Class	Index Number	Name

BUKIT MERAH SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2024
SECONDARY 4 EXPRESS

PHYSICS **6091/01**

Paper 1 **16 August 2024**

1 hour

Candidates answer on the Multiple Choice Answer Sheet.
Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all the work you hand in.
Write in soft pencil.
Do not use staples, paper clips, 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.

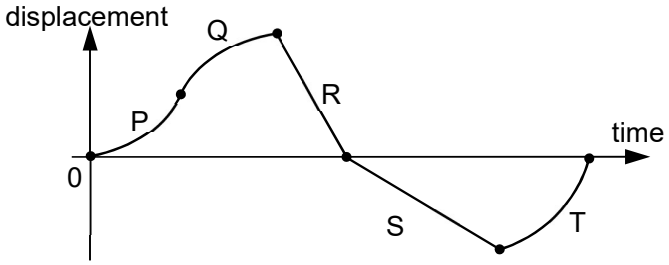
The use of an approved scientific calculator is expected, where appropriate.

1 The S.I. unit of potential difference is the volt.

Which of the following correctly expresses the volt in base units?

A $\frac{\text{kg m}^2}{\text{A s}^3}$ **B** $\frac{\text{kg}^2\ \text{m}^2}{\text{A s}^2}$ **C** $\frac{\text{kg m}}{\text{A s}^3}$ **D** $\frac{\text{kg m}^2}{\text{A}}$

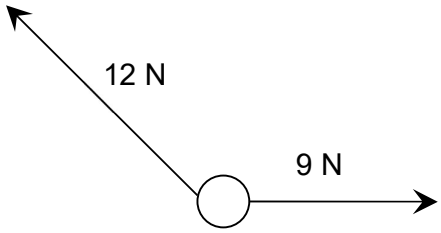
2 The graph shows how the displacement of a particle changes with time.



Which row shows the section(s) of the graph where the particle is undergoing acceleration and deceleration?

	acceleration	deceleration
A	P, Q	R
B	P, Q	R, S
C	P, T	Q
D	P, Q, S	R, T

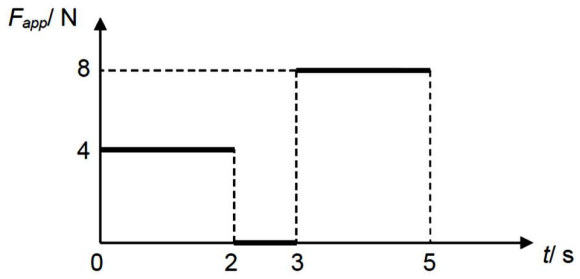
3 The diagram shows two forces acting on a small sphere. The angle between the two forces is more than 90°.



Which is a possible resultant force acting on the small sphere?

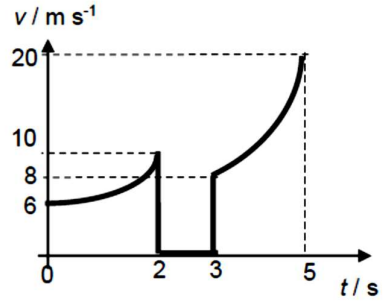
A 3 N **B** 11 N **C** 17 N **D** 21 N

4 The graph below shows the force acting on a 1 kg block of wood which is originally moving at 6 m/s on a table.

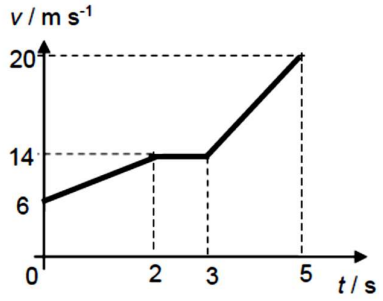


If the table has a friction of 2 N, what is the velocity-time graph of the wood?

