SINGAPORE CHINESE GIRLS' SCHOOL
END-OF-YEAR EXAMINATION 2023
YEAR FOUR
INTEGRATED PROGRAMME

CANDIDATE NAME						
CLASS				REGISTER NUMBER		

PHYSICS

PAPER 1 Multiple Choice

Thursday **5 October 2023** **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.

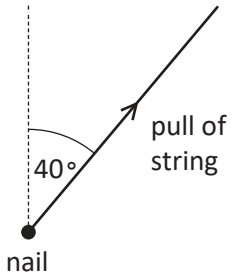
There are **forty** questions in this paper. Answer **all** questions. For each question, there are four possible answers, **A**, **B**, **C**, **D**.

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.
Take g = 10 ms^{-2} or 10 Nkg^{-1} unless specified otherwise.

1 A heavy nail is fixed firmly to a wall. It is pulled by a string at 40° to the vertical. The nail does not move.



Three forces act on the nail:

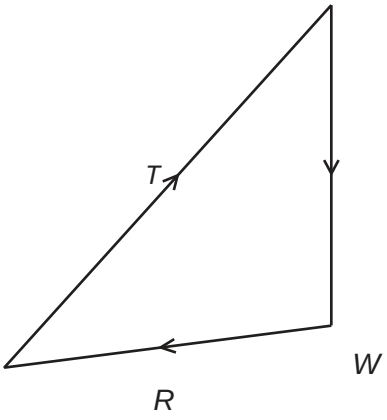
its weight *W*,

the tension *T* in the string,

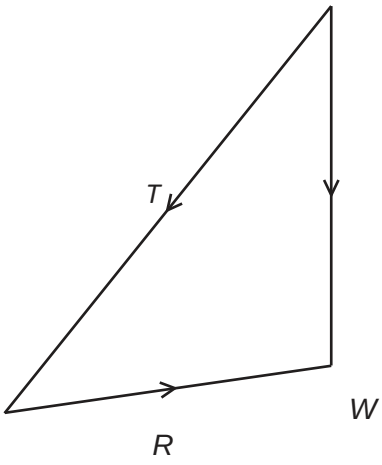
the force *R* exerted by the wall.

Which diagram, drawn to scale, represents the three forces?

A



B



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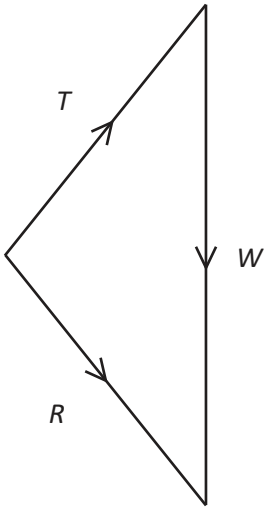
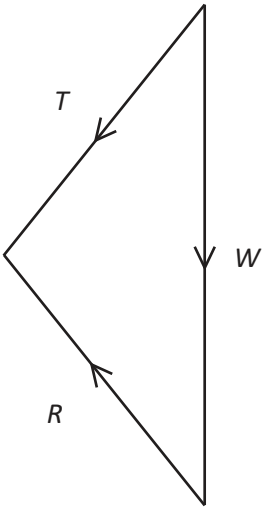


D



2 The gravitational field strength in space is smaller than on the Earth's surface.

A rocket is used to launch a satellite from the Earth's surface into space.

How are the mass and the weight of the satellite affected as the satellite moves away from the surface of the Earth and into space?

A Both the mass and the weight are unaffected.

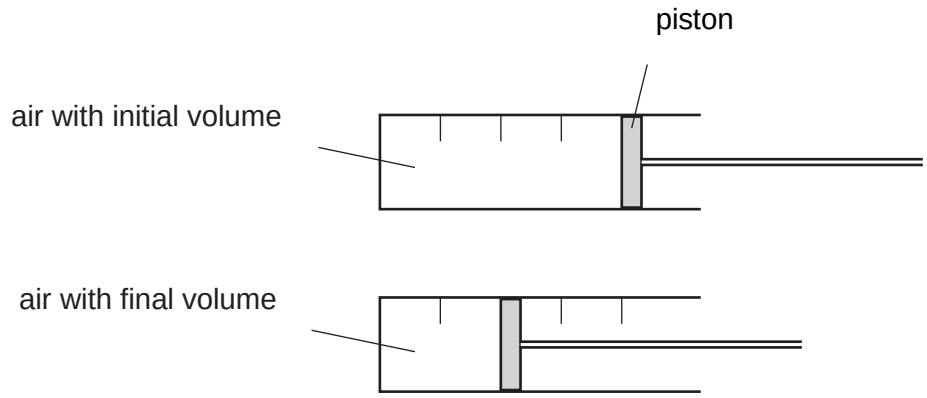
B The mass decreases and the weight decreases.

C The mass increases and the weight is unaffected.

D The mass is unaffected and the weight decreases.

3 Air is trapped in a cylinder by a piston.

The piston is moved inwards so that the volume of the air decreases.



The density of the air in the syringe at the initial volume is $0.0012\,g/cm^3$.

What is the density of the air in the syringe at the final volume?

