

Class:	Index No.:	Name: Answer Key w/ Solutions
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CRESCENT GIRLS' SCHOOL
SECONDARY FOUR
PRELIMINARY EXAMINATION

PHYSICS **6091 / 01**
Paper 1 Multiple Choice

02 September 2025
1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class in the spaces provided at the top of this page and on the optical 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 optical 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 What is the volume of air in a typical classroom in Crescent Girl's School?

A $8 \times 10^0 \text{ m}^3$ B $8 \times 10^1 \text{ m}^3$ **C** $8 \times 10^2 \text{ m}^3$ D $8 \times 10^3 \text{ m}^3$

volume of air in a typical classroom: (L) 16 m $\times$ (W) 12 (m) $\times$ (H) 4 m $\approx 800 \text{ m}^3$.
Hence correct order of magnitude is $\times 10^2 \text{ m}^3$

Ans: C

- 2 Which set of quantities are all scalars?

A displacement, force, work done
B distance, pressure, kinetic energy
C speed, weight, chemical energy
D velocity, gravitational field strength, moment

vectors: displacement, force, weight, velocity, gravitational field strength, moment

Ans: B

- 3 A car travels from town A to town B with an average speed of 45 km h^{-1} . It then travels from town B to town A along the same road with an average speed of 65 km h^{-1} .

What is the average speed of the car for the entire journey?

A 0 km h^{-1} B 20 km h^{-1} **C** 53 km h^{-1}

$$\text{From town A to town B: } \frac{d}{t_1} = 45 \rightarrow t_1 = \frac{d}{45}$$

$$\text{From town B to town A: } \frac{d}{t_2} = 65 \rightarrow t_2 = \frac{d}{65}$$

$$\text{Average speed} = \frac{2d}{t_1 + t_2} = \frac{2d}{\frac{d}{45} + \frac{d}{65}} = 53.2 \text{ km h}^{-1}$$

Ans: C

- 4 A moon buggy used by astronauts has a weight of 2100 N on the Earth.

The gravitational field strength on the Moon is $\frac{1}{6}$ of that on the Earth.

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

A 210 N **B** 350 N C 2100 N D 12600 N

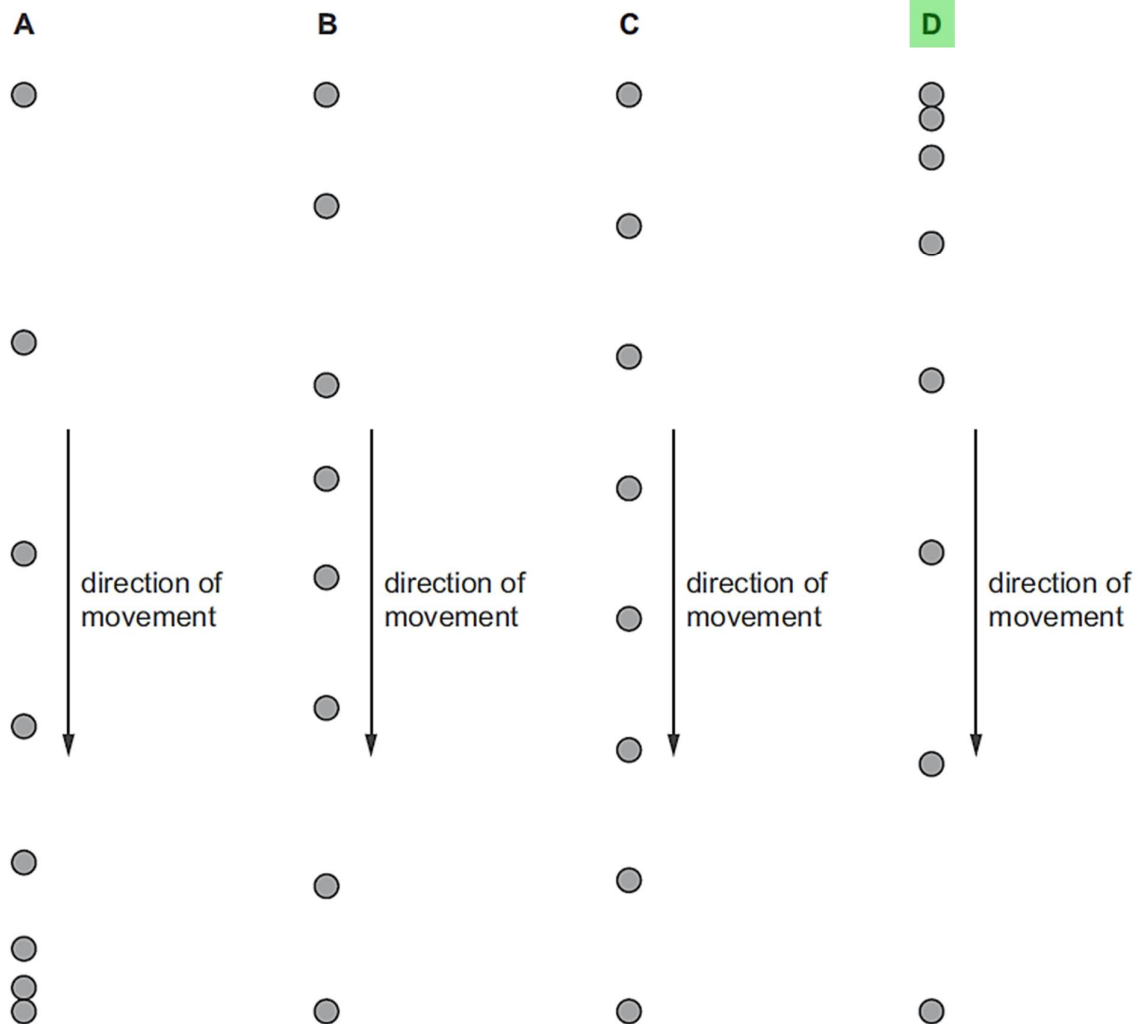
$$\text{weight on earth} = mg_{\text{earth}} = 2100 \text{ N}$$