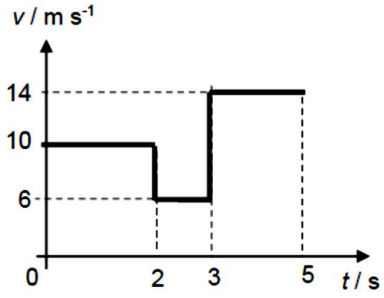
A



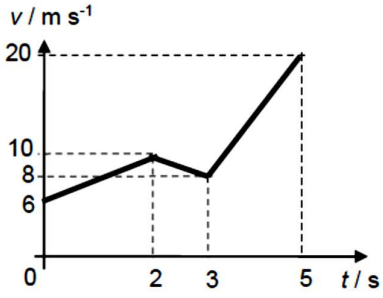
B



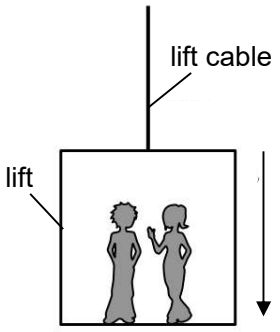
C



D



5 Two students are in a lift that is travelling downwards with a deceleration of 0.40 m/s^2



The total weight of the two students and the lift is 4000 N.
The gravitational field strength on Earth is 10 N/kg.

What is the tension in the lift cable?

A 160 N **B** 3840 N **C** 4000 N **D** 4160 N

6 An object is brought to planet P from planet Q. The gravitational field strength on the surface of planet P is twice that on the surface of planet Q. No air resistance acts on the object at planets P and Q.

Which statement is incorrect?

A The object's acceleration during free fall on planet P is twice of that on planet Q.

B The object's energy in the gravitational potential store on planet P is twice of that on planet Q when the object is placed at the same height above ground.

C The object on planet P would have more reluctance to move from its original stationary position as compared to on planet Q.

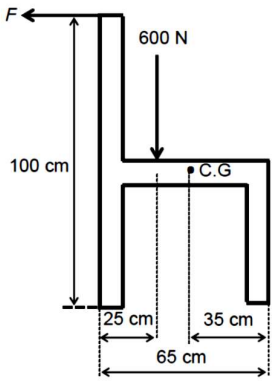
D The object on planet P would need twice the force to be lifted as compared to on planet Q.

7 A stoppered thin-walled bottle of mass 30 g and volume 120 cm^3 is partly filled with 50 g of fine powder M.

What is the maximum mass of powder M which may be added into the bottle so that the bottle floats freely in a liquid of density 1.2 g/cm^3?

A 40 g **B** 60 g **C** 64 g **D** 94 g

8 The diagram shows the dimensions of a chair. A boy sits on the chair and exerts a 600 N force on it. The diagram also shows the position of the centre of gravity of the chair.

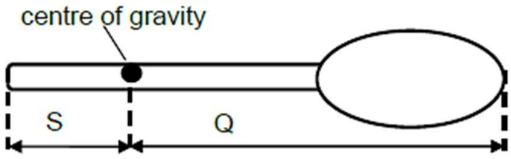


The mass of the chair is 5.0 kg. The gravitational field strength is 10 N/kg.

What is the magnitude of the horizontal force, *F*, needed to overturn the chair with the boy sitting on it?

A 150 N **B** 165 N **C** 240 N **D** 258 N

9 The diagram shows the position of the centre of gravity of a spoon made of different materials for parts S and Q.



Which statement is incorrect?

A The clockwise moment due to the weight of Q about the centre of gravity is equal to the anticlockwise moment due to the weight of S.

B The material used to make part S is denser than the material used to make part Q.

C The spoon can be balanced by placing a knife-edge at the centre of gravity.

D The weight of part Q of the spoon is equal to the weight of part S.

10 A parachutist opens his parachute and falls to Earth at constant speed.

What is the principal energy transfer taking place as he falls?

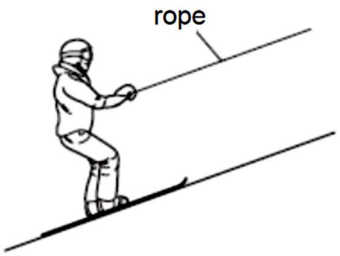
A kinetic store to gravitational potential store

B kinetic store to internal store of energy

C gravitational potential store to kinetic store of energy

D gravitational potential store to internal store of energy

11 A skier is pulled up a short straight slope at constant speed by a rope.



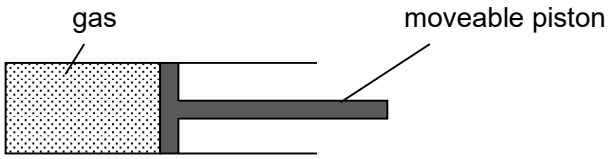
The tension in the rope is 100 N and there is combined frictional and air resistance force of 20 N acting on the skier.