A $0.0006\,g/cm^3$

B $0.0012\,g/cm^3$

C $0.0024\,g/cm^3$

D $0.0048\,g/cm^3$

4 A car begins to move. It speeds up until it reaches a constant speed. It continues to travel at this constant speed for the rest of the journey.

What happens to the acceleration and to the velocity of the car during the journey?

A Both the acceleration and the velocity change.

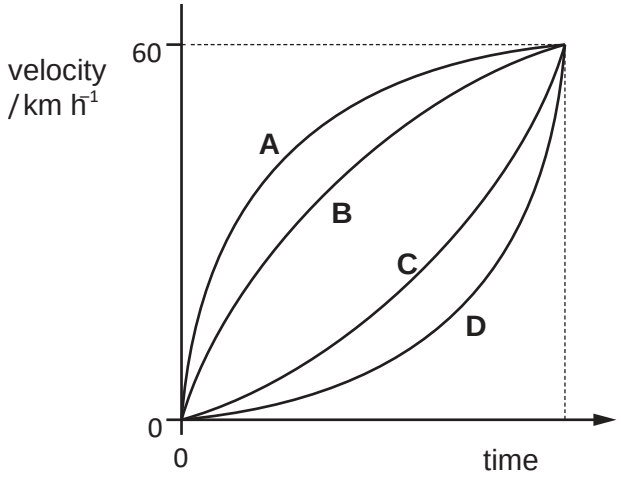
B Only the acceleration changes.

C Only the velocity changes.

D Neither the acceleration nor the velocity changes.

5 Four cars, **A**, **B**, **C** and **D**, move from rest in a straight line. The cars take the same time to accelerate to a velocity of 60 km h^{-1}. Their velocity–time graphs are shown.

Which car reaches a velocity of 60 km h^{-1} in the shortest displacement?



6 A sprinter takes a time of 11.0 s to run a 100 m race. She first accelerates uniformly from rest, reaching a speed of 10 m s^{-1}. She then runs at a constant speed of 10 m s^{-1} until the finish line.

What is the uniform acceleration of the sprinter for the first part of the race?

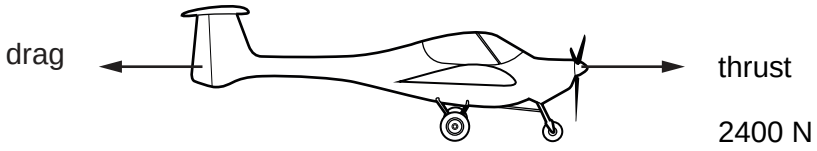
A 0.5 m s^{-2} **B** 0.91 m s^{-2} **C** 1.7 m s^{-2} **D** 5.0 m s^{-2}

7 A parachutist falling at a steady speed opens her parachute.

Which row is correct for the direction of the resultant force and for the direction of the acceleration of the parachutist just after her parachute opens?

	resultant force direction	acceleration direction
A	downwards	downwards
B	downwards	upwards
C	upwards	downwards
D	upwards	upwards

8 An aircraft travels at a constant velocity of 90 m s^{-1} in horizontal flight. The diagram shows the horizontal forces acting on the aircraft.



The mass of the aircraft is 2000 kg.

What is the power produced by the thrust force?

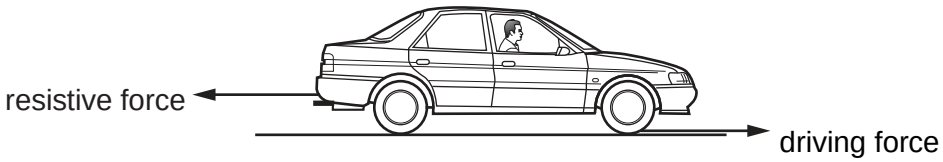
A 1.8×10^5 W

B 2.2×10^5 W

C 1.8×10^6 W

D 2.0×10^6 W

9 A car of mass 750 kg has a horizontal driving force of 2.0 kN acting on it. It has a forward horizontal acceleration of 2.0 m s^{-2}.



What is the resistive force acting horizontally?

