Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

PHYSICS **0625/31**

Paper 3 Theory (Core) **October/November 2021**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.
- Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m / s^2).

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages.

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1 A student uses a ruler to measure the length of a piece of wire, as shown in Fig. 1.1.

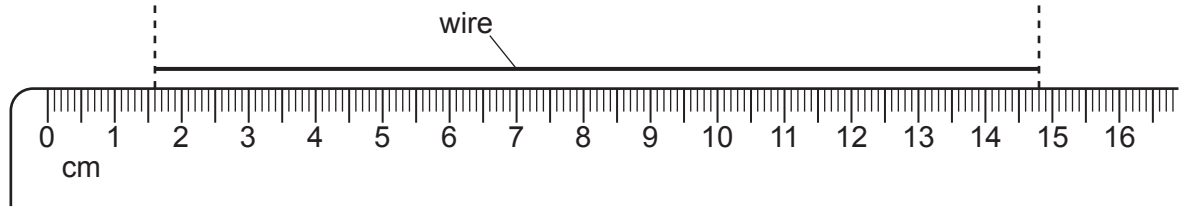

Fig. 1.1 (not to scale)

(a) Use the ruler in Fig. 1.1 to determine the length of the piece of wire.

View solution

length of wire = ... cm [2]

(b) The student folds the piece of wire and measures its mass.

View solution

(i) State the name of an instrument the student can use to measure mass.

..... [1]

(ii) The student determines the volume of the wire.

He uses a measuring cylinder part-filled with water and places the wire in it, as shown in Fig. 1.2.

View solution

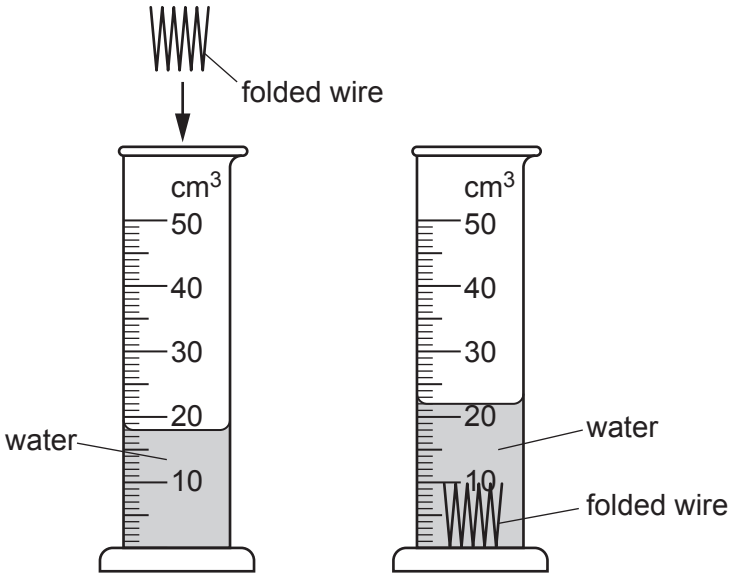

Fig. 1.2

Determine the volume of the wire by using information in Fig. 1.2.

volume of wire = ...cm^3 [2]

(c) The student measures the mass and the volume of a piece of metal.
The mass of the piece of metal is 93.6 g and its volume is 12 cm^3.

View solution

Calculate the density of the metal.

density of metal = ...g / cm^3 [3]

[Total: 8]

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2 A slope is made by resting one end of a plank of wood on a block, as shown in Fig. 2.1.