The slope is 10 m long and the skier rises 1.5 m vertically.

How much work is done by the rope pulling the skier up the slope?

A 120 J **B** 150 J **C** 1000 J **D** 1200 J

12 A gas is heated in a vessel shown below. The piston is moveable.



The following quantities are given.

I the average speed of the gas molecules
II the average frequency of collisions between the gas molecules and the walls of the vessel
III the average distance between the molecules

Which quantity/quantities will increase when the gas is heated?

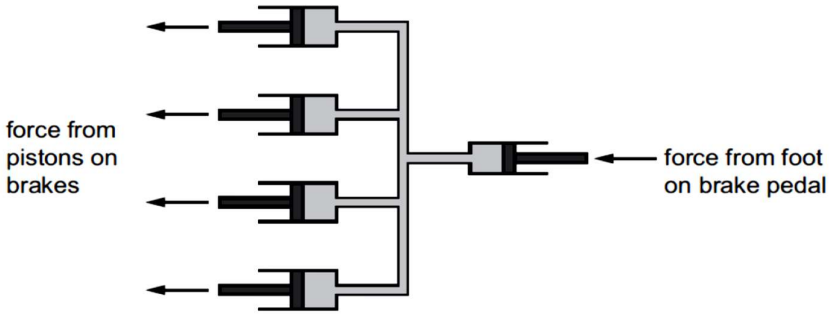
A I only

B I and II only

C I and III only

D I, II and III

13 The diagram shows the brake system of a car.



The pipes are filled with an incompressible liquid. When a force is applied to the brake pedal, the pressure in the liquid increases and applies a force to each of the four wheels.

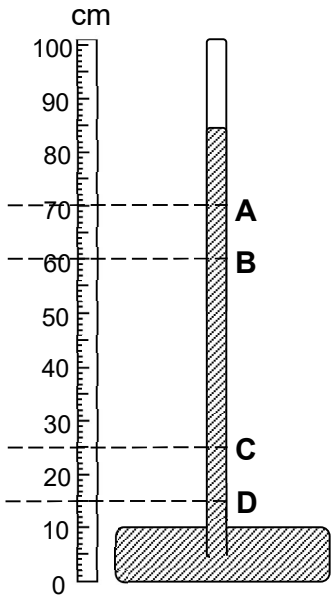
The area of the piston connected to the brake pedal is 8 cm^2. The area of each piston connected to the brakes is 12 cm^2. A force of 800 N is applied by the foot to the brake pedal.

What is the force applied to each brake?

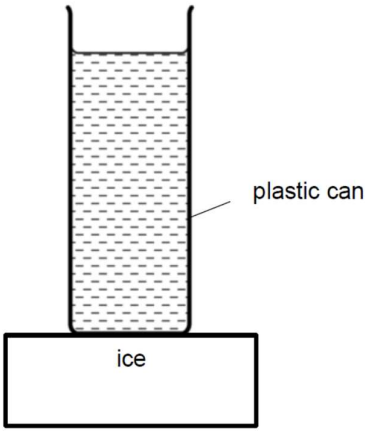
A 300 N **B** 530 N **C** 1200 N **D** 4800 N

14 The diagram shows a mercury barometer on a day when the atmospheric pressure is 75 cm Hg.

At which position is the pressure 15 cm *below* atmospheric pressure?



15 A tall plastic can contains water at room temperature.



The can is placed on top of a big block of ice.

What is the main method that cools the water at the top of the can?

