

Sec 4 Physics

Exam papers with worked solutions

SET C

PAPER 1

QUESTION

Compiled by

THE PHYSICS CAFE

READ THESE INSTRUCTIONS FIRST

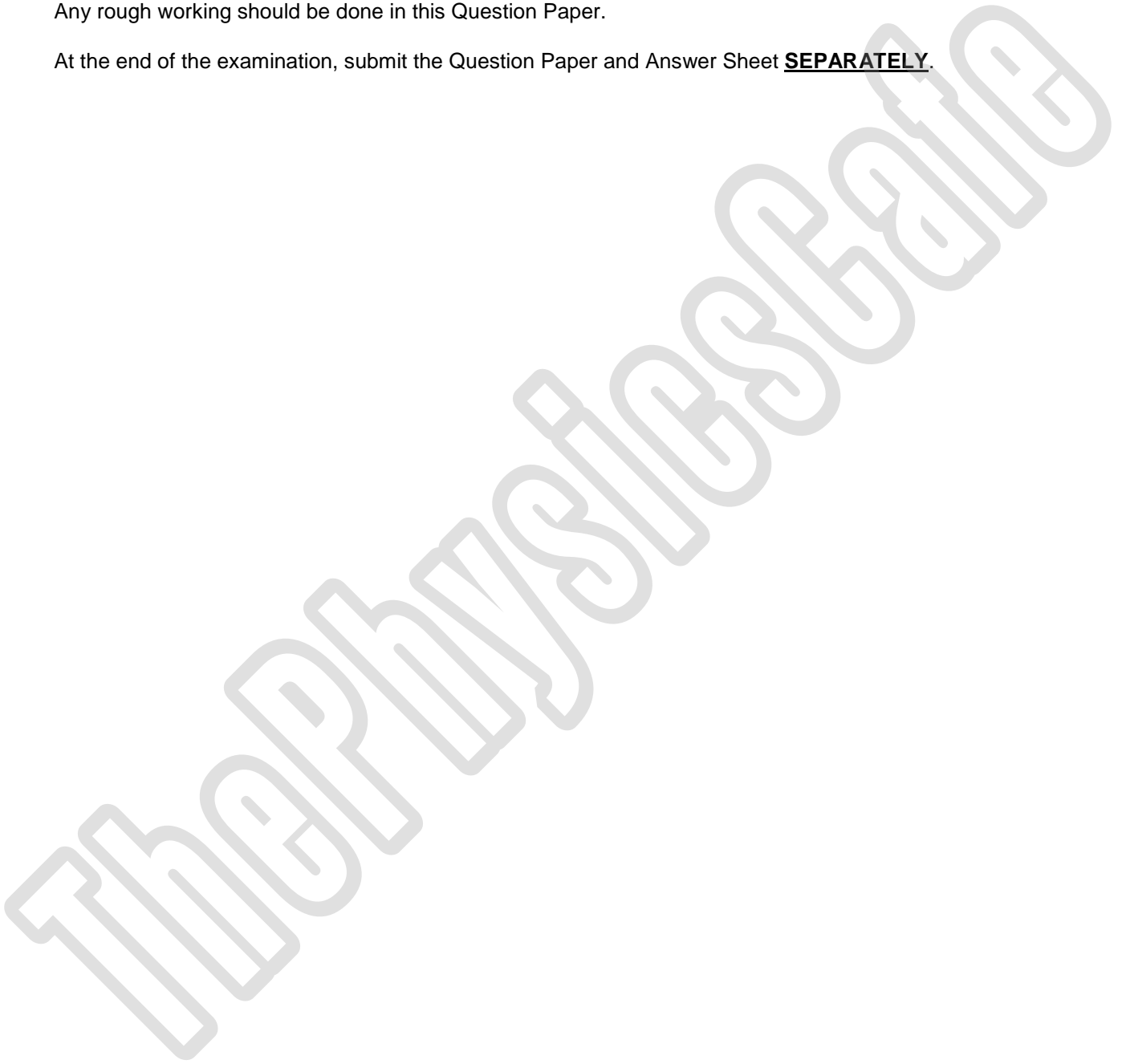
Write your name, class and index number on the cover page of this Question Paper and the Answer Sheet.
Write in soft pencil on the Multiple Choice Answer Sheet.
Do not use staples, paper clips, highlighters, glue or correction fluid.

