



Geylang Methodist School (Secondary) Preliminary Examination 2024

PHYSICS

6091/01

Paper 1

Sec 4 Express

Additional materials : Multiple Choice Answer Sheet

1 hour

15 August 2024

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 all the work you hand in.

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 work should be done in this paper.

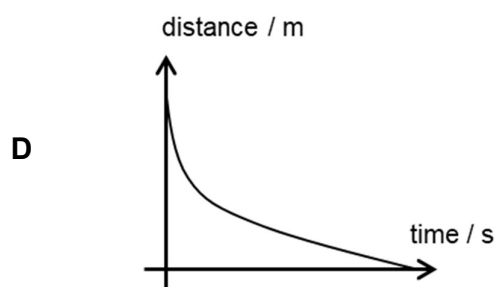
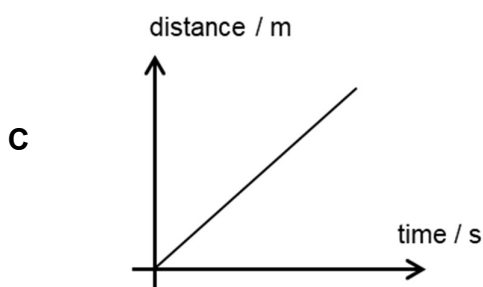
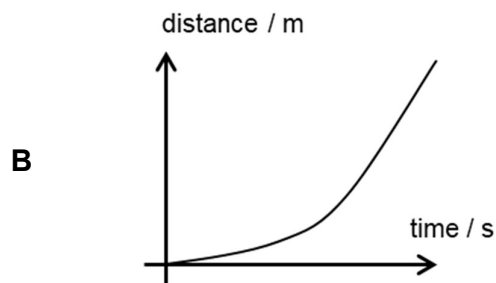
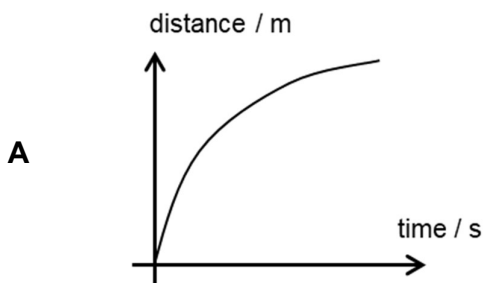
Acceleration due to gravity, ***g***, is assumed to be 10 m/s^2 and gravitational field strength, ***g***, is assumed to be 10 N/kg , unless otherwise specified.

- 1 Which measurement represents the longest length?

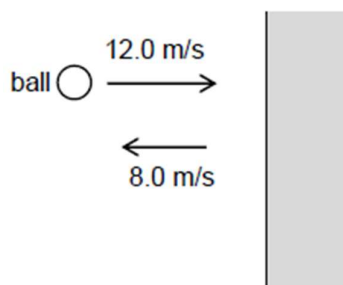
A 1.2×10^{-4} Mm **B** 1.2×10^3 km **C** 1.2×10^5 cm **D** 1.2×10^7 μ m

- 2 A ball made of plasticine is thrown vertically upwards towards the ceiling. At the highest point of its path, it is stuck at the ceiling.

Which distance-time graph best represents the motion of the ball?



- 3 A squash ball hits the vertical sidewall of the court with a horizontal velocity of 12 m/s. It rebounds off the wall with a horizontal velocity of 8.0 m/s as shown in the diagram.



The collision between the ball and the wall is 0.08 s. Take leftward as positive direction.

What is the acceleration of the squash ball when it rebounds off the wall?

A -50 m/s^2 **B** 50 m/s^2 **C** -250 m/s^2 **D** 250 m/s^2

- A** 2500 N **B** 4000 N **C** 5000 N **D** 6000 N

- 8 5000 kg of iron is melted and mixed with 2.0 m^3 of molten copper. The density of molten iron and molten copper are 7500 kg/m^3 and 9000 kg/m^3 respectively.

What is the approximate density of the mixture?

