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**ASSUMPTION ENGLISH SCHOOL
PRELIMINARY EXAMINATION 2024**

**PHYSICS
6091 / 01**



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LEVEL: Sec 4 Express

DATE: 28 August 2024

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

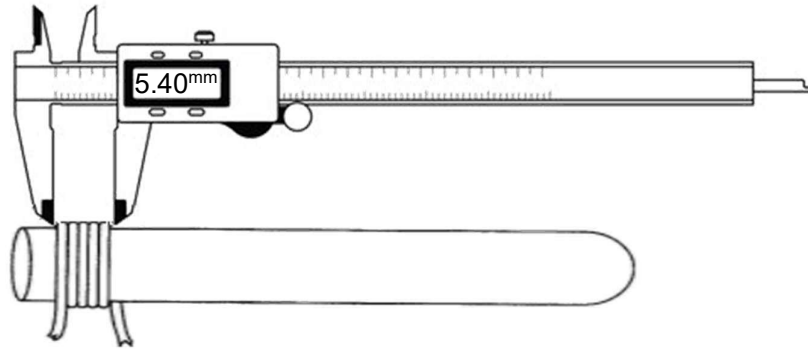
MULTIPLE-CHOICE QUESTIONS (40 marks)

Answer **all** questions on the OAS paper provided.

1 Which is a base quantity?

- | | |
|-----------------|----------------------|
| A area | B charge |
| C energy | D temperature |

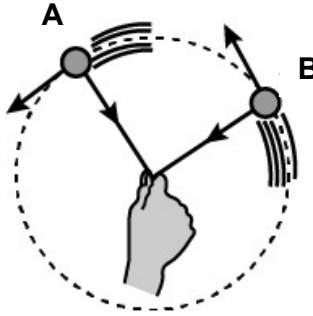
2 A digital caliper is used to measure the length of a few turns of wire.



What is the diameter of the wire?

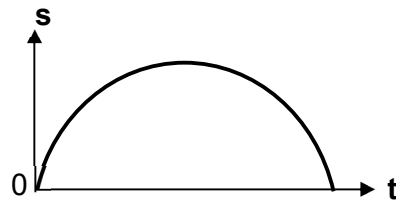
- | | |
|------------------|------------------|
| A 0.54 mm | B 1.08 mm |
| C 2.70 mm | D 5.40 mm |

- 3 The diagram below shows the top view of a light ball swinging at constant speed on a taut string. Two positions of the ball, **A** and **B**, are shown.

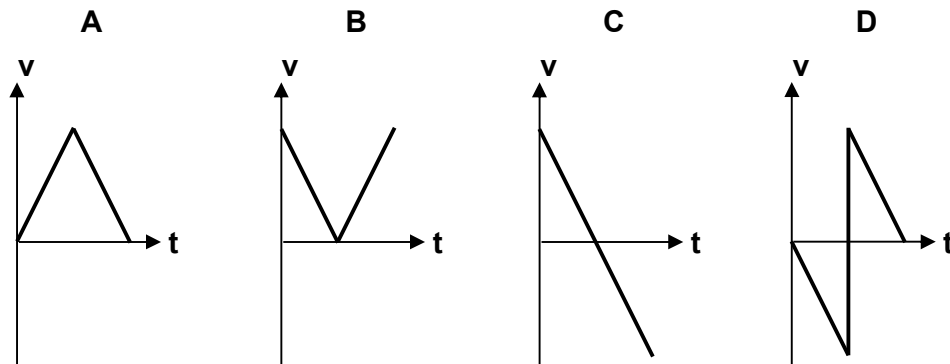


What can be said about the motion of the ball?