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

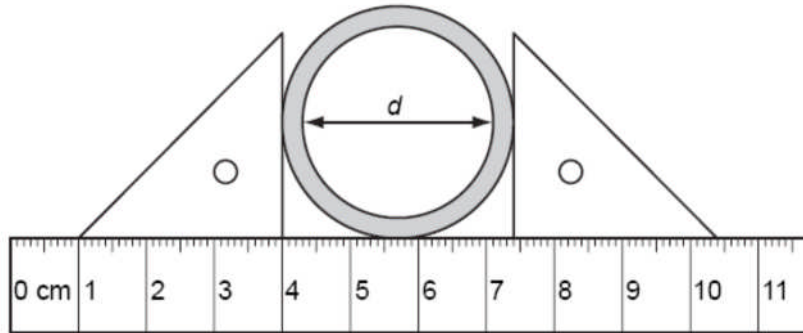
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

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 Question Paper.

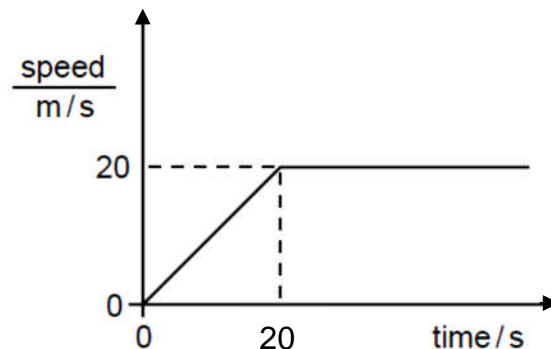
At the end of the examination, submit the Question Paper and Answer Sheet **SEPARATELY**.



- 1 The diagram shows a thick-walled tube. The thickness of the wall is 4 mm. What is the internal diameter d of the tube?



- A 2.6 cm
B 3.0 cm
C 3.4 cm
D 7.4 cm
- 2 A car accelerates from rest when the traffic lights turn green. The graph shows how the car's speed changes with time.



How far does the car travel before it reaches a steady speed?

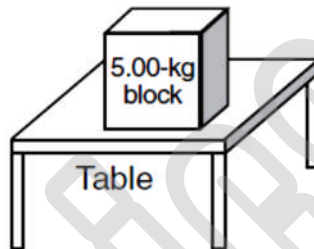
- A 100 m
B 200 m
C 300 m
D 400 m
- 3 If all the forces acting on a moving object are removed, the object will
- A stop immediately.
B slow down to a stop.
C continue moving with constant velocity.

D speed up.

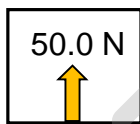
4 A ball is thrown vertically downward with a speed of 0.50 m/s from a height of 4.0 m. What is the speed of the ball 0.70 s after it is released? The acceleration of free fall g is taken to be 10 m/s^2 and air resistance is negligible.

- A 0.35 m/s
- B 2.0 m/s
- C 7.0 m/s
- D 7.5 m/s

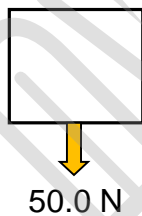
5 The diagram below shows a 5.00 kg block at rest on a horizontal, frictionless table.



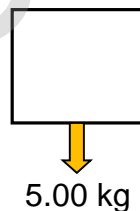
Which diagram below best represents the force exerted on the block by the table?