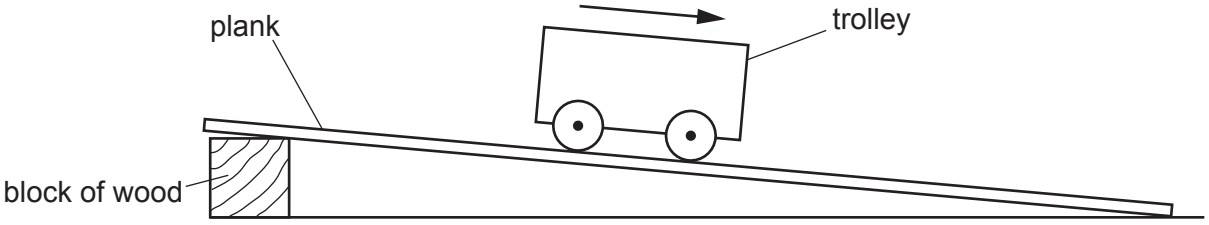

Fig. 2.1

Two students each use a digital stop-watch to measure the time for a small trolley to roll down the full length of the slope.

Fig. 2.2 shows the times on the stop-watches.

student 1 

time = ... s

student 2 

time = ... s

Fig. 2.2

View solution

(a) (i) On the line next to each stop-watch, write the time it shows. [1]

(ii) Calculate the average time for the trolley to roll down the slope.

View solution

average time = ... s [2]

(iii) The students want the same trolley to take more time to roll down the plank.

View solution

Suggest how the students alter the arrangement in Fig. 2.1.

..... [1]

(b) A different trolley travels 1.2 m down the slope in a time of 7.8 s.

View solution

Calculate the average speed of the trolley.

average speed = ... m / s [3]

(c) The trolley travels down a different slope. Fig. 2.3 shows the speed–time graph.

View solution

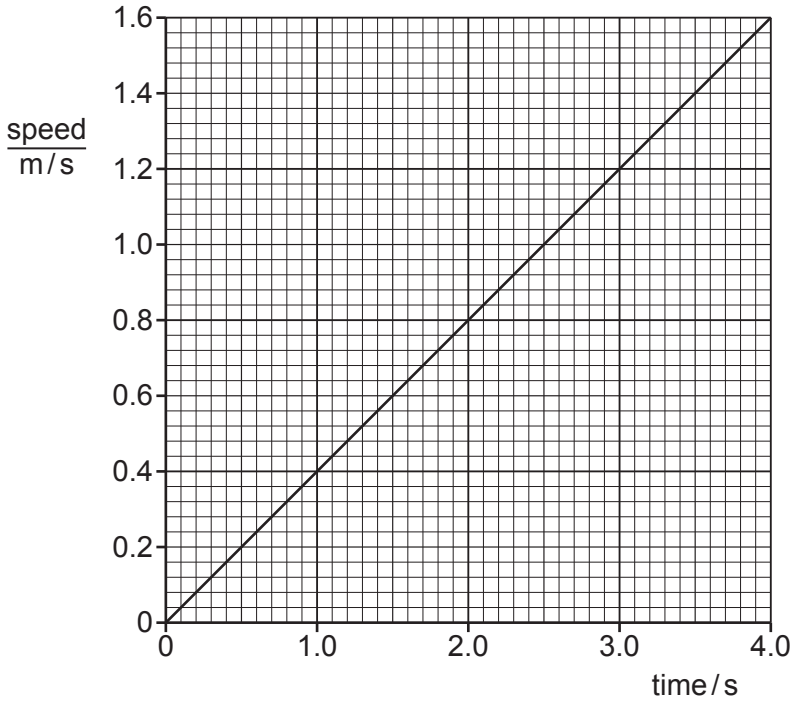

Fig. 2.3

Calculate the distance travelled by the trolley between time = 0 and time = 4.0 s.

distance travelled = ... m [3]

[Total: 10]

3 **(a)** A student determines the centre of mass of a piece of card. Fig. 3.1 shows the equipment the student uses.

