XINMIN SECONDARY SCHOOL
新民中学
SEKOLAH MENENGAH XINMIN

Preliminary Examination 2024

CANDIDATE NAME					
CLASS				INDEX NUMBER	

PHYSICS **6091/01**

Secondary 4 Express **28 Aug 2024**

Setter: Ms Kris Chua
Vetter: Mr Zhuang Haoyang

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.

For Examiner's Use	
Total	/40
Parent's Signature	

[Turn over

1 A student determines the circumference of a football.

Which instrument gives a reading that is the circumference of the football?

A digital calipers

B digital micrometer gauge

C measuring tape

D metre rule

2 Which of the following groups of physical quantities consists only of scalars?

A force, time, velocity

B mass, speed, time

C acceleration, force, velocity

D acceleration, mass, speed

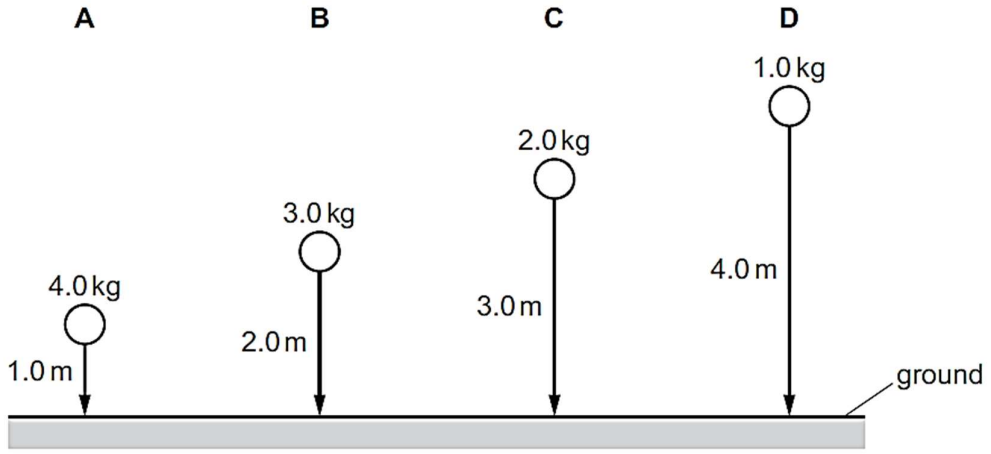
3 A metal cube has a mass of 15 g. Each side measures 4.0 cm. The density of the metal is 3.0 g/cm^3. There is empty space in the middle of the cube.

What is the volume of the empty space?

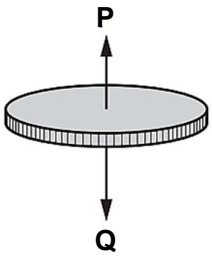
A 5.0 cm^3 **B** 11 cm^3 **C** 19 cm^3 **D** 59 cm^3

4 Four balls with different masses are dropped from the heights shown. Air resistance may be ignored.

Which ball has the smallest average speed?



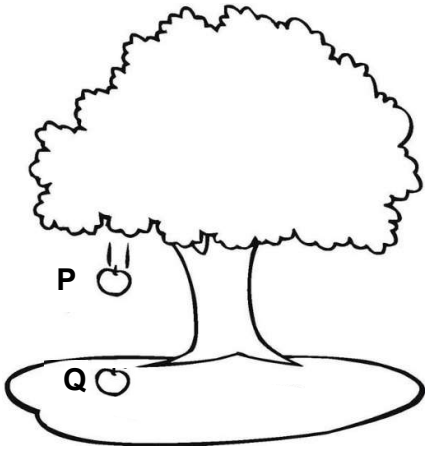
5 A coin falls from rest through the air and eventually reaches a constant speed. There is a resultant force acting on the coin due to the two forces **P** and **Q** shown in the diagram.



What happens to force **P** and what happens to the resultant force **before** the coin reaches constant speed?

	force **P**	resultant force
A	decreases	increases
B	decreases	decreases
C	increases	decreases
D	increases	increases

6 An apple falls freely from a tree. The diagram shows the apple at **P**, as it starts to fall, and at **Q**, just before it hits the ground. The acceleration due to gravity is 10 m/s^2.

