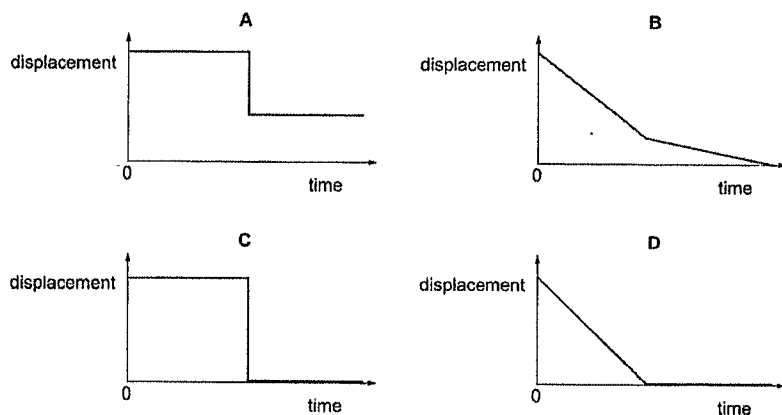
- 1 Some factors that affect a rocket's acceleration and maximum velocity are its mass and amount of air resistance it experiences.

How many of the underlined are scalar quantities?

- A 1
B 2
C 3
D 4

- 2 A parachutist is free-falling at his terminal velocity. After some time, he opens his parachute and continues to fall to the Earth at a lower constant speed.

Which diagram shows how the displacement of the parachutist varies with time?



- 3 A car travels at a constant velocity of 19.0 m/s along a straight road.

After seeing a traffic light, the driver applies the brakes which results in a constant deceleration of 2.0 m/s^2 . The driver holds the brakes until the car comes to a complete stop.

What is the total distance travelled by the car when the driver is braking?

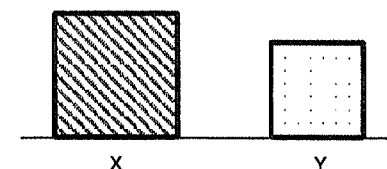
- A 9.5 m
B 38 m
C 90 m
D 181 m

- 4 A spacecraft travels from the Earth to the Moon. At a certain point in the journey, it has zero weight.

Why is the weight zero at this point?

- A The gravitational field strength of the Earth and the Moon cancels each other.
B The mass of the spacecraft is zero at that point.
C The spacecraft has left the Earth's atmosphere.
D The spacecraft is moving at constant speed.

- 5 X and Y are two different cubes with the same weight.



Which statement is correct?

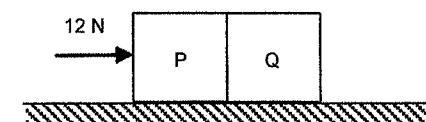
- A Y has a greater inertia and higher density than X.
B Y has a smaller inertia and a higher density than X.
C Y has the same inertia as X and Y has a higher density than X.
D Y has the same inertia as X and Y has a lower density than X.

- 6 A 4.0 N force and a 6.0 N force act on an object.

Which of the following cannot be the resultant force acting on the ball?

- A 1.0 N
B 2.0 N
C 6.0 N
D 10.0 N

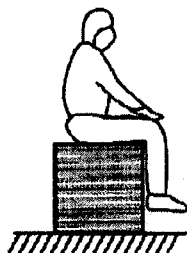
- 7 Block P and Q have equal mass and are placed on a smooth horizontal surface. A 12 N force is applied on block P such that the two blocks move together to the right.



What is the force exerted by block Q on block P?

- A 6 N to the left
B 6 N to the right
C 12 N to the left
D 12 N to the right

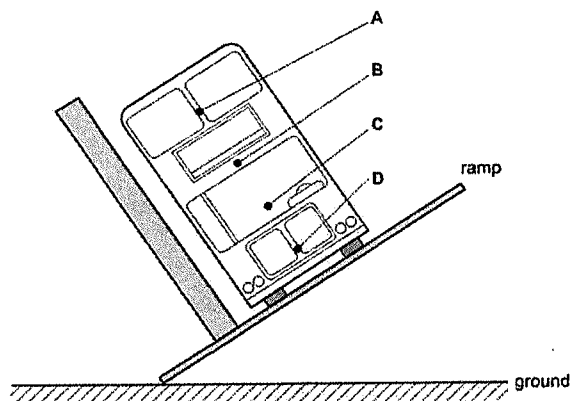
- 8 The diagram shows a man sitting on a box that rests on the ground.



Which of the following correctly describes an action-reaction pair in the scenario?

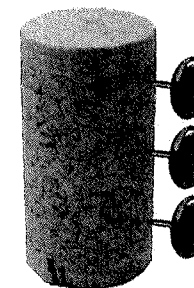
- A The weight of the box and the normal force from the ground on the box.
 B The weight of the man and the gravitational force of the man on the Earth.
 C The normal force from the box on the man and the weight of the man and the normal force from the box supporting the man.
 D The normal force from the box on the man and the normal force from the box on the ground.
- 9 The stability of a bus is tested on a lift ramp. The bus is tilted such that it is just about to topple over.

Where is the centre of gravity of the bus?



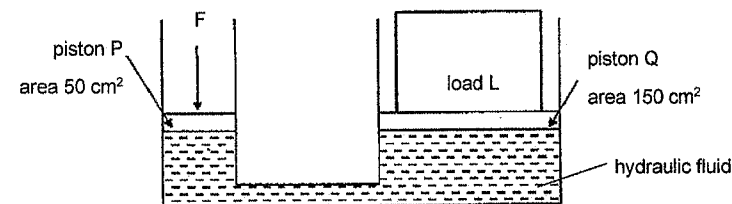
- 10 A piece of cork has a density of 0.2 g/cm^3 and a volume of 4.8 cm^3 .

Three metal pins, each of mass 0.6 g and volume of 0.06 cm^3 were stuck into the cork as shown.



What is the overall density of the cork and pins?

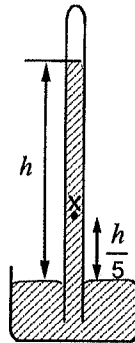
- A 0.32 g/cm^3
 B 0.55 g/cm^3
 C 10.2 g/cm^3
 D 30.2 g/cm^3
- 11 The diagram shows a frictionless hydraulic press. A force F is applied on piston P such that the load L of 1200 N can be lifted. During the process, piston Q moves by 0.025 m .



Assuming pistons P and Q are weightless, what is the distance moved by piston P?

- A 0.050 m
 B 0.075 m
 C 0.10 m
 D 0.13 m

- 12 The diagram shows a barometer placed at ground level where the atmospheric pressure is 1×10^5 Pa. What is the pressure at point X?



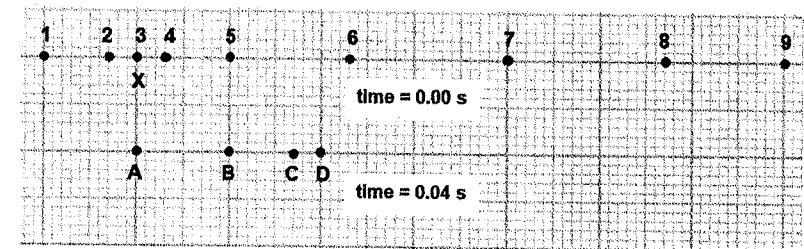
- A 20 000 Pa
B 80 000 Pa
C 100 000 Pa
D 180 000 Pa
- 13 Which of the following is **not** a renewable energy resource?
- A Biofuels
B Hydropower
C Geothermal reservoirs
D Nuclear fuels
- 14 Which statement describes the mechanism that allows a metallic conductor to conduct heat quickly?
- A The diffusion of free electrons from the hotter end to the cooler end of the conductor, carrying the energy along with them.
B The diffusion of atoms in the conductor from the heated end to the cool end, carrying the energy along with them.
C The atoms near the heated end vibrate vigorously about their fixed positions and transfer their energy to neighbouring atoms through collisions.
D The free electrons at the heated end vibrate vigorously about their fixed positions and transfer their energy to neighbouring electrons through collisions.

- 15 The body temperature of a marathon runner rises during a race. In order to cool off, the runner generates sweat on his body.

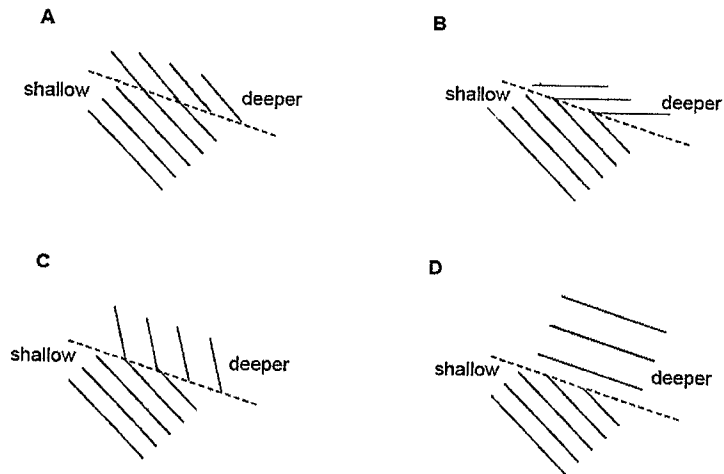
How does the runner maintain his body temperature in this way?

- A Convection current is set up in the sweat and this carries the heat away from the body.
B The sweat conducts heat away from the body as it is a good conductor of heat.
C When sweat evaporates, heat is absorbed from the body, giving it a cooling effect.
D When sweat evaporates, the water radiates heat away from the body, giving it a cooling effect.
- 16 The diagram shows the initial position of some particles at $t = 0.00$ s as a longitudinal wave passes by.

Given that the period of the wave is 0.02 s, what would the position of the particle X be at time = 0.04 s?



- 17 Which of the following correctly shows the wavefront of water waves as it enters a deeper region of the water?



- 18 What is the approximate range of audible frequencies for a young and healthy person?

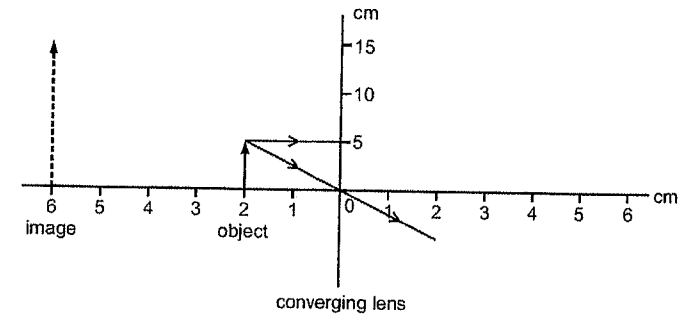
- A 1.0 Hz to 20 Hz
 B 20 Hz to 20 kHz
 C 20 kHz to 100 kHz
 D 100 kHz to 2000 kHz

- 19 The wavelength of X-ray is approximately the same as the diameter of an atom.

What is the frequency of X-ray?

- A 3.0×10^{-18} Hz
 B 3.0×10^{-6} Hz
 C 3.0×10^4 Hz
 D 3.0×10^{18} Hz

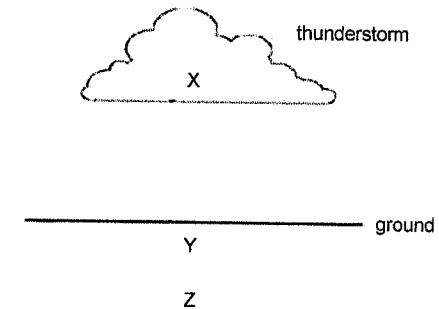
- 20 An object is placed 2.0 cm from a converging lens. The image produced is 6.0 cm from the lens as shown in the diagram.



What is the focal length of the lens?

- A 2.0 cm
 B 3.0 cm
 C 4.0 cm
 D 6.0 cm

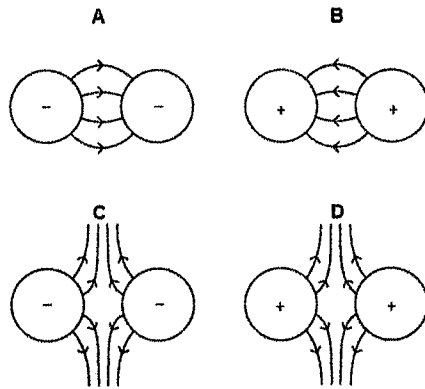
- 21 The following diagram shows a storm cloud. The cloud has lost electrons through friction as it moves. The X charges on the clouds have induced charges Y and Z on the ground below.



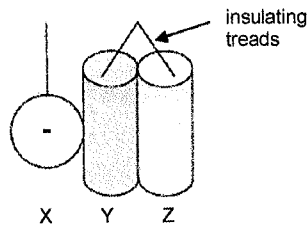
Which of the following shows the charges X, Y and Z and the direction of a resulting electron flow in the ground?

	X	Y	Z	direction
A	negative	positive	negative	downwards
B	positive	negative	positive	upwards
C	positive	negative	negative	upwards
D	positive	positive	negative	upwards

- 22 Which diagram shows the correct electric field between two charged spheres?



- 23 Two light metal rods Y and Z and a negatively-charged metal sphere X are suspended by insulating threads as shown. The three objects are placed in contact with one another.



Which of the following correctly describes the charges on rods Y and Z?

	rod Y	rod Z
A	positively-charged	positively-charged
B	positively-charged	negatively-charged
C	negatively-charged	positively-charged
D	negatively-charged	negatively-charged

- 24 A current of 500 mA flows through a bulb in 5 minutes.

What is the quantity of electric charge that passes through the filament of the bulb?

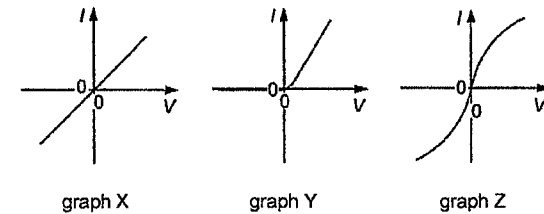
- A 2.5 C
B 42 C
C 150 C
D 2500 C

- 25 A malleable resistive wire of length L and cross-sectional area A has a resistance of R .

What is the resistance of the wire when it is stretched to a length of $2L$?

- A $0.5 R$
B R
C $2 R$
D $4 R$

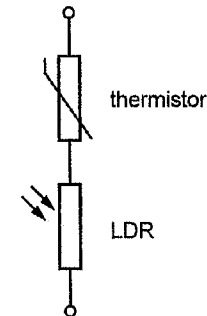
- 26 The I-V characteristics for three different components are shown below.



Which components do the graphs represent?

	graph X	graph Y	graph Z
A	diode	filament lamp	ideal metallic conductor
B	filament lamp	diode	ideal metallic conductor
C	ideal metallic conductor	diode	filament lamp
D	ideal metallic conductor	filament lamp	diode

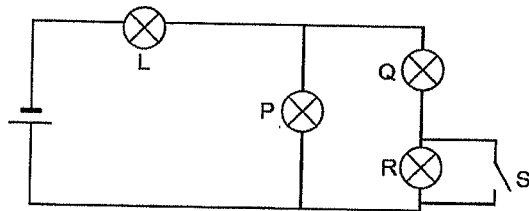
- 27 A thermistor and a light-dependent resistor (LDR) are connected in series in a circuit.



Which conditions would give the largest total resistance across the two components?

- A bright and cold
B bright and hot
C dark and cold
D dark and hot

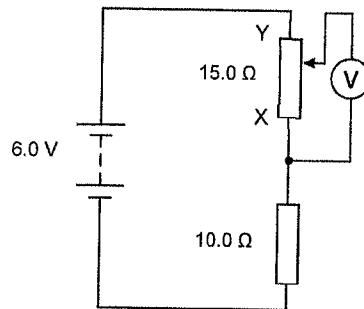
- 28 The diagram shows a circuit with four identical light bulbs L, P, Q and R.



Which option describes the changes in brightness of the bulbs L and P when switch S is closed?

	bulb L	bulb P
A	brighter	brighter
B	brighter	dimmer
C	dimmer	brighter
D	dimmer	dimmer

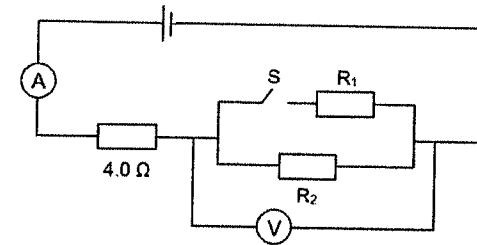
- 29 The diagram shows a circuit with a potential divider connected in series with a fixed resistor. X and Y marks the ends of the potential divider.



What are the minimum and maximum readings that can be obtained on the voltmeter when the contact of the potential divider is moved from X to Y?

	minimum / V	maximum / V
A	0	2.4
B	0	3.6
C	2.4	6.0
D	3.6	6.0

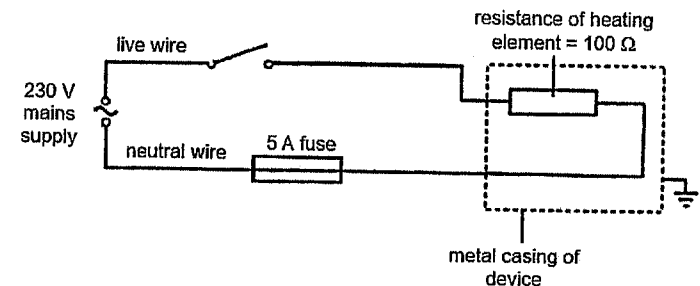
- 30 Two resistors R_1 and R_2 are connected in a circuit as shown. When switch S is open, the ammeter and voltmeter read 1.0 A and 8.0 V respectively. When switch S is closed, the readings changes to 1.5 A and 6.0 V respectively.



What is the resistance of R_1 and R_2 ?

	R_1 / Ω	R_2 / Ω
A	4.0	4.0
B	4.0	8.0
C	8.0	4.0
D	8.0	8.0

- 31 A student constructs a circuit for a heating device, and connects it to the mains socket.

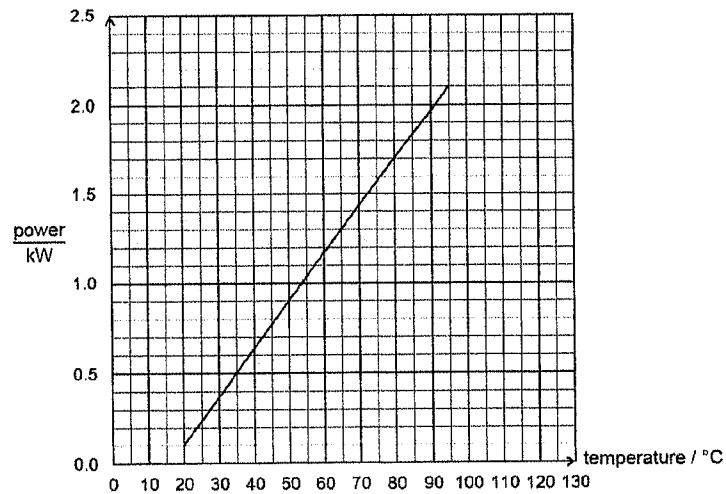


The teacher states that there is one error in the circuit setup.

What is the error in the circuit constructed by the student?

- A The earth wire is not connected to the circuit.
- B The fuse rating chosen is too low.
- C The placement of the fuse is wrong.
- D The placement of the switch is wrong.

- 32 The diagram shows how the power of a washing machine changes at different wash temperature.

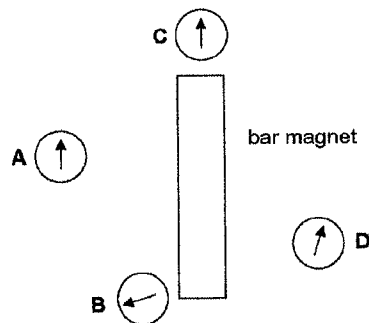


The washing machine was programmed to complete a 90 minutes wash cycle at 80 °C. The cost of 1kWh of electricity is \$0.30. What is the cost of washing the load?

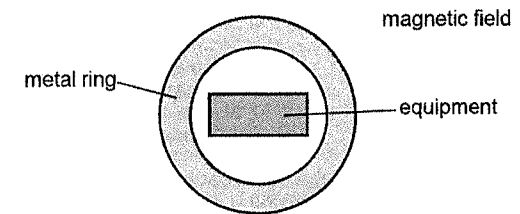
- A \$ 0.34
B \$ 0.77
C \$ 45.90
D \$ 765.00

- 33 Four magnetic compasses are placed near a bar magnet as shown.

Which compass is faulty?



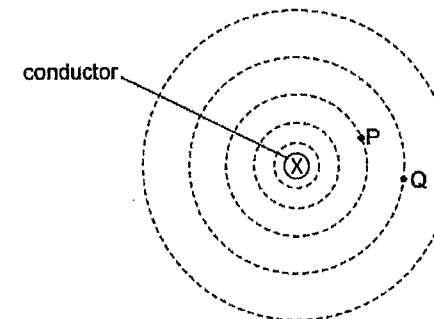
- 34 The diagram below shows a metal ring used for shielding of sensitive equipment from external magnetic fields.



Which row correctly describes the material used for the ring?

- A Copper is used as the metal carries the field lines around the equipment.
B Copper is used as the metal is non-magnetic.
C Iron is used as the metal redirects the field lines around the equipment.
D Iron is used as the metal is non-magnetic.

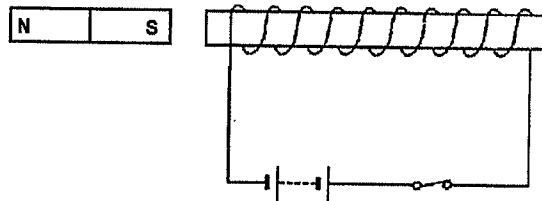
- 35 The diagram shows the shape of the magnetic field lines near a current-carrying conductor.



Which row correctly states the direction of the field lines and the relative strength of the magnetic field at points P and Q?

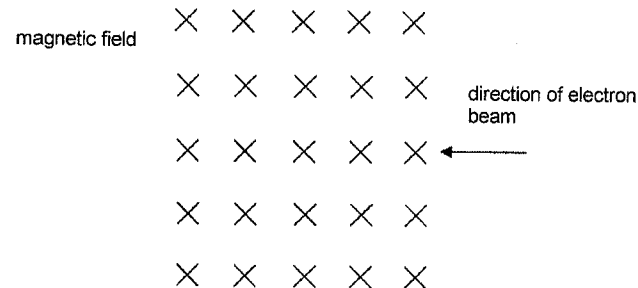
	direction of field lines	the field is stronger at
A	anticlockwise	P
B	anticlockwise	Q
C	clockwise	P
D	clockwise	Q

- 36 A brass rod is placed in a solenoid connected to a battery. A permanent magnet is then placed near the solenoid with its South pole facing the brass rod.



What will happen to the permanent magnet?

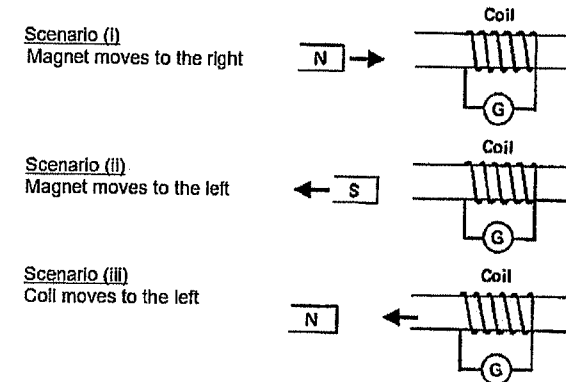
- A It will move towards the solenoid.
 B It will move away from the solenoid.
 C It will move towards and then away from the solenoid.
 D It will not move.
- 37 The diagram shows a beam of electron entering a region with a constant magnetic field.



Which of the following describes the movement of the electrons as it enters the magnetic field?

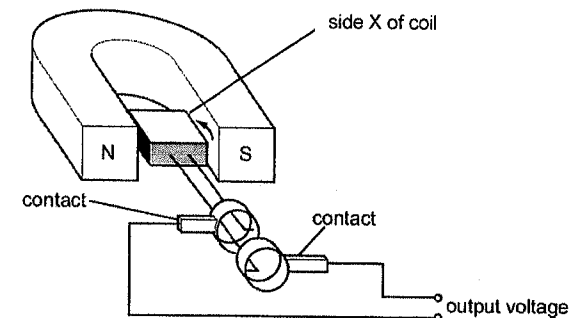
- A The electrons are deflected into the page.
 B The electrons are deflected out of the page.
 C The electrons are deflected to the bottom of the page.
 D The electrons are deflected to the top of the page.

- 38 The diagram below shows three scenarios of interactions between a permanent magnet and a wire coil connected to a galvanometer.



In which of the scenarios do the galvanometer deflect in the same direction?

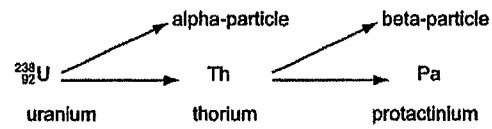
- A (i) and (ii)
 B (i) and (iii)
 C (ii) and (iii)
 D (i), (ii) and (iii)
- 39 A coil is rotated steadily between the poles of a permanent magnet. One side of the coil is labelled as X.



During rotation, when is the output voltage zero?

	orientation of coil	position of X
A	horizontal	near the N-pole only
B	horizontal	near N-pole or S-pole
C	vertical	at the top only
D	vertical	at both top and bottom

- 40 The diagram below shows the decay chain of a uranium-238 nucleus.



What is the proton number of protactinium?

- A 89
- B 90
- C 91
- D 95

END OF PAPER

Paper 1 (40 marks)

1	2	3	4	5	6	7	8	9	10
A	B	C	A	C	A	A	B	C	B

11	12	13	14	15	16	17	18	19	20
B	B	D	A	C	A	C	B	D	B

21	22	23	24	25	26	27	28	29	30
B	D	D	C	D	C	C	B	B	D

31	32	33	34	35	36	37	38	39	40
C	B	C	C	C	B	D	D	D	C



ST. MARGARET'S SCHOOL (SECONDARY)

Preliminary Examinations 2025

CANDIDATE NAME

CLASS

REGISTER NUMBER

Physics

6091/01

Paper 1

02 September 2025

Secondary 4 Express

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and register number on the Answer Sheet in the spaces provided unless this has been done for you.

There are forty questions on this paper. Answer all questions. For each question there are four possible answers A, B, C and D.

Choose the one you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

2

- 1 A student is studying the following equations.

power =	work / time
force =	mass x acceleration
velocity =	displacement / time

How many vector quantities are present in these three equations?

- A 1 B 2 C 3 D 4

- 2 In an experiment, the time taken by a simple pendulum to complete 50 oscillations was measured and recorded as shown in the table below.

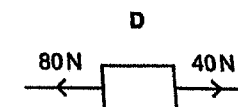
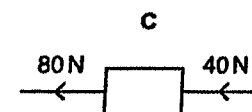
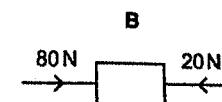
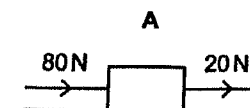
trial number	time for 50 oscillations / s
1	70.7
2	70.1
3	69.2

What is the period of the pendulum?

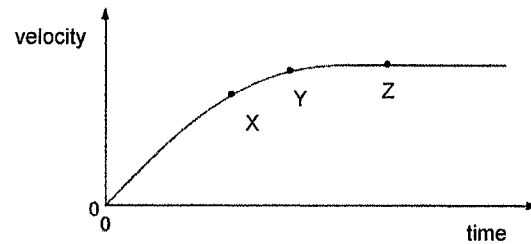
- A 0.71 s B 1.4 s C 70.0 s D 210 s

- 3 The diagram shows the same object on a smooth table. Four different pairs of forces act on the object.

Which pair of forces causes the greatest acceleration?

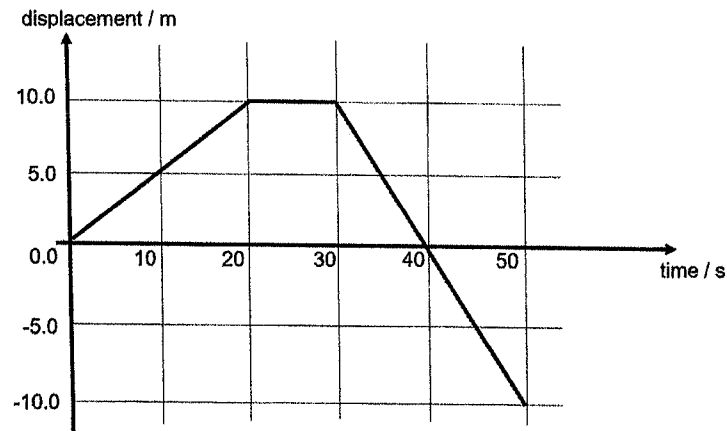


- 4 A raindrop falls vertically from rest in air. The variation with time of the velocity of the raindrop is shown in the graph.



Which statement about the raindrop is correct?

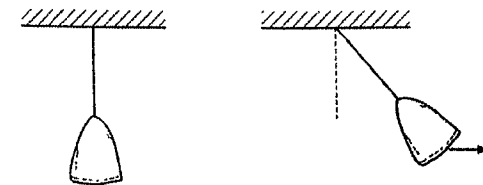
- A At point X, the raindrop has an acceleration of 10 m/s^2 .
 B At point Z, the force on the raindrop due to air resistance has reached its maximum value and so the acceleration of the raindrop has also reached its maximum value.
 C At point Z, the force due to air resistance is equal and opposite to the weight of the raindrop and so the speed of the raindrop is zero.
 D The resultant force on the raindrop at point Y is less than the resultant force on the raindrop at point X.
- 5 The diagram shows the displacement-time graph of a car traveling on a straight and horizontal road.



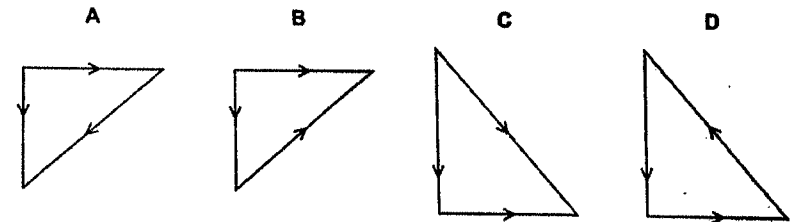
What is the total distance travelled by the car in 50 s?

- A -10 m B 0 m C 30 m D 300 m

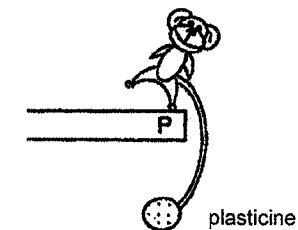
- 6 A heavy sack is suspended from the ceiling by a rope. The sack is then pulled to one side and held stationary.



Which diagram represents the forces acting on the sack in its new position?



- 7 The diagram shows a toy monkey with a lump of plasticine placed at the end of its tail. When displaced about point P, it oscillates and eventually comes to rest at this same position.

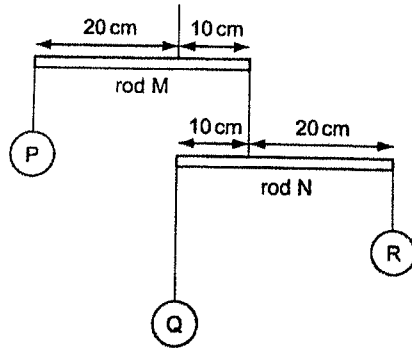


How does the plasticine help the toy monkey maintain its state of equilibrium?

- A It increases the weight of the toy.
 B It moves the centre of gravity to be directly above P.
 C It moves the centre of gravity to be directly below P.
 D It moves the centre of gravity to be exactly at P.

5

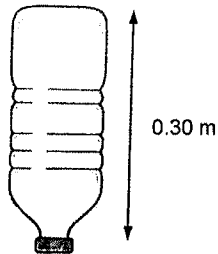
- 8 The diagram shows a decoration, made by suspending objects, P, Q and R from light rods M and N. The masses P, Q and R are such that the rods are horizontal.



Which row gives a possible combination of the masses of P, Q and R?

	mass of P/g	mass of Q/g	mass of R/g
A	10	10	10
B	15	10	10
C	15	20	10
D	20	40	20

- 9 A bottle is filled with water, and a cap is placed on it. It is then turned upside down. There is no air inside the bottle.



The area of the cap in contact with the water is $4.0 \times 10^{-4} \text{ m}^2$.
The density of water is 1000 kg/m^3 and the gravitational field strength is 10 N/kg .

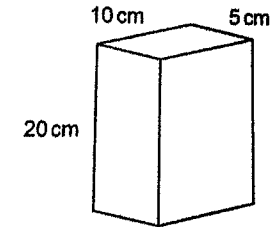
The water produces a force on the cap.

What is the value of this force?

- A 0.075 N B 0.12 N C 1.2 N D 13 N

6

- 10 A brick of weight 80 N stands upright on the ground as shown.



What is the pressure it exerts on the ground?

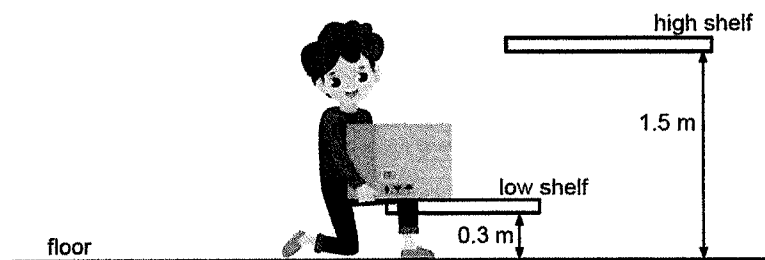
- A $\frac{80}{20 \times 10} \text{ N/cm}^2$
B $\frac{20 \times 10}{80} \text{ N/cm}^2$
C $\frac{80}{10 \times 5} \text{ N/cm}^2$
D $\frac{10 \times 5}{80} \text{ N/cm}^2$

- 11 Various forms of energy can be used to generate electrical energy. Some sources of energy are renewable while others are non-renewable.

Which row shows the correct types of energy?

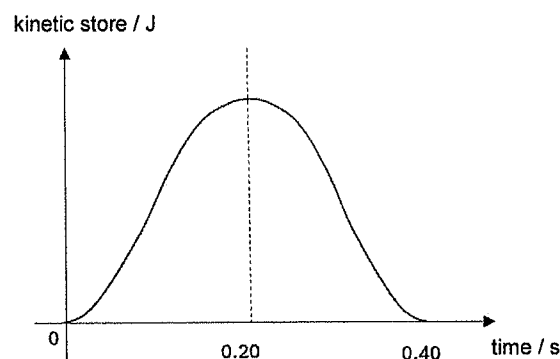
	renewable	non-renewable
A	geothermal	nuclear
B	geothermal	solar
C	nuclear	fossil fuel
D	solar	geothermal

- 12 The diagram shows a student lifting a box of weight 50 N from a low shelf to a high shelf.



How much work is done by the student?

- A 30 J B 60 J C 75 J D 90 J
- 13 The diagram below shows part of the kinetic store-time graph of an oscillating pendulum.



What is the frequency of the oscillation? Assume air resistance is negligible.

- A 1.25 Hz B 1.67 Hz C 2.50 Hz D 5.00 Hz
- 14 When fine pollen grains suspended in water are viewed under a microscope, they are seen to be making small, erratic movements.

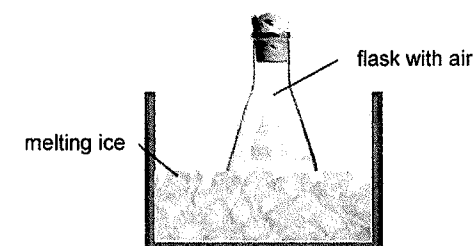
Why is this so?

- A There are convection currents in the water.
 B They are being hit by water molecules.
 C They are moving and colliding with one another.
 D They are living organisms so they move around.

- 15 What happens when a solid is heated and expands?

- A The molecules do not change size and the spaces between the molecules become larger.
 B The molecules expand and the spaces between the molecules become larger.
 C The molecules expand and the spaces between the molecules become smaller.
 D The molecules expand and the spaces between the molecules remain the same.

- 16 A conical flask is filled with air and tightly capped at room temperature. The flask is then placed in melting ice as shown.



Which of the following is correct about the pressure and the speed of air molecules in the flask?

	pressure	speed of molecules
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

- 17 Four bars, all of the same size, are each placed with one end in boiling water. The time taken for the temperature of the other end to increase by 2 °C are measured.

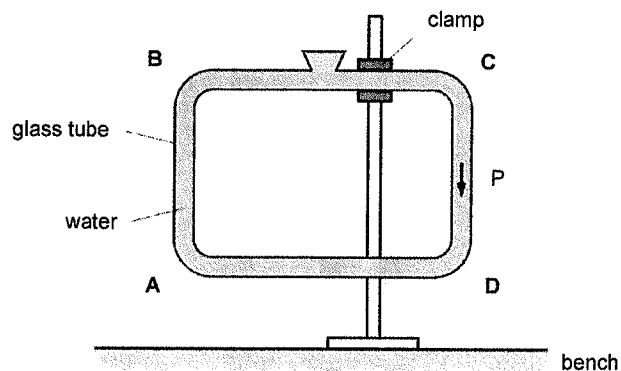
material of bar	time taken for 2 °C increase / s
aluminium	10
copper	5
cork	800
styrofoam	1200

To make a large metal tank with **minimal** heat loss, which materials should be used for the tank and its insulation?

	tank	insulation
A	aluminium	cork
B	aluminium	styrofoam
C	copper	cork
D	copper	styrofoam

- 18 The diagram shows a glass tube filled with water and suspended above a bench. The water is free to circulate around the tube.

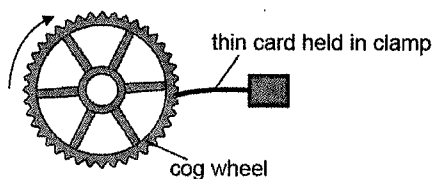
At point P, there is a convection current moving in a downwards direction. At which point is the tube heated to cause this convection current?



- 19 The energy required to change liquid water into water vapour at the same temperature is called latent heat of vaporisation.

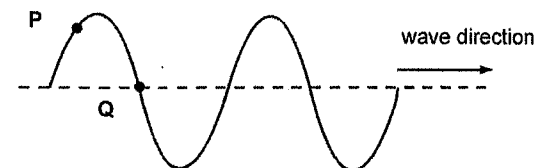
What does this energy do?

