AQA GCSE Physics | 8463

SPECIFICATION POINT 4.3.1.1

Density of materials

Past-paper questions

Tier	**Higher**
Question groups	**20**
Available paper years	**2003–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

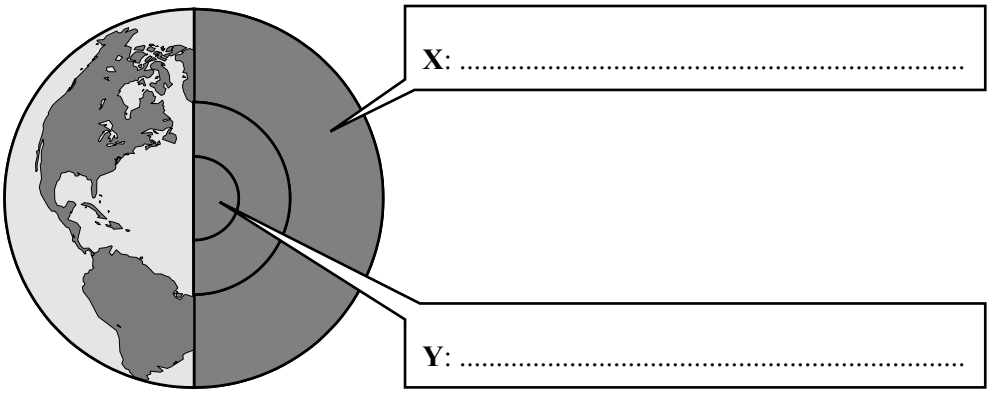
Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.3.1.1 Density of materials

Question 01

June 2003 | 3451H | Original Q7 | Legacy

7 (a) The diagram shows the layered structure of the Earth.



(i) Write in the boxes the name of layer **X** and the name of layer **Y**.

(2 marks)

(ii) The overall density of the Earth is about 5500 kg/m^3. The average density of the rocks in the Earth's crust is about 2800 kg/m^3. What does this suggest about the material that makes up the lower layers of the Earth?

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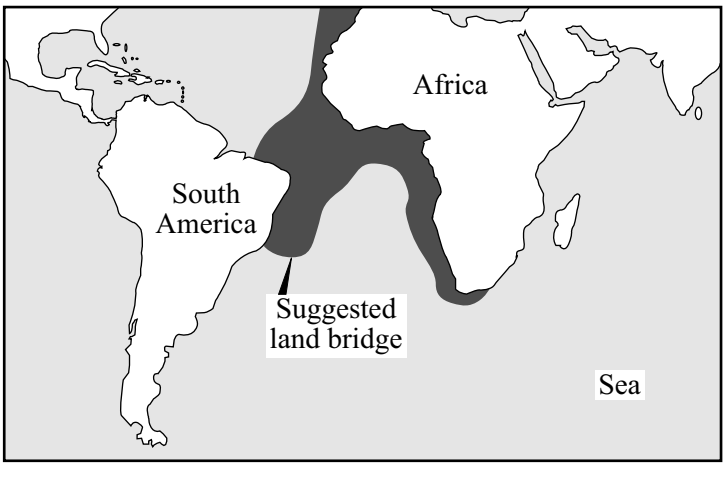
(2 marks)

4.3.1.1 Density of materials

Question 01 · continued

MARGIN BLANK

(b) In 1915, the scientist Alfred Wegener suggested that Africa and South America had once been joined but had since drifted apart. Evidence for his theory came from the animal fossils found in the two continents. The fossils are almost the same, although animals now living in Africa and South America are different. Other scientists did not agree with Wegener and suggested that a land bridge had once joined the two continents.



How could scientists use the idea of a land bridge to explain the evidence put forward by Wegener?

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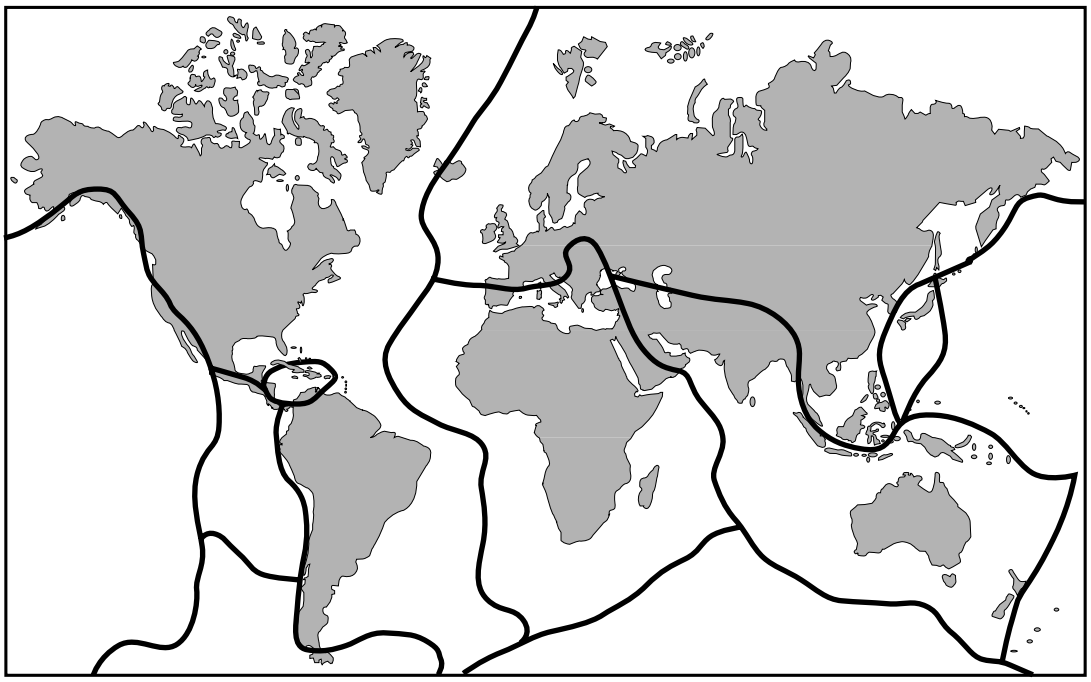
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(2 marks)

QUESTION 7 CONTINUES ON THE NEXT PAGE

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(c) Scientists now think that the outer layer of the Earth is cracked into a number of large pieces called tectonic plates. The tectonic plates are moving very slowly. The lines on the diagram show the boundaries between the major tectonic plates.



(i) Explain why there are no major earthquakes in Britain.

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(2 marks)

(ii) What is causing the tectonic plates to move?

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(1 mark)

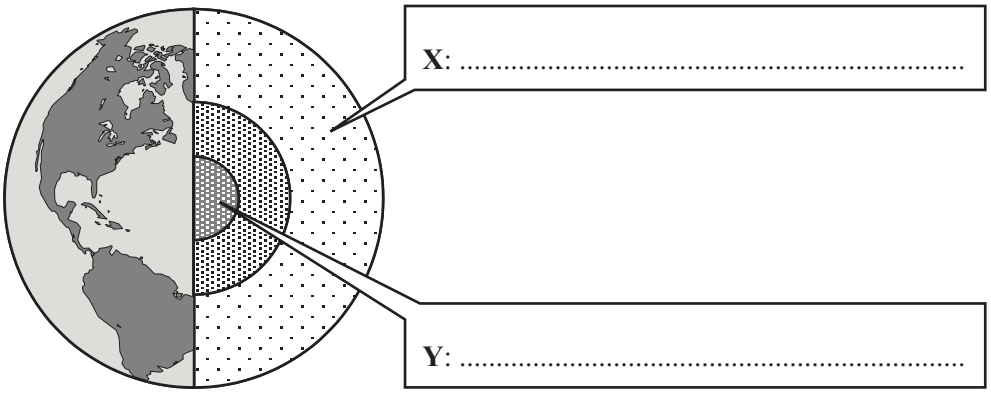
9

4.3.1.1 Density of materials

Question 02

June 2003 | 3462H3 | Original Q5 | Legacy

5 (a) The diagram shows the layered structure of the Earth.



(i) Write in the boxes the name of layer **X** and the name of layer **Y**.

(2 marks)

(ii) The overall density of the Earth is about 5500 kg/m^3. The average density of the rocks in the Earth's crust is about 2800 kg/m^3. What does this suggest about the material that makes up the lower layers of the Earth?

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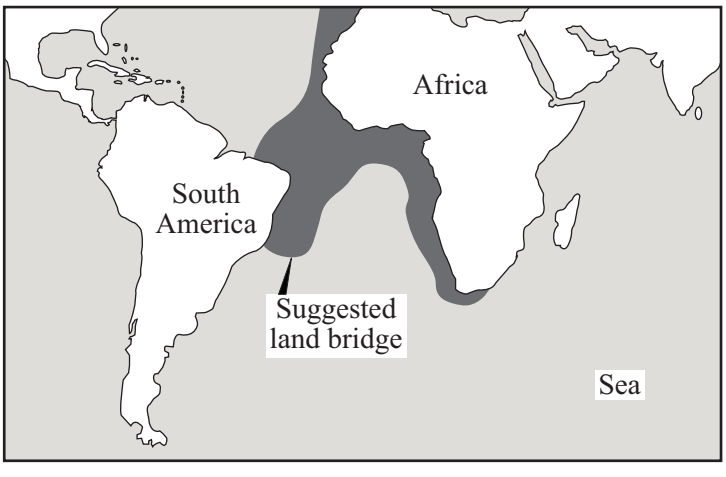
(2 marks)

4.3.1.1 Density of materials

Question 02 · continued

MARGIN
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(b) In 1915, the scientist Alfred Wegener suggested that Africa and South America had once been joined but had since drifted apart. Evidence for his theory came from the animal fossils found in the two continents. The fossils are almost the same, although animals now living in Africa and South America are different. Other scientists did not agree with Wegener and suggested that a land bridge had once joined the two continents.