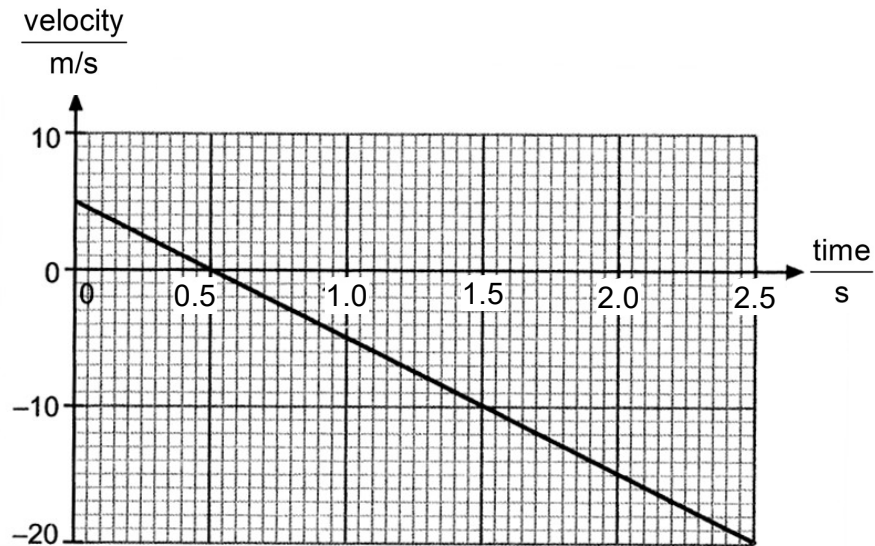
- A** The acceleration of the ball is changing.
 - B** The mass of the ball is not constant.
 - C** The resultant force on the ball is zero.
 - D** The velocity of the ball is constant.
- 4 The diagram shows a graph of displacement **s** against time **t** of an object moving in a straight line.



Which graph of velocity **v** against time **t** correctly represents the motion of the object?



- 5 The graph shows how the velocity of a pebble projected vertically upwards from the top of a building varies with time. The pebble reaches the ground in 2.5 s.



What is the height of the building?

- A** 1.25 m **B** 18.8 m
C 20.0 m **D** 31.3 m
- 6 An astronaut has a mass of 80 kg on Earth. He can jump to a vertical height of 1.5 m on the surface of the Earth.

How high can he reach when he jumps on the Moon using the same force?

	height on the Moon	reason
A	higher than 1.5 m	gravitational field strength of Moon is stronger
B	higher than 1.5 m	gravitational field strength of Moon is weaker
C	lower than 1.5 m	gravitational field strength of Moon is stronger
D	lower than 1.5 m	gravitational field strength of Moon is weaker

- 7 The weights of some masses on the surface of four different planets are recorded below. Which planet has the greatest acceleration due to gravity?

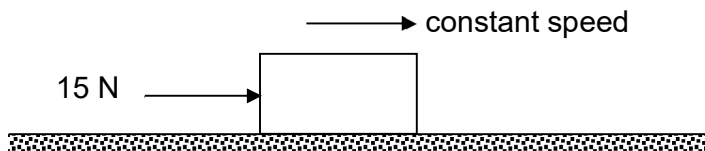
planet	mass / kg	weight / N
A	0.5	10
B	1.0	8.0
C	1.5	18
D	2.0	5.0

- 8 Two forces act at a point at an angle θ .



Which angle θ will produce the largest resultant force?

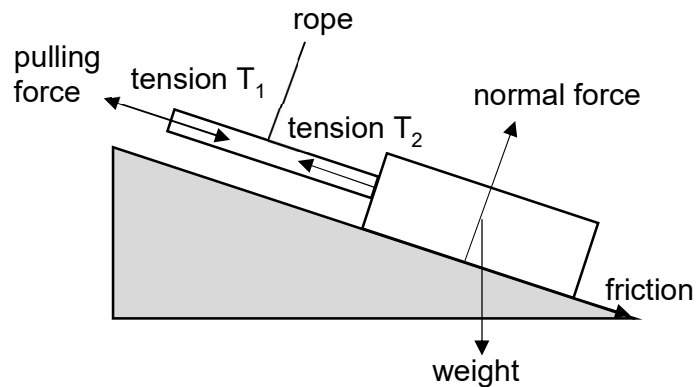
- A** 0°
B between 0° and 90°
C between 90° and 180°
D 180°
- 9 A block of mass is moving along a rough surface at constant speed when a force of 15 N acts on it.



If the 15 N force is removed, how would the motion of the mass change?

- A** accelerate constantly before reaching terminal velocity
B comes to a stop immediately
C continues to move at the same constant speed
D decelerates constantly to a stop

- 10 A rope is attached to a box. A person pulls the box up the slope in the direction shown.