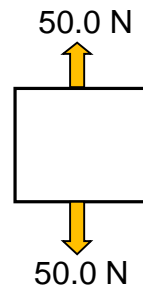
A



B



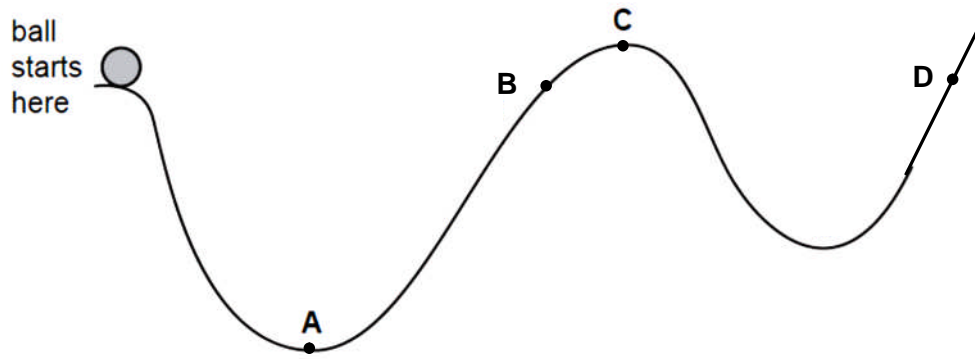
C



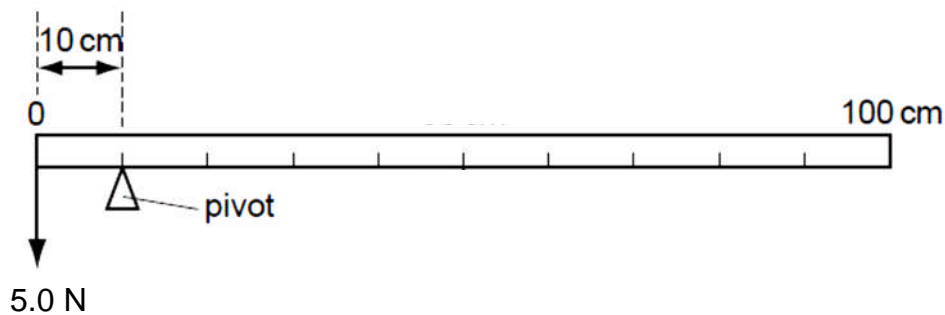
D

6 A ball is released from rest and rolls down a track from the position shown.

What is the furthest position the ball can reach?



- 7 A uniform metre rule is pivoted at the 10 cm mark and balanced by a 5.0 N weight as shown below.



What is the weight of the metre rule?

- A 0.50 N
 - B 0.56 N
 - C 1.3 N
 - D 20 N
- 8 A box slides horizontally across a floor. The amount of work done against friction depends most on the
- A time taken to move the box.
 - B distance the box is moved.
 - C speed of the box.
 - D direction of the box's motion.
- 9 Student A lifts a box weighing 50 N from the floor to a height of 0.40 m in 2.0 s. Student B lifts another box weighing 40 N from the floor to a height of 0.50 m in 1.0 s. Compared to student A, student B does
- A the same work but exerts more power.

- B the same work but exerts less power.
- C more work but exerts less power.
- D less work but exerts more power.

- 10 The total number of particles and the average kinetic energy of the particles of three bodies P, Q and R are given in the following table.

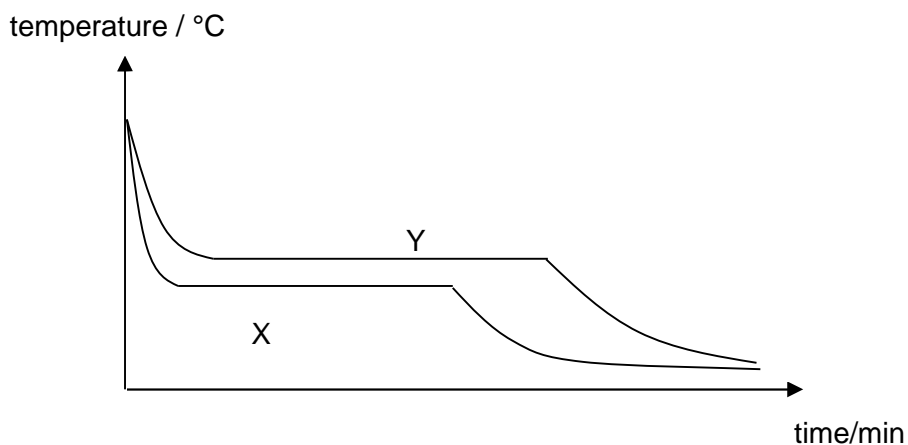
	Total number of particles	Average kinetic energy of particles
P	N	E
Q	$N/2$	$2E$
R	$2N$	E

The temperatures of the bodies P, Q and R are denoted by T_P , T_Q and T_R respectively. Which of the following best represents the relationship between T_P , T_Q and T_R ?

- A $T_P = T_Q < T_R$
 - B $T_P = T_R < T_Q$
 - C $T_Q < T_P < T_R$
 - D $T_Q < T_P = T_R$
- 11 1.5 kg of liquid X is heated up by an immersion heater of power 100 W for 7.5 min in a vessel of heat capacity 20 J/°C. The temperature of X is raised from 20 °C to 30 °C and 600 J of energy is lost to the surroundings. What is the specific heat capacity of X?
- A 5 900 J/kg°C
 - B 4 430 J/kg°C
 - C 3 000 J/kg°C
 - D 2 950 J/kg°C
- 12 People usually feel colder during the time when snow melts than when snow falls, even if they occur at the same temperature. This is mainly because
- A people's sensation are not reliable.
 - B snow melts at a temperature below 0 °C.
 - C internal energy is released by falling snow.

D when snow melts, it absorbs a lot of latent heat from the surroundings.

- 13** John performed an experiment to compare the physical properties of two liquids X and Y. He poured equal mass of the liquids, initially at the same temperature, into two identical test tubes and placed them at room temperature. The cooling curves are shown in the graph below.



Which of the following statements is/are correct?

- (I) Liquid X has a higher specific latent heat of fusion than liquid Y.
- (II) Liquid X has a lower freezing point than liquid Y.
- (III) Liquid X has a lower specific heat capacity than liquid Y.

