ST JOSEPH'S INSTITUTION
PRELIMINARY EXAMINATION 2021
(YEAR 4)

CANDIDATE NAME							
CLASS						INDEX NUMBER	

PHYSICS **6091/1**

27 AUGUST 2021

Paper 1 Multiple Choice

1 hour

Additional Materials: Multiple Choice Answer Sheet **(10:30 – 11:30)**

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 in the multiple choice answer sheet.

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 Multiple Choice 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 on this question paper.
The use of an approved scientific calculator is expected, where appropriate.

1 Which combination of lengths gives the smallest rectangular area?

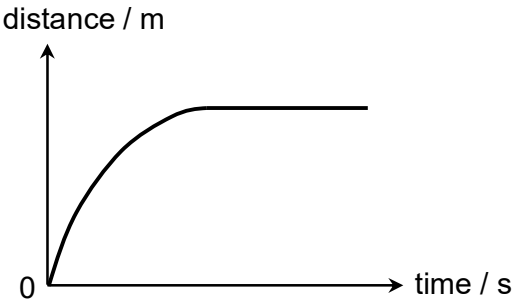
A 1.0 Gm x 1.0 mm
B 1.0 km x 1.0 cm
C 1.0 Mm x 1.0 nm
D 1.0 μm x 1.0 m

2 A ball is thrown vertically upwards, where it stops momentarily at the maximum height, before falling vertically down.

Taking downwards as the positive direction, and ignoring the effects of air resistance, which of the following states its acceleration of its motion?

	Going up	At maximum height	Coming down
A	-10 m/s^2	0 m/s^2	+10 m/s^2
B	-10 m/s^2	-10 m/s^2	-10 m/s^2
C	+10 m/s^2	+10 m/s^2	+10 m/s^2
D	+10 m/s^2	0 m/s^2	-10 m/s^2

3 The diagram shows the distance-time graph of a moving object.



Which of the following describes this moving object?

A It is a ball thrown vertically upwards and falling back to the thrower.
B It is a car that starts from rest and speeds up as it moves away from a traffic signal.
C It is a rock that is dropped from a high cliff and falling into the sea below.
D It is a train slowing down and coming to a stop at a train station.

4 A gymnast of mass 60 kg lands on a trampoline. If he rebounds upwards with an acceleration of 0.60 m/s^2, what is the maximum force exerted by the trampoline on the gymnast?

A 36 N **B** 564 N **C** 636 N **D** 672 N

5 A parachutist jumps off a plane. After 1.0 min, he opens the parachute and his velocity decreases at a decreasing rate. The following statements are possible explanations why the velocity of the parachutist decreases at a decreasing rate.

(I) The velocity decreases as such the air resistance acting on the parachute decreases.
(II) The tension exerting on the parachutist decreases.
(III) The force of the parachute acting on the air increases.

Which of the above statements is/are correct?

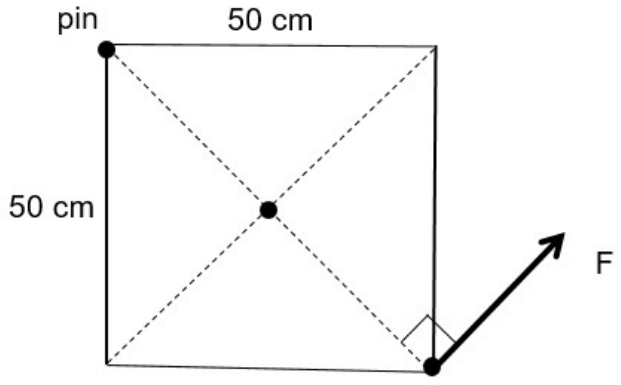
A (I) only
B (I) and (II) only
C (II) only
D (III) only

6 A container completely filled with water has a mass of 900 g. When it is completely filled with an unknown liquid X, its mass is 865 g. If the weight of the empty container is 2.0 N, what is the density of the unknown liquid, X?

Take density of water to be 1000 kg/m^3 and gravitational field strength as 10 N/kg.

A 0.74 g /cm^3 **B** 0.95 g /cm^3 **C** 1.04 g /cm^3 **D** 1.33 g /cm^3

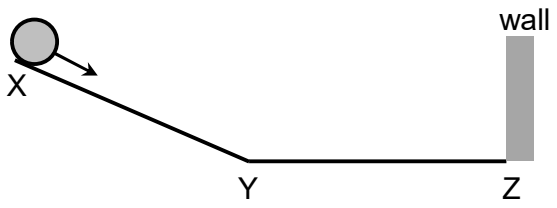
7 A uniform square cardboard of weight 16 N is pivoted freely about a pin fixed at its top left corner to the wall. The square is held at an angle by a force F as shown.



What is the value of F?