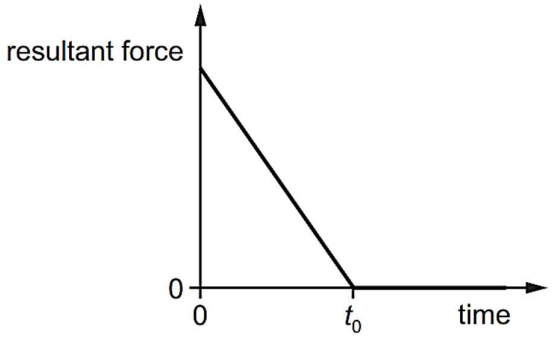


What is the acceleration of the apple at position **P** and at position **Q**?

	acceleration at **P** m/s^2	acceleration at **Q** m/s^2
A	0	0
B	0	10
C	10	0
D	10	10

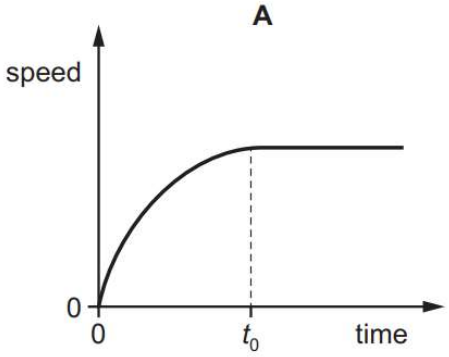
[Turn over

7 A resultant force acts on an object and causes it to move in a straight line. The graph shows how the resultant force varies with time.

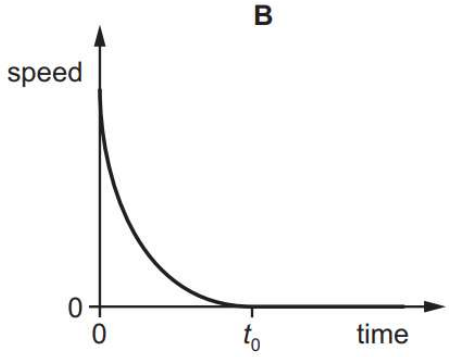


Which graph is the speed-time graph for the object?

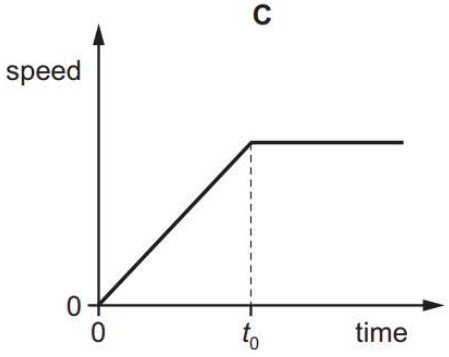
A



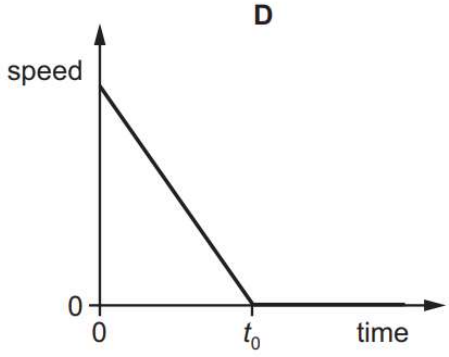
B



C



D



8 The diagram shows a uniform metal bar of mass 30 kg. A student pulls straight up with a force **F** at one end **Y** of the bar so that it pivots about the end **X**.

When the end **Y** just comes off the ground, what is the value of the force **F**?