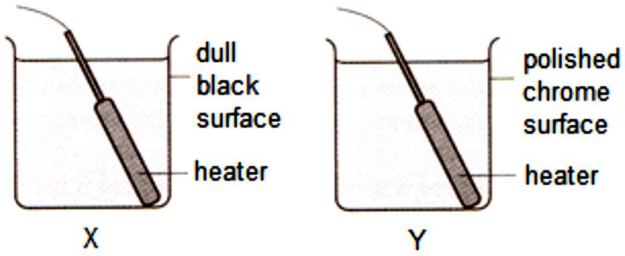
A conduction

B conduction and convection

C convection

D convection and radiation

16 The diagram shows two copper cans, X and Y, with outer surface of different texture filled with the same amount of water at room temperature and heated by heaters of same power.



Which statement is correct?

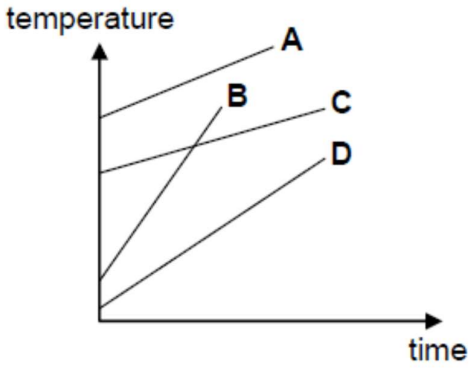
A Water in both cans take same length of time to boil because texture of outer surface will not affect the rate of energy absorbed by the water.

B Water in X boils faster because dull black surface is a good absorber.

C Water in X boils faster because dull black surface is a good emitter.

D Water in Y boils faster because polished chrome surface is a poor radiator.

17 Four different materials of equal mass were heated by the same heater. The temperature-time graph of the four different materials were shown below.



Which material has the lowest specific heat capacity?

18 When solid wax is heated, the solid wax melts into liquid wax.

Which statement describes this process correctly?

A Energy is absorbed by the solid wax and there is a change in temperature.

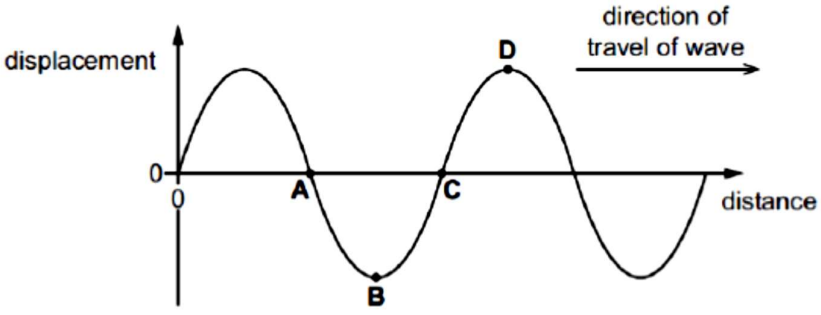
B Energy is absorbed by the solid wax and there is no change in the temperature.

C Energy is lost to the surrounding from the solid wax and there is a change in the temperature.

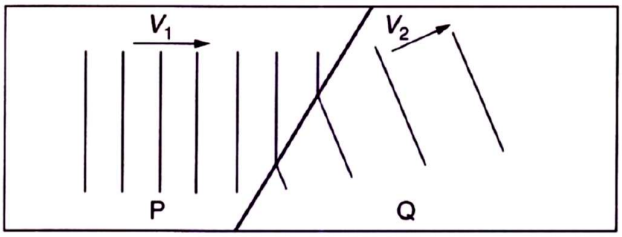
D Energy is lost to the surrounding from the solid wax and there is no change in the temperature.

19 The graph shows the variation of the displacement of particles with distance along a transverse wave at an instant in time. The wave is moving to the right.

Which position along the wave correspond to a point where particles in the wave are travelling the fastest upwards?



20 The diagram shows the waves in a ripple tank in which the water in parts P and Q is of different depths.



How do the wavelengths and the speeds V_1 and V_2 of the waves compare in P and in Q?

	wavelength	speed
A	greater in P	V_1 is greater
B	greater in P	V_2 is greater
C	greater in Q	V_1 is greater
D	greater in Q	V_2 is greater