- 20 A piece of thin card was held against the teeth of a cog wheel. When the wheel is turned at high speed, a note is heard.



How can the pitch of this note be raised?

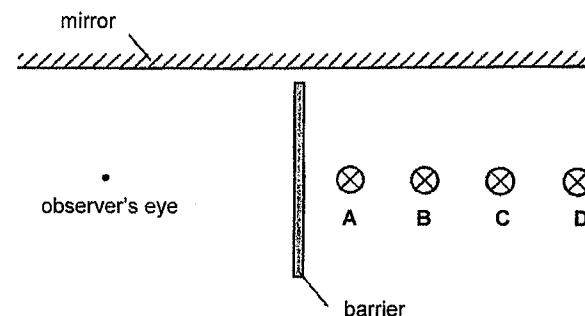
- 21 The diagram shows a wave on a string with two points P and Q marked. The wave is moving in the direction shown.



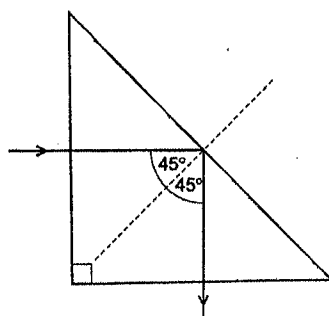
What will happen next?

- 22 Which type of electromagnetic radiation travels at the highest speed through vacuum?
- 23 Which of the following types of electromagnetic radiation is used in medical imaging to view bones?
- 24 The diagram shows a barrier placed at right-angles to a plane mirror with four lamps at positions A, B, C and D.

Which lamp can be seen by the observer?

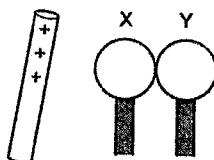


- 25 The diagram shows a right-angled prism being used to bend a ray of light through 90° .



What is the critical angle for the light in the glass?

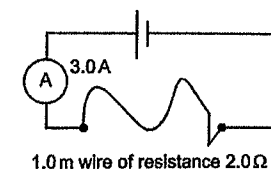
- A equal to 45°
 B equal to 90°
 C greater than 45°
 D less than 45°
- 26 Two insulated, uncharged metal spheres X and Y are in contact. While a positively charged rod is held near X, the spheres are physically separated by hand. After this, X is found to have a negative charge.



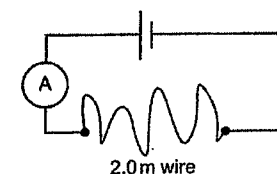
What will be the charge on Y?

- A negative and smaller than that on X
 B negative and the same size as that on X
 C positive and smaller than that on X
 D positive and the same size as that on X
- 27 A total charge of 100 C flows through a 12 W light bulb in 50 s.
- What is the potential difference across the light bulb during this time?
- A 0.12 V B 2.0 V C 6.0 V D 24 V

- 28 A wire of length 1.0 m has a resistance of 2.0Ω . When connected to a cell, the current in the wire is 3.0 A.



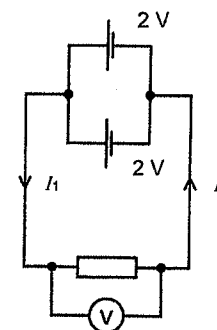
A 2.0 m length of the same wire is connected to the same cell.



What is the resistance of the wire and the current in it?

	resistance / Ω	current / A
A	1.0	1.5
B	1.0	3.0
C	4.0	1.5
D	4.0	3.0

- 29 The diagram shows a circuit.



Which row shows the relationship between currents I_1 and I_2 and gives the correct voltmeter reading?

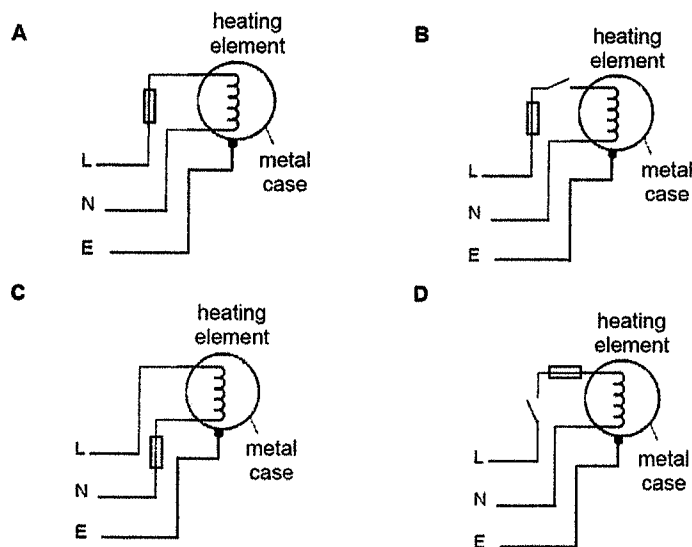
	relationship	voltmeter reading
A	$I_1 > I_2$	2 V
B	$I_1 > I_2$	4 V
C	$I_1 = I_2$	2 V
D	$I_1 = I_2$	4 V

30 Which of the following would cost the least if operated from the same voltage supply?

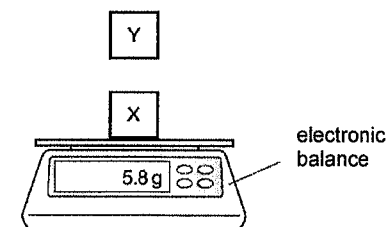
- A a 5000 W electric cooker used for 1 minute
- B a 1000 W electric fire used for 10 minutes
- C a 500 W electric iron used for 1 hour
- D a 100 W lamp used for a day

31 An electric iron with a metal case is connected to the electrical mains of a house. The heating element is not in electrical contact with the metal case.

Which is the correct wiring for the live wire L, the neutral wire N and the earth wire E?



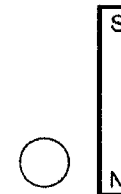
32 Object X is placed on an electronic balance. Object Y is held above object X as shown. The reading on the balance increases when Y is moved closer to X.



What could be the identities of X and Y?

	X	Y
A	a magnet	a magnet
B	a magnet	an unmagnetised iron
C	an unmagnetised iron	a magnet
D	an unmagnetised iron	an unmagnetised iron

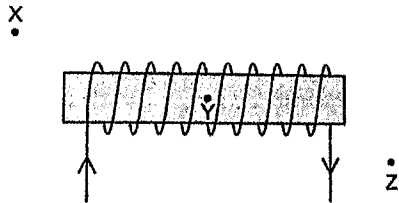
33 The diagram shows a bar magnet with a compass placed near it.



Which of the following best represents the orientation of the compass if the magnetic field of the Earth is neglected?



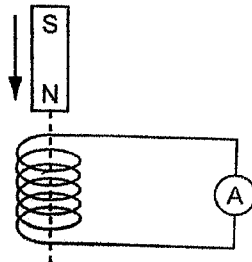
- 34 There is a current in the solenoid.



How does the strength of the magnetic field at points X, Y and Z compare?

- A equal at X and Z but stronger at Y
 B equal at X and Z but weaker at Y
 C stronger at X than Y, and stronger at Y than Z
 D the same at X, Y and Z
- 35 A small coil is connected to a sensitive ammeter. The ammeter needle can move to either side of the zero position.

When the magnet is allowed to fall towards the coil, the ammeter needle moves quickly to the right of the zero position.

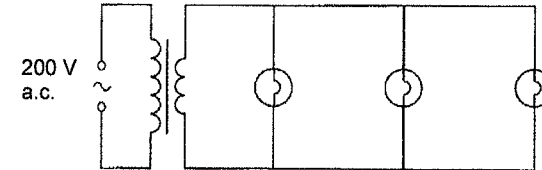


The magnet moves through and out of the coil.

How does the ammeter needle move as the magnet falls out of the coil?

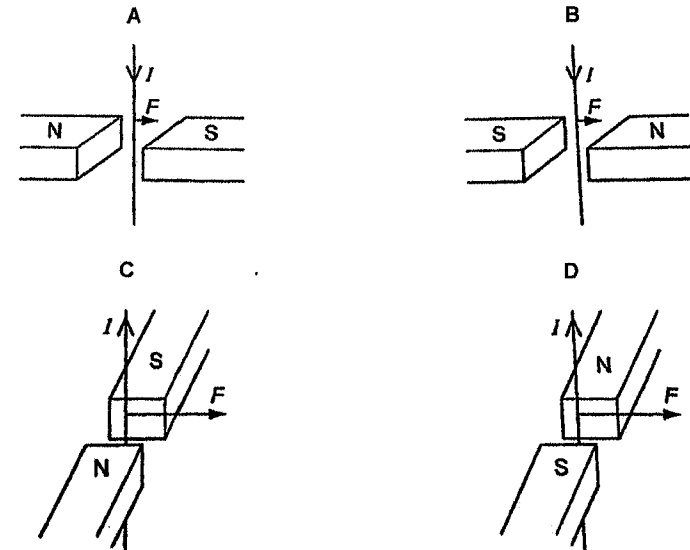
- A It does not move.
 B It gives a steady reading to the right.
 C It moves quickly to the left of the zero position and then returns to zero.
 D It moves quickly to the right of the zero position and then returns to zero.

- 36 In the figure below, the transformer is 60% efficient. Each light bulb is 12 V, 24 W and working at its rated value.

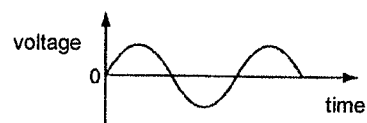


What is the primary current?

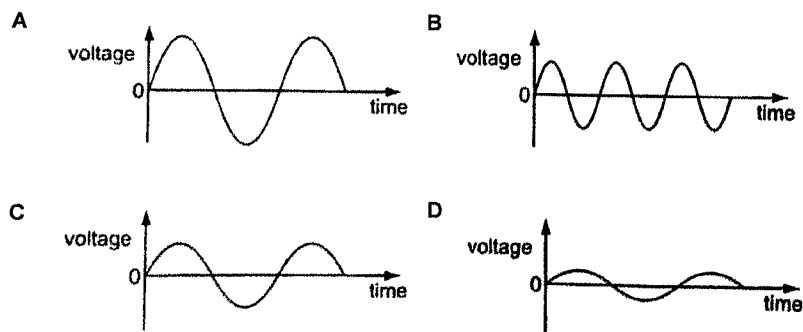
- A 0.20 A B 0.45 A C 0.60 A D 0.80 A
- 37 Which diagram correctly shows the direction of the force F that is produced by a current I in a magnetic field?



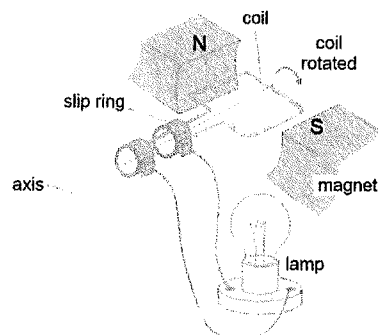
- 38 A transformer has more turns on the secondary coil than on the primary coil. The graph shows how the input voltage varies with time.



Which graph, drawn to the same scale as the input graph, shows how the output voltage varies with time?



- 39 A simple a.c. generator is used to operate a lamp.

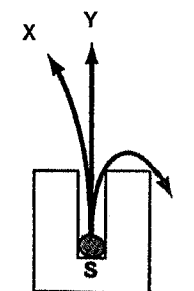


Which change will **not** increase the brightness of the lamp?

- A increase the diameter of the slip rings used
 B increase the frequency of rotation of the coil
 C increase the number of turns in the coil
 D increase the strength of the magnets used

- 40 The diagram shows the emission of alpha, beta and gamma radiation from a source S within a lead block.

There is a strong magnetic field present.



What are the names of the radiation X, Y and Z?

	X	Y	Z
A	alpha	beta	gamma
B	alpha	gamma	beta
C	beta	alpha	gamma
D	beta	gamma	alpha

1	D	6	D	11	A	16	A	21	D	26	D	31	B	36	C
2	B	7	C	12	B	17	B	22	A	27	C	32	A	37	D
3	C	8	C	13	A	18	A	23	D	28	C	33	C	38	A
4	D	9	C	14	B	19	A	24	C	29	C	34	A	39	A
5	C	10	C	15	A	20	B	25	D	30	A	35	C	40	B



**SINGAPORE SPORTS SCHOOL
PRELIMINARY EXAMINATION 2025
SECONDARY 4 EXPRESS**

CANDIDATE
NAME

CLASS

4B

INDEX
NUMBER

PHYSICS

6091/01

Paper 1 Multiple Choice

29 August 2025

Candidates answer on the separate answer sheet provided.

1 Hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Write your name and index number on the answer sheet in the spaces provided unless this has been done for you.

Do not use staples, paper clips, glue or correction fluid.

There are **forty** questions on this paper. Answer **all** questions.

For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in soft pencil on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

Take the value of $g = 10 \text{ m/s}^2$, unless otherwise stated.

The use of an approved scientific calculator is expected, where appropriate.

This document consists of 22 printed pages and 2 blank pages.

- 1 What is the joule (J) in SI base units?

A kg m s^{-1}
B $\text{kg m}^2 \text{s}^{-1}$
C kg m s^{-2}
D $\text{kg m}^2 \text{s}^{-2}$

- 2 Z is the product of two lengths, X and Y.

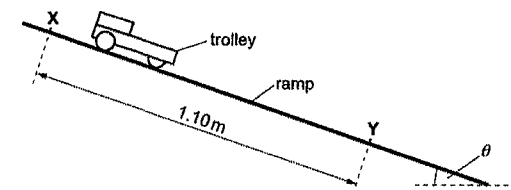
Which values of X and Y will give the highest value for Z?

	X	Y
A	$0.1 \mu\text{m}$	1.0 Tm
B	0.1 km	1.0 Mm
C	$100 \mu\text{m}$	1.0 Gm
D	10 mm	0.01 Gm

- 3 A motion sensor is used to determine the velocity of the trolley at points X and Y.

The distance between X and Y is 1.10 m .

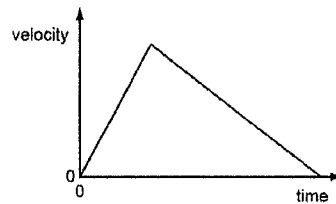
The trolley has velocity 1.3 m/s at X and velocity 2.5 m/s at Y.



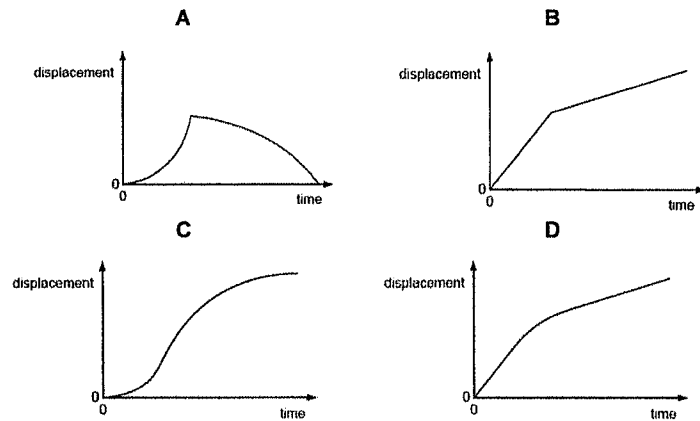
What is the acceleration of the trolley?

A 0.71 m/s^2
B 1.2 m/s^2
C 1.4 m/s^2
D 2.1 m/s^2

- 4 The velocity-time graph represents a short journey.



Which of the following displacement-time graphs correctly represents the same journey?



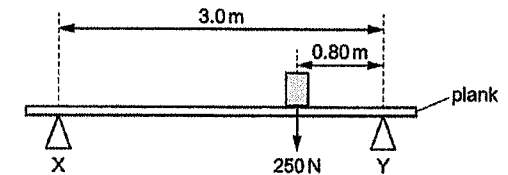
- 5 A cable is attached to an object of weight 30 N. The object is pulled vertically upwards with an acceleration of 6.0 m/s^2 .

What is the tension in the cable?

- A 12 N
B 18 N
C 30 N
D 48 N

- 6 A plank of negligible mass is held horizontal by supports X and Y that are placed 3.0 m apart.

A weight of 250 N is placed on the plank 0.80 m from support Y.

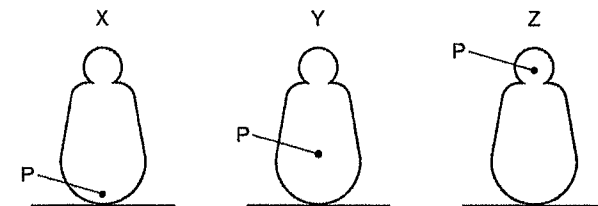


What is the force exerted by support Y on the plank?

- A 67 N
B 100 N
C 180 N
D 200 N

- 7 Three children's toys, X, Y and Z, are the same size and shape.

They have weights at different positions inside so that the position of the centre of gravity of each toy is different. Each toy's centre of gravity is marked P.



Which toy is the most stable and which toy is the least stable when balanced in the positions shown?

	most stable	least stable
A	X	Y
B	X	Z
C	Y	X
D	Y	Z

- 8 A roller-coaster train of mass 2000 kg is stationary at the top of its run. The train has 1600 kJ of energy in its gravitational potential store.

When released, it rolls down the track and reaches the bottom at a speed of 30 m/s.

How much energy is transferred out of the train as it travels down the run?

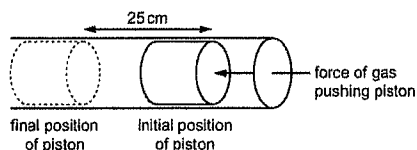
- A 700 kJ
- B 900 kJ
- C 1510 kJ
- D 2500 kJ

- 9 As a cyclist uses the brakes on a bicycle, energy is transferred from the kinetic store to the internal (thermal) store.

What causes the transfer of energy?

- A mass
- B weight
- C friction
- D thrust

- 10 The gas in an engine does work on a piston of cross-sectional area 80 cm^2 . The pressure on the piston has a constant value of $4.6 \times 10^5 \text{ Pa}$.



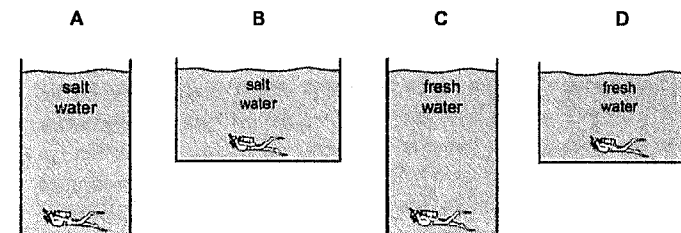
How much work is done by the gas on the piston when it moves through a distance of 25 cm?

- A $9.2 \times 10^2 \text{ J}$
- B $9.2 \times 10^4 \text{ J}$
- C $9.2 \times 10^6 \text{ J}$
- D $9.2 \times 10^8 \text{ J}$

- 11 The diagrams show four divers at the bottom of four different swimming pools.

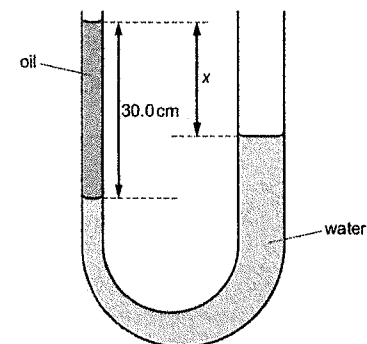
Two swimming pools contain fresh water and two contain salt water. Fresh water is less dense than salt water.

Which diver feels the least pressure from the water?



- 12 A U-tube has one arm of area of cross-section A and the other of cross-section 4A.

The tube contains water of density 1000 kg/m^3 and oil of density 850 kg/m^3 , as shown.



The column of oil on top of the water in the left-hand arm is of length 30.0 cm.

What is the difference in height x between the levels in the two arms of the tube?

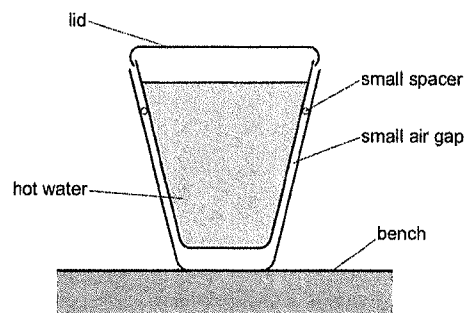
- A 4.5 cm
- B 6.2 cm
- C 23.8 cm
- D 25.5 cm

- 13 A fixed mass of gas in a container of fixed volume is heated.
- I The average speed of the gas molecules increases.
 - II The average intermolecular spacing between gas molecules increases.
 - III The frequency of collisions between gas molecules and the container walls increases.
 - IV The pressure in the container decreases.

Which of the following statements is true of the gas in the container?

- A I and II only
 - B I and III only
 - C I, II and III only
 - D All of the above
- 14 Two plastic cups are placed one inside the other. A small spacer keeps the two cups separated.

Hot water is poured into the inner cup and a lid is put on top, as shown.

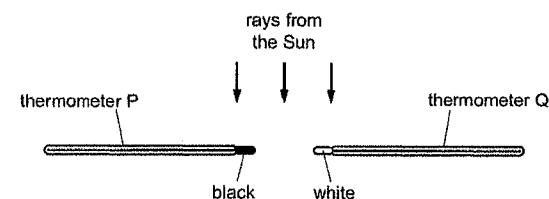


Which statement is correct?

- A Emission of infra-red radiation is prevented by the small air gap
- B The bench is heated by convection from the bottom of the outer cup.
- C The lid reduces the energy lost by convection.
- D There is no thermal conduction through the sides of either cup.

- 15 Which statement describes one way in which solids conduct thermal energy?
- A Electrons are tightly packed so that vibrations pass from one electron to the next.
 - B Molecules are tightly packed so that vibrations pass from one molecule to the next.
 - C Solids contain free molecules that are able to move through the solid.
 - D Solids contain molecules that are arranged in a regular structure so that thermal energy can pass through the spaces between them.
- 16 The diagram shows two identical thermometers, initially at the same temperature, placed in bright sunshine.

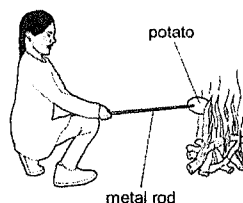
The bulb of thermometer P is painted black.
The bulb of thermometer Q is painted white.



How are the thermometer readings different and why?

- A The reading on P is greater than on Q because black surfaces are good absorbers of radiation.
- B The reading on P is greater than on Q because black surfaces are poor emitters of radiation.
- C The reading on P is smaller than on Q because black surfaces are good emitters of radiation.
- D The reading on P is smaller than on Q because black surfaces are poor absorbers of radiation.

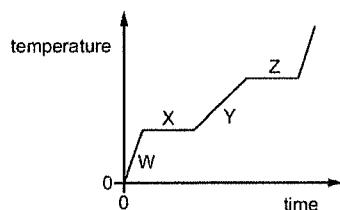
- 17 A student holds a potato using a metal rod and cooks it over a fire.



Which transfer of thermal energy is caused mainly by radiation?

- A from the fire to the air above the fire
 B from the fire to the student's face
 C from the inside of the potato to the student's hand
 D from the outside of the potato to the inside of the potato
- 18 Heat is supplied at a constant rate to a fixed mass of a substance that is initially solid.

The graph shows how the temperature of the fixed mass of the substance varies with time.

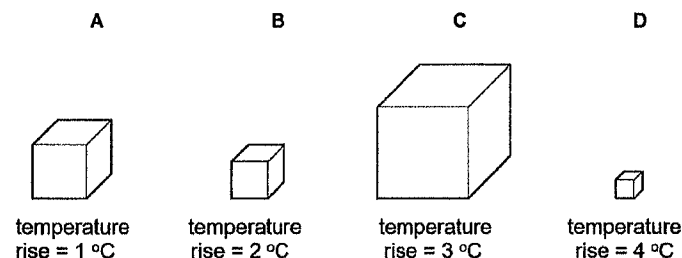


In which sections of the graph does the substance absorb latent heat?

- A W and X
 B W and Y
 C X and Z
 D Y and Z

- 19 Four different metal blocks are given the same quantity of thermal energy.

Which block has the greatest thermal capacity?



- 20 Which statements about evaporation of water are correct?

- I Evaporation causes the remaining liquid to cool.
 II During evaporation, the more energetic particles escape from the surface of the liquid.
 III Evaporation only happens at 100 °C.

- A I, II and III
 B I and II only
 C I and III only
 D II and III only

- 21 A loudspeaker on a boat produces a pulse of sound in the sea. The echo of the pulse is received back at the boat after 3.0 s.

The depth of the sea under the boat is 2250 m.

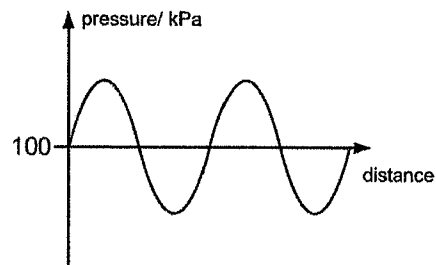
From this information, what is the speed of sound in the sea water?

- A 330 m/s
 B 750 m/s
 C 1500 m/s
 D 6750 m/s

- 22 A sound wave travels through the air. The graph shows the variation of pressure against distance along the wave at a particular instant.

Below the graph are four representations of the positions of the air particles along the wave at the same instant.

Which representation of the position of the particles in the wave is correct?



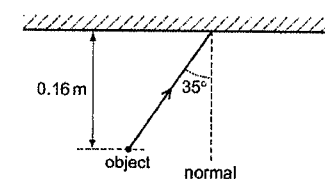
A

B

C

D

- 23 An object is placed 0.16 m from a plane mirror. A ray of light from the object strikes the mirror at an angle of incidence of 35° .

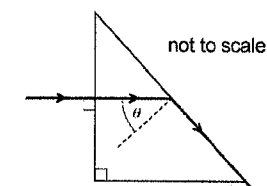


How far is the image from the object and what is the angle between the normal and the reflected ray?

	distance of image from the object/ m	angle between the normal and the reflected ray/ $^\circ$
A	0.16	35
B	0.16	55
C	0.32	35
D	0.32	55

- 24 A prism is made from transparent plastic. In this plastic, light travels at $0.80c$, where c is its speed in air.

Light enters one face of the prism at right-angles as shown.

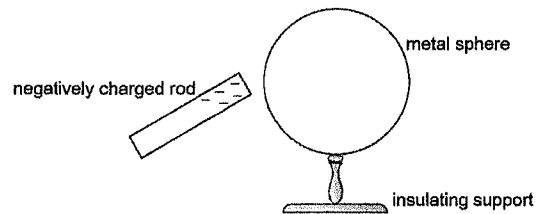


The light just escapes from the sloping face of the prism.

What is angle θ ?

- A 37°
 B 39°
 C 51°
 D 53°

- 25 A metal sphere is placed on an insulating stand. A negatively charged plastic rod is then brought near to the metal sphere.

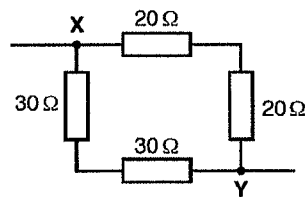


- I Negative charge will flow from the plastic rod to the metal sphere.
- II Positive charge will flow from the earth to the metal sphere when the sphere is earthed by a finger.
- III Net positive charges will be left on the metal sphere when the sphere is earthed by a finger.

Which of the following descriptions is/are correct?

- A I only
- B III only
- C I and III only
- D II and III only

- 26 The diagram shows a circuit connected by a student.

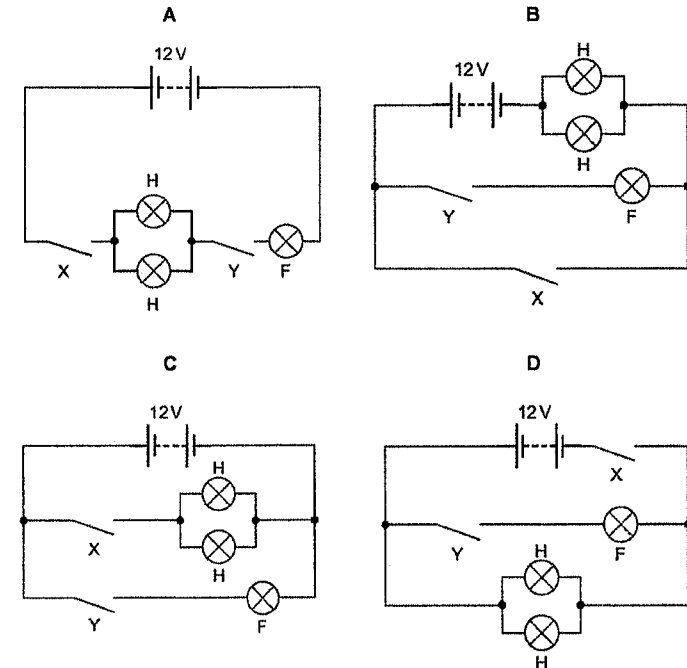


What is the total resistance of the circuit between points X and Y?

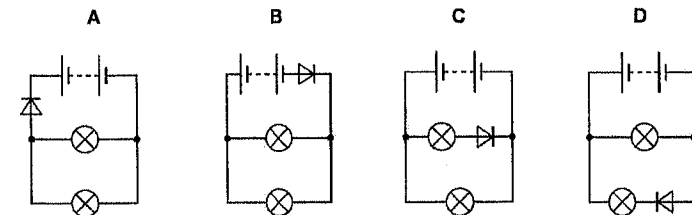
- A 24 Ω
- B 29 Ω
- C 38 Ω
- D 100 Ω

- 27 In a car, the headlamps H are controlled by switch X. The foglamp F is controlled by switch Y, but only comes on if the headlamps are also switched on.

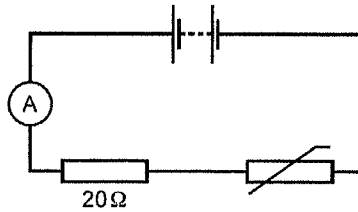
Which circuit would allow all the lamps to work as above and at full brightness of 12 V each?



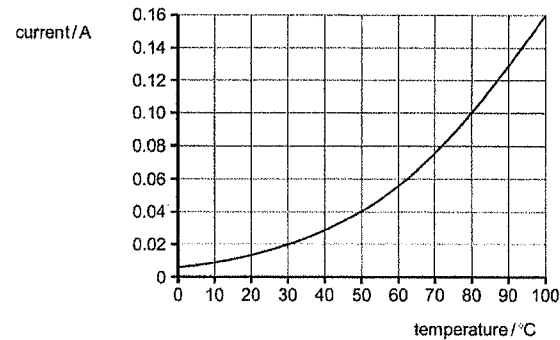
- 28 In which circuit do both lamps light?



- 29 A thermistor is connected in series with a resistor of resistance $20\ \Omega$, an ammeter and a $6.0\ \text{V}$ battery.



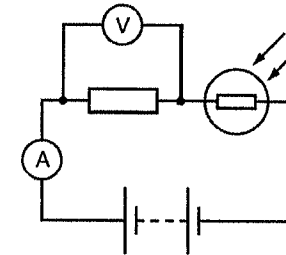
The graph shows the variation of current in the circuit with the temperature of the thermistor.



What is the resistance of the thermistor at $80\ ^\circ\text{C}$?

- A $20\ \Omega$
- B $40\ \Omega$
- C $60\ \Omega$
- D $80\ \Omega$

- 30 The diagram shows a potential divider circuit with a light-dependent resistor (LDR).



The intensity of the light incident on the LDR is reduced.

Which row correctly describes the observed change on the ammeter and voltmeter readings?

	ammeter reading	voltmeter reading
A	decreases	decreases
B	decreases	increases
C	increases	stays the same
D	stays the same	decreases

- 31 The instructions for a household lamp state that the plug must be fitted with a $3\ \text{A}$ fuse.

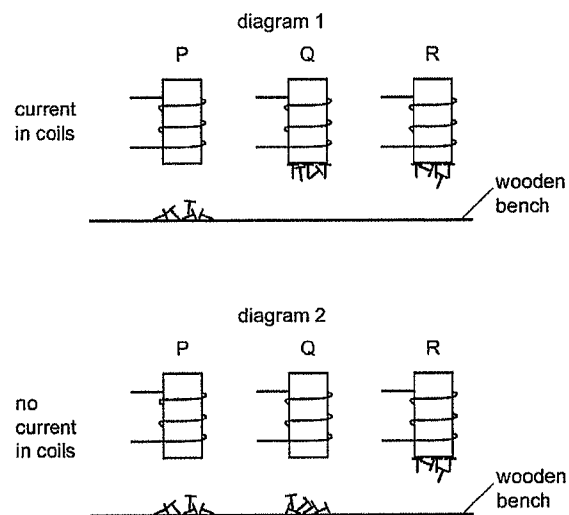
What happens if a $13\ \text{A}$ fuse is fitted by mistake?

- A The fuse blows too easily.
- B The lamp lights less brightly.
- C The wires connecting the lamp to the plug overheat if a fault develops.
- D Too much voltage is supplied to the lamp.

- 32 The diagrams show three different metal rods P, Q and R, inside coils of wire.

Small iron nails are placed on a wooden bench under the rods.

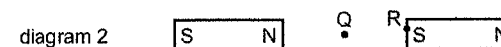
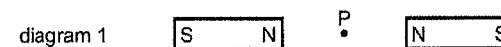
Diagram 1 shows the situation when there are electric currents in the wires.
Diagram 2 shows the situation when the currents are switched off.



Which row correctly identifies the metal rods?

	P	Q	R
A	copper	soft iron	steel
B	soft iron	copper	steel
C	steel	soft iron	copper
D	copper	steel	soft iron

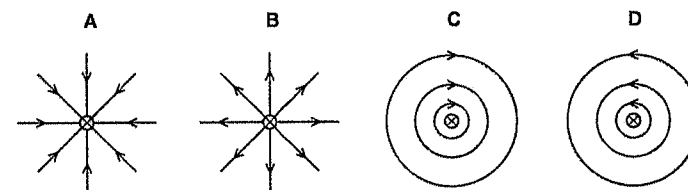
- 33 The diagrams show two arrangements of a pair of identical bar magnets. Three points, P, Q and R, are shown.



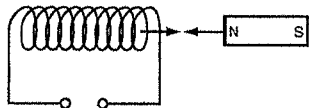
At which point is the magnetic field due to the magnets weakest and at which point is it strongest?

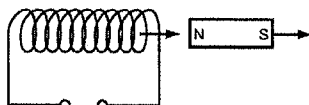
	strongest magnetic field	weakest magnetic field
A	P	Q
B	Q	P
C	R	P
D	R	Q

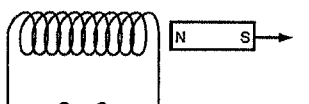
- 34 Which diagram shows the pattern and the direction of the magnetic field around a straight wire that is carrying a current into the page?

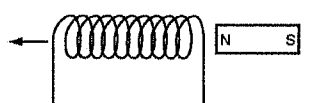


- 35 Which diagram shows a movement that will not produce the changing magnetic field needed to induce an electromotive force in the coil?

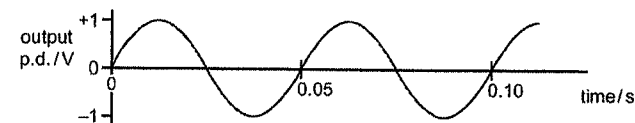
A  moving a magnet and a coil towards each other at the same speed

B  moving a magnet and a coil in the same direction at the same speed

C  moving a magnet away from a fixed coil

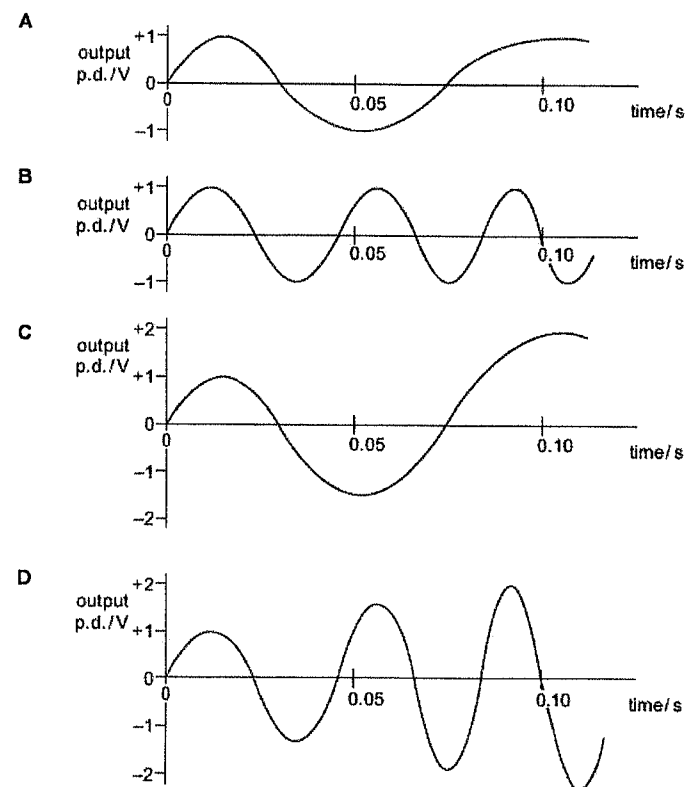
D  moving a coil away from a fixed magnet

- 36 The graph shows the output of an a.c. generator. The coil in the generator rotates 20 times in one second.

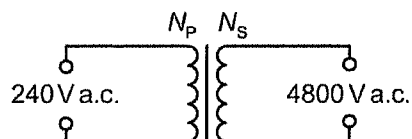


The speed of rotation of the coil steadily increases.

Which graph best shows how the output changes?



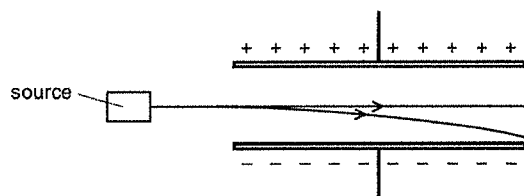
- 37 A transformer is needed to convert a supply of 240 V a.c. into 4800 V a.c.



Which pair of coils would be suitable for this transformer?

	number of turns on primary coil N_p	number of turns on secondary coil N_s
A	50	1000
B	240	48 000
C	480	24
D	2000	100

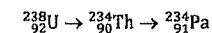
- 38 The diagram shows emissions from a source passing into the electric field between two charged plates.



What is emitted by this source?

- A neutrons and γ -rays only
 B β -particles and γ -rays only
 C α -particles and β -particles only
 D α -particles and γ -rays only

- 39 A uranium nucleus decays into a thorium nucleus. The thorium nucleus then decays into a protactinium nucleus.