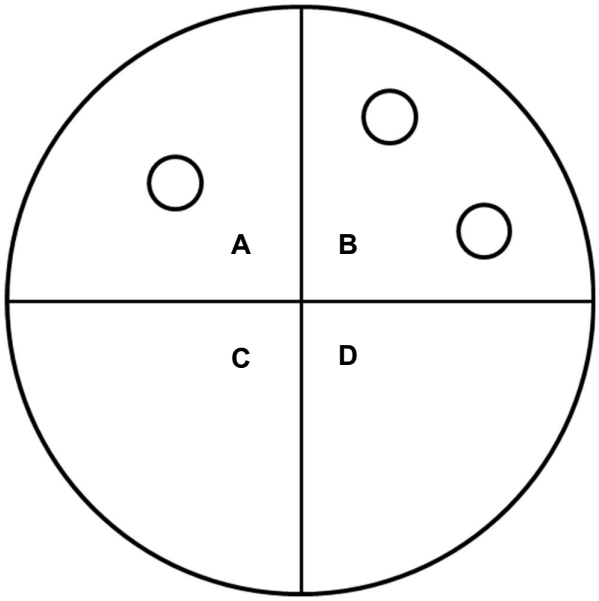
A 15 N

B 60 N

C 150 N

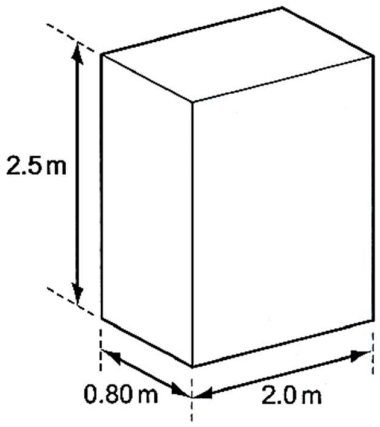
D 240 N

9 A circular lamina with uniform density has three holes drilled on it as shown in the diagram below. Where is the most possible location of its centre of gravity?



[Turn over

10 The base for a statue rests on level ground. It is made from stone and is 2.0 m long, 2.5 m high and 0.80 m wide. It has a weight of 96000 N.



What is the pressure that the base exerts on the ground?

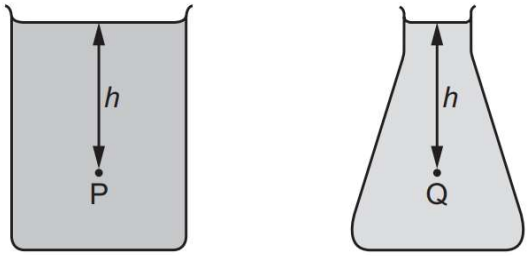
A 24 kPa

B 48 kPa

C 60 kPa

D 60 000 kPa

11 Two glass containers filled with different liquids are placed next to each other. Point **P** is a distance *h* below the surface of the liquid in one container. Point **Q** is a distance *h* below the surface of the liquid in the other container.



Why is the pressure at **P** different from the pressure at **Q**?

A The atmospheric pressure is different at **P**.

B The densities of the liquids are different.

C The gravitational field strength is different at **P**.

D The shapes of the containers are different.

12 Some solar panels have a total area of 12 m^2. Each 1.0 m^2 of the panels receives 0.85 kJ of energy from the Sun in 1.0 s. The efficiency of the panels is 16 %.

How much power do they produce?

A 1.6 kW

B 2.2 kW

C 64 kW

D 160 kW

13 A parachutist has opened his parachute and is falling to Earth at constant speed.

What is the overall energy store conversion taking place as he falls?

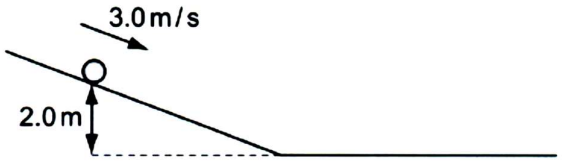
A kinetic store → internal store

B kinetic store → gravitational potential store

C gravitational potential store → internal store

D gravitational potential store → kinetic store

14 A ball of mass 0.40 kg rolls down a hill. 2.0 m above the bottom of the hill, the speed of the ball is 3.0 m/s.



The gravitational field strength g is 10 N/ kg.

What is the kinetic energy of the ball at the bottom of the hill given that the work done to overcome friction is 1.8 J?

A 1.8 J

B 8.0 J

C 8.6 J

D 9.8 J

15 The simple kinetic theory explains that when a solid at melting point melts, the molecules

A grow in size to become gas molecules.

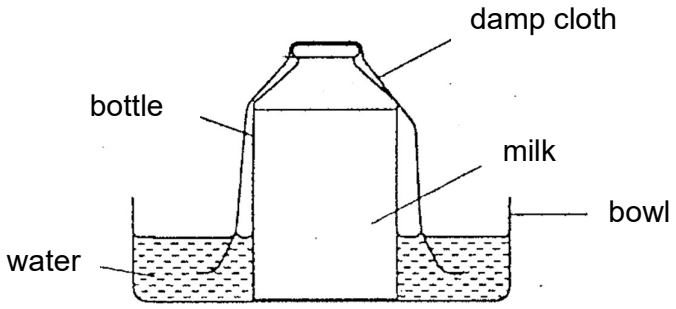
B break off their intermolecular bonds.