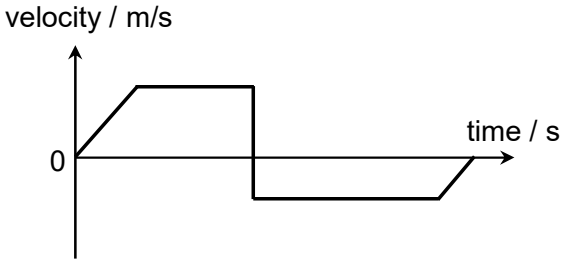
A 4.0 N
B 5.7 N
C 8.0 N
D 11 N

8 A ball is released from rest at X. It rolls down a frictionless slope XY, then across a frictionless horizontal surface YZ. It hits the wall at Z with a sound, and then rolls back up the slope, where it stops momentarily along XY.

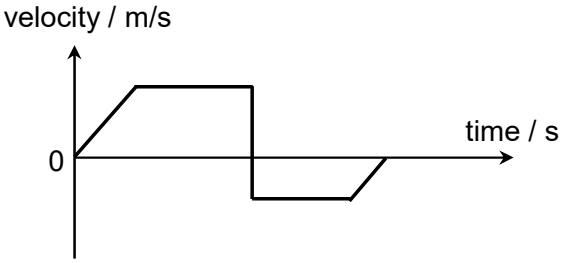


Which of the velocity-time graphs represents the motion of the ball?

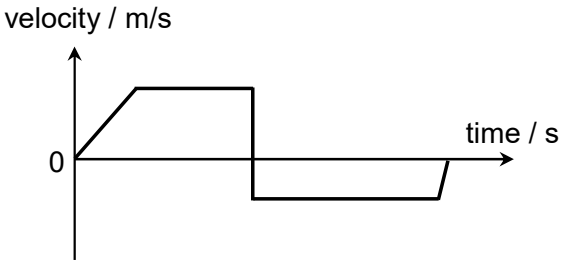
A



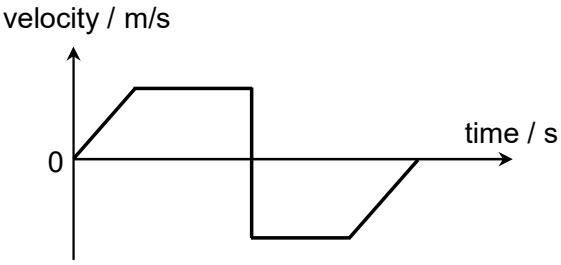
B



C



D

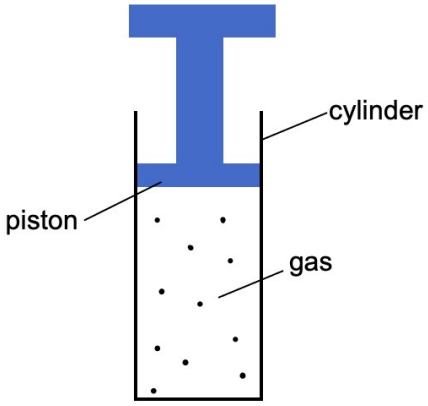


9 A 10 kg object initially at rest is being pulled with a constant force of 8.0 N. The object moves a horizontal distance of 2.0 m and its speed increases to 1.0 m/s.

What is the work done against the resistive forces?

A 5.5 J **B** 11 J **C** 16 J **D** 21 J

10 A piston of mass 4.0 kg is supported by gas trapped in a cylinder. The pressure of the gas is 1.2×10^5 Pa and atmospheric pressure is 1.0×10^5 Pa. The acceleration of free fall is 10 m/s^2.

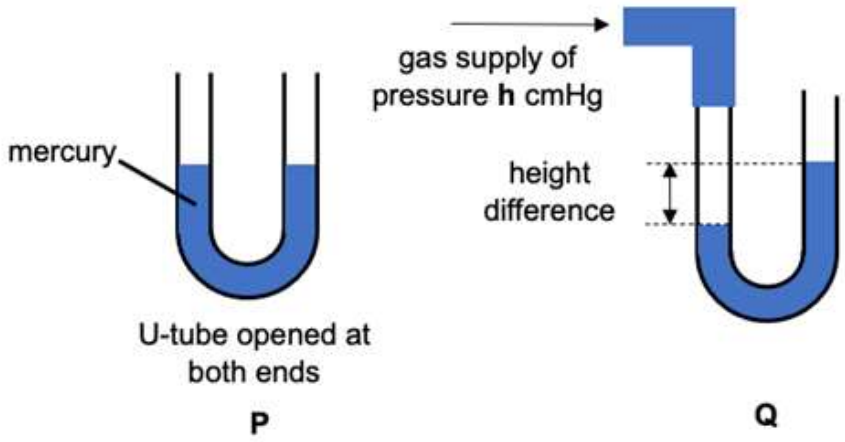


What is the area over which the gas exerts a pressure on the piston?