$$\text{weight on moon} = m\left(\frac{1}{6} g_{\text{earth}}\right) = \frac{1}{6} \times \text{weight on earth} = \frac{1}{6} \times 2100 = 350 \text{ N}$$

Ans: B

- 5 An object falls without air resistance. Its position at equal time intervals is shown by a sequence of dots.

Which sequence of dots is correct?

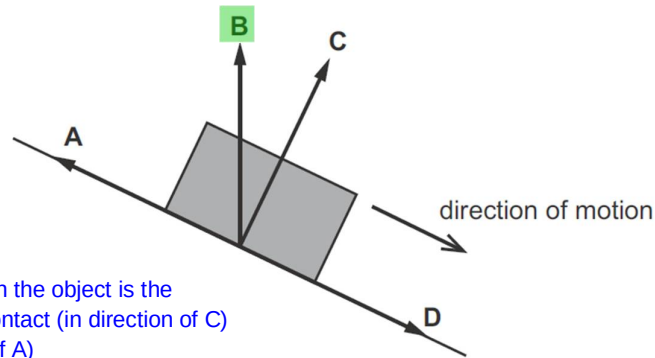


Without air resistance, object falls with a constant acceleration. Hence the displacement (which is given by the separation of the dots) for the next time interval increases.

Ans: D

- 6 An object slides down a rough slope as shown.

In which direction does the surface exert a force on the object?



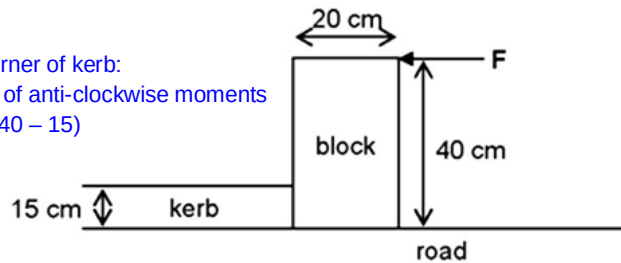
Force that surface acts on the object is the resultant of the normal contact (in direction of C) and friction (in direction of A)

Ans: B

- 7 The diagram shows a uniform solid block on a road next to a kerb that is 15 cm high.

Taking moments about top-right corner of kerb:
Sum of clockwise moments = Sum of anti-clockwise moments
 $(6 \times 10) \times 10 = F \times (40 - 15)$
 $F = 24 \text{ N}$

Ans: C



The block is 40 cm high, 20 cm thick and 30 cm long and has a mass of 6.0 kg.

Determine the minimum force, F, required to tilt the block onto the kerb.

- A 3.0 N B 15 N **C 24 N** D 30 N
- 8 A man uses clay to make a pot. He wants the pot to be as stable as possible when placed on a flat surface.

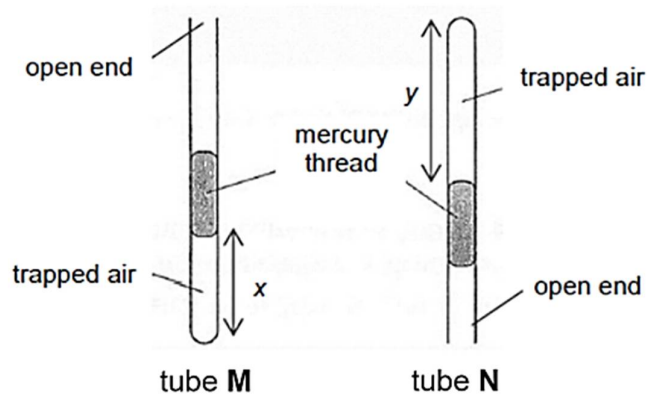
Which two features of the pot must the man consider?

- A** the area of the base and the height of the centre of gravity
B the density of the clay and the area of the base
C the density of the clay and the height of the centre of gravity
D the weight and the height of the centre of gravity

The stability of an object is affected by
1. the position of its C.G.
2. its base area

Ans: A

- 9 Two identical thin tubes, M and N, contain mercury as shown. One end is opened to the atmosphere and the other end has trapped air inside.



The pressure at the open ends is equal to atmospheric pressure.

For the tube on the left, pressure of trapped air is equal to the sum of atmospheric pressure and the pressure due to the column of liquid.