- A 8000 kg/m^3 B 8200 kg/m^3 C 8400 kg/m^3 D 8600 kg/m^3

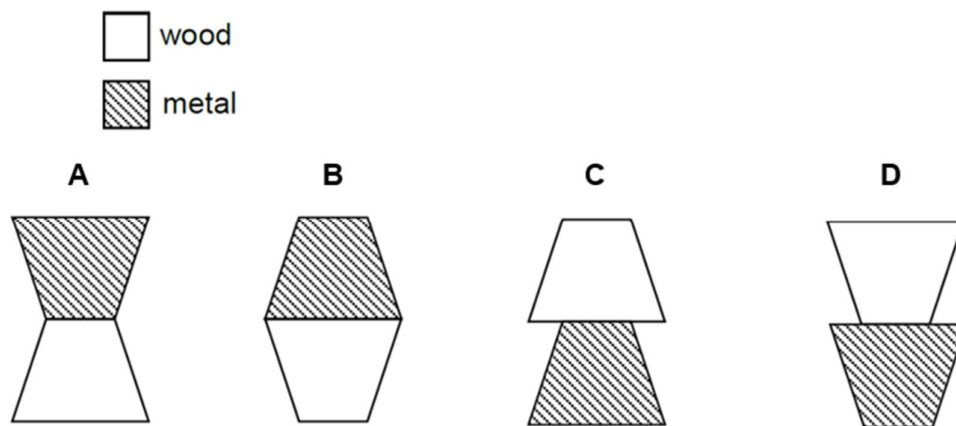
- 9 A granite rock at the surface of the Earth has density ρ . The rock is transported to the surface of another planet. The acceleration of free fall on the surface of the other planet is twice that on the surface of the Earth.

What is the density of the rock on the other planet?

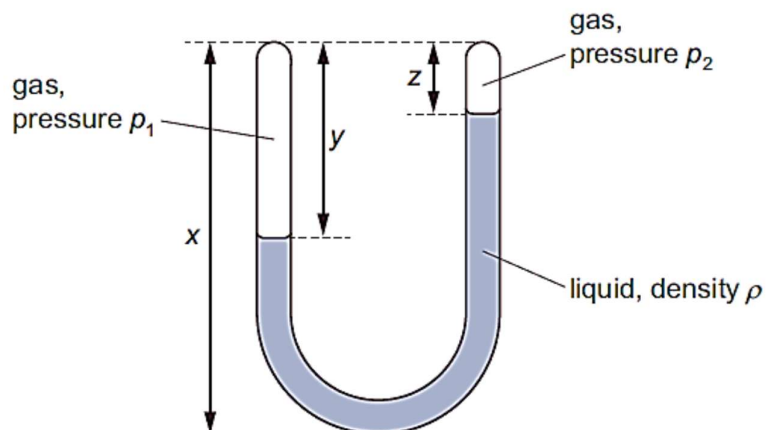
- A 0.5ρ B ρ C 2ρ D 4ρ

- 10 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?

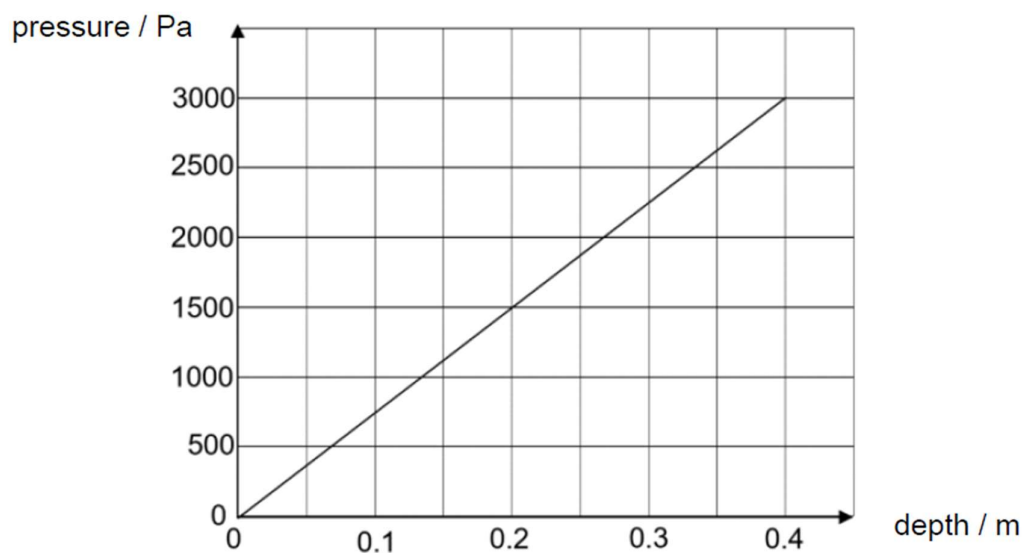


- 11 A closed U-shaped tube contains a stationary liquid of density ρ . One side of the tube contains a gas at pressure p_1 and the other side contains a gas at pressure p_2 , as shown. (The acceleration of free fall is g .)