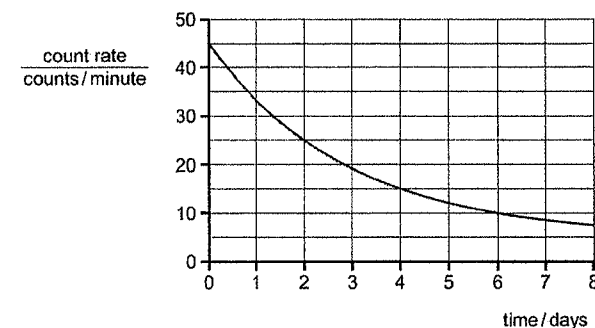


Which emissions take place during the decays?

- A an alpha-particle followed by another alpha-particle
 B an alpha-particle followed by a beta-particle
 C a beta-particle followed by an alpha-particle
 D a beta-particle followed by another beta-particle

- 40 The graph shows how the count rate registered by a counter near to a sample of a radioactive isotope changes over a period of a few days.

The background count rate is 5 counts per minute.



What is the half-life of the isotope?

- A 2.0 days
 B 2.5 days
 C 3.0 days
 D 4.0 days

Sec 4 Express Pure Physics 6091/4EXP/PRELIM/2025

Paper 1: Multiple Choice Questions [40 Marks]

Record your choice in the table provided below.

Question:	Ans:
1	D
2	B
3	D
4	C
5	D
6	C
7	B
8	A
9	C
10	A

Question:	Ans:
11	D
12	A
13	B
14	C
15	B
16	A
17	B
18	C
19	A
20	B

Question:	Ans:	Question:	Ans:
21	C	31	C
22	A	32	A
23	C	33	C
24	D	34	C
25	B	35	B
26	A	36	D
27	D	37	A
28	C	38	D
29	B	39	B
30	A	40	A
		Total:	



TANJONG KATONG GIRLS' SCHOOL
PRELIMINARY EXAMINATION
SECONDARY FOUR
PHYSICS

CANDIDATE
NAME

CLASS

INDEX
NUMBER

PHYSICS

Paper 1 Multiple Choice

6091/01

25 August 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Write your name, index number on the Answer Sheet.

There are **forty** questions in this paper. Answer **all** questions. For each question, there are four possible answers **A, B, C** and **D**.

Choose the one you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **18** printed pages.

- 1 A list of 8 physical quantities is shown below:

length	time	energy	force
speed	weight	mass	acceleration

How many of them are derived quantities?

- A 3 B 4 C 5 D 6

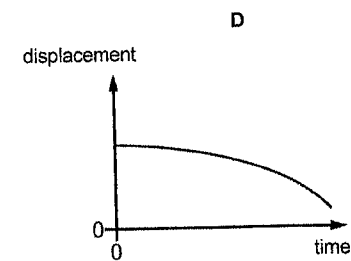
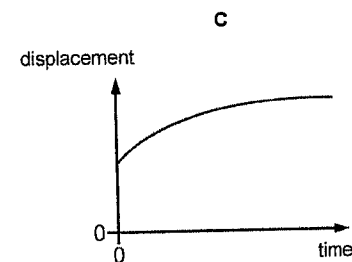
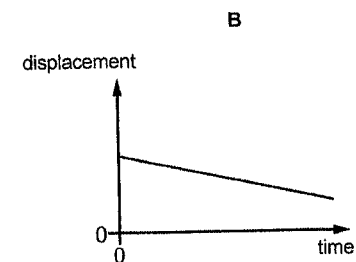
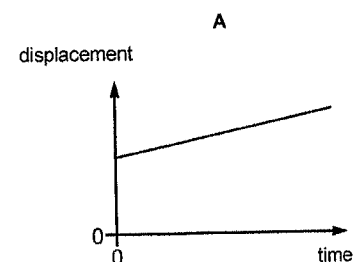
- 2 Which sound frequency is within the range that can be heard by a healthy human ear?

- A 12 mHz B 12 Hz C 12 kHz D 12 MHz

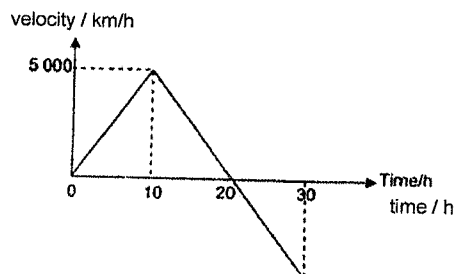
- 3 Which pair of physical quantities contains a vector and a scalar quantity?

- A area and displacement
B distance and volume
C temperature and pressure
D weight and velocity

- 4 Which displacement-time graph represents a body whose velocity is decreasing?

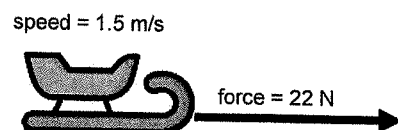


- 5 A spacecraft is launched vertically. The velocity-time graph of the motion of the spacecraft is shown in the diagram.



What is the maximum height reached by the spacecraft?

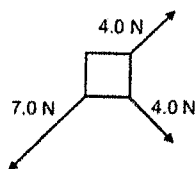
- A 25 000 km
B 50 000 km
C 75 000 km
D 100 000 km
- 6 A sledge of mass 12 kg is pulled along the surface of a frozen lake at a constant speed of 1.5 m/s by a horizontal force of 22 N.



What is the frictional force acting on the sledge?

- A 0 N B 4 N C 18 N D 22 N

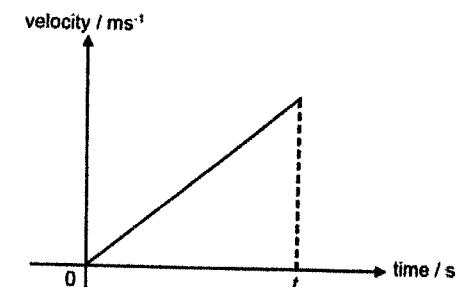
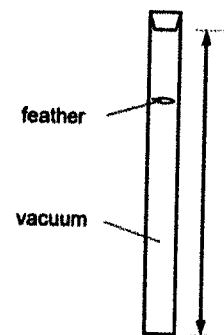
- 7 The diagram shows multiple forces acting on a square object along the diagonal.



What is the possible magnitude of the resultant force acting on the object?

- A 1.0 N B 3.0 N C 5.0 N D 11.0 N

- 8 In a laboratory experiment, a feather falls from rest in an evacuated vertical tube of length L . The feather took a time of t to fall from the top to the bottom of the tube.

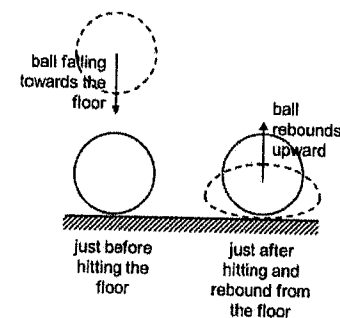


The diagram shows the experiment setup and the velocity-time graph of the feather as it falls.

How far will the feather have fallen from the top of the tube in $0.5t$?

- A 0.13 L B 0.25 L C 0.50 L D 0.75 L

- 9 A ball is dropped downwards, hits the floor and rebounds upward. The figure below shows the instance of the ball just before and right after it hits the floor.

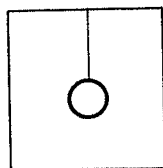


Which row shows the correct description of the acceleration just before and after the ball hits the floor?

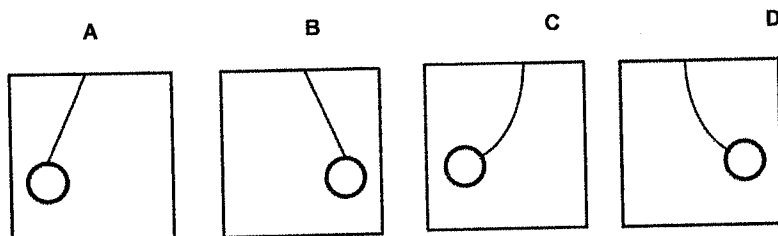
	just before hitting the floor	just after hitting the floor
A	acceleration is 10 m/s^2 downwards	acceleration is 10 m/s^2 upwards
B	acceleration is 0 m/s^2 downwards	acceleration is 0 m/s^2 upwards
C	acceleration is 0 m/s^2 downwards	acceleration is 0 m/s^2 downwards
D	acceleration is 10 m/s^2 downwards	acceleration is 10 m/s^2 downwards

- 10 Ahmad hung a ball to the ceiling of his car using a thin thread.

The figure shows the ball when the car is at rest.

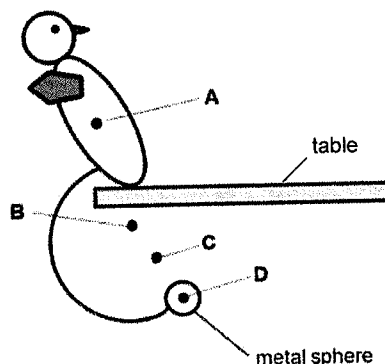


What is the position of the ball when his car starts moving to the right?

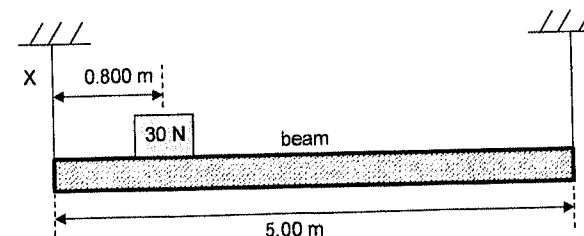


- 11 A toy is balanced and at rest when positioned as shown in the diagram on the edge of a table. The toy has a metal sphere attached to it.

Where is the likely centre of gravity of the toy?



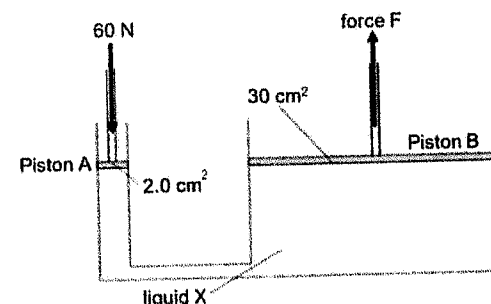
- 12 A uniform beam of 5.00 m has a weight of 140 N, is hung by two ropes at its ends. A wooden block of mass of 30.0 N is placed on the beam at 0.800 m from rope X.



What is the tension in each rope?

	tension in rope X / N	tension in rope Y / N
A	4.8	25.2
B	25.2	4.8
C	74.8	95.2
D	95.2	74.8

- 13 A hydraulic press contains an incompressible liquid X. Piston A has an area of 2.0 cm^2 and piston B has an area of 30 cm^2 .



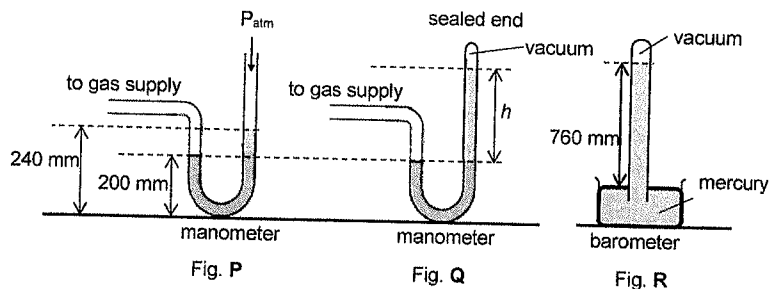
A downward force of 60 N is exerted on piston A and moves piston A downwards through a distance of 15.0 cm.

What is the upward force F exerted on piston B and the distance d moved by piston B?

	force F / N	distance d / cm
A	900	1.0
B	900	0.50
C	1800	1.0
D	1800	0.50

- 14 The pressure inside a gas cylinder is measured separately using two different mercury manometers as shown in Fig. P and Q. One of the manometers has an open end while the other has a sealed end.

A barometer, as shown in Fig. R, is used to measure the atmospheric pressure at the location of the experiment.



The diagrams are not drawn to scale.

What is the height, h , of the mercury in Fig. Q?

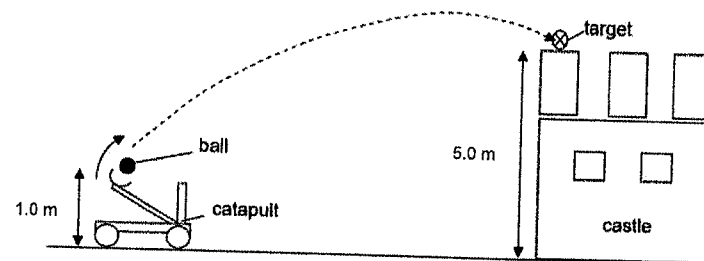
- A 40 mm
 - B 720 mm
 - C 800 mm
 - D 1000 mm
- 15 Two identical measuring cylinders containing different liquids are placed on a simple balance. They are balanced as shown.



How does the density of P compare with the density of Q?

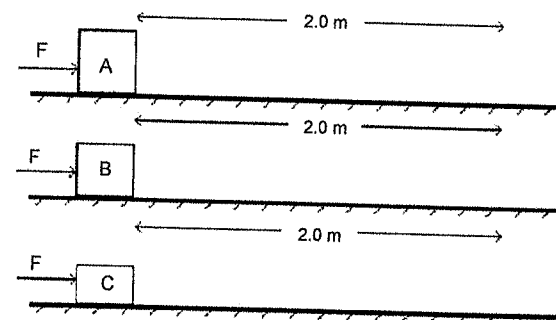
- A Density of P is half the density of Q.
- B Density of P is equal to the density of Q.
- C Density of P is twice the density of Q.
- D Density of P is four times the density of Q.

- 16 A catapult launches a 3.0 kg ball into a castle. The ball leaves the catapult at a height of 1.0 m and with a speed of 15 m/s. A target is placed 5.0 m at the top of the castle.



What is the speed of the ball when it hits the target? Assume there is no air resistance.

- A 9.80 m/s
 - B 11.1 m/s
 - C 12.0 m/s
 - D 13.0 m/s
- 17 Three blocks A, B, and C are each pushed by equal forces, F , across a smooth horizontal floor for a distance of 2.0 m.



The mass of block A is greater than block B, and the mass of block B is greater than block C.

Which block/s would have the greatest amount of energy in the kinetic store at the end of the 2.0 m push?

- A Block A
- B Block B
- C Block C
- D All blocks will have the same amount of energy in the kinetic store

18 A cup of coffee is warmed from 20 °C to 30 °C. Which energy store of the coffee rises?

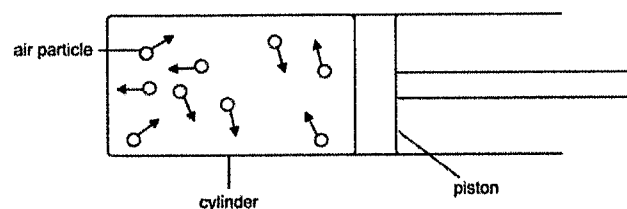
- A Its nuclear store
- B Its internal store
- C Its chemical potential store
- D Its kinetic store

19 Electrical power of 3000 W is supplied to a motor to lift a weight of 100 N at a speed of 20 m/s for 5.0 s.

What is the efficiency of the motor?

- A 0.07
- B 0.33
- C 0.67
- D 1.30

20 Which statement describes what happens when a gas in a piston is compressed at constant temperature?



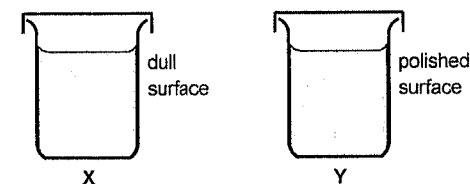
- A The number of gas molecules per unit volume decreases.
- B The rate of collisions between the gas molecules and the piston wall increases.
- C The speed of gas molecules increases.
- D The volume of each gas molecule decreases.

21 Brownian motion can be observed by the behaviour of smoke particles in a smoke cell.

What does Brownian Motion show?

- A Air is a poor conductor.
- B Air molecules are moving.
- C Air molecules have more mass than smoke particles.
- D Convection occurs in air.

22 In the diagram, two copper cans X and Y with outer surface of different texture are filled with the same amount of water at boiling point and left in the room.



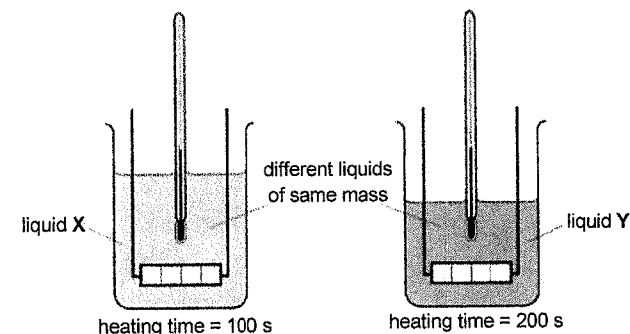
Which of the following statements about the temperature of the two cans after a short while is true?

- A X is cooler because a dull surface is a good absorber.
- B X is cooler because a dull surface is a good emitter.
- C X is warmer because a dull surface is a good absorber.
- D X is warmer because a dull surface is a good emitter.

23 Equal masses of two different liquids are put into identical beakers.

Liquid X is heated for 100 s and liquid Y is heated for 200 s by heaters of the same power.

Each liquid has the same rise in temperature.

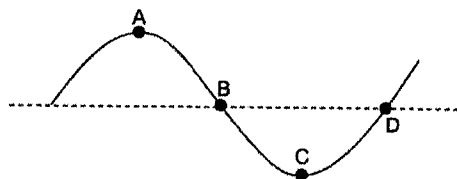


Which of the following statements is correct?

- A Each beaker of liquid has the same heat capacity.
- B Each beaker of liquid receives the same energy.
- C Liquid X receives more energy than liquid Y.
- D The heat capacity of liquid X is less than the heat capacity of liquid Y.

- 24 The diagram below shows the position of a string at a particular instant of time as a transverse wave travels along it from left to right.

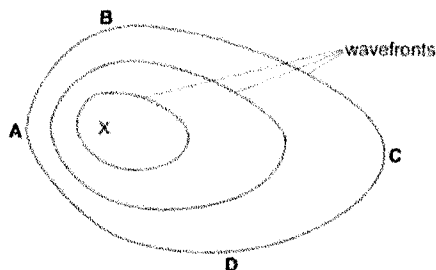
Which point represents the particle on the string that is moving downwards and with highest speed?



- 25 Waves travel more quickly on the surface of water when the water is deep.

A stone is dropped at point X into a pool of varying depth. The diagram shows the first three wavefronts on the surface of the pool.

The region between X and which labelled point is likely to be the deepest?



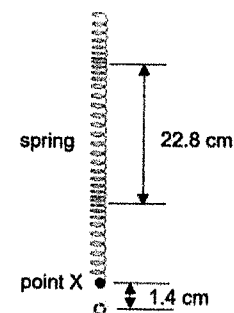
- 26 Visible light, X-ray and microwaves are all components of the electromagnetic spectrum.

Which of the following statements about the waves is correct?

- A In a vacuum, microwaves travel faster than visible light and have a shorter wavelength.
- B In a vacuum, microwaves travel at the same speed as visible light and have a shorter wavelength.
- C In a vacuum, X-rays travel faster than visible light and have a shorter wavelength.
- D In a vacuum, X-rays travel at the same speed as visible light and have a shorter wavelength.

- 27 The diagram shows a spring oscillating vertically.

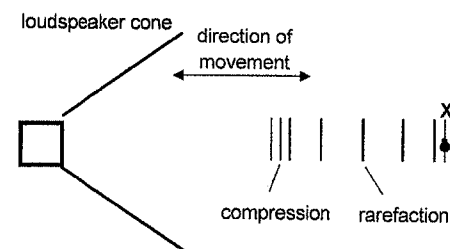
Point X at the end of the spring is oscillating between two vertical points 1.4 cm apart.



Which row describes the wave?

	amplitude / cm	wavelength / cm
A	0.7	11.4
B	0.7	22.8
C	1.4	11.4
D	1.4	22.8

- 28 Compressions and rarefactions are sent out from a loudspeaker cone as it vibrates backwards and forward. The frequency of vibration is 50 Hz.

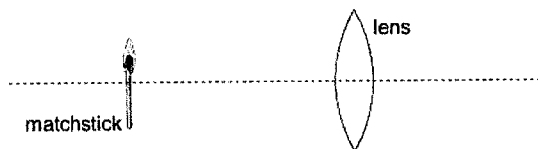


A compression is at point X.

How much time elapses before the first rarefaction arrives at X?

- A 0.010 s
- B 0.020 s
- C 25 s
- D 50 s

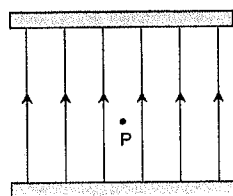
- 29 A lighted matchstick is placed 20 cm from a converging lens with a focal length of 10 cm.



How much should the matchstick move in order to form a parallel beam of light on the other side of the lens?

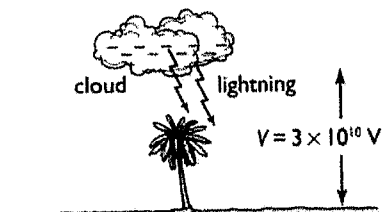
- A 5 cm to the right B 5 cm to the left
C 10 cm to the right D 15 cm to the right
- 30 The figure shows a uniform electric field between two metal plates.

Describe the movement of the electron at P.



- A downwards
B to the left
C to the right
D upwards

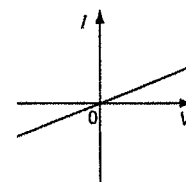
- 31 During a thunderstorm, a lightning sent an electric charge of 90 C from a thundercloud to the earth. The potential difference between the thundercloud and the earth was 3×10^{10} V during the discharge.



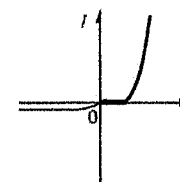
How much energy was produced during the lightning?

- A 2.7×10^{10} J
B 2.7×10^{12} J
C 3.0×10^{12} J
D 1.3×10^{13} J

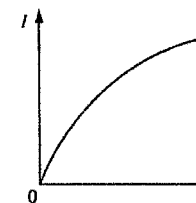
- 32 The three graphs X, Y and Z show the I-V characteristics for three different components.



graph X



graph Y

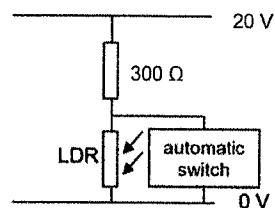


graph Z

Which components do each of the graphs represent?

	graph X	graph Y	graph Z
A	diode	filament lamp	metallic conductor
B	filament lamp	diode	metallic conductor
C	metallic conductor	diode	filament lamp
D	metallic conductor	filament lamp	diode

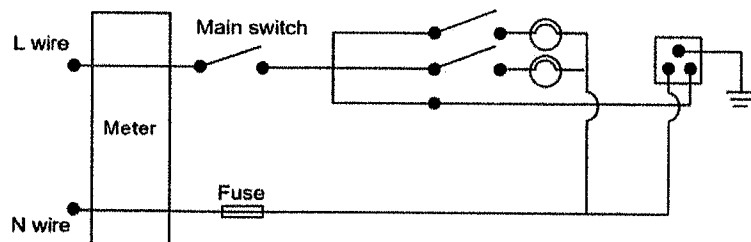
- 33 The circuit shown below is connected to an automatic switch for a streetlight. The automatic switch needs a voltage of 12 V or higher for the lights to be on. The lights are to turn on at sunset and the value of the fixed resistor is $300\ \Omega$.



What must the minimum resistance of the light-dependent resistor be in order for lights to turn on at sunset?

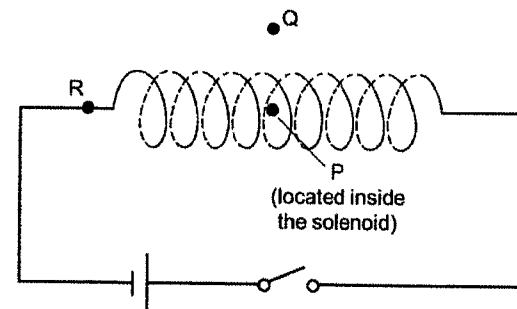
- A $120\ \Omega$
- B $200\ \Omega$
- C $450\ \Omega$
- D $600\ \Omega$

- 34 What is the mistake in the household circuit shown below?



- A The position of the earth wire in the socket is wrong.
- B There should be an earth wire connected to the bulbs.
- C The fuse should be installed at the live wire.
- D The neutral and the live wire in the socket should be interchanged.

- 35 A solenoid is connected to a DC supply and three compasses, P, Q and R, are placed around the solenoid as shown below.

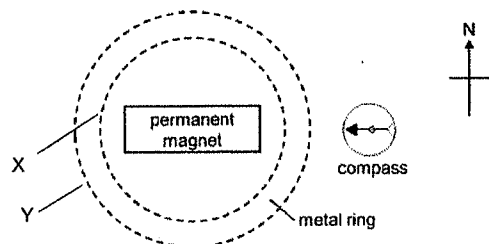


When the switch is closed, which row shows the direction in which the compass needles point to?

	P	Q	R
A	→	←	→
B	←	→	←
C	←	←	→
D	→	→	←

- 36 A magnet and a compass is placed next to each other as shown. Under the influence of the magnet, the compass pointer is deflected from the North direction.

Two different metal rings (X and Y) are then placed around the magnet, occupying the dotted area.

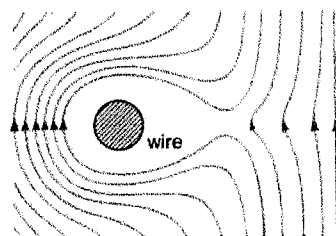


When metal ring X is placed first around the magnet, the compass pointer continues to point left. However, when metal ring Y is placed around the magnet, the compass pointer returns to the North direction.

What are rings X and Y made of?

	ring X	ring Y
A	aluminium	copper
B	copper	iron
C	iron	aluminium
D	iron	steel

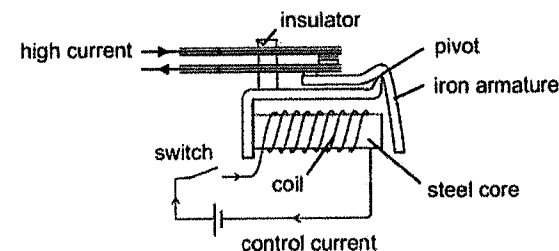
- 37 The diagram below shows the resultant field pattern around the cross-section of a direct-current carrying straight wire placed in a uniform magnetic field.



What is the direction of the current flowing through the wire?

- A left B right
C out of the paper D into the paper

- 38 The diagram shows a magnetic relay.



When the switch is turned on, the electromagnet is unable to attract the iron armature to allow the high current to flow in the circuit.

Which change will resolve this problem?

- A moving the armature further from the steel core
B reducing the number of turns of coil around the steel core
C replacing the steel core by an iron core
D using a smaller control current

- 39 A power station produces 150 MW of power. It uses a transformer to step-up the transmission voltage to 250 kV. The transmission cable has a resistance of 15 Ω .

What is the ratio of power loss in the transmission cable to the power produced?

- A 0.00036 B 0.0036 C 0.036 D 0.36

- 40 In an experiment to determine the half-life of a radioactive isotope, the following results were obtained.

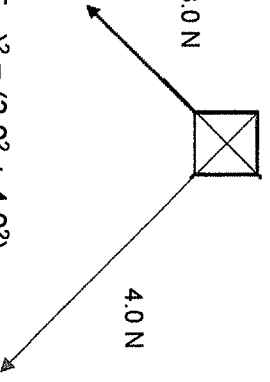
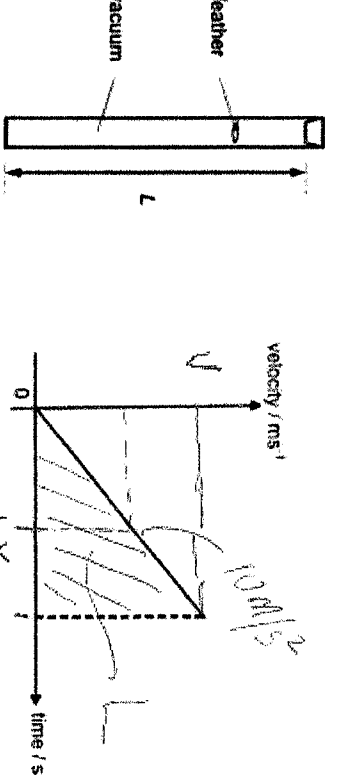
activity/counts per second	60	44	29	21	15	11
time/s	0	1	2	3	4	5

What is the approximate half-life of the isotope?

- A 1.0 s B 2.0 s C 3.0 s D 4.0 s

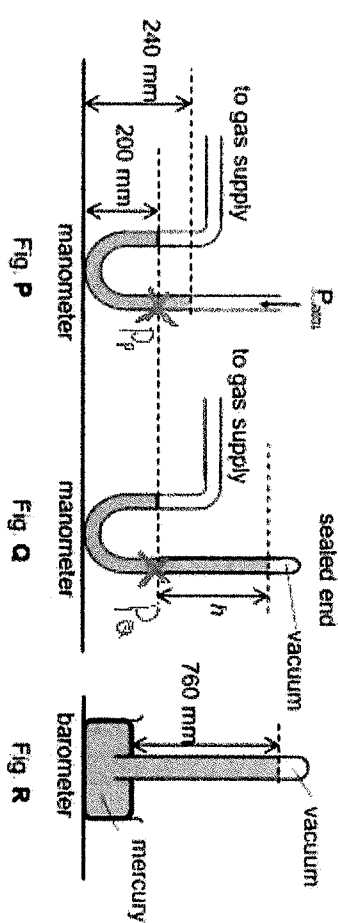
Solution to Sec 4 Physics Prelim 2025 Paper 1

1	C	6	D	11	B	16	C	21	B	26	D	31	B	36	B
2	C	7	C	12	D	17	D	22	B	27	B	32	C	37	D
3	A	8	B	13	A	18	B	23	D	28	A	33	C	38	C
4	C	9	D	14	C	19	C	24	D	29	C	34	C	39	C
5	B	10	A	15	A	20	B	25	C	30	A	35	B	40	B

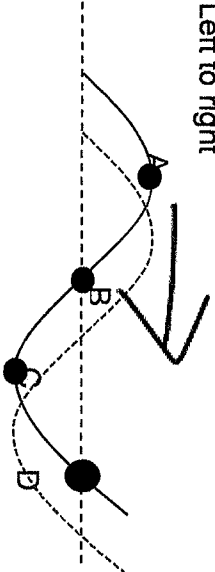
Qn	Solution	Ans
1	Derived: Energy, Force, Speed, Weight, Acceleration Base: Length, Mass, Time	C
2	12 kHz is within the human hearing range (20 Hz–20 kHz)	C
3	Weight, velocity and displacement are vectors; area, volume, distance, pressure, and temperature are scalars.	A
4	Graph with decreasing slope (gradient) = decreasing velocity.	C
5	Highest point reached is at 20 hr Area under v-t graph (triangle) = $0.5 \times 20 \times 5000 = 50,000$ km.	B
6	Constant speed means net force is 0 $\rightarrow$ friction = 22 N.	D
7	Between 7.0 N and 4.0 N, the net force is 3.0 N in the direction of the 7.0 N.  $(F_{\text{net}})^2 = (3.0^2 + 4.0^2)$ $F_{\text{net}} = 5.0$ N	C
8	Free fall – Acceleration due to gravity – 10 ms^{-2}  velocity / ms⁻¹ time / s	B

1 2

224

	At t, Acceleration is a constant $a = (v - u) / (t)$ $u = 0$ $v = at$ $L = \frac{1}{2} vt = \frac{1}{2} (at)t = \frac{1}{2} at^2$	At $0.5t$, Acceleration is a constant $a = (v - u) / (\frac{1}{2} t)$ $u = 0$ $v(\frac{1}{2} t) = \frac{1}{2} at$ $L(\frac{1}{2} t) = \frac{1}{2} v(\frac{1}{2} t) (\frac{1}{2} t) = \frac{1}{2} (\frac{1}{2} at) (\frac{1}{2} t)$ $= \frac{1}{2} at^2 (\frac{1}{4}) = \frac{1}{4} L$	
9	Acceleration due to gravity is always 10 m/s^2 downward.	D	
10	Inertia causes the ball to swing backward (towards the left) when the car moves right.	A	
11	The toy is balanced. CG is directly below the point of contact with the table.	B	
	Use moments about one point: Tensions are 95.2 N and 74.8 N. Taking moments about Y, $CW = ACW$ $(5.00) \times T_x = (2.50 \times 140) + (4.20 \times 30)$ $T_x = (350 + 126) / 5.00$ $T_x = 95.2 \text{ N}$ Upward forces = Downward forces $T_x + T_y = 140 + 30$ $T_y = 74.8 \text{ N}$	D	
13	Pascal's principle Force = $60 \times (30/2) = 900 \text{ N}$; Conservation of energy, distance = $(60 \times 15) / 900 = 1 \text{ cm}$.	A	
14	 Fig. P Fig. Q Fig. R	C	
Same level, same liquid, same pressure			

	$P_p = P_q$ $40 + P_{atm} = P_q$ $P_{atm} = 760 \text{ mm}$ $P_q = 760 + 40 = 800 \text{ mm}.$	
15	Equal mass; density inversely proportional to volume: $P = \rho Q / 2$. Using energy conservation: speed when hitting target = 12 m/s. Initial total energy = Final total energy * Initial energy: $E_i = \frac{1}{2}mv^2 + mgh_i = \frac{1}{2}m(15)^2 + m \cdot 10 \cdot 1 = \frac{1}{2}m \cdot 225 + 10m = 112.5m + 10m = 122.5m$ * Final energy: $E_f = \frac{1}{2}mv^2 + mgh_f = \frac{1}{2}mv^2 + 10m \cdot 5 = \frac{1}{2}mv^2 + 50m$ * Equating initial and final energy: $122.5m = \frac{1}{2}mv^2 + 50m$ Cancel out m from both sides: $122.5 = \frac{1}{2}v^2 + 50$ $\frac{1}{2}v^2 = 122.5 - 50 = 72.5$ $v^2 = 145$ $v = \sqrt{145} \approx \boxed{12.0 \text{ m/s}}$	A
16		C
17	Work done = $F \times d$ is same $\rightarrow$ same KE.	D
18	Temperature increase $\rightarrow$ internal energy increase.	B
19	Power out = $100 \times 20 = 2000 \text{ W}$. Efficiency = $2000 / 3000 = 0.67$.	C
20	Compression $\rightarrow$ more collisions per unit time with walls.	B
21	Brownian motion shows air molecules are in constant random motion.	B
22	X is cooler because a dull surface is a good emitter. Explanation: 1. Surface Texture and Thermal Radiation: A dull (matte) surface is both a good absorber and a good emitter of thermal radiation.	B

	- A polished (shiny) surface is a poor absorber and a poor emitter of thermal radiation. 2. Cooling Process: - Both cans X (dull surface) and Y (polished surface) are filled with water at the same initial temperature (boiling point) and left in the room. - The cans cool down primarily by emitting thermal radiation to the surroundings. - Can X (dull surface) emits thermal radiation more efficiently than Can Y (polished surface), so it loses heat faster. - As a result, after a short while, the temperature of Can X will be cooler than Can Y.	
23	Same energy, different times → X has lower heat capacity.	D
24	Left to right  A is moving downwards but not with highest speed. B is moving with highest speed but moving upwards. C is moving upwards. D is moving downwards and with highest speed.	D
25	Wavefronts spread out more in deeper region. Larger the wavelength, larger the speed, when frequency remains constant. $v = f\lambda$	C
26	All EM waves same speed in vacuum; X-rays shorter λ .	D
27	Amplitude = 0.7 cm; wavelength = 22.8 cm from given data.	B
28	$f = 50 \text{ Hz} \rightarrow T = 1/50 = 0.020 \text{ s}$. Rarefaction arrives in 0.010 s.	A
29	Matchstick must move 10 cm right to be at focal point. Application – As a spotlight	C
30	Electron moves opposite to field direction → down.	A
31	Energy = $Q \times V = 90 \times 3 \times 10^{10} = 2.7 \times 10^{12} \text{ J}$.	B
32	X = metallic conductor, Y = diode, Z = filament lamp.	C
33	Voltage divider: $V = 20 \times R/(R+300) \geq 12 \rightarrow R \geq 450 \Omega$.	C
34	Fuse should be on live wire to break circuit.	C

35	Compass aligns with field; use right-hand rule.	B
36	Iron affects compass, aluminium does not. Magnetic shielding – Field lines can go through aluminium but not through iron. Iron ring concentrates the magnetic fieldlines	B
37	Use Fleming's Left-hand Rule: current is into the paper. Field is upwards Force will be from the higher concentration of magnetic field lines to the lower concentration of magnetic field lines	D
38	The relay fails to attract the iron armature when the switch is turned on, meaning the electromagnet is not strong enough. Iron cores magnetize more easily than steel, making the electromagnet stronger. This ensures the armature is attracted when the switch is on. Other options (increasing distance, reducing coil turns, or lowering current) weaken the magnetic field, worsening the problem. Iron's higher permeability solves the relay's failure to conduct high current.	C
39	$I = 600 \text{ A} \rightarrow \text{Power loss} = I^2 R = 5.4 \times 10^6 \text{ W} \rightarrow \text{ratio} = 0.036.$	C
40	$60 \rightarrow 29$ is approximately 1 half life = 2.0 s	B

Name: _____ () Class: _____



WOODLANDS SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2025

EXPRESS

Level: Sec 4 Express

Marks: 40 marks

Subject: Physics

Day: Tuesday

Paper: 6091 / 01

Date: 2 September 2025

Duration: 1 hour

Time: 8.00 am to 9.00 am

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on the question paper.
Write in dark blue or black pen. You may use a soft pencil for any diagrams, graphs, tables or rough working. Do not use staples, paper clips, highlighters, glue or correction fluid.

There are forty questions. Answer **all** questions.
For each question, there are four possible answers, **A, B, C and D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate optical answer sheet provided. Hand in **both** multiple choice answer sheet and question paper separately.

Paper 1	/40
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DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.
This document consists of 18 printed pages.

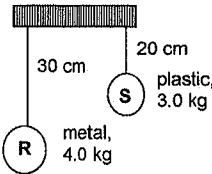
Section A : Multiple Choice Questions (40 marks)
Write your answers in the boxes provided.