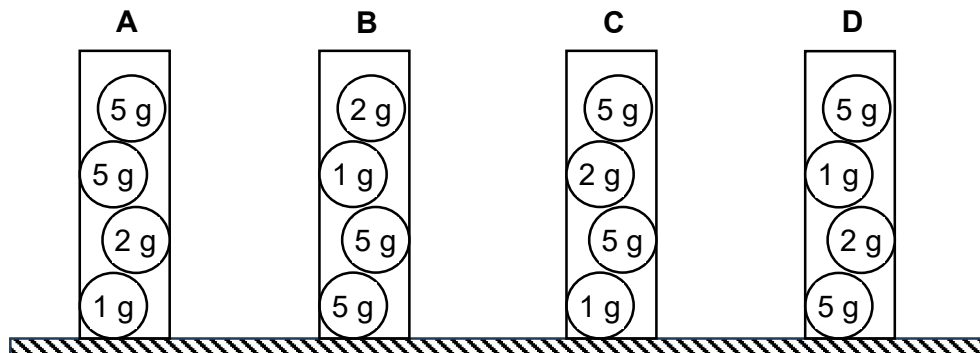


Which pair of forces is an action-reaction pair?

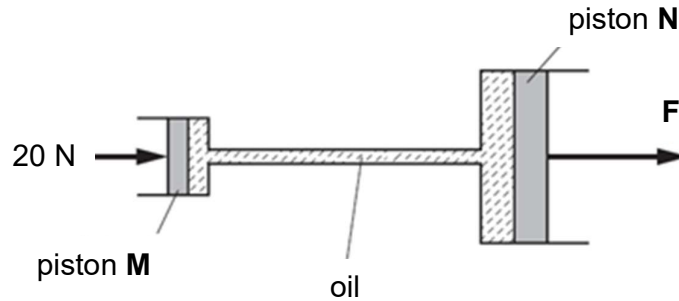
	action	reaction
A	friction on the box	pulling force of the hand on the rope
B	normal force	weight
C	pulling force of the hand on the rope	T_1 on the hand by the rope
D	T_1 on the hand by the rope	T_2 on the box by the rope

- 11 Objects of the same size but different mass are placed in identical containers.

Which set-up is most likely to topple over?

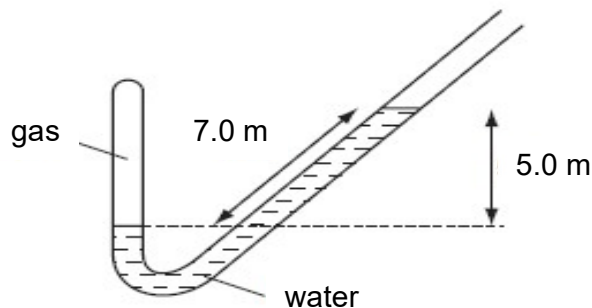


- 12 The diagram shows a model of the braking system of a car. Piston **M** has an area of 5.0 cm^2 and piston **N** has an area of 25 cm^2 . A force of 20 N is applied to piston **M**.



What is the force **F** acting on piston **N**?

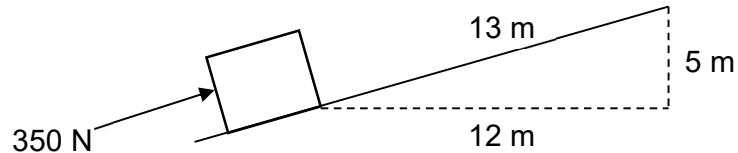
- | | | | |
|----------|-------|----------|-------|
| A | 4.0 N | B | 6.3 N |
| C | 20 N | D | 100 N |
- 13 A pipe is closed at one end and contains some gas, trapped by a column of water. The atmospheric pressure is 100 kPa , the density of water is 1 g/cm^3 and the gravitational field strength is 10 N/kg .



What is the pressure of gas?

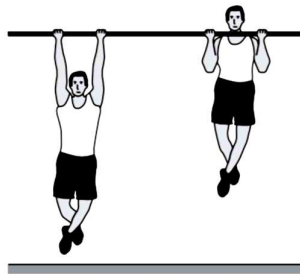
- | | | | |
|----------|----------|----------|---------|
| A | 0.15 kPa | B | 5.1 kPa |
| C | 150 kPa | D | 170 kPa |
- 14 What is work done?
- | | |
|----------|---|
| A | product of force and distance between force and object |
| B | product of force and distance moved by the object in the same direction |
| C | rate of energy transfer per unit time |
| D | rate of change of displacement per unit time |

- 15** A 80 kg box is pushed up along a smooth slope by a force of 350 N. The gravitational field strength is 10 N/kg.