Which equation is correct?

- A** $p_1 = \rho g y$
B $p_2 = \rho g (y - z)$
- C** $p_1 - p_2 = \rho g (y - z)$
D $p_1 - p_2 = \rho g (x - y)$
- 12 The graph shows how the pressure exerted by a liquid varies with depth below the surface.



What is the density of the liquid if the gravitational field strength is 10 N/kg ?

- A** 600 kg/m^3
B 750 kg/m^3
C 1200 kg/m^3
D 7500 kg/m^3

- 13 A car of mass 1500 kg is initially travelling at a speed of 15 m/s. 3.0×10^5 J of energy is transferred to its kinetic store by mechanical work while undergoing a constant acceleration.

What is the new speed of the car?

- A 20 m/s B 25 m/s C 30 m/s D 35 m/s

- 14 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%?

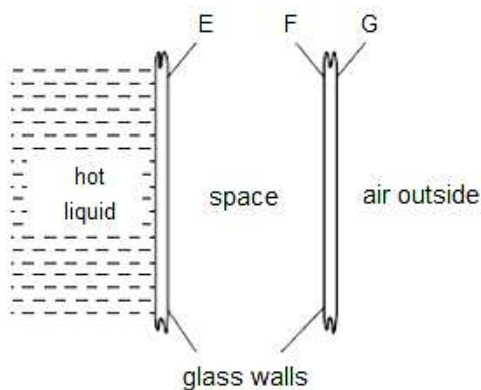
- A 400 W B 625 W C 24 000 W D 37 500 W

- 15 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

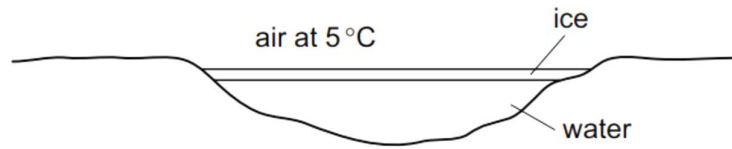
- 16 A student uses a double-walled glass vessel to contain a hot liquid.



Which reduces the energy transfer by radiation?

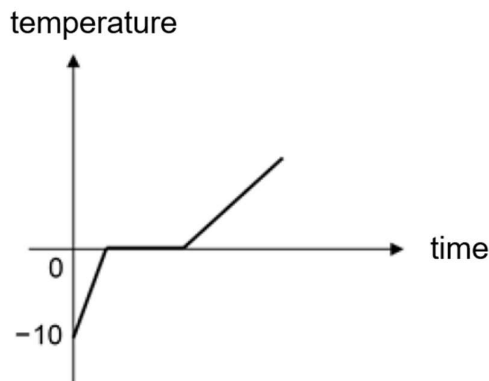
- A vacuum in the space between the walls
B painting surface E black
C painting surface F silver
D painting surface G black

- 17 The diagram shows a frozen pond with the surface of the ice slowly melting as energy is transferred by heating from the warmer air above it.



By which processes is the energy transferred from the air to the ice?

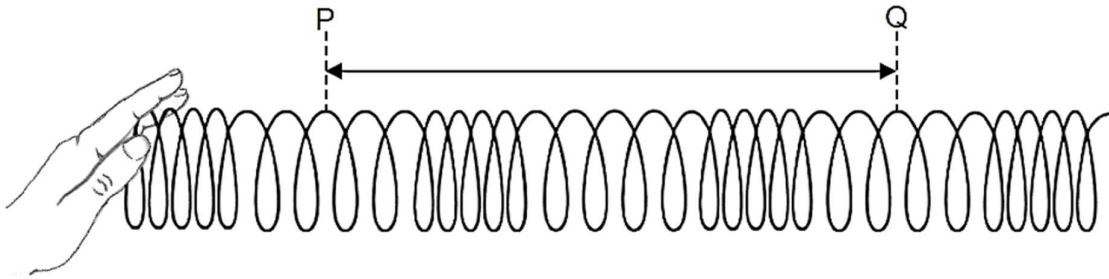
- A conduction, convection and radiation
 - B conduction and convection only
 - C conduction and radiation only
 - D convection and radiation only
- 18 A solid substance is heated. Its temperature variation with time is shown in the graph.