A 2.0×10^{-4} m^2 **B** 2.0×10^{-3} m^2 **C** 5.0×10^{2} m^2 **D** 8.0×10^{5} m^2

11 Diagram P shows a U-tube containing some mercury. The open ends are at atmospheric pressure of 76 cmHg.

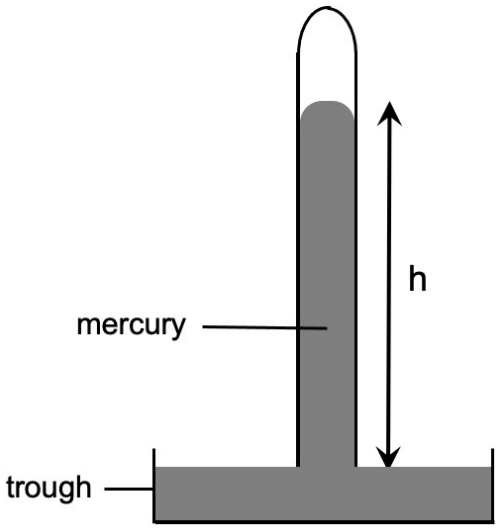
Diagram Q shows the mercury levels when one of the arms is connected to a gas supply of pressure **h** cmHg.



Which of the following gives the correct height difference in cm between the mercury levels in diagram Q?

A **h** - 76
B ½ (**h** – 76)
C 76 - **h**
D ½ (76 – **h**)

12 The diagram shows a working barometer. Which of the following would not cause the height h of the mercury column to vary?



A Adding mercury to the trough.
B Change in gravitational field strength.
C Change in the temperature.
D Leakage of air into the tube.

13 The diagrams show the scale on a voltmeter, connected to a thermocouple thermometer. The probe of the thermocouple is placed in different materials.

in melting ice | in steam | in unknown liquid

What is the temperature of the unknown liquid?

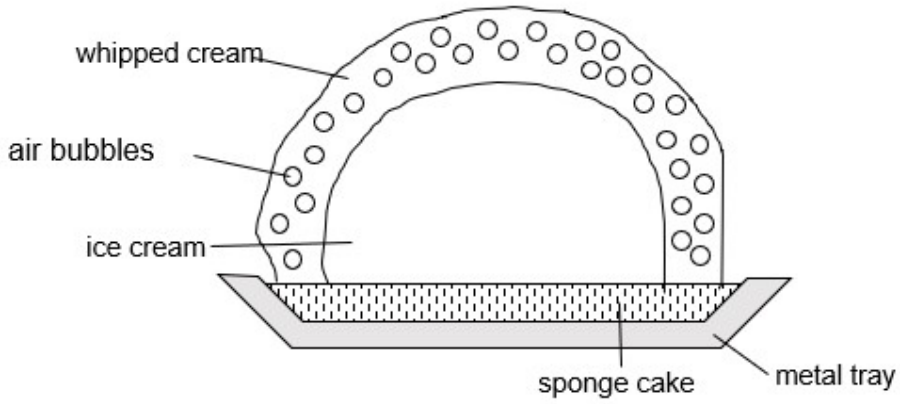
A 87.5 °C
B 113 °C
C 120 °C
D 125 °C

14 A fixed mass of gas is enclosed in a cylinder by a frictionless piston which is free to move.

When the temperature of the gas changes, the density of the gas inside the cylinder increases. Which of the following conditions must be true?

	frequency of collision	temperature
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

15 The diagram below shows a type of ice cream dessert with a sponge cake below it, covered with whipped cream on top. The dessert is placed on a metal tray and the ice cream remains frozen when the entire dish is placed into a hot oven.



Which of the following statements about the dessert is correct?

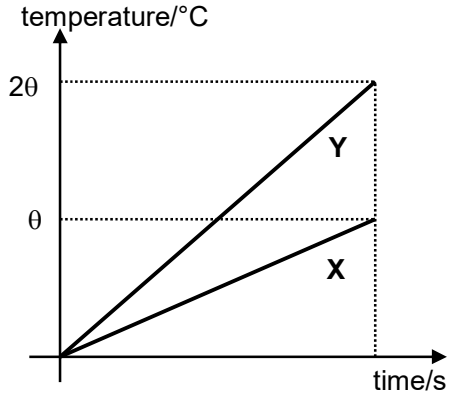
A Air is a good conductor of heat and it conducts heat away from the ice cream.

B The sponge cake is a good conductor of heat and it conducts heat away from the ice cream to the tray.

C The sponge cake is a good insulator and it reduces the transfer of heat from the ice cream to the metal tray.

D The whipped cream is a good insulator of heat and this reduces heat gain from the environment.

16 The diagram shows how the temperature of liquid X and liquid Y changes with time when the same electric heater is used to heat the liquids.