A 0.50 kN

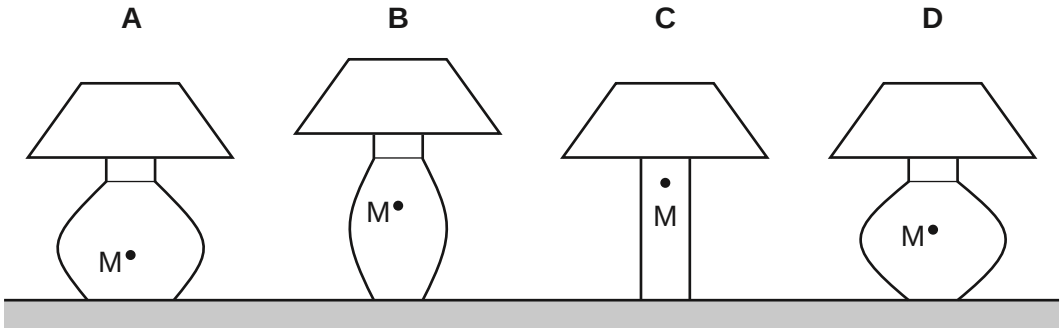
B 1.5 kN

C 2.0 kN

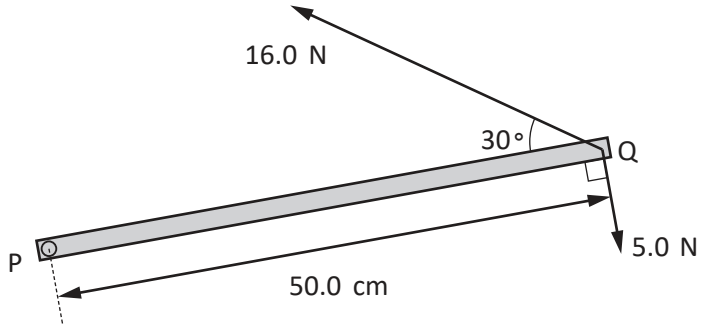
D 3.5 kN

10 Four table lamps are shown along with the position of the centre of gravity, M, in each case.

Which lamp is the most stable?



11 A horizontal metal bar PQ of length 50.0 cm is hinged at end P. The diagram shows the metal bar viewed from above.



Two forces of 16.0 N and 5.0 N are in the horizontal plane and act on end Q, as shown.

What is the resultant moment about P due to the two forces?

A 1.5 N m

B 4.4 N m

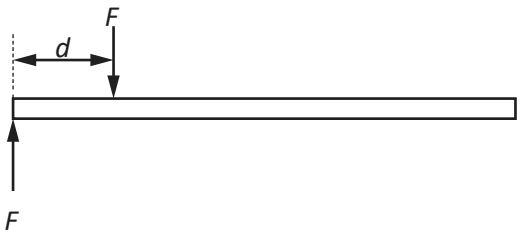
C 6.5 N m

D 9.4 N m

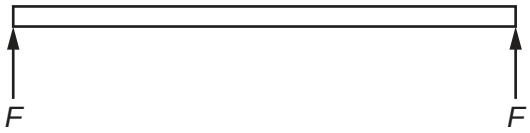
12 Two parallel forces, each of magnitude *F*, act on a uniform rod of length 5*d*.

By taking moments about the centre of the rod, which diagram shows the positions of the two forces that will produce the largest moment on the rod?

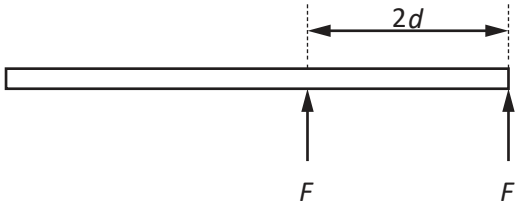
A



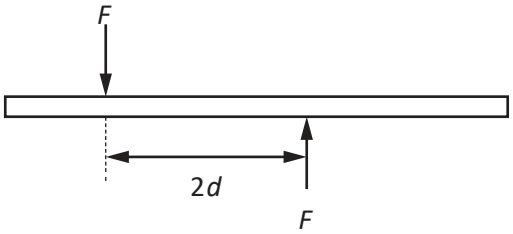
B



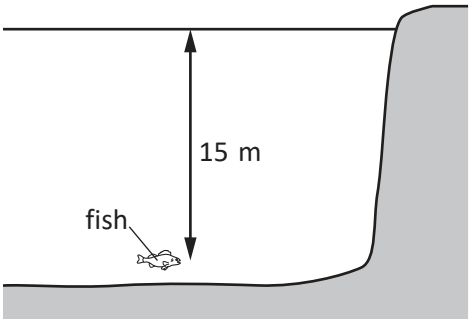
C



D



13 A fish is swimming 15 m below the surface of a lake, as shown.



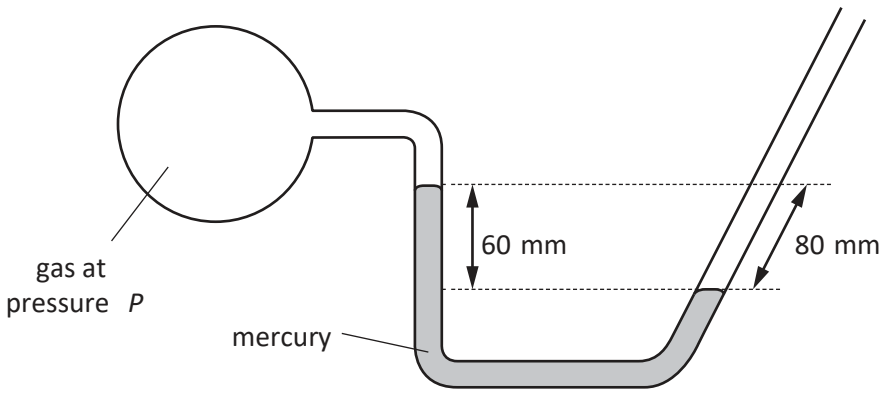
The density of the water is 1000 kg / m^3. Atmospheric pressure is 100 000 Pa.
The acceleration of free fall *g* is 10 m / s^2.

What is the total pressure on the fish?