- A** (I) and (II) only
- B** (I) and (III) only
- C** (II) and (III) only
- D** (I), (II) and (III)

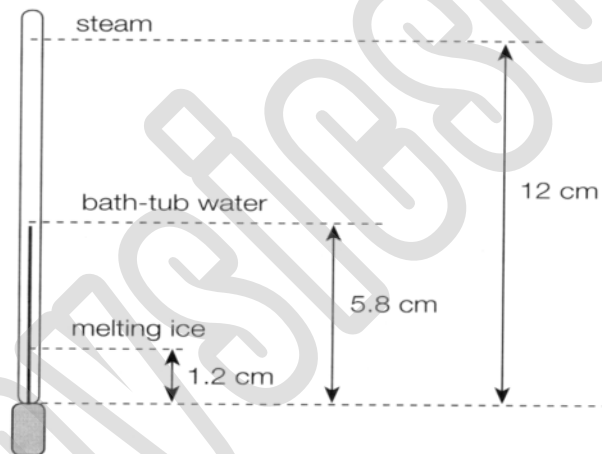
- 14** Stews and soups can be kept warm in clay pots for a long time. Which of the following is/are the reason(s)?

- (I) Clay is a poor conductor of heat.
- (II) The food contains a lot of water, which has a large specific heat capacity.
- (III) Clay does not emit infrared radiation.

- A** (I) only

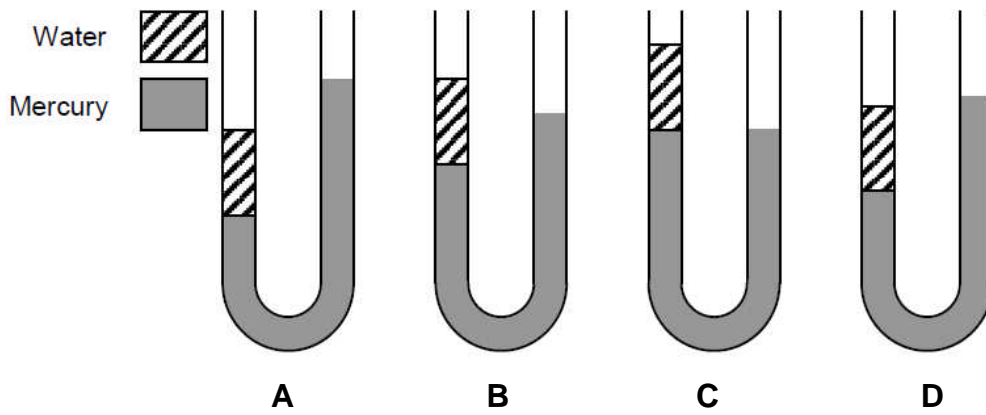
- B (I) and (II) only
- C (I) and (III) only
- D (II) and (III) only

- 15 Mary wants to know the temperature of bath-tub water, but the markings on her thermometer are worn out and invisible. She puts the thermometer into melting ice, then into steam over boiling water and finally into bath-tub water. Each time she waits until the liquid level in the thermometer becomes steady and then marks the level on it.

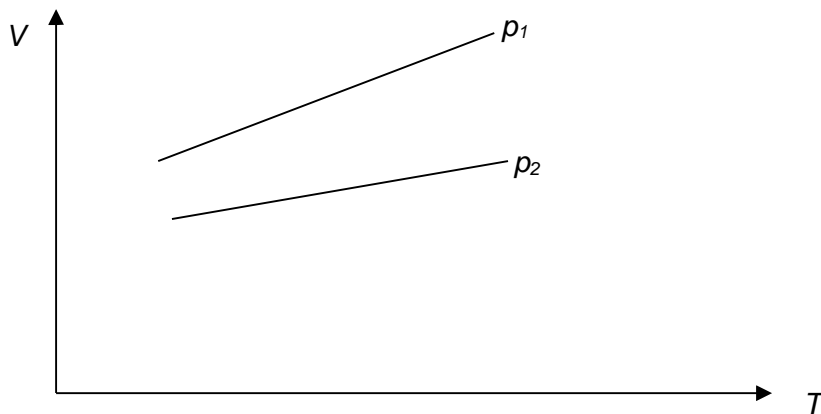


What is the best estimate of the temperature of the bath-tub water?

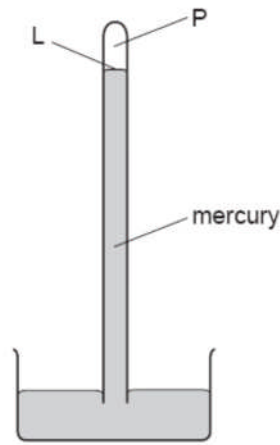
- A 38 °C
 - B 43 °C
 - C 48 °C
 - D 54 °C
- 16 Water and mercury are placed in either side of a manometer. Which diagram below correctly shows this?