C vibrate faster and collide more often with one another.

D grow in size and form bubbles.

[Turn over

16 To keep a bottle of milk cold without a refrigerator on a hot day, the bottle can be covered with a damp cloth in a bowl of water.



How does this method keep the milk cold?

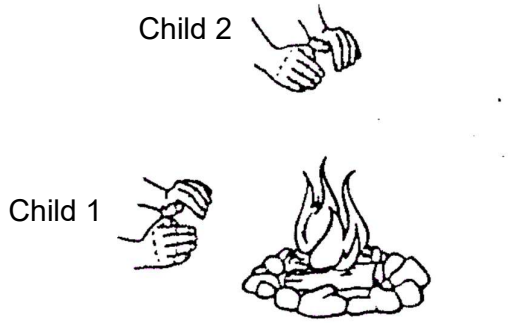
A Milk condenses on the cloth.

B Milk evaporates from the cloth.

C Water condenses on the cloth.

D Water evaporates from the cloth.

17 On a cold night, two children sit next to a campfire to warm their hands. Their hands are at the same distance from the fire. Child 2 holds his hand over the fire and child 1 holds her hands in front of the fire.



How does the heat from the fire reach each child's hands?

	Child 1	Child 2
A	convection only	radiation only
B	convection	radiation only
C	radiation only	convection and radiation
D	radiation only	convection only

18 A liquid is heated and its temperature rises.

Which of the following statements about the particles of the liquid is correct?

A The kinetic energy and internal energy of the liquid particles remain constant.

B The kinetic energy of the liquid particles remains constant but the internal energy of the liquid particles increases.

C The kinetic energy of the liquid particles increases but the internal energy of the liquid particles remains constant.

D The kinetic energy and internal energy of the liquid particles increase.

19 An ice-cube has a mass of 7.50 g. The ice-cube is at 0 °C. Heat from the surroundings reaches the ice-cube at an average rate of 1.25 J/s.

Given that the specific latent heat of fusion of ice is 330 J/g, how long does it take the ice to melt?

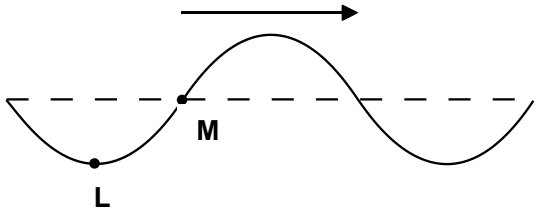
A 35.5 s

B 55.5 s

C 1980 s

D 3120 s

20 The diagram shows a wave on a rope. The wave is travelling from left to right.



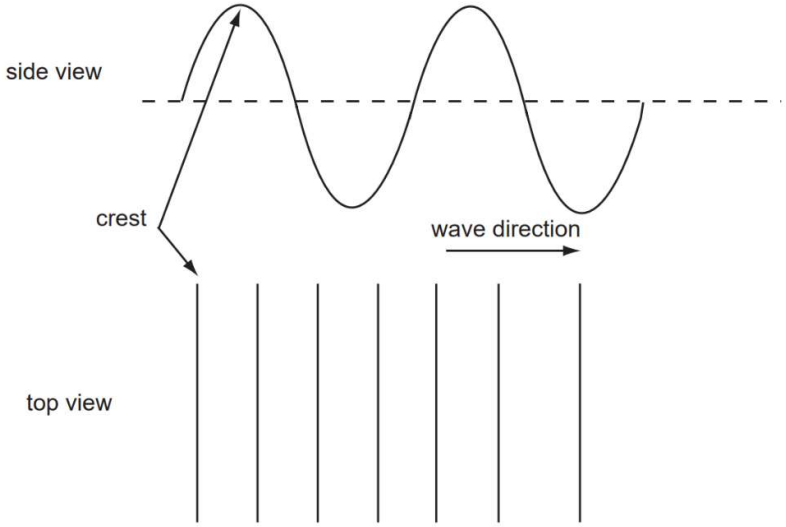
At the instant shown, point L is at a maximum displacement and point M has zero displacement.

Which row in the table correctly describes the motion of points L and M during the next **half** cycle of the wave?