How could scientists use the idea of a land bridge to explain the evidence put forward by Wegener?

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(2 marks)

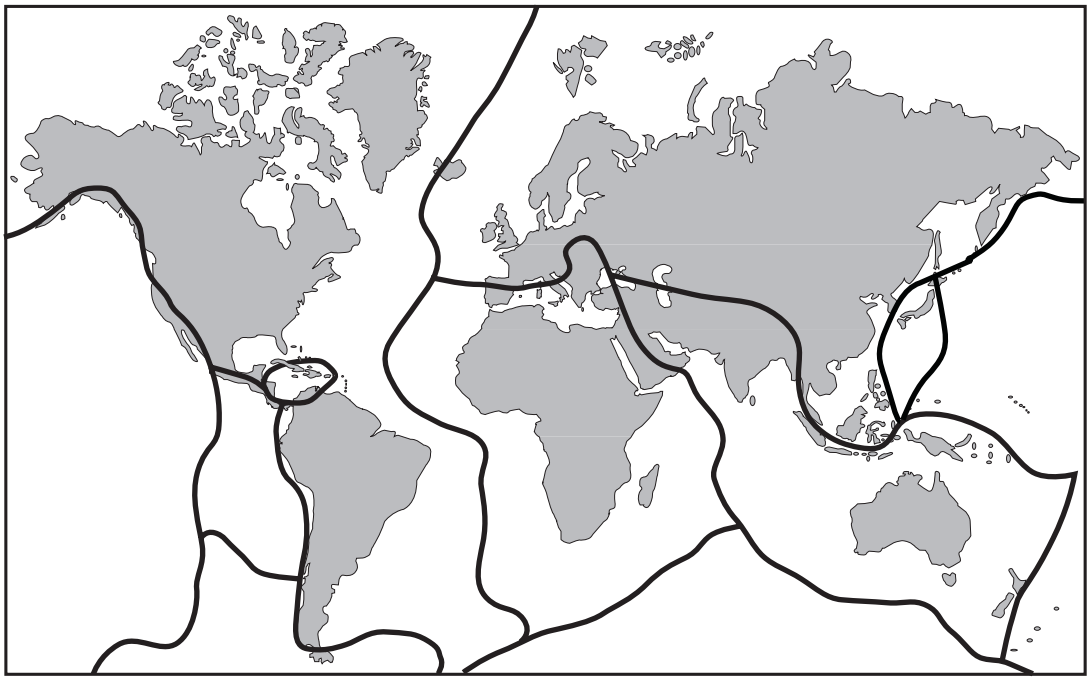
QUESTION 5 CONTINUES ON THE NEXT PAGE

4.3.1.1 Density of materials

Question 02 · continued

MARGIN BLANK

(c) Scientists now think that the outer layer of the Earth is cracked into a number of large pieces called tectonic plates. The tectonic plates are moving very slowly. The lines on the diagram show the boundaries between the major tectonic plates.



(i) Explain why there are no major earthquakes in Britain.

.....

.....

.....

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(2 marks)

(ii) What is causing the tectonic plates to move?

.....

.....

(1 mark)

9

4.3.1.1 Density of materials

Question 03

June 2018 | 8463/1H | Original Q10

1 0 **Figure 16** shows a wind turbine.

Figure 16



1 0 . 1 At a particular wind speed, a volume of 2.3×10^4 m^3 of air passes the blades each second.

The density of air is 1.2 kg/m^3.

Calculate the mass of air passing the blades per second.

[3 marks]

Mass of air per second = _____ kg

1 0 . 2 The power output of the turbine is directly proportional to the kinetic energy of the air passing the blades each second.

Describe the effect on the power output when the wind speed is halved.

[3 marks]

4.3.1.1 Density of materials

Question 03 · continued

1 0 . 3 At a different wind speed, the wind turbine has a power output of 388 kW.

The mass of air passing the wind turbine each second is 13 800 kg.

Calculate the speed of the air passing the blades each second.

Assume that the process is 100% efficient.

[3 marks]

Speed of air = _____ m/s

9

4.3.1.1 Density of materials

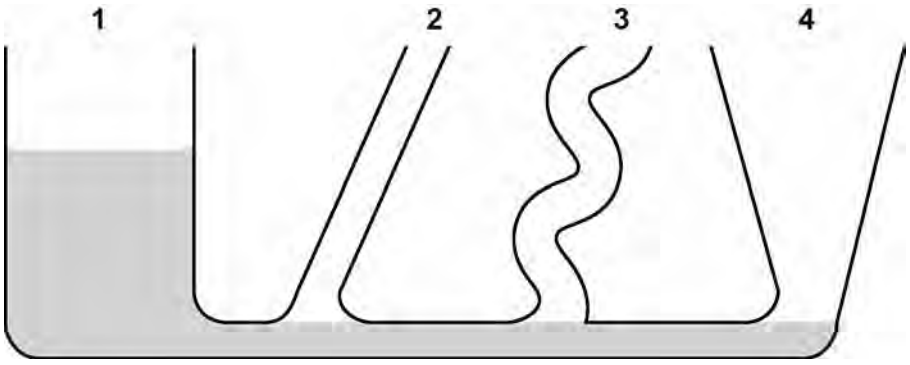
Question 04

June 2018 | 8463/2H | Original Q4

0 4 **Figure 6** shows an unusually shaped container.

The container has four vertical tubes of different shape and size.

Figure 6



Water is poured into the container up to the level shown in tube **1**.

0 4 . 1 Complete **Figure 6** to show the height of the water in tubes **2**, **3** and **4**.

[1 mark]

0 4 . 2 The further a swimmer dives below the surface of the sea, the greater the pressure on the swimmer.

Explain why.

[2 marks]

4.3.1.1 Density of materials

Question 04 · continued

0 4 . 3 A person swims from a depth of 0.50 m to a depth of 1.70 m below the surface of the sea.

density of the sea water = 1030 kg/m^3

gravitational field strength = 9.8 N/kg

Calculate the increase in pressure on the swimmer.

Give the unit.

Use an equation from the Physics Equation Sheet.

[4 marks]

Increase in pressure = _____ Unit _____

4.3.1.1 Density of materials

Question 05

1 0 The circle in **Figure 18** represents a straight wire carrying a current. The cross shows that the current is into the plane of the paper.

Figure 18



1 0 . 1 Complete **Figure 18** to show the magnetic field pattern around the wire.

[2 marks]

1 0 . 2 The magnetic flux density 10 cm from the wire is 4 microtesla.

Which of the following is the same as 4 microtesla?

Tick **one** box.

[1 mark]

- 4×10^{-2} T ☐
- 4×10^{-3} T ☐
- 4×10^{-6} T ☐
- 4×10^{-9} T ☐

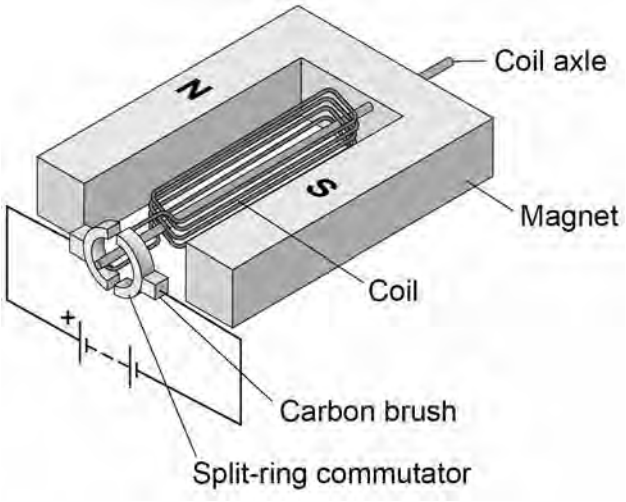
Question 10 continues on the next page

4.3.1.1 Density of materials

Question 05 · continued

1 0 . 3 **Figure 19** shows a simple electric motor.

Figure 19



When there is a current in the coil, the coil rotates continuously.

Explain why.

[4 marks]

7

4.3.1.1 Density of materials

Question 06

June 2019 | 8463/1H | Original Q4

0 4 Electric cars have motors that are powered by a battery.

Diesel cars have engines that are powered by diesel fuel.

Table 2 compares one type of electric car with one type of diesel car.

Table 2

Power source	Energy density in MJ / kg	Mass of power source in kg	Total mass of car in kg	Time to recharge battery or refill fuel tank in minutes
Battery	0.95	280	1600	40
Diesel fuel	45	51	1500	3

0 4 . 1 The electric car has a range of 400 km with a fully charged battery.

The diesel car has a range of 1120 km with a full tank of diesel.

Explain the difference in the time needed to complete a 500 km journey using the electric car compared with the diesel car.

Assume both cars travel at the same speed.

[2 marks]

4.3.1.1 Density of materials

Question 06 · continued

0 4 . 2 Energy density is the amount of energy stored per kilogram of the energy source.

Show why the diesel car has a greater range than the electric car.

Use data from **Table 2**.

Assume the efficiency of the two cars is the same.

Include calculations in your answer.