For the tube on the right, the sum of the pressure of trapped air and the pressure due to the column of liquid is equal to the sum of atmospheric pressure.

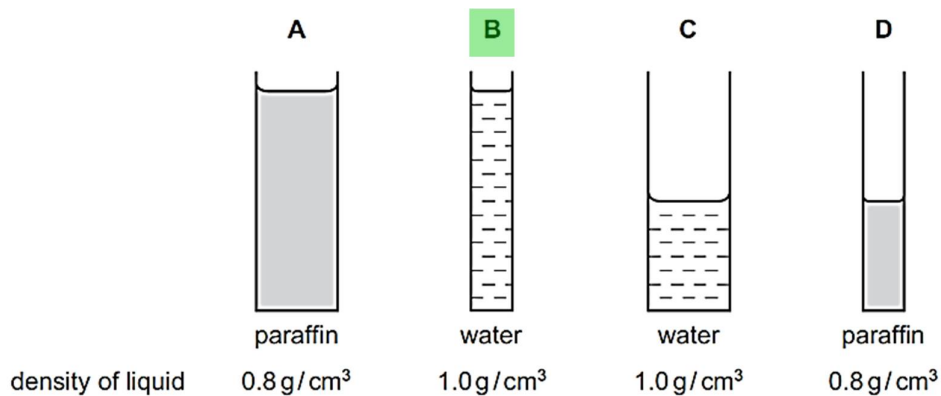
It is observed that x is shorter than y in length.

Ans: C

Which statement is the correct explanation?

- A Atmospheric pressure on the mercury is larger in M than that in N.
 - B Atmospheric pressure on the mercury is smaller in M than that in N.
 - C** Pressure of trapped air in M is larger than that in N.
 - D Pressure of trapped air in M is smaller than that in N.
- 10 The diagrams show liquids in containers.

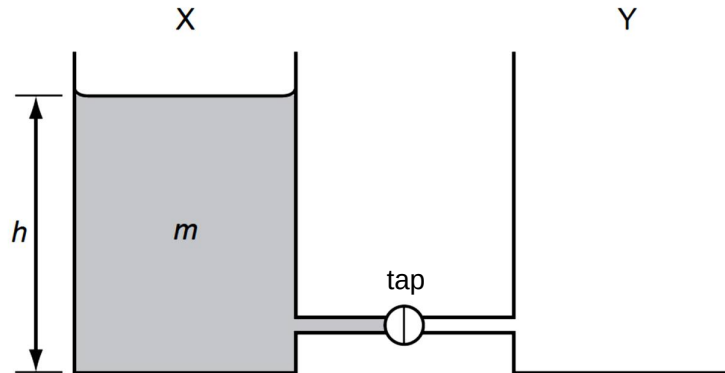
Which column of liquid exerts the greatest pressure on the base of its container?



The pressure exerted by liquid on base of container = $h\rho g$

Ans: B

- 11 The diagram shows two identical vessels X and Y connected by a very short pipe with a tap.



Initially, X is filled with water of mass m to a depth h and Y is empty. When the tap is opened, water flows from X to Y until the depths of water in both vessels are equal.

By considering the change to the position of the centre of gravity of the entire body of water, what is the decrease in the gravitational potential store of the water during this process?

- A 0 **B** $\frac{mgh}{4}$ C $\frac{mgh}{2}$ D mgh

Depth of water at equilibrium is $\frac{h}{2}$. Hence, the centre of gravity of the water decreases from $\frac{h}{2}$ to $\frac{h}{4}$.
Thus loss in potential energy is $\frac{mgh}{4}$.

Ans: B

- 12 A 15 W lamp is turned on for 30 minutes. During this period, it transfers 1000 J of energy to its internal store and 2500 J of energy to the internal store of the surrounding air.

What is the efficiency of the lamp?

- A 0.13 B 0.29 C 0.71 **D** 0.87

$$\begin{aligned} \text{efficiency} &= \frac{\text{useful work}}{\text{total energy input}} \\ &= \frac{15 \times 30 \times 60 - (1000 + 2500)}{15 \times 30 \times 60} \\ &= 0.87 \end{aligned}$$

Ans: D

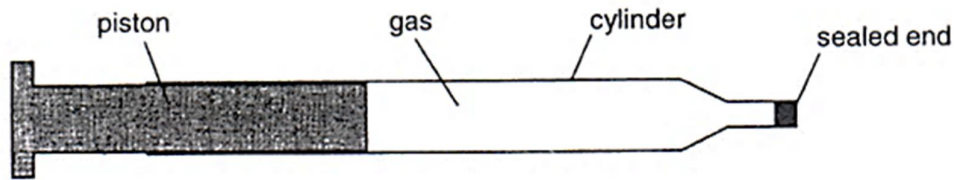
13. What happens when a solid is heated and expands?

- 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 do not change size.

size of molecules does not change with temperature
the distance between molecules increases with temperature

Ans: A

- 14 The syringe in the diagram contains a gas at atmospheric pressure. The piston moves freely along the cylinder without any friction. When the syringe is heated from $40\text{ }^{\circ}\text{C}$ to $100\text{ }^{\circ}\text{C}$, the piston moves outwards. When the temperature becomes steady, the piston stops moving.