- 1 Which of the following expresses *work* in base unit(s)?
- A J

B kgms⁻²

C kgm²s⁻²

D Nm
- 2 The diagram shows two different pendulums **R** and **S** hung from a horizontal rod.



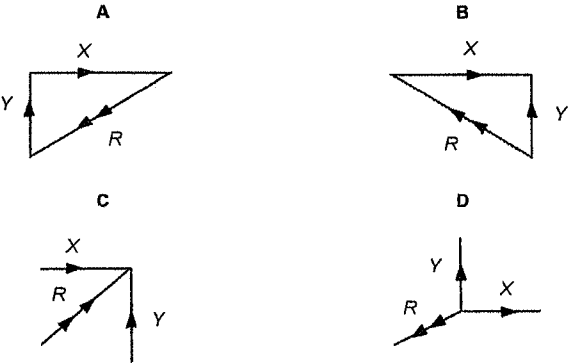
Which of the following statements is true?

- A **R** has a shorter period as it has a greater density.

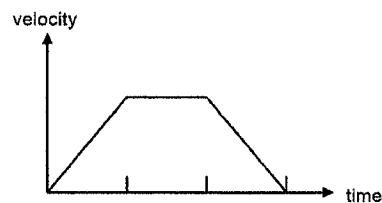
B **R** has a shorter period as it is larger in size.

C **S** has a shorter period as it has a smaller mass.

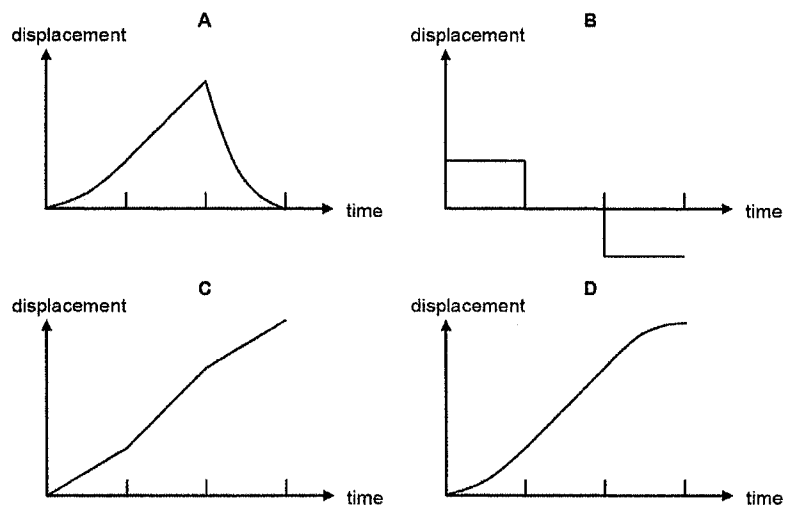
D **S** has a shorter period as it is shorter.
- 3 Two forces **X** and **Y** acting on a ball produce a resultant force **R** on the ball.
- Which vector diagram correctly represents the vector addition of forces **X** and **Y** to produce resultant force **R**?



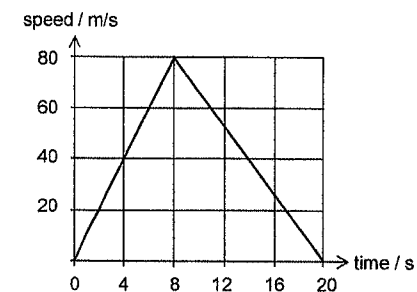
- 4 The diagram shows the velocity of a moving object.



Which graph is the corresponding displacement – time graph for the moving object?

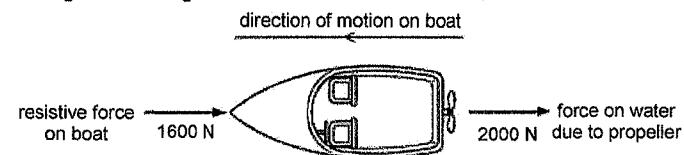


- 5 The diagram shows how the speed of a racing car changes with time.



What is the average speed of the racing car?

- A 30 m/s B 40 m/s C 60 m/s D 80 m/s
- 6 A cyclist applies a braking force to slow down from 10 m/s to 4 m/s in 5 seconds.
Given that the cyclist and his bicycle have a combined mass of 150 kg, what is the braking force acting on them?
- A 180 N B 300 N C 900 N D 4500 N
- 7 The propeller on a boat pushes water backward with a force of 2000 N. The boat moves through the water against a total resistive force of 1600 N.



Which of the following is correct?

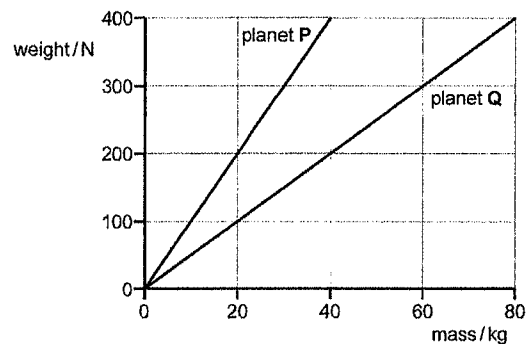
	net force on boat / N	force on the propeller due to the water / N
A	400	1600
B	400	2000
C	2000	400
D	3600	2000

- 8 The mass and volume of a bar made from metal **X** are measured. The masses and volumes of four other bars are measured.

Which bar is made from a metal with a density that is double that of **X**?

	mass compared with X	volume compared with X
A	double	half
B	half	same
C	same	double
D	same	half

- 9 The graph shows how weight varies with mass on planets **P** and **Q**.

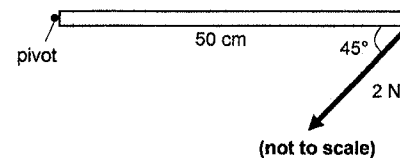


An object weighs 400 N on planet **P**. The object is taken to planet **Q**.

Which of the following is correct?

	mass of object on planet Q / kg	weight of object on planet Q / N
A	40	200
B	40	400
C	80	200
D	80	400

- 10 A force of 2 N acts on a 50 cm rod pivoted at one end, as shown.

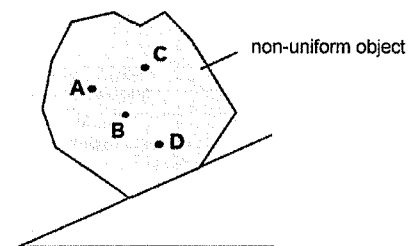


What is the moment of the 2 N force about the pivot?

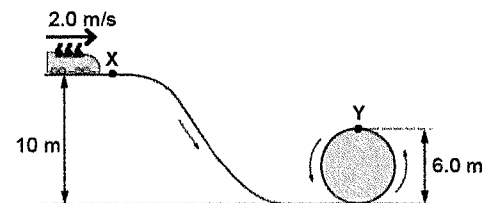
- A** 35 Ncm **B** 71 Ncm **C** 100 Ncm **D** 140 Ncm

- 11 A non-uniform object is placed on an inclined plane as shown below.

If the object is just about to topple, which position will be its centre of gravity?



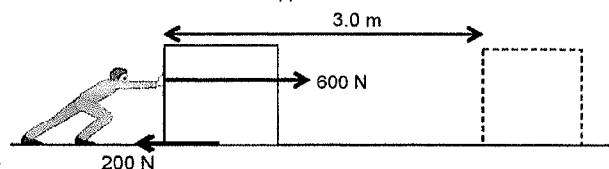
- 12 A roller coaster train has an initial speed of 2.0 m/s at **X** as shown in the diagram. The gravitational field strength is 10 N/kg, and friction is assumed to be negligible.



What is the speed of the train at **Y**?

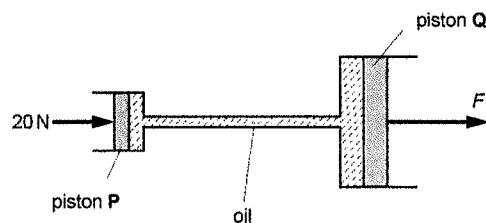
- A** 8.9 m/s **B** 9.2 m/s **C** 11 m/s **D** 13 m/s

- 13 A person exerts a horizontal force of 600 N on a box as shown in the diagram. A frictional force of 200 N acts in the opposite direction. The box moves 3.0 m in 4.0 s.



What is the useful power developed by the person?

- A 300 W B 450 W C 1200 W D 1800 W
- 14 The diagram shows a simple model of the braking system of a car.

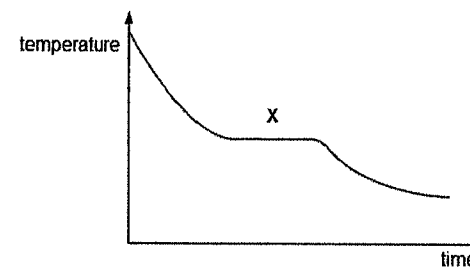


Piston P has an area of 5.0 cm^2 and piston Q has an area of 25 cm^2 .

What is the force F ?

- A 4.0 N B 20 N C 100 N D 500 N

- 15 A hot liquid is poured into a beaker. It is left to cool towards room temperature.



What is occurring at region X?

- A water molecules gain internal potential energy and move closer together
 B water molecules gain internal potential energy and move further apart
 C water molecules lose internal potential energy and move closer together
 D water molecules lose internal potential energy and move further apart
- 16 The total number of particles and the average kinetic energy of the particles in three bodies, P, Q and R, are given in the table.

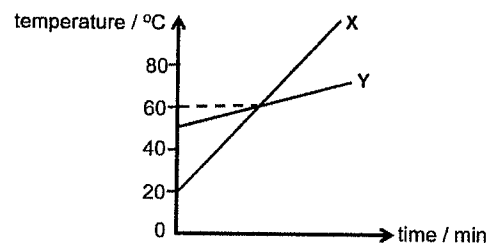
	total number of particles	average kinetic energy of particles
P	N	E
Q	0.5N	2E
R	2N	E

The temperature of the bodies P, Q and R, are denoted by T_P , T_Q and T_R respectively.

Which relationship between T_P , T_Q and T_R is correct?

- A $T_P = T_Q < T_R$
 B $T_P = T_R < T_Q$
 C $T_Q < T_P < T_R$
 D $T_Q < T_P = T_R$
- 17 An electric kettle contains 1.5 kg of water at 100°C and is powered by a 2.0 kW electric element. The specific latent heat of vaporisation of water is $2\,000 \text{ kJ/kg}$.
- What is the time taken for the kettle to boil the water away completely?
- A 500 s B 1000 s C 1500 s D 3000 s

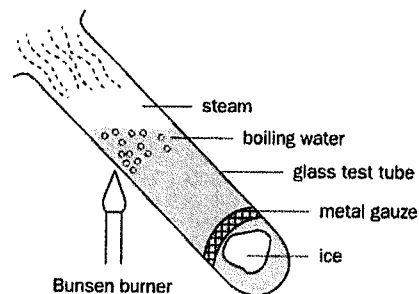
- 18 Two blocks, X and Y, are made of the same metal and are heated by heaters with the same power rating. The graph below shows the variation of temperature with time.



What is the approximate ratio of the mass of X to that of Y?

- A 1:3 B 1:4 C 4:1 D 3:4

- 19 An experiment is carried out as shown in the diagram.



The ice takes a long time to melt, even though the water at the top of the test-tube is boiling. What statement explains this?

- A Convection cannot occur in water.
 B Ice is a poor radiator of heat.
 C The wire gauze prevents water from reaching the ice.
 D Water is a poor conductor of heat.

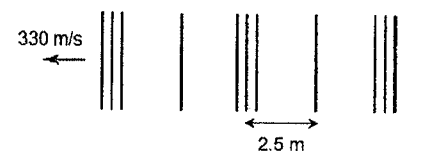
- 20 A vibrating source S produces circular water waves near a straight reflector.



If the speed is 60 mm/s, what is the wavelength and frequency of the waves shown?

	wavelength / mm	frequency / Hz
A	15.0	4.0
B	15.0	40
C	22.5	2.6
D	22.5	26

- 21 A longitudinal wave travelling at 330 m/s produces the waveform shown before.



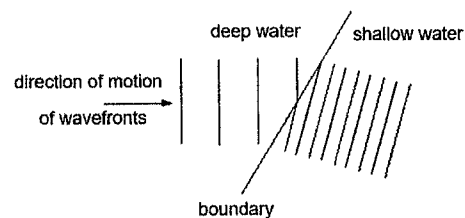
What is the frequency of the sound wave?

- A 66.0 Hz B 132 Hz C 825 Hz D 1650 Hz

- 22 Which of the following shows the similarity and difference between a low-pitch sound and a high-pitch sound produced by the same instrument?

	similarity	difference
A	frequency	speed
B	frequency	wavelength
C	speed	frequency
D	wavelength	frequency

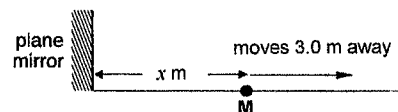
- 23 In an experiment using a ripple tank, straight wavefronts arrive at the boundary between deep and shallow water as shown in the diagram below.



Which row correctly describes the speed and wavelength of the waves as they move into the shallow water?

	speed	wavelength
A	higher	longer
B	higher	shorter
C	lower	longer
D	lower	shorter

- 24 The diagram shows a man standing at a position M in front of a plane mirror, a distance of x m from the mirror.

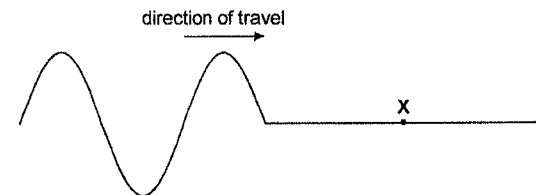


When the man moves 3.0 m away from the mirror, the new distance between the man and his image becomes 12 m.

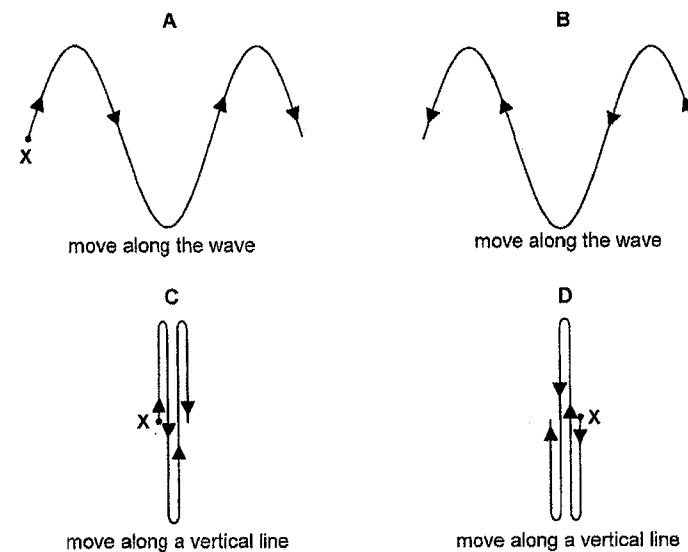
What is the value of x ?

- A 1.0 B 2.0 C 3.0 D 4.0

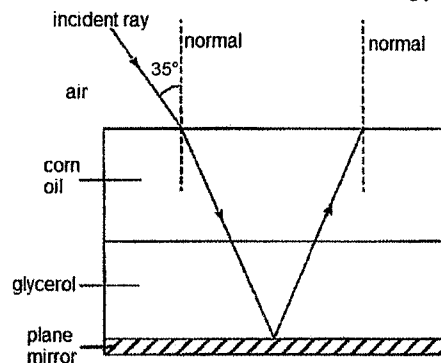
- 25 X is a particle on a string. A wave is travelling along the string towards X.



How will particle X move when the wave first reaches it?



- 26 A ray of light is incident on a layer of corn oil. Beneath the corn oil is a layer of glycerol and a plane mirror placed at the bottom. The refractive index of the glycerol is 1.45.



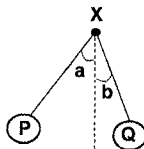
What is the angle of reflection of the light ray at the plane mirror?

- A 12° B 23° C 43° D 47°

- 27 Which instrument does not use electromagnetic waves in its operation?

- A camera B microphone C radio set D television

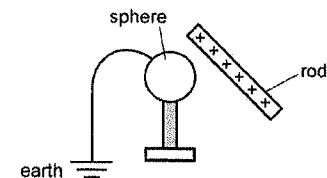
- 28 The diagram shows two small charged spheres P and Q of small mass which are hung by identical fine nylon threads from a fixed point X. It is found that, in equilibrium, the angle a is greater than angle b.



Which statement is correct?

- A The charge on P is larger than that on Q.
B The charge on P is smaller than that on Q.
C The mass of P is larger than that of Q.
D The mass of P is smaller than that of Q.

- 29 A positively charged rod is held close to an earthed metal sphere.



Which of the following describes the charge on the metal sphere?

- A It is negative because electrons are attracted towards the rod.
B It is neutral because electrons are attracted towards the rod and protons are repelled.
C It is neutral because it is earthed.
D It is positive because protons are repelled by the rod.

- 30 A current of 200 A flows through the filament of a light bulb for 3 minutes.

What is the amount of charge that flows through it?

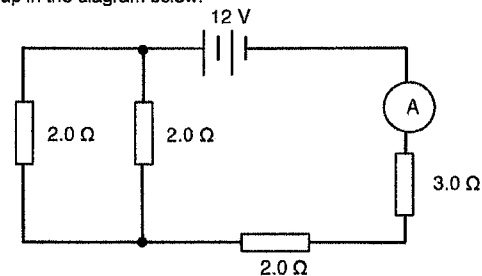
- A 0.036 kC B 0.6 kC C 3.6 kC D 36 kC

- 31 The resistance of a wire is 2.0Ω . A second wire is made of the same material but has twice the length and half the radius.

What is the resistance of the second wire?

- A 2.0Ω B 4.0Ω C 8.0Ω D 16Ω

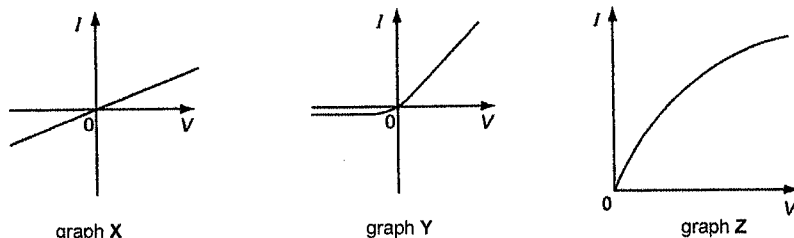
- 32 A circuit is set up in the diagram below.



What is the ammeter reading in the circuit?

- A 0.5 A B 0.67 A C 1.5 A D 2.0 A

- 33 The three graphs X, Y, and Z show the I/V characteristics for three different components.



Which component corresponds to graphs X, Y, and Z?

	Graph X	Graph Y	Graph Z
A	filament lamp	metallic conductor	semiconductor diode
B	metallic conductor	filament lamp	semiconductor diode
C	semiconductor diode	filament lamp	metallic conductor
D	metallic conductor	semiconductor diode	filament lamp

- 34 The ratings of some electrical appliances are shown below.

Electrical appliance	Rating
Television	135 W
Air conditioner	2.75 kW
Lamps	100 W

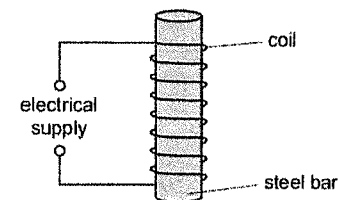
If the cost of 1 kWh electricity is 80 cents, what is the total cost of operating the three electrical appliances for 3 hours?

- A \$7.16 B \$12.20 C \$73.40 D \$429.80
- 35 A student tries to magnetise a short steel rod.

Which of the following tests will show that he has been successful.

- A both ends of a permanent magnet attract the rod
 B one end of a permanent magnet repels the rod
 C the rod picks up a small piece of paper
 D when freely suspended, the rod points in any direction

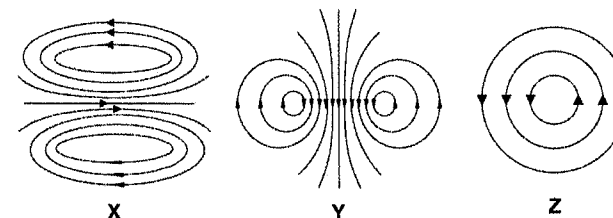
- 36 A student wishes to demagnetise a steel bar. He uses the apparatus shown.



Which type of electrical supply should the student use and what should he do with the steel bar?

	electrical supply	what to do with steel bar
A	a.c.	keep it inside the coil
B	a.c.	slowly remove it from the coil
C	d.c.	keep it inside the coil
D	d.c.	slowly remove it from the coil

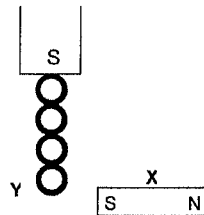
- 37 Three sets of magnetic fields obtained are shown below.



Which of the following correctly lists the origins of the magnetic fields illustrated?

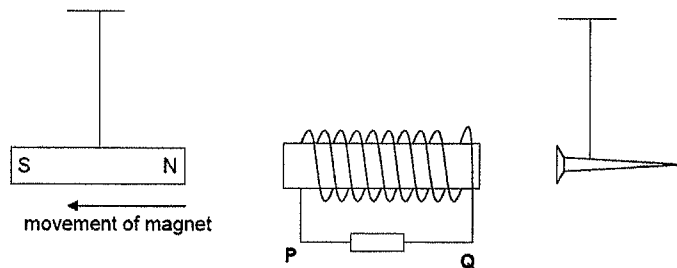
	X	Y	Z
A	A pair of like poles permanent magnets facing each other.	Current flowing opposite direction in two straight wires.	Current flowing in a circular coil of wire.
B	Current flowing in a solenoid.	Current flowing opposite direction in two straight wires.	Current flowing in a straight wire.
C	Current flowing in a solenoid.	Current flowing same direction in two straight wires.	Current flowing in a circular coil of wire.
D	A pair of like poles permanent magnets facing each other.	Current flowing same direction in two straight wires.	Current flowing in a straight wire.

- 38 The diagram shows a strong magnet holding a chain of four small iron rings. A weak magnet, X is brought close to the end of the last ring Y as shown.



What will happen to the chain of rings?

- A It will stay still.
 B It will bend towards X.
 C It will bend away from X.
 D It will drop.
- 39 A solenoid is placed in between a magnet and an iron nail that are freely suspended from the ceiling, as shown in the diagram. The magnet is then moved away from the solenoid.



What is the direction of the current flowing through wire PQ and the direction that the iron nail moves when the magnet is moved away from the solenoid?

	direction of current on PQ	direction of movement of iron nail
A	from Q to P	towards solenoid
B	from Q to P	away from solenoid
C	from P to Q	towards solenoid
D	from P to Q	away from solenoid

- 40 A radioactive nucleus emits a β -particle. What is the product of this type of radioactive emission?

- A a nucleus of a different element and different charge
 B a nucleus of a different element but the same charge
 C a nucleus of the same element and the same charge
 D a nucleus of the same element but different charge

End of Paper

Paper 1 (40 Marks):

1	2	3	4	5	6	7	8	9	10
C	D	C	D	B	A	B	D	A	B
11	12	13	14	15	16	17	18	19	20
B	B	A	C	C	B	C	B	D	A
21	22	23	24	25	26	27	28	29	30
A	C	D	C	C	B	B	D	A	D
31	32	33	34	35	36	37	38	39	40
D	D	D	A	B	B	B	C	A	A

Name: _____ () Class: _____



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PRELIMINARY EXAMINATION 2025

SUBJECT : PHYSICS PAPER 1 (6091/01)

LEVEL : Sec 4 G3

DATE : 2 September 2025

DURATION : 1 hr

SETTER : Mr Krishan Sanjay

VETTER : Ms Keira Htay

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, Class and index number on the Answer Sheet in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

For Examiner's Use	
Total	/ 40

This document consists of **21** printed pages and **3** blank pages

- 1 What is the correct order of magnitude for the diameter of an atom, the diameter of the Earth, and the diameter of a human hair?

	diameter of an atom	diameter of Earth	diameter of human hair
A	0.1 μm	10 Mm	100 μm
B	0.1 μm	10 Gm	10 μm
C	0.1 nm	10 Mm	100 μm
D	0.1 nm	10 Gm	10 μm

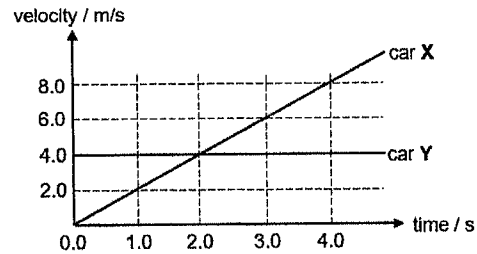
- 2 Which of the following lists of SI units contains only base units?

- A** ampere, kilogram, kelvin, metre, mole
B ampere, kilogram, metre, newton, ohm
C kelvin, mole, newton, second, volt
D kilogram, metre, mole, ohm, second

- 3 A car is travelling at a velocity of 2.0 m / s. It accelerates at 0.20 m / s² for 2.5 minutes. What is the final velocity of the car?

- A** 2.5 m / s
B 5.2 m / s
C 30 m / s
D 32 m / s

- 4 The velocity-time graph of two cars is shown. Car X and car Y started off their journey from the same position when $t = 0.0$ s.

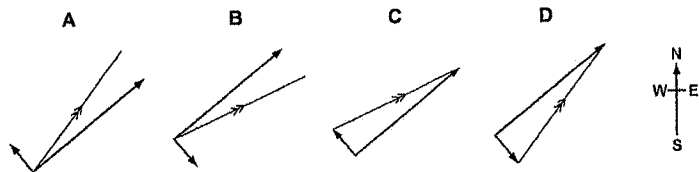


At what time will the two cars pass each other again?

- A 1.0 s
B 2.0 s
C 3.0 s
D 4.0 s
- 5 An aircraft heads north-east at 400 km / h.

The wind is blowing towards the north-west at 100 km / h.

Which vector diagram represents the correct way to obtain the resultant velocity of the aircraft?

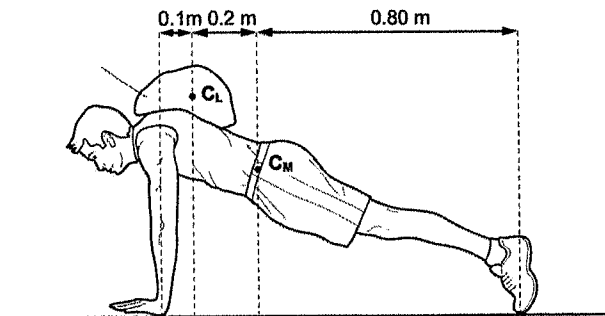


- 6 Two boxes, P and Q, were pushed along a smooth surface from rest. The acceleration of box P is twice that of box Q. The mass of box Q is thrice of box P.

Which of the following shows the correct relationship between force exerted on box P, F_P and force on box Q, F_Q ?

- A $F_P = (2/3) F_Q$
B $F_P = (3/2) F_Q$
C $F_P = 3 F_Q$
D $F_P = 6 F_Q$

- 7 An athlete with mass 80 kg trains by performing press-ups with a load on his back. The diagram shows the perpendicular distances involved. The centre of mass of the athlete is C_M and the centre of mass of the load he is carrying is C_L .

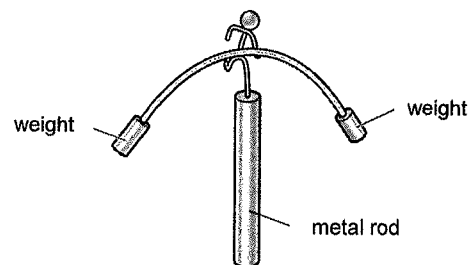


The mass of the load is 10 kg.

What is the upward force exerted on his two arms?

- A 90 N
B 230 N
C 670 N
D 900 N

- 8 A student makes a model toy which balances on the end of a metal rod.

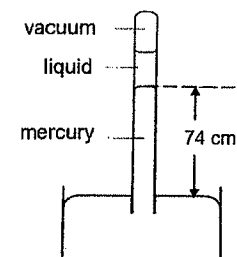


Why are the weights needed?

- A They increase the pressure on the rod.
 - B They increase the weight of the model.
 - C They lower the centre of gravity below the top of the rod.
 - D They raise the centre of gravity above the top of the rod.
- 9 Which object will exert the greatest pressure on the ground?

	weight / N	contact area with ground / cm ²
A	50	100
B	280	150
C	9400	200
D	20000	600

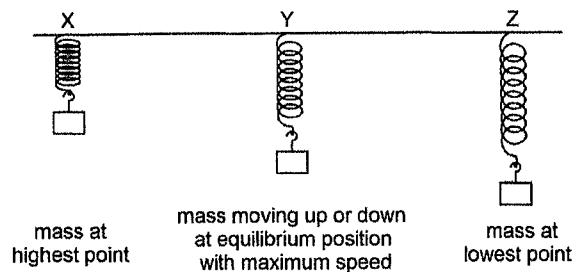
- 10 The diagram shows a mercury barometer. Some liquid less dense than mercury is found above the mercury column. The atmospheric pressure is 76 cm Hg, density of the liquid and mercury are 1200 kg / m^3 and 13600 kg / m^3 respectively.



What is the height of the liquid column?

- A 0.02 cm
- B 2.0 cm
- C 22.7 cm
- D 26.0 cm

- 11 A spring fixed at one end, has a mass attached to the other end. The mass bounces up and down. It is shown in the diagram at three positions X, Y and Z.



Which row correctly describes the kinetic and gravitational potential stores for the mass and the elastic potential stores in the spring?

	kinetic store	gravitational potential store	elastic potential store
A	maximum for Y	maximum for X	maximum for Z
B	maximum for Y	minimum for Z	maximum for Y
C	zero for X	maximum for X	maximum for X
D	zero for Z	minimum for Z	zero for X

- 12 Which option correctly describes the mechanism by which energy is transferred to food in a microwave oven?

- A electrically
- B heating
- C mechanically
- D propagation of waves

- 13 A gas placed in a container of fixed volume is heated.

What effect does this have on the gas?

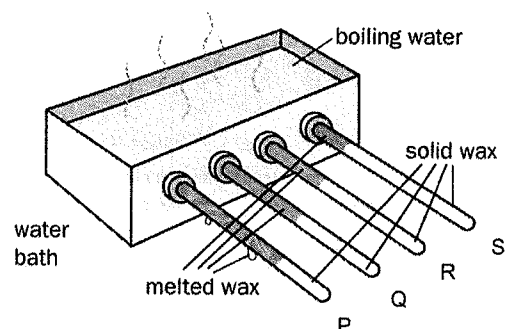
- A Both the pressure and temperature of the gas increase.
- B Neither the pressure nor temperature of the gas increases.
- C Only the pressure of the gas increases.
- D Only the temperature of the gas increases.

- 14 Results from a Brownian motion experiment involving smoke particles in air shows that heavy particles settle quickly. However, very small particles remain suspended for a long period of time.

Which of the following statements explain the behavior of very small particles?

- A Air pressure has a greater effect on smaller particles.
- B Random molecular bombardment by air molecules keeps the particles suspended.
- C The Earth's gravitational field does not act on small particles.
- D The small smoke particles have the same density as the air.

- 15 A water bath is filled with boiling water. Four rods of different materials are coated with solid wax and placed in contact with the metal container holding the boiling water. At the end of the experiment, rod P had the most melted wax, while rod S had the least melted wax.



Which row best fits the likely materials of all 4 rods?

	rod P	rod Q	rod R	rod S
A	copper	glass	iron	wood
B	copper	iron	glass	wood
C	wood	glass	iron	copper
D	wood	iron	glass	copper

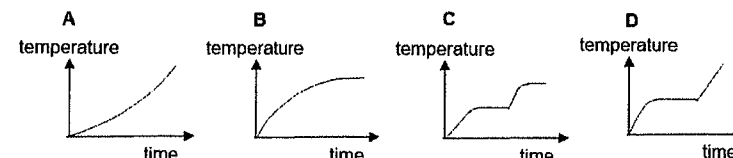
- 16 A person places his two feet on two separate surfaces, a woolen carpet and a marble tile. Both surfaces are initially at the same temperature.

Which statement best describes how the person will feel?

- A Both surfaces feel the same since both are at the same temperature initially.
 B The foot on the carpet feels warmer because the carpet transfers heat to the foot.
 C The foot on the tile feels cooler because the tile transfers coldness to the foot.
 D The foot on the carpet feels warmer because the rate of heat transfer is slower through the wool.

- 17 A container of water is heated at a constant rate in an insulated container till half of it vaporizes.

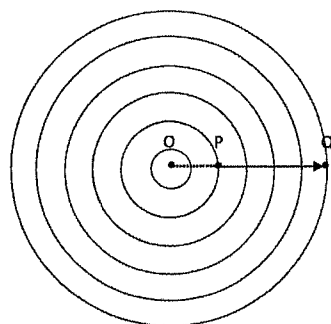
Which of the following graphs shows how the temperature changes during this time?



- 18 Which of the following is **not** a difference between boiling and evaporation?

- A Evaporation is a slow process but boiling is a fast process.
 B Evaporation occurs from 0 °C to 100 °C but boiling takes place only at the boiling point.
 C During evaporation, there is a change in state and temperature while boiling involves a change in state only.
 D Evaporation does not require an external thermal energy source while boiling requires.

- 19 The figure shows circular wavefronts travelling from a point source O.



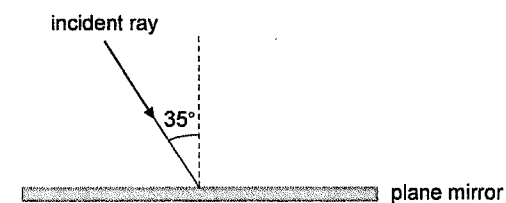
If the time taken for a wavefront to travel from point P to Q is 12.0 s and the wavelength of the wave is 200 cm, what is the speed of the wave?

- A 0.67 m / s
 B 1.0 m / s
 C 17 m / s
 D 67 m / s
- 20 In which of the following scenarios will sound **not** be heard?
- A A bell ringing in air.
 B A drum being played in an open field.
 C A tuning fork vibrating inside a vacuum chamber.
 D An alarm clock ringing inside a box with small openings.
- 21 The wavelength of an ultraviolet ray is approximately 1×10^{-7} m. What is the approximate wavelength of X-rays?
- A 1×10^{-10} m
 B 1×10^{-7} m
 C 1×10^{-5} m
 D 1×10^{-2} m

- 22 Which electromagnetic wave can cause structural damage to living cells and tissue?

- A infra-red radiation
 B microwaves
 C radio waves
 D ultraviolet radiation

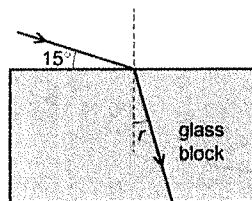
- 23 A ray of light strikes a plane mirror at an angle of incidence of 35° . The mirror is then rotated 10° clockwise while the incident ray remains fixed.



What is the angle between the new reflected ray and the original reflected ray?

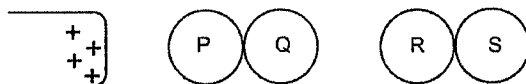
- A 10°
 B 20°
 C 35°
 D 45°

- 24 Light in air strikes the top surface of a glass block at an angle of 15° as shown. The refractive index of glass is 1.5.



What is the angle of refraction r ?

- A 10°
 B 23°
 C 40°
 D 50°
- 25 P, Q, R and S are identical insulated neutral metal spheres. They are arranged as shown.

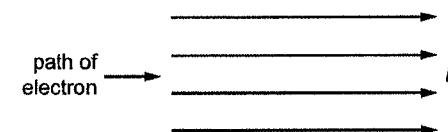


A positively-charged bar is brought near to P. Only sphere S is earthed momentarily.

What would the charge on spheres R and S be after the bar is removed?

	R	S
A	negative	neutral
B	negative	negative
C	neutral	neutral
D	positive	positive

- 26 An electron enters a region of space where there is a uniform electric field E as shown.



Initially, the electron is moving parallel to, and in the direction of, the electric field.

What is the subsequent path and change of speed of the electron caused by the electric field?

	path of electron	speed of electron
A	curved	decreases
B	curved	increases
C	linear	decreases
D	linear	increases

- 27 A typical lightning strike occurs when there is a potential difference of 50 MV between the clouds and the ground. When the lightning strikes, it transfers 800 MJ of energy.

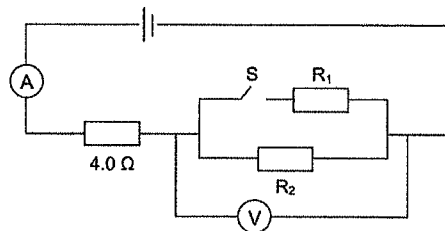
What is the number of electrons that travels through the lightning strike? (charge of an electron = 1.6×10^{-19} C)

- A 1.6×10^1
 B 4.0×10^{17}
 C 1.0×10^{20}
 D 3.1×10^{26}

- 28 The resistance of a cylindrical wire X of length 1.0 m and cross-sectional area of $1.0 \times 10^{-6} \text{ m}^2$ is 0.5Ω . A second wire Y is made from the same material. It has a length of 2.0 m and a cross-sectional area of $0.50 \times 10^{-6} \text{ m}^2$.

What is the resistance of Y?

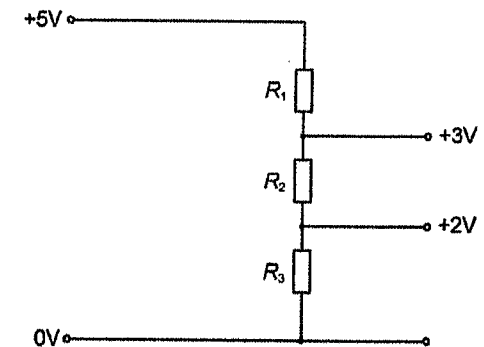
- A 0.25Ω
 B 0.5Ω
 C 1.0Ω
 D 2.0Ω
- 29 Two resistors, R_1 and R_2 are connected in parallel in a circuit as shown in the diagram. When switch S is open, the ammeter reads 1.0 A and the voltmeter reads 8.0 V. When the switch S is closed, the ammeter reads 1.5 A and the voltmeter reads 6.0 V



What are the resistances of R_1 and R_2 ?