	Point L	**Point M**
A	rises	falls
B	rises	falls then rises
C	rises then falls	rises
D	rises then falls	falls then rises

[Turn over

21 A ripple tank is used to study water waves. The diagram shows a top view and a side view of a wave. A wave crest is marked.



What is the speed of the wave?

A the distance travelled horizontally by a crest in one second

B the distance travelled vertically by a crest in one second

C the number of wave crests passing a point in one second

D the time taken for a crest to make one vibration

22 A guitar string is made to vibrate. What would make the pitch of the noise rise?

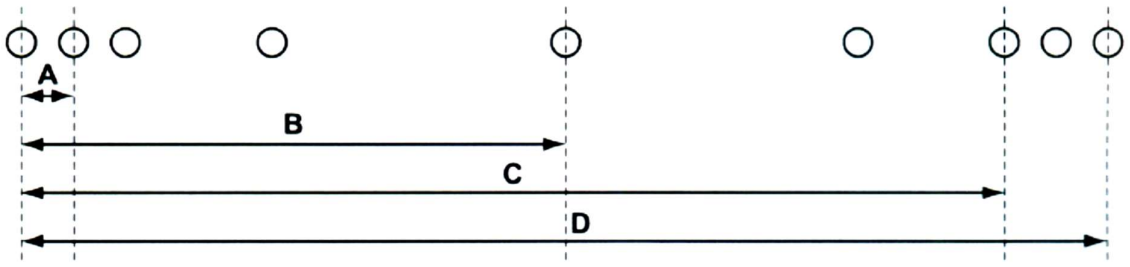
A A decrease in the amplitude of vibration.

B A decrease in the frequency of vibration.

C An increase in the amplitude of vibration.

D An increase in the frequency of vibration.

23 A sound wave passes through air. The diagram represents the arrangement of air molecules at one instant. Which distance is the wavelength of the sound wave?



24 Which of the following lists of electromagnetic radiation is arranged in order of increasing wavelength?

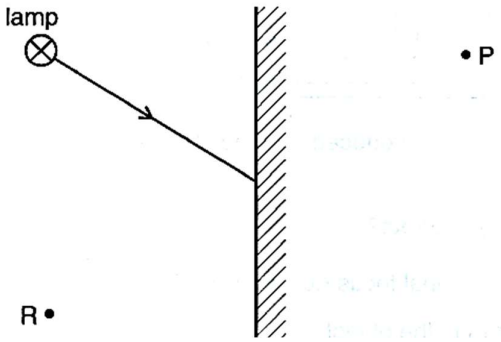
A gamma, ultraviolet, infrared, radio

B infrared, radio, ultraviolet, gamma

C ultraviolet, radio, gamma, infrared

D radio, ultraviolet, infrared, gamma

25 The diagram shows a ray of light from one point on a lamp striking a plane mirror.



The image of the point on the lamp formed by the mirror is

A at P and is real.

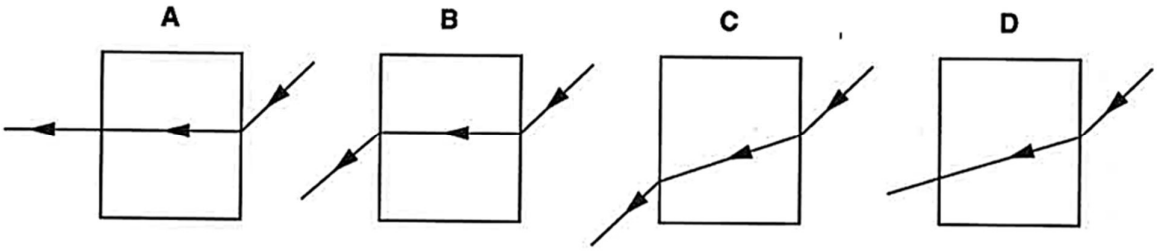
B at P and is virtual.

C at R and is real.

D at R and is virtual.