If the mass of liquid Y is twice that of liquid X, what is the relationship between the heat capacity of liquid Y, C_Y to the heat capacity of liquid X, C_X?

A $4C_X = C_Y$ **B** $2C_X = C_Y$ **C** $C_X = 2C_Y$ **D** $C_X = 4C_Y$

17 80 g of ice at 0°C is added into 500 g of water at 30°C. What is the final temperature of the water?

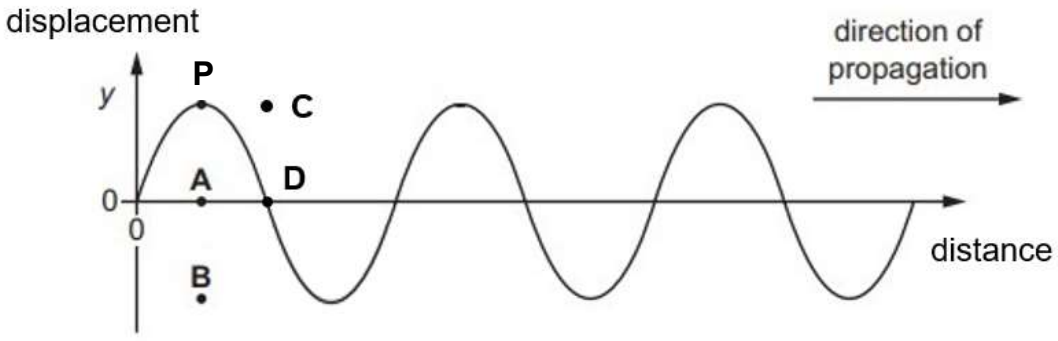
Specific heat capacity of water = 4200 J/kgK.
Specific latent heat of fusion of ice = 334 J/g.

A 14.9°C **B** 17.3°C **C** 20.6°C **D** 25.9°C

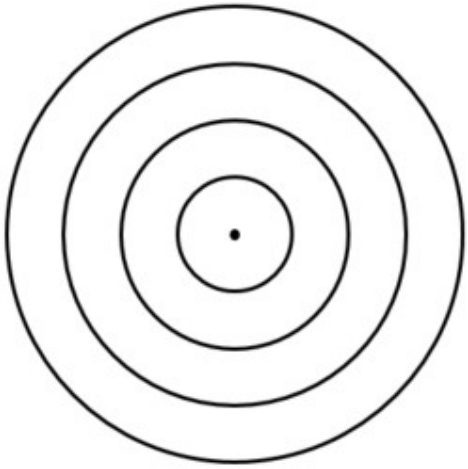
18 The diagram shows the displacement-distance graph of all the particles on a transverse wave on a rope at time t = 0 s. The wave has a frequency of 0.25 Hz.

A point P on the rope is marked. The diagram shows the original position of P and four possible new positions of P.

What is the position of P at time t = 1.0 s?

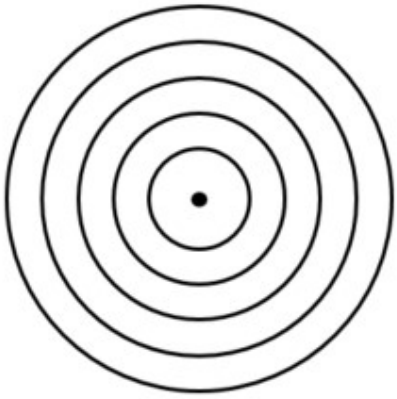


19 The diagram shows crests of circular wavefronts radiating from a point source.

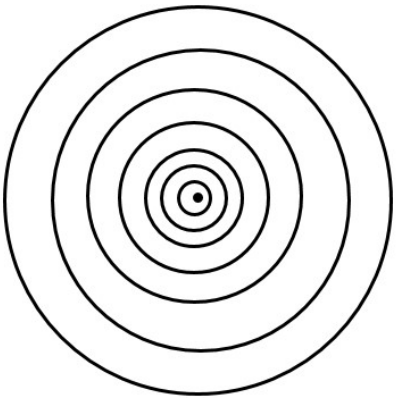


The point source is then set to vibrate with a gradually increasing frequency.
Which one of the following diagrams shows the new wavefronts?