	R_1 / Ω	R_2 / Ω
A	4.0	4.0
B	4.0	8.0
C	8.0	4.0
D	8.0	8.0

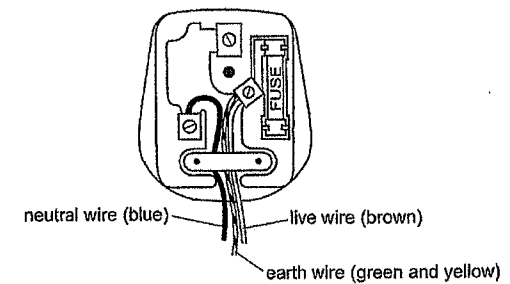
- 30 A potential divider is used to give outputs of 2V and 3V from a 5V source, as shown.



What are possible values for the resistances R_1 , R_2 and R_3 ?

	$R_1 / \text{k}\Omega$	$R_2 / \text{k}\Omega$	$R_3 / \text{k}\Omega$
A	2	1	5
B	3	2	2
C	4	2	4
D	4	6	10

- 31 The plug of an electrical appliance is incorrectly wired, as shown.



What is the effect of using the plug wired this way?

- A The appliance catches fire.
 B The appliance does not work.
 C The fuse in the plug blows.
 D The metal case of the appliance becomes live.



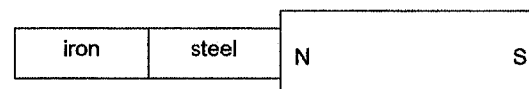
A Decrease the distance between the solenoid and the iron latch.

B Decrease the number of turns of coil in the solenoid.

C Increase the mass of the iron latch.

D Remove the iron core.

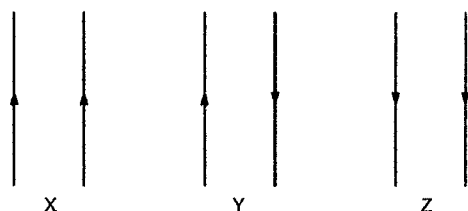
34 A steel bar and an iron bar are attracted to a magnet as shown.



What will happen when the magnet is removed?

- A** Both steel and iron bars lose their magnetism.
- B** The iron bar retains its magnetism and steel bar loses its magnetism.
- C** The steel and iron bars remain attracted to each other.
- D** The steel and iron bars repel each other.

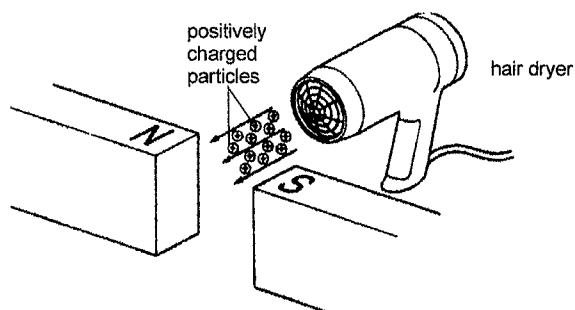
- 35 Three pairs of current-carrying parallel wires X, Y and Z are shown in the diagram.



Which row shows the force between the two wires for pairs X, Y, and Z?

	X	Y	Z
A	attraction	attraction	attraction
B	attraction	repulsion	attraction
C	repulsion	attraction	repulsion
D	repulsion	repulsion	repulsion

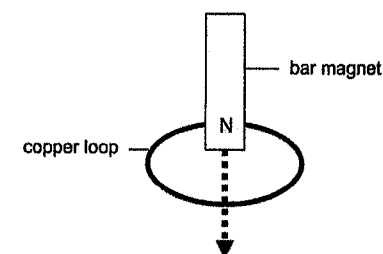
- 36 Hot air from a hair dryer contains many positively-charged particles. The hot air is directed between the poles of a strong magnet as shown in the diagram below.



How would the particles move as they pass through the strong magnet?

- A The particles move downwards.
- B The particles move in its original direction.
- C The particles move towards the North pole.
- D The particles move upwards.

- 37 A bar magnet is dropped through a loop of copper wire as shown.

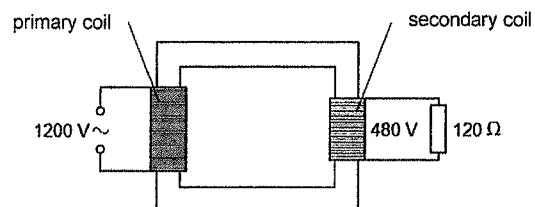


Which of the following statement(s) is/are correct?

- 1. Energy in the thermal store increases in the copper loop.
- 2. The magnet falls through the copper loop with an acceleration that is lower than the acceleration of free fall due to gravity
- 3. When the magnet approaches the copper loop, a current is induced in the loop that flows in a clockwise direction as seen by the observer from the top of the loop.
- 4. When the magnet moves through the copper loop, the current induced in the copper loop sets up a magnetic field that always repel the magnet.

- A 2 only
- B 1 and 2 only
- C 2 and 3 only
- D 3 and 4 only

- 38 The primary coil of an ideal transformer is connected to a 1200 V alternating current source. Its secondary coil is connected to a $120\ \Omega$ resistor.



What is the power dissipated in the resistor and the current in the primary coil?

	power / W	current / A
A	480	1.6
B	480	4.0
C	1920	1.6
D	1920	4.0

- 39 Astatine is a radioactive substance. It has a nucleon number of 218 and a proton number of 85. It forms a polonium nucleus when it decays, emitting an α -particle and a β -particle.

What are the nucleon number and the proton number of the polonium nucleus?

	nucleon number	proton number
A	214	84
B	214	83
C	216	83
D	215	82

- 40 In a nuclear fission reactor, which particle causes a Uranium-235 nucleus to split into smaller nuclei?

- A alpha-particle
- B gamma ray
- C neutron
- D proton

End of Paper

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237

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2025 4G3 Phy Prelim ans

Paper 1

1	C	9	C	17	B	25	B	33	B
2	A	10	C	18	B	26	C	34	C
3	D	11	A	19	A	27	C	35	B
4	D	12	D	20	C	28	D	36	D
5	A	13	A	21	A	29	D	37	B
6	A	14	B	22	D	30	C	38	C
7	C	15	B	23	B	31	D	39	A
8	C	16	D	24	C	32	A	40	C

Name:	Index Number:	Class:
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YIO CHU KANG SECONDARY SCHOOL
O-LEVEL PRELIMINARY EXAMINATION 2025
SECONDARY FOUR EXPRESS



PHYSICS
 Paper 1

6091/01
 1 hour

Additional Materials:
 Optical Answer Sheet (OAS)

15 September 2025 (Monday)

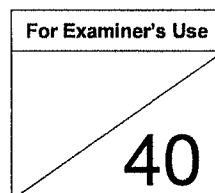
READ THESE INSTRUCTIONS FIRST

Write in soft pencil on the OAS.
 Do not use staples, paper clips, glue or correction fluid.
 Write your name, index number and class on the OAS in the spaces provided.

There are **forty** questions on this paper. Answer all questions.
 For each question there are four possible answers **A, B, C** and **D**.
 Choose the **one** you consider correct and record your choice in **soft pencil** on the separate OAS.

Read the instructions on the OAS very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
 Any rough working should be done in this question paper.
 The use of an approved scientific calculator is expected, where appropriate.



Setter: Ms Sin Puay San

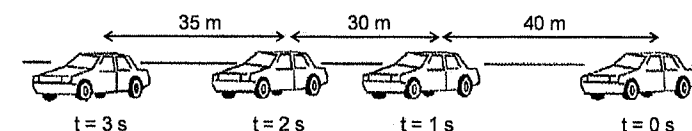
This document consists of **18** printed pages and **2** blank pages.

2

- 1 Which row correctly shows one scalar and one vector?

	scalar	vector
A	displacement	distance
B	energy	mass
C	force	velocity
D	time	acceleration

- 2 A car travels towards the left along a straight road as shown in the diagram below.



Which of the following statements is correct about the car?

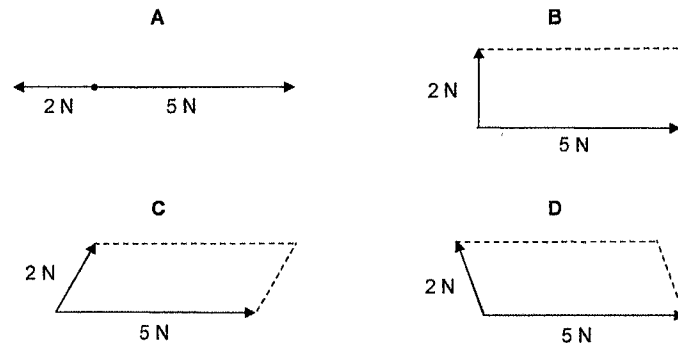
- A The average speed of the car is 35 m/s.
 B The car increases its acceleration from 0 s to 3 s.
 C The car shows a constant deceleration throughout its journey.
 D The car travels at a constant speed throughout the journey.
- 3 A ball bearing is released and sinks into a viscous liquid. It fell vertically until it reached terminal velocity.
- What can be deduced about the resultant force acting on the ball bearing when it is sinking at terminal velocity?
- A constant
 B decreasing
 C increasing
 D zero
- 4 When a horizontal force of 6.0 N is applied to a wooden block of mass 2.0 kg on a horizontal rough surface, the block moves with an acceleration of 1.0 m/s².

What is the acceleration of the block if the applied force is increased to 12.0 N?

- A 2.0 m/s²
 B 3.0 m/s²
 C 4.0 m/s²
 D 9.0 m/s²

- 5 Forces of 5 N and 2 N act on a point.

Which scale diagram shows the forces producing the largest resultant force?



- 6 A cyclist is riding at a steady speed on a level road.

According to Newton's Third Law of motion, what is the equal and opposite force to the backward push of the back wheel on the road?

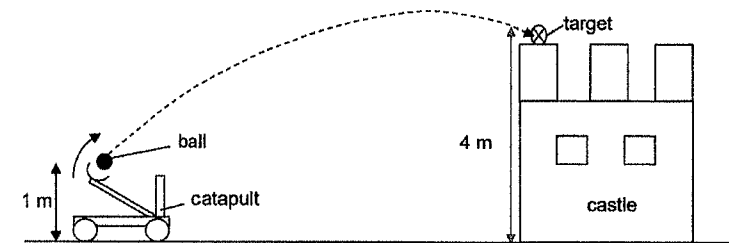
- A the force exerted by the cyclist on the pedals
- B the forward push of the road on the back wheel
- C the tension in the bicycle chain
- D the total air resistance and frictional force

- 7 A motor drives a pump that raises 500 kg water up by 10.0 m in 5 minutes. The efficiency of the pump is 60 % and the gravitational field strength is 10 N/kg.

What is the power generated by the motor?

- A 100 W
- B 167 W
- C 278 W
- D 6000 W

- 8 A 2.0 kg ball is launched from a catapult. The ball leaves the catapult with a speed of 12 m/s and hits a target at the top of a castle. The gravitational field strength g is 10 N/kg.

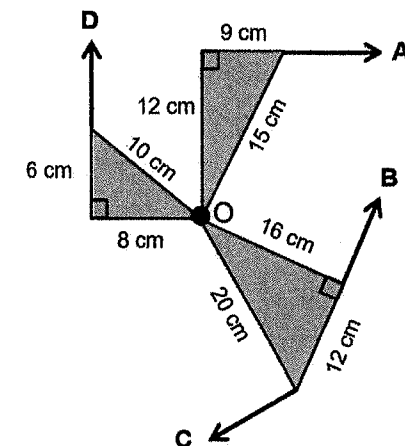


What is the speed of the ball when it hits the target?

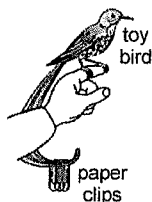
- A 4.00 m/s
- B 6.63 m/s
- C 8.00 m/s
- D 9.17 m/s

- 9 A wheel with three triangular arms rotates about O. Forces of equal magnitude (A, B, C and D) are directed at different parts of the wheel.

Which force would result in the largest clockwise turning effect about O?

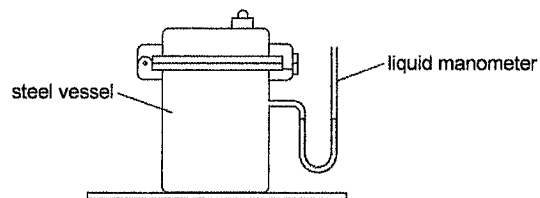


- 10 A student uses paper clips to balance a toy bird on his finger as shown.



What is the effect of the paper clips?

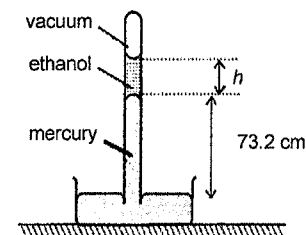
- A They add length to the tail so that the height and depth are equal.
 - B They increase the base area of the toy bird for stability.
 - C They lower the centre of gravity of the setup.
 - D They provide a pivot point for the finger.
- 11 A manometer is used to indicate the pressure in a steel vessel, as shown in the diagram below.



Which statement correctly describes the pressure in the vessel as indicated by the liquid manometer?

- A It is between zero and atmospheric pressure.
- B It is equal to atmospheric pressure.
- C It is greater than atmospheric pressure.
- D There is no pressure in the vessel.

- 12 The diagram below shows a barometer with two immiscible liquids, mercury and ethanol.



The following data is given:

atmospheric pressure	= 75.6 cm Hg
density of ethanol	= 789 kg/m ³
density of mercury	= 13 600 kg/m ³
gravitational field strength	= 10 N/kg

What is the height h , of the ethanol above the mercury column?

- A 17.2 cm
 - B 24.0 cm
 - C 30.4 cm
 - D 41.4 cm
- 13 When fine pollen grains suspended in water are viewed under a microscope, they are seen to be making small random movements.
- Which of the following statements explains this observation?
- A There are convection currents in the water.
 - B The pollen grains are being hit by water molecules.
 - C The pollen grains are living organisms so they move around.
 - D The pollen grains are moving and colliding with one another.
- 14 Substance K consists of particles that are close together and sliding past each other randomly. The average speed of the particles in substance K is also gradually increasing.

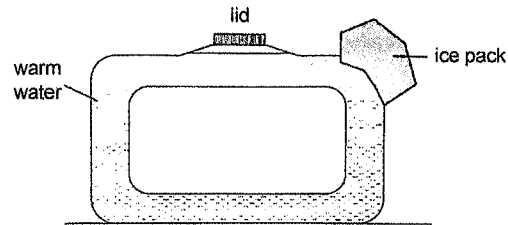
Which of the following best describes the substance?

- A Substance K is a liquid at boiling point.
- B Substance K is a liquid being heated.
- C Substance K is a solid at melting point.
- D Substance K is a solid being heating.

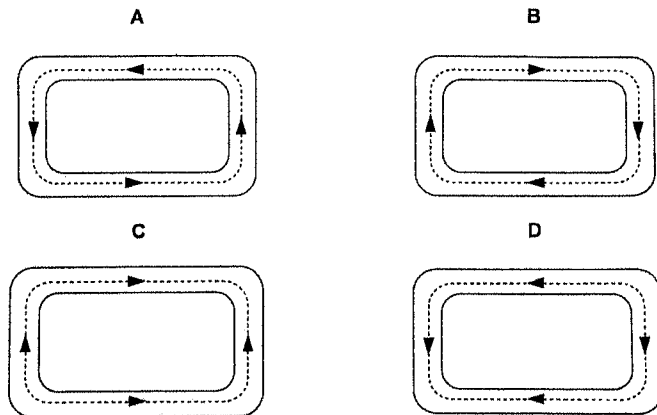
- 15 Solid X is in thermal equilibrium with solid Y which is at the same temperature as solid Z.

What will happen when solid X is placed in contact with solid Z?

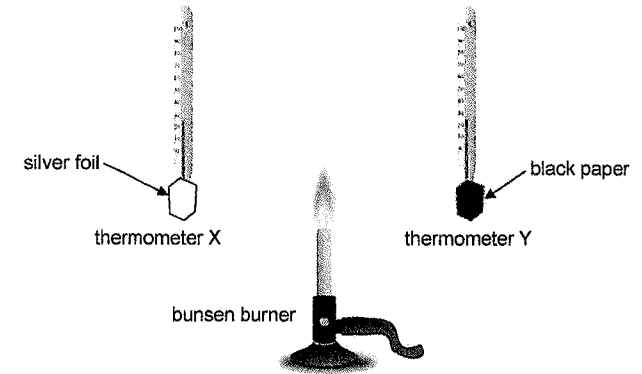
- A Heat will only flow from solid X to solid Z.
 - B Heat will only flow from solid Z to solid X.
 - C The heat flowing from solid X to solid Z is equal to the heat flowing from solid Z to solid X.
 - D There is no heat flow at all between solid X and solid Z.
- 16 A student filled an upright ring-shaped container completely with warm water. He then placed a pack of ice at a corner of the container as shown in the diagram below.



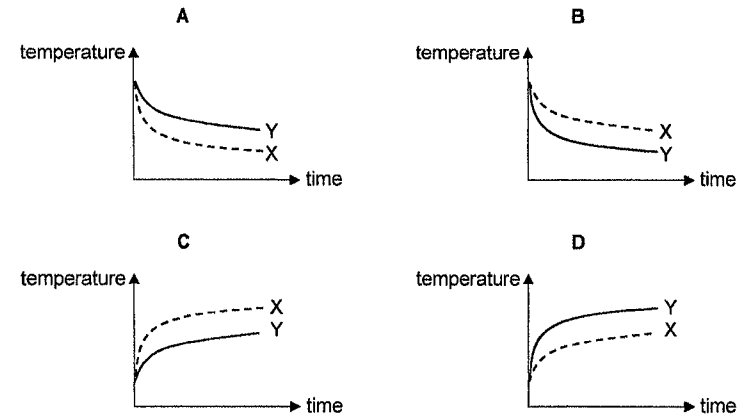
Which is a correct illustration of the convection current that was set up?



- 17 The diagram below shows two thermometers, X and Y held at the same distance away from a lighted Bunsen burner. The bulb of thermometer X is wrapped with a silver foil while the bulb of thermometer Y is wrapped with a black paper.



Which of the following graphs show the correct change in temperature of the two thermometers?



- 18 A block of copper is placed at room temperature.

Which row describes a smaller block of copper at the same temperature?

	internal energy	heat capacity	specific heat capacity
A	less	less	same
B	less	same	less
C	same	less	same
D	same	same	same

- 19 Infrared radiation has wavelengths between 700 nm to 1.0 mm.

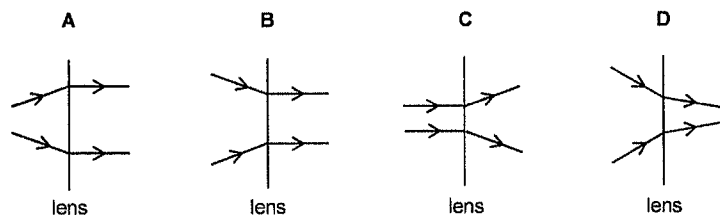
What is the maximum frequency of infrared radiation in vacuum?

- A 3.0×10^8 Hz
 B 3.0×10^{11} Hz
 C 4.3×10^{14} Hz
 D 4.3×10^{17} Hz

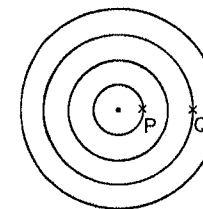
- 20 Which of the following statements about electromagnetic waves is **incorrect**?

- A Electromagnetic waves are neutral.
 B Electromagnetic waves cannot be deflected by magnetic field.
 C Electromagnetic waves obey wave equation, $v = f \lambda$.
 D Electromagnetic waves travel at the same speed in any medium.

- 21 Which diagram shows rays of light passing through a converging lens?



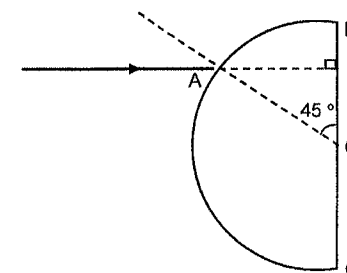
- 22 A pebble is dropped into still water so that the circular wavefronts are seen to travel outwards with a speed of v .



If the wavelength is λ , what is the time taken for the disturbance at P to reach Q?

- A $2 \lambda v$
 B $\frac{\lambda}{v}$
 C $\frac{2\lambda}{v}$
 D $\frac{\lambda}{2v}$

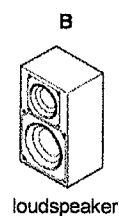
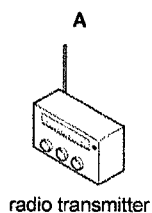
- 23 The diagram below shows a semi-circular glass prism with centre O. The critical angle of glass is 45° .



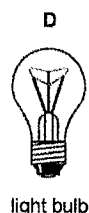
What happens when a ray of light, perpendicular to the diameter POQ, is incident at A?

- A The light ray emerges at O.
 B The light ray emerges at some point between O and P.
 C Total internal reflection occurs at O.
 D Total internal reflection occurs at some point between O and P.

- 24 Which of the following sources generates longitudinal waves?



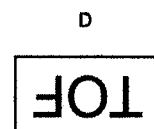
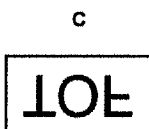
twig dropped quietly into water
creating ripples on the surface



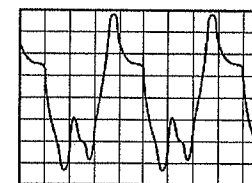
- 25 A student holds a sheet of paper with letters on it facing a plane mirror. The letters on the paper are shown.



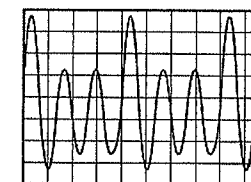
What does the student see in the mirror?



- 26 Waveforms are shown on a cathode-ray oscilloscope for a flute and a guitar. The oscilloscope settings are the same for both waveforms.



flute



guitar

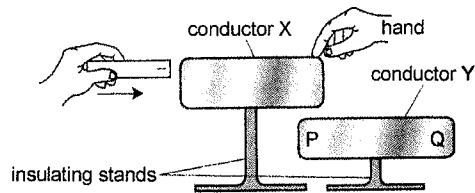
What is/are the similarity/similarities between the two sounds?

- A the loudness only
 - B the pitch only
 - C the loudness and the pitch
 - D they have no similarities
- 27 Ultrasound and X-rays are both used in hospital to produce images of regions inside the human body.
- Which of the following statements about ultrasound and X-rays is correct?
- A Both ultrasound and X-rays are transverse waves.
 - B Both ultrasound and X-rays can travel through vacuum.
 - C Ultrasound has longer wavelength than that of X-rays.
 - D Ultrasound travels at a faster speed than X-rays.
- 28 Which of the following statements about electric fields is/are correct?

- I An electron in the field will experience a force.
- II The direction of the electric field is the direction that an electron moves in the field.
- III The electric field strength decreases with increasing distance from the source.

- A I and III
- B I, II and III
- C II only
- D III only

- 29 A negatively charged rod is brought near conductor X which is earthed momentarily as shown below.



After the rod is removed, what are the resulting charges on conductor Y at P and Q?

	charge at P	charge at Q
A	positive	positive
B	positive	negative
C	negative	positive
D	negative	negative

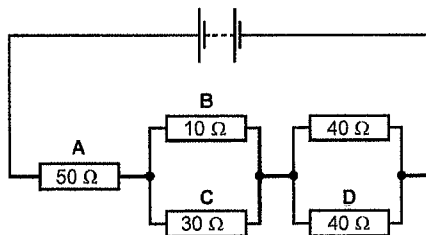
- 30 A wire has a current of 500 mA in it.

How much charge passes a point in the wire in 3 minutes?

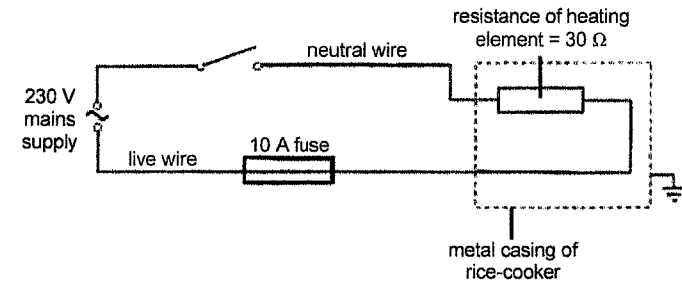
- A 25 C
B 90 C
C 167 C
D 1500 C

- 31 The diagram shows a circuit containing five resistors connected to a battery.

Which resistor has the least current flow?



- 32 The diagram below shows the circuit formed when a rice-cooker is plugged into a mains socket.



What is the fault in this arrangement?

- A The earth wire is missing.
B The fuse rating is too low.
C The resistance of the heating element is too high.
D The switch is connected wrongly.

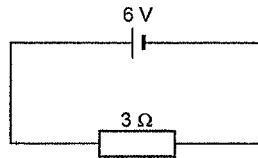
- 33 The table shows some common household electrical appliances, their power rating and the duration of their use. The cost of a unit (kWh) of electricity is 20 cents.

appliance	power rating	time used
lamp	100 W	5 hours
heater	1.5 kW	3 hours
cooker	3 kW	30 minutes

What is the total cost when all these appliances are used in the times shown above?

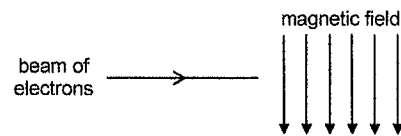
- A \$1.30
B \$6.50
C \$24.70
D \$118.90

- 34 The circuit below is switched on for a minute.



Calculate the amount of energy dissipated by the resistor.

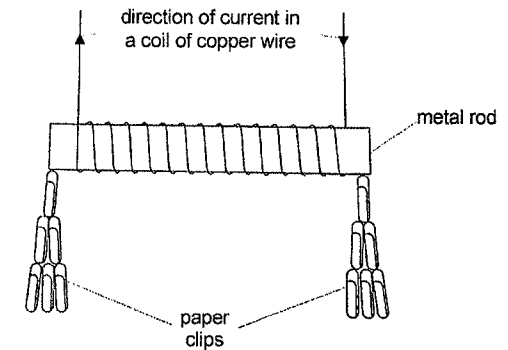
- A 120 J
 B 360 J
 C 720 J
 D 1080 J
- 35 The diagram shows a beam of electrons entering a magnetic field.



What is the effect of the magnetic field on the electrons?

- A They are deflected into the plane of the paper.
 B They are deflected out of the plane of the paper.
 C They are deflected towards the bottom of the paper.
 D They are deflected towards the top of the paper.

- 36 Four metal rods are placed, one at a time, inside a coil of copper wire.



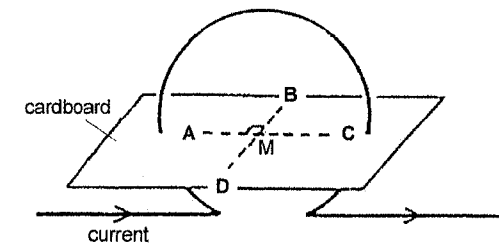
The table below gives the results of the experiment.

Which rod would be the most suitable to use for the core of a coil in a circuit breaker?

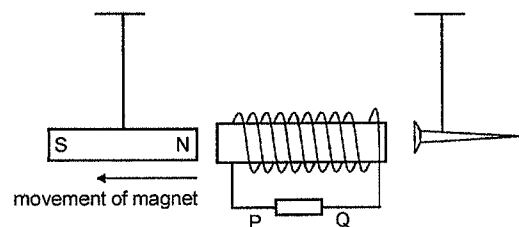
metal rod	number of paper clips picked up when there is current in the coil	number of paper clips still attracted when the current is switched off
A	1	0
B	20	2
C	35	0
D	35	30

- 37 A compass is placed at point M on the cardboard shown in the diagram below.

Where will the north pole of the compass needle point towards?



- 38 A solenoid is placed in between a magnet and an iron nail that are freely suspended from the ceiling.

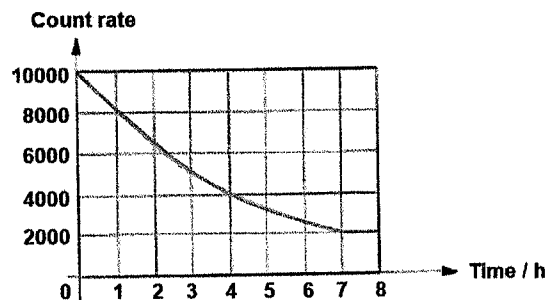


The magnet is then moved away from the solenoid.

What is the direction of the current flowing through resistor PQ and the direction that the iron nail moves when the magnet is moved in the direction shown?

	direction of current on PQ	direction of movement of iron nail
A	from P to Q	away from solenoid
B	from P to Q	towards solenoid
C	from Q to P	away from solenoid
D	from Q to P	towards solenoid

- 39 The graph shows the count rate of a radioactive sample plotted against time.



What is the half-life of this radioactive sample?

- A 1 h
B 3 h
C 7 h
D 8 h

- 40 Which pair of properties is correct for beta particles?

	pass through 2 cm of aluminium	deflected by an electric field
A	no	no
B	no	yes
C	yes	no
D	yes	yes

PAPER ONE (MCQ)

01.	D
02.	A
03.	D
04.	C
05.	C
06.	B
07.	C
08.	D
09.	C
10.	C

11.	B
12.	D
13.	B
14.	B
15.	C
16.	B
17.	D
18.	A
19.	C
20.	D

21.	A
22.	C
23.	B
24.	B
25.	B
26.	A
27.	C
28.	A
29.	C
30.	B

31.	C
32.	D
33.	A
34.	C
35.	B
36.	C
37.	B
38.	D
39.	B
40.	B


YUAN CHING SECONDARY SCHOOL

 Secondary Four Express Course
 Preliminary Examination 2025

 CANDIDATE
 NAME

CLASS

 INDEX
 NUMBER

PHYSICS
6091 / 01

Paper 1 Multiple Choice

2 September 2025

Additional Materials : Multiple Choice Answer Sheet

1 hour
READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and index number on the Answer Sheet in the spaces provided unless this has been done for you.

 There are **forty** questions for this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

 Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

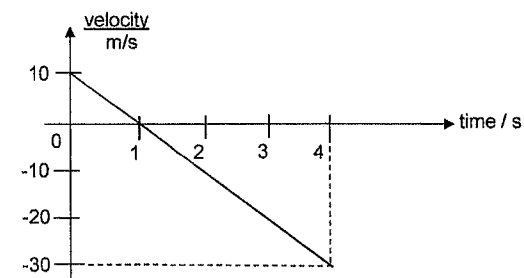
Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

The total number of marks for this paper is 40.

This paper consists of 17 printed pages.

- 1 The average mass of a human hair is 0.75 mg.
What is the mass of a human hair in microgram?
 A $7.5 \times 10^{-7} \mu\text{g}$ B $7.5 \times 10^{-4} \mu\text{g}$ C $7.5 \times 10^{-1} \mu\text{g}$ D $7.5 \times 10^2 \mu\text{g}$
- 2 What is the unit of work done expressed in base units?
 A kg m s^2
 B $(\text{kg m}^2) / \text{s}^2$
 C $\text{kg} / (\text{m s}^2)$
 D $\text{kg} / (\text{m}^2 \text{s}^2)$
- 3 A train travels east at a velocity of 20 m/s along a straight, horizontal track.
At time $t = 10.0 \text{ s}$, it undergoes a constant acceleration of -4.0 m/s^2 .
How is the train moving at time $t = 16.0 \text{ s}$?
 A travelling east with decreasing speed
 B travelling east with increasing speed
 C travelling west with decreasing speed
 D travelling west with increasing speed
- 4 The diagram shows a velocity-time graph of a stone thrown vertically upwards from the top of a cliff. The stone reaches the bottom of the cliff in 4.0 s.
Assume negligible air resistance and take $g = 10 \text{ N/kg}$.



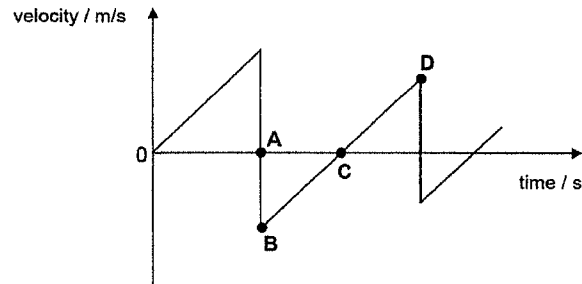
What is the height of the cliff?

- A 40 m B 45 m C 50 m D 80 m

3

- 5 A ball is released from rest above a hard, horizontal ground. The graph shows the velocity-time graph of the bouncing ball.

At which point on the graph does the ball reach its maximum height after the first bounce?

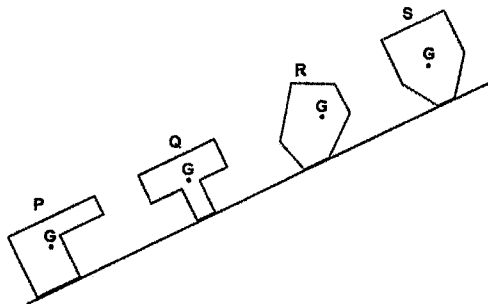


- 6 A man is sitting on a bench. Two forces act on him – his weight, W and the normal contact force, N .

Which of the following makes an action-reaction pair with his weight, W ?

- A The force acting on the bench by the man.
- B The force acting on the Earth by the man.
- C The force acting on the man by the bench.
- D The force acting on the man by the Earth.

- 7 Four objects, P, Q, R and S, of different shapes are placed on a slope. G represents the centre of gravity of each object.

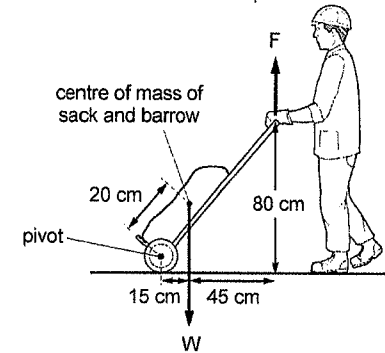


Which objects will topple?

- A P, Q and R
- B Q and R
- C Q and S
- D Q, R and S

4

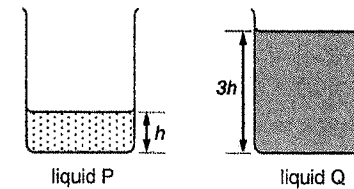
- 8 The diagram shows a man holding a stationary sack and barrow. He applies a vertical force, F , to the handle of the barrow. The weight of the sack and barrow, W , and the centre of mass are shown. The wheel acts as a pivot.



What are the moments produced about the pivot due to F and W ?

	moment due to F / N cm	moment due to W / N cm
A	$45 \times F$	$15 \times W$
B	$60 \times F$	$15 \times W$
C	$60 \times F$	$20 \times W$
D	$80 \times F$	$20 \times W$

- 9 Two identical beakers contain equal masses of two different liquids.



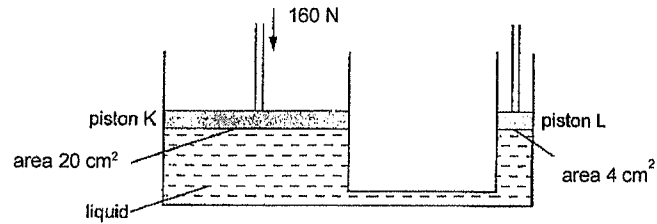
Liquid P has a density ρ .

What is the density of liquid Q?

- A $\frac{\rho}{27}$
- B $\frac{\rho}{3}$
- C 3ρ
- D 27ρ

5

- 10 The hydraulic system shown in the diagram contains a liquid. Piston K has a cross-sectional area of 20 cm^2 and piston L has a cross-sectional area of 4 cm^2 .

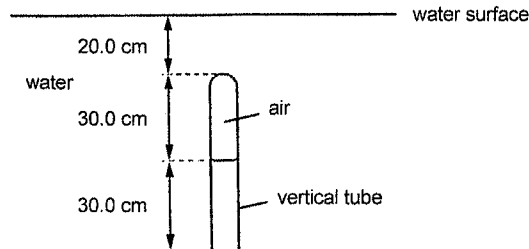


A downward force of 160 N is exerted on the piston K.

What is the upward force exerted by the liquid on piston L?

- A 5.0 N B 32 N C 160 N D 800 N

- 11 A vertical tube, closed at one end, is immersed in water. A column of air is trapped inside the tube.



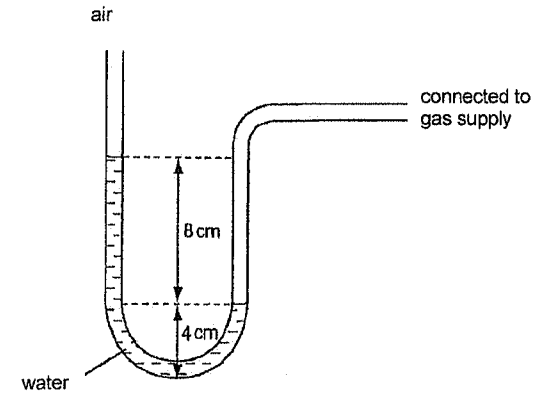
The density of water is $1\,000 \text{ kg/m}^3$. The gravitational field strength is 10 N/kg .

What is the difference between the pressure of the air in the tube and the atmospheric pressure?

- A 2 000 Pa B 3 000 Pa C 5 000 Pa D 8 000 Pa

6

- 12 A manometer is connected to a gas supply.



Pressure can be measured in *cm of water*.

What is the pressure of the gas?

- A 8.0 cm of water greater than atmospheric pressure
B 8.0 cm of water lesser than atmospheric pressure
C 12.0 cm of water greater than atmospheric pressure
D 12.0 cm of water lesser than atmospheric pressure

- 13 Which of pair of energy resources are renewable?

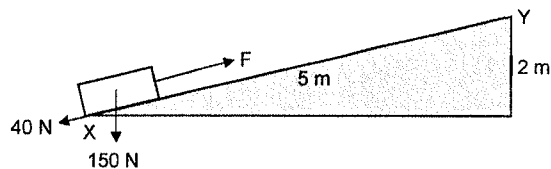
- A coal and oil
B geothermal and hydropower
C hydropower and oil
D nuclear fuel and solar power

- 14 An electric motor pulls a 6.0 kN concrete block vertically up 8.0 m in 4.0 s . The efficiency of the motor is 60%.

What is the power of the motor?

- A 4.8 kW
B 7.2 kW
C 12 kW
D 20 kW

- 15 The diagram shows a box, of weight 150 N, being pulled up a rough slope from X to Y at a constant velocity. The box experiences a friction of 40 N during the motion.



