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West Spring Secondary School

PRELIMINARY EXAMINATION 2020

Physics

6091/01

SECONDARY 4 EXPRESS

Name _____ () **Date** 18 Sept 2020

Class _____ **Duration** 1 hr

Additional Materials: 1 OTAS

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper-clips, highlighters, glue or correction fluid.

Write your name and shade your index number on the Answer Sheet (OTAS) in the spaces provided.

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.

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.

This document consists of **16** printed pages, including this cover page.

Setter : Mr Prakash s/o Radakrishna

[Turn over

- 1 Which of the following shows the best estimate of the diameter of Earth?

A 1.3×10^4 km
B 1.3×10^5 km
C 1.3×10^6 km
D 1.3×10^7 km

- 2 The diameter of a glass rod is measured with a set of vernier calipers.

With jaws closed and no glass rod between them, the reading is shown in diagram 1.

With the jaws closed around the glass block, the vernier calipers reading is shown in diagram 2.

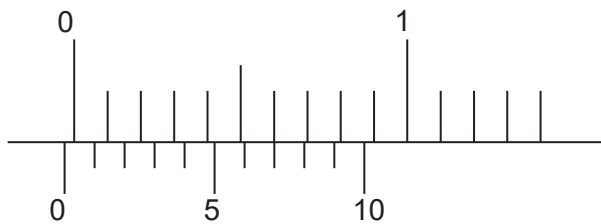


diagram 1

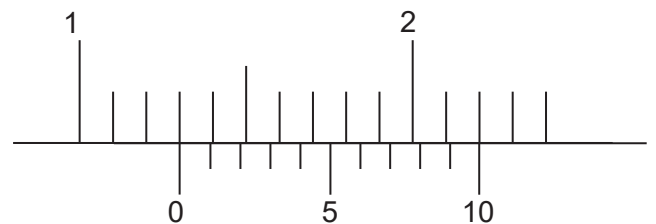


diagram 2

What is the diameter of the glass rod?

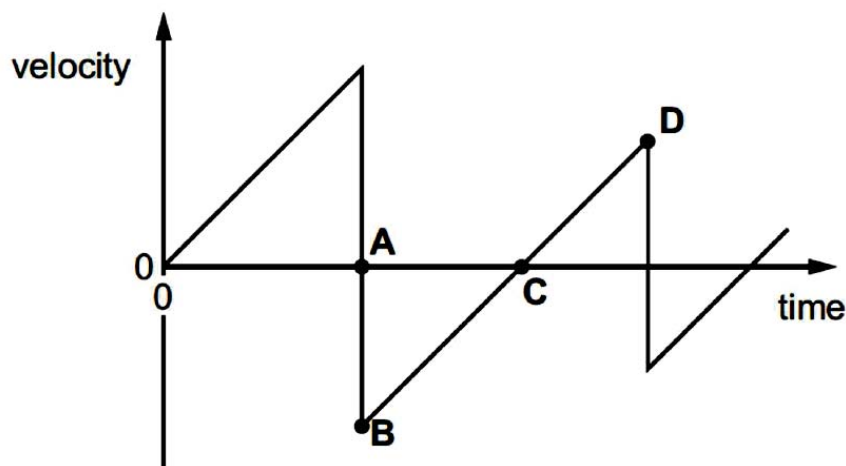
A 1.27 cm **B** 1.33 cm **C** 1.37 cm **D** 1.43 cm

- 3 A runner runs 300 m at an average speed of 3.0 m/s. She then runs another 300 m at an average speed of 6.0 m/s.

What is her average speed for the total distance of 600 m?

A 2.0 m/s **B** 4.0 m/s **C** 4.5 m/s **D** 8.0 m/s

- 4 A ball is released from rest above a hard, horizontal surface. The graph shows how the velocity of the bouncing ball varies with time.



At which point on the graph does the ball reach its maximum height after the first bounce?

- 5 At lift off, the mass of a Saturn V rocket is 3.2×10^6 kg. The rocket engines produce a thrust of 3.4×10^7 N. The gravitational field strength g is 10 N / kg .

What is the initial acceleration of the rocket?