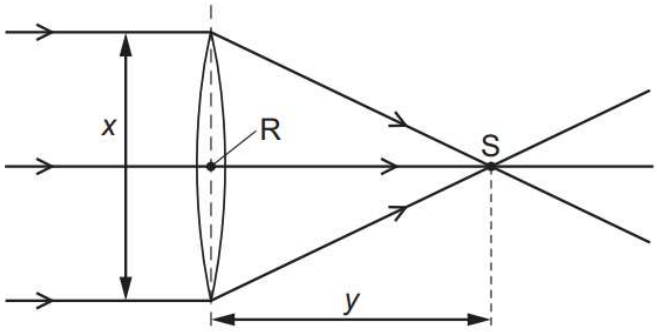
26 A ray of light travels from air into a glass block.

Which diagram correctly shows the path of the ray through the glass block?



[Turn over

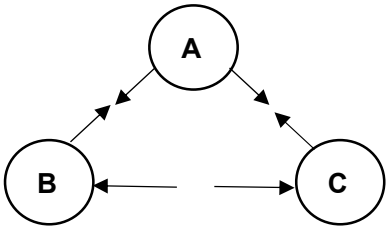
27 The diagram shows three rays of light passing through a converging lens.



Which labelled point is the principal focus of the lens, and which labelled distance is the focal length of the lens?

	principal focus	focal length
A	R	*x*
B	R	*y*
C	S	*x*
D	S	*y*

28 The diagram shows the arrangement of three charged metal spheres, **A**, **B** and **C**.



The arrows indicate the direction of the electric forces acting between the spheres. At least two of the spheres are positively charged.

Which sphere, if any, could be negatively charged?

A Sphere **A**

B Sphere **B**

C Sphere **C**

D No sphere

29 The wire of a heating element has resistance *R*. The wire breaks and is replaced by a different wire. Data for the original wire and the replacement wire are shown in the table.

	length	diameter	resistivity of metal
original wire	l	d	ρ
replacement wire	l	$2d$	2ρ

What is the resistance of the replacement wire?

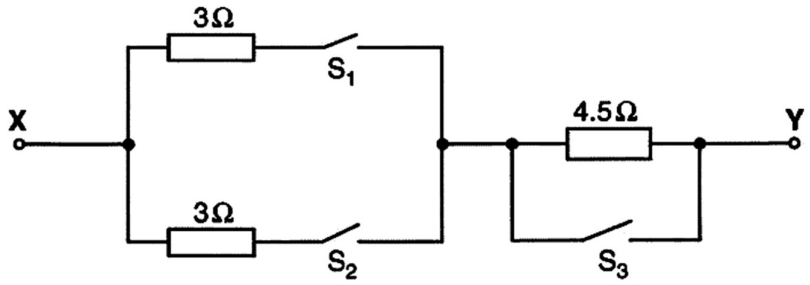
A $\frac{R}{4}$

B $\frac{R}{2}$

C R

D $2R$

30 The diagram shows a circuit in which all the switches are open.



Which switch positions would obtain a resistance of 6 Ω between **X** and **Y**?

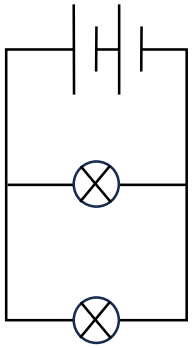
	S_1	S_2	S_3
A	closed	closed	closed
B	closed	closed	open
C	closed	open	closed
D	closed	open	open

[Turn over

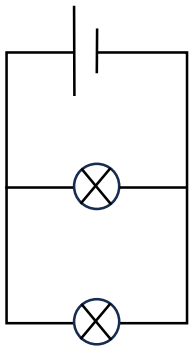
31 The circuits contain identical lamps and identical cells.

In which circuit will the lamps be the brightest?

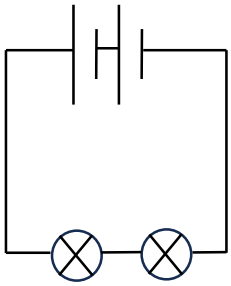
A



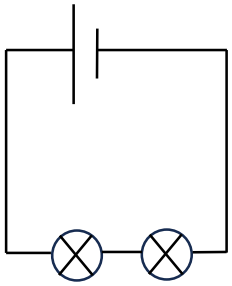
B



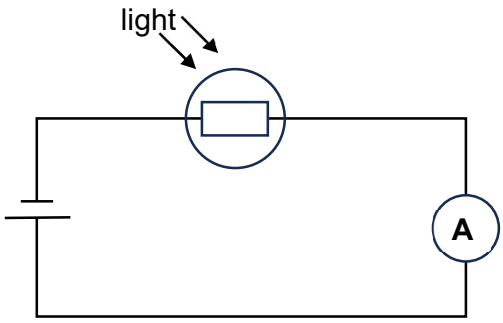
C



D



32 In the circuit shown, the brightness of the light reaching the light-dependent resistor increases.



What happens to the current through the ammeter?