[3 marks]

Question 4 continues on the next page

4.3.1.1 Density of materials

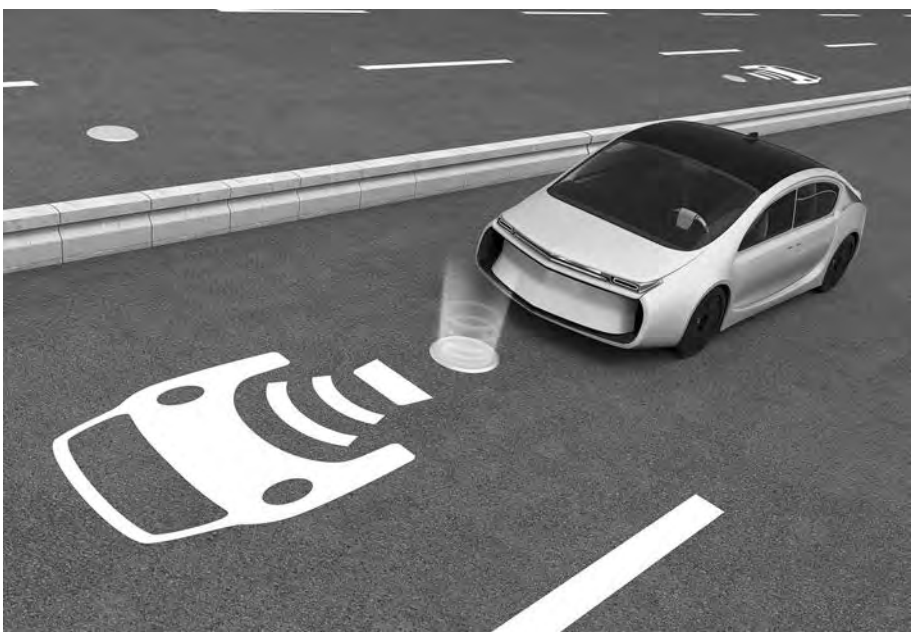
Question 06 · continued

Engineers have developed a way of charging electric cars while they are driving along the road.

Coils of wire buried under the road transfer energy to the car's battery as the car is passing over the coils.

Figure 6 shows a charging lane on a motorway.

Figure 6



0 4 . 3 Suggest **two** advantages of using this method to charge electric cars compared with plugging them into the mains electricity supply.

[2 marks]

1 _____

_____

_____

_____

2 _____

_____

_____

_____

4.3.1.1 Density of materials

Question 06 · continued

0 4 . 4 When electric cars are not being driven, energy stored in their batteries could be used to meet sudden peaks in electricity demand.

Suggest how.

[2 marks]

9

4.3.1.1 Density of materials

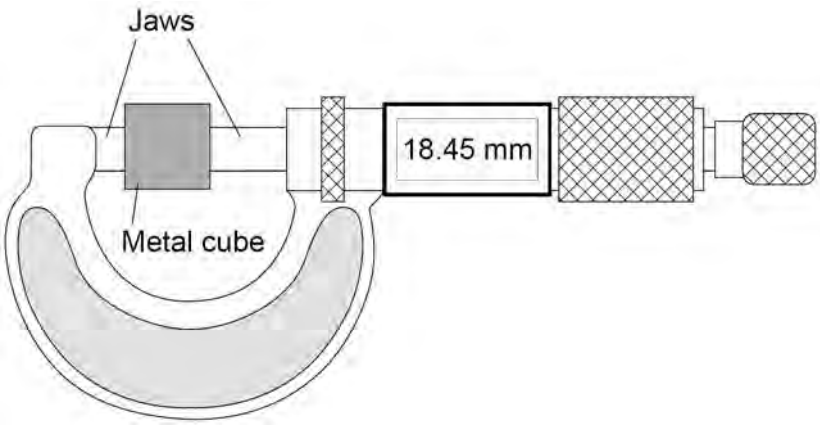
Question 07

June 2019 | 8463/1H | Original Q9

0 9 A student measured the width of a solid metal cube using a digital micrometer.

Figure 11 shows the micrometer.

Figure 11



0 9 . 1 The resolution of the micrometer is 0.01 mm

The student could have used a metre rule to measure the width of the cube.

Explain how using a metre rule would have affected the accuracy of the student's measurement of width.

[2 marks]

Question 9 continues on the next page

4.3.1.1 Density of materials

Question 07 · continued

0 9 . 2 The mass of the metal cube was measured using a top pan balance.

The balance had a zero error.

Explain how the zero error may be corrected after readings had been taken from the balance.

[2 marks]

0 9 . 3 The width of the cube was 18.45 mm. The density of the cube was 8.0×10^3 kg/m^3

Calculate the mass of the cube.

[5 marks]

Mass = _____ kg

9

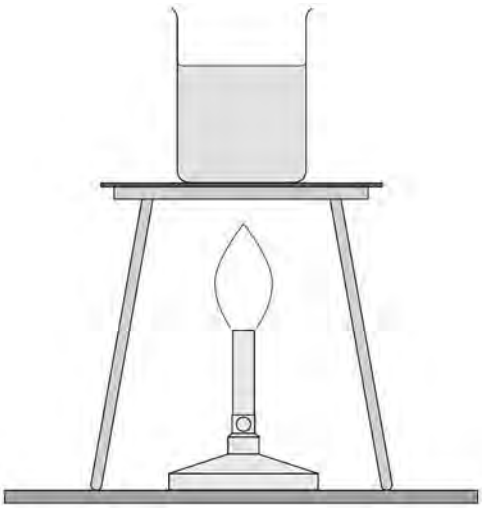
4.3.1.1 Density of materials

Question 08

June 2019 | 8463/1H | Original Q11

1 1 **Figure 14** shows a Bunsen burner heating some water in a beaker. Eventually the water changes into steam.

Figure 14



1 1 . 1 Explain how the internal energy of the water changes as it is heated from 20 °C to 25 °C

[2 marks]

1 1 . 2 How is the particle model used to explain the difference in density between a liquid and a gas?

[1 mark]

Tick (✓) **one** box.

- Particles in a gas have less kinetic energy than particles in a liquid. ☐
- Particles in a gas have more potential energy than particles in a liquid. ☐
- Particles in a liquid are further apart than particles in a gas. ☐
- Particles in a liquid are larger than particles in a gas. ☐

4.3.1.1 Density of materials

Question 08 · continued

1 1 . 3 A student measured the mass of boiling water that was turned into steam in five minutes.

Explain how the student could use this information to estimate the power output of the Bunsen burner in watts.

[4 marks]

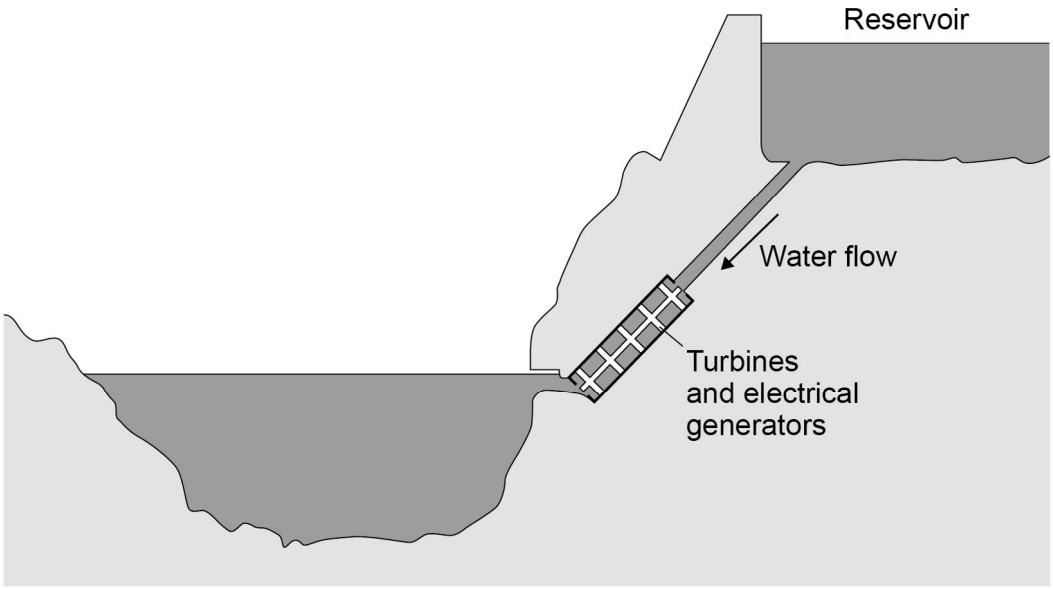
7

4.3.1.1 Density of materials

Question 09

0 3 **Figure 4** shows a hydroelectric power station.

Figure 4



Electricity is generated when water from the reservoir flows through the turbines.

0 3 . 1 Write down the equation which links density (ρ), mass (m) and volume (V).

[1 mark]

0 3 . 2 The reservoir stores 6 500 000 m^3 of water.

The density of the water is 998 kg/m^3.

Calculate the mass of water in the reservoir.

Give your answer in standard form.

[4 marks]

Mass (in standard form) = _____ kg

4.3.1.1 Density of materials

Question 09 · continued

0 3 . 3 Write down the equation which links energy transferred (E), power (P) and time (t).

[1 mark]

0 3 . 4 The electrical generators can provide 1.5×10^9 W of power for a maximum of 5 hours.

Calculate the maximum energy that can be transferred by the electrical generators.