Which row correctly describes how the value of each of the following quantities at $100\text{ }^{\circ}\text{C}$ compares with its corresponding value at $40\text{ }^{\circ}\text{C}$, after the piston stops moving?

	average speed of gas molecules	pressure of gas in the cylinder
A	increases	increases
B	increases	unchanged
C	unchanged	increases
D	unchanged	unchanged

microscopic kinetic energy and hence average speed of molecules increases with temperature
pressure of gas must be equal to atmospheric pressure for piston to stop moving

Ans: B

15. A copper rod is heated at one end.

Which statement describes how heat transfer occurs in the copper?

- A Energetic copper molecules move from the cooler end to the hotter end.
- B Energetic copper molecules move from the hotter end to the cooler end.
- C Energetic free electrons move from the cooler end to the hotter end.
- D** Energetic free electrons move from the hotter end to the cooler end.

In metals, free electrons transfer energy away from hotter region to cooler region.

Ans: D

- 16 During a barbeque, a piece of aluminium foil is used to wrap around a potato before placing it in the fire. The foil has a shiny and dull side.

Which side should be on the outside and why?

	outside surface	reason
A	dull	absorbs heat faster
B	dull	conducts heat faster
C	shiny	absorbs heat faster
D	shiny	conducts heat faster

A shiny surface will reflect infrared waves (causes heating), which reduces its absorption.

Ans: A

- 17 The temperature of a body increases by 1 °C.

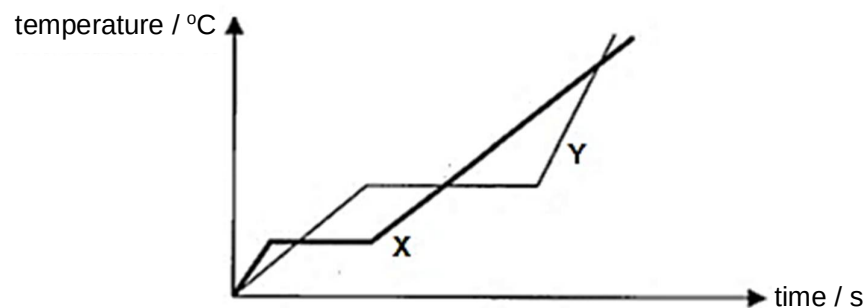
Which other quantity also increases?

- A heat capacity
- B** internal energy
- C specific heat capacity
- D specific latent heat

Heat capacity, specific heat capacity and specific latent heat are independent of the change in temperature.

Ans: B

- 18 Equal masses of solids X and Y are heated successively in a well-insulated container. Heat is transferred to each of them at the same rate. A temperature-time graph for the process is shown below.



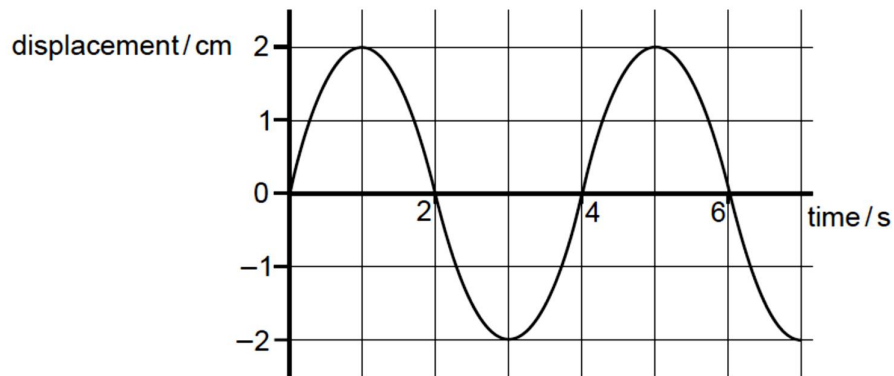
Which statement is correct about X and Y?

- A Solid X has a higher melting point than solid Y.
- B** Solid X has a lower specific heat capacity than solid Y.
- C Solids X and Y have the same specific latent heat of fusion.
- D Solids X and Y melt with the same amount of heat transferred.

Before melting, X took a shorter time for the same temperature rise. Thus, less heat is transferred to X than Y. Using $Q = mc\Delta\theta$, a smaller Q and the same mass and $\Delta\theta$ for both X and Y means a smaller c for X.

Ans: B

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



Which of the following gives the features of the wave?

	amplitude / cm	frequency / Hz	type
A	2.0	0.17	transverse
B	2.0	0.25	transverse or longitudinal
C	4.0	0.17	transverse or longitudinal
D	4.0	0.25	longitudinal

From the graph, the wave has an amplitude (max. displacement) of 2.0 cm and a period of 4.0 s, hence a frequency of $1/4.0 = 0.25$ Hz. As the type of wave was not mentioned, it can either be a transverse or longitudinal wave.

Ans: B

- 20 A police car with its siren sounding is stationary in heavy traffic. A pedestrian notices that, although the loudness of the sound produced does not change, the pitch varies.

Which row describes the amplitude and the frequency of the sound?

	amplitude	frequency
A	constant	constant
B	constant	varying
C	varying	constant
D	varying	varying

Loudness is affected by the amplitude of the sound wave.

