



**SINGAPORE CHINESE GIRLS' SCHOOL
PRELIMINARY EXAMINATION 2024
SECONDARY FOUR**

CANDIDATE NAME

CLASS

4		
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REGISTER
NUMBER

CENTRE NUMBER

INDEX NUMBER

PHYSICS

**6091/1
(Revised)**

Tuesday

27 August 2024

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.

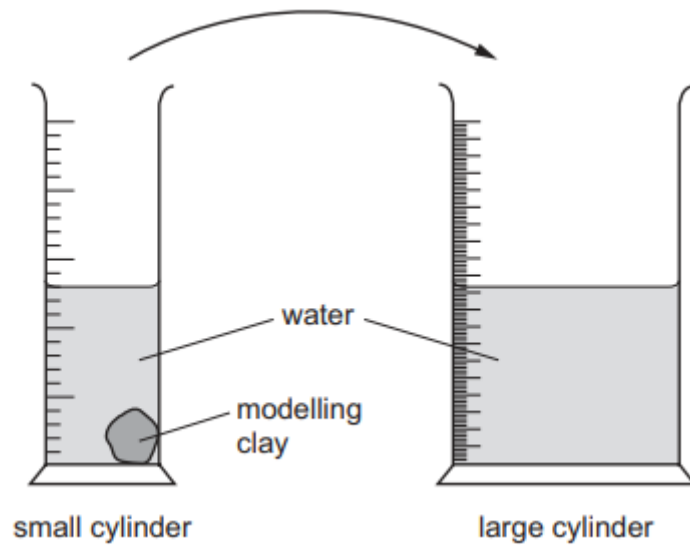
Any rough working should be done in this booklet.

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 21 printed pages and a blank page.

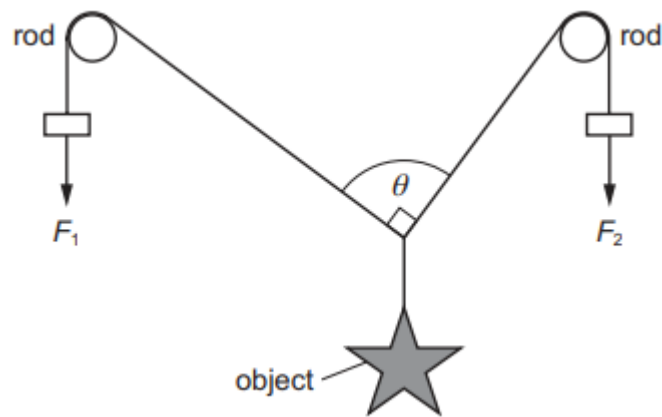
- 1 A lump of modelling clay is moved from a small measuring cylinder to a large measuring cylinder that has twice the diameter.



The reading on the small measuring cylinder goes down by 20 cm^3 . By how much does the reading on the large cylinder go up?

- A** 10 cm^3 **B** 20 cm^3 **C** 40 cm^3 **D** 80 cm^3
- 2 An object is moved from point X to point Y.
- The acceleration of free fall at X is different from that at Y.
- Which statement about the object at Y is correct?
- A** Both its mass and its weight are different from those at X.
- B** Both its mass and its weight are the same as those at X.
- C** Its mass is the same as at X but its weight is different.
- D** Its weight is the same as at X but its mass is different.

- 3 An object hangs by means of two cords around two rods, as shown.

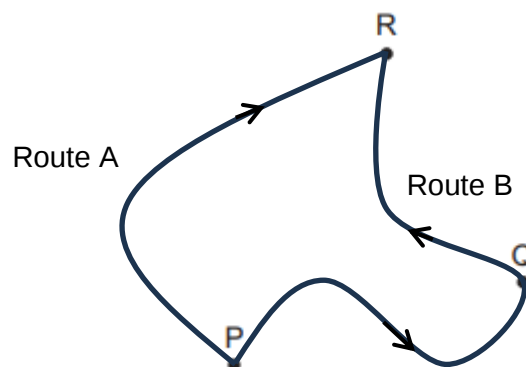


The object is held in equilibrium by the forces F_1 and F_2 . The object weighs 10 N. There is negligible friction between the rods and cords. Angle θ is 90° .

Which row of the table gives an angle θ of 90° ?

	F_1/N	F_2/N
A	4.0	6.0
B	6.0	4.0
C	6.0	8.0
D	8.0	6.0

- 4 Two objects travel from P to R along two routes as shown.