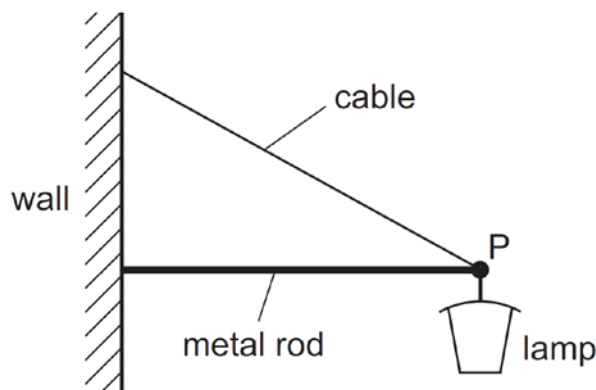
- A 0.094 m / s^2 B 0.63 m / s^2 C 1.6 m / s^2 D 11 m / s^2

- 6 Forces of 3 N, 4 N and 5 N act at one point on an object. The angles at which the forces act can vary.

What is the value of the **minimum** resultant force of these forces?

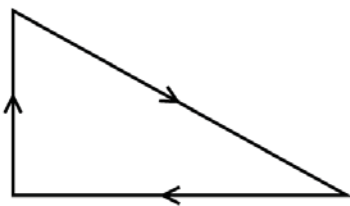
- A 0 B between 0 and 2 N
C 2 N D between 2 N and 4 N

- 7 A street lamp is fixed to a wall by a metal rod and a cable.

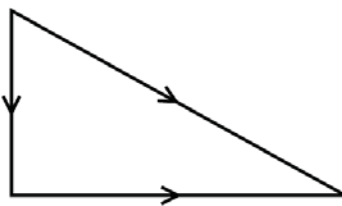


Which vector triangle could represent the forces acting at point P?

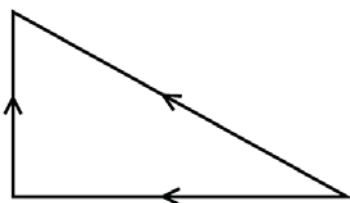
A



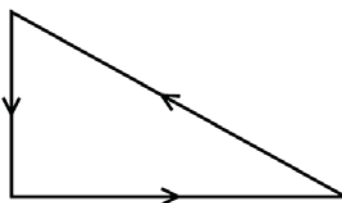
B



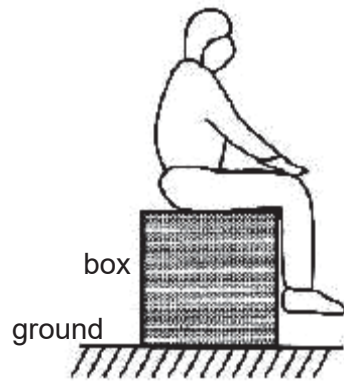
C



D

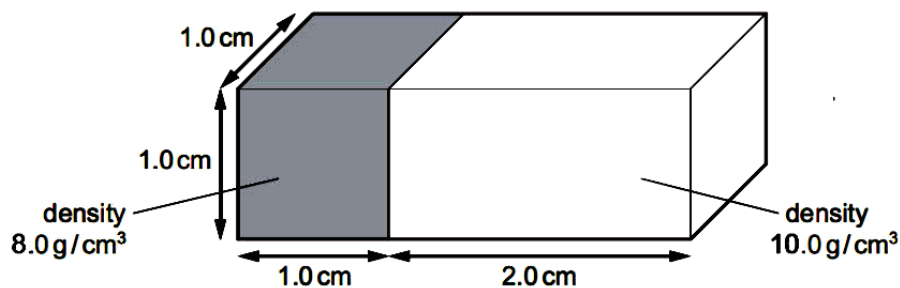


- 8 The diagram shows a man sitting on a box that rests on the ground.



Which of the following action-reaction pairs is correct?

- A The weight of the man and the normal force from the box supporting man.
 - B The weight of the man and the normal force on the box by the man.
 - C The weight of the box and the normal force from the ground on the box.
 - D The weight of the man and the gravitational force of man on Earth.**
- 9 A gravitational field is a region in which a body with mass experiences a force.
- Which statement about this force is correct?
- A It can be attractive or repulsive.
 - B It depends on the charge on the body.
 - C It depends on the volume of the body.
 - D It keeps a planet in orbit around the sun.**
- 10 Two blocks of solids with different densities are joined together.