Pitch is affected by the frequency of the sound wave.

Ans: B

- 21** Excessive exposure to some regions of the electromagnetic spectrum can cause harmful effects to people.

Which regions cause mutation of cells in the body, skin burns and internal heating of body cells?

	mutation of cells	skin burns	internal heating of body cells
A	radio waves	infrared	visible light
B	radio waves	ultraviolet	microwaves
C	X-rays	infrared	microwaves
D	X-rays	ultraviolet	visible light

mutation of cells can be caused by X-rays and γ-rays.

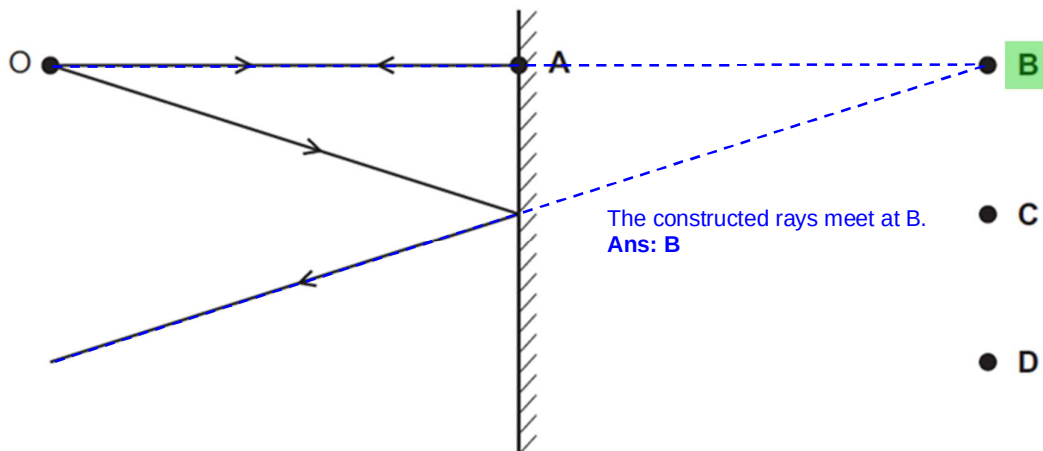
skin burns can be caused by ultraviolet and infrared radiation.

internal heating of body cells is caused by microwaves (of frequency equal to the natural frequency of water molecules)

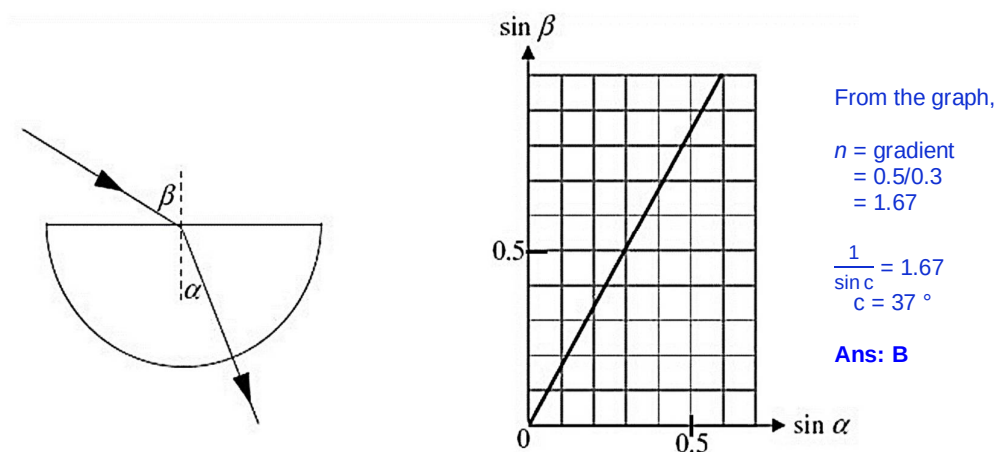
Ans: C

- 22** The diagram shows two divergent rays of light from an object O being reflected from a plane mirror.

At which position is the image formed?

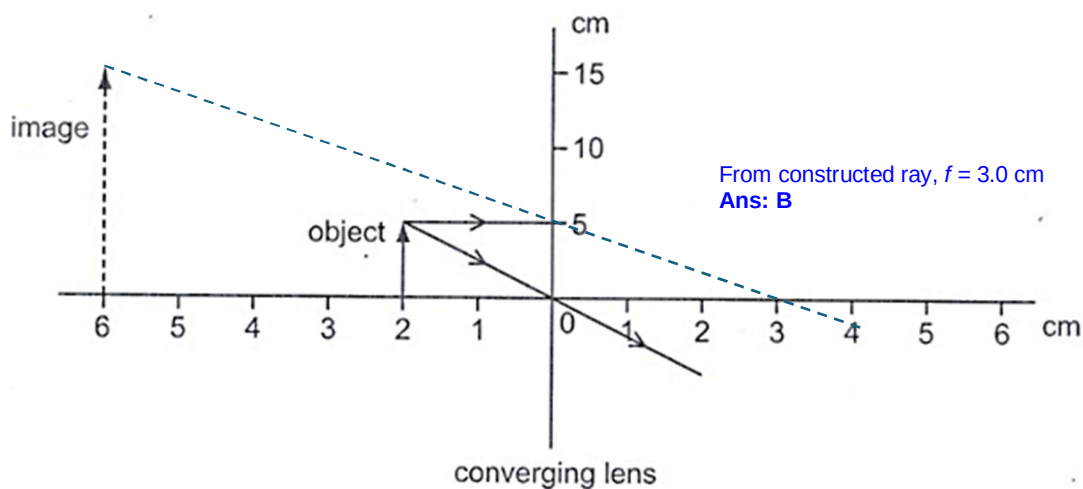


- 23 A light beam strikes a semi-circular glass block and refracts out as shown. A graph of $\sin \beta$ against $\sin \alpha$ is plotted.