A 50 000 Pa **B** 120 000 Pa **C** 150 000 Pa **D** 250 000 Pa

14 The diagram shows a mercury manometer. The tube is open to the atmosphere on the right-hand side.

The left-hand side is connected to a container containing a gas at pressure *P*.



Atmospheric pressure on its own supports a column of mercury of height 756 mm.

What is the pressure of the gas?

A 676 mm of mercury

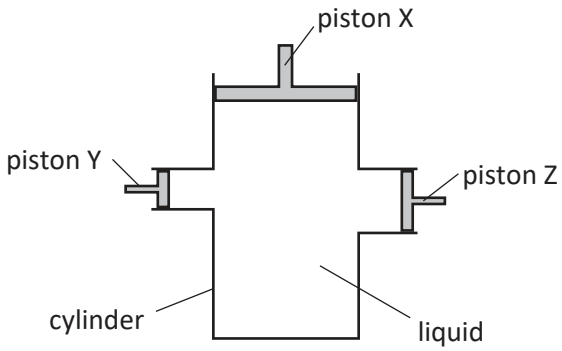
B 696 mm of mercury

C 816 mm of mercury

D 836 mm of mercury

15 Piston X is pushed into a hydraulic cylinder. Piston X produces a pressure P_X in the liquid in the cylinder.

The diagram shows the cylinder viewed from above.



view from above

There are two other pistons, Y and Z, in the cylinder.

The pressures on piston Y and Z are P_Y and P_Z.

What is the relationship between P_X, P_Y and P_Z?

A $P_X = P_Y + P_Z$

B $P_X > P_Z > P_Y$

C $P_X < P_Z < P_Y$

D $P_X = P_Y = P_Z$

16 Data for three types of electricity generators are shown.

	input energy / MJ	wasted energy / MJ
oil	500	300
nuclear	200	160
hydroelectric	10	1.0

Which is the least efficient generator and which is the most efficient?

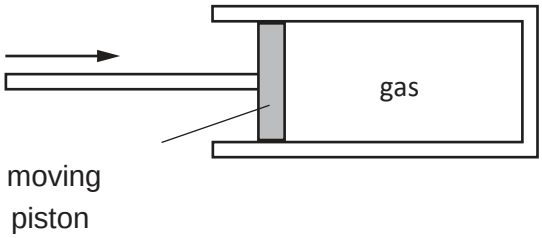
	least efficient	most efficient
A	hydroelectric	nuclear
B	hydroelectric	oil
C	nuclear	hydroelectric
D	oil	hydroelectric

17 The table shows some data from a high-jump competition.

Which athlete jumps the highest?

	weight / N	increase in gravitational potential energy / J
A	600	1320
B	700	1610
C	800	1760
D	900	1800

18 A mass of gas is trapped inside a cylinder by a moving piston.



As the piston moves in, the volume of the gas decreases but the temperature stays the same.

What happens to the gas pressure, and why?

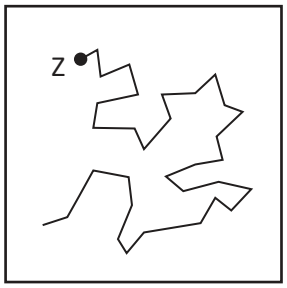
	pressure	reason
A	increases	the molecules have less room to move in the cylinder and collide with each other more often
B	decreases	the molecules move more slowly between collisions hence the force of impact with the wall decreases
C	increases	the molecules collide more frequently with the walls of the inner walls of the cylinder with the same average speed
D	unchanged	the average speed of the gas molecules remains the same hence the average force on per unit area remains unchanged

19 A gas is heated in a cylinder.

What happens to the kinetic energy and to the potential energy of the molecules?

	kinetic energy	potential energy
A	increase	increase
B	increase	decrease
C	decrease	increase
D	decrease	decrease

20 A smoke particle Z is seen to move randomly when suspended in air as illustrated.



Which statement explains why Z moves randomly?

A Air molecules are much larger than Z.

B Air molecules are smaller than Z.

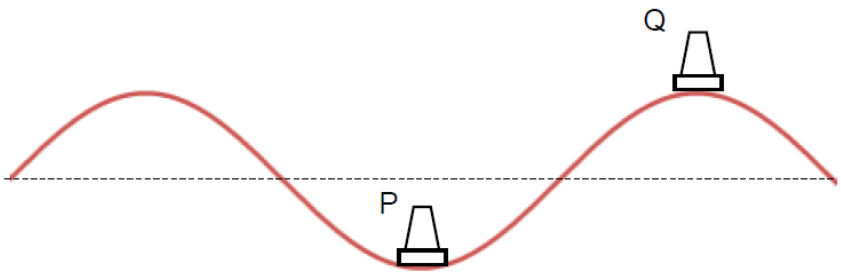
C Air molecules hit Z from different directions.

D Air molecules vibrate about a fixed position

21 Which row lists the applications of parts of the electromagnetic spectrum?

	Gamma ray	**infra-red radiation**	**Microwave**
A	intruder alarm	satellite communication	sunbed
B	satellite communication	treatment of cancer	remote controller
C	treatment of cancer	intruder alarm	remote controller
D	treatment of cancer	remote controller	satellite communication

22 The diagram shows two buoys P and Q sitting on a pond. A wave moves across the pond from left to right.



At the moment shown, buoy Q is at the crest and buoy P is at the trough.