- 17 The graph below shows how the volume V of an ideal gas varies with temperature T under constant pressure p_1 and p_2 . Which of the following is/are correct?

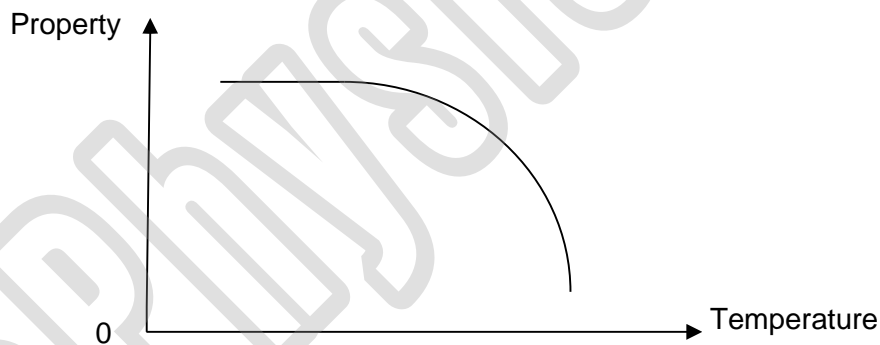


- (I) T is not in the Kelvin scale.
 (II) p_1 is larger than p_2 .
 (III) V must be measured in m^3 .
- A (I) only
 B (III) only
 C (I) and (II) only
 D (I) and (III) only
- 18 The diagram shows a working mercury barometer used to measure atmospheric pressure. What happens to the level L and the pressure at P when atmospheric pressure increases?



- | | Level L | Pressure at P |
|----------|---------|----------------|
| A | falls | increases |
| B | falls | stays the same |
| C | rises | increases |
| D | rises | stays the same |

- 19** A physical quantity is found to vary with temperature as shown in the diagram below.



Which of the following statements best explains why such a physical property cannot be used to define a temperature scale?

- A** The correlation between the property and temperature is not positive.
 - B** The trend depicted in the diagram is not linear.
 - C** One-to-one relationship between the variables is not available for lower range of temperature.
 - D** The graph does not pass through the true origin.
- 20** Both transverse and longitudinal waves can be demonstrated using a/an
- A** electromagnetic wave.
 - B** rope.

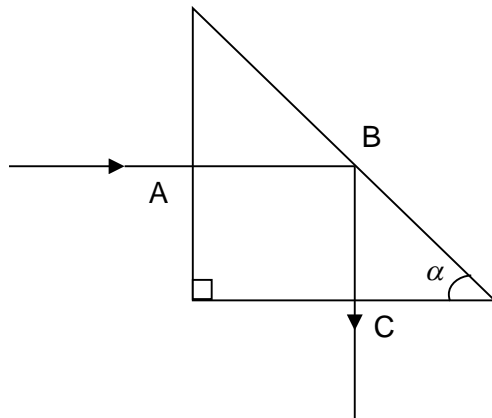
- C sound wave.
- D slinky coil.

21 A dipper connected to a motor is used to set up water waves in a ripple tank.

Which of the following steps can be taken to reduce the separation between the wavefronts?

- A use a smaller dipper
- B use a shallower pool of water in ripple tank
- C lower the frequency of vibration of dipper
- D use a more efficient motor

22 A ray of light enters normally into a right-angled glass block at A, and undergoes total internal reflection at B and exits at C.



If the glass block has a refractive index of 1.5, what is the minimum value of α such that light can exit at B instead?

- A 41°
- B 42°
- C 49°
- D 50°

23 Bob stands beside Jane facing a plane mirror which is 2.5 m in front of them. If Jane moves 2.0 m away from Bob in the direction parallel to the mirror, how much has the distance between Jane's image and Bob increase?

- A 0.39 m
- B 2.0 m
- C 4.0 m
- D 5.4 m

24 Which of the following descriptions is associated with an electromagnetic wave?

- A It can only travel in vacuum.
- B It can only move at a speed of 3.0×10^8 m/s.
- C It carries energy from the source via oscillating electric and magnetic fields.
- D It cannot undergo total internal reflection.

25 Four different notes, produced by a sound machine, are each associated with a different time taken for one oscillation as follows:

Note	A	B	C	D
Time taken/s	6.7×10^{-2}	5.0×10^{-4}	5.6×10^{-5}	4.0×10^{-5}

Which is the lowest note that is audible to a normal person?

26 When a sound wave travels in air, energy is propagated via vibration of air molecules through a series of compressions and rarefactions.