View solution

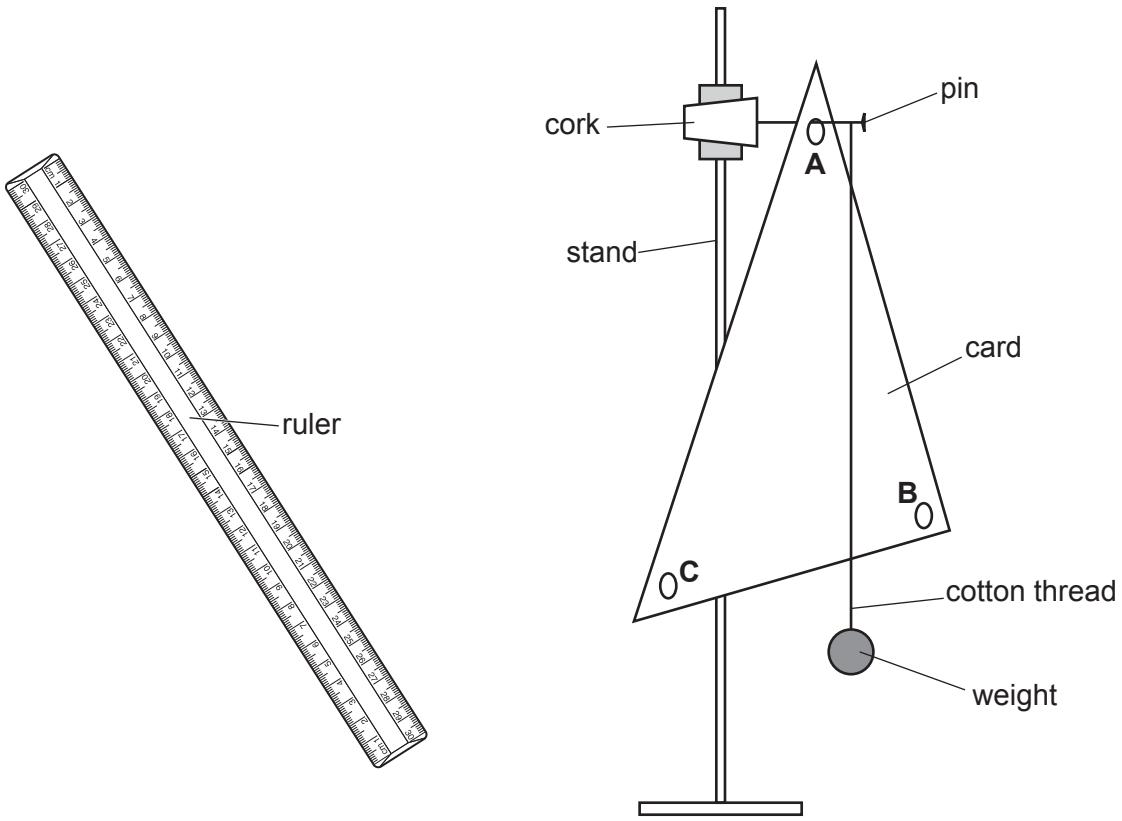

Fig. 3.1

Describe how the student determines the centre of mass of the card using the equipment in Fig. 3.1.

.....

.....

.....

.....

.....

..... [3]

(b) Another card is pivoted at point P. The weight of the card is 1.4 N and acts through a point 20 cm from P.

View solution

Fig. 3.2 shows the arrangement.

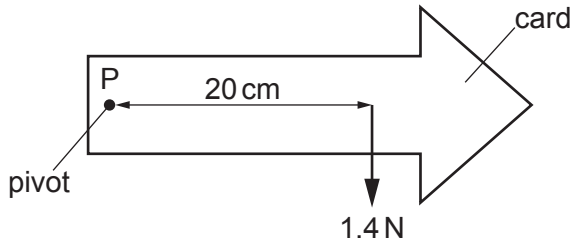

Fig. 3.2

Calculate the moment of the weight of the card about point P.

moment of weight = ... N cm [3]

[Total: 6]

4 **(a)** A substance cools from 50 °C to 5.0 °C. Its melting point is 20 °C. The substance takes 30 minutes to cool from 50 °C to its melting point.

View solution

The substance takes a total time of 80 minutes to cool from 50 °C to 5.0 °C.

On Fig. 4.1, sketch a graph that shows how the temperature of the substance varies with time as it cools from 50 °C to 5.0 °C.