[3 marks]

Energy transferred = _____ J

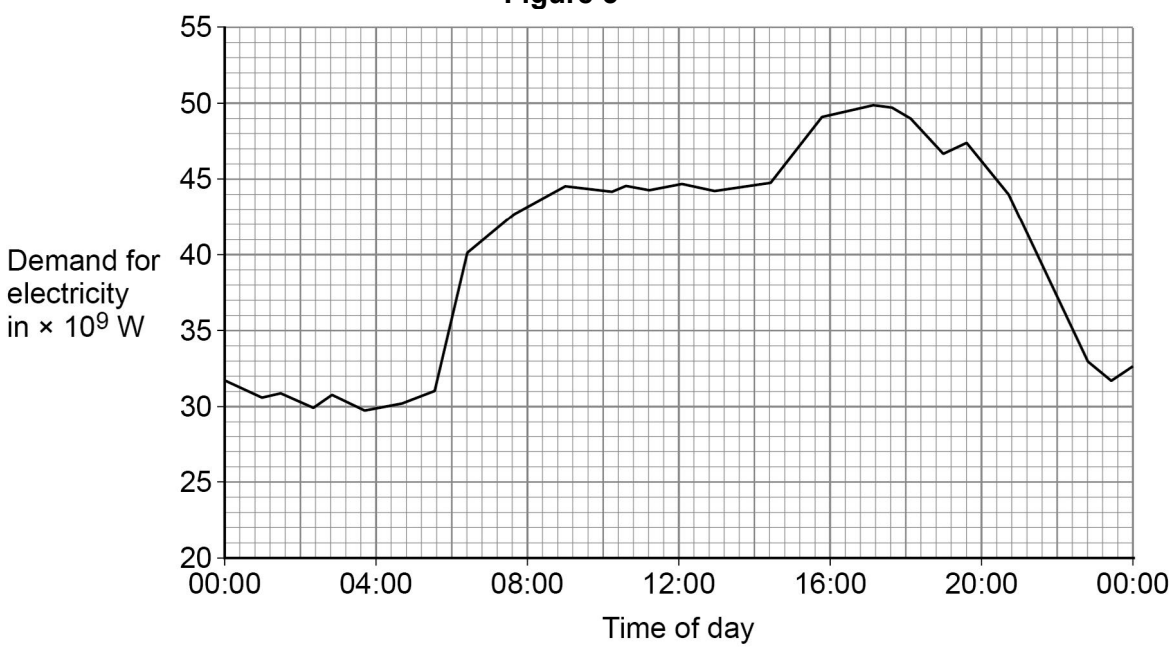
Question 3 continues on the next page

4.3.1.1 Density of materials

Question 09 · continued

0 3 . 5 **Figure 5** shows how the UK demand for electricity increases and decreases during one day.

Figure 5



The hydroelectric power station in **Figure 4** can provide 1.5×10^9 W of power for a maximum of 5 hours.

Give **two** reasons why this hydroelectric power station is not able to meet the increase in demand shown between 04:00 and 16:00 in **Figure 5**.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

11

4.3.1.1 Density of materials

Question 10

November 2021 | 8463/1H | Original Q4

0 4 A student investigated the density of different fruits.

Table 1 shows the results.

Table 1

Fruit	Density in g/cm^3
Apple	0.68
Kiwi	1.03
Lemon	0.95
Lime	1.05

0 4 . 1 The student determined the volume of each fruit using a displacement can and a measuring cylinder.

What other piece of equipment would the student need to determine the density of each fruit?

[1 mark]

4.3.1.1 Density of materials

Question 10 · continued

0 4 . 2 Write down the equation which links density (ρ), mass (m) and volume (V).

[1 mark]

0 4 . 3 The mass of the apple was 85 g.

The density of the apple was 0.68 g/cm^3.

Calculate the volume of the apple.

Give your answer in cm^3.

[3 marks]

Volume = _____ cm^3

0 4 . 4 The student only measured the volume of each fruit once.

The volume measurements **cannot** be used to show that the method to measure volume gives precise readings.

Give the reason why.

[1 mark]

6

4.3.1.1 Density of materials

Question 11

November 2021 | 8463/2H | Original Q9

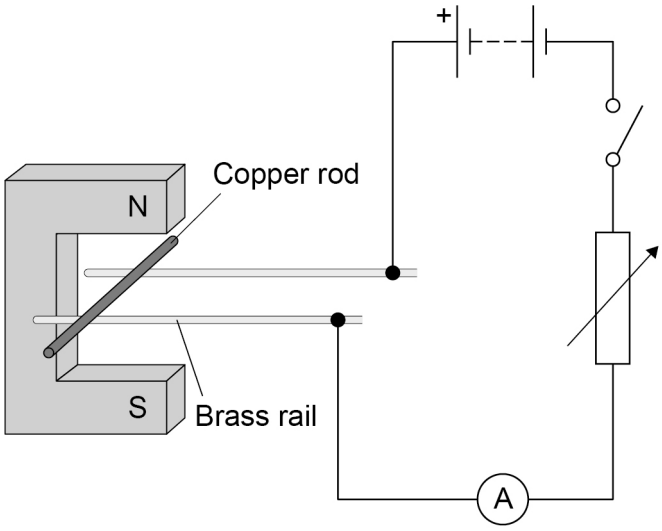
0 9 A teacher demonstrated how a magnetic field can cause a copper rod to accelerate.

The teacher placed the copper rod on two brass rails in a magnetic field.

The copper rod was able to move.

Figure 16 shows the equipment used.

Figure 16



4.3.1.1 Density of materials

Question 11 · continued

0 9 . 1 The teacher closes the switch and the copper rod accelerates.

Explain how Fleming's left hand rule can be used to predict the direction in which the copper rod will move.

[5 marks]

0 9 . 2 Suggest **two** changes to the equipment that would increase the force on the copper rod.

[2 marks]

1

2

Question 9 continues on the next page

4.3.1.1 Density of materials

Question 11 · continued

0 9 . 3 The teacher closed the switch and the copper rod accelerated uniformly from rest for 0.15 s.

The current in the copper rod was 1.7 A.

mass of copper rod = 4.0 g

length of copper rod in the magnetic field = 0.050 m

magnetic flux density = 0.30 T

Calculate the maximum possible velocity of the copper rod when it left the magnetic field.

[6 marks]

Maximum velocity = _____ m/s

13

4.3.1.1 Density of materials

Question 12

June 2022 | 8463/1H | Original Q2

0 2 **Figure 2** shows a rock found by a student on a beach.

To help identify the type of rock, the student took measurements to determine its density.

Figure 2



0 2 . 1 Describe a method the student could use to determine the density of the rock.

[6 marks]

4.3.1.1 Density of materials

Question 12 · continued

The student determined the density of the rock to be 2.55 ± 0.10 g/cm^3.

0 2 . 2 What are the maximum and minimum values for the density of the rock?

[1 mark]

Maximum density = _____ g/cm^3

Minimum density = _____ g/cm^3

0 2 . 3 **Table 1** gives the density of five different types of rock.

Table 1

Type of rock	Density in g/cm^3
Basalt	2.90 ± 0.10
Chalk	2.35 ± 0.15
Flint	2.60 ± 0.10
Sandstone	2.20 ± 0.20
Slate	2.90 ± 0.20

Which two types of rock in **Table 1** could be the type of rock the student had?

[1 mark]

Tick (✓) **one** box.

Basalt or chalk ☐

Chalk or flint ☐

Flint or sandstone ☐

Sandstone or slate ☐

Question 2 continues on the next page

4.3.1.1 Density of materials

Question 12 · continued

0 2 . 4 The student only took one set of measurements to determine the density of the rock.

Explain why taking the measurements more than once may improve the accuracy of the density value.

[2 marks]

10

4.3.1.1 Density of materials

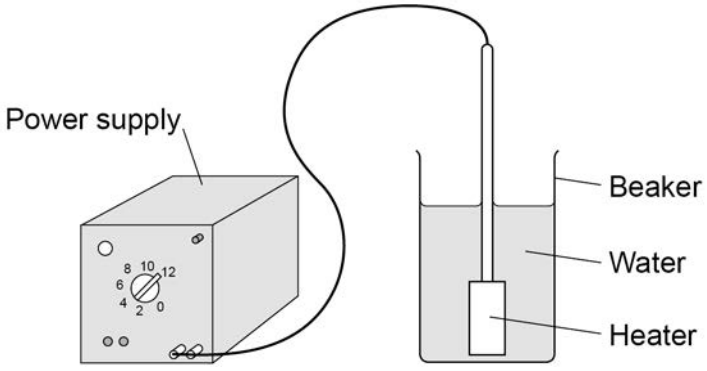
Question 13

June 2022 | 8463/1H | Original Q8

0 8 A student determined the specific latent heat of vaporisation of water.

Figure 9 shows some of the equipment used.

Figure 9



This is the method used:

1. Put 50 cm^3 of water in a beaker.
2. Measure the mass of the beaker and water.
3. Use a heater to boil the water and keep it boiling for 600 seconds.
4. Measure the mass of the beaker and water after 600 seconds.

0 8 . 1 What measuring instrument should be used to measure the volume of water?

[1 mark]

0 8 . 2 What is a hazard in the student's investigation?

[1 mark]

Tick (✓) **one** box.

- burns ☐
- boiling water ☐
- heatproof gloves ☐
- safety goggles ☐

4.3.1.1 Density of materials

Question 13 · continued

0 8 . 3 The initial mass of the beaker and water was 0.080 kg.

The final mass of the beaker and water was 0.071 kg.

The energy transferred by the immersion heater as the water boiled was 25 200 J.

Calculate the specific latent heat of vaporisation of water given by the student's data.

Give the unit.

Use the Physics Equations Sheet.

[5 marks]

Specific latent heat of vaporisation = _____ Unit _____

Question 8 continues on the next page

4.3.1.1 Density of materials

Question 13 · continued

0 8 . 4 Some thermal energy was transferred to the surroundings while the water was being heated.

Explain how this affected the student's value for the specific latent heat of vaporisation of water.

[2 marks]

0 8 . 5 Some of the water evaporated before its temperature reached 100 °C.

Explain how this affected the student's value for the specific latent heat of vaporisation of water.