Which row describes the movement of the buoys during the next cycle of the wave?

	P	Q
A	not moving	not moving
B	only rises	only falls
C	rises and falls	falls and rises
D	towards the right	towards the right

23 Which statement about ultrasound is **incorrect**?

A Ultrasound can travel through vacuum.

B Ultrasound has a frequency larger than 20 kHz.

C Ultrasound is used for prenatal imaging.

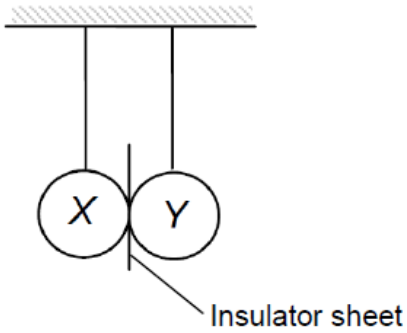
D Ultrasound is a type of longitudinal wave.

24 A student wishes to determine the speed of sound in air. She plans to measure the time from making a sound to hearing the echo from a cliff.

What type of sound and which distance should she use for her experiment?

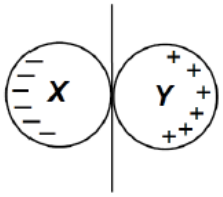
	type of sound	distance to use
A	continuous sound	distance to cliff ÷ 2
B	continuous sound	distance to cliff × 2
C	short, sharp sound	distance to cliff ÷ 2
D	short, sharp sound	distance to cliff × 2

25 Two neutral conducting balls *X* and *Y* are suspended by insulating threads from the ceiling as shown below. They are separated by a sheet of insulator.

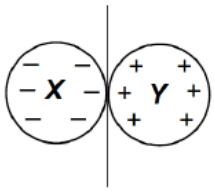


If *X* is touched by a negatively charged rod, which diagram best represents the charge distribution on them?

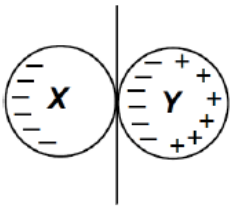
A



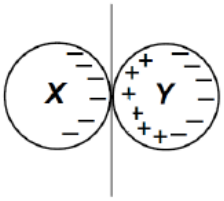
B



C

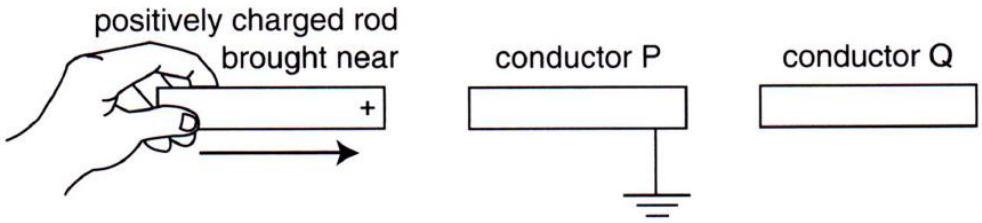


D



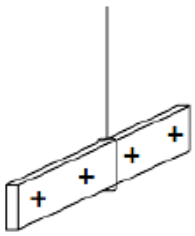
26 A positively charged plastic rod is brought near two conductors P and Q as shown below. P and Q are mounted on insulating stands. Conductor P is earthed. The earthing is then removed, followed by the positively charged rod.

What are the net charges in conductors P and Q?

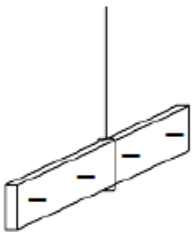


	P	Q
A	negative	neutral
B	negative	positive
C	positive	negative
D	positive	neutral

27 The diagram shows a positively charged acetate strip and a negatively charged polythene strip that are freely suspended.



acetate strip



polythene strip

When an object is brought either to the acetate strip or polythene strip, the strip moves towards the object.

What is the state of charge of the object?

A Neutral

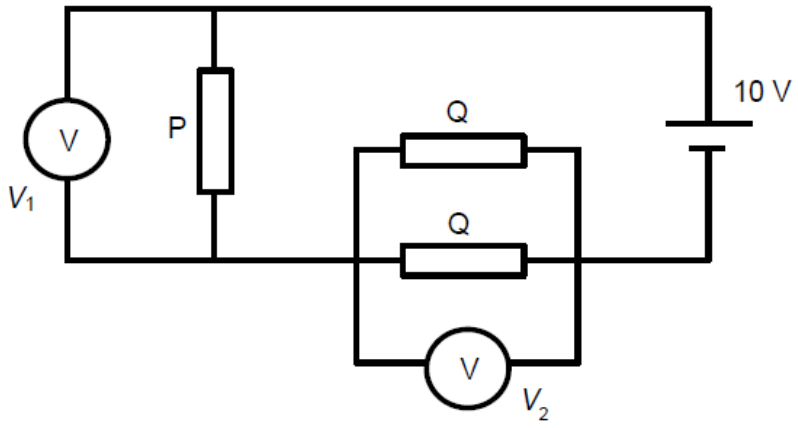
B Positively charged

C Negatively charged

D Cannot be determined

28 In the circuit shown, the resistance of resistor P is twice the resistance of resistor Q. A cell with an electromotive force of 10 V forms part of the circuit.