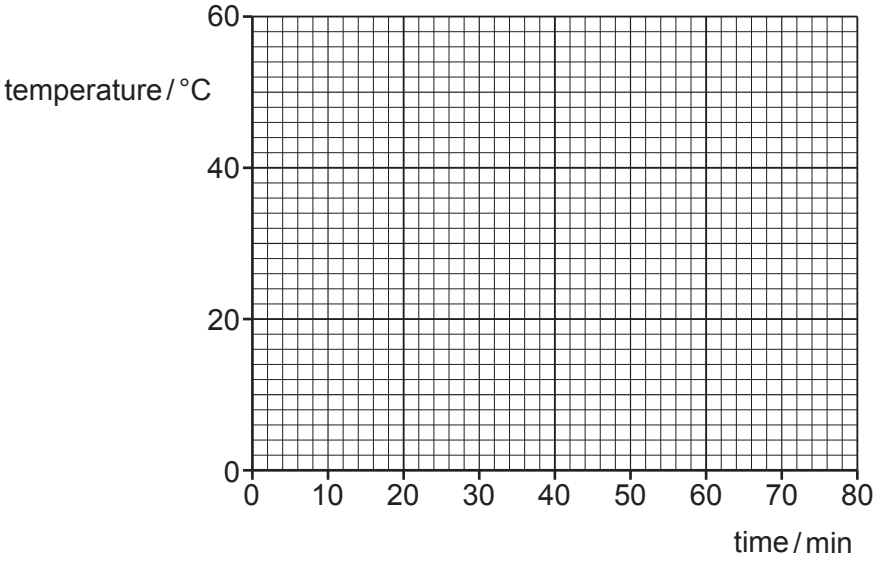

Fig. 4.1

[4]

(b) Describe the arrangement and motion of the molecules in the substance when they are in the solid state.

.....

.....

.....

..... [2]

[Total: 6]

View solution

5 Fig. 5.1 shows a plastic bottle on a bench. The plastic bottle contains a liquid.

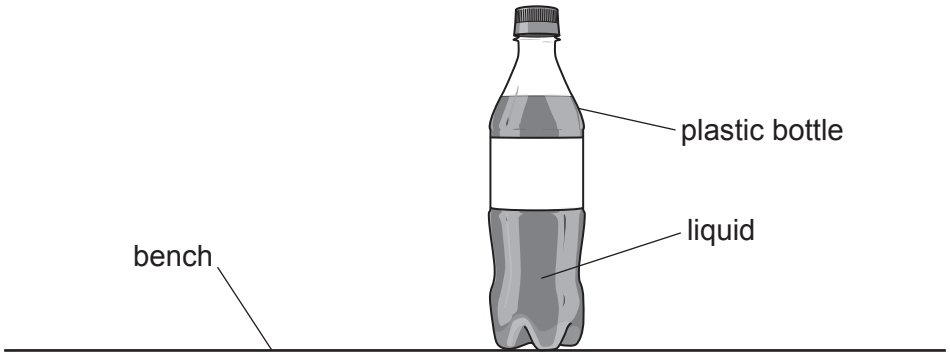

Fig. 5.1

(a) The weight of the bottle and liquid is 12 N. The area of the bottle in contact with the bench is 25 cm^2.

Calculate the pressure of the bottle on the bench.

View solution

pressure on bench = ... N/cm^2 [3]

(b) A student pours out all the liquid from the bottle. She then connects the bottle to a vacuum pump which removes most of the air from the bottle. Fig. 5.2 shows the bottle after most of the air is removed.