What is the critical angle of the glass block?

- A 24° **B 37°** C 44° D 90°
- 24 An object of height 5.0 cm is placed 2.0 cm from a converging lens which is being used as a magnifying glass.



The image produced is 6.0 cm from the lens and has height 15.0 cm.

What is the focal length of the lens?

- A 2.0 cm **B 3.0 cm** C 4.0 cm D 6.0 cm

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



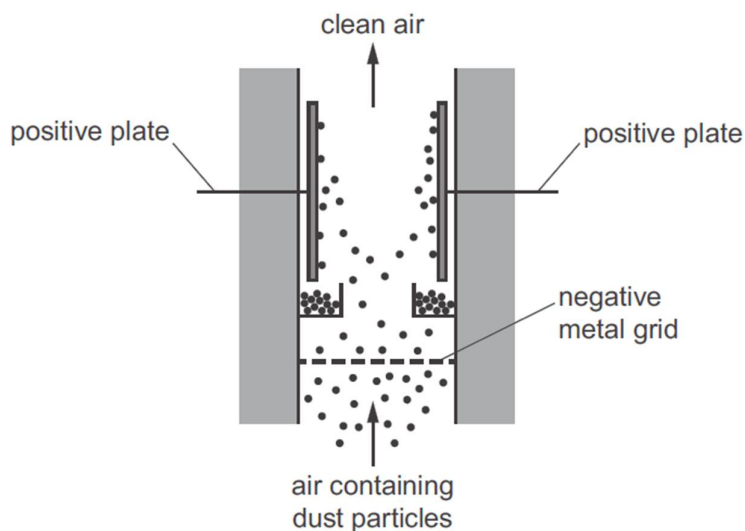
What is the direction of the electric field?

- A** to the left
- B** to the right
- C** down the page
- D** up the page

Direction of electric field is the direction where a **positive** charge experiences a force.

Ans: A

- 26 The diagram shows an electrostatic precipitator which is used to remove dust particles from air after they are charged by the negative metal grid.



What happens at the negative grid?

- A** Dust particles gain electrons.
- B** Dust particles gain protons.
- C** Dust particles lose electrons.
- D** Dust particles lose protons.

Electrons from the negative metal grid (at negative potential) will move onto the dust particles (at zero potential) upon contact.

Ans: A

- 27 600 C of charge passes through a point in an electrical circuit in 4 minutes.

What is the current flowing through the point?

- A 6.7×10^{-3} A B 0.40 A **C** 2.5 A D 150 A

$$I = \frac{Q}{t} = \frac{600}{4 \times 60} = 2.5 \text{ A}$$

Ans: C

- 28 X is a piece of wire with length l , cross-sectional area a and resistance R ,

Wire Y is made from the same material and is connected to wire X to produce a component with a total resistance of $\frac{R}{2}$.

What are the dimensions of Y and how is it connected to X?

	length	area	connection
A	$2l$	$0.5a$	in parallel
B	$2l$	$0.5a$	in series
C	$4l$	$4a$	in parallel
D	$4l$	$4a$	in series

For total resistance to be lower than individual resistance of X, connection must be in parallel.

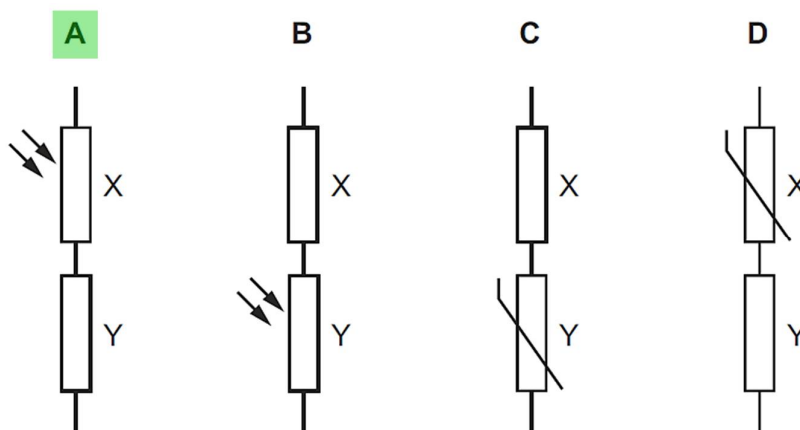
For total resistance to be half that of X, Y needs to have the same resistance.

Since $R = \rho l / A$, length l , and cross-sectional area a must change by the same factor.