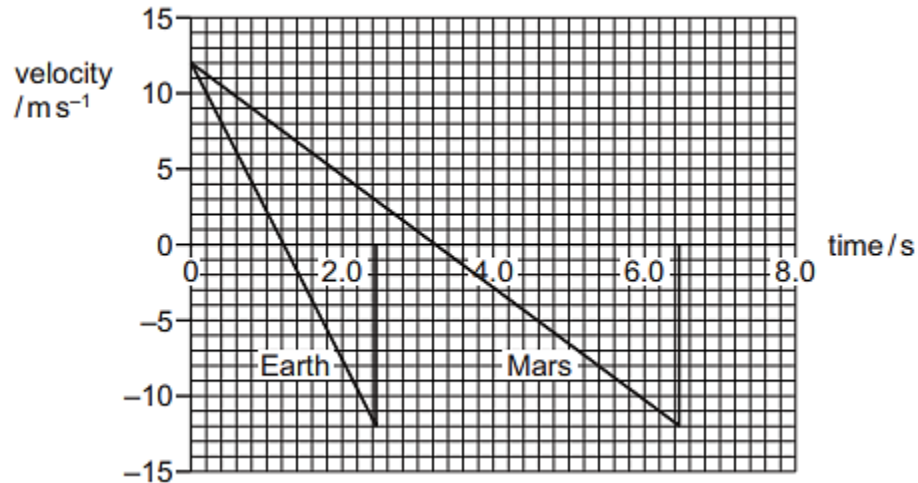
One moves along route A while the other along route B. Both reach R at the same time.

Which statement about the two objects 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.

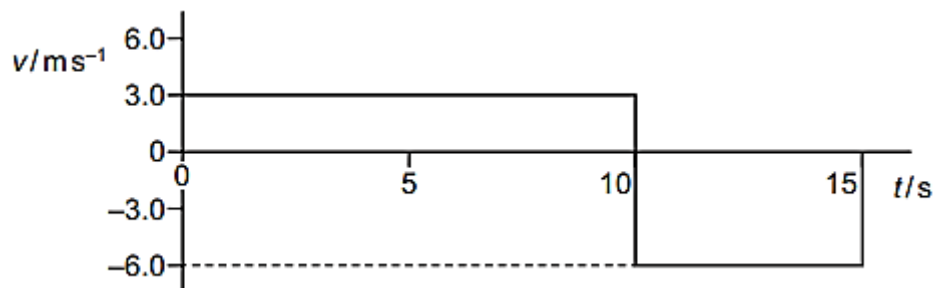
- 5 A rock is launched vertically upwards from the surface of the Earth and an identical rock is launched vertically upwards from the surface of Mars. Each rock is launched with an initial velocity of 12 m s^{-1} .

Each rock then reaches its maximum height above the surface before returning back down to the surface. The velocity–time graph for each rock is shown. In both cases, air resistance is negligible.



What is the difference in the maximum heights of the two rocks?

- A 12 m B 15 m C 19 m D 24 m
- 6 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.

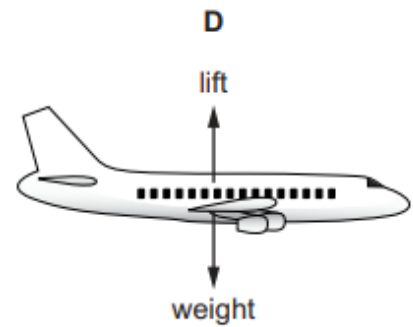
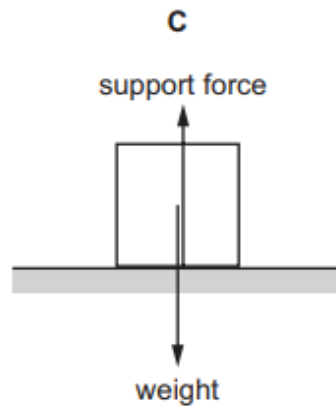
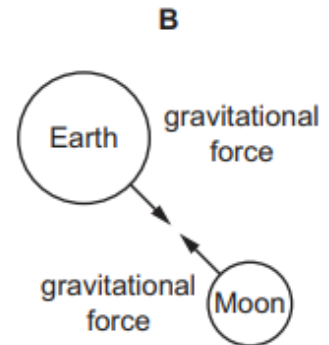
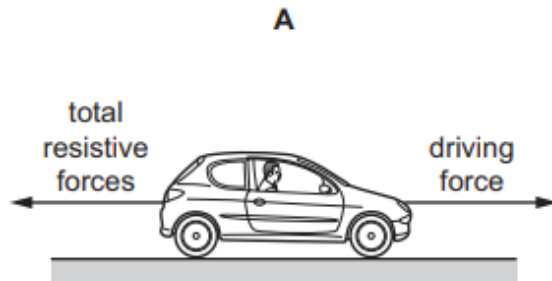


What is the average velocity of the toy car for the journey shown by the graph?

- A -1.5 m s^{-1} B 0.0 m s^{-1} C 4.0 m s^{-1} D 4.5 m s^{-1}

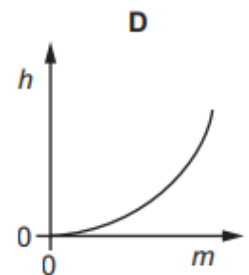
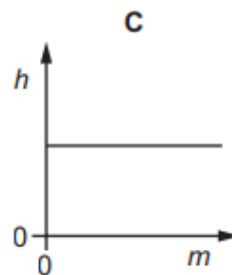
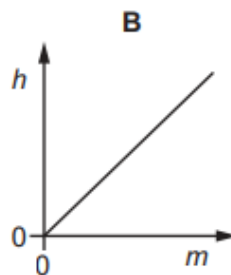
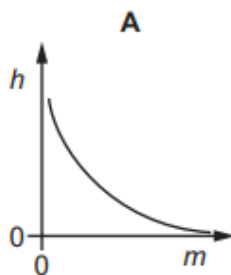
- 7 Each diagram illustrates a pair of forces of equal magnitude.