[2 marks]

11

4.3.1.1 Density of materials

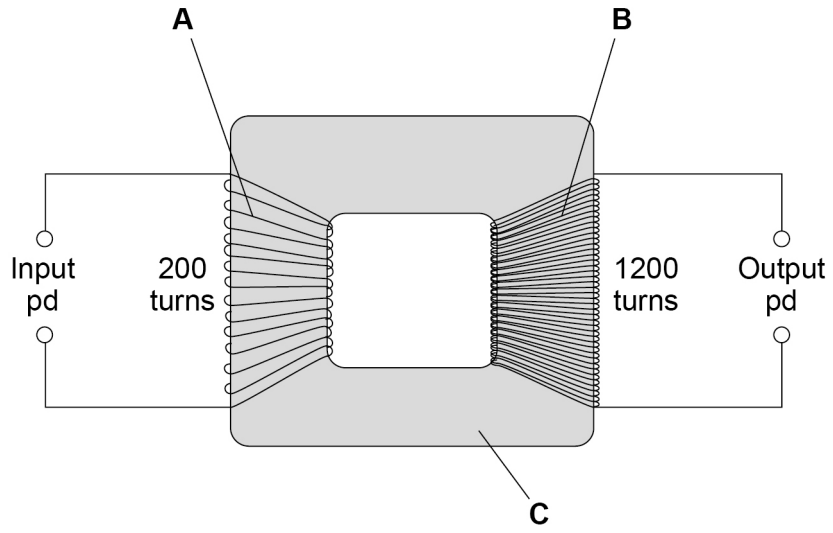
Question 14

June 2022 | 8463/2HR | Original Q7

0 7 The National Grid uses transformers to change potential difference (pd).

Figure 12 shows a transformer.

Figure 12



0 7 . 1 Identify the parts of the transformer labelled in **Figure 12**.

[2 marks]

A _____

B _____

C _____

0 7 . 2 There is an alternating input pd of 230 V.

Determine the output pd.

Use the Physics Equations Sheet.

[3 marks]

_____

_____

_____

_____

_____

Output pd = _____ V

4.3.1.1 Density of materials

Question 14 · continued

0 7 . 3 The input pd causes an alternating current.

Explain why there is an alternating current in the output when the transformer is connected to a circuit.

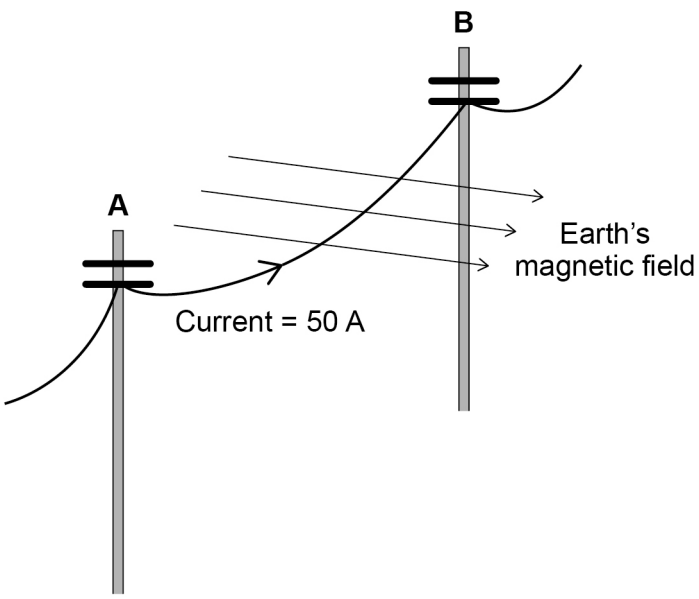
[3 marks]

Question 7 continues on the next page

Question 14 · continued

Figure 13 shows a large cable supported by two wooden poles. The cable is connected to an electricity supply.

Figure 13



0 7 . 4 There is a force on the cable due to the Earth's magnetic field when the current is in the direction **A** to **B**.

What is the direction of this force?

[1 mark]

Tick (✓) **one** box.

Down ☐

Left ☐

Right ☐

Up ☐

4.3.1.1 Density of materials

Question 14 · continued

0 7 . 5 The cable experiences a force of 0.045 N due to the Earth's magnetic field.

magnetic flux density = 60 μT

current = 50 A

Calculate the length of the cable between **A** and **B**.

Use the Physics Equations Sheet.

[4 marks]

Length = _____ m

0 7 . 6 State **one** assumption you made in your calculation.

[1 mark]

_____

14

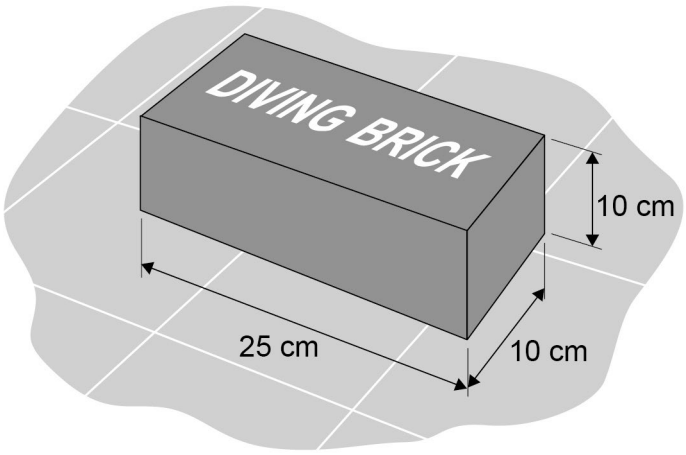
4.3.1.1 Density of materials

Question 15

0 8 Diving bricks sink to the bottom of a swimming pool.

Figure 14 shows a diving brick.

Figure 14



Swimmers practise diving to the bottom of the swimming pool to pick up the diving brick.

0 8 . 1 Explain why the forces on the brick at the bottom of the pool cause the brick to be stationary.

[3 marks]

4.3.1.1 Density of materials

Question 15 · continued

0 8 . 2 When the brick from **Figure 14** is at the bottom of the pool, the top surface of the brick is 2.50 m below the surface of the water.

The force acting on the top surface of the brick due to the weight of the water is 637 N.

gravitational field strength = 9.8 N/kg

Calculate the density of the water in the swimming pool.

Use the Physics Equations Sheet.

[6 marks]

Density of water = _____ kg/m^3

Question 8 continues on the next page

4.3.1.1 Density of materials

Question 15 · continued

0 8 . 3 Professional divers are trained in a very deep swimming pool.

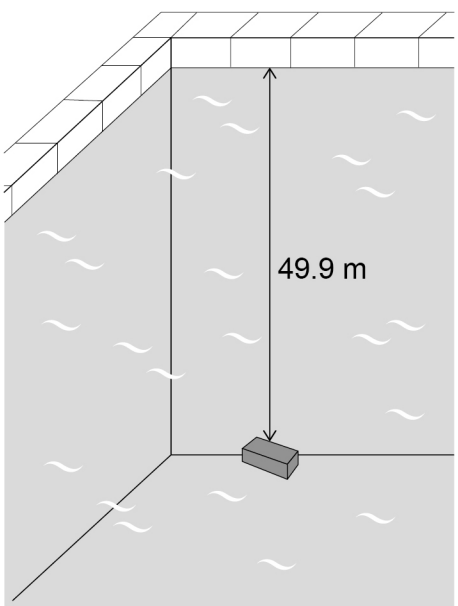
The density of the water in this pool is **not** the same as the density of the water in Question **08.2**

The diving brick was dropped into the very deep swimming pool.

When the brick was at a depth of 2.50 m, the force due to the weight of the water on the top surface of the brick was 618 N.

Figure 15 shows the diving brick at the bottom of the very deep swimming pool.

Figure 15



4.3.1.1 Density of materials

Question 15 · continued

Determine the force due to the weight of the water on the top surface of the brick in **Figure 15**.

Use the Physics Equations Sheet.

Give your answer to 3 significant figures.

[3 marks]

Force (3 significant figures) = _____ N

12

4.3.1.1 Density of materials

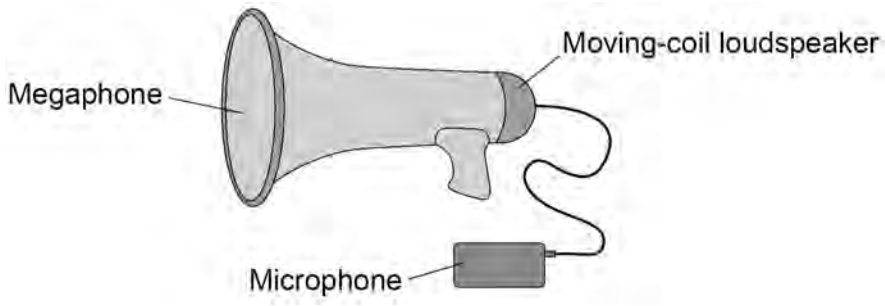
Question 16

June 2023 | 8463/2H | Original Q4

0 4 A megaphone uses a loudspeaker to amplify sounds that are detected by a microphone.

Figure 10 shows a megaphone and microphone.

Figure 10



0 4 . 1 Complete the sentence.

[1 mark]

The microphone is used to convert the pressure variations in sound waves into variations in _____ .

Question 16 · continued

0 4 . 2 The loudspeaker contains a permanent magnet.