Which of the following statements is true?

- A The total internal energy of the substance remains constant throughout.
 - B The substance does not gain thermal energy when temperature is constant.
 - C The substance has a greater specific heat capacity in its solid state, than in its liquid state.
 - D The substance has an overall increase in internal potential energy and internal kinetic energy.
- 19 Which source generates longitudinal waves?
- A a lamp
 - B a wireless microphone
 - C a loudspeaker
 - D a noise level detector in the library

- 20 The diagram shows a wave travelling in a slinky spring after being pushed by a hand.



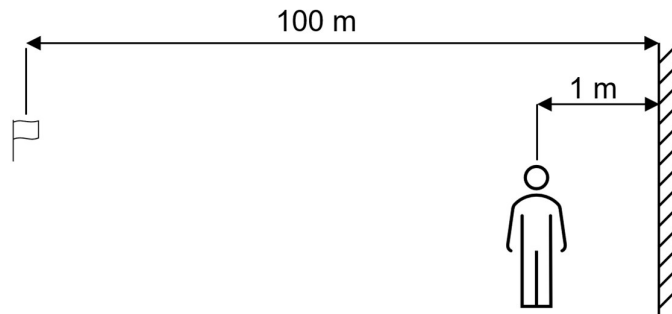
If a compression takes 1.0 s to travel from point P to Q, what is the frequency of this wave?

- A** 0.33 Hz **B** 0.5 Hz **C** 2.0 Hz **D** 3.0 Hz
- 21 Ultrasound is used to map the ocean floor. During one survey, the depth of water is 1200 m. An ultrasound pulse is sent from the surface and when it returns to the ship, another pulse is sent immediately. In any period of 8.0 s, five pulses are sent down from the surface.
- What is the speed of the ultrasound in water?
- A** 600 m/s **B** 750 m/s **C** 1200 m/s **D** 1500 m/s
- 22 An experimenter standing at one end of a long solid steel pipe hits one end of the steel pipe with a hammer. A detector on the other end detects two sounds with an interval of 2.0 s between the two sounds. The speed of sound in steel is 5100 m/s and speed of sound in air is 300 m/s.

What is the length of the steel pipe?

- A** 600 m **B** 638 m **C** 9600 m **D** 10200 m

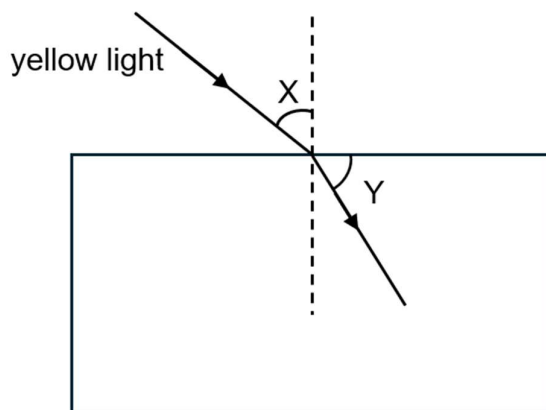
- 23** An object is placed at 100 m in front of a plane mirror, while an observer stands 1 m in front of the mirror.



Which of the following correctly describes the characteristics of the image compared to the object?

	orientation	size
A	inverted	same size
B	laterally inverted	diminished
C	upright	diminished
D	laterally inverted	same size

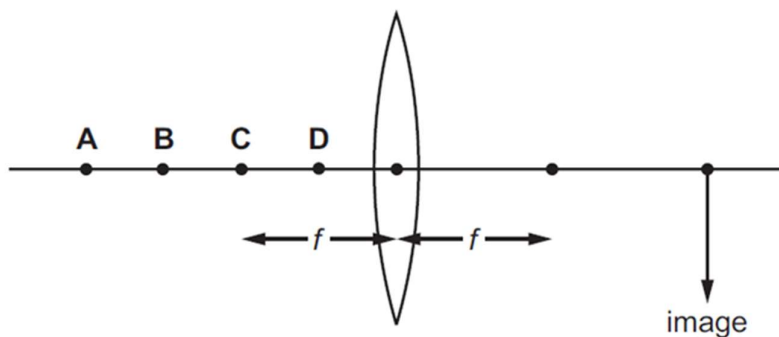
- 24** Elly shone a yellow light through a glass block and it refracted in the glass block as shown.



Which of the following correctly describes the path indigo light will travel as it is shone at the same angle of incidence, X through the glass block?