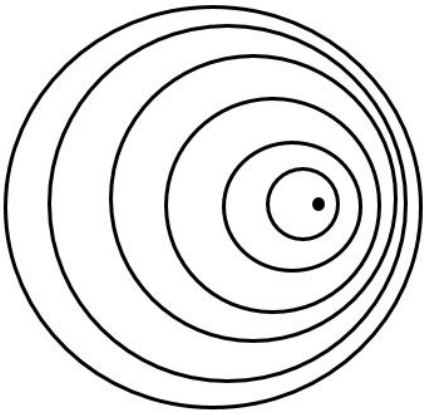
A



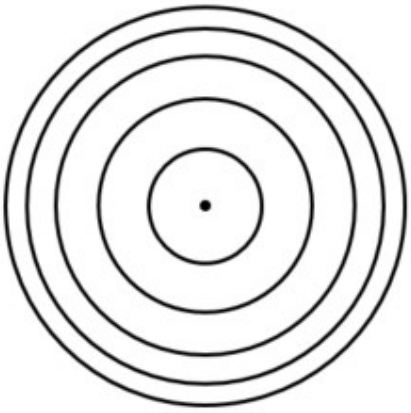
B



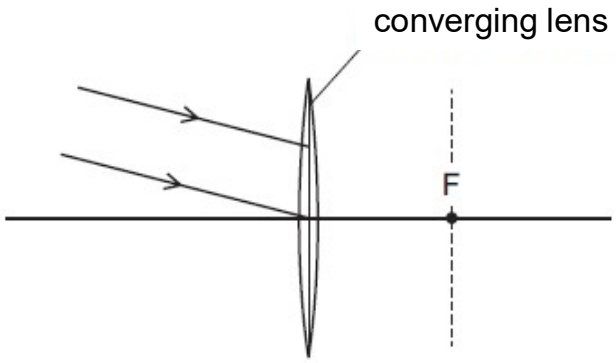
C



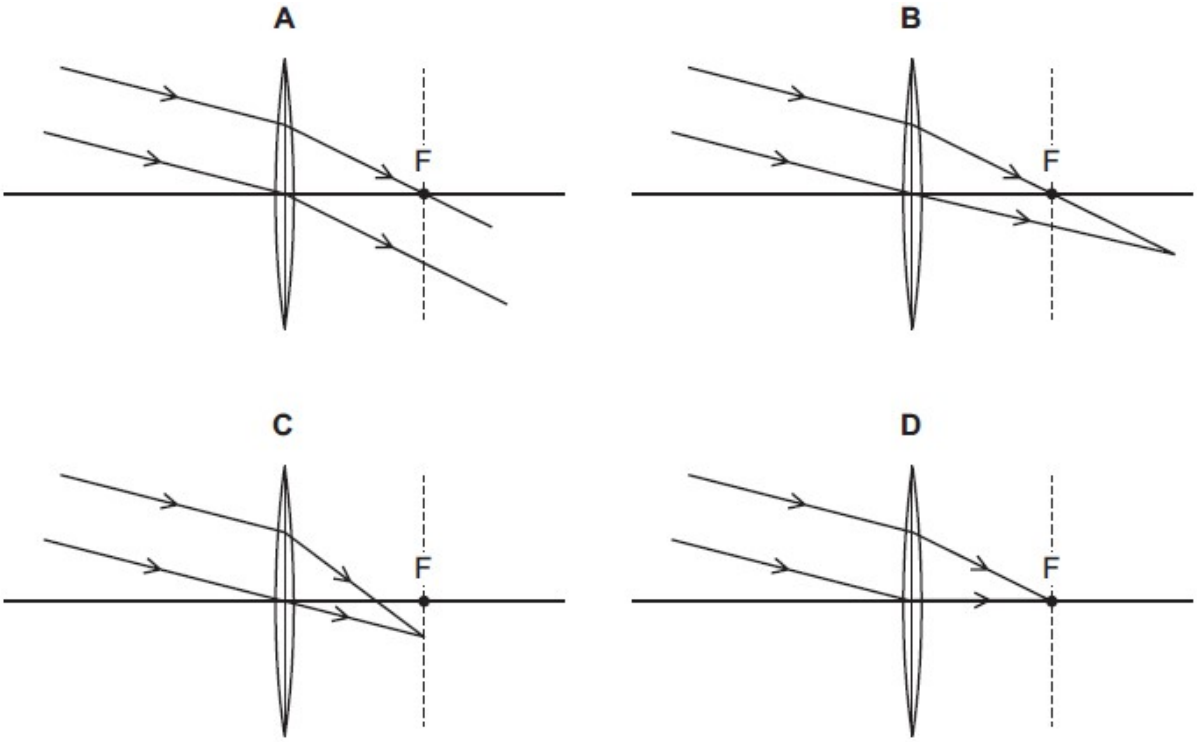
D



20 Two parallel light rays are incident on a converging lens.



F is the focal point of the lens. Which of the following shows how the two light rays travel after passing through the lens?



21 A ray of light strikes a plane mirror at an angle of incidence of 20°.

The angle of incidence is then increased by 5°. What is the new angle between the incident ray and the reflected ray?

A 10º
B 25º
C 30º
D 50º

22 An object is placed at a distance from a converging lens that is equal to twice the focal length of the lens.

Which statement about the image is correct?

A It is enlarged.
B It is inverted.
C It is on the same side of the lens as the object.
D It is virtual.