View solution

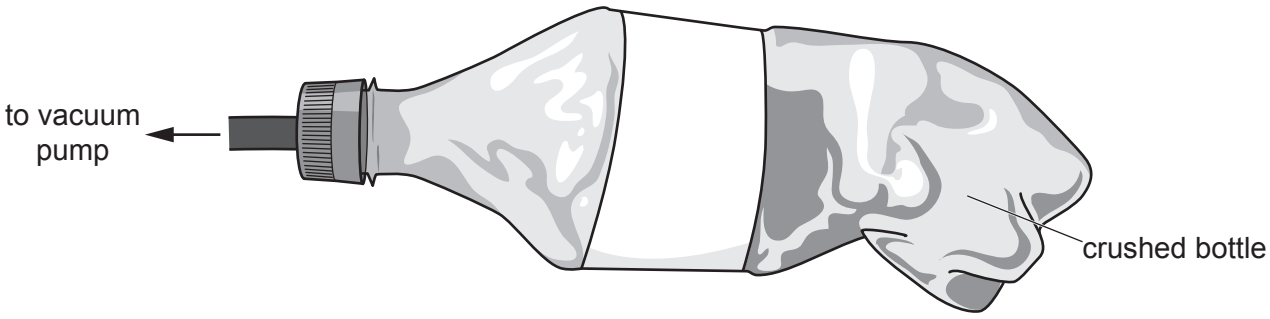

Fig. 5.2

Explain why the bottle is crushed. Use your ideas about molecules.

.....

.....

.....

.....

..... [4]

[Total: 7]

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6 **(a)** Fig. 6.1 shows part of a water wave.

View solution

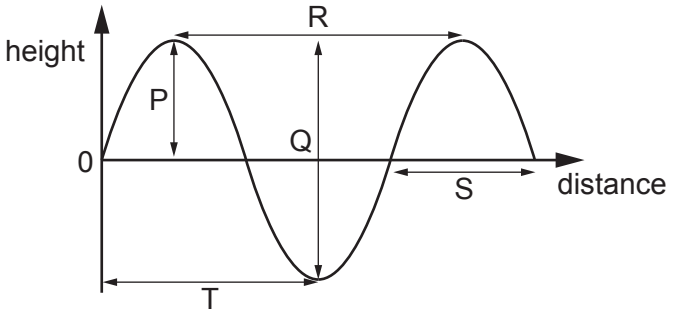

Fig. 6.1

(i) State the letter P, Q, R, S or T on Fig. 6.1 that represents the wavelength of the water wave.

..... [1]

(ii) State the letter P, Q, R, S or T on Fig. 6.1 that represents the amplitude of the water wave.

..... [1]

(iii) State what is meant by the term *frequency* of a wave.

.....

..... [1]

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(b) Two students, A and B, use echoes to measure the speed of sound.
Student A has two blocks of wood that make a loud sound when banged together. Student B has a stop-watch. They stand 120 m from a school wall as shown in Fig. 6.2.

View solution

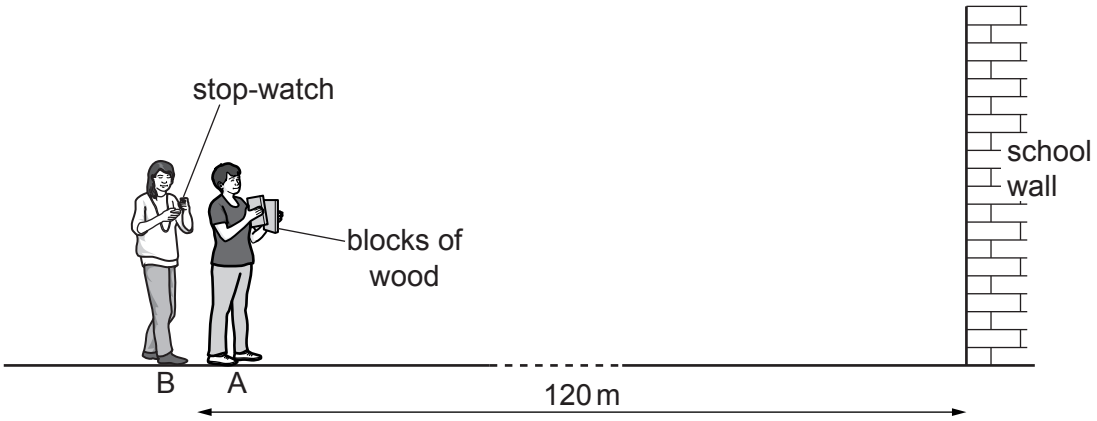

Fig. 6.2 (not to scale)

Describe how the students use the arrangement in Fig. 6.2 to determine the speed of sound in air.