- A** Angle Y will decrease as indigo light travels slower than yellow light in glass block.
- B** Angle Y will decrease as indigo light travels faster than yellow light in glass block.
- C** Angle Y will increase as indigo light travels faster than yellow light in glass block.
- D** Angle Y will increase as indigo light travels slower than yellow light in glass block.

- 25** The diagram shows a thin converging lens of focal length f and an image.

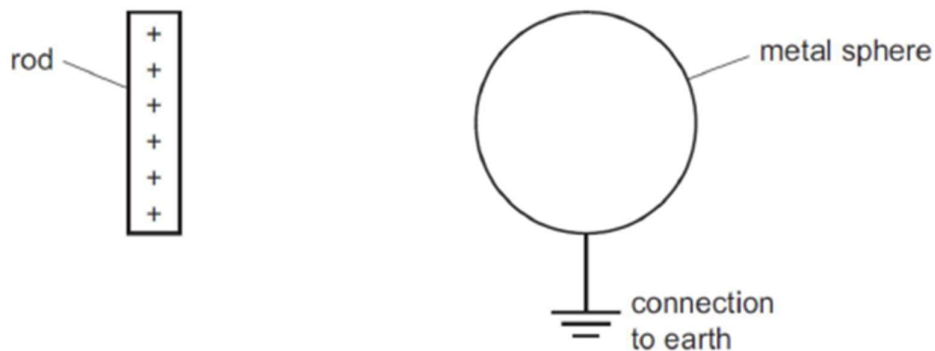


Where should the object be placed in order to produce an image as shown?

- 26** Many devices produce electromagnetic waves when operating.

Which device produces electromagnetic waves of the highest frequency?

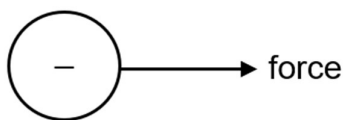
- A** sunbed
 - B** mobile phone
 - C** television remote controller
 - D** toaster
- 27** A metal sphere is connected to earth. A positively charged rod approaches the sphere and stops before touching it.



Which of the following describes the charge on the metal sphere?

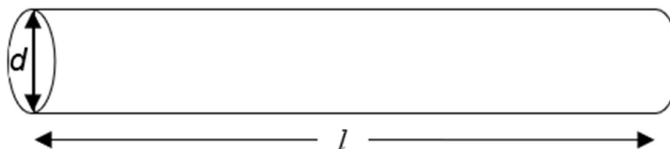
- A** It is negative because electrons are attracted towards the rod.
- B** It is neutral because it is earthed.
- C** It is positive because protons are repelled by the rod.
- D** It is neutral because electrons are attracted towards the rod and protons are repelled.

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



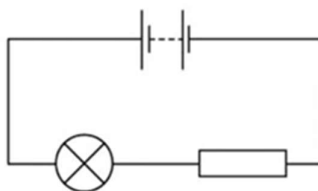
What is the direction of the electric field?

- A horizontally to the left
 - B horizontally to the right
 - C vertically down
 - D into the page
- 29 The diagram shows a segment of a uniform copper wire with length l and diameter d .



Which one of the following changes will cause the resistance of the wire to increase by four times?

- A increase the diameter to $2d$ and increase the length to $4l$
 - B increase the diameter to $2d$ and decrease the length to $l/2$
 - C decrease the diameter to $d/2$ and decrease the length to $l/2$
 - D decrease the diameter to $d/2$ and keep the length unchanged
- 30 Peter sets up the circuit below, but he noticed that the lamp is too dim.



What change can be made to the circuit to increase the brightness of the lamp?

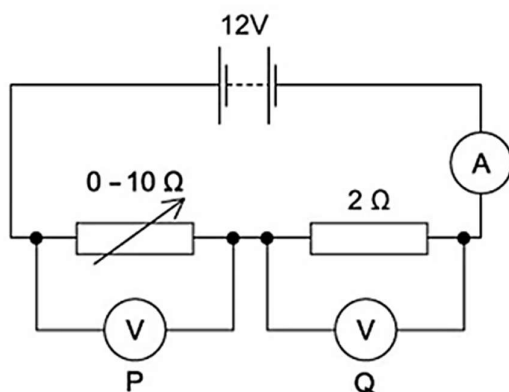
- A Putting another resistor in parallel with the battery.
- B Putting a resistor in parallel with the lamp.
- C Putting another resistor in series with the resistor.
- D Putting another resistor in parallel with the resistor.