Two voltmeters display the readings of V_1 and V_2.



What is the difference between V_1 and V_2?

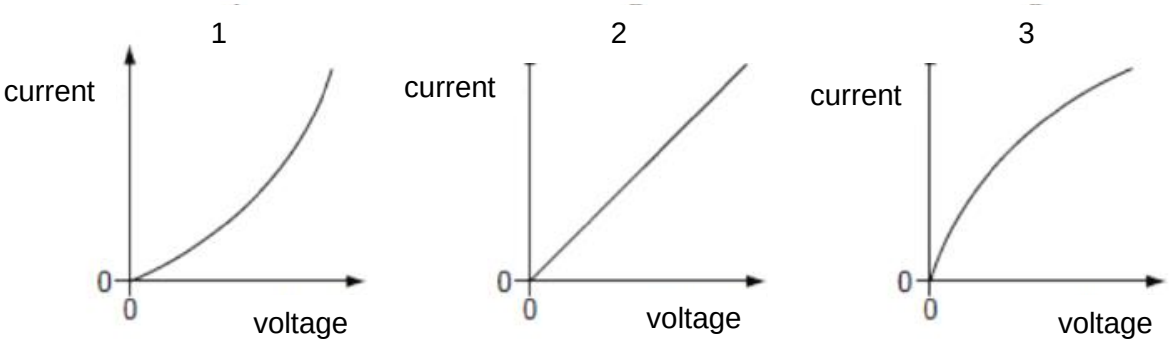
A 3.3 V

B 6.0 V

C 8.0 V

D 10 V

29 The current - voltage graphs shown are for different electrical components.

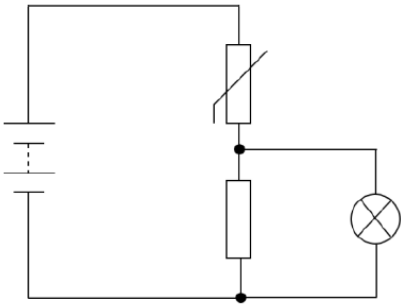


Which graph is for a filament lamp and which is for a resistor at constant temperature?

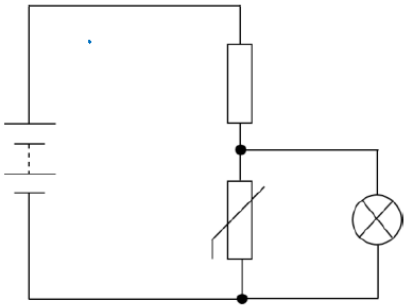
	filament lamp	resistor
A	1	2
B	2	1
C	2	3
D	3	2

30 In which circuit will the lamp glow more brightly when more light shines on the light-dependent resistor?

A



B



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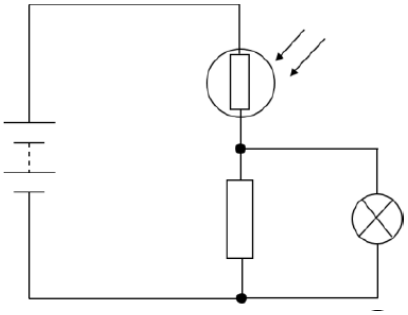
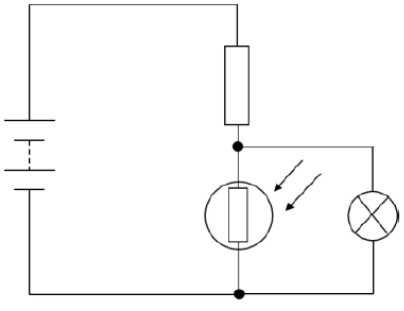
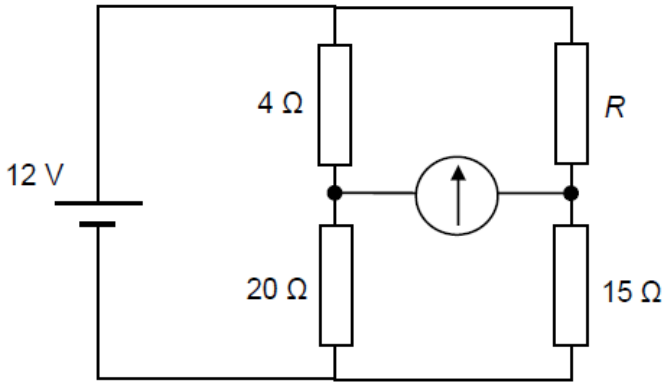


D



31 The circuit shows a cell with an electromotive force of 12 V and the reading on the galvanometer is zero.



What is the value of resistor *R*?

A 3 Ω

B 4 Ω

C 9 Ω

D 45 Ω

32 The diagram shows the label on a hair dryer. The hair dryer is used for 2 hours every month. The cost of 1 kWh of electrical energy is 25 cents.

HAIR DRYER	
Operating Voltage	240 V
Power	2.4 kW
Fuse Rating	13 A

Which statement is correct ?