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

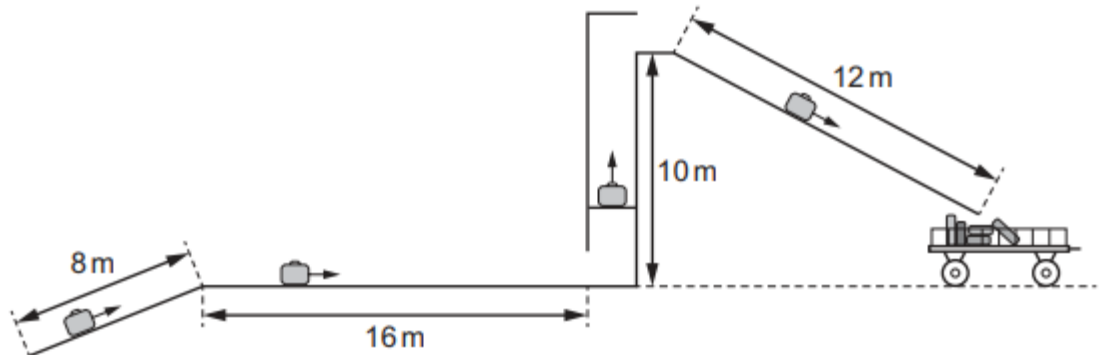


- 8 Objects with different masses are placed on the horizontal surface of a table. The objects are then raised to different heights above the table. The gain in gravitational potential store of each object is the same.

Which graph best shows the variation of the height h of the objects above the table with their mass m ?



- 9 An airport has a mechanical system for moving luggage. The system uses a sloping conveyor belt, a horizontal conveyor belt, a lift and a frictionless slide. A suitcase is moved around the airport using this system.

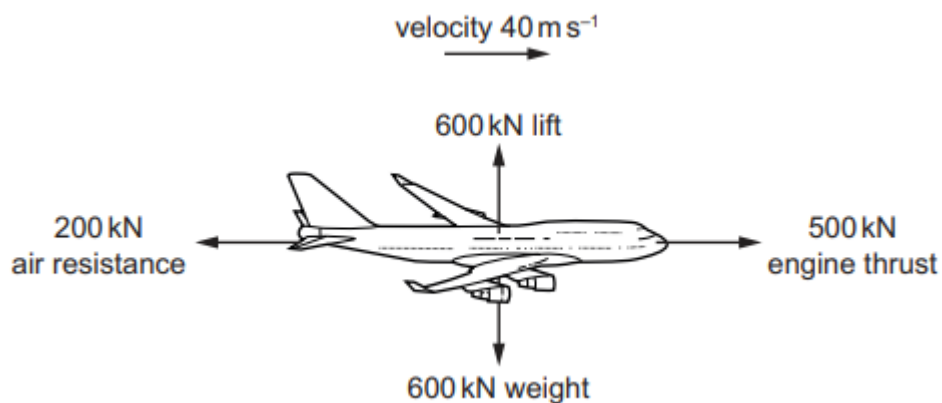


Resistive forces opposing the motion of the suitcase are negligible.

For which movement of the suitcase is the net work done on the suitcase greatest?

- A moving the suitcase a distance of 8 m at a constant speed up the sloping conveyor belt
 - B moving the suitcase a distance of 16 m at a constant speed along the horizontal conveyor belt
 - C moving the suitcase a distance of 10 m at a constant speed vertically upwards on the lift
 - D moving the suitcase a distance of 12 m at increasing speed downwards on the slide
- 10 The force diagram shows an aircraft accelerating to the right.

At the instant shown, the velocity of the aircraft is 40 m s^{-1} .

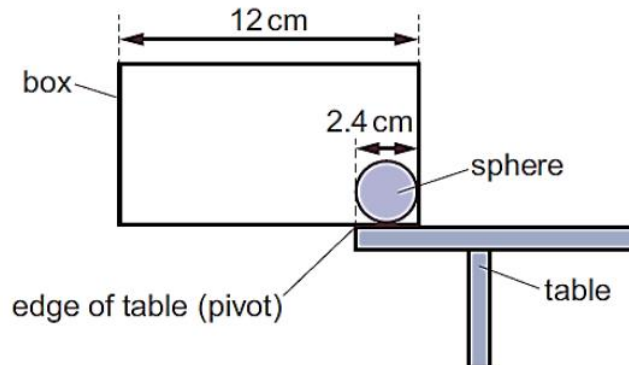


At which rate is its kinetic store increasing?