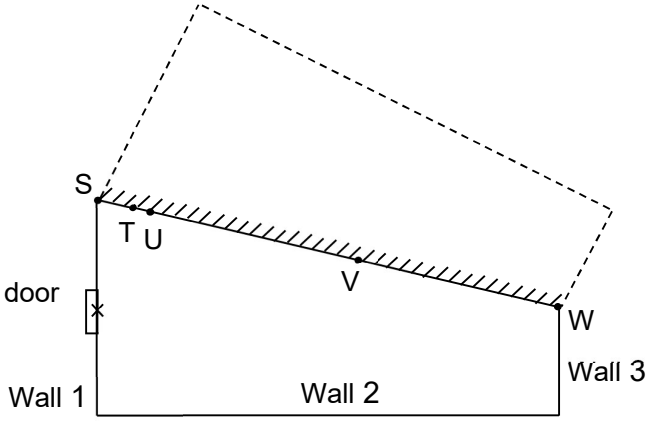
21 The diagram shows the electromagnetic spectrum with three components named. The spectrum is in order from long wavelength to short wavelength.

Which component of the spectrum is used in a sunbed to produce a suntan?

long wavelength short wavelength

radio waves	**A**	**B**	visible light	**C**	**D**	gamma rays

22 A room has an odd shape and with a mirror covering the biggest side of the wall. The diagram shows the top view of the room and the image of the walls 1, 2 and 3 is represented by the dotted lines.

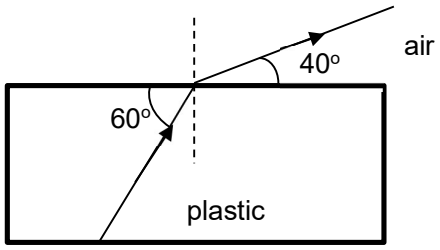


A person represented by a cross wants to see all the images of the walls of the room and uses the **smallest** length of the mirror.

What is the correct length?

A TU **B** UV **C** TV **D** SW

23 A ray of light travels from plastic to air as shown.



The speed of light in air is 3.0×10^8 m/s.

What is the speed of light in the plastic?

A 1.5×10^8 m/s

B 2.0×10^8 m/s

C 3.0×10^8 m/s

D 4.5×10^8 m/s

24 A bat produces ultrasound and audible sound at the same time.

Which statement is true?

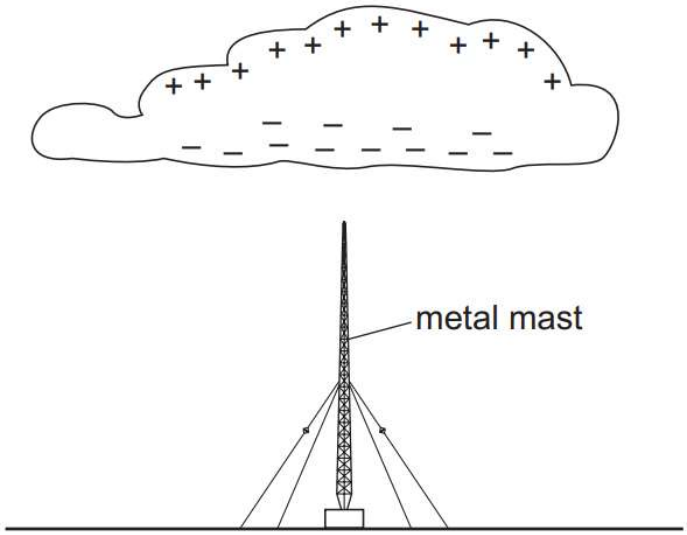
A Ultrasound always has a higher amplitude than audible sound.

B Ultrasound and audible sound will reach the same distance at the same time.

C Ultrasound and audible sound have the same frequency.

D The wavelength of the ultrasound is longer than the wavelength of the audible sound.

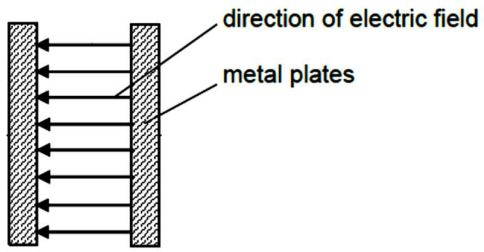
25 The base of a cloud is negatively charged. The cloud is over a metal mast as shown in the diagram below.