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 7]

7 Fig. 7.1 shows a ray of red light entering a semicircular glass block. The ray strikes the flat surface of the block at X and emerges into the air. Fig. 7.1 does not show the path of the refracted ray in the air.

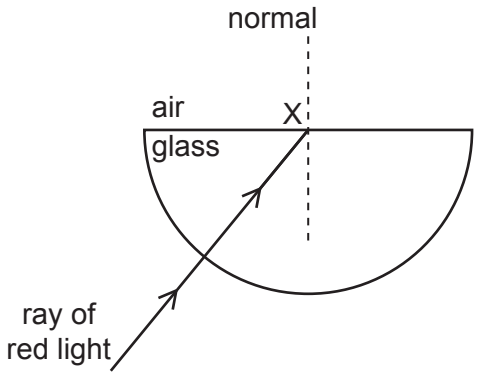

Fig. 7.1

(a) On Fig. 7.1:

View solution

(i) draw the path of the refracted ray in the air [1]

(ii) mark, and label with the letter *i*, the angle of incidence [1]

(iii) mark, and label with the letter *r*, the angle of refraction. [1]

(b) When the angle of incidence at X is 70°, the ray does **not** emerge from the glass into the air.

State what happens to the ray at X and explain why this happens.

View solution

.....

.....

..... [2]

(c) Visible light is one part of the electromagnetic spectrum. X-rays are also part of the electromagnetic spectrum.

View solution

(i) Visible light and X-rays are travelling through a vacuum.

Compare their speed and frequency by completing the sentences.

The speed of visible light is ..... the speed of X-rays.

The frequency of visible light is ..... the frequency of X-rays. [2]

(ii) Describe **one** use of X-rays.

View solution

..... [1]

[Total: 8]

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8 **(a)** Fig. 8.1 shows the magnetic field pattern around a bar magnet.

View solution

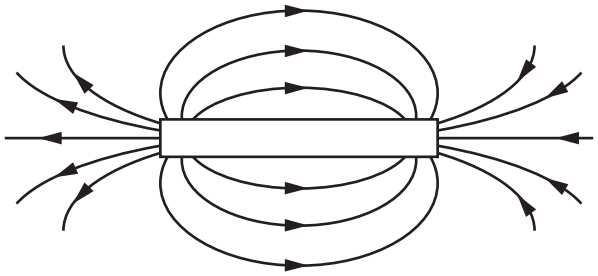

Fig. 8.1

(i) On Fig. 8.1, label the north and south poles of the magnet, using the letters N and S. [1]

(ii) A soft-iron bar is positioned as shown in Fig. 8.2.

View solution

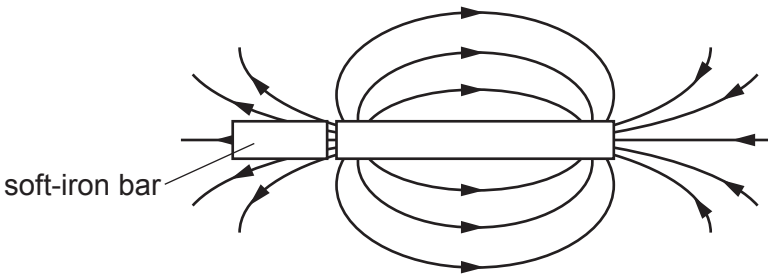

Fig. 8.2

State and explain what happens to the soft-iron bar.

.....

.....

..... [3]

(b) **(i)** A plastic rod is rubbed with a cloth. The plastic rod becomes positively charged.

Explain how the friction between the cloth and the rod causes the rod to become positively charged.

Use your ideas about the movement of charge.

View solution

.....