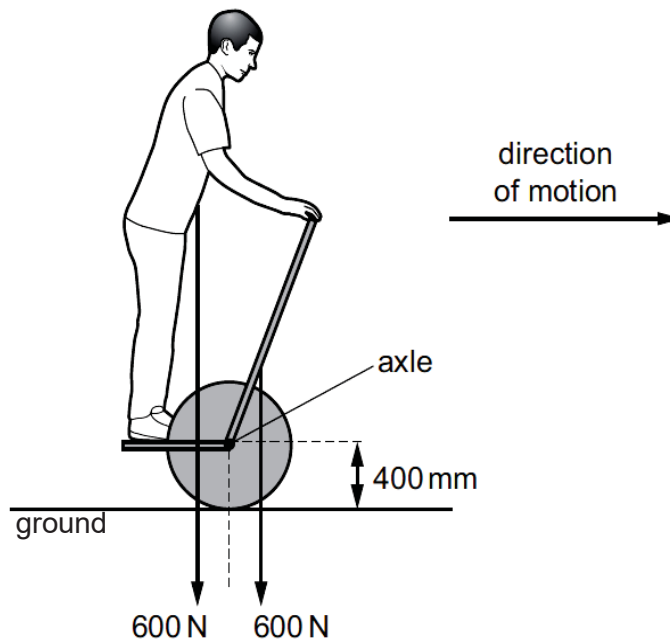


One block has a density of 8.0 g/cm^3 and the other has a density of 10.0 g/cm^3 .

What is the average density of the two blocks joined together?

- A 8.7 g/cm^3
- B 9.0 g/cm^3
- C 9.3 g/cm^3**
- D 18.0 g/cm^3

- 11 The diagram shows a motorised vehicle for carrying one person.



The vehicle has two wheels on one axle. The passenger stands on a platform between the wheels.

The weight of the machine is 600 N. Its centre of gravity is 200 mm in front of the axle. The wheel radius is 400 mm. When stationary, a passenger of weight 600 N stands with his centre of gravity 200 mm behind the axle to balance the machine.

The motor is now switched on to provide a forward horizontal force of 90 N at the ground to move the vehicle forwards.

How far and in which direction must the passenger move his centre of gravity to maintain balance?

- A** 60 mm backwards **B** 60 mm forwards
C 140 mm backwards **D** 140 mm forwards
- 12 A thin horizontal plate of area 0.036 m^2 is beneath the surface of a liquid of density 930 kg/m^3 . The force on one side of the plate due to the pressure of the liquid is 290 N.

The gravitational field strength g is 9.81 N/kg .

What is the depth of the plate beneath the surface of the liquid?

- A** 0.88 m **B** 1.1 m **C** 1.8 m **D** 8.7 m

- 13** A piston in a gas supply pump has an area of 400 cm^2 . The pump moves the gas against a fixed pressure of 3000 Pa . During part of its stroke, the piston moves a distance of 25 cm in one direction.

How much work is done by the piston during this movement?

- A** 30 J **B** $3.0 \times 10^3 \text{ J}$ **C** $3.0 \times 10^5 \text{ J}$ **D** $3.0 \times 10^7 \text{ J}$

- 14** On the surface of a planet, 30 J of work is done against gravity to raise a mass of 1.0 kg through a height of 10 m .

How much work must be done to raise a mass of 4.0 kg through a height of 5.0 m on this planet?

- A** 15 J **B** 60 J **C** 120 J **D** 200 J

- 15** An electric motor produces 120 W of useful mechanical output power. The efficiency of the motor is 60% .

Which row is correct?

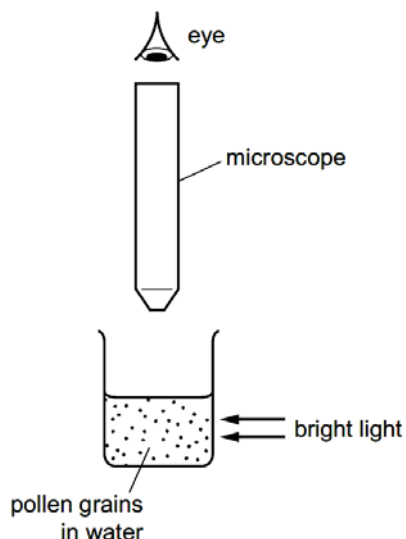
	electrical power input / W	waste heat power output / W
A	72	48
B	192	72
C	200	72
D	200	80

- 16** Which row correctly describes the spacing, ordering and motion of the molecules in water and in ice when both are at a temperature of 0°C ?

	spacing	ordering	motion
A	molecules in ice are closer together than molecules in water	a regular pattern of molecules in both ice and water	molecules in both ice and water have the same average speed
B	molecules in ice are closer together than molecules in water	a regular pattern of molecules in ice but not in water	molecules in ice travel more slowly than those in water
C	molecules in ice are further apart than molecules in water	a regular pattern of molecules in both ice and water	molecules in ice travel more slowly than those in water
D	molecules in ice are further apart than molecules in water	a regular pattern of molecules in ice but not in water	molecules in both ice and water have the same average speed