What is the force F needed to pull the box up the slope and how much work is done by F ?

	force F	work done by F
A	40 N	200 J
B	60 N	300 J
C	100 N	500 J
D	150 N	750 J

- 16 Which of the following statements explains the Brownian motion of smoke particles?
- A It is due to the collisions between the smoke particles.
- B It is due to the collisions between the smoke particles and air particles.
- C It is due to the collisions between the smoke particles and light.
- D It is due to the collisions between the smoke particles and the walls of the container.
- 17 A man selling balloons notices that the balloons are bigger in the afternoon than in the morning during a hot day. Some statements about this observation are given.
1. The average distance between the air molecules in the balloon increases.
 2. The kinetic energy of the air molecules in the balloon increases.
 3. The pressure in the balloon increases.

Which statements are correct?

- A 1 and 2 B 1 and 3 C 1, 2 and 3 D 2 and 3

- 18 What happens to a fixed mass of gas when the gas is cooled at a constant volume?

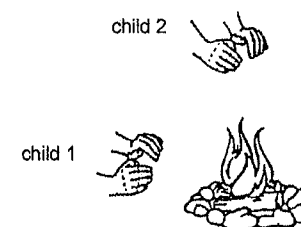
- A The average mass of the particles decreases.
- B The average separation of the particles decreases.
- C The average speed of the particles decreases.
- D The average volume of the particles decreases.

- 19 Some water is heated in a metal kettle over an electric stove.

Which row best describes how energy is transferred from the stove through the metal kettle and throughout the water?

	metal kettle	water
A	conduction	conduction
B	conduction	convection
C	convection	conduction
D	convection	convection

- 20 On a cold night, two children sit next to a campfire to warm their hands. Their hands are at the same distance from the fire. Child 2 holds his hand over the fire and child 1 holds her hands in front of the fire.

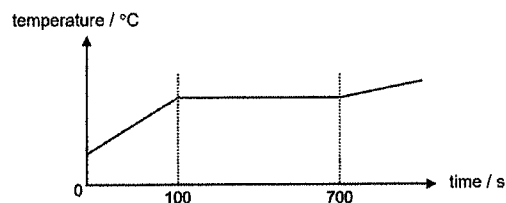


How does the heat from the fire reach each child's hands?

	child 1	child 2
A	convection only	radiation only
B	convection only	convection only
C	radiation only	convection and radiation
D	radiation only	convection only

- 21 A 550 g of unknown liquid is heated using a 1.5 kW electric heater.

The temperature of this liquid over a period time is plotted on a graph shown below.



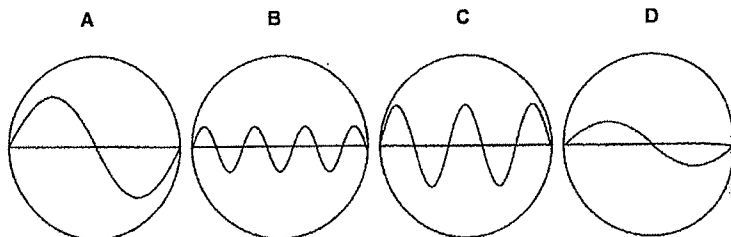
What is the specific latent heat of vaporisation of the substance?

- A 1.6 kJ/kg B 270 kJ/kg C 1600 kJ/kg D 1900 kJ/kg
- 22 An exploding star gives out energy in the form of waves. The waves travel to Earth through space.
- Which of these waves could not be received from the star?
- A infrared waves
B light waves
C radio waves
D sound waves

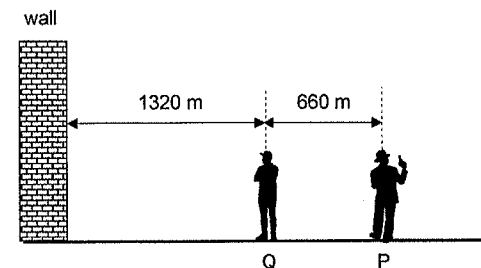
- 23 An oscilloscope is an electronic test instrument that allows you to observe varying signal voltages.

The diagrams represent sound waves displayed on an oscilloscope. The settings of the oscilloscope remain the same for each sound.

Which diagram represents the loudest sound with the lowest pitch?

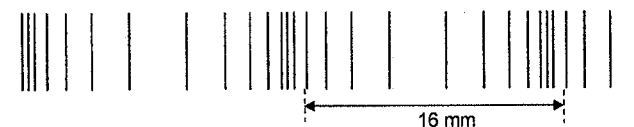


- 24 A man standing at P fires a pistol and starts a stopwatch at the same time. Another man at Q hears the first shot 2.0 s later.



At what time will the man at P hear the echo from the wall?

- A 4.0 s
B 6.0 s
C 8.0 s
D 12.0 s
- 25 The diagram shows part of a longitudinal wave travelling in a medium.

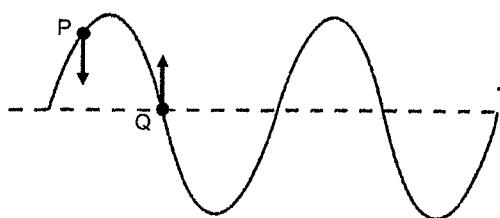


A particle in the medium moves forward and backward continuously between two positions that are 4.0 mm apart. The distance between two particles in successive waves is 16 mm.

What is the amplitude of the wave?

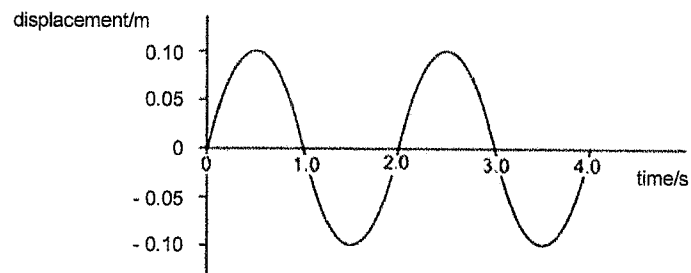
- A 2.0 mm B 4.0 mm C 8.0 mm D 16.0 mm

- 26 The diagram shows the direction of motion of two particles on a wave at P and Q at this instant.



In which direction is the wave moving?

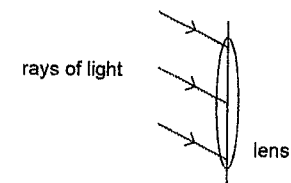
- A downwards
 B towards the left
 C towards the right
 D upwards
- 27 The figure shows how displacement varies with time as a wave passes a fixed point.



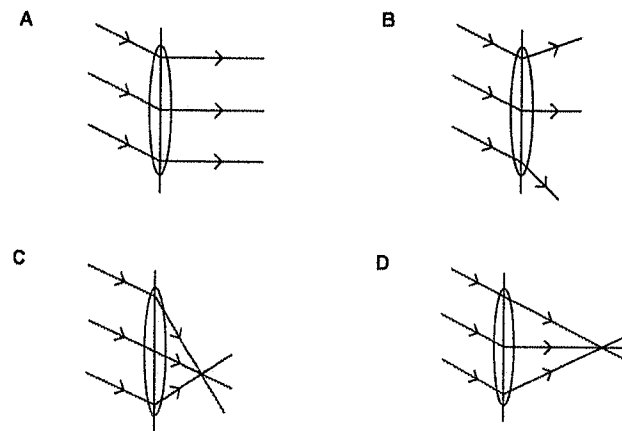
Given that the wavelength of the wave is 0.20 m, how long does it take for the wave to travel 20.0 m?

- A 200 s B 400 s C 600 s D 800 s

- 28 The diagram shows three rays of light fall on a converging lens.

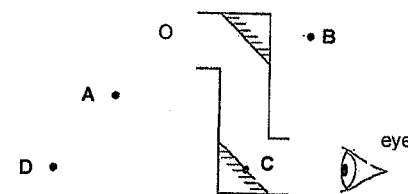


Which diagram shows the path of the rays after passing through the lens?



- 29 The diagram shows an object O viewed using two mirrors. A person looks into the mirrors as shown.

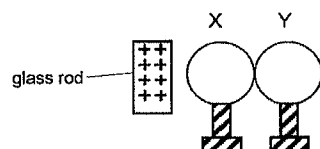
At which position is the image of O as seen by the eye?



- 30 Which row does **not** show a correct application of the stated electromagnetic wave?

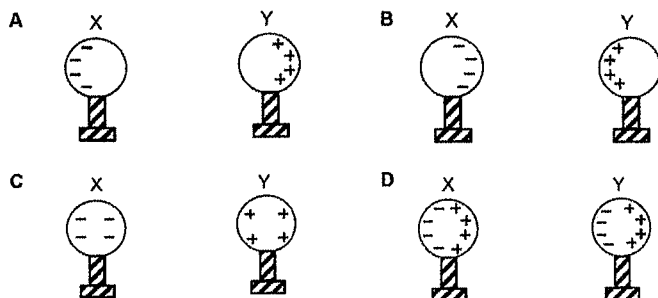
	electromagnetic wave	application
A	gamma rays	medical treatment
B	ultraviolet radiation	sterilisation
C	visible light	optical fibre
D	X-rays	satellite communication

- 31 In an experiment, two insulated brass spheres X and Y are placed together so that they touch one another. A positively-charged glass rod is brought near the left side of X.



The two spheres are then pulled far apart with the glass rod still in position. The glass rod is then moved away from X.

Which diagram correctly shows the end result of the experiment?



- 32 The resistance of a wire can be changed by varying its cross-sectional area and length.

Which row shows the changes that doubles the resistance of the wire?

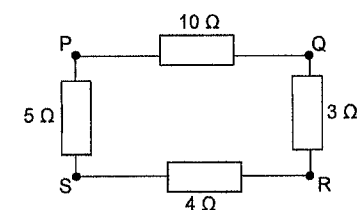
	cross-sectional area	length
A	double	double
B	double	no change
C	halve	halve
D	halve	no change

- 33 A 12.0 V car battery is fully charged. It is connected in series to a lamp rated 12.0 V, 24.0 W. The lamp shines at normal brightness for 25.0 hours.

What is the amount of charge that passes through the lamp in this time?

- A 50 C
B 3 000 C
C 45 000 C
D 180 000 C

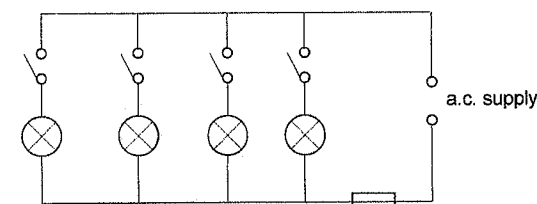
- 34 The diagram below shows a circuit with four different resistors.



Across which junctions will the maximum effective resistance be achieved?

- A PQ B QR C RS D SP

- 35 The diagram shows four lamps connected to an a.c. power supply. Each lamp is rated 120 V, 240 W.

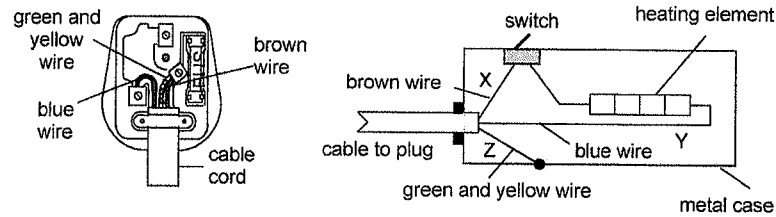


What is a suitable fuse rating?

- A 4 A B 8 A C 10 A D 12 A

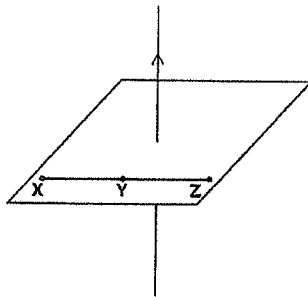
- 36 The diagram shows the wiring inside a three pin plug which is connected to an electrical heater.

The electrical heater has a metal case and a switch.



What is the effect on using this heater when the switch is turned on?

- A The heater does not work and it is dangerous to touch the metal case.
 B The heater does not work and it is safe to touch the metal case.
 C The heater works and it is dangerous to touch the metal case.
 D The heater works and it is safe to touch the metal case.
- 37 The diagram shows a current-carrying wire passing through the centre of a sheet of paper. X, Y and Z forms a straight line and Y is the shortest distance from the line to the current-carrying wire.

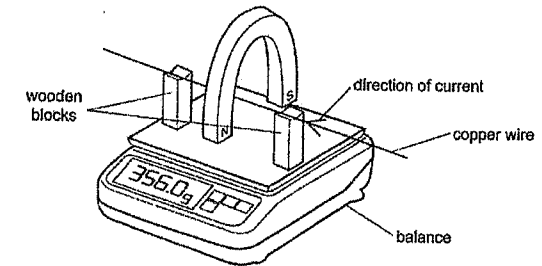


How do the strengths of the magnetic fields at points X, Y and Z compare?

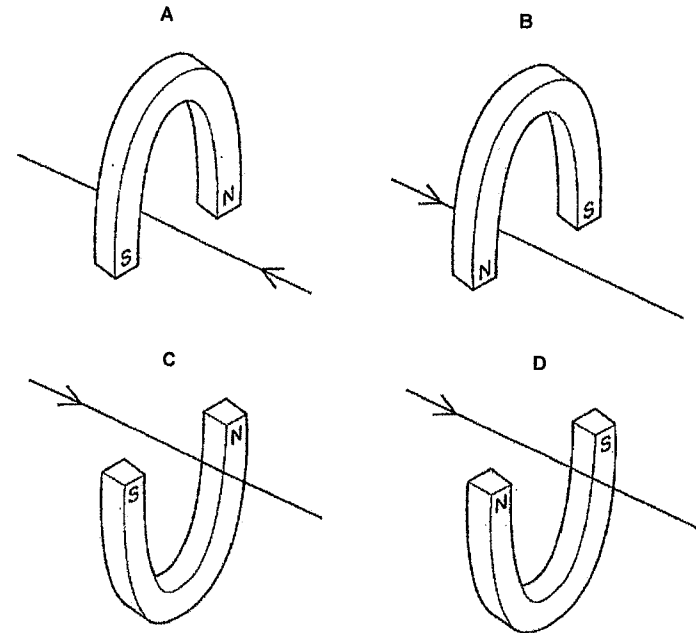
- A equal at X, Y and Z
 B equal at X and Z, but stronger at Y
 C equal at X and Z, but weaker at Y
 D stronger at X than Y and stronger at Y than Z.

- 38 A copper wire is taped to two wooden blocks which stand on a sensitive balance.

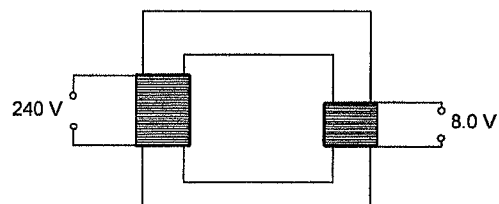
When there is a current in the wire and a magnet is held in the position shown, the balance reading increases.



Which other arrangement of magnet and current will give the same increased reading?



- 39 The diagram shows an ideal transformer in a computer speaker. The mains supply of 240 V is connected to the transformer.



The speaker has a resistance of $6.0\ \Omega$ and the output voltage from the transformer is 8.0 V.

What current is drawn from the mains supply?

- A 0.044 A B 1.33 A C 30 A D 40 A

- 40 One nucleus of a uranium isotope contains 238 nucleons, of which 146 are neutrons.

Which is the nucleus of another isotope of uranium?

	number of nucleons in the nucleus	number of neutrons in the nucleus
A	235	143
B	237	147
C	238	144
D	241	146

END OF PAPER 1

1	D	11	C	21	C	31	C
2	B	12	A	22	D	32	D
3	D	13	B	23	A	33	D
4	A	14	D	24	D	34	A
5	C	15	C	25	A	35	C
6	B	16	B	26	C	36	C
7	C	17	A	27	A	37	B
8	B	18	C	28	C	38	C
9	B	19	B	29	D	39	A
10	B	20	C	30	D	40	A



**YISHUN SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2025
SECONDARY 4 EXPRESS**

CANDIDATE
NAME

CLASS

INDEX
NUMBER

PHYSICS

Paper 1 Multiple Choice

6091/01

26 August 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and index number on the Answer Sheet in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

2

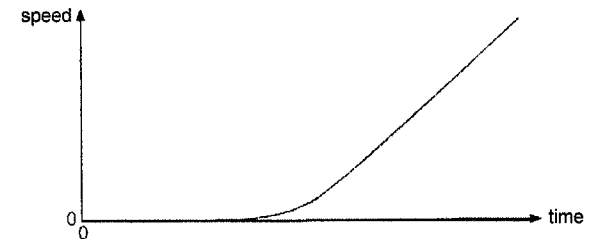
- 1 Which row shows the approximate diameter of an atom and the average diameter of the Earth?

	diameter of an atom	diameter of the Earth
A	0.5 μm	0.012 Mm
B	0.5 μm	0.012 Gm
C	0.5 nm	0.012 Mm
D	0.5 nm	0.012 Gm

- 2 Which row correctly lists one scalar and one vector quantity?

	scalar quantity	vector quantity
A	displacement	work
B	energy	force
C	energy	work
D	weight	acceleration

- 3 The diagram below shows the speed-time graph for a car initially at rest.

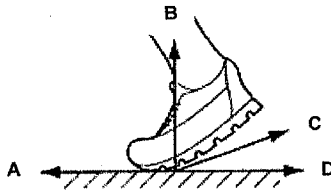


The car starts to move.

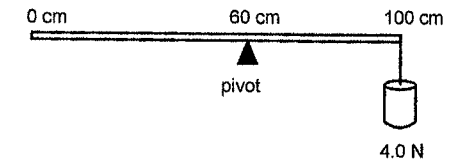
Which correctly describes the car's subsequent motion?

- A** moving with non-uniform acceleration and then moving with uniform acceleration
- B** moving with uniform acceleration and then moving with non-uniform acceleration
- C** moving with uniform speed and then moving with non-uniform acceleration
- D** moving with uniform speed and then moving with uniform acceleration

- 4 Which statement is correct?
- A When two objects move with the same acceleration, they have the same speed.
 - B When two objects move with the same acceleration, they have the same velocity.
 - C When two objects move with the same speed, they have the same velocity.
 - D When two objects move with the same velocity, they have the same speed.
- 5 A skydiver jumps from a stationary helicopter and reaches a steady vertical speed. She then opens her parachute.
- Which statement about the falling skydiver is correct?
- A As her parachute opens, her acceleration is upwards.
 - B As she falls at a steady speed with her parachute open, her weight is zero.
 - C When she accelerates, the resultant force on her is zero.
 - D When she falls at a steady speed, air resistance is zero.
- 6 The diagram shows a runner's shoe at the start of a race.
- Which arrow indicates the direction of the frictional force acting on the runner's shoe?



- 7 A car of mass 700 kg has a forward acceleration of 2.2 m/s^2 . A frictional force of 1000 N opposes the motion of the car.
- What is the driving force due to the engine of the car?
- A 1000 N
 - B 1500 N
 - C 2500 N
 - D 7000 N
- 8 The diagram shows a uniform metre rule pivoted at the 60.0 cm mark. A 4.0 N weight is suspended from one end.



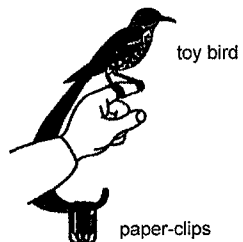
The metre rule is in equilibrium.

What is the magnitude of the resultant moment about the pivot?

- A zero
- B 160 Ncm anticlockwise
- C 160 Ncm clockwise
- D 400 Ncm clockwise

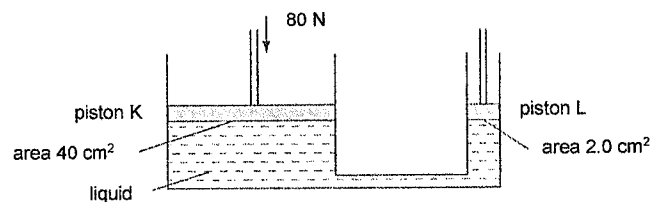
5

- 9 A girl uses paper-clips to balance a toy bird on her finger as shown in the diagram.



What is the effect of the paper-clips?

- A They do not affect the centre of gravity but increase the weight.
 B They help to lower the centre of gravity below her finger.
 C They help to lower the centre of gravity above her finger.
 D They help to raise the centre of gravity above her finger.
- 10 The system shown in the diagram contains a liquid.



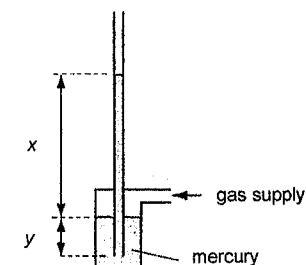
A downward force of 80 N is exerted on piston K.

What will be the upward force exerted by the liquid on piston L?

- A 1.0 N
 B 4.0 N
 C 80 N
 D 1600 N

6

- 11 An open tube stands, with one end in mercury, in a chamber that is connected to a gas supply. The atmospheric pressure is h mHg.

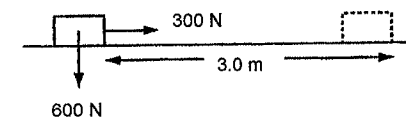


x and y are measured in metres.

What is pressure of the gas supply?

- A x
 B $x - h$
 C $x + h$
 D $x + y$

- 12 When a 300 N force is applied to a box weighing 600 N, the box moves 3.0 m horizontally in 20 s.

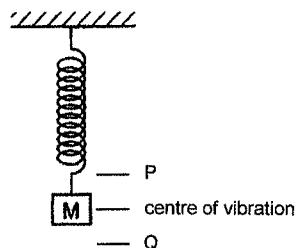


What is the average power?

- A 45 W
 B 90 W
 C 900 W
 D 1800 W

[Turn over

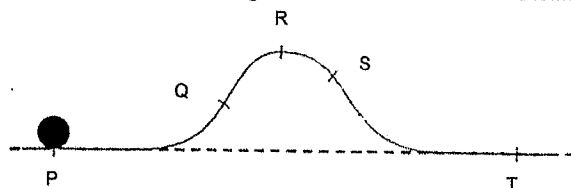
- 13 A mass M is hung from a spring. It is then pulled down slightly and allowed to vibrate vertically between P and Q .



Which row is correct?

	energy store at point P	energy store at point Q
A	kinetic store	kinetic store
B	kinetic store	potential store
C	potential store	kinetic store
D	potential store	potential store

- 14 A ball is given an initial push at P . It rolls along a smooth track from P to T as shown in the diagram.



Which statement(s) is/are correct?

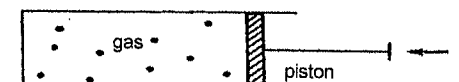
- I The energy in the kinetic store of the ball at S is zero.
- II The velocities of the ball at P and T are the same.
- III The total energies of the ball at Q and S are the same.

- A II only
- B III only
- C II and III only
- D I, II and III

- 15 Which row explains why a liquid has a fixed volume but does not have a fixed shape?

	force between particles in the liquid	movement of particles in the liquid
A	large	move throughout the liquid
B	large	vibrate at fixed positions
C	small	move throughout the liquid
D	small	vibrate at fixed positions

- 16 A fixed mass of gas is trapped inside a cylinder by an air-tight and frictionless piston under the action of a constant force F as shown in the diagram.



If the temperature of the gas is gradually lowered, which statement(s) is/are true?

- I The pressure of the gas decreases.
- II The volume of the gas decreases.
- III The average speed of the particles in the gas decreases.

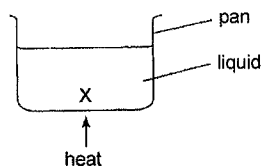
- A I only
- B I and II only
- C I and III only
- D II and III only

- 17 A substance consists of particles that are close together and moving past each other at random. The average speed of the particles is gradually increasing.

What best describe the substance?

- A a liquid being heated
- B a liquid boiling
- C a solid being heated
- D a solid being melted

- 18 Some liquid in a pan is heated.



What happens to the mass, volume and density of the liquid in the region X?

	mass	volume	density
A	decreases	stays the same	increases
B	increases	decreases	stays the same
C	stays the same	decreases	decreases
D	stays the same	increases	decreases

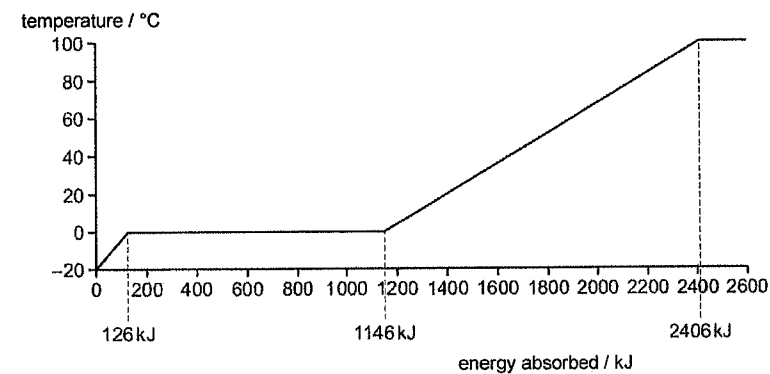
- 19 A block of iron of mass M is heated and gains 10 kJ of energy in its internal store. The temperature of the block rises by θ °C.

A second block of iron of mass $2M$ is heated and gains 5.0 kJ of energy in its internal store.

What is the temperature rise of the second block?

- A $\frac{\theta}{4}$ °C
 B $\frac{\theta}{2}$ °C
 C 2θ °C
 D 4θ °C

- 20 A block of ice at -20 °C is heated until it turns to steam. The graph of temperature against energy absorbed is shown in the diagram.



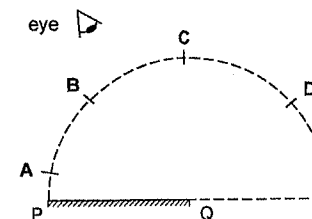
The latent heat of fusion of ice is 340 kJ/kg.

What is the mass of ice?

- A 1.0 kg
 B 2.0 kg
 C 3.0 kg
 D 4.0 kg

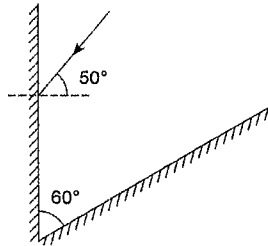
- 21 Four small objects A, B, C and D are placed along a semi-circle as shown.

Which object's image **cannot** be seen by the eye in the mirror PQ?



11

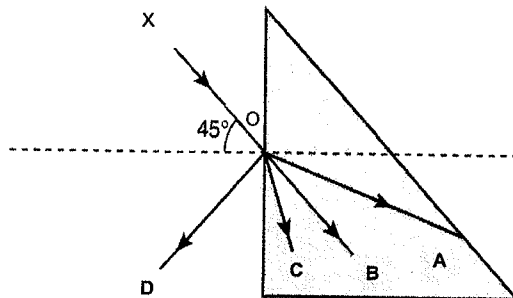
- 22 The diagram, not drawn to scale, shows two mirrors placed at an angle of 60° to each other. A ray of light is incident at an angle of 50° to one of the mirrors.



After reflection, the ray is incident onto the second mirror.

What is the angle of incidence at the second mirror?

- A 10°
 B 40°
 C 50°
 D 80°
- 23 The diagram shows a light ray, XO, travelling from air towards a triangular glass block. The angle of incidence is 45° .



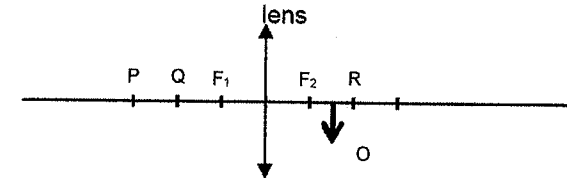
The critical angle of light in glass is 42° .

In which direction does the light travel from point O?

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12

- 24 The diagram shows a converging lens with principal foci at F_1 and F_2 . An object is placed at O.

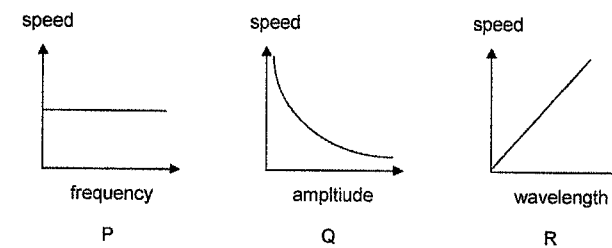


The distance between each point, P, Q, R, F_1 and F_2 is one focal length.

Where is the image located?

- A between the lens and F_1
 B between lens and F_2
 C between F_2 and R
 D between P and F_1

- 25 Which graph(s) about electromagnetic waves travelling in vacuum is/are correct?



- A P only
 B Q only
 C R only
 D Q and R only

26 Which application of ultraviolet ray is incorrect?

- A They are used for sterilisation of surgical instruments.
- B They are used for checking on the health of foetus.
- C They are used in sunbeds for artificial tanning.
- D They are used in detection of counterfeit notes.

27 What is the final effect on a neutral conducting sphere after it has undergone the following steps?

Step 1: Place a positively charged insulator near the conducting sphere.

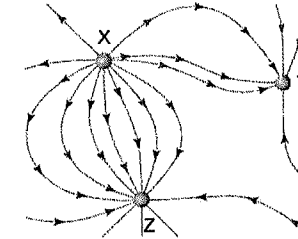
Step 2: Touch the conducting sphere with a wire connected to earth.

Step 3: Remove the positively charged insulator.

Step 4: Remove the wire from the conducting sphere.

- A The conducting sphere remains neutral.
- B One side of the conducting sphere becomes negatively charged and the other side becomes positively charged.
- C The conducting sphere becomes negatively charged.
- D The conducting sphere becomes positively charged.

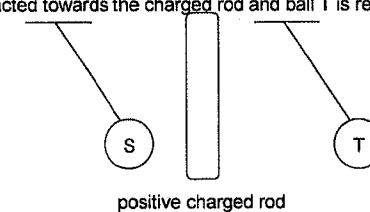
28 The electric field pattern between three charged spheres X, Y and Z is shown.



Which is the correct charge on each sphere?

	X	Y	Z
A	+	+	+
B	+	+	-
C	+	-	-
D	-	-	+

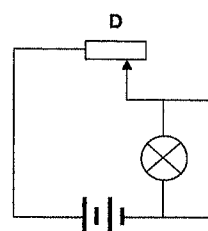
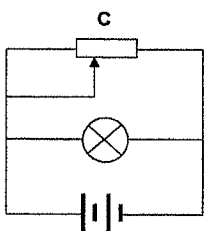
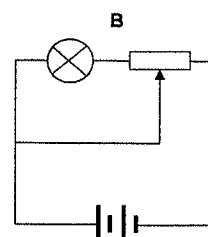
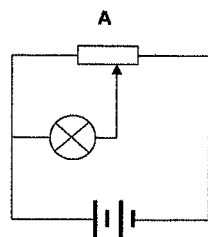
29 Two metal balls, S and T, are suspended using nylon thread. A positive charged rod is placed between the two balls. Ball S is attracted towards the charged rod and ball T is repelled away from the rod.



Which description of the charge on each ball is correct?

	S	T
A	positive	negative
B	negative	negative
C	negative	neutral
D	neutral	positive

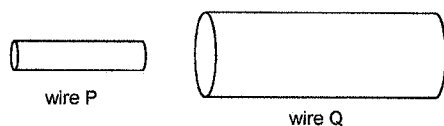
- 30 To adjust the brightness of a light bulb, a student connects a variable resistor to a circuit. Which connection is correct?



- 31 Which unit is equivalent to that of current?

A J/s **B** C/s **C** V/s **D** Ω/V

- 32 The diagram, not drawn to scale, shows two wires, P and Q.



The resistance of wire P is $80\ \Omega$. A second wire Q is made from the same material.

The cross-sectional area of Q is four times that of P. The length of Q is twice the length of P.

What is the resistance of Q?

A $10\ \Omega$ **B** $40\ \Omega$ **C** $80\ \Omega$ **D** $160\ \Omega$

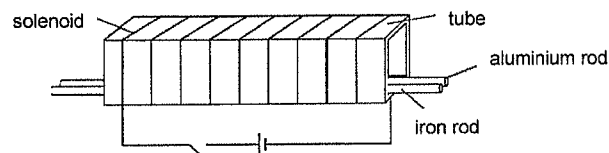
Refer to the information of an electrical appliance for Question 33 and 34.

An appliance is rated 230 V 500W.

- 33 The appliance is connected to a socket in Singapore. The cost of a unit of electricity is \$0.25. What is the cost of using the appliance for 50 minutes every day for a week?
- A** \$104 **B** \$6.25 **C** \$0.73 **D** \$0.10
- 34 The appliance is connected to a socket rated 110 V. What is the current flowing through the wires when it is switched on?
- A** 2.17 A **B** 1.04 A **C** 0.96 A **D** 0.46 A
- 35 Which statement about the wires connected to electrical appliances when they are functioning normally is correct?
- A** The potential difference between the blue and green/yellow wires is 230 V.
- B** The potential difference between the brown and blue wires is 0 V.
- C** The current in the green/yellow wire is 0 A.
- D** The switch is placed in the blue wire.
- 36 Which change will decrease the rate of rotation of the coil in a DC motor?
- A** increase the number of turns of the coil
- B** change the direction of current in the coil
- C** increase the diameter of the split ring
- D** increase the resistance of the variable resistor in the external circuit

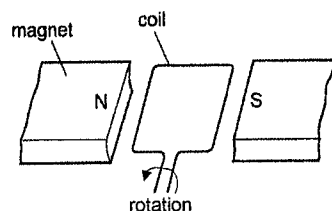
17

- 37 A copper and an aluminium rod are placed in a solenoid as shown. The switch is then closed.



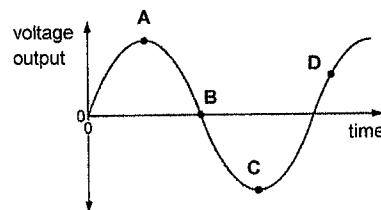
Which statement is correct?

- A There is a repulsion force between the two rods.
 B There is an attraction force between the two rods.
 C A N-Pole is induced on the left end of the iron rod.
 D A S-Pole is induced on the right end of the aluminium rod.
- 38 The diagram shows part of an a.c. generator.



The coil is turning in an anti-clockwise direction.

Which point on the voltage output against time graph shows the coil is in a vertical position?

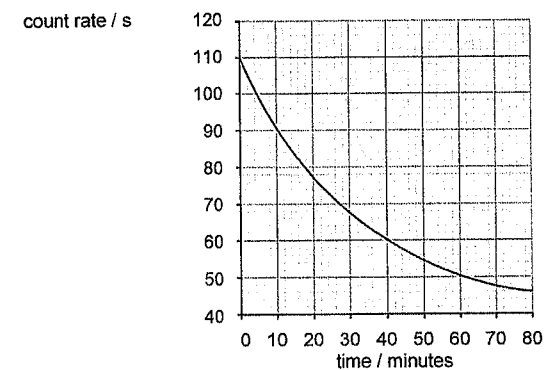


18

- 39 Gamma rays are used to check the thickness of a lead foil in a factory.

Which statement best explains why gamma rays are used?

- A Gamma rays do not carry charges.
 B Gamma rays are will not pass through the lead foil.
 C Gamma rays may pass through the lead foil depending on the thickness.
 D Gamma rays have a short half-life.
- 40 The diagram shows the count rate registered by a GM-counter when it is placed in front of a radioactive sample outdoors.



What is the count rate per second of the radioactive sample after two half-life?

- A 16 B 28 C 62 D 74

End of Paper

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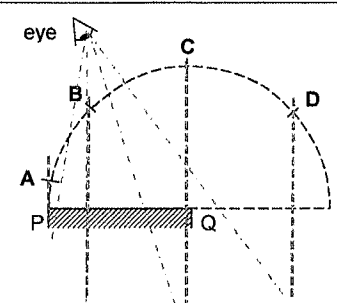
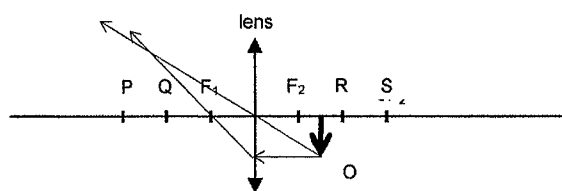
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Answers for Paper 1

1	D	Approximate diameter of an atom = 5×10^{-10} m Approximate diameter of the Earth = 1.2×10^7 m
2	B	Scalar quantity: energy; work Vector quantity: acceleration; displacement; force; weight
3	A	Gradient of the speed-time graph represents the acceleration of the car.
4	D	When two objects move with the same velocity, their magnitude and direction must be the same.
5	A	Since the air resistance is greater than her weight, the resultant force is upwards. Thus, her acceleration is upwards, in the direction of the resultant force.
6	A	Frictional force opposes motion. Since the runner is pushing backward on the ground, the frictional force must be forward.
7	C	$F = ma$ $F_{\text{engine}} - 1000 = 700 \times 2.2$ $F_{\text{engine}} = 2540 \text{ N}$
8	A	When an object is in equilibrium, the resultant moment is zero.
9	B	With more weight at the bottom, the centre of gravity will be lowered.
10	B	Pressure is uniformly transmitted in an enclosed hydraulic system. $80/40 = F/2.0$ $F = 4.0 \text{ N}$
11	C	Gas supply pressure will be equal to the sum of the column of mercury above the mercury surface and atmospheric pressure.
12	A	Work done is the product of the force and the distance moved in the direction of the force. Power = work done / time = $300 \times 3.0 \div 20$ = 45 W
13	D	At point P and Q, the mass M is momentarily stationary. All the energy is transferred to its potential store.
14	C	At S, the ball has energy in both its kinetic store and potential store. By principle of conservation of energy, total energies of the ball is constant. Thus, the total energies of the ball at Q and S are the same. At P and T, the ball has energy in its kinetic store only. Thus, their velocities are the same.
15	A	Force between particles in the liquid is strong. Thus, the repulsive force prevents the particles from collapsing. However, the force between particles are not strong enough to hold them in fixed position, thus, the particles move throughout the liquid.
16	D	As temperature is lowered, the average speed of the particles in the gas decreases. However, since the piston is under the action of a constant force, the volume of the gas decreases while the pressure of the gas remains constant.
17	A	Particles of liquid are closely packed and move past each other throughout the liquid. As the substance is heated, the average speed of the particles increases.
18	D	As the liquid is heated, it expands, its volume increases. Since $\rho = \frac{\text{mass}}{\text{volume}}$, and mass remains constant, its density decreases.
19	A	Since the mass of the second block is doubled, for a given amount of energy gained, the temperature rise will be halved. Furthermore, since the amount of energy gained is halved, the temperature rise will again be halved.
20	C	$Q = mI$ $(1146 - 126) = m \times 340$ $m = 3.0 \text{ kg}$

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21	D	 The line (representing reflected ray to the eye) does not pass through the mirror
22	A	Angle of reflection at first mirror = 50° Angle between incident ray at second mirror with surface of second mirror = 80° Angle of incidence at second mirror = 10°
23	A	Light does not undergo total internal reflection in air. When it enters glass, it bends towards the normal.
24	D	
25	A	Speed in vacuum is constant regardless of frequency, amplitude and wavelength.
26	B	Ultrasound is used to check on the health of foetus.
27	A	When the charged insulator is removed while the sphere is still earthed, the sphere will become neutral.
28	C	Positive charged: electric field lines out of the body Negative charged: electric field lines into the body
29	D	Neutral and negative charged balls will be attracted to the positively charged rod. Positive charged ball will be repelled by the positively charged rod.
30	A	There is no current in the bulb for option B and D because of short circuit. Brightness of bulb in option C remains constant because p.d. across it is constant (parallel circuit).
31	B	Current = charge / time [or Q/t]
32	B	4 times the cross sectional area = $\frac{1}{4}$ x resistance of P 2 times the length = 2 x resistance of P Resistance of Q = $\frac{1}{4} \times 2 \times 80 \Omega = 40 \Omega$
33	C	Cost = $\$0.25 \times 0.50 \text{ kW} \times 50/60 \text{ h} \times 7 \text{ days} = \0.73
34	B	Resistance = $(230 \text{ V})^2 \div 500 \text{ W} = 106 \Omega$ Current = $110 \text{ V} / 106 \Omega = 1.04 \text{ A}$
35	C	Brown wire is live wire at 230 V. We place the switch and fuse here. Blue wire is neutral wire at 0 V. Green/yellow is earth wire at 0 V.
36	D	Current in the coil will decrease and reduce the induced force on the coil. Direction of current will not change the rate of rotation. Only change the direction of rotation. Size of split ring does not affect rotation.