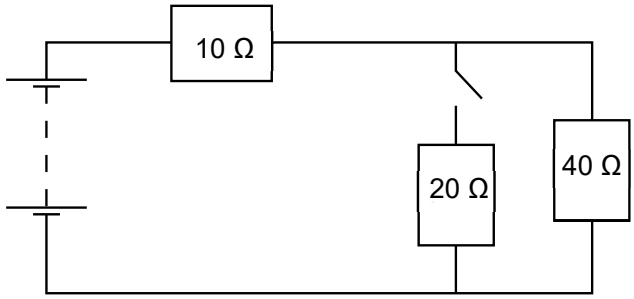
A It becomes zero.

B It decreases.

C It does not change.

D It increases.

33 A circuit is set up as shown in the diagram.



When the switch is closed, the potential difference across the 20 Ω resistor would

A equal the potential difference across the 10 Ω resistor

B be twice the potential difference across the 10 Ω resistor

C equal the potential difference across the 40 Ω resistor

D be half the potential difference across the 40 Ω resistor

34 The case of an electric fan is earthed. The plug to the fan contains a 5 A fuse. There is a current of 4 A when the fan works normally.

The cable to the fan becomes so worn that the live wire makes electrical contact with the metal case.

What happens?

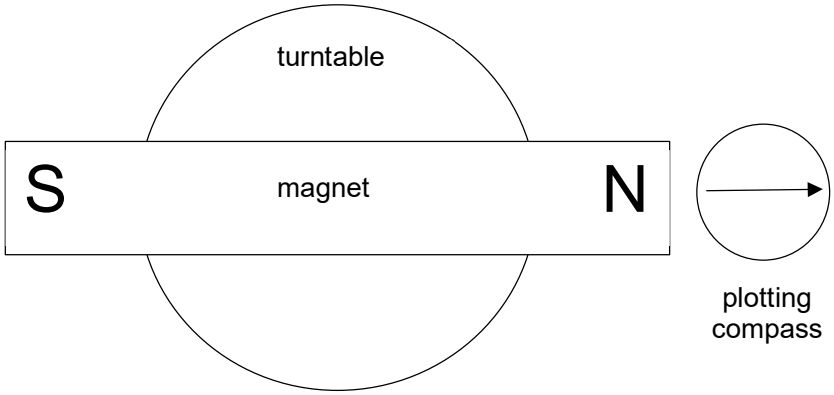
A The current flows to earth and the fuse is not affected.

B The fuse melts and switches off the circuit.

C The metal case becomes live and dangerous.

D The metal case becomes very hot.

35 The figure shows a bar magnet resting on a turntable. A plotting compass is placed in front of the magnet as shown.



When the turntable rotates in a clockwise direction, the compass needle

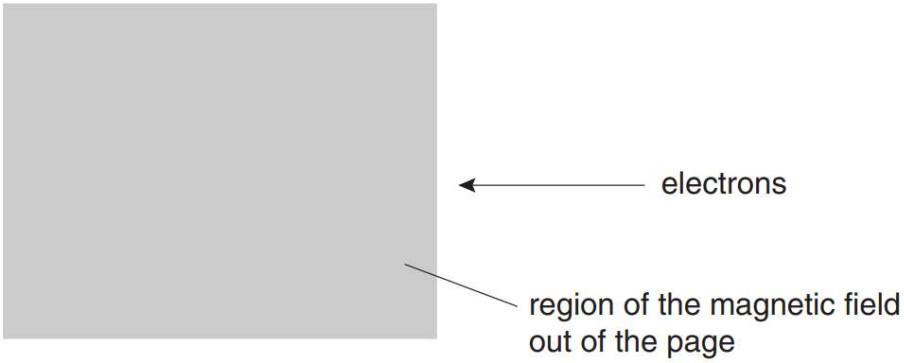
A does not move.

B rotates anticlockwise.

C rotates clockwise.

D oscillates.

36 The diagram shows a beam of electrons entering a magnetic field. The direction of the magnetic field is out of the page.