23 Which of the following statements about electromagnetic wave is not correct?

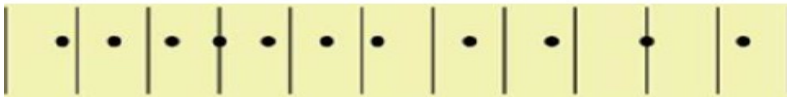
A The frequency and speed of the electromagnetic wave will change when travelling from one medium to another medium.
B They are all transverse waves.
C They obey laws of reflection and refraction.
D They will not deflect when they enter into a magnetic field or electric field.

24 A thermal imaging device is usually mounted on a sniper's gun to allow him to quickly spot a target in poor visibility.

Which of the following electromagnetic waves is used in such a device?

A infra-red radiation
B gamma rays
C ultra-violet radiation
D x-rays

25 The diagram shows the actual positions of the particles in the air at a particular instant when a sound wave passes through it. The lines indicate the positions of the particles before the wave arrived.



Given that the diagram is drawn to scale, what is the amplitude and the wavelength of the wave?

	amplitude / cm	wavelength / cm
A	0.5	6.0
B	0.8	6.0
C	0.8	12.0
D	1.6	12.0

26 The sound wave produced by a cello has a larger amplitude but lower frequency than the sound produced by a violin.

Which of the following statements is true about the characteristics of sound produced by both instruments?

	louder sound	higher pitch
A	cello	violin
B	cello	cello
C	violin	violin
D	violin	cello

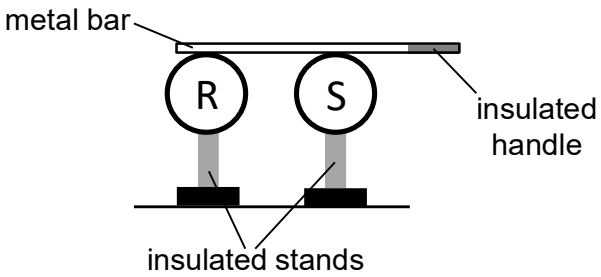
27 A negative charge in an electric field experiences an electric force in the direction shown.

(left) ⊖→ force (right)

What is the direction of the electric field?

A It is acting to the left.
B It is acting to the right.
C It is acting down the page.
D It is acting up the page.

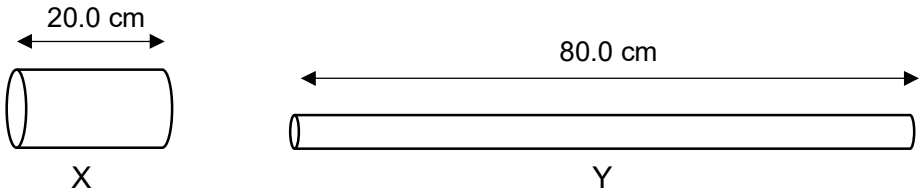
28 The diagram shows two metal spheres R and S mounted on insulated stands. S is initially uncharged while R is initially positively charged. A man holds a metal bar at the insulated handle and places it in contact with R and S.



What are the charges on R and S after the metal bar is placed over them?

	charge on R	charge on S
A	positive	positive
B	positive	uncharged
C	uncharged	positive
D	uncharged	uncharged

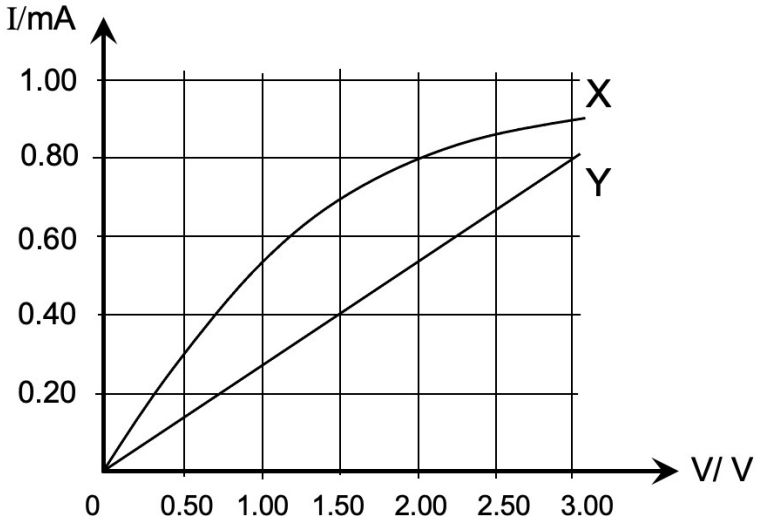
29 Two steel wires X and Y with equal volumes have lengths of 20.0 cm and 80.0 cm respectively as shown.



What is the ratio of the resistance of wire X to wire Y?