37	C	Use Fleming's Left Hand Rule. Aluminium cannot be magnetised and will not exert any magnetic force.
38	B	No voltage induced because there is no change in magnetic flux linkage with the coil. The motion of the coil is parallel to the direction of the magnetic field.
39	C	To check thickness, the radiation must be able to travel through thin sheet but absorbed by thick sheet.
40	A	Initial count-rate without background count = $110 - 46 = 64$ counts/s count rate after 2 half life without background life = $64 \div 2 \div 2 = 16$ counts/s

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YISHUN TOWN SECONDARY SCHOOL

G3

PRELIMINARY EXAMINATION 2025

SECONDARY 4

G3 PHYSICS

(6091/1)

DATE : 22 Aug 2025

DAY : Friday

DURATION: 1 hr

MARKS: 40 marks

ADDITIONAL MATERIALS

Multiple Choice Answer Sheet (OMS)

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces provided at the top of this page.

There are forty questions. Answer all questions. For each question, there are four possible answers, **A, B, C** and **D**. Choose the one you consider correct and record your choice in soft pencil on the separate answer sheet. Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

INFORMATION FOR CANDIDATES

Any rough working should be done in this booklet.

You may use an approved calculator.

This question paper consists of **16** printed pages.

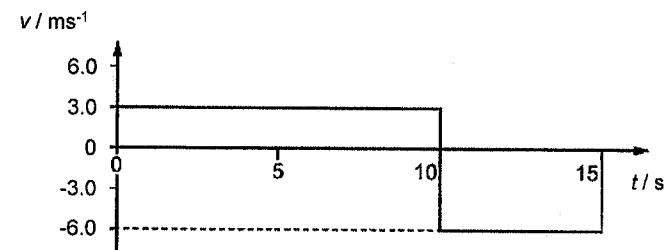
1 Which statement is false about a physical vector quantity?

- A It has both magnitude and direction.
- B It can be represented by an arrow.
- C It must have a unit.
- D It can change direction without changing the vector itself.

2 Energy is measured in joules. Which unit is also equivalent to the joule?

- | | |
|--------------------------------------|--------------------|
| A W / s | B N / m |
| C kg m ² / s ² | D N m ² |

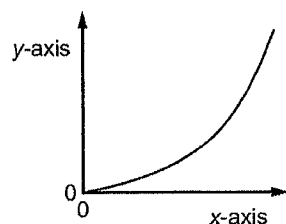
3 A radio-controlled toy car travels along a straight line for a time of 15 s. The velocity-time graph is shown below.



What is the average velocity of the toy car for the journey shown by the graph?

- | | |
|------------|-----------|
| A -1.5 m/s | B 0.0 m/s |
| C 4.0 m/s | D 4.5 m/s |

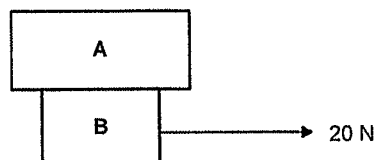
- 4 A taxi stops by the roadside to pick up passengers. After they board the taxi, it starts moving with a constant acceleration. The graph below represents this motion.



Which quantity is plotted on the x-axis and which quantity is plotted on the y-axis?

	x-axis	y-axis
A	distance	time
B	speed	time
C	time	distance
D	time	speed

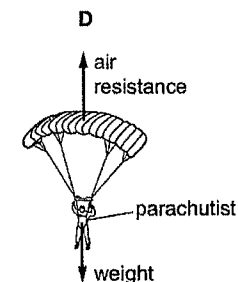
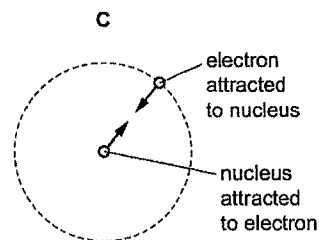
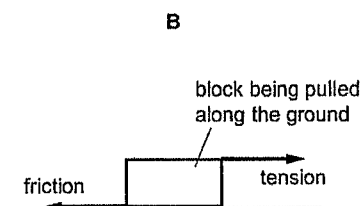
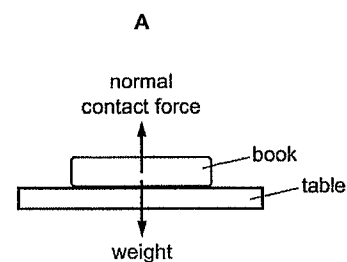
- 5 Two objects are stacked, one on top of the other as shown. A has a mass of 6.0 kg and B has a mass of 4.0 kg.



B is pulled by a force of 20 N and all surfaces are frictionless. What is the acceleration of A?

- A 0 m/s² B 2.0 m/s²
C 3.3 m/s² D 5.0 m/s²

- 6 Each diagram shows two forces that are equal in magnitude. Which diagram shows two forces that demonstrates Newton's third law?

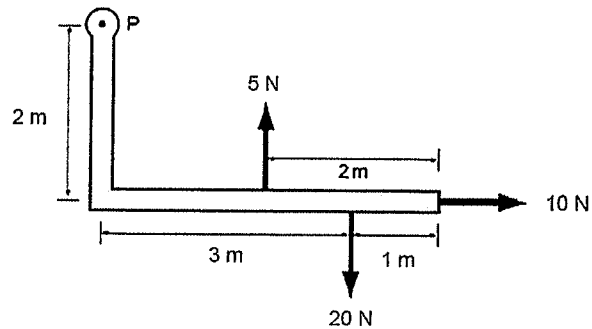


- 7 The mass of a solid block is measured using a beam balance and is found to be 3.0 kg. Its weight is measured using a weighing scale and is found to be 30 N. The solid block is then brought to the moon together with the same beam balance and weighing scale.

Given that the gravitational field strength of the moon is one-sixth that of Earth, which row correctly shows its mass and weight when measured on the moon?

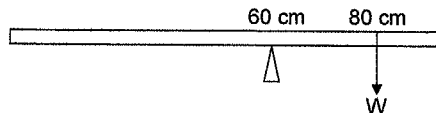
	mass / kg	weight / N
A	0.50	5.0
B	0.50	30
C	3.0	5.0
D	3.0	30

- 8 An L-shaped rigid lever arm is pivoted at point P. Three forces act on the lever arm, as shown in the diagram.



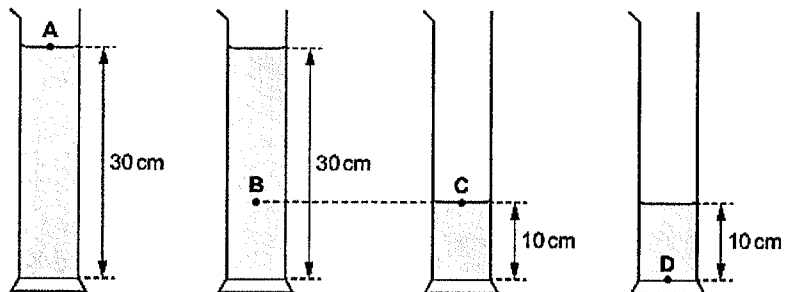
What is the magnitude of the resultant moment of these forces about point P?

- A 30 Nm
B 35 Nm
C 50 Nm
D 90 Nm
- 9 A uniform metre rule of weight 12 N balances at the 60 cm mark, while a weight of W is placed at the 80 cm mark.

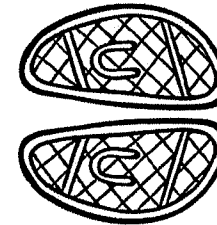


What is the value of W ?

- A 6.0 N
B 12 N
C 24 N
D 36 N
- 10 Four measuring cylinders are filled with the same liquid to the heights shown. At which position is the pressure the greatest?



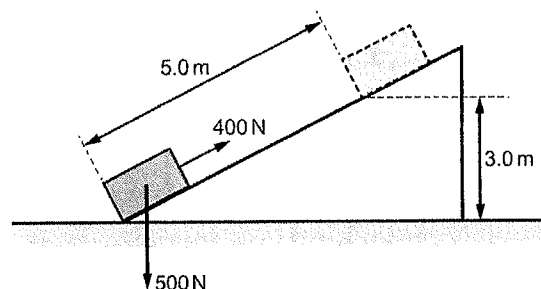
- 11 In the arctic, explorers wear snow shoes such as the ones shown below to travel across the snow.



Which statement best explains why snow shoes have large surface areas when in contact with the snow?

- A To increase the friction between the shoes and the snow.
B To spread the wear and tear over a larger area.
C To reduce the depth in which the person sinks when walking on snow.
D To help melt the snow quickly from the body heat.
- 12 A car is moving initially at a constant speed on level ground. The driver steps on the brake pedal and the car eventually comes to a stop, with the brakes heating up. Which of the following best shows the correct energy conversions?
- A kinetic store of car $\rightarrow$ work done by friction $\rightarrow$ internal store of brakes
B kinetic store of car $\rightarrow$ work done by friction + internal store of brakes
C kinetic store of car $\rightarrow$ work done by friction $\rightarrow$ thermal store of brakes
D kinetic store of car $\rightarrow$ work done by friction + thermal store of brakes
- 13 The input power to a light bulb used in a lighting system is 6.0 W. The bulb emits 2.7 J of heat in 3.0 s. What is the efficiency of this bulb?
- A 15%
B 45%
C 55%
D 85%

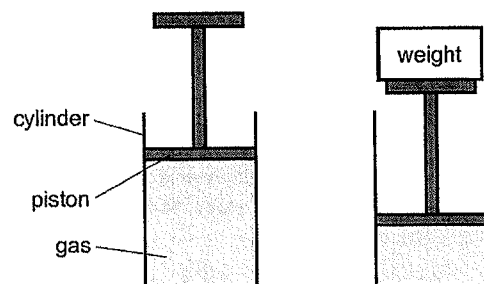
- 14 Work is done when a force of 400 N pulls a crate of weight 500 N at a constant speed along a ramp as shown.



Part of the work done increases the gravitational potential store E of the crate and the rest is work done W against friction. What are the values of E and W ?

	E / J	W / J
A	1500	500
B	1500	2000
C	2000	2500
D	3500	500

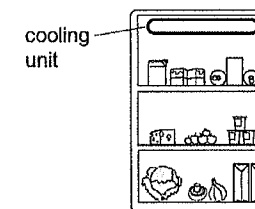
- 15 A piston is supported by gas trapped in a cylinder.



A weight is put on the piston. The volume of gas supporting the piston decreases but the temperature of the gas is unchanged. What happens to the molecules?

- A They hit the piston more frequently.
- B They move more slowly.
- C They have a smaller size.
- D They have more kinetic energy.

- 16 The diagram shows the inside of a refrigerator.



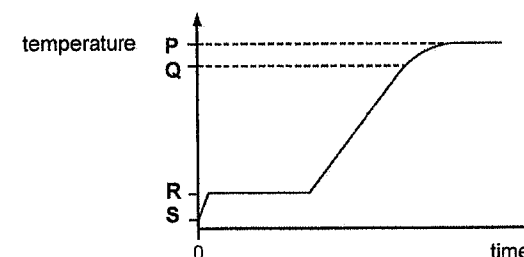
When the refrigerator is first switched on, what happens to the air near the cooling unit?

	particles of this air	density of this air
A	become smaller	decreases
B	become smaller	increases
C	move closer together	decreases
D	move closer together	increases

- 17 Tom stands barefooted with one foot on a stone floor and the other on a carpet. He observes that the foot on the stone floor feels cooler than the one on the carpet. Which statement explains this observation?

- A Air is unable to circulate through the carpet fibres.
- B More heat flows from the carpet to his foot.
- C More heat flows from his foot to the stone floor.
- D The stone floor is at a lower temperature than the carpet.

- 18 A solid substance X, is placed in a metal container. The container is heated at a constant rate and readings of temperature and time are taken. The results are recorded in the graph below.



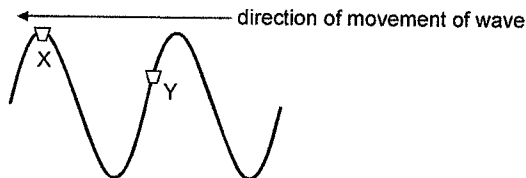
At which temperatures would evaporation be able to take place?

- A Q only
- B S only
- C R & Q only
- D P, Q and R only

- 19 Less heat is needed to raise the temperature of 1.0 kg of copper by 1.0 K than is needed to raise the temperature of 1.0 kg of water by 1.0 K. Which statement explains this?

A Copper has a higher melting point.
 B Copper has a lower specific heat capacity.
 C Copper has a smaller specific latent heat.
 D Copper is a better conductor of heat.

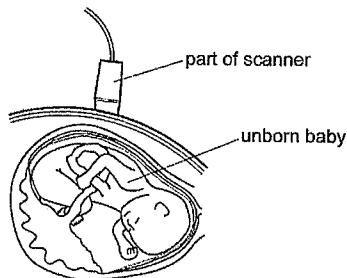
- 20 The diagram shows two corks, X and Y, floating on water.



What will happen to both corks as the wave passes in the next moment?

A X will move downwards, Y will move upwards.
 B X will move upwards, Y will move downwards.
 C Both X and Y will move upwards.
 D Both X and Y will move downwards.

- 21 The diagram shows an ultrasound scanner used to produce an image of an unborn baby.



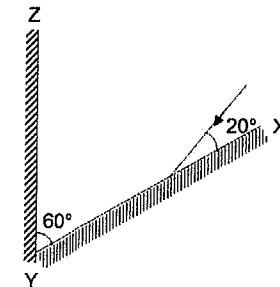
How does the scanner form an image?

A from ultrasound absorbed by the baby
 B from ultrasound emitted by the baby
 C from ultrasound reflected by the baby
 D from ultrasound refracted by the baby

- 22 Electromagnetic waves are produced by various devices when in operation. Which device produces electromagnetic waves of the lowest frequency?

A sunbed
 B mobile phone
 C television remote
 D toaster

- 23 A ray of light is incident at an angle of 20° to a mirror XY. Another mirror YZ is arranged at an angle of 60° to XY as shown in the diagram below.

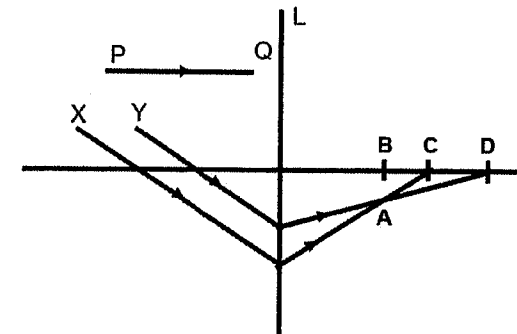


After reflection from XY, the ray is incident on YZ.

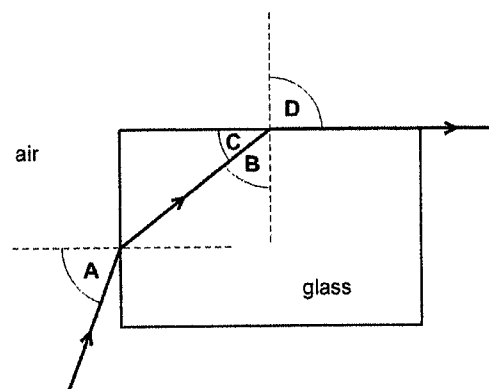
What is the angle of incidence of the ray at the mirror YZ?

A 0° B 10° C 20° D 60°

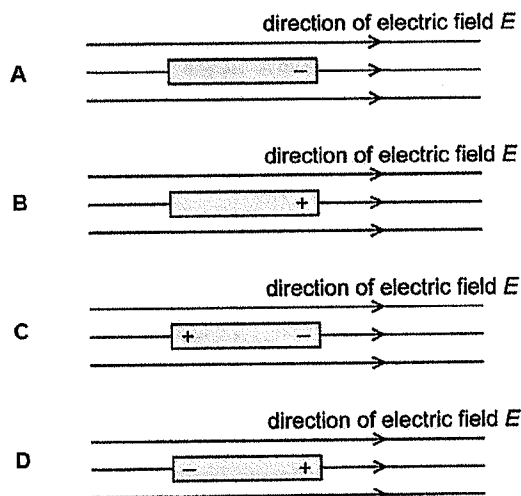
- 24 The diagram shows two incoming parallel rays of light X and Y, which pass through a converging lens, L. Which point will ray PQ pass through after passing through the lens?



- 25 Light travels through a glass block as shown. Which angle is the critical angle for the light in the glass?



- 26 An initially uncharged copper rod is placed in a uniform electric field E . The rod is parallel to the field. Which diagram shows the charges induced on the rod?



- 27 A polythene rod becomes charged when rubbed with a dry woolen cloth. What causes the polythene rod to be charged?

- A Friction producing a movement of electrons.
- B Friction producing a movement of protons.
- C Magnetism producing a movement of electrons.
- D Magnetism producing a movement of protons.

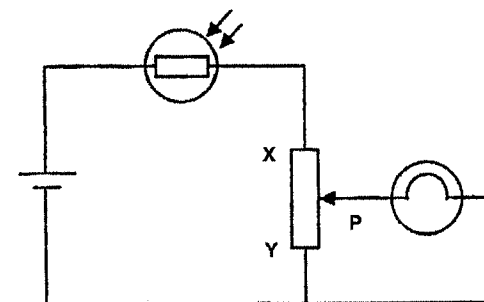
- 28 An electrical cell uses 1.0 kJ of energy to send 3.0 A of current around a circuit for 2.0 minutes. What is the e.m.f. of the cell?

- A 2.8 V
- B 6.0 V
- C 25 V
- D 360 V

- 29 Which changes to a wire will double its resistance?

	cross-sectional area	length
A	double	double
B	double	no change
C	half	no change
D	no change	half

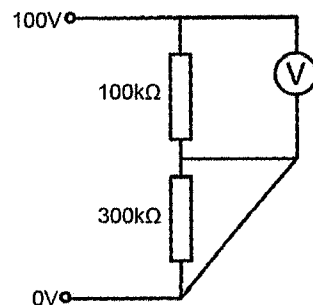
- 30 A circuit is set up as shown in the diagram below.



Which steps taken would allow the lamp to be at its brightest?

- A Cover the LDR and P is moved to Y.
- B Cover the LDR and P is moved to X.
- C Light falls on the LDR and P is moved to Y.
- D Light falls on the LDR and P is moved to X.

- 31 A circuit is shown below.



What is the reading on the voltmeter?

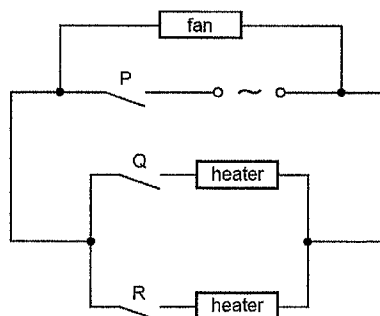
- A 25 V B 33 V C 50 V D 100 V

- 32 The current in a filament lamp is 0.25 A when working normally. The lamp is connected to a plug and the mains a.c. supply.

When the lamp is switched on, it does not light. What is a possible cause for this?

- A The earth wire in the plug is not connected.
B The fuse in the plug is 1 A.
C The lamp only works on a d.c. power supply.
D The live wire in the plug is disconnected.

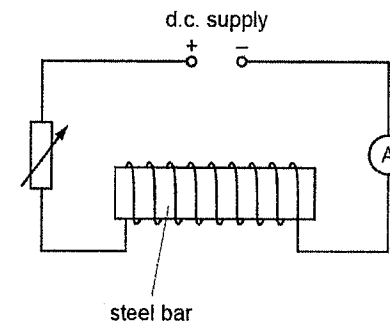
- 33 The diagram shows the circuit for a hair dryer.



The fan has a power rating of 0.10 kW and the heaters each have a rating of 0.40 kW. The cost of electricity is 8 cents / kWh. What is the cost of running the hair dryer for 2 hours with switches P and Q closed only?

- A 1.6 cents B 3.2 cents C 6.4 cents D 8.0 cents

- 34 The diagram shows how a steel bar can be magnetised.



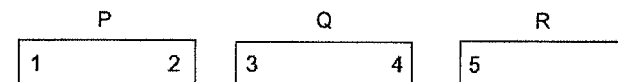
Which statement describes how the steel bar can be demagnetised?

- A Reverse the d.c. supply and gradually decrease the current in the circuit.
B Reverse the d.c. supply and gradually increase the current in the circuit.
C Use an a.c. supply and gradually decrease the current in the circuit.
D Use an a.c. supply and gradually increase the current in the circuit.

- 35 Three metal bars P, Q, and R are identical in size and shape. They are suspected to be magnets.

Tests are carried out and it is found that there is attraction between poles 1 and 6, between poles 2 and 4, and between poles 2 and 6.

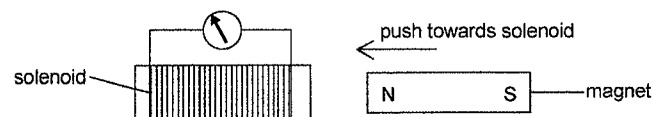
Between poles 2 and 3, there is repulsion.



Without making any further tests, which statement is correct?

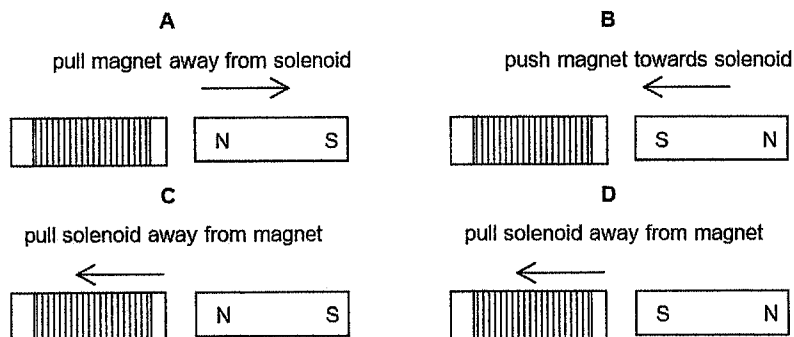
- A P and Q are magnets.
B P and R are magnets.
C Poles 2 and 5 would repel each other.
D All three metal bars are magnets.

- 36 The diagram shows the North pole of a bar magnet being pushed into a solenoid.

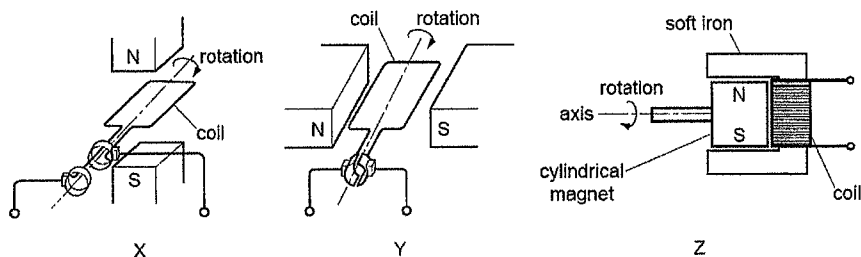


An electromotive force is induced in the solenoid and the galvanometer needle deflects to the left as shown.

Using the same end of the solenoid, which action will cause the galvanometer needle to deflect in the same direction?



- 37 The diagrams show three electrical devices, X, Y and Z.



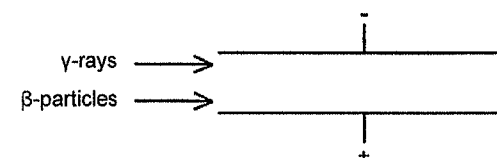
Which devices provide an alternating current (a.c.) output?

- A X only B Y only C X and Y D X and Z

- 38 One nucleus of a uranium isotope contains 92 protons and 146 neutrons. What does the nucleus of another isotope of uranium contain?

	no. of nucleons	no. of neutrons
A	235	143
B	237	147
C	238	144
D	241	146

- 39 Beta and gamma radiation are passed through two charged metal plates as shown in the diagram below.



Which direction, if any, would the β -particles and γ -rays be deflected?

	β -particles	γ -rays
A	into the page	continue straight
B	towards the negative plate	out of the page
C	continue straight	towards the negative plate
D	towards the positive plate	continue straight

- 40 Beta particles are often used in the measurement of the thickness of materials. Which statement explains why beta particles are suitable for this application?

- A They can pass through thin materials but are partially absorbed by thicker ones.
 B They are completely blocked by all materials, making them ideal for precise measurements.
 C They have high penetrating power, so they easily pass through all materials.
 D They can only be detected in a vacuum, which ensures accurate readings.

YTSS 4E PHYSICS PRELIM ANS KEY

Ques	Ans	Ques	Ans	Ques	Ans	Ques	Ans
1	D	11	C	21	C	31	D
2	C	12	A	22	B	32	D
3	B	13	D	23	B	33	D
4	C	14	A	24	B	34	C
5	A	15	A	25	B	35	A
6	C	16	D	26	D	36	D
7	C	17	C	27	A	37	D
8	A	18	D	28	A	38	A
9	A	19	B	29	C	39	D
10	B	20	A	30	D	40	A

		To award for answers based on intermediate working so long physics concept shown is correct / logical -1 max for sf (per question) -1 max for unit (per question)	
1	(a)	4.5 cm [1]	
	(b)	Digital calipers or vernier calipers [1]	Digital micrometer is not accepted.
	(c)	Do not agree with student B. [1] The instrument could be more precise but not necessarily accurate. [1]	Award zero if agree with student B
2	(ai)	Acceleration = $(8.8 - 0) / (3.0 - 2.1)$ [1] $a = 9.8 \text{ m/s}^2$ [1]	Award 1m for any correct value of time or velocity
	(aii)	Initial height = $0.5 \times 10.8 \times 1.1$ [1] $= 5.9 \text{ m}$ [1]	Award 1m if show idea of area of triangle AND at least time or velocity is correct.
	(aiii)	new max height = $0.5 \times 8.8 \times 0.9 = 4.0 \text{ m}$ [1] displacement = $5.9 - 4.0 = 1.9 \text{ m}$ [1]	If new max height is incorrect, max 1m for showing difference in heights.
	(b)	The gradient of the graph is constant, showing that air resistance does not affect the acceleration. Do not just accept acc is constant	[1] Ans MUST have reference to fig.
3	(ai)	It states that, The sum of CW moments about a pivot is equal to the sum of ACW moments <u>about the same pivot</u>	[1]



YUYING SECONDARY SCHOOL
PRELIMINARY EXAMINATION
 Secondary 4 Express

NAME

CLASS

REG. NO

PHYSICS**6091/01**

Paper 1

29 Aug 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet

Setter: Mr Alvin Peh**READ THESE INSTRUCTIONS FIRST**

Write your name, class and register number on this question booklet and the separate Answer Sheet.

Write in dark blue or black pen on both sides of the paper.

You may use a pencil for any diagrams, graphs, tables or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

There are **forty** questions. Answer **all** questions.For each question there are four possible answers **A, B, C** and **D**.Choose the one you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

The use of an approved calculator is expected, where appropriate.

For Examiner's Use

Total

40

Answer all questions in this section.

The total mark for this section is 40.

1. The symbol ' g ' can be used to refer to acceleration due to gravity as well as gravitational field strength. The acceleration due to gravity has the unit m/s^2 .

Which of the following is an alternative unit for ' g ' when it refers to the gravitational field strength?

- A. J / kg
 B. J / kg^2
 C. N / kg
 D. N / kg^2

2. A student studies some equations:

density = mass / volume

work done = force x displacement

acceleration = change of velocity / time taken

How many different vector quantities can be found in these equations?

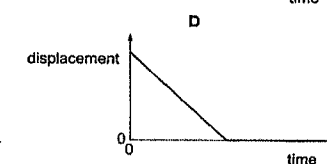
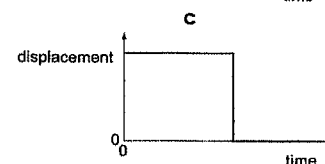
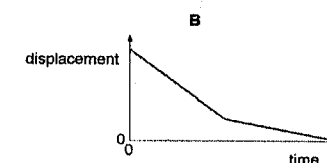
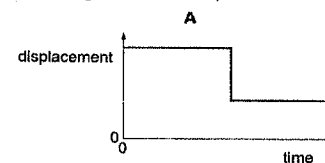
- A. 2 B. 3 C. 4 D. 5

3. A moving bicycle cruising at a speed of 5.0 m/s brakes to stop at a traffic light. Given that it brakes uniformly and stops in 3.0 m , how long does the cyclist take to stop?

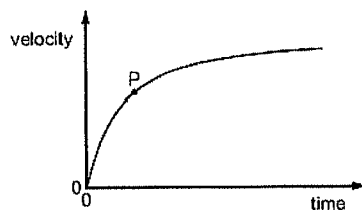
- A. 0.60 s B. 1.2 s C. 1.3 s D. 3.0 s

4. A free-fall parachutist falls at a constant speed. He then opens his parachute and continues to fall to Earth at a lower constant speed.

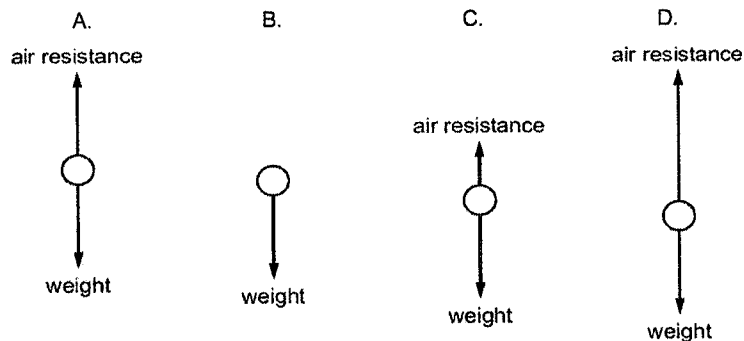
Which diagram below represents the motion described above?



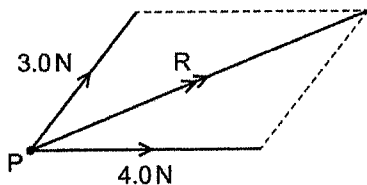
5. A sphere falls from rest through the air. The graph shows the variation of the sphere's velocity with time.



Which diagram shows the forces acting on the sphere when it is at the velocity corresponding to point P on the graph?



6. The diagram shows the resultant R of a 3.0 N force and a 4.0 N force that acts at point P .

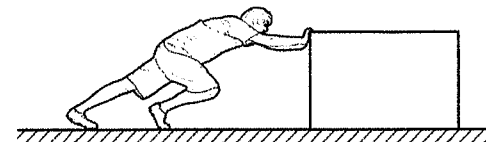


The angle between the 3.0 N force and the 4.0 N force can be any value from 0° to 90° .

Which value of R is not possible?

- A. 4 N B. 5 N C. 6 N D. 7 N

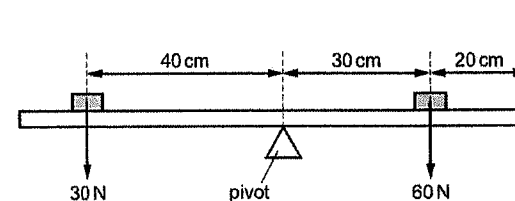
7. A man pushes a heavy box along the ground. A force acts between the man's hands and the box. Another force acts between the man's feet and the floor.



In which directions do these forces act on the man?

	force on man's hands	force on man's feet
A.	towards the left	towards the right
B.	towards the left	towards the left
C.	towards the right	towards the right
D.	towards the right	towards the left

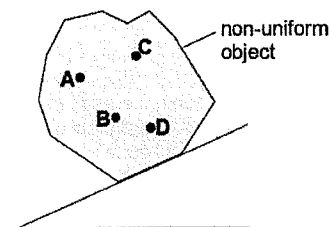
8. A uniform beam is pivoted at its centre. Two weights are placed on the beam in the positions shown and the beam is balanced by an upward force F .



What is the size of force F ?

- A. 6 N B. 12 N C. 30 N D. 60 N

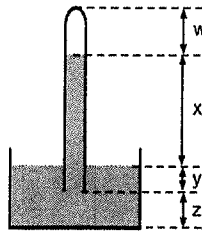
9. A non-uniform object is placed on an inclined plane as shown below. In this position, it is just about to topple.



Which point is likely the centre of gravity?

5

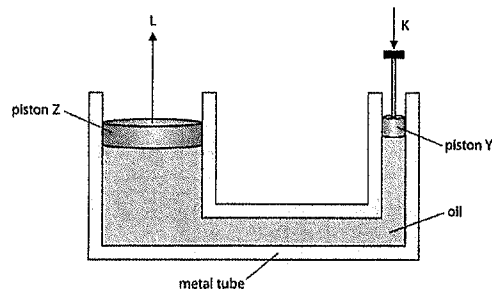
10. An ideal barometer contains water.



If w , x , y and z are measured in metres, the atmospheric pressure in metres of water measured by the barometer is

- A. x
- B. $w + x$
- C. $x + y$
- D. $x + y + z$

11. The diagram below shows a hydraulic system.

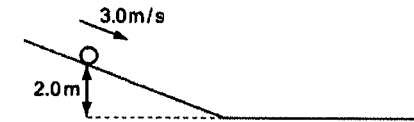


Which statement is correct?

- A. The force exerted on the oil by piston Y is greater than the force exerted by the oil on piston Z.
- B. The pressure exerted on the oil by piston Y is greater than the pressure exerted by the oil on piston Z.
- C. The force exerted on the oil by piston Y is the same as the force exerted by the oil on piston Z.
- D. The pressure exerted on the oil by piston Y is the same as the pressure exerted by the oil on piston Z.

6

12. A ball of mass 0.40 kg rolls down a hill, 2.0 m above the bottom of the hill, at a speed of 3.0 m/s .



The gravitational field strength is 10 N/kg .

What is the kinetic energy of the ball at the bottom of the hill given that the work done to overcome friction is 1.8 J ?

- A. 1.8 J
- B. 8.0 J
- C. 8.6 J
- D. 9.8 J

13. Some solar panels have a total area of 12 m^2 . Each 1.0 m^2 of the panels receives 0.85 kJ of energy from the Sun in 1.0 s . The efficiency of the panels is 16% .

How much power do they produce?

- A. 1.6 kW
- B. 2.2 kW
- C. 64 kW
- D. 160 kW

14. A parachutist has opened his parachute and is falling to Earth at constant speed.

Between which energy store is the overall transfer of energy store taking place as he falls?

- A. kinetic store $\rightarrow$ internal store
- B. kinetic store $\rightarrow$ gravitational potential store
- C. gravitational potential store $\rightarrow$ internal store
- D. gravitational potential store $\rightarrow$ kinetic store

15. What happens to a fixed mass of gas when the gas is cooled at a constant volume?

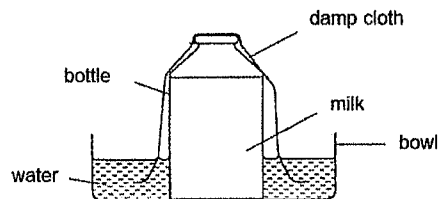
- A. The average volume of particles decreases.
- B. The average mass of particles decreases.
- C. The average speed of particles decreases.
- D. The average separation of particles decreases.

16. A mug of hot coffee is left on a wooden table.

In which way will energy be transferred out from the hot coffee?

- A. conduction only
- B. conduction and convection only
- C. convection and radiation only
- D. conduction, convection and radiation

17. To keep a bottle of milk cold without a refrigerator on a hot day, the bottle can be covered with a damp cloth in a bowl of water.



How does this method keep the milk cold?

- A. Milk condenses on the cloth.
- B. Milk evaporates from the cloth.
- C. Water condenses on the cloth.
- D. Water evaporates from the cloth.

18. Different amounts of energy are transferred to the internal store of the iron blocks of different masses.

Which block experiences the greatest temperature change?

	mass of block/ kg	energy supplied/ J
A.	1.0	120
B.	1.5	150
C.	2.0	180
D.	2.5	210

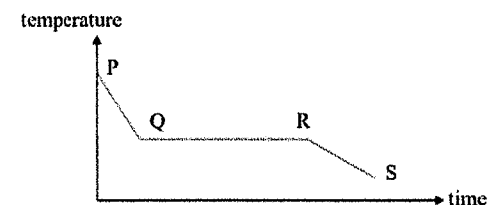
19. Water from two identical containers is mixed. One container contains 2.0 kg of water at 25°C and the other contains 3.0 kg of water at 90°C.

What is the final temperature of the mixture?