Ans: C

- 29 Each potential divider is placed in a circuit with a power supply.

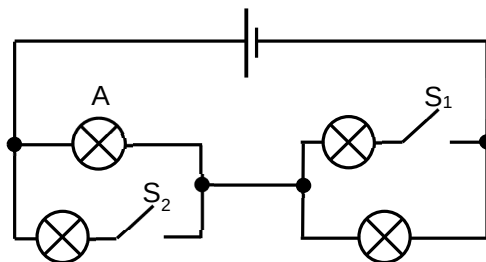
Which potential divider makes the potential difference across component Y increase when the light intensity increases?



The resistance of an LDR decreases with an increase in light intensity. By potential divider principle, the p.d. across the LDR will decrease.

Ans: A

- 30 The circuit below shows the arrangement of 4 identical light bulbs.



In which of the following situations would the bulb marked A be the brightest?

- A When both switches are open.
- B When S_1 is open and S_2 is closed.
- C** When S_1 is closed and S_2 is open.
- D When both switches are closed.

For A to be the brightest, the current through it / p.d. across it should be the highest.

Ans: C

- 31 An electrical appliance is rated for 480 W, 240 V.

Which is the most suitable fuse that should be fitted to this appliance?

- A 1 A
- B 2 A
- C** 3 A
- D 5 A

Operating current, $I = P / V = 480 / 240 = 2$ A. Hence fuse rating needs to be the next higher possible (than 2 A).

Ans: C

- 32 In a typical day of a household, a 450 W refrigerator is turned on continuously for one day while a 3.0 kW air-conditioner is used for 8.0 hours.

Given that the cost of electricity is \$0.32 per kWh, what would be the cost of using the two electrical appliances each day?

- A \$ 8.83
- B \$ 10.11
- C** \$ 11.14
- D \$ 19.20

cost = $(0.45 \times 24 + 3.0 \times 8) \times \$0.32 = 11.14$

Ans: C

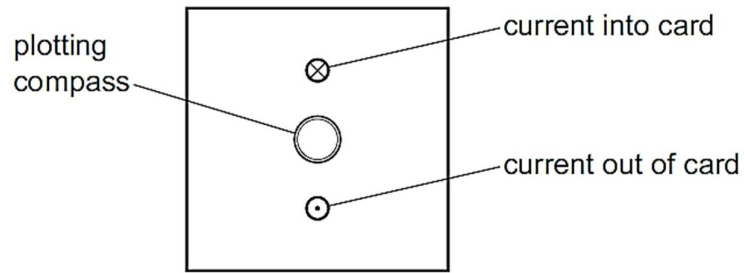
- 33 Which safety precautions must be taken when wiring an electrical kettle that has a stainless-steel outer casing?

- A** It must be earthed and have a fuse in the live wire.
- B It must be earthed and have a fuse in the neutral wire.
- C It needs a fuse in the live wire but does **not** need to be earthed.
- D It needs a fuse in the neutral wire but does **not** need to be earthed.

A fuse should always be placed in series on the live wire. Since appliance has a metal external casing, it must also be earthed.

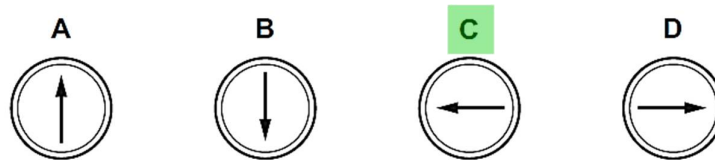
Ans: A

- 34 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.

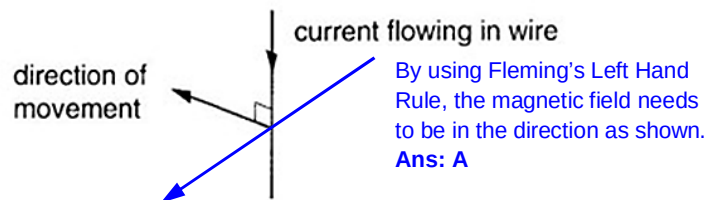
Which diagram shows the direction in which the needle of the plotting compass points?



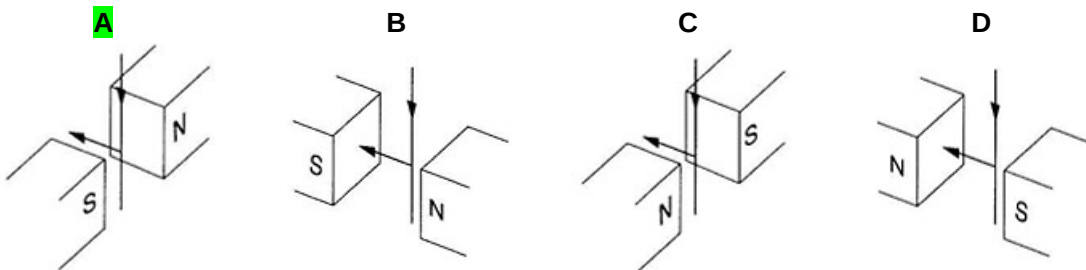
By using right hand grip rule, the resultant field direction due to both wires is to the left.