A 1 : 2
B 1 : 4
C 1 : 16
D 1 : 64

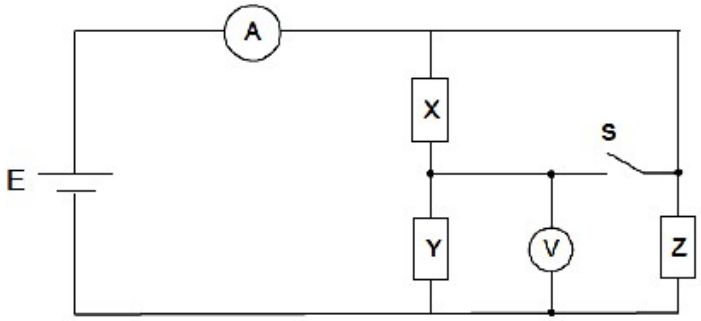
30 The voltage-current characteristics of two components X and Y are shown in the graph below.



Two components X and Y are connected in parallel with a 3.0 V battery. What is the amount of energy used in the battery in 1.5 minutes?

A 0.30 J
B 0.46 J
C 7.7 J
D 460 J

31 Three identical resistors X, Y and Z are connected in an electric circuit as shown below.



Which of the following is true when switch S is closed?

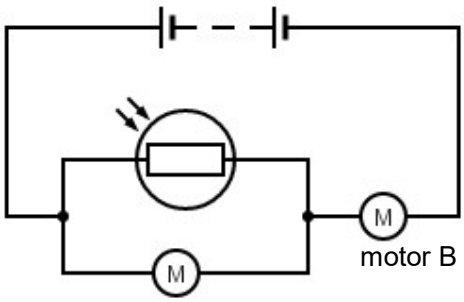
A The ammeter reading decreases.

B The potential difference across X and Y will be the same.

C The voltmeter reading will increase from E/2 to 2/3 E.

D The voltmeter reading will increase from E/2 to E.

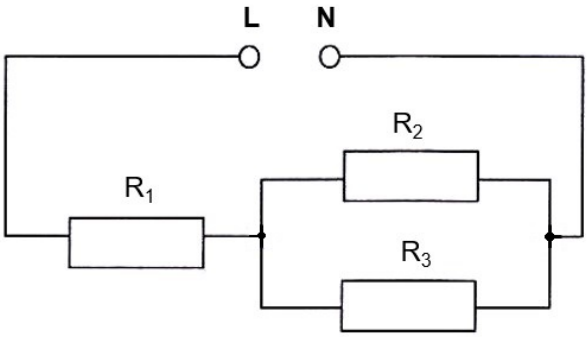
32 The diagram shows a circuit with two identical motors and an LDR placed in a bright room.



When the lights in the room are switched off, what would happen to the speed of motors A and B?

	motor A	motor B
A	speed decreased	speed increased
B	speed increased	speed decreased
C	speed decreased	speed remained the same
D	speed increased	speed remained the same

33 The diagram shows a circuit with three identical resistors, R_1, R_2 and R_3.



What is the ratio of power dissipated by R_1, R_2 and R_3?

A 1:2:2

B 1:4:4

C 3:1:1

D 4:1:1

34 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 of the following statements about the hair dryer is true?

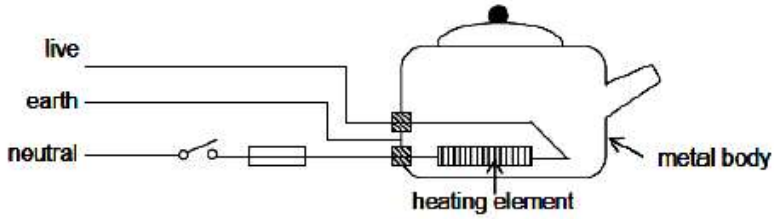
A It cost $1.50 every month to use the hair dryer.

B The energy dissipated in the hair dryer every month is 17 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.

35 The diagram shows the circuit of an electric kettle that has been wrongly wired.



Which of the following statements about the kettle is not true?

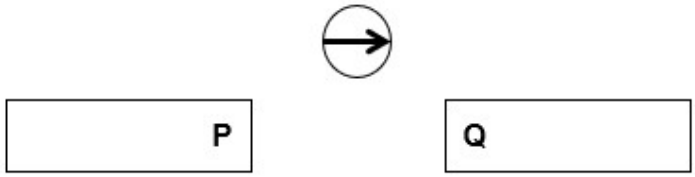
A The kettle can still work and the fuse will not blow.

B The neutral wire will have a low potential when the switch is closed.

C When the live wire accidentally touches the metal body, earthing will not occur.

D When the switch is opened, the heating element will still be at a high potential.

36 A plotting compass is placed between two bars as shown in the diagram below.



Which of the following statements is incorrect?