- 31** A 12 V battery is charged for 20 minutes by connecting it to a source of electromotive force (e.m.f). The battery is supplied with 7.2×10^4 J of energy in this time.

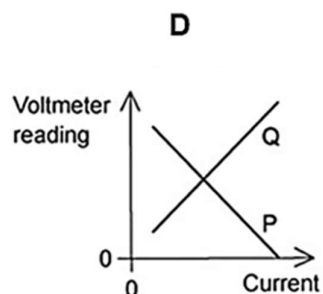
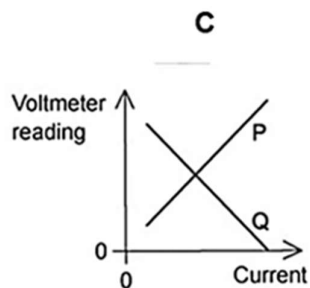
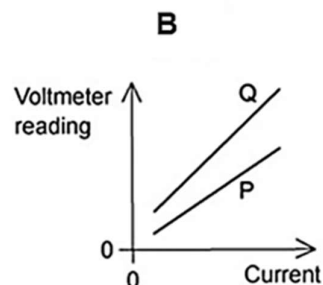
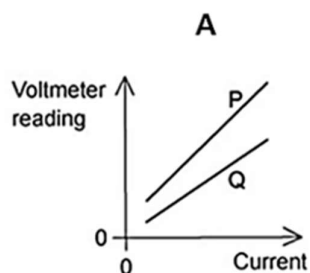
How much charge flows into the battery?

- A** 5.0 C **B** 60 C **C** 100 C **D** 6000 C

- 32** A 12 V battery is in series with an ammeter, a $2\ \Omega$ fixed resistor and a $0 - 10\ \Omega$ variable resistor. High-resistance voltmeters P and Q are connected across the variable resistor and the fixed resistor, respectively, as shown.



Which graph shows the variation with current of the voltmeter readings?



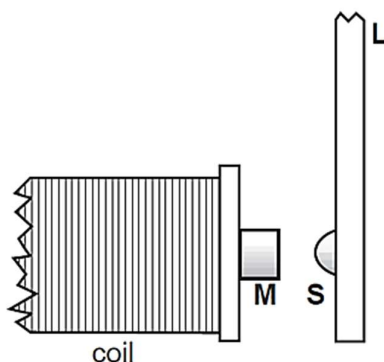
- 33** In the three-pin plug of a heater, a fuse is connected at the live wire but not at the neutral wire.

Which 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 'blew', the heater still works.
D None of the above.
- 34** 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?

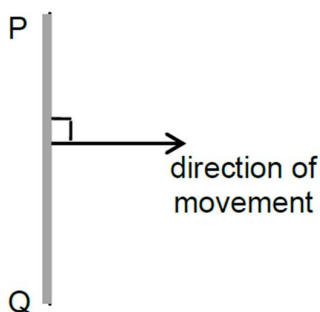
- A** \$2.32 **B** \$2.54 **C** \$2.76 **D** \$5.08
- 35** The diagram shows part of a magnetic relay. M is part of the core of the magnet. L is part of the armature which is attracted to the core when a current flows through the coil. S is a stud which stops the armature being attracted too strongly.



Which line of the table gives the best materials for M, L and S?

	M	L	S
A	copper	iron	steel
B	iron	iron	copper
C	steel	copper	iron
D	iron	copper	iron

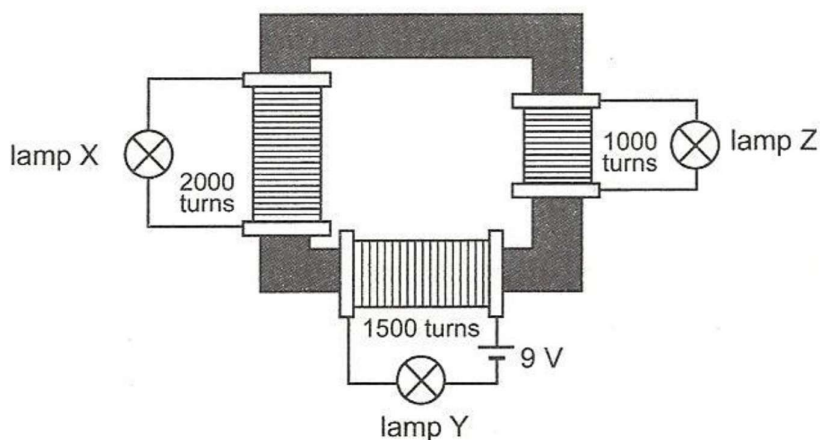
- 36** A beam of electrons travels along wire PQ. The wire starts to move in the direction shown.