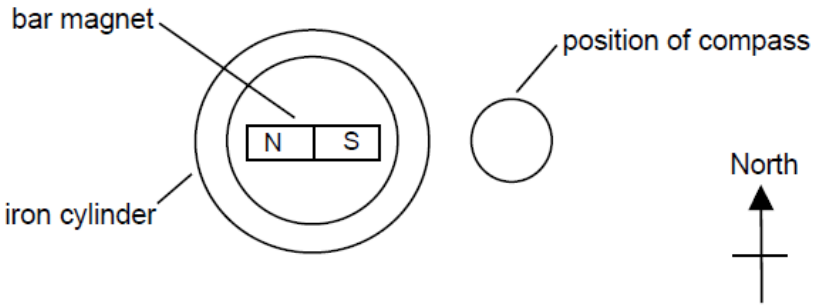
A It costs $1.50 every month to use the hair dryer.

B The energy dissipated in the hair dryer every month is 17.3 MJ.

C The fuse rating in the hair dryer is too low, hence it will blow when it is switched on.

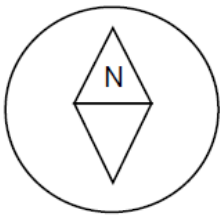
D The hair dryer has a resistance of 10 Ω.

33 A bar magnet is placed in a hollow iron cylinder. A small plotting compass is placed near the bar magnet as shown.

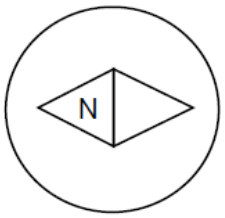


Which diagram shows the direction in which the compass needle points?

A



B



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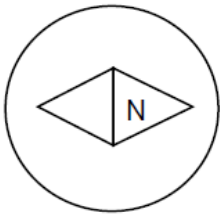
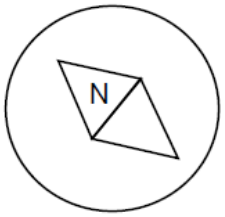
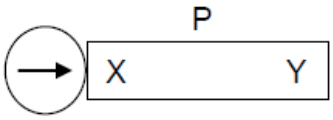


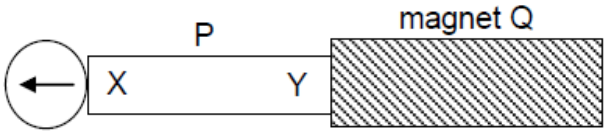
D



34 A compass placed at end X of a metal bar P points to the right.



When Y, the opposite end of bar P is next to a magnet Q, P is attracted to Q. The compass at X points to the left.



What can be deduced about P?

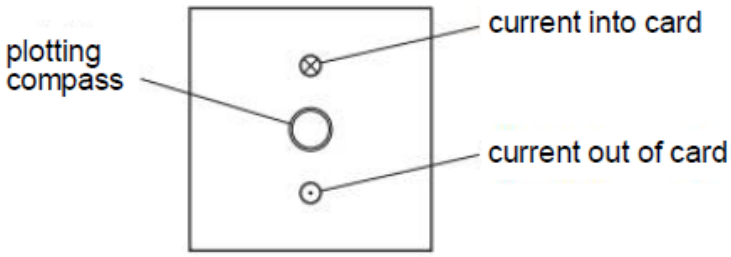
A It is made of a material such as iron.

B It is a magnet with X as the North pole.

C It is a magnet with X as the South pole.

D It is made of a material such as aluminium.

35 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?

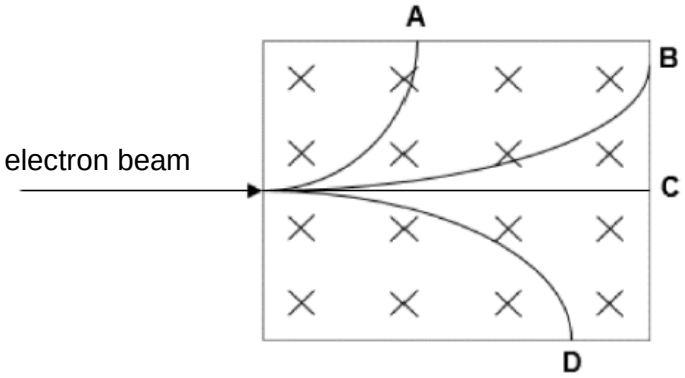
A

B

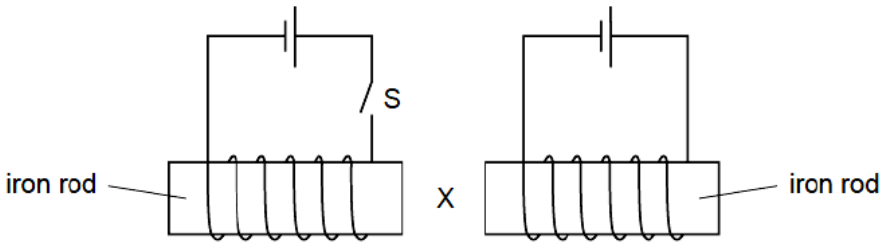
C

D

36 An electron beam enters a uniform magnetic field as shown.
Which is the correct path of the electron beam?



37 Two circuits are set up as shown. The iron rods are placed close together, and are free to move.



What happens to the size of the gap at X when switch S is closed?