(Assume there is no change to the energy in the internal store of the surroundings)

- A. 32 °C
- B. 46 °C
- C. 64 °C
- D. 78 °C

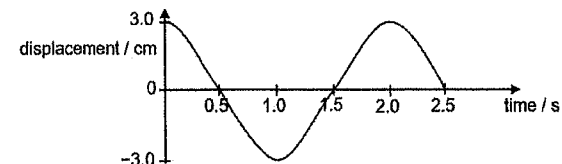
20. The graph shows how the temperature of a sample of molten wax changes as it cools.



Which statement is correct?

- A. From P to Q, the molecules lose internal energy and intermolecular forces of attraction decrease.
- B. From Q to R, latent heat is given out to the surroundings and intermolecular forces of attraction increase.
- C. From Q to R, the molecules come closer together and internal energy increases.
- D. From R to S, latent heat is given out to the surroundings and molecules move more slowly.

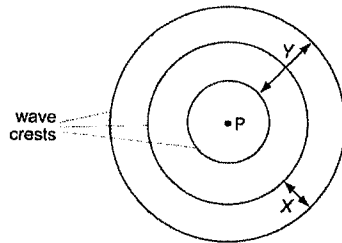
21. The diagram shows a graph of wave motion.



What is the frequency of the wave?

- A. 0.5 Hz
- B. 1.0 Hz
- C. 1.5 Hz
- D. 2.0 Hz

22. A vertical stick is dipped up and down in the water at point P.



In two seconds, three wave crests are produced on the surface of the water.

Which statement is correct?

- A. Distance X is the amplitude of the waves.
- B. Distance Y is the wavelength of the waves.
- C. Each circle represents a wavefront.
- D. The frequency of the waves is 3 Hz.

23. A student stands at point P between two walls as shown and claps once.



The speed of sound is 320 m/s in air.

What is the time interval between the first and second echo heard by the student?

- A. 0.25 s
- B. 0.50 s
- C. 0.75 s
- D. 1.0 s

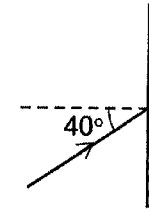
24. A guitar string is made to vibrate. What would cause the pitch of the note to rise?

- A. a decrease in the amplitude of vibration
- B. a decrease in the frequency of vibration
- C. an increase in the amplitude of vibration
- D. an increase in the frequency of vibration

25. Which statement about electromagnetic waves is correct?

- A. Infrared rays are used in sunbeds for artificial sun tanning.
- B. Microwaves are used in satellite communications.
- C. Visible light can damage human proteins and DNA.
- D. X-rays are used to check counterfeit notes.

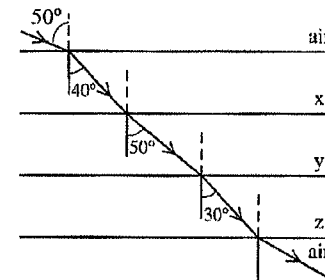
26. The diagram shows a ray of light striking on a plane mirror.



Through which angle does the direction of the ray of light change?

- A. 40°
- B. 80°
- C. 100°
- D. 280°

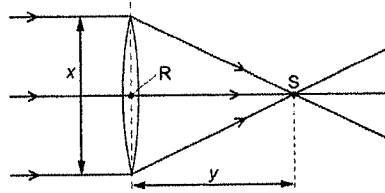
27. The diagram shows a ray of light passing through three different medium X, Y, and Z. The refractive indices of X, Y, and Z are n_x , n_y , and n_z respectively.



Which one of the following is correct?

- A. $n_x < n_y$
- B. $n_y > n_z$
- C. $n_z > n_x$
- D. $n_y > n_x > n_z$

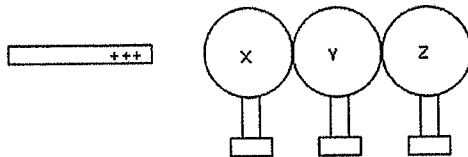
28. The diagram shows three rays of light passing through a converging lens.



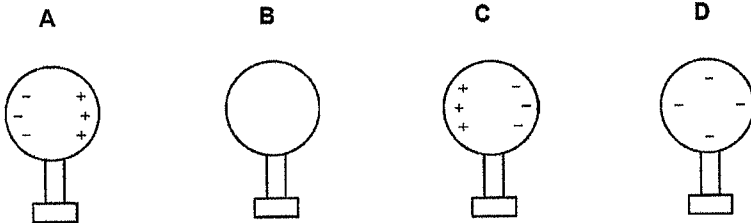
Which labelled point is the principal focus of the lens, and which labelled distance is the focal length of the lens?

	principal focus	focal length
A.	R	x
B.	R	y
C.	S	x
D.	S	y

29. Three initially uncharged conducting spheres X, Y and Z are in contact, each supported on an insulating stand. A positively charged rod is placed close to but not touching X.



Which of the following best illustrates the distribution of charges on sphere Y?

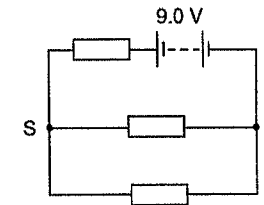


30. A plastic rod is rubbed with a dry cloth, the rod gains electrons from the cloth.

What is the final charge on the rod and on the cloth?

	charge on rod	charge on cloth
A.	negative	negative
B.	negative	positive
C.	positive	negative
D.	positive	positive

31. The diagram shows a battery connected to three identical resistors.



What is the potential difference across ST?

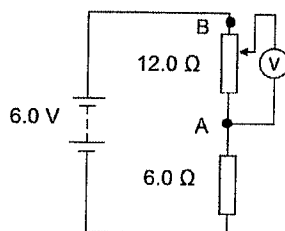
- A. 1.5 V
- B. 3.0 V
- C. 4.5 V
- D. 9.0 V

32. A wire has a resistance of $8.0 \, \Omega$. A second wire, made of the same material, has double the length and half the thickness.

What is the resistance of the second wire?

- A. $8.0 \, \Omega$
- B. $16.0 \, \Omega$
- C. $32.0 \, \Omega$
- D. $64.0 \, \Omega$

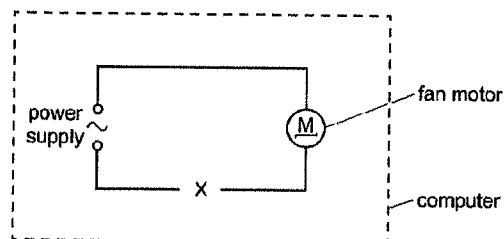
33. The diagram shows a circuit with a potential divider connected in series with a fixed resistor.



What are the minimum and maximum readings that can be obtained on the voltmeter when the contact of the potential divider moved from A to B?

	minimum / V	maximum / V
A.	0	4.0
B.	0	6.0
C.	2.0	4.0
D.	6.0	12.0

34. A computer engineer wants the speed of a fan to increase when the temperature inside a computer increases.



Which component should be placed at X to make this happen?

- A. relay
- B. thermistor
- C. transformer
- D. variable resistor

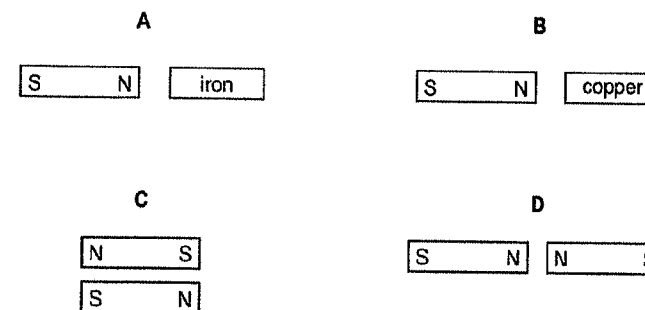
35. The total energy consumption of two identical lamps is 0.10 kWh. Each lamp is marked "10 W, 240 V".

How long have the two lamps been operated at normal brightness?

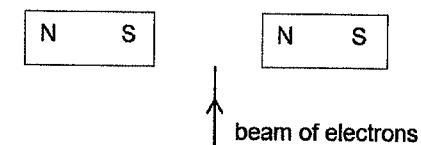
- A. 0.5 h
- B. 2.0 h
- C. 5.0 h
- D. 10 h

36. Bar magnets and various non-magnetic and demagnetised metal bars are placed in the different arrangements shown.

In which arrangement do the bars repel?



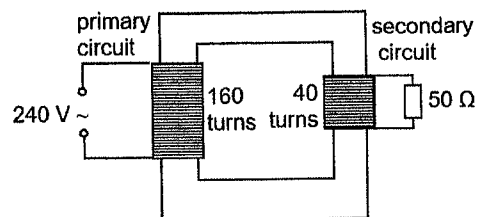
37. The diagram shows a beam of electrons entering a region between two magnets.



In which direction will the beam of electrons be deflected?

- A. to the left of the diagram
- B. to the right of the diagram
- C. into the plane of the diagram
- D. out of the plane of the diagram

38. The diagram shows an ideal transformer connected to a $50\ \Omega$ resistor.



What is the current flowing in the secondary circuit?

- A. 0.30 A
- B. 1.2 A
- C. 1.5 A
- D. 3.3 A

39. The half-life of a certain radioactive element is such that $\frac{7}{8}$ of a given quantity decays in 12 days.

What fraction remains undecayed after 24 days?

- A. $\frac{1}{128}$
- B. $\frac{1}{64}$
- C. $\frac{1}{32}$
- D. $\frac{1}{16}$

40. A nucleus consists of 90 protons and 144 neutrons.
This nucleus emits two beta particles followed by an alpha particle.

Which of the following shows the number of protons and neutron in the new nuclide formed?

- A. 86 protons and 140 neutrons
- B. 86 protons and 142 neutrons
- C. 90 protons and 140 neutrons
- D. 90 protons and 142 neutrons

END OF PAPER

Paper 1

1	2	3	4	5
C	C	B	B	C
6	7	8	9	10
A	A	D	C	A
11	12	13	14	15
D	B	A	C	C
16	17	18	19	20
C	D	A	C	B
21	22	23	24	25
B	C	C	D	B
26	27	28	29	30
C	C	D	B	B
31	32	33	34	35
B	C	A	B	C
36	37	38	39	40
D	C	B	B	C



ZHONGHUA SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2025
SECONDARY 4 EXPRESS

Candidate's Name

Class

Register Number

PHYSICS

Paper 1

6091 /01

26 August 2025

1 hour

Additional Materials: OTAS

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, index number and class on the OTAS in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions.

For each question, there are four possible answers **A**, **B**, **C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate OTAS.

Read the instructions on the OTAS very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

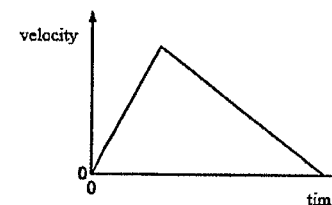
2

- 1 Velocity is given by the change in displacement divided by the change in time.

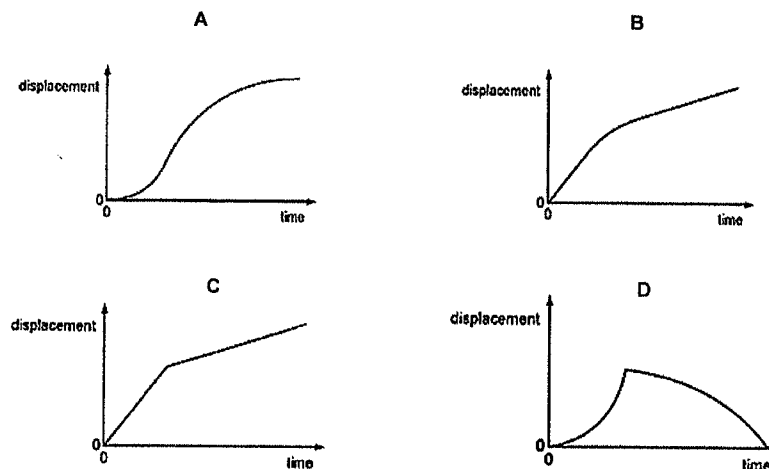
How many vector quantities appear in this statement?

A 0 B 1 C 2 D 3

- 2 The velocity-time graph represents a short journey of an object.



Which displacement-time graph represents the same journey?



- 3 A man drives from Serangoon to Woodlands. The total distance he travels is 19 km. He started driving from Serangoon for 15 min and rested half an hour at a coffee shop. He then continued driving 20 min before he reached Woodlands.

What is the man's average driving speed?

A 0.54 km/h B 18 km/h C 19 km/h D 33 km/h

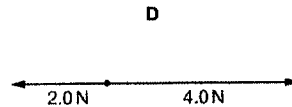
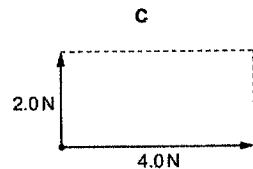
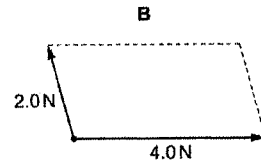
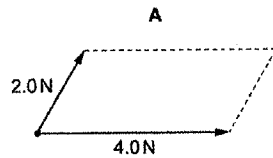
- 4 The table below shows the readings on a car speedometer at every five seconds interval.

time / s	speed / km/h
0	0
5	10
10	22
15	36
20	54

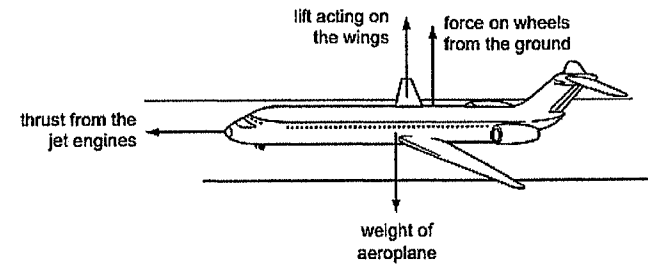
Which of the following describes the acceleration of the car?

- A constant
 B decrease
 C increase
 D zero
- 5 Forces of 4.0 N and 2.0 N act at a point.

Which scale diagram shows the forces that have a resultant of 4.0 N?



- 6 An aeroplane is half way along a runway before it takes off. The arrows show the directions of four forces acting on the aeroplane.

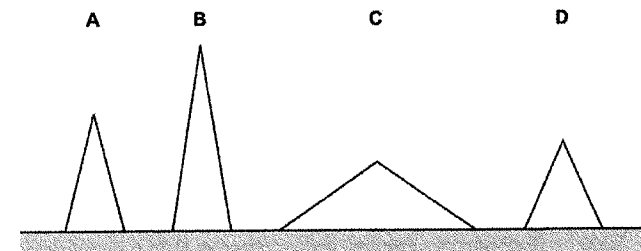


The drag forces on the aeroplane are negligible. The gravitational field strength g is 10 N/kg . The acceleration of the aeroplane is 2.0 m/s^2 .

What is the largest force?

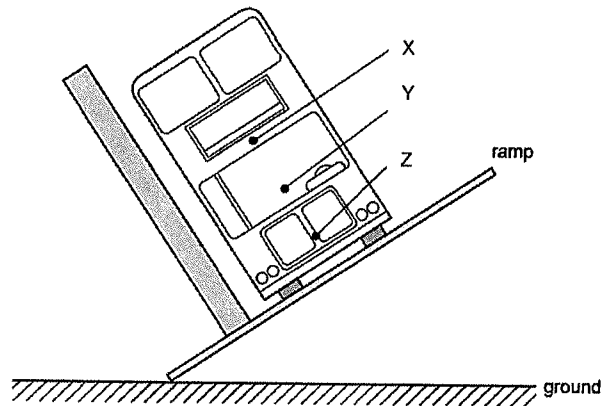
- A the force on wheels from the ground
 B the lift acting on the wings
 C the thrust from the jet engines
 D the weight of the aeroplane
- 7 Four solid uniform cones have equal weight. They are placed on a bench as shown in the scale diagram.

Which cone is the most stable?



5

- 8 The stability of a bus is tested by tilting it on a ramp. The diagram shows a bus that is just about to topple over.



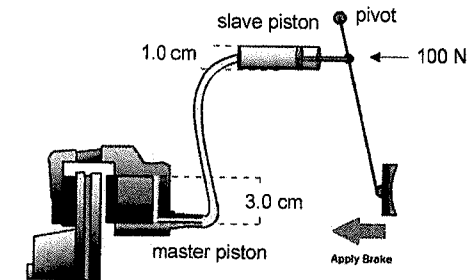
Which statement is correct?

- A Centre of gravity is at position X and anti-clockwise moments is contributed by the weight of the bus, about the pivot.
- B Centre of gravity is at position Y and zero moments is contributed by the weight of the bus, about the pivot.
- C Centre of gravity is at position Z and zero moments is contributed by the weight of the bus, about the pivot.
- D Centre of gravity is at position Z and clockwise moments is contributed by the weight of the bus, about the pivot.

265

6

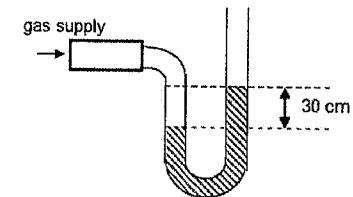
- 9 The diagram shows a simple car brake system. The slave piston and the master piston has a diameter of 1.0 cm and 3.0 cm respectively.



If the force exerted on the slave piston is 100 N, what is the force exerted on the master piston during braking?

- A 200 N B 300 N C 600 N D 900 N

- 10 A mercury manometer that is connected to a gas supply. Atmospheric pressure is assumed to be 0.75 mHg.



What is the pressure of the gas supply?

- A 29 cmHg B 31 cmHg C 45 cmHg D 105 cmHg

- 11 A man lifts five slabs from the ground on to the back of a lorry 1.5 m high. The total time taken is 50 s and each slab weighs 20N.

How much useful power does the builder produce?

- A 0.60 W B 3.0 W C 30 W D 1500 W

[Turn over

- 12 Hydroelectric, biofuel and fossil fuel power stations generate electrical energy.

Which option shows renewable and non-renewable energy sources?

	hydroelectric	biofuel	fossil fuel
A	non-renewable	renewable	renewable
B	non-renewable	non-renewable	renewable
C	renewable	non-renewable	non-renewable
D	renewable	renewable	non-renewable

- 13 Gas in a sealed glass container is cooled.

What happens to the gas molecules?

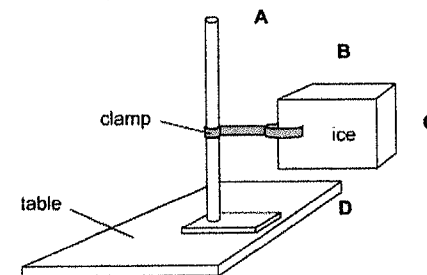
- A They move closer together and their average speed decreases.
 - B They move closer together and their average speed increases.
 - C They move further apart and their average speed decreases.
 - D They stay the same distance apart and their average speed decreases.
- 14 When pollen grains suspended in water are viewed under the microscope, they are seen to be making small, erratic movements.

Which statement explains the movements?

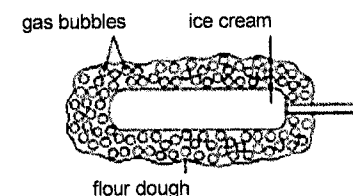
- A There are convection currents in the water.
- B The grains are being hit by air molecules.
- C The grains are being hit by water molecules.
- D The grains are moving and colliding with one another.

- 15 The diagram shows a block of ice placed in a warm room.

At which point is the temperature the lowest?



- 16 The diagram shows a stick of ice cream that is fried in hot oil. Before the ice cream was fried, it was dipped in dough mixed with bicarbonate of soda.



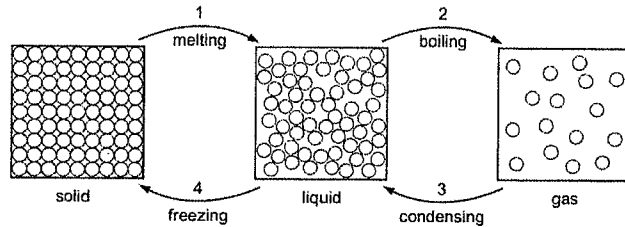
Why does the ice cream remain frozen after it has been fried?

- A The dough contains gas bubbles which allow heat energy that is trapped in the region near the ice cream to escape to the environment via convection currents.
- B The dough contains gas bubbles which is a poor conductor of heat energy from hot oil to cold ice cream.
- C The heat energy from the hot oil is not able to radiate effectively to the cold ice cream.
- D The ice cream which is removed from the freezer has a layer of ice around it and ice is a good insulator of heat energy.

- 17 What is the correct unit for latent heat of vaporisation?

- A J B J/kg C J/kgK D J/kg°C

- 18 Substances can change from one state to another as shown.



For substances to change from one state to another, there is a change in the internal energy between the particles in the system.

Which option correctly shows the changes involving the energy store that is made up of the total kinetic energy and the total potential energy between the particles in the system?

	stage	change in total kinetic energy	change in total potential energy
A	1	increases	increases
B	2	increases	decreases
C	3	no change	decreases
D	4	decreases	increases

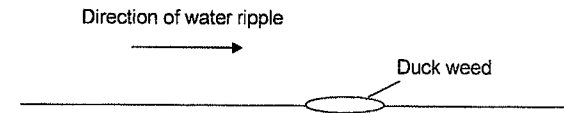
- 19 A heater with a power rating of 1000 W is used to heat water of mass 0.10 kg. The water was initially at 30 °C and started boiling. At the end of time t , the mass of water left is 0.080 kg.

The specific heat capacity of water is 4.2 kJ/(kgK).
The specific latent heat of vaporization of water is 2.2×10^6 J/kg.

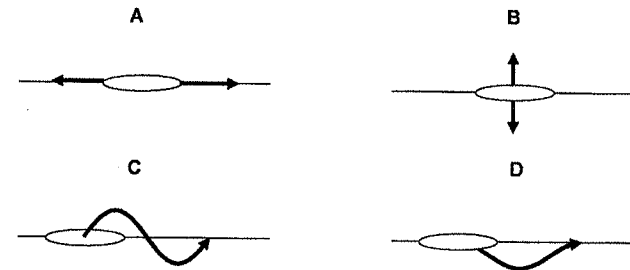
What is t ?

- A 44 s B 73 s C 180 s D 210 s

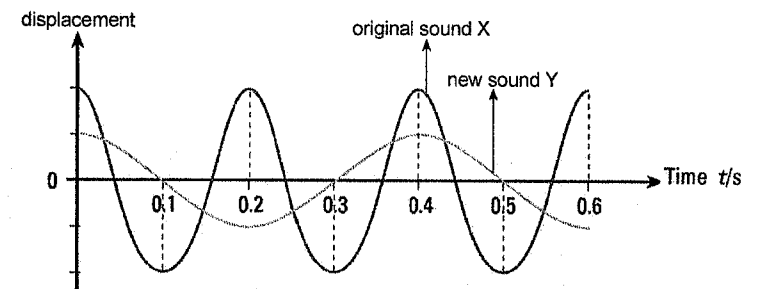
- 20 Diagram shows a duck weed in the way of a water ripple.



Which best describes how the duck weed will move as the water ripple passes through?



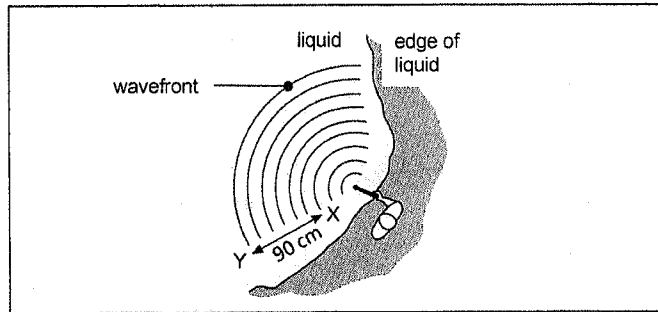
- 21 The displacement-time graph below represents the original, sound X and the new sound, Y, made by a violin.



Which of the following describes the change in loudness and pitch correctly?

	loudness	pitch
A	decreased	decreased
B	decreased	increased
C	increased	decreased
D	increased	increased

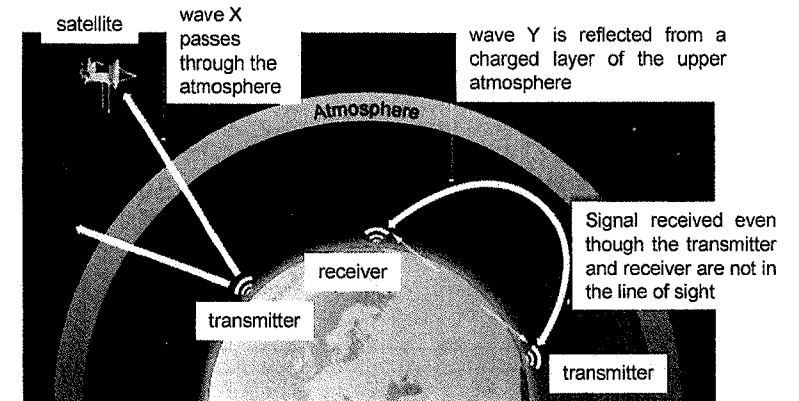
- 22 The robotic arm of a space probe is used to map the depth of the liquid body in Planet W as shown in the diagram below.



What is the wavelength of the wave and how did the frequency and speed change?

	wavelength / cm	frequency	speed
A	13	increased	increased
B	15	unchanged	unchanged
C	15	decreased	decreased
D	90	unchanged	unchanged

- 23 The diagram shows radio waves being transmitted from transmitters and received by either a receiver or a satellite.



What is electromagnetic wave X and Y?

	X	Y
A	gamma ray	radio wave
B	radio wave	gamma ray
C	microwave	radio wave
D	radio wave	infra-red wave

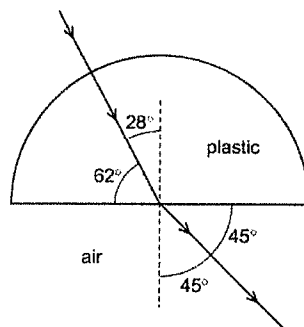
- 24 A student holds a sheet of paper with letters on it facing a plane mirror. The letters on the paper are shown.

TOF

What does the student see in the mirror?

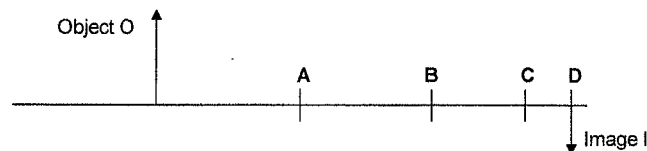
A	B	C	D
FOT	FOF	TOF	TOF

- 25 A semi-circular block is made from a plastic. A ray of light passes through it at the angles shown.

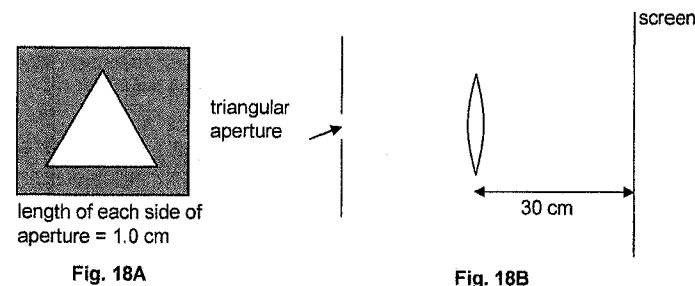


What is the refractive index of the plastic?

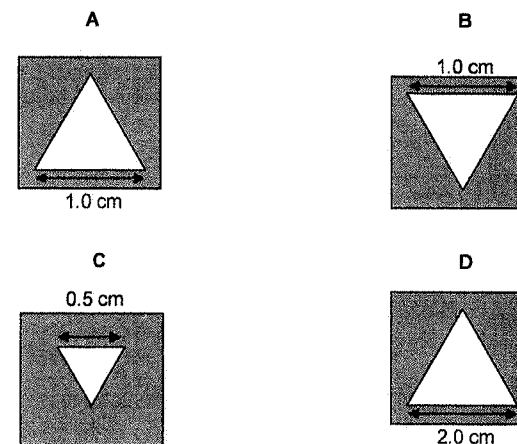
- A 1.3 B 1.4 C 1.5 D 1.6
- 26 Which statement correctly describes total internal reflection?
- A Light travels from optically denser to less dense medium and is total reflected within the denser medium.
- B Light travels from optically denser to less dense medium and is total reflected within the less dense medium.
- C Light travels from optically less dense to denser medium and is total reflected within the denser medium.
- D Light travels from optically less dense to denser medium and is total reflected within the less dense medium.
- 27 Diagram shows the image I formed when object O is placed in front of a thin converging lens. Which is the principal focus of the lens?



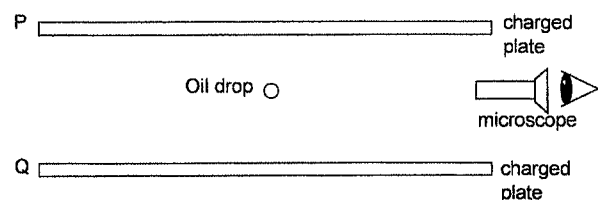
- 28 A triangular aperture of side 1.0 cm (Fig. 18A) is placed in front of a thin converging lens, as shown in Fig. 18B. When light is shone through the aperture, an image is formed on the screen placed 30.0 cm away.



If the focal length of the lens is 15.0 cm, which is the image formed on the screen?



- 29 Diagram shows an experiment performed by physicist Robert Millikan in 1909.

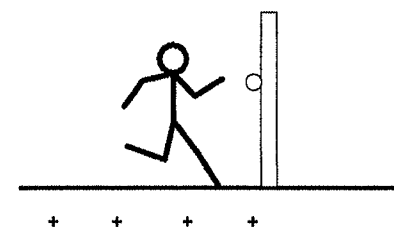


In the experiment, he placed a negatively charged oil drop between a pair of charged parallel plates. He then attempted to stop the oil drop from falling under the influence of gravity by changing the strength of the electric field between the plates.

What are the charges formed on plates P and Q, and the combined electric field pattern between the oil drop and the two plates?

	P	Q	Electric field pattern
A	Positive	Negative	
B	Positive	Negative	
C	Negative	Positive	
D	Positive	Positive	

- 30 A man walks bare-foot in an air-conditioned room and rubs his feet against the carpet. The carpet is then charged positively.



He then touches a wooden door knob. Which correctly describes the charges on the knob and the man?

	charge on man	charge on knob
A	negatively charged	neutral
B	negatively charged	positively charged
C	positively charged	neutral
D	positively charged	negatively charged

- 31 Sets of voltage-current readings are obtained for different electrical components.

Which set of readings is for a $100\ \Omega$ resistor?

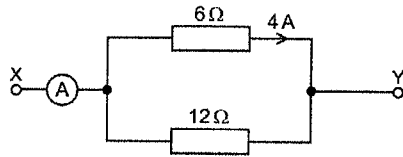
	voltage/ V	-3	-2	-1	0	+1	+2	+3
A	current/ mA	-30	-15	-5	0	+5	+15	+30
	voltage/ V	-3	-2	-1	0	+1	+2	+3
B	current/ mA	-30	-20	-10	0	+10	+20	+30
	voltage/ V	-3	-2	-1	0	+1	+2	+3
C	current/ mA	-60	-40	-20	0	+20	+40	+60
	voltage/ V	-3	-2	-1	0	+1	+2	+3
D	current/ mA	-60	-45	-30	0	+30	+45	+60

- 32 A pair of crocodile clips is inserted into a lemon and connected to a small light-bulb. The lemon carries $2.0\ \text{C}$ of charge and the charge takes $8.5 \times 10^{-3}\ \text{min}$ to travel from one end of the clip to the other.

What is the current produced by the lemon?

- A $0.017\ \text{A}$ B $1.0\ \text{A}$ C $3.9\ \text{A}$ D $240\ \text{A}$

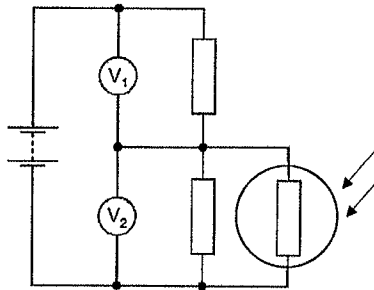
- 33 Two resistors of $6\ \Omega$ and $12\ \Omega$ are arranged in parallel. A potential difference is connected across the terminals X and Y. The current in the $6\ \Omega$ resistor is $4\ \text{A}$.



What is the current in the ammeter?

- A $4\ \text{A}$ B $6\ \text{A}$ C $8\ \text{A}$ D $12\ \text{A}$

- 34 The circuit diagram shows a light dependant resistor (L.D.R.) connected in parallel to the lower half of a potential divider.

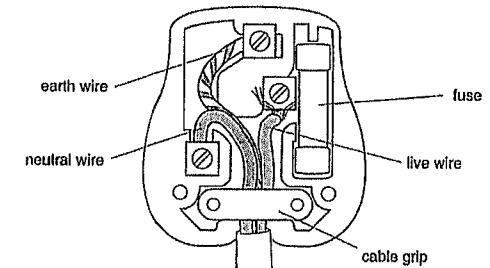


The brightness surrounding the L.D.R. decreases.

What happens to the two voltmeter readings?

	reading on V_1	reading on V_2
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

- 35 The following shows a three-pin plug of a kettle whose live wire has not been connected properly.

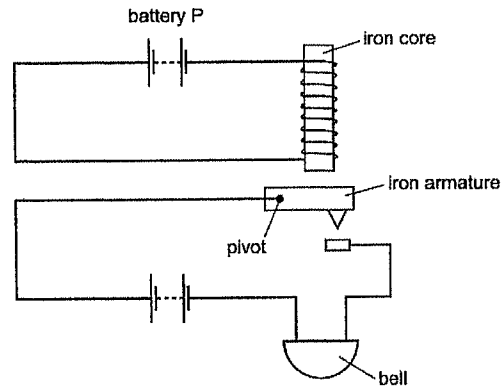


The exposed copper wires of the exposed live wire touch the neutral pin.

Which of the following will occur?

- A The current increases and the fuse will blow to prevent any electrical fire risk.
 B The earth wire will divert the high current to the ground to prevent any electrical risk.
 C The metal casing of the kettle will be at high potential and pose an electrocution risk.
 D The neutral wire will divert the high current to the ground to prevent any electrical risk.

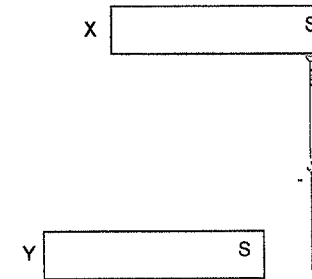
- 36 The diagram shows an alarm system.



What happens when battery P is disconnected?

	iron armature	bell
A	falls	rings
B	moves up	stop ringing
C	moves up	rings
D	stays horizontal	stop ringing

- 37 Two nails are attracted to a magnet X. A second magnet Y is held near the bottom of the nails.

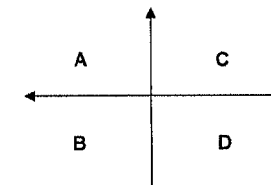


Which statement describes the motion of the nails?

The nails will

- A drop to the ground.
 - B remain stationary.
 - C swing to the left.
 - D swing to the right.
- 38 Equal amount of current is flowing in two insulated wires, perpendicular to each other as shown in the figure below.

Which segment, A, B, C or D, has the strongest magnetic field flowing into the paper?



- 39 Fig. 39.1(a) shows a simple alternating current (a.c.) generator and Fig. 39.1(b) shows the initial voltage produced against time.

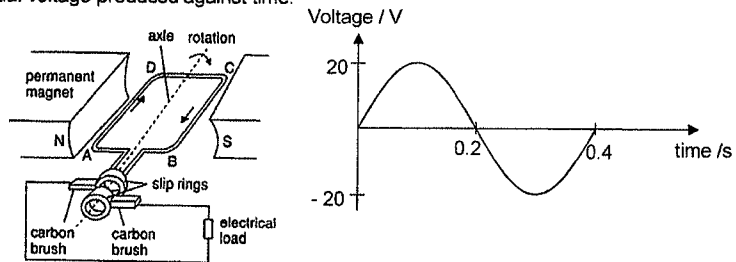


Fig. 39.1(a)

Fig. 39.1(b)

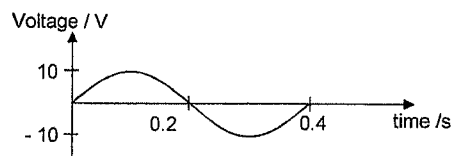


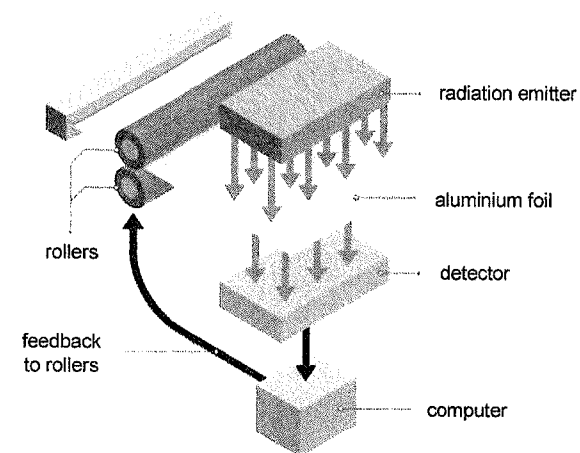
Fig. 39.2

After a certain change was made to the a.c. generator, the voltage against time waveform is as shown in Fig. 39.2.

What is likely to be the change?

- A Reduce the rotating speed.
- B Use a magnet that has a weaker strength.
- C Increase the number of turns of the coil in the generator.
- D Place a soft iron core in the centre of the coil.

- 40 The diagram shows a machine that is used to produce aluminium foil of the correct thickness. Radiation is made to pass through the foil.



If the foil is too thick, it absorbs more radiation and if the foil is too thin, it absorbs less radiation. The detector will send signals to the rollers to either increase or decrease the force on the foil.

Which type of radiation is suitable to use?

- A alpha-particles only
- B beta-particles only
- C gamma-rays only
- D either alpha-particles or beta-particles

Paper 1

1	C	11	B	21	A	31	B
2	A	12	D	22	B	32	C
3	B	13	D	23	C	33	B
4	C	14	C	24	B	34	B
5	A	15	D	25	C	35	A
6	D	16	B	26	A	36	A
7	C	17	A	27	C	37	D
8	B	18	C	28	B	38	C
9	D	19	B	29	A	39	B
10	D	20	B	30	A	40	B