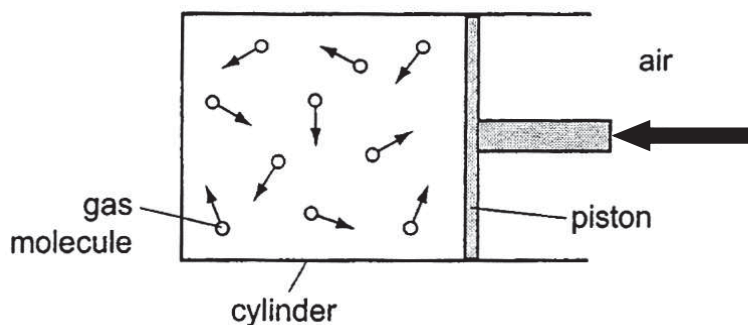
- 17 Very small pollen grains are suspended in water. A bright light shines from the side.

When looked at through a microscope, small specks of light are seen to be moving in a random, jerky manner.



What are the moving specks of light?

- A** Pollen grains being hit by water molecules.
B Pollen grains being hit by other pollen grains.
C Water molecules being hit by other water molecules.
D Water molecules being hit by pollen grains.
- 18 Gas inside a cylinder is cooled slowly to a lower temperature and the piston moves inwards.



As the volume decreases, the pressure of the gas remains constant.

How does the speed of the gas molecules and their rate of collisions with the piston compare with their initial values at the higher temperature?

	speed of molecules	rate of collision
A	decreases	decreases
B	decreases	stays constant
C	decreases	increases
D	stays constant	decreases

- 19 When a thermometer is calibrated, the fixed points are marked.

What are fixed points?

- A All the marks on the temperature scale which cannot be removed.
- B All the marks of the temperature scale.
- C The lowest and highest temperatures shown on the thermometer.
- D Two temperatures of known value which are easily reproduced.

- 20 A test-tube contains 1.0 cm^3 of liquid water at 100°C . The liquid water boils to form 1600 cm^3 of steam.

What is the reason for the large increase in volume?

- A Steam molecules are bigger than water molecules.
- B The average distance between the molecules is much greater in the steam.
- C The molecules do not move until the water turns into a gas.
- D There are more steam molecules than there were water molecules.

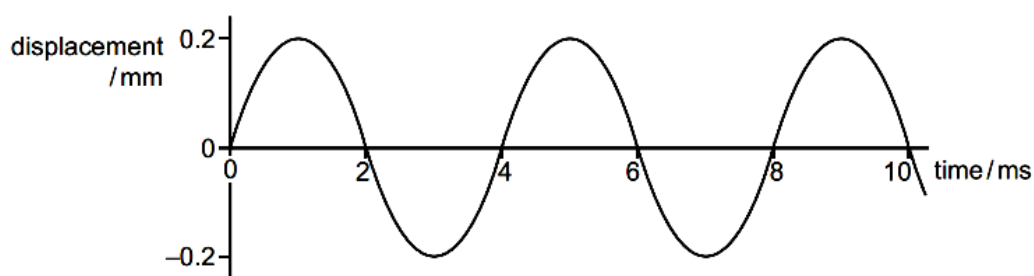
- 21 A piece of iron of mass m has a specific heat capacity of c .
A piece of aluminium of mass $2m$ has a specific heat capacity of $2c$.

Both of these metals receive the same quantity of heat energy and the temperature of the aluminium rises by 10°C .

What is the temperature rise of the iron?

- A 5.0°C B 10°C C 20°C D 40°C

- 22 A sound wave moves with a speed of 340 m/s through air. The variation with time of the displacement of an air particle due to this wave is shown in the graph.

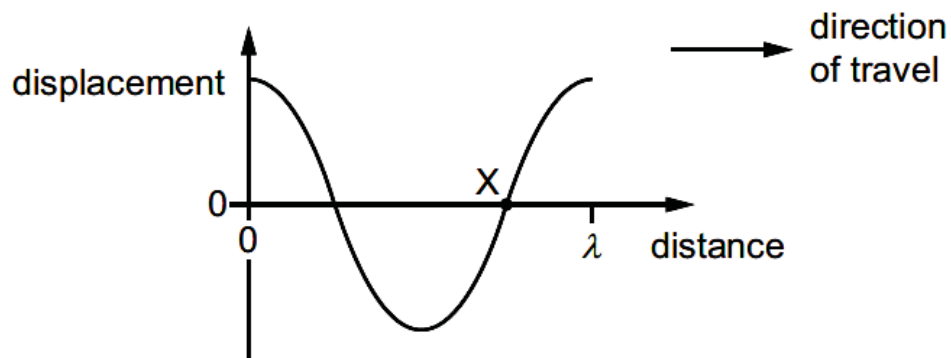


Which statement about the sound wave is correct?