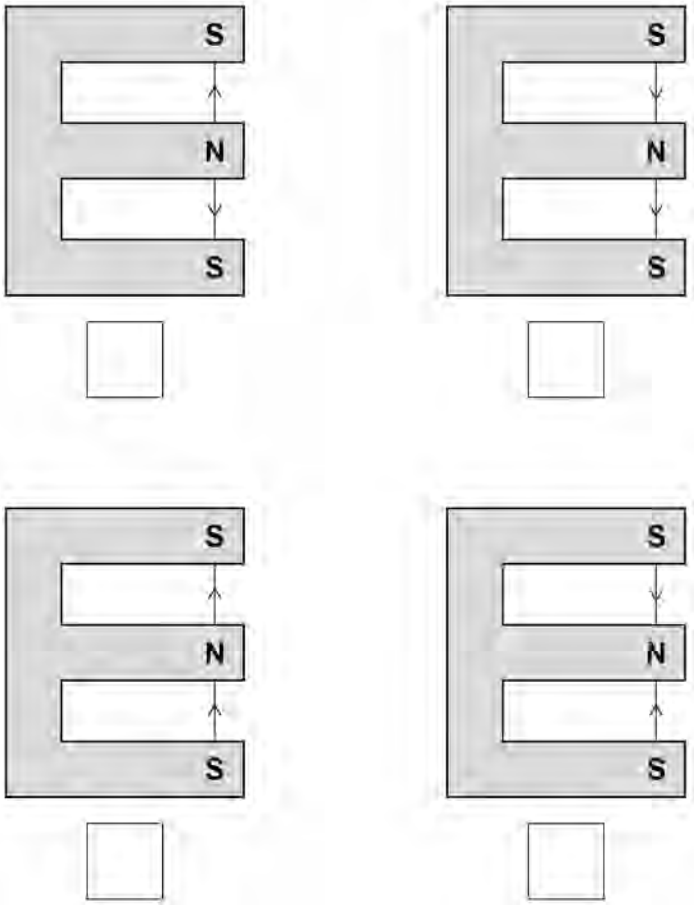
Which diagram in **Figure 11** shows the direction of the magnetic field between the north pole and the south pole of the magnet?

The magnets are shown in cross-section.

[1 mark]

Tick (✓) **one** box.

Figure 11



0 4 . 3 Some magnets are permanent magnets and some are induced magnets.

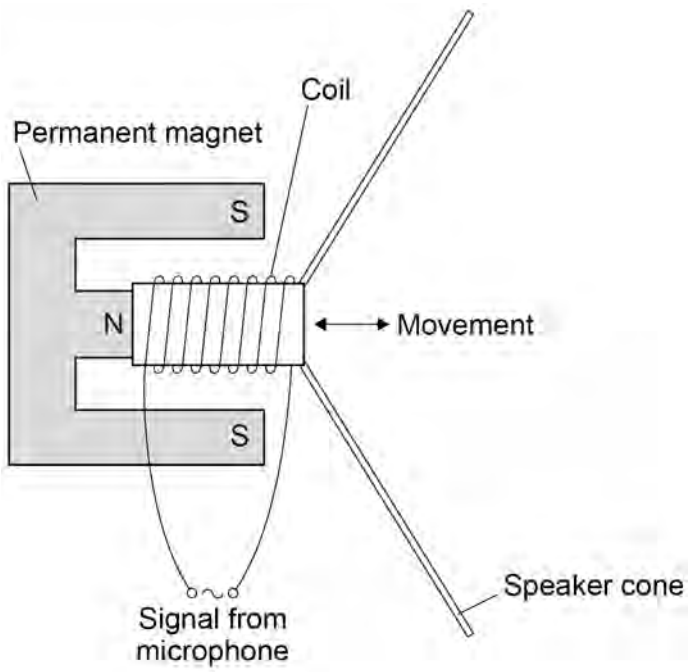
What is an induced magnet?

[1 mark]

Question 16 · continued

Figure 12 shows the parts of the loudspeaker in the megaphone.

Figure 12



A current in the coil of the loudspeaker causes the coil to move.

0 4 . 4 What is the name of the effect that causes the coil to move?

[1 mark]

Tick (✓) **one** box.

- Electromagnet effect ☐
- Induction effect ☐
- Motor effect ☐
- Speaker effect ☐

4.3.1.1 Density of materials

Question 16 · continued

0 4 . 5 When the current in the coil is 16 mA, the force on the coil is 0.013 N.

The length of the wire that makes up the coil is 6.5 m.

Calculate the magnetic flux density around the coil in the electromagnet.

Use the Physics Equations Sheet.

[4 marks]

Magnetic flux density = _____ T

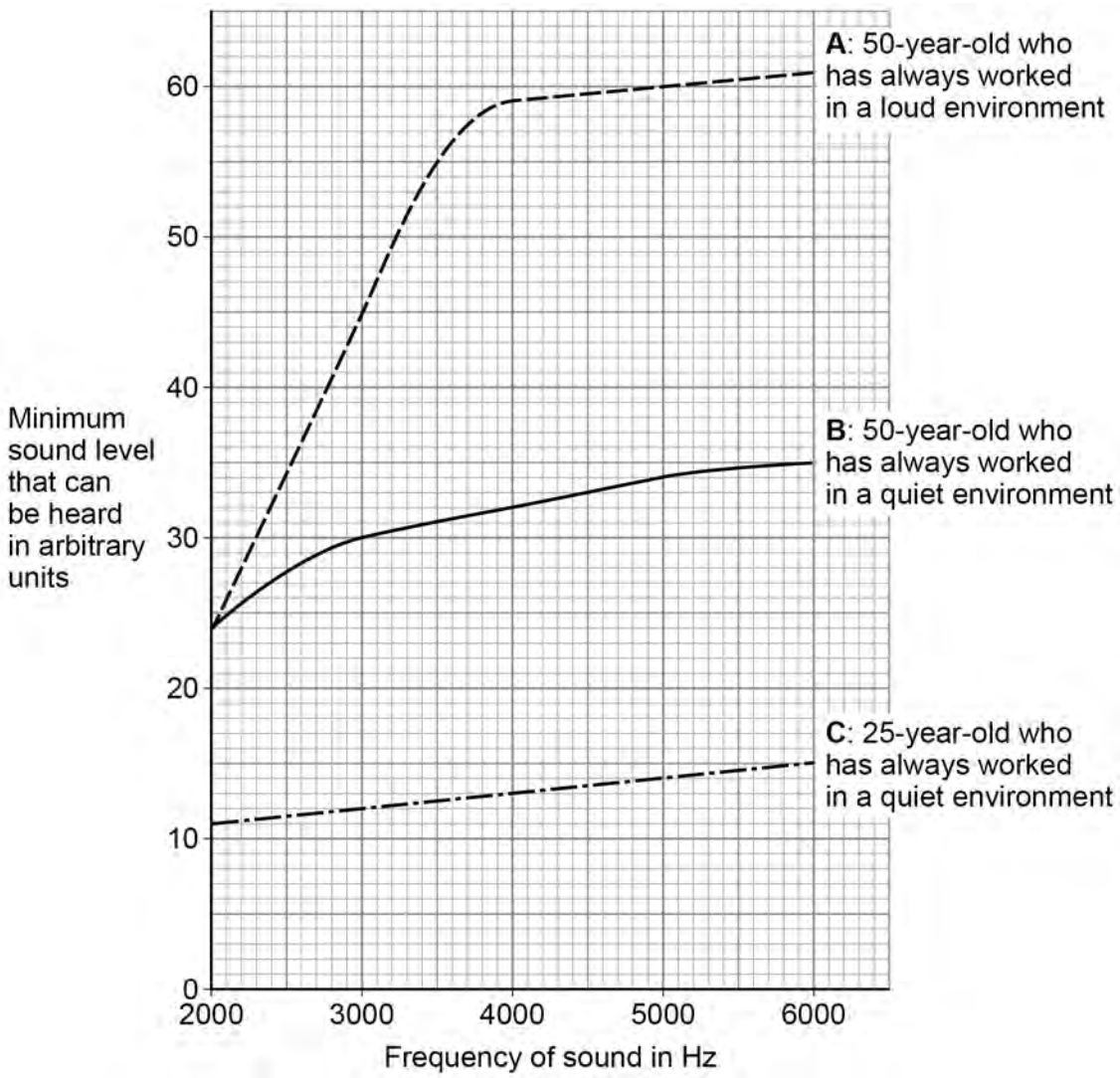
Question 4 continues on the next page

0 4 . 6 Megaphones can produce very loud sounds.

A person's hearing can be affected by age and by working in a loud environment.

Figure 13 shows how frequency affects the minimum sound level that can be heard by three different people, **A**, **B** and **C**.

Figure 13



4.3.1.1 Density of materials

Question 16 · continued

Compare how different factors affect the minimum sound level that these people can hear.

[4 marks]

12

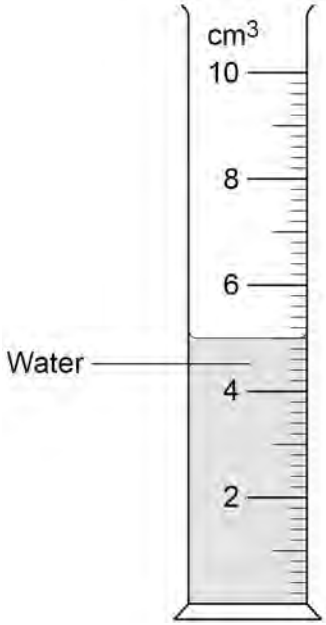
4.3.1.1 Density of materials

Question 17

June 2024 | 8463/1H | Original Q7

0 7 **Figure 11** shows a measuring cylinder containing some water, which a student used to measure the volume of a metal ring.

Figure 11



0 7 . 1 When measuring the volume, the student's eye was in line with the level of the water.

Which type of error would have been caused if the student's eye was **not** in line with the level of the water?

[1 mark]

Tick (✓) **one** box.

Random error ☐

Systematic error ☐

Zero error ☐

4.3.1.1 Density of materials

Question 17 · continued

0 7 . 2 The student tied a piece of thick string to the metal ring and lowered the ring into the water.

Suggest **one** reason why the student should have used thin string instead of thick string.

[1 mark]

Question 7 continues on the next page

Question 17 · continued

Table 2 shows the results.

Table 2

Volume of water in cm^3	Volume of water and ring in cm^3	Volume of ring in cm^3
5.0	5.4	0.4

0 7 . 3 The true volume of the ring was 0.44 cm^3.

Even without using the string, the measuring cylinder could not give an accurate value for the volume of the ring.

Give **one** reason why.