Ans: C

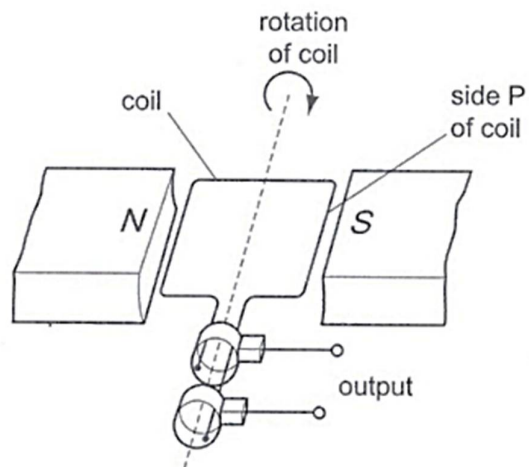
- 35 A current flows in a wire hanging between the poles of a magnet. The wire starts to move in the direction shown.



Which diagram shows the position and the polarity of the magnet?



- 36 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?

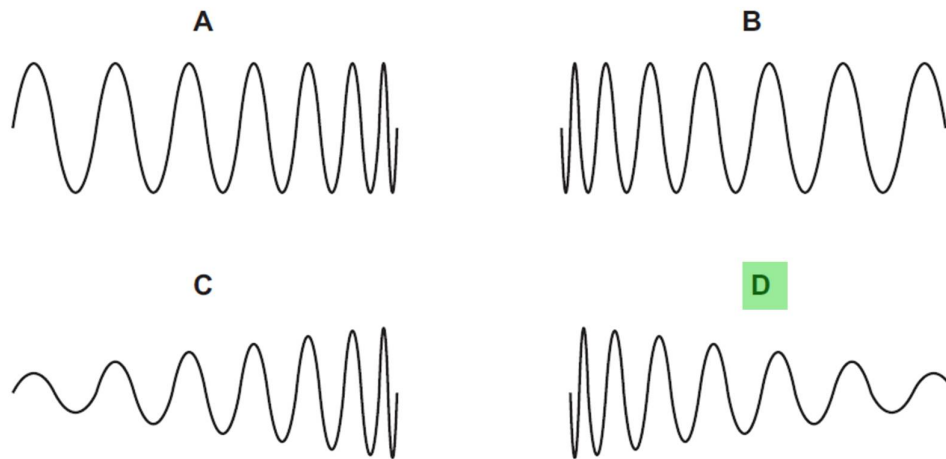
	orientation of coil	position of P
A	horizontal	near the N-pole only
B	horizontal	near the N-pole or near the S-pole
C	vertical	at the top only
D	vertical	at the top or bottom

output voltage is zero when flux linkage through the coil is maximum, which occurs when it is in the vertical position

Ans: D

- 37 In an alternating current (a.c.) generator, a magnet rotates near a coil of wire. A time-based waveform of the induced electromotive force (e.m.f.) in the coil is obtained.

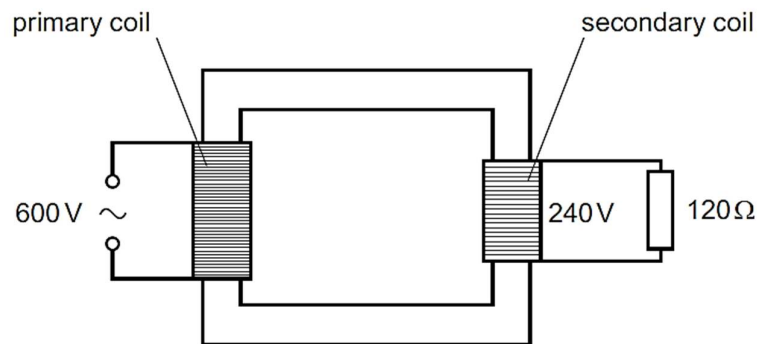
Which trace is produced as the rotation of the magnet slows down?



As rotation of the magnet slows down, the period of the induced e.m.f. increases and the magnitude of the induced e.m.f. decreases.

Ans: D

- 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 120 Ω .



What is the power dissipated in the resistor and the current in the primary coil?

	power / W	current / A
A	120	0.20
B	120	5.0
C	480	0.80
D	480	1.3

power developed in primary coil
 = power dissipated in resistor
 = $V^2 / R = 240^2 / 120 = 480 \text{ W}$

$I_P = P / V_P = 480 / 600 = 0.80 \text{ A}$

Ans: C

- 39 The reading on a detector placed near a radioactive material is 536 counts per second.

The background count rate is 44 counts per second.

The half-life of the radioactive material is 34 hours.

What is the expected reading on the detector after 68 hours?

A 123 counts per second

B 134 counts per second

C 167 counts per second

D 178 counts per second

Initial count of source = $536 - 44 = 492$ cps

Count of source after 2 half-lives = $492 \times (\frac{1}{2})^2 = 123$ cps

Recorded count = $123 + 44 = 167$ cpm

Ans: C

- 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 form a heavier nucleus

C the melting of an unstable nucleus

D the splitting of a nucleus into two lighter nuclei

nuclear fusion is the joining together of two nuclei to form a heavier nucleus

Ans: B