- A 2.4 MW
- B 8.0 MW
- C 12 MW
- D 20 MW

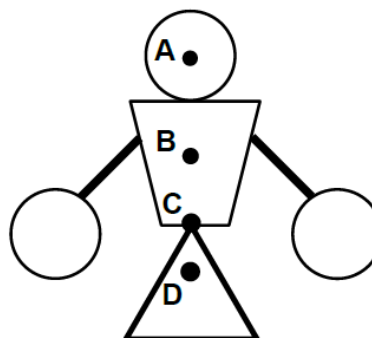
- 11** A box of length 12 cm and weight 0.43 N is placed on a horizontal table, with a greater part of its length overhanging the edge of the table. The edge of the table acts as a pivot. The centre of gravity of the box is at its geometric centre.

To balance the box, a uniform sphere of diameter 2.4 cm is placed at one end of the box as shown.

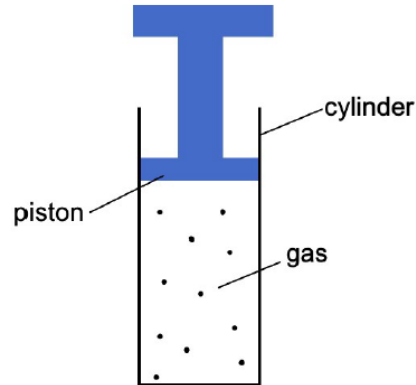


What is the minimum weight of the sphere required to maintain the system in equilibrium?

- A** 0.65 N
B 1.0 N
C 1.3 N
D 2.2 N
- 12** 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?

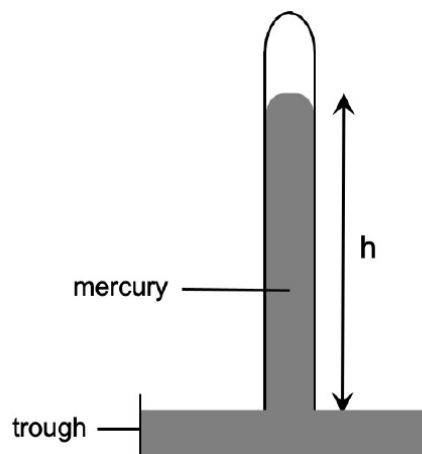


- 13** A piston of mass 4.0 kg is supported by gas trapped in a cylinder. The pressure of the gas is 1.2×10^5 Pa and atmospheric pressure is 1.0×10^5 Pa. The acceleration of free fall is 10 m/s^2 .



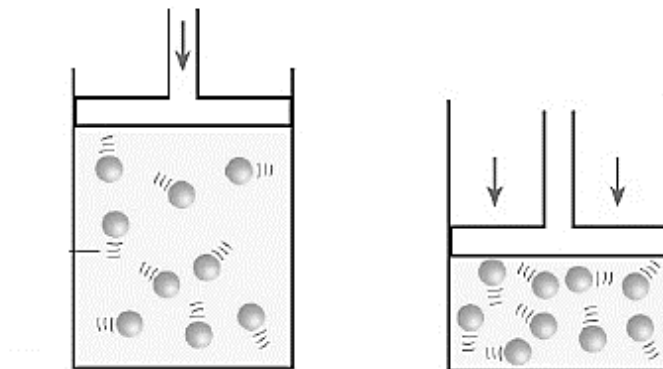
What is the area over which the gas exerts a pressure on the piston?

- A** $2.0 \times 10^{-4} \text{ m}^2$
 - B** $2.0 \times 10^{-3} \text{ m}^2$
 - C** $5.0 \times 10^2 \text{ m}^2$
 - D** $8.0 \times 10^5 \text{ m}^2$
- 14** The diagram shows a working barometer. Which change would NOT cause the height h of the mercury column to vary?



- A** Adding mercury to the trough.
- B** Change in gravitational field strength.
- C** Change in the temperature.
- D** Leakage of air into the tube.

- 15** A fixed mass of helium gas is compressed to a smaller volume at constant temperature.

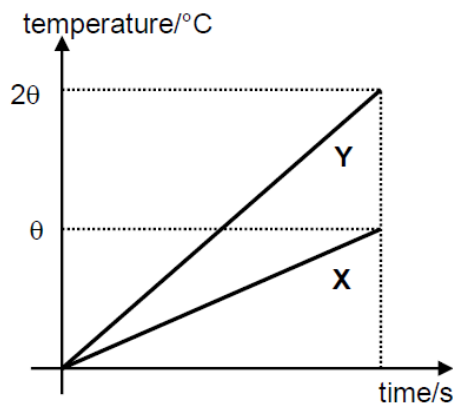


How do these properties of the gas molecules change?