What is the speed of the box at the top of the slope?

- | | | | |
|----------|---------|----------|---------|
| A | 2.2 m/s | B | 3.7 m/s |
| C | 10 m/s | D | 11 m/s |
- 16** The diagram shows a student doing a chin-up exercise. Each time the student does one chin-up, he lifts his body 0.40 m vertically upwards. The weight of the student is 600 N. The student can do 18 chin-ups in 1 minute.



What is the power developed by the student?

- | | | | |
|----------|-------|----------|--------|
| A | 4 W | B | 72 W |
| C | 144 W | D | 4320 W |

- 17 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** $T_Q < T_P = T_R$
- 18 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**.

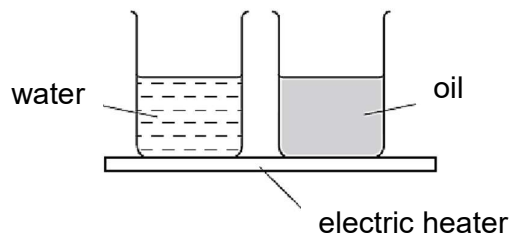
Below are some statements to explain the observation.

1. Container **X** has a lid and container **Y** is not covered.
2. Container **X** is black and container **Y** is white.
3. Container **X** has a larger surface and container **Y** has a smaller surface.

Which statements are possibly correct?

- A** 1 and 2 only **B** 1 and 3 only
C 2 and 3 only **D** 1, 2 and 3
- 19 Why is it more dangerous to expose our skin to 50 g of steam at 100 °C than to 50 g of water at 100 °C?
- 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.

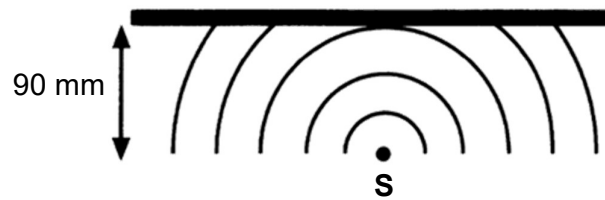
- 20** The diagram shows an electric heater being used to heat a beaker of water and an identical beaker of oil for several minutes.



The temperatures of the water and the oil increase constantly. The rise in temperature of the oil is much greater than that of the water. Why is this so?

- A** The oil has a higher specific heat capacity than water.
 - B** The oil has a lower specific heat capacity than water.
 - C** The water has a higher specific latent heat of fusion than oil.
 - D** The water has a lower specific latent heat of fusion than oil.
- 21** In an experiment, 500 g of ice at $0\text{ }^{\circ}\text{C}$ is added to 1 kg of water at $50\text{ }^{\circ}\text{C}$.
- The specific latent heat of fusion of ice is 334 J/g and the specific heat capacity of water is $4.2\text{ J/g }^{\circ}\text{C}$.
- What is the final temperature of the water?
- A** $6.8\text{ }^{\circ}\text{C}$
 - B** $10.2\text{ }^{\circ}\text{C}$
 - C** $25\text{ }^{\circ}\text{C}$
 - D** $40.0\text{ }^{\circ}\text{C}$
- 22** What is a wavefront?
- A** distance between two successive peaks of a wave
 - B** distance between two successive troughs of a wave
 - C** line that joins all the crests that are in phase
 - D** line that joins all the troughs that are in phase

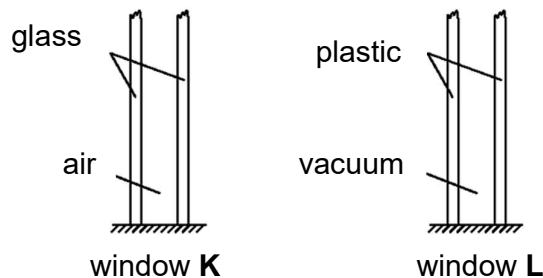
- 23 A vibrating source **S** produces circular water waves near a straight reflector.