Which row describes the charge induced at the top of the mast and how it is produced?

	charge at top of mast	charge at the top of the mast is produced by
A	negative	electrons moving to the top of the mast
B	negative	protons moving to the bottom of the mast
C	positive	electrons moving to the bottom of the mast
D	positive	protons moving to the top of the mast

26 The diagram shows the electric field produced by two metal plates which are connected to an electrical supply.



A small negative charge is placed in the gap between the two plates.

What is the direction of the force exerted by the electric field on the negative charge?

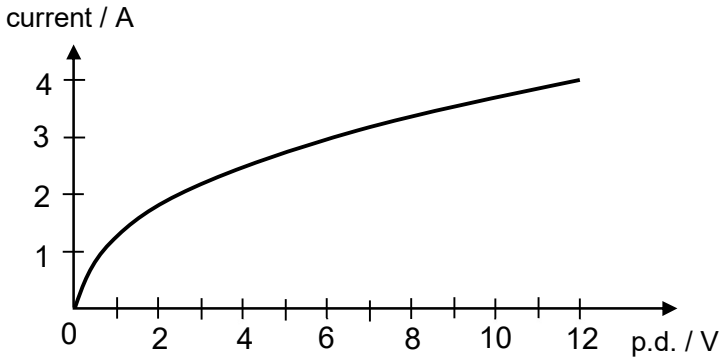
A down **B** left **C** right **D** up

27 A 12 V car battery is fully charged. It is connected in series to a lamp labelled 12 V, 24 W. The lamp shines at normal at normal brightness for 8 hours.

What is the magnitude of the charge that passes through the lamp during this time?

A 960 C **B** 14 400 C **C** 57 600 C **D** 691 200 C

28 The graph shows how the current flowing through a 12 V lamp varies with the potential difference (p.d.) across the lamp.



From the graph, which statement correctly describes the resistance of the lamp as the p.d. increases?

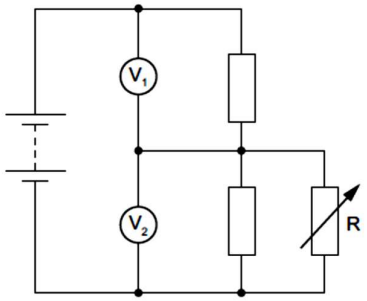
A The resistance of the decreases throughout the voltage range.

B The resistance of the lamp increases at first and then decreases.

C The resistance of the lamp increases throughout the voltage range.

D The resistance of the lamp remains constant.

29 The circuit diagram shows a variable resistor R connected in parallel to the lower half of a potential divider.

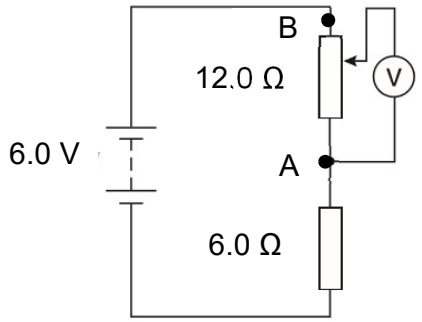


The resistance of R increases.

What happens to the voltmeter readings?

	reading on V_1	reading on V_2
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

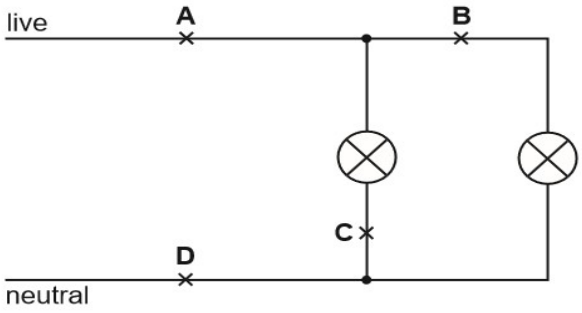
30 The diagram shows a circuit with a potential divider connected in series with a fixed resistor.



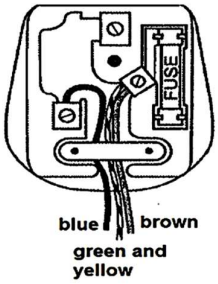
What are the minimum and maximum readings that can be obtained on the voltmeter when the contact of the potential divider moved from A to B?

	minimum / V	maximum / V
A	0	4.0
B	0	6.0
C	2.0	4.0
D	6.0	12.0

31 In order to turn off only one lamp, which is the safest switch position?



32 The diagram shows a plug that has been wired wrongly.



What effect will this cause?