	Average speed of the gas molecules	Frequency of collisions with the walls of the container
A	increases	increases
B	increases	remains unchanged
C	remains unchanged	increases
D	remains unchanged	remains unchanged

- 16** As air is sucked from a straw out of a sealed packet drink at constant temperature, the packet shrinks in volume. Which statement explains why the packet drink shrinks in volume?
- A** The number of air molecules per unit volume in the packet drink has decreased and the force for each collision has decreased.
 - B** The number of air molecules per unit volume in the packet drink has decreased and the frequency of collisions of the air molecules on the packet wall has decreased.
 - C** The partial vacuum created in the packet drink produce a force that pulls at the walls of the packet drink inwards.
 - D** The surrounding atmospheric pressure increases and crushes the packet drink.

- 17** Which statement correctly describes thermal energy transfer?
- A** Conduction is a process of thermal energy transfer that involves the vibration of particles.
 - B** Heat flows from a hotter body to a colder body, and coldness flows in the opposite direction.
 - C** Radiation refers to the process of heat transfer by the movement of fluid due to density differences.
 - D** There is no heat flow when two bodies are in thermal equilibrium.
- 18** When the water is freezing, internal energy is removed to decrease the
- A** average kinetic energy of the water molecules.
 - B** average potential energy of the water molecules.
 - C** average size of the water molecules.
 - D** average density of the water molecules.
- 19** The diagram shows how the temperature of liquid X and liquid Y changes with time when the same electric heater is used to heat the liquids.



If the mass of liquid Y is twice that of liquid X, what is the relationship between the heat capacity of liquid Y, C_Y to the heat capacity of liquid X, C_X ?

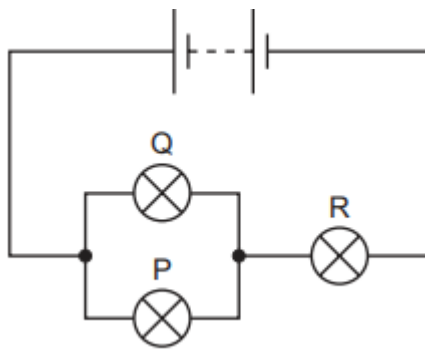
- A** $4C_X = C_Y$
- B** $2C_X = C_Y$
- C** $C_X = 2C_Y$
- D** $C_X = 4C_Y$

- 20** 80 g of ice at 0°C is added into 500 g of water at 30°C . What is the final temperature of the water?

Specific heat capacity of water = $4200 \text{ J}/(\text{kgK})$.
 Specific latent heat of fusion of ice = 334 J/g .

- A** 14.9°C
B 17.3°C
C 20.6°C
D 25.9°C

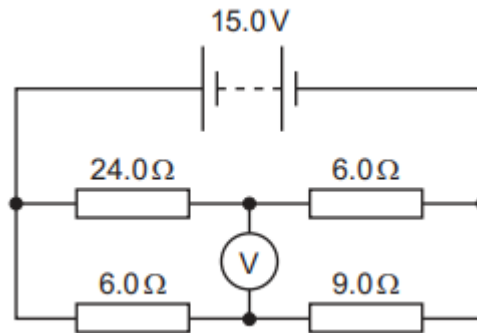
- 21** Three identical filament lamps, P, Q and R, are connected to a battery of negligible internal resistance, as shown.



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

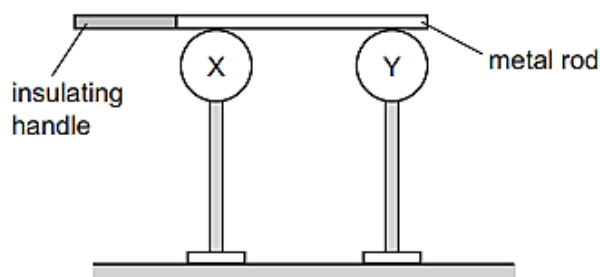
- 22** A circuit consists of a battery, a high-resistance voltmeter and four fixed resistors, as shown. The battery has an electromotive force (e.m.f.) of 15.0V and negligible internal resistance.



What is the reading on the voltmeter?

- A** 3.0V **B** 6.0V **C** 9.0V **D** 12.0V
- 23** A 100W 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** \$25.20
- 24** A teacher asks, 'Why do we put a fuse in a mains circuit?'
- Student 1 says, 'It protects the wiring from overheating.'
- Student 2 says, 'It protects us from getting a shock if we touch the live wire.'
- Who is correct?
- A** both students
- B** neither student
- C** student 1 only
- D** student 2 only

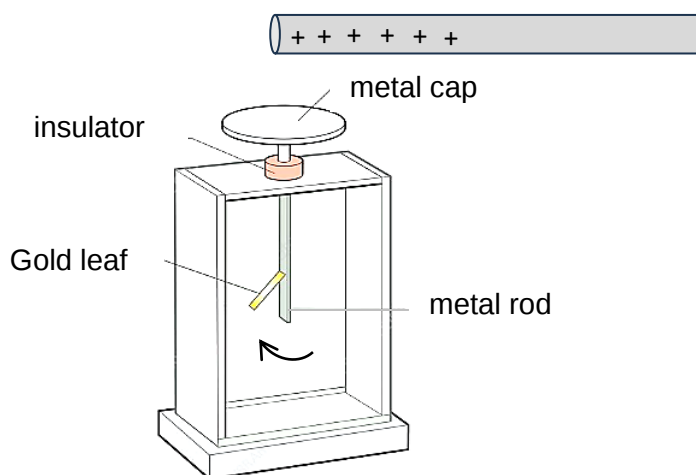
- 25** Two metal spheres are mounted on insulating stands. Sphere X is initially uncharged and sphere Y is initially positively charged. A metal rod, held by an insulating handle, is placed in contact with X and Y as shown.