In which direction does the deflection of the electrons occur?

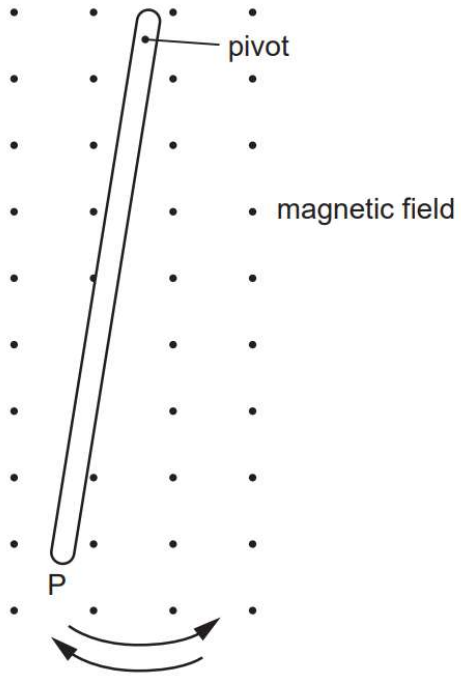
A into the page

B out of the page

C towards the bottom of the page

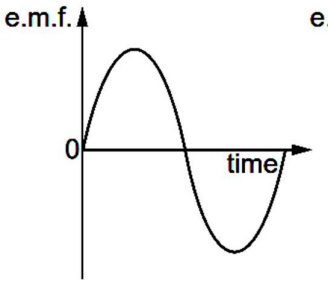
D towards the top of the page

37 The diagram shows a metal bar swinging like a pendulum across a uniform magnetic field. The motion induces an e.m.f. between the ends of the bar.

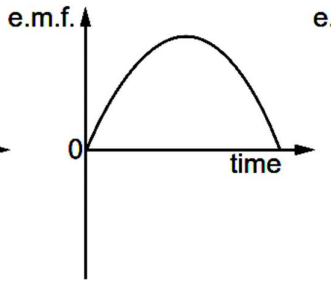


Which graph represents this e.m.f. during one complete oscillation of the bar, starting and finishing at P?

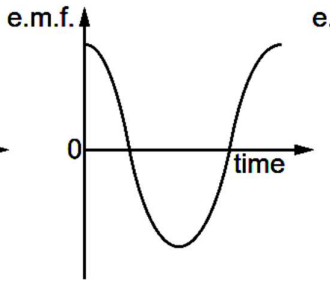
A



B



C



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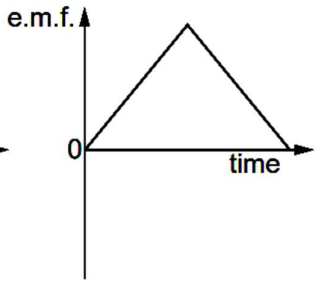
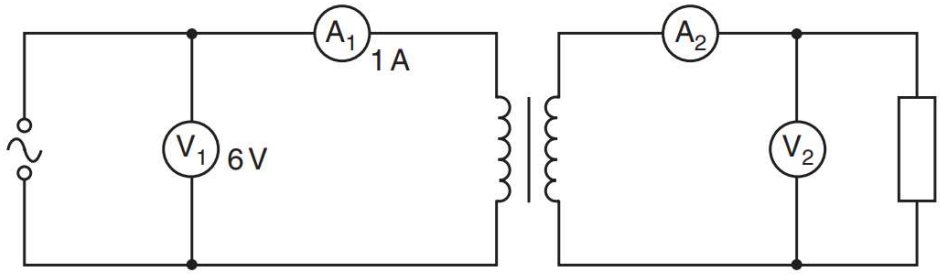


[Turn over

38 The diagram shows a 100 % efficient step-up transformer.



Which pair of readings are possible on meters V_2 and A_2?

	V_2	A_2
A	0.6	0.1
B	0.6	10.0
C	60.0	0.1
D	60.0	10.0

39 Which statement about an alpha particle is correct?

A It can pass through thick paper.

B It has no charge.

C It is a helium nucleus.

D It is a type of electromagnetic radiation.

40 A sample contains 12 000 radioactive atoms of a particular nuclide. After an interval of two half-lives, how many atoms have disintegrated?

A 0

B 3000

C 6000

D 9000

End of paper