Which statement does not describe regions of compression or rarefaction correctly?

- A Molecules at the centre of each region are at zero displacement.
- B Distance between adjacent compression and rarefaction regions is equal to half of a wavelength of the wave.
- C Molecules in these regions only vibrate about their mean position.
- D Molecules at the centre of a compression region can become the centre of a rarefaction region when a full period has elapsed.

27 Which of the following statements about electric field are correct?

- (I) An electron experiences a force when it is placed in an electric field.

- (II) Field lines show the direction where a charge will move with constant speed.
 (III) Field lines point from a positively charged object to a negatively charged object.

- A** (I) and (II) only
B (I) and (III) only
C (II) and (III) only
D (I), (II) and (III)

- 28** The diagram below shows a positive point charge equidistant from a stationary positive object and a stationary negative object. Both objects have the same magnitude of charge.

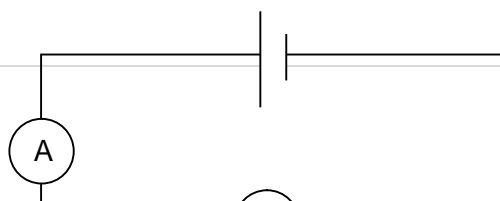


point charge \oplus

In which direction will the positive point charge move?

- A** \uparrow
B \nearrow
C \leftarrow
D \rightarrow

- 29** The diagram below shows a light dependent resistor (LDR) connected in series to an ammeter and a 3.0 V cell. A voltmeter is connected parallel to the LDR.

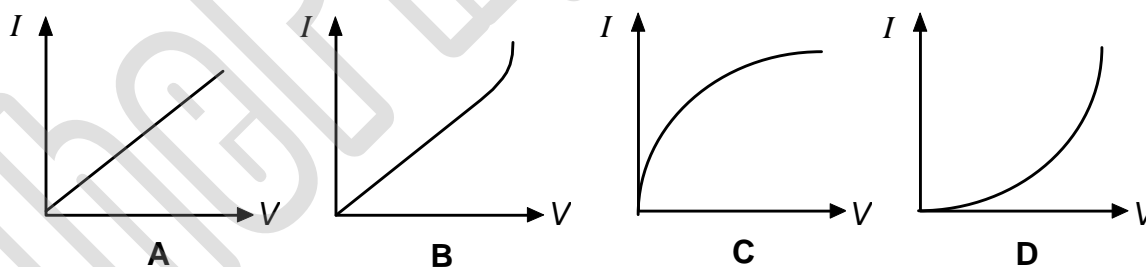


Which of the following statements is incorrect?

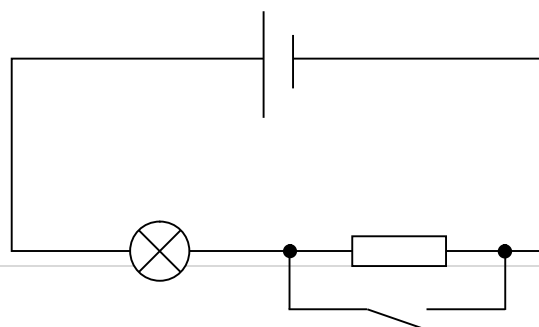
- A As the light intensity on the LDR increases, the voltmeter reading decreases.
- B As the light intensity on the LDR increases, the ammeter reading increases.
- C Every one coulomb of charge supplied by the cell has 3.0 J of electrical energy.
- D The electrons in the wire flow clockwise in the circuit.

30 The resistance of tungsten increases with increasing temperature.

Which of the graphs below show the relation between the current, I , flowing in the tungsten filament of an electric lamp and the potential difference, V , between its ends?



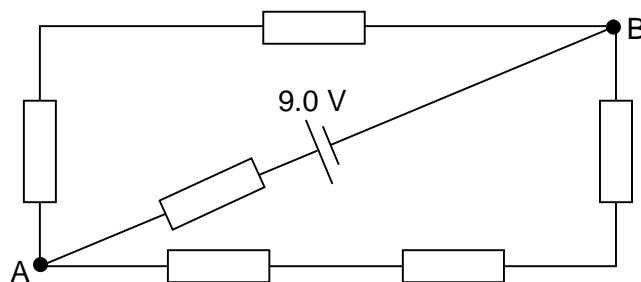
31 A lamp and resistor are connected in series.



What happens to the brightness of the lamp when the switch is closed?

- A It becomes brighter.
- B It becomes dimmer.
- C It remains the same.
- D It goes off.

- 32 Six identical resistors are connected to a 9.0 V cell of negligible internal resistance as shown below.