- A It is a transverse wave.
- B The frequency of the wave is 0.25 Hz .
- C The maximum displacement from the rest position of a particle is 0.40 mm .
- D The wavelength of the sound wave is 1.36 m .

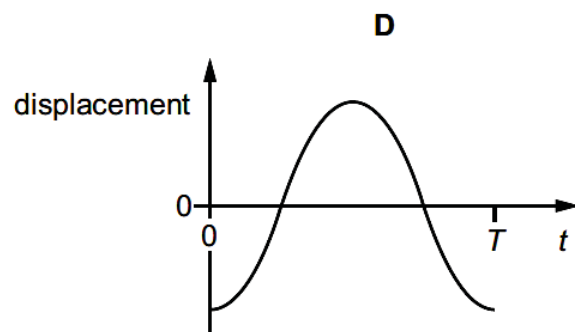
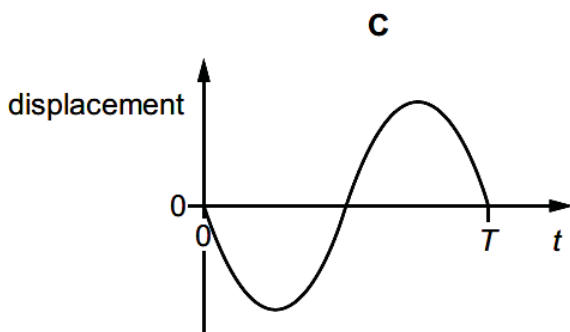
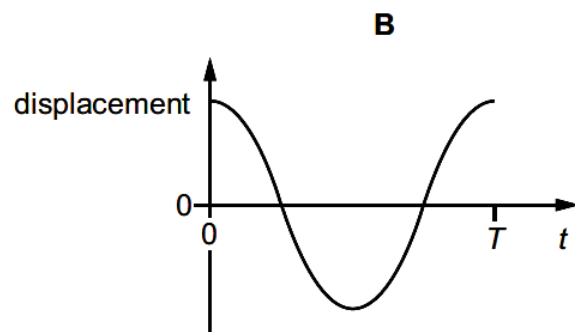
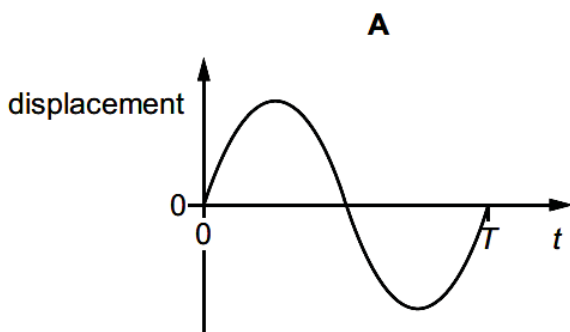
- 23 A transverse wave on a rope has wavelength λ and period T .

The graph shows the variation of the displacement of the particles of the rope with distance in the direction of travel of the wave at time $t = 0$.



A particle X is labelled.

Which graph shows the variation of the displacement of particle X with time t ?

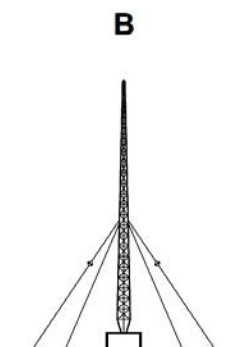


- 24 The diagrams show four sources of waves.

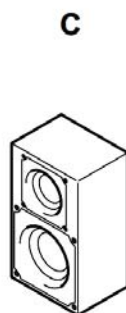
Which source produces longitudinal waves?



stick pushed up
and down in water



radio
transmitter

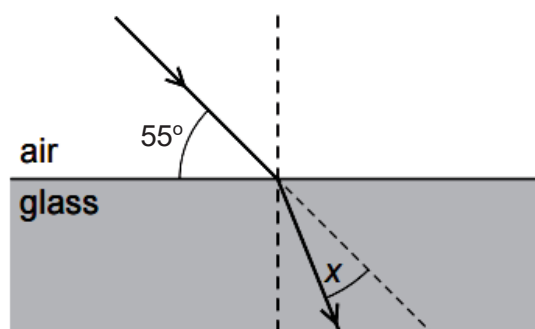


loudspeaker



lamp

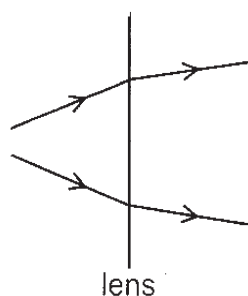
- 25 A ray of light enters a glass block at an angle of 55° with the boundary (surface).