[1 mark]

0 7 . 4 The student used a balance to measure the mass of the ring.

After the ring was removed from the balance, the reading on the balance was 0.02 g.

How could the student use the readings from the balance to determine the correct mass of the ring?

[1 mark]

4.3.1.1 Density of materials

Question 17 · continued

0 7 . 5 The student determined that the density of the ring was 21 500 kg/m^3.

The volume of the ring was 0.44 cm^3.

Calculate the mass of the ring.

Use the Physics Equations Sheet.

Give your answer in kg.

[4 marks]

Mass = _____ kg

8

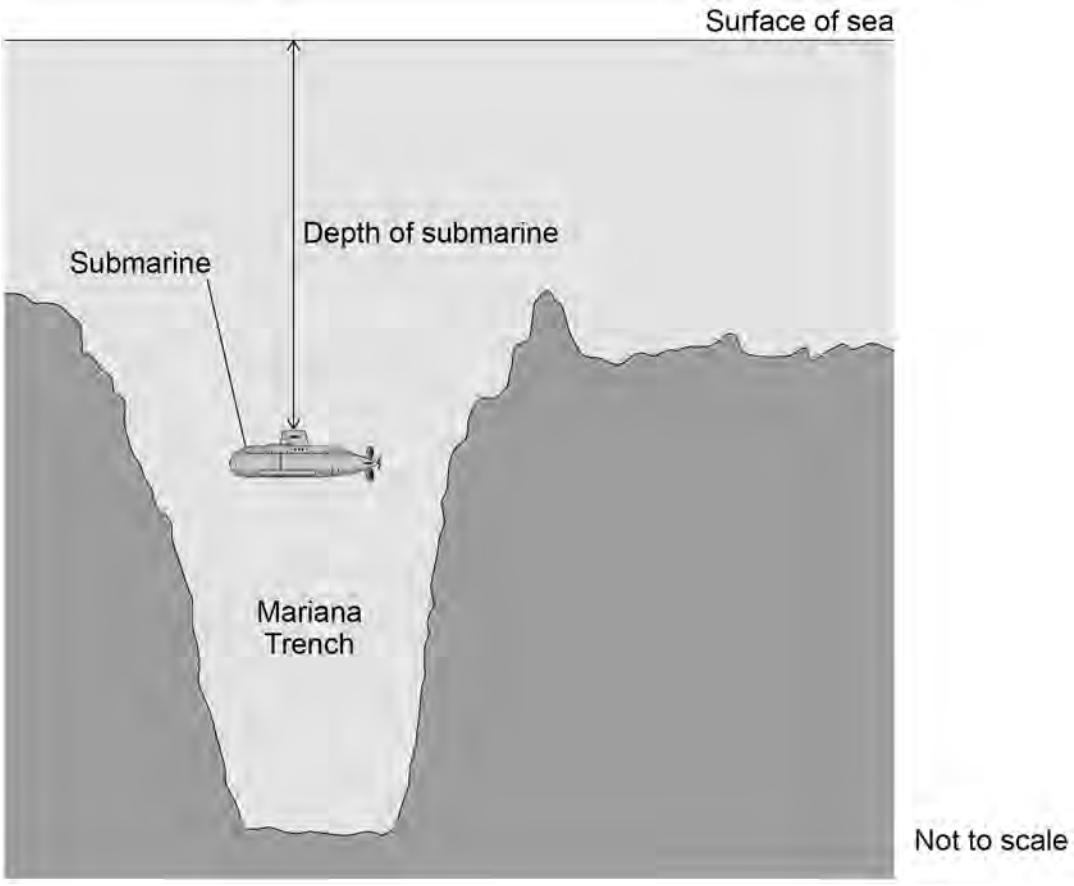
4.3.1.1 Density of materials

Question 18

0 4 The Mariana Trench is the deepest part of the Pacific Ocean.

Figure 8 shows a submarine going to the bottom of the Mariana Trench.

Figure 8



0 4 . 1 The depth of the submarine increases.

Explain what happens to the pressure on the submarine.

[2 marks]

4.3.1.1 Density of materials

Question 18 · continued

0 4 . 2 The submarine moved from the surface of the water to the bottom of the Mariana Trench.

The change in pressure was 110 000 kPa.

mean density of sea water = 1026 kg/m^3

gravitational field strength = 9.8 N/kg

Calculate the depth of the Mariana Trench.

Use the Physics Equations Sheet.

[4 marks]

Depth = _____ m

Question 4 continues on the next page

4.3.1.1 Density of materials

Question 18 · continued

Earthquakes often occur at the Mariana Trench.

P-waves and S-waves are produced by earthquakes.

0 4 . 3 Which statement describes P-waves and S-waves?

[1 mark]

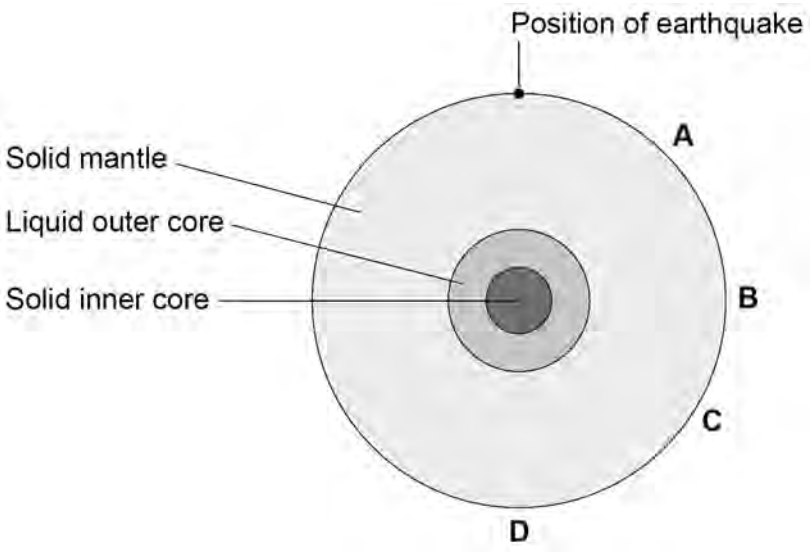
Tick (✓) **one** box.

- Both P-waves and S-waves are longitudinal. ☐
- Both P-waves and S-waves are transverse. ☐
- P-waves are longitudinal and S-waves are transverse. ☐
- P-waves are transverse and S-waves are longitudinal. ☐

0 4 . 4 **Figure 9** shows the layers inside the Earth.

An earthquake occurs at the position shown.

Figure 9



Which letter shows the position where **only** P-waves will be detected?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

Reason _____

_____

Question 4 continues on the next page

Question 18 · continued

0 4 . 5 An S-wave has a frequency of 3.6 Hz.

The S-wave has a speed of 4.5 km/s.

Calculate the wavelength of this S-wave.

Use the Physics Equations Sheet.

[3 marks]

Wavelength = _____ m

0 4 . 6 A seismometer is a device that detects earthquakes.

P-waves travel at a known speed between an earthquake and a seismometer.

S-waves travel at a slower speed than P-waves.

A P-wave and an S-wave from the earthquake arrive at the seismometer at different times.

Describe the relationship between the distance from the earthquake to the seismometer and the time between the P-wave and the S-wave arriving.

[2 marks]

14

4.3.1.1 Density of materials

Question 19

June 2025 | 8463/1H | Original Q1

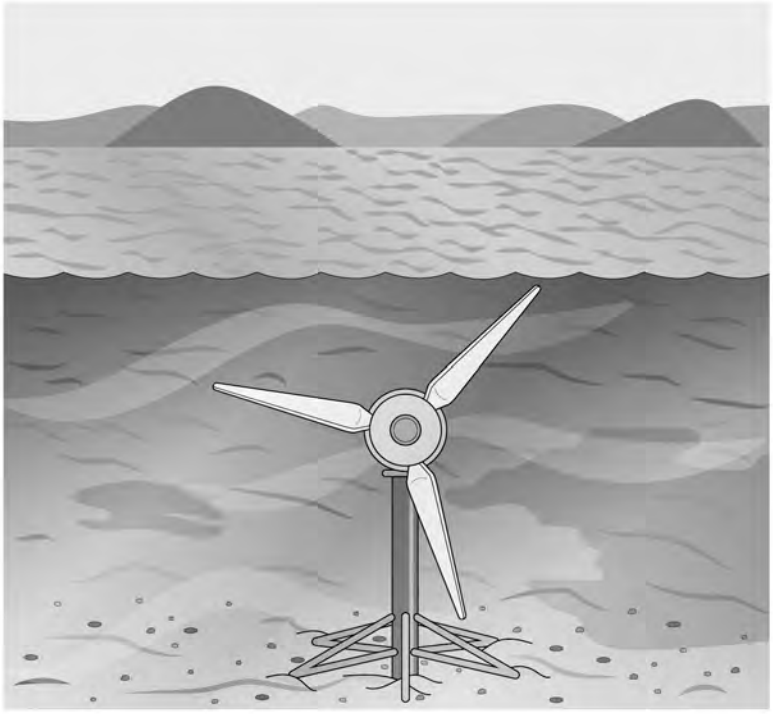
0 1 Tides and wind are two renewable energy resources.

0 1 . 1 Describe the difference between renewable energy resources and non-renewable energy resources.

[2 marks]

Figure 1 shows a new design of tidal turbine to generate electricity using the tides.

Figure 1



4.3.1.1 Density of materials

Question 19 · continued

Use the Physics Equations Sheet to answer questions **01.2** and **01.3**.

0 1 . 2 Write down the equation which links density (ρ), mass (m) and volume (V).

[1 mark]

0 1 . 3 The mass of seawater passing through the tidal turbine each second is 824 000 kg.

The density of seawater is 1030 kg/m^3.