What are the charges on X and on Y after the rod is placed in contact with them?

	charge on X	charge on Y
A	positive	Positive
B	positive	uncharged
C	uncharged	positive
D	uncharged	uncharged

- 26** The figure below shows an apparatus known as an electroscope. When a positively charged rod is brought near and placed above the metal cap of the apparatus, the gold leaf moves to the position as shown.



This is because

- A** electrons are induced by the positively-charged rod and migrated up to the metal cap.
- B** positive charges are repelled down to the metal rod and the gold leaf.
- C** positive charges from the rod are attracted by the induced electrons on the metal cap, move across the air and down to the gold leaf and metal rod.
- D** there are excess positive charges on the gold leaf and the metal rod.

27 Iron filings are picked up by an electromagnet.

The current in the electromagnet is switched off and the filings fall on a plastic bench.

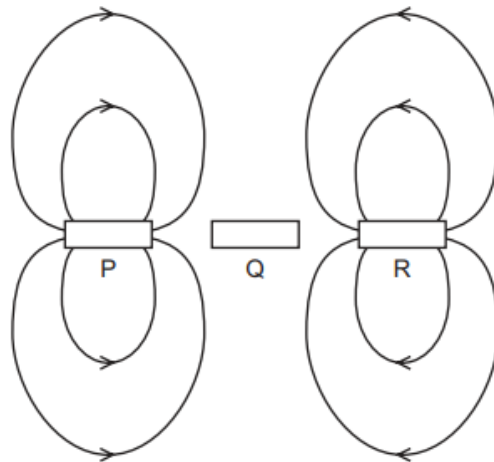
A plastic comb is rubbed with a woolen cloth and held just above the iron filings.

Some of the filings jump and stick to the comb.

Which statement correctly explains the last observation?

- A** The comb has been electrically charged by rubbing with the cloth.
- B** The comb has been magnetised by rubbing with the cloth.
- C** The filings have been electrically charged by the electromagnet.
- D** The filings have been magnetised by the electromagnet.

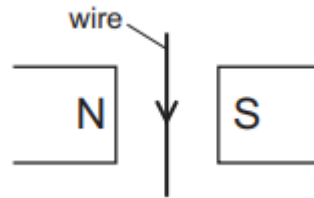
- 28** The diagram shows the magnetic fields around three objects, P, Q and R, placed close to each other.



Which row shows the nature of each of the objects?

	P	Q	R
A	N S	copper rod	N S
B	N S	copper rod	S N
C	N S	iron rod	N S
D	N S	iron rod	S N

- 29** A conducting wire is placed between the poles of a magnet. When an electric current in the wire is in the direction shown, the force on the wire acts out of the page.



Three statements about different conditions and how the wire is affected are given.

- 1 When the current is towards the top of the page and the direction of the magnetic field is unchanged, the force produced acts into the page.
- 2 When the current is towards the bottom of the page and the magnetic field is reversed, the force produced acts into the page.
- 3 When the current in the wire is alternating, the wire vibrates into and out of the page.

Which statements are correct?

- A** 1 and 2 only **B** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3
- 30** The coils in two electric motors are identical in size, but motor X is observed to spin more quickly than motor Y.

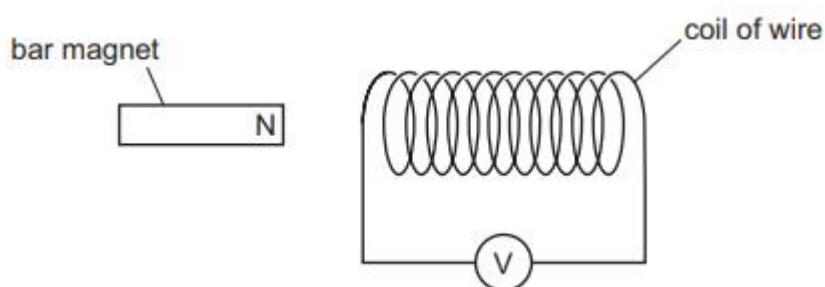
Three suggestions are made to explain this observation.

- 1 The current in the coil of motor X is greater than the current in the coil of motor Y.
- 2 The number of turns on the coil of motor X is greater than that on the coil of motor Y.
- 3 The magnets in motor X are stronger than the magnets in motor Y.

Which suggestion(s) explain(s) this observation?

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

- 31** A bar magnet is held near a coil of wire. The coil is connected to a sensitive voltmeter.