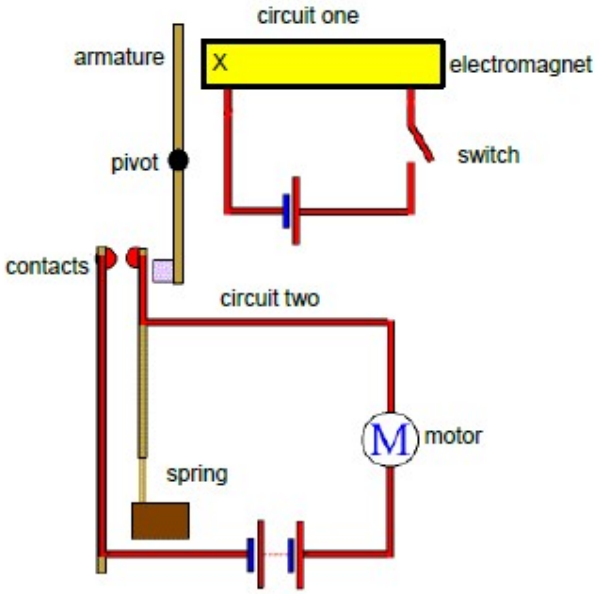
A P is a steel bar and Q is the South pole of a magnet

B P is an iron bar and Q is the South pole of a magnet.

C P is a North pole of a magnet and Q is an iron bar.

D P is a South pole of a magnet and Q is a North pole of a magnet.

37 The diagram below shows a magnetic relay. When the switch is closed, the soft iron armature is attracted to the electromagnet, closing the contacts and the motor will be turned on.



If the current flowing in the electromagnet is decreased, which of the following changes should be made to the circuit such that the motor can still be turned on when the switch is closed?

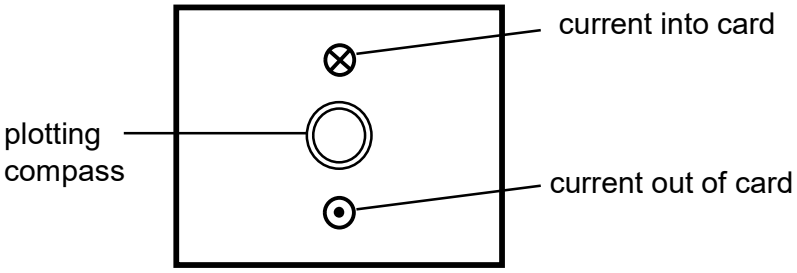
A Bring the electromagnet nearer to the armature.

B Reduce the number of turns of the solenoid in the electromagnet.

C Replace the soft iron core in the electromagnet with a steel bar.

D Replace the wire in the electromagnet with a wire of higher resistance.

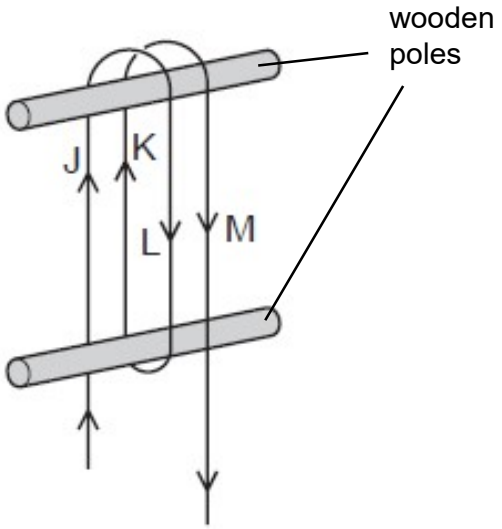
38 Two wires pass perpendicularly through a piece of cardboard that is held horizontally. The diagram below shows the top view of the cardboard. Both wires carry a large current flowing in the direction indicated in the diagram.



A plotting compass is placed on the card and in the middle of the two wires. Which diagram shows the direction in which the needle of the compass points?

A **B** **C** **D**

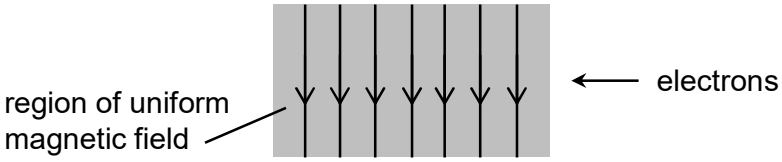
39 A long wire is wrapped around two wooden poles. A large current flows through the wire in the direction shown.



Which two pairs of wire attract and repel each other?

	attract	repel
A	J and K	K and M
B	J and K	L and M
C	J and L	K and M
D	J and L	L and M

40 The figure below shows a beam of electrons entering a region of uniform magnetic field. The magnetic field is pointing downwards, towards the bottom of the page.



In which of the following directions do the electrons deflect to?

A Into the page
B Out of the page
C Towards the bottom of the page
D Towards the top of the page

END OF PAPER

Answer

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