Calculate the volume of seawater passing through the tidal turbine each second.

[3 marks]

Volume = _____ m^3

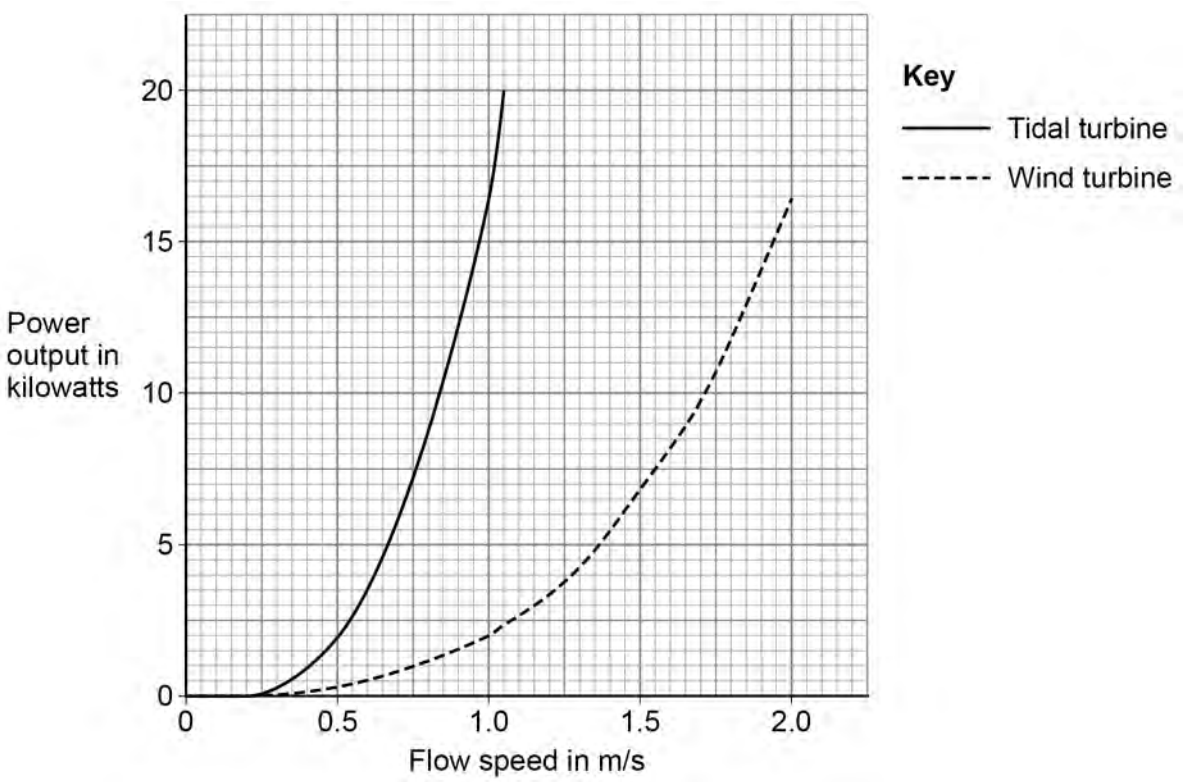
Question 1 continues on the next page

Question 19 · continued

The speed of the tide or the speed of the wind past a turbine is called the 'flow speed'.

Figure 2 shows how the power output of a tidal turbine compares with a wind turbine for different flow speeds.

Figure 2



0 1 . 4 As flow speed increases, power output increases.

Give **two** other conclusions that can be made using information from **Figure 2**.

[2 marks]

1 _____

_____

2 _____

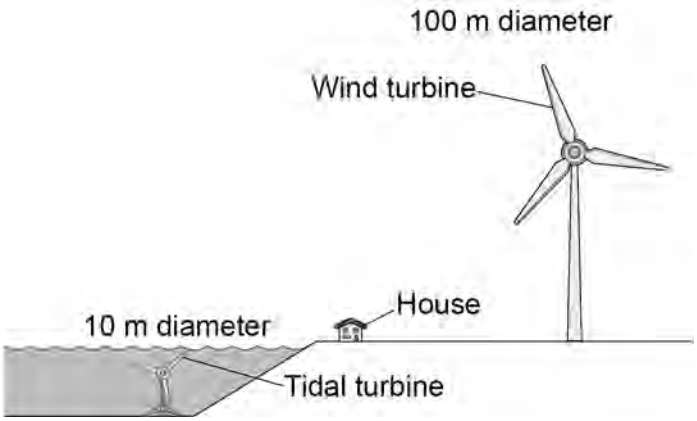
_____

4.3.1.1 Density of materials

Question 19 · continued

0 1 . 5 **Figure 3** shows the turbines used to obtain the data for **Figure 2**.

Figure 3



Compare the environmental impacts of the wind turbine and the tidal turbine in **Figure 3**.

[4 marks]

12

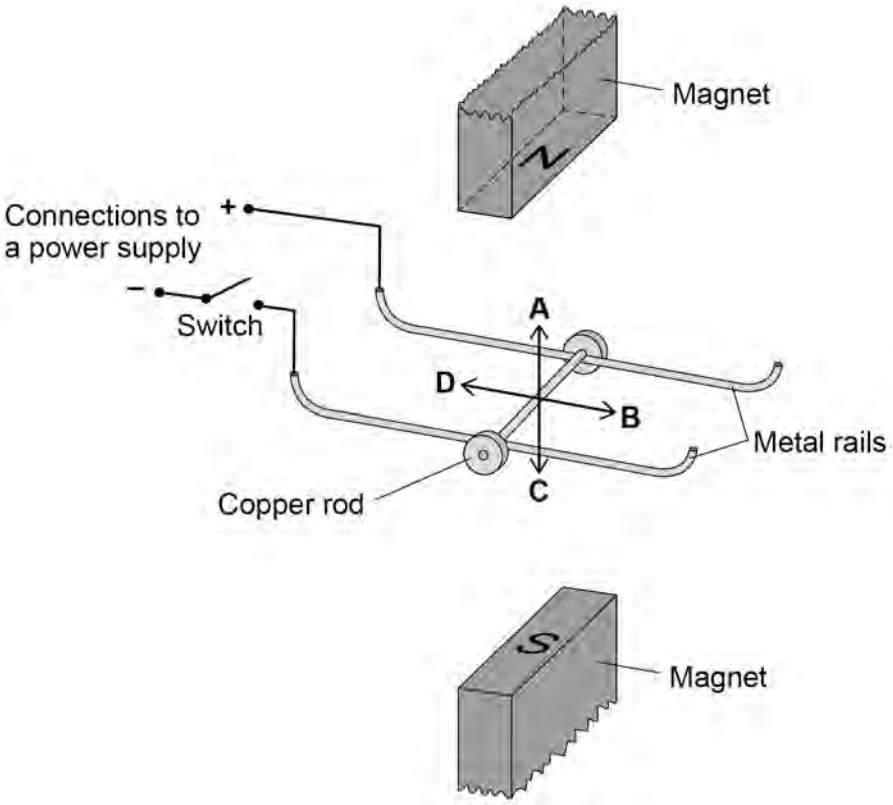
4.3.1.1 Density of materials

Question 20

June 2025 | 8463/2H | Original Q7

0 7 **Figure 7** shows some apparatus used to demonstrate the motor effect.

Figure 7



When the switch is closed the copper rod accelerates.

0 7 . 1 What direction is the acceleration of the copper rod?

[1 mark]

Tick (✓) **one** box.

A ☐

B ☐

C ☐

D ☐

Question 20 · continued

0 7 . 2 The copper rod has a mass of 5.0 g.

The length of the copper rod in the magnetic field is 0.070 m.

The magnetic flux density is 0.30 T.

Calculate the initial acceleration of the rod when the current in the rod is 2.0 A.

Use the Physics Equations Sheet.

[5 marks]

Initial acceleration = _____ m/s^2

Question 7 continues on the next page

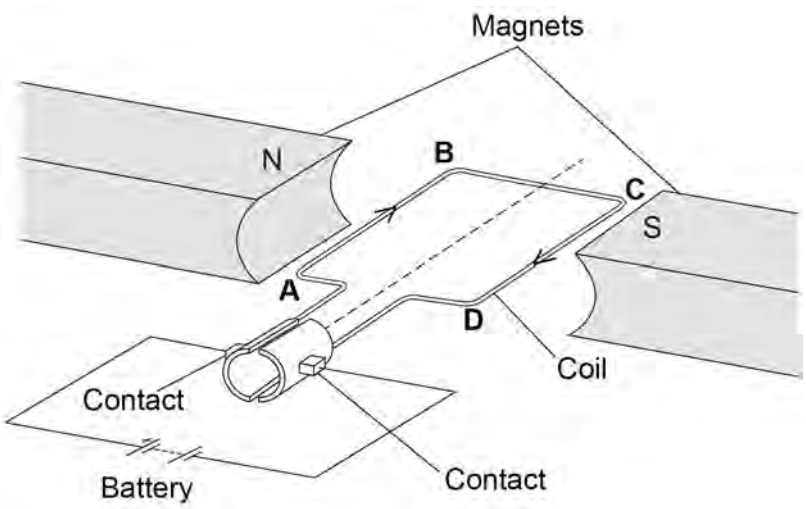
Question 20 · continued

Figure 8 shows a simple motor.

There is a magnetic field between the two permanent magnets.

When there is a current in the coil, a magnetic field is produced around the coil.

Figure 8



0 7 . 3 Explain how these magnetic fields cause the coil to continuously rotate.

[4 marks]

4.3.1.1 Density of materials

Question 20 · continued

0 7 . 4 In **Figure 8** the coil of the motor is in a horizontal position.

Explain why the resultant moment on the coil is zero when the coil is in a vertical position.

[2 marks]

12

Turn over for the next question