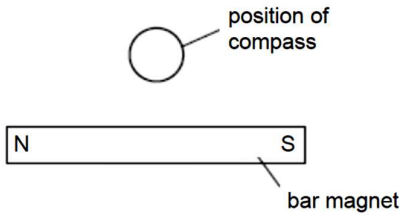
A The metal case becomes live.

B The electric iron catches fire.

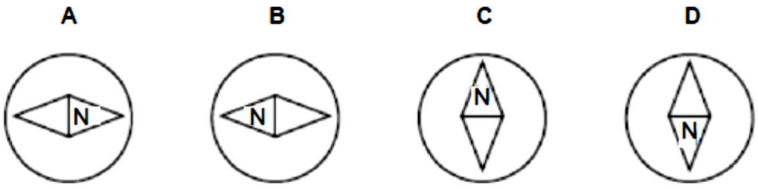
C The electric iron does not work.

D The fuse in the plug blows.

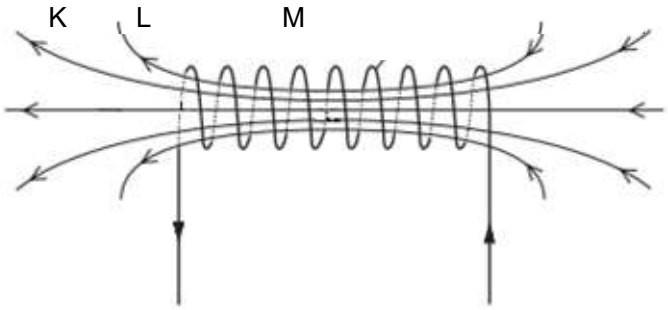
33 A small plotting compass is placed near to a bar magnet as shown.



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



34 The diagram shows the magnetic field pattern of a current in a solenoid.



When the current in the solenoid is increased, where is the increase in the magnetic field strength of the solenoid?

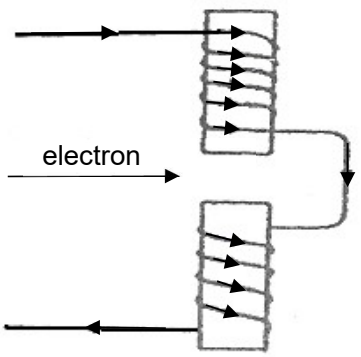
A at M only

B at K and L only

C at M and L only

D at K, L and M

35 An electron passes through a pair of electromagnets.



Which direction will the electron be deflected when it passes through the gap between the electromagnets?

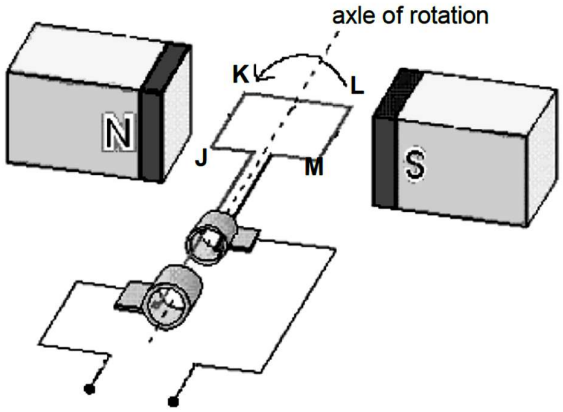
A downwards

B into the page

C out of the page

D upwards

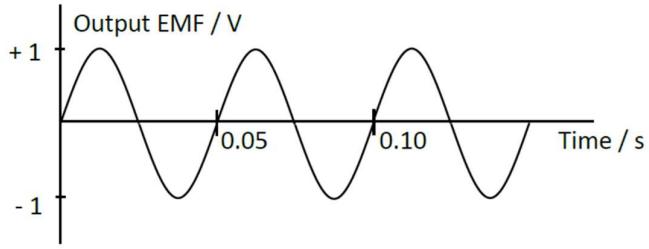
36 The diagram shows a generator turning in the anti-clockwise direction.