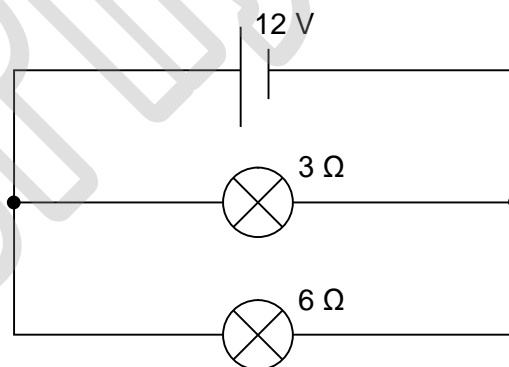
What is the potential difference across points A and B?

- A 4.1 V
 - B 4.9 V
 - C 7.5 V
 - D 9.0 V
- 33 An air purifier has a power rating of 170 W and an air conditioner a power rating of 2500 W. During a hazy day, the air purifier is switched on for 15 hours and the air conditioner is switched on for 10 hours.

What is the cost of using both appliances on that day, assuming that the cost of electricity is 26 cents per kWh?

- A \$7.16
- B \$25.75
- C \$27.55
- D \$71.60

- 34 In the circuit shown below, two lamps each of resistance $3\ \Omega$ and $6\ \Omega$ are connected in parallel to a $12\ \text{V}$ battery.

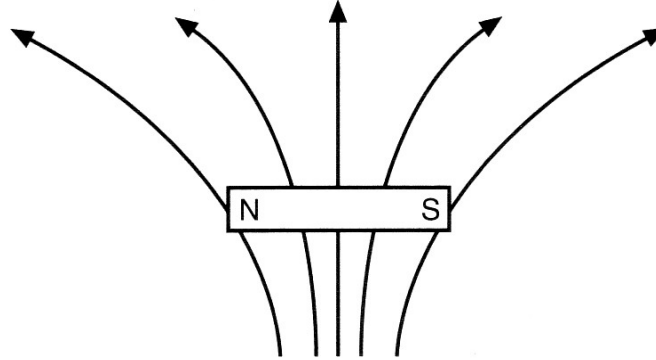


Which of the following statements is incorrect?

- A The power dissipated across the $3\ \Omega$ lamp is smaller than the power dissipated across the $6\ \Omega$ lamp.
- B The $3\ \Omega$ lamp is brighter than the $6\ \Omega$ lamp.
- C The current flowing in the $3\ \Omega$ lamp is larger than the current flowing in the $6\ \Omega$ lamp.
- D The potential difference across the $3\ \Omega$ lamp is the same as the potential

difference across the $6\ \Omega$ lamp.

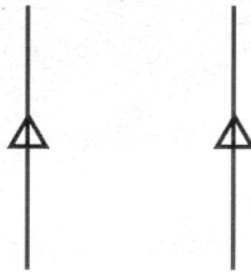
- 35** The diagram below shows the top view of a magnet suspended in an external magnetic field.



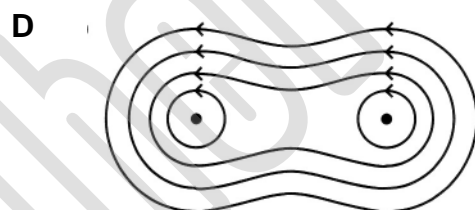
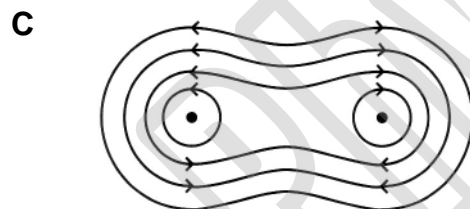
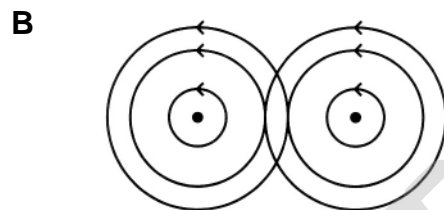
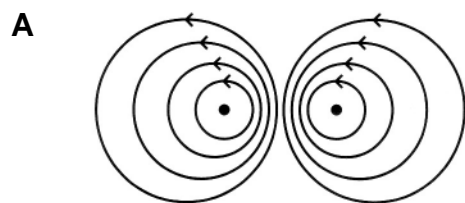
The magnet will

- A** move to the right.
- B** move to the left.
- C** rotate clockwise.
- D** rotate anticlockwise.