If the speed of the waves is 60 mm/s, what is its wavelength and frequency?

	wavelength / mm	frequency / Hz
A	30	1.5
B	30	2.0
C	45	0.5
D	45	2.0

- 24 Windows **K** and **L** are double glazed using different materials.



Which window can be used for soundproofing and why?

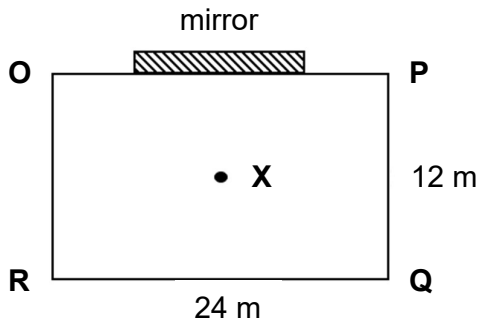
- A** **K**, glass slows down the vibrations and collisions of particles
B **K**, sound travels slower in air
C **L**, plastic is a poor transmitter of sound
D **L**, sound cannot travel in vacuum
- 25 A floating ship sends ultrasonic pulse towards the seabed and the reflected pulse is only received 1.6 s later. If the depth of the sea is 1.22 km, what is the speed of the ultrasonic wave in seawater?

- A** 381 m/s **B** 763 m/s
C 1530 m/s **D** 3×10^8 m/s

26 Which radiation in the electromagnetic spectrum is used in mobile phone communication?

- | | |
|-----------------------------|--------------------------------|
| A infrared radiation | B microwave |
| C radio wave | D ultraviolet radiation |

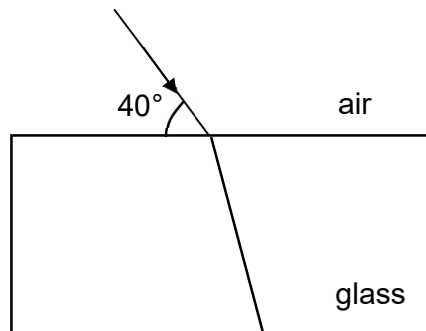
27 A plane mirror is to be installed in the middle of wall **OP** in a rectangular room 24 m by 12 m.



What is the minimum width of the plane mirror on wall **OP** such that a person at **X** can see the entire wall **QR**?

- | | |
|---------------|---------------|
| A 8 m | B 12 m |
| C 16 m | D 24 m |

28 A light ray enters a glass block at an angle of 40° to the surface.



Given that the glass block has a refractive index of 1.5, what is the angle of refraction in the glass?

- | | |
|---------------------|---------------------|
| A 25° | B 31° |
| C 40° | D 75° |

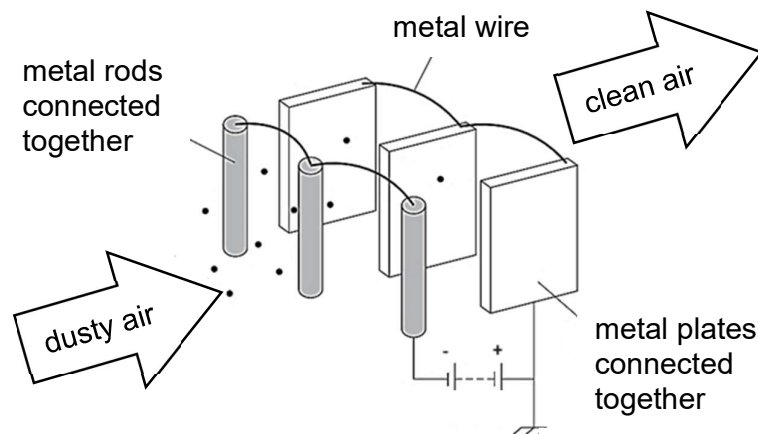
- 29** When an object is placed 40 cm from a thin converging lens, a real image equal in size to the object is formed.

The object is then moved nearer the lens, to 10 cm away from the lens.