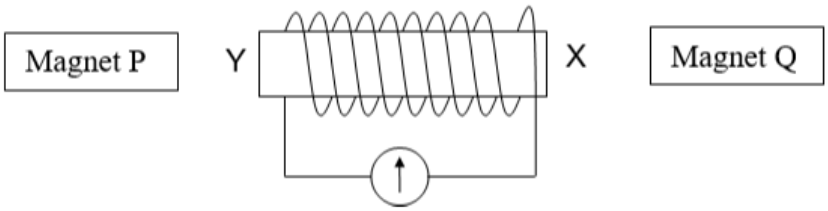
A It decreases.

B It decreases and then increases.

C It increases.

D It does not change.

38 The north pole of permanent magnet Q is moving towards X. The galvanometer deflects to the left.



Which action will produce a deflection in the same direction?

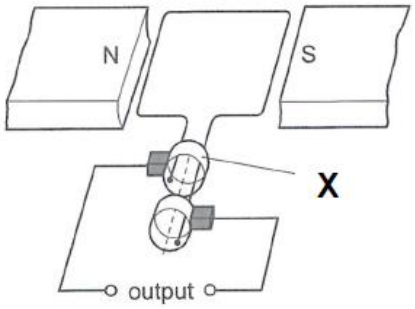
A moving N-pole of magnet P towards Y

B moving N-pole of magnet Q away from X

C moving S-pole of magnet Q towards from X

D moving S-pole of magnet P toward Y

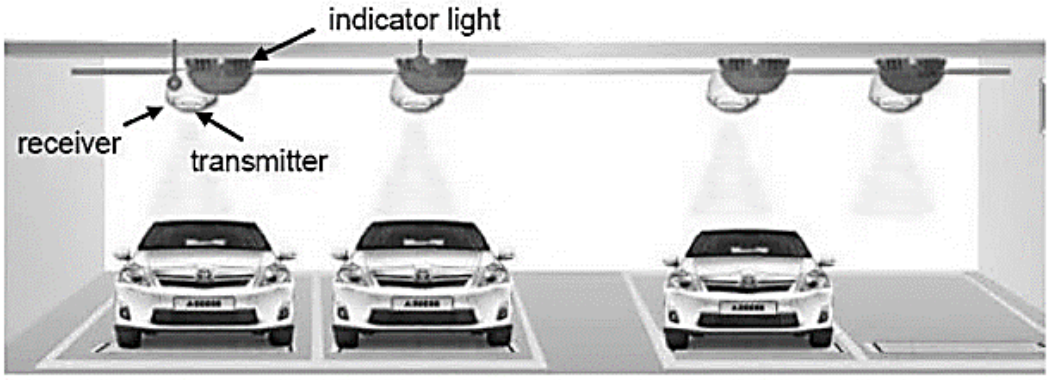
39 The diagram shows a simple a.c. generator.



What is component **X** and how does one increase the magnitude of the induced e.m.f of the a.c. generator?

	component **X**	increase magnitude of e.m.f
A	split ring commutator	use a stronger permanent magnet
B	split ring commutator	use a thicker wire
C	slip rings	use a thicker wire
D	slip rings	use a stronger permanent magnet

40 An ultrasonic sound transmitter and a receiver are installed at the ceiling of a carpark as shown in the diagram. They can be used to determine the height of a car. Diagram 1 shows the c.r.o. display when the lot is empty. Diagram 2 shows the c.r.o. display when a car is parked beneath the transmitter and receiver.



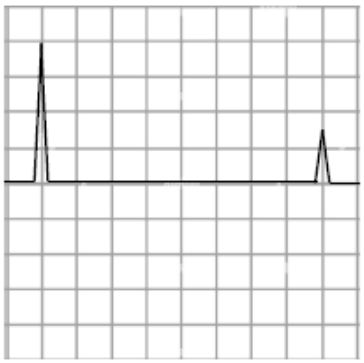


Diagram 1

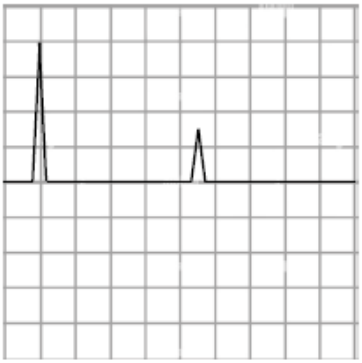


Diagram 2

The time-base (horizontal scale) of the c.r.o. is 2.5 ms/div. If the speed of ultrasound is 330 m/s, what is the height of the car?

A 1.44 m

B 1.86 m

C 2.88 m

D 3.30 m

END OF PAPER

1		**2**		**3**		**4**		**5**	
6		**7**		**8**		**9**		**10**	
11		**12**		**13**		**14**		**15**	
16		**17**		**18**		**19**		**20**	
21		**22**		**23**		**24**		**25**	
26		**27**		**28**		**29**		**30**	
31		**32**		**33**		**34**		**35**	
36		**37**		**38**		**39**		**40**	