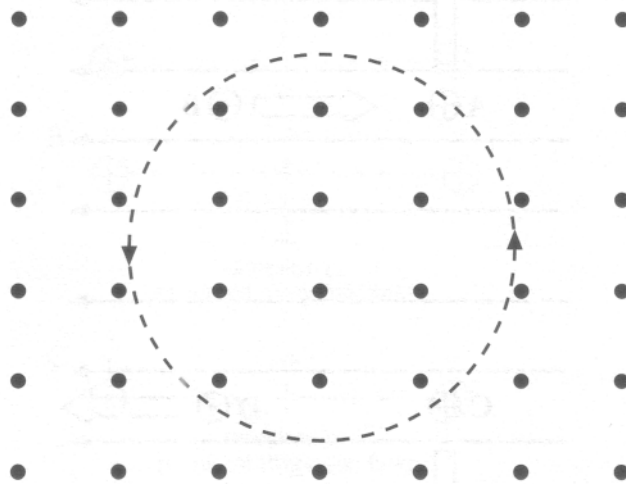
- 36 In the diagram below, two wires are placed close to each other and carry current in the same direction.



Which one of the following shows the correct magnetic field pattern from the top?

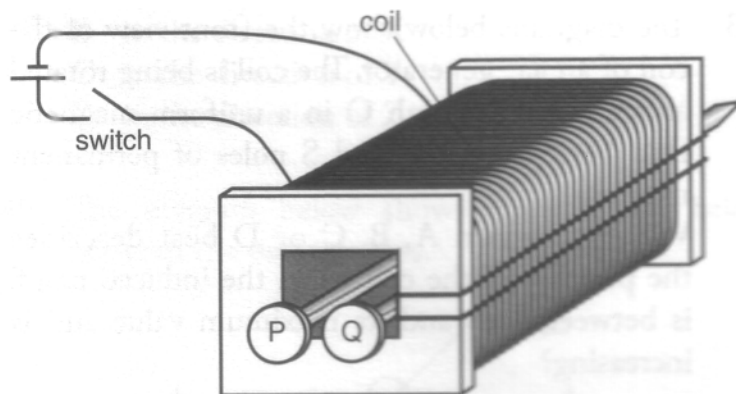


- 37** The diagram below shows the circular anti-clockwise path of a charged particle in a field. The direction of the field is out of the paper.



Ignoring the effect of gravity, which of the following correctly describes a possible state of charge of the particle and the nature of the field?

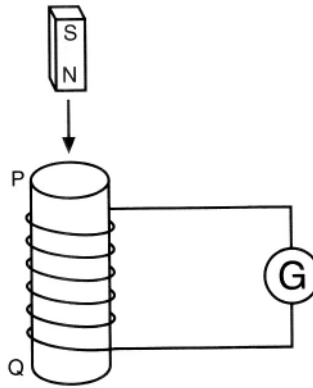
- | | Charge | Field |
|----------|----------|----------|
| A | negative | magnetic |
| B | positive | electric |
| C | negative | electric |
| D | positive | magnetic |
- 38** Two nails P and Q are placed inside a coil, as shown in the diagram below. P is free to move but Q is fixed. The coil is joined to a battery and a switch.



When the switch is closed, P

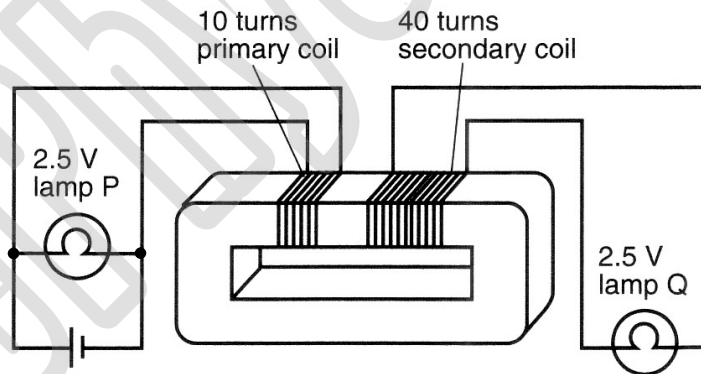
- A** shoots out of the coil.
- B** moves to and fro.
- C** moves towards Q.
- D** moves away from Q.

- 39 A magnet is dropped through a solenoid PQ coiled around a hollow tube. At the moments when the magnet is entering and leaving the coil, what are the polarities of the end P and end Q respectively?



	Polarity of P (magnet entering the coil)	Polarity of Q (magnet leaving the coil)
A	N	N
B	N	S
C	S	N
D	S	S

- 40 A student sets up a model transformer as shown below.



It is connected to a 2.5 V d.c. supply. Both lamps P and Q have the rating of 2.5 V, 50 W. What does the student notice about the lamps?

	Lamp P	Lamp Q
A	normal brightness	not lit
B	very bright	dim
C	normal brightness	very bright
D	dim	very bright