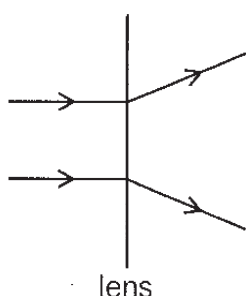
The refractive index of the glass is 1.5. The light ray changes direction when entering the glass.

What is the angle X through which the ray moves?

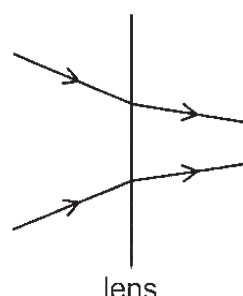
- A** 1.9° **B** 12.5° **C** 22.5° **D** 33.1°
- 26 Which diagram shows rays of light passing through a converging lens?



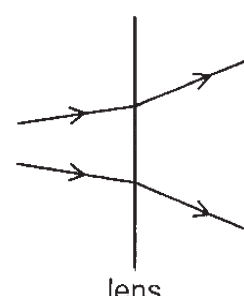
A



B

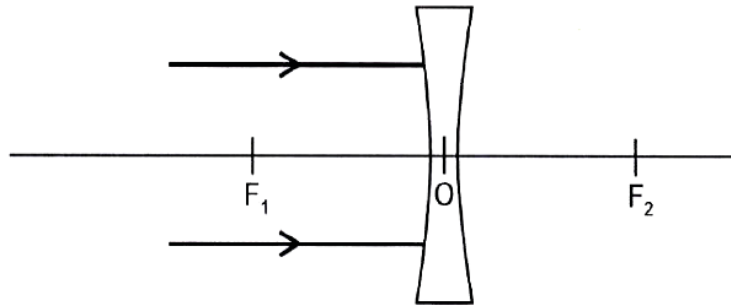


C



D

- 27 Two rays of light strike a diverging lens as shown in the diagram.



The distance from the centre of the lens, O to F_1 or to F_2 is the focal length of the lens.

Which statement about the rays after they have passed through the lens is correct?

- A** They appear to come from F_1 .
 - B** They appear to come from O.
 - C** They appear to come from F_2 .
 - D** They meet at F_2 .
- 28 Different parts of the electromagnetic spectrum are used for different purposes.

Below are four statements about parts of the spectrum.

statement 1: Infra-red waves are used in television remote controllers.

statement 2: Radio waves are used to transmit television pictures from satellites to Earth.

statement 3: Ultra-violet waves are used for intruder alarms.

statement 4: X-rays are used for security checks.

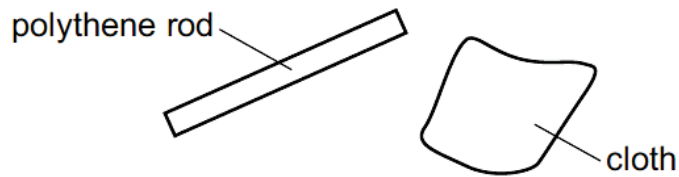
Which statements are correct?

- A** 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4
- 29 A sound wave has a frequency of 2500 Hz and a speed of 1500 m/s.

What is the shortest distance from a point of maximum pressure in the wave to a point of minimum pressure?

- A** 0.15 m **B** 0.30 m **C** 0.60 m **D** 1.20 m

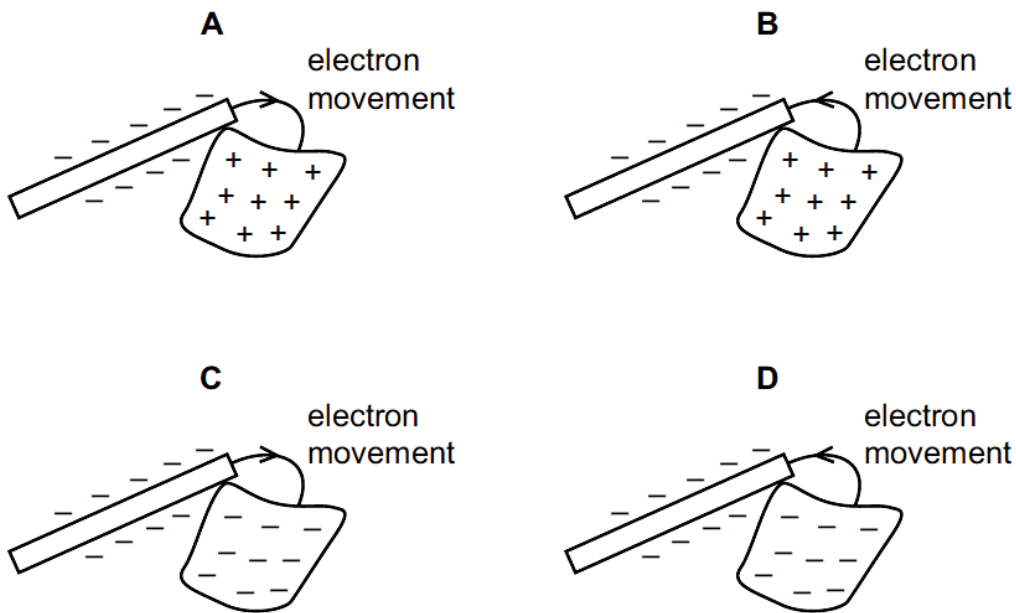
- 30 A polythene rod is rubbed with a cloth.