Which of the following is correct?

	direction of current flow through the coil at the position shown	position of coil when current through the coil is maximum
A	J → K → L → M	horizontal
B	J → K → L → M	vertical
C	M → L → K → J	horizontal
D	M → L → K → J	vertical

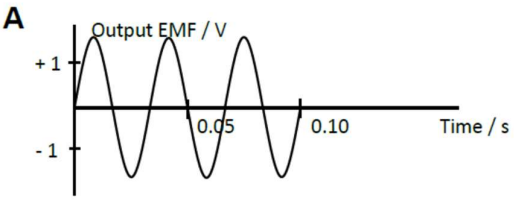
37 The graph shows the output of an a.c. generator. The coil in the generator rotates 20 times in one second.



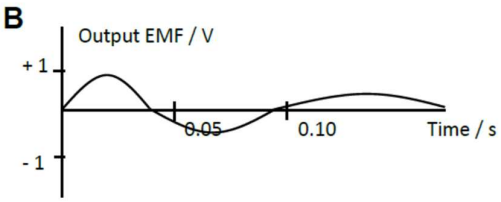
The speed of rotation of the coil steadily **decreases**.

Which graph shows how the output changes?

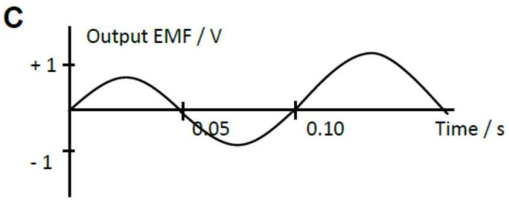
A



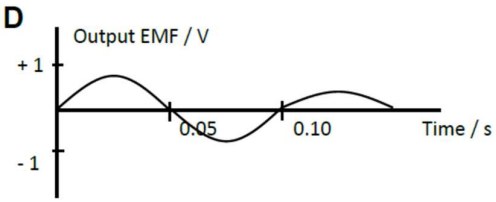
B



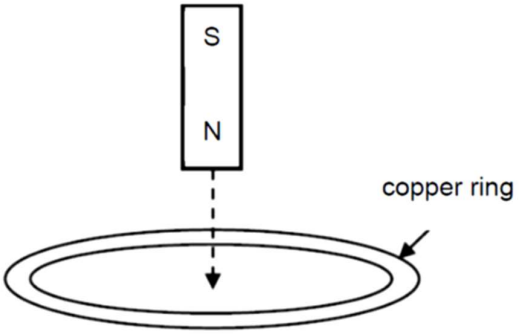
C



D



38 A magnet is dropped vertically through a copper ring. The induced electromotive force is larger than the weight of the magnet.



Which statement is incorrect?

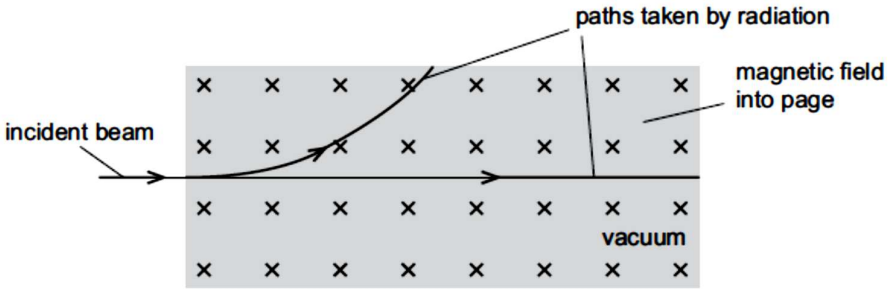
A A current flows in the ring just before the magnet passes through the ring.

B A current flows in the ring just after the magnet passes through the ring.

C The magnet slows down just before it passes through the ring.

D The magnet accelerates just after it passes through the ring.

39 A beam of radiation enters a region in which there is a strong, uniform magnetic field directed into the page. All equipment is in 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 The table below shows the count rate of a radioactive substance over two weeks.

number of weeks	0	1	2
count rate	3000	2120	1500

What is the count rate at the end of six weeks?

A 30 **B** 375 **C** 500 **D** 1000