The N-pole of the magnet is moved quickly towards the coil. The voltmeter shows a reading of +10 mV.

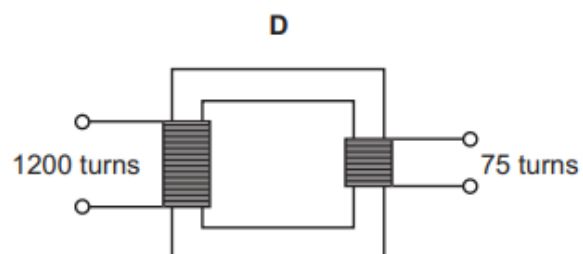
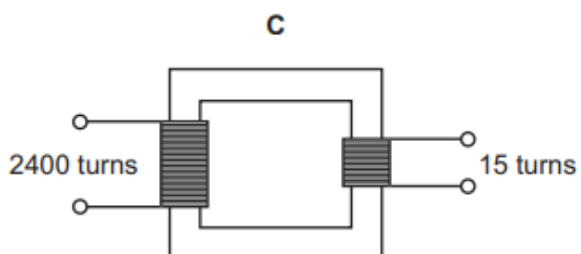
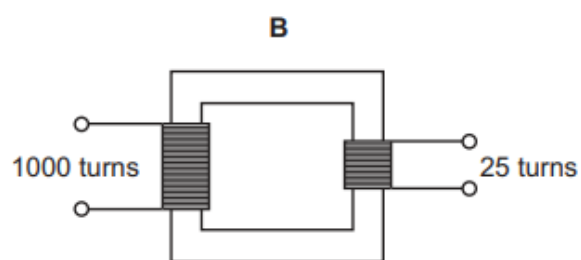
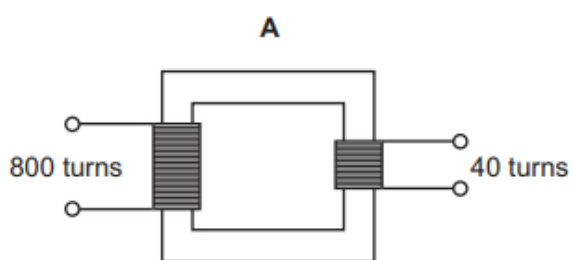
The N-pole of the magnet is then moved slowly away from the same end of the coil.

The reading on the voltmeter is observed.

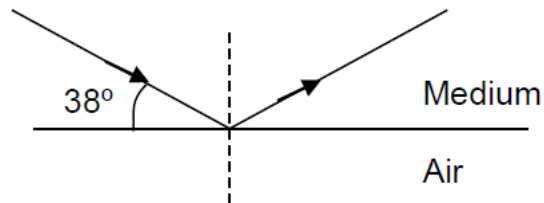
Which voltmeter reading is possible?

- A** -15 mV **B** - 5 mV **C** 0 mV **D** +5 mV

- 32** Which transformer can change a 240V a.c. input into a 15V a.c. output?

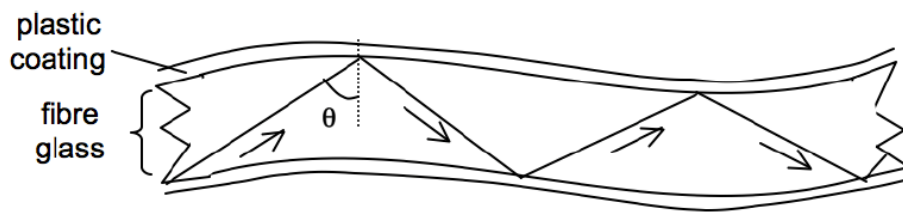


- 33 A ray of light that makes an angle of 38° with the medium boundary reflected back into the medium boundary as shown below.



Which option cannot be the refractive index of the medium?

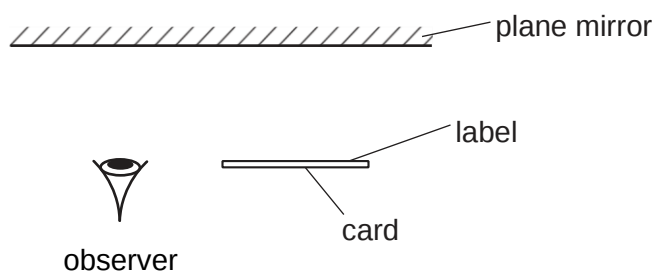
- A 1.24 B 1.27 C 1.44 D 1.62
- 34 Fibreglass of refractive index 1.4, is sheathed in plastic coating of refractive index close to 1.3, to transmit data in the form of light packets.



What is the minimum value of θ so that the above phenomenon can occur?

- A 42° B 46° C 48° D 51°

- 35 A card is placed in front of a plane mirror so that its label is facing the mirror, as shown.



The label is shown.