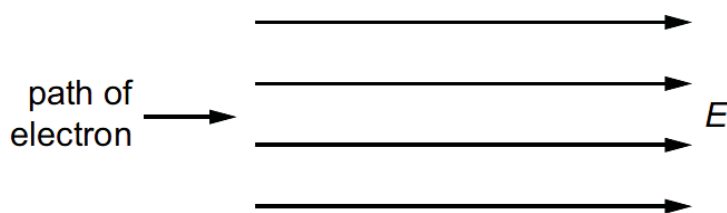
The rod and the cloth both become charged as electrons move between them.

The rod becomes negatively charged.

Which diagram shows how the rod becomes negatively charged, and the final charge on the cloth?



- 31 An electron enters a region of space where there is a uniform electric field E as shown.

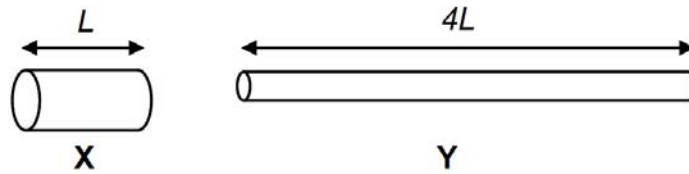


Initially, the electron is moving parallel to, and in the direction of, the electric field.

What is the subsequent path and change of speed of the electron caused by the electric field?

	path of electron	speed of electron
A	curved	decreases
B	curved	increases
C	linear	decreases
D	linear	increases

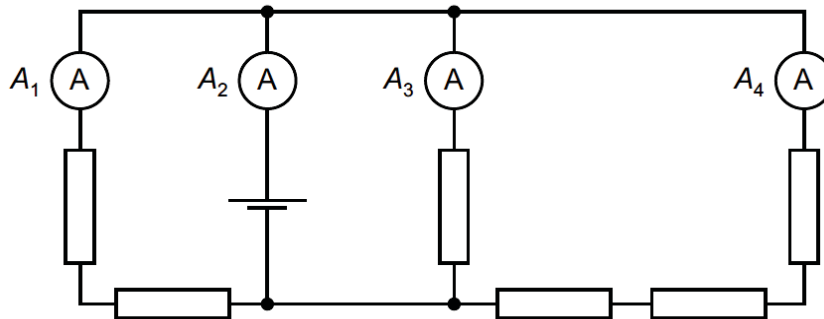
- 32 The diagram below shows two copper wires **X** and **Y**. Both wires have the same volume and wire **Y** is four times as long as wire **X**.



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

- A** 4:1 **B** 8:1 **C** 16:1 **D** 64:1

- 33 In the circuit shown, all the resistors are identical and all the ammeters have negligible resistance.

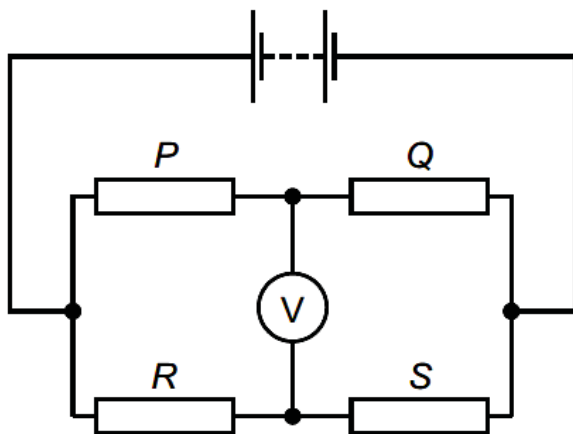


The reading A_1 is 0.6 A.

What are the readings on the other ammeters?