Which of the following combinations will give the induced force as shown?

	electrons flow from	magnetic field lines
A	P to Q	to the bottom of page
B	P to Q	into the page
C	Q to P	into the page
D	Q to P	out of the page

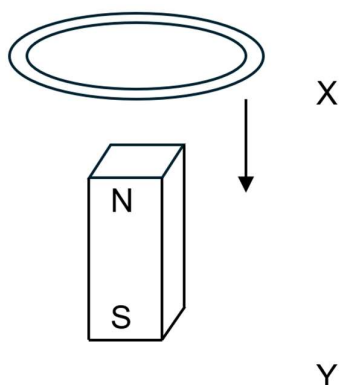
- 37** Three identical filament lamps, X, Y and Z, are connected to an iron core with multiple coils of different number of turns as shown. The resistance of each lamp is $4.5\ \Omega$ and each requires a minimum current of $2.0\ \text{A}$ to light up normally. Lamp Y is connected to the coil with a direct current supply of $9.0\ \text{V}$.



What can be observed about the brightness of the three lamps after a few seconds?

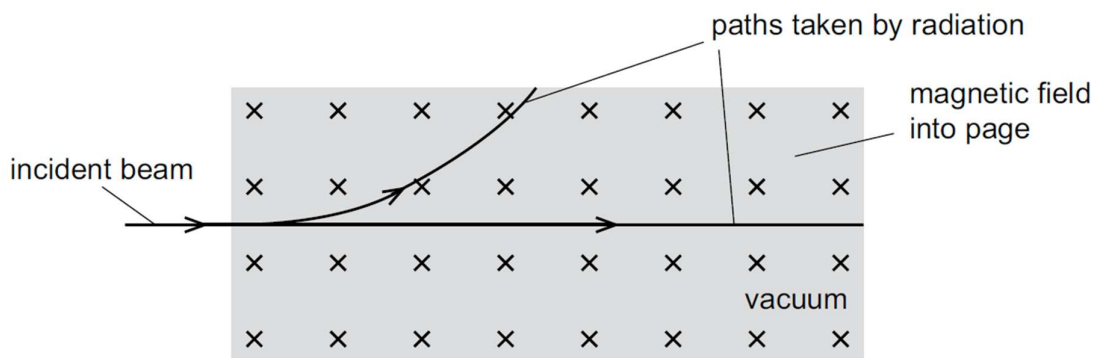
	lamp X	lamp Y	lamp Z
A	brighter than normal	normal brightness	dimmer than normal
B	dimmer than normal	normal brightness	brighter than normal
C	not light up	normal brightness	not light up
D	not light up	not light up	not light up

- 38 A copper ring is dropped over a bar magnet from point X to Y as shown below.



As seen from the top, which statement about the induced current in the ring at point X and Y is correct?

- A It flows in a clockwise direction at both X and Y.
 - B It flows in an anti-clockwise direction at X and then a clockwise direction at Y.
 - C It flows in a clockwise direction at X and then an anti-clockwise direction at Y.
 - D It flows in an anti-clockwise direction at both X and Y.
- 39 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.

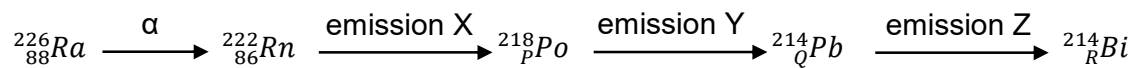


The beam splits and the curved path and the straight path taken by the radiation in the magnetic field are shown on the diagram.

What types of radiation are in the incident beam?

- A α -particles and β -particles only
- B α -particles and γ -rays only
- C β -particles and γ -rays only
- D α -particles, β -particles and γ -rays

- 40 Consider the radioactive decay of $^{226}_{88}\text{Ra}$.



Which of the following correctly describes the radioactive decay of $^{226}_{88}\text{Ra}$?

	type of emission			proton number		
	X	Y	Z	P	Q	R
A	α	α	β	84	82	83
B	α	β	α	84	85	83
C	β	α	β	86	84	85
D	β	β	α	86	87	85

End of Paper