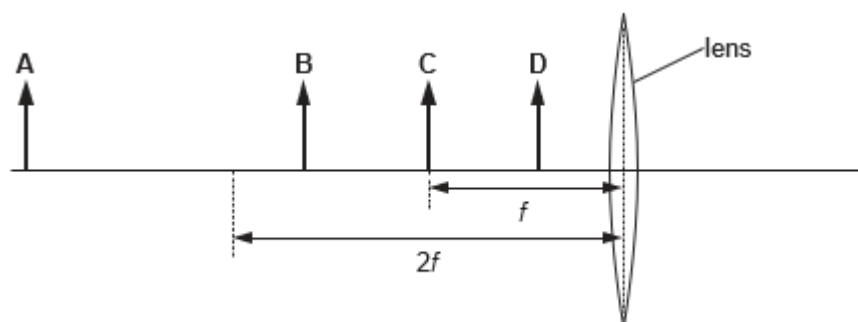


How does the image of the label formed by the mirror appear to the observer?

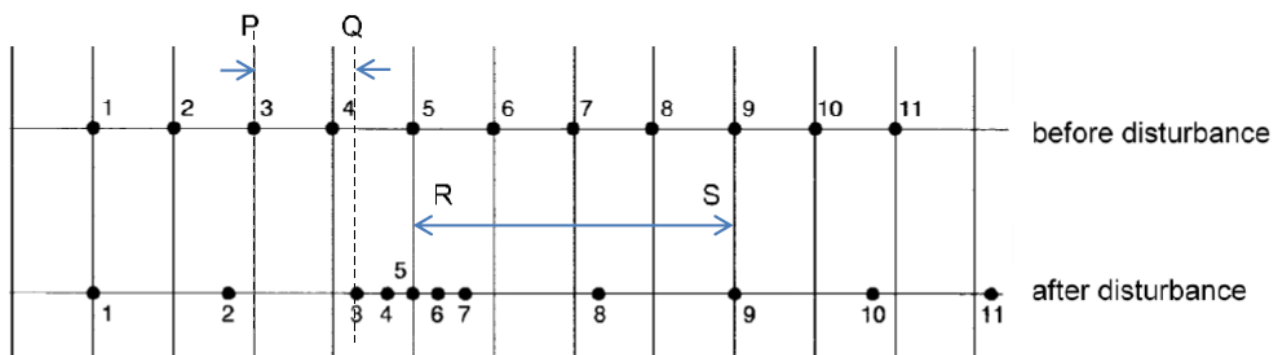


- 36 An object is placed in front of a converging lens. The lens has a focal length f .

In which labelled position should the object be placed in order to produce a real image that is smaller than the object?



- 37 The following diagram shows the positions of air particles before and after they were disturbed by the sound of a vibrating guitar string.



Which option correctly describes the lengths indicated as PQ and RS?

	PQ	RS
A	one amplitude	one wavelength
B	one amplitude	half a wavelength
C	double amplitude	one wavelength
D	double amplitude	half a wavelength

- 38 A sound wave is transmitted in water. The shortest time duration for the water particles to move from its rest position to its maximum displacement is 2.5 ms. The distance from the centre of a compression to the adjacent centre of rarefaction is 7.5 m.

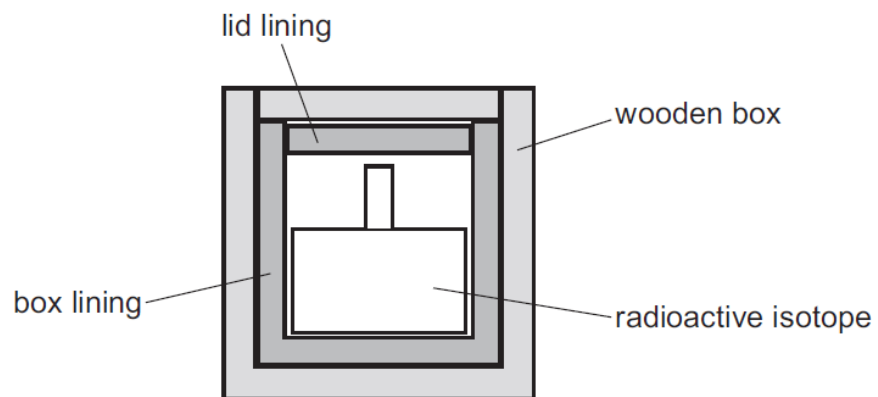
What is the distance travelled by the sound wave in 0.10 s?

- A 150 m
- B 750 m
- C 1500 m
- D 3000 m

- 39 A sound is produced by a musical instrument in air with a frequency f_1 and wavelength λ_1 . The sound then enters the water and has a frequency f_2 and wavelength λ_2 .

Which option is correct?

- A $f_2 < f_1$ and $\lambda_2 = \lambda_1$
- B $f_2 < f_1$ and $\lambda_2 < \lambda_1$
- C $f_2 = f_1$ and $\lambda_2 < \lambda_1$
- D $f_2 = f_1$ and $\lambda_2 > \lambda_1$
- 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 radiation escaping from the box.



Which material is used for the lining?

- A copper
- B glass
- C lead
- D plastic

END OF PAPER

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