	A_2 / A	A_3 / A	A_4 / A
A	1.0	0.3	0.1
B	1.4	0.6	0.2
C	1.8	0.9	0.3
D	2.2	1.2	0.4

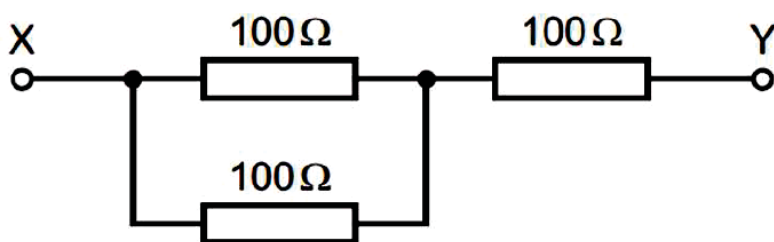
- 34 The circuit diagram shows four resistors of different resistances P , Q , R and S connected to a battery.



The voltmeter reading is zero.

Which equation is correct?

- A $P - Q = R - S$
 B $P - S = Q - R$
 C $PQ = RS$
 D $PS = QR$
- 35 Three resistors are to be connected into a circuit with the arrangement shown.



The power in any resistor must not be greater than 4.0 W.

What is the maximum voltage across XY?

- A 24 V B 30 V C 40 V D 60 V

- 36 The box contains the names of eight different energy resources.

natural gas	geothermal	solar	waves
hydroelectric	oil	wind	coal

How many of these energy resources are renewable?

- A 3 B 4 C 5 D 6

- 37 An electrical cable contains three wires: live, neutral and earth. The cable is correctly wired to a plug which contains a 3 A fuse. The insulation becomes damaged and the bare metal wires show.

Five possible events may occur.

- The live wire touches the neutral wire.
- The live wire touches the earth wire.
- A person touches the earth wire.
- A person touches the neutral wire.
- A person touches the live wire.

How many of these events will cause the fuse in the plug to blow?

- A 1 B 2 C 3 D 4

- 38 Bernice wishes to magnetise two steel bars X and Y.

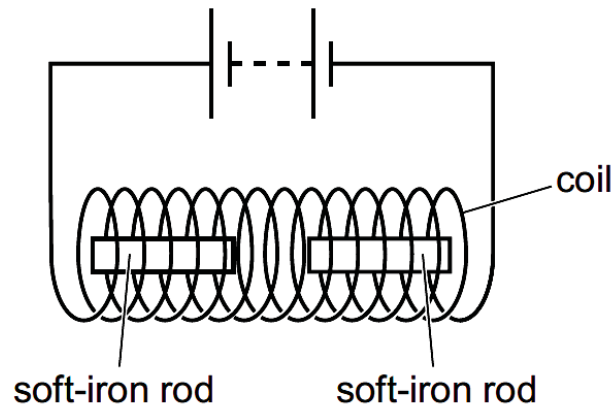
She places bar X in a coil connected to a d.c. power supply.

She places bar Y parallel to a magnetic field and hammers it.

Which bar(s) become(s) magnetised?

- A X and Y
B X only
C Y only
D neither X nor Y

- 39 Two soft-iron rods are placed end-to-end inside a coil. The coil is connected to a battery.

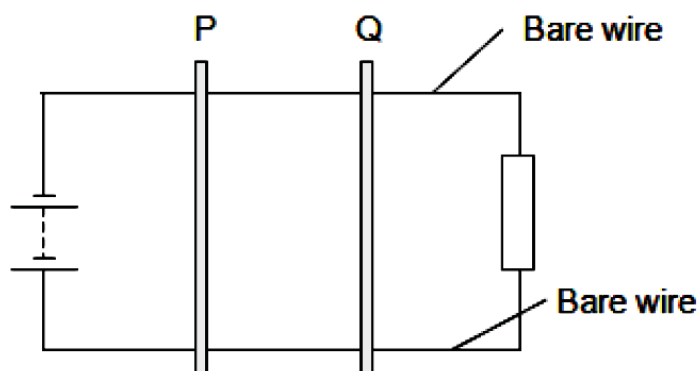


The connections from the battery to the coil are now reversed.

What happens to the soft-iron rods in each case?

	battery connections as shown	battery connections reversed
A	rods attract	rods attract
B	rods attract	rods repel
C	rods repel	rods attract
D	rods repel	rods repel

- 40 Copper rods P and Q are placed on top of rigid bare wires as shown.



Which observation is correct when the power supply is changed to a low frequency alternating current?

- A** P and Q attract each other.
- B** P and Q repel each other.
- C** P and Q repel then attract each other.
- D** P and Q both roll to the right and then to the left, keeping the same distance apart.

End of Paper