What are the new properties of the image formed?

	size of image	position of image
A	diminished	opposite side of lens
B	diminished	same side as object
C	magnified	opposite side of lens
D	magnified	same side as object

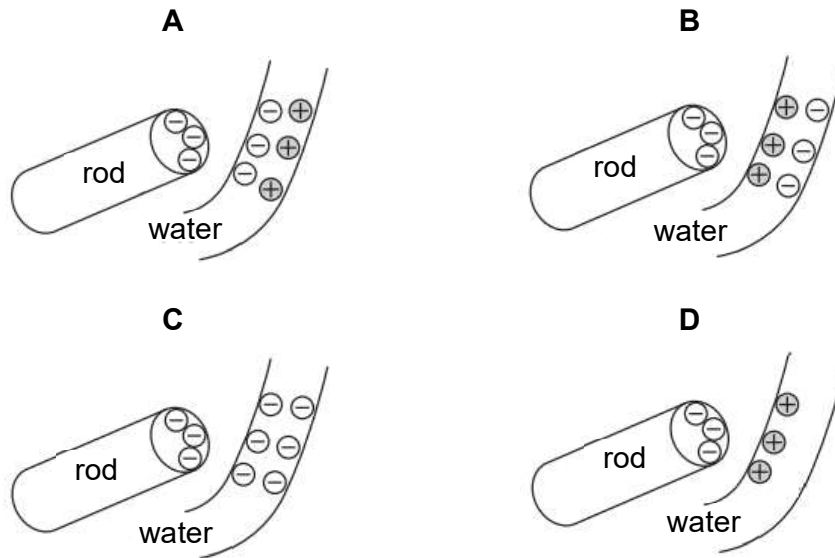
- 30** In an electrostatic precipitator, a fan blows dusty air past several metal rods and metal plates. There is a large potential difference between the metal rods and the metal plates.



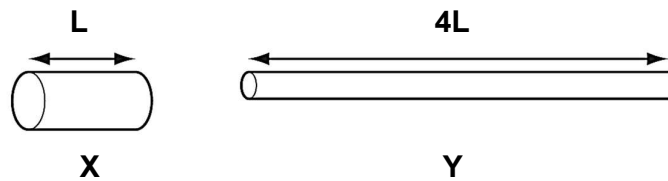
How does dust particles get removed in this precipitator?

- 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

- 31 A negatively charged plastic rod is held near a stream of water coming from a tap. Which picture shows the correct arrangement of charges in the water?



- 32 Two copper wires **X** and **Y** have the same volume. Wire **Y** is four times as long as wire **X**.

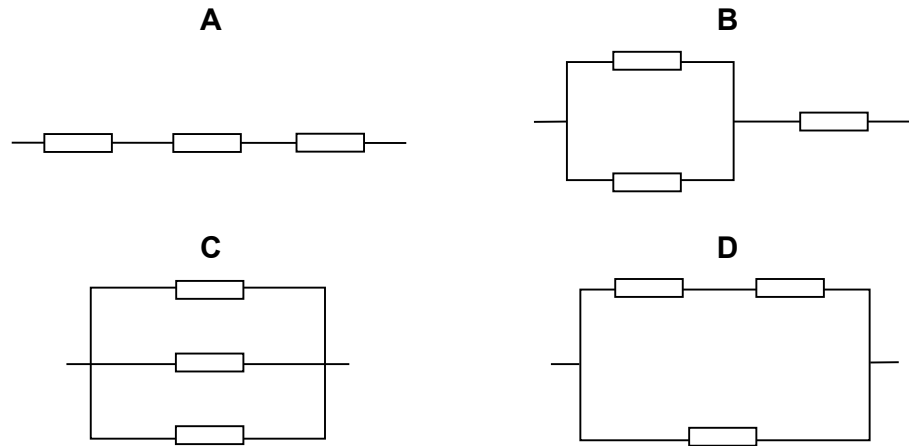


If the resistance of wire **X** is **R**, what is the resistance of wire **Y**?

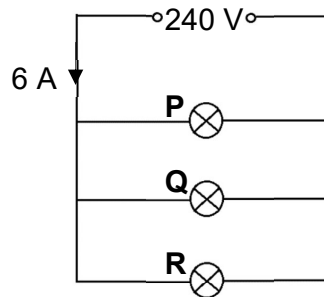
- | | | | |
|----------|------------|----------|------------|
| A | 4R | B | 8R |
| C | 16R | D | 64R |

- 33** The circuits below show different arrangements of three identical resistors between two points. The two points are connected to the same power supply.