..... [2]

(ii) Plastic is an electrical insulator. Iron is an electrical conductor.

View solution

State **two** other materials that are electrical conductors.

1 .....

2 .....

[1]

[Total: 7]

9 This question is about electric circuits.

(a) (i) State the name of the instrument used to measure potential difference (p.d.) in an electric circuit.

..... [1]

(ii) State the unit for the electromotive force (e.m.f.) of a battery. View solution

..... [1]

(b) (i) A student connects a circuit to determine the resistance of a wire. The current in the wire is 0.20 A when the potential difference across the wire is 6.4 V.

Calculate the resistance of the wire.

View solution

resistance = ... Ω [3]

(ii) The student has some wires of the same material as those in **(b)(i)** but of various lengths and thicknesses. He wants a wire with higher resistance than the wire in **(b)(i)**.

State **two** ways of identifying a wire with a higher resistance by comparing its length and thickness with the wire in **(b)(i)**.

1 .....

2 .....

[2]

[Total: 7]

View solution

10 **(a)** A student plans to demonstrate the induction of an electromotive force (e.m.f.) in a wire.

He has a length of wire, a sensitive centre-reading galvanometer and a permanent magnet.

(i) Describe how the student uses the equipment.

View solution

.....

..... [2]

(ii) State **two** ways in which the student can increase the size of the induced e.m.f.

View solution

1 .....

2 .....

[2]

(b) Fig. 10.1 shows a d.c. motor.

View solution

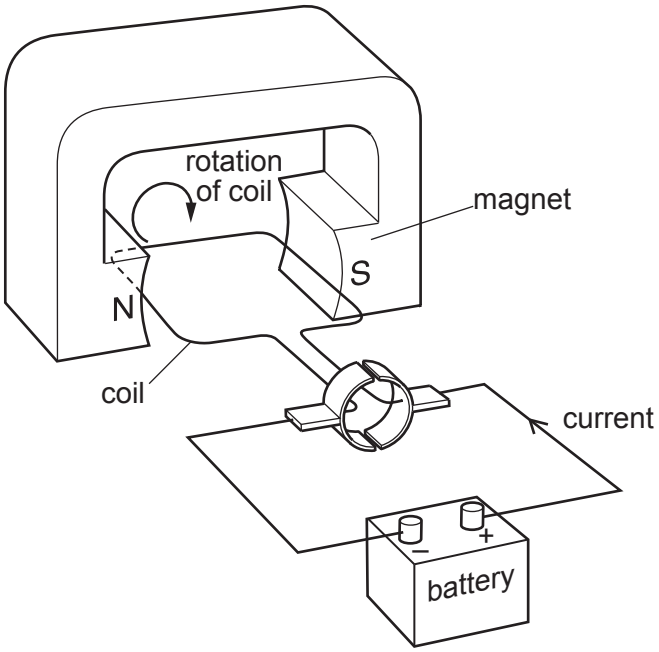

Fig. 10.1

(i) On Fig. 10.1, draw an arrow between the poles of the magnet to show the direction of the magnetic field. [1]

(ii) State **two** ways of making the coil spin faster.

View solution

1 .....

2 .....

[2]

(iii) State **one** way of making the coil spin in the opposite direction.

View solution

..... [1]

[Total: 8]

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11 (a) α (alpha)-particles, β (beta)-particles and γ (gamma)-rays have different characteristics.

View solution

Complete Table 11.1 by indicating the correct type of radiation for each characteristic. The first one is done for you.

Table 11.1

characteristic	type of radiation		
	α-particles (alpha-particles)	β-particles (beta-particles)	γ-rays (gamma-rays)
largest mass	✓		
most ionising			
most penetrating			
negatively charged			
greatest speed			

[3]

(b) A sample of radioactive material contains 80 mg of sodium-24.
The half-life of sodium-24 is 15 hours.

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Calculate the mass of sodium-24 remaining in the sample after 45 hours.

mass remaining = ... mg [3]

[Total: 6]

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