Which arrangement will give the smallest effective resistance?



- 34** Three $120\ \Omega$ lamps, **P**, **Q** and **R**, are connected in parallel to a $240\ \text{V}$ source.

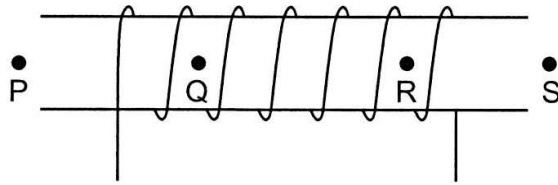


How much does it cost to use lamp **R** for $100\ \text{min}$ if $1\ \text{kWh}$ costs $\$0.33$?

- | | | | |
|----------|----------|----------|-----------|
| A | $\$0.26$ | B | $\$0.79$ |
| C | $\$2.38$ | D | $\$47.52$ |
- 35** Which investigation can determine whether an object is a magnet?

- A** find out if it can deflect electric charges
- B** find out if it can deflect needle of a compass
- C** find out if it is a metal or non-metal
- D** find out if it is an insulator or conductor of electricity

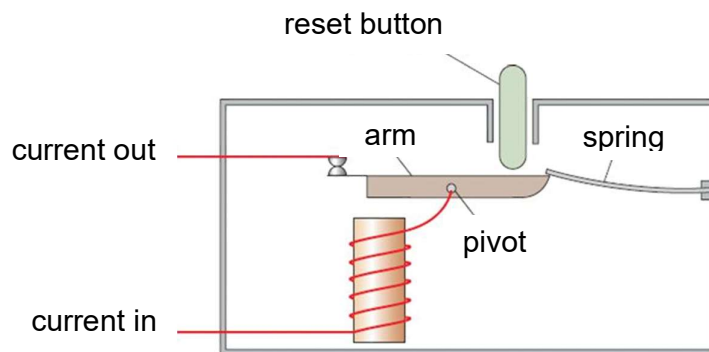
- 36** A steady current is passed through a solenoid. **P**, **Q**, **R** and **S** are four points on the axis of the solenoid. **Q** and **R** are points inside the solenoid.



Which is a possible direction of the magnetic field due to the current?

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

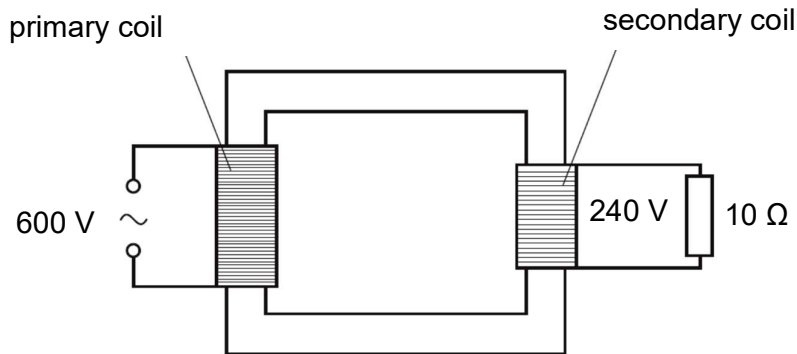
- 37** The circuit diagram shows a circuit breaker.



What material should the arm be made from?

- | | | | |
|----------|---------|----------|-------|
| A | copper | B | iron |
| C | plastic | D | steel |

- 38** An ideal transformer has a primary voltage of 600 V and a secondary voltage of 240 V. The secondary coil is attached to a resistor of resistance $10\ \Omega$.



What is the turn ratio and the current in the primary coil?

	turn ratio	primary current / A
A	0.4	9.6
B	0.4	24
C	2.5	0.25
D	2.5	60

- 39** What is the meaning of spontaneous decay?

- A** each nucleus has the same chance of decaying per unit time
- B** unable to predict the direction of emission
- C** unable to predict when a nucleus is going to decay
- D** unaffected by external factors such as temperature and pressure

- 40** A Geiger-Muller counter is placed in front of a radioactive isotope. The activity recorded is 4100 counts/min. After 8 days, it becomes 1325 counts/min.

It was known that the background count is 400 counts/min. What is the approximate half-life of the isotope?

- A** 2 days
- B** 4 days
- C** 6 days
- D** 8 days

- End of Paper -