

Density, Mass and Volume

Solutions

For AQA GCSE Mathematics (8300) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (1 mark)

A block of cheese has mass 360 g and density 1.2 g/cm^3

Circle the volume of the block of cheese.

Options: 300 cm^3 , 358.8 cm^3 , 361.2 cm^3 , 432 cm^3

Volume = mass $\div$ density

$$360 \div 1.2 = 300$$

(Check: $300 \times 1.2 = 360 \text{ g}$.)

Answer: 300 cm^3

Tip: To find a volume, divide the mass by the density. $360 \times 1.2 = 432$ is a common wrong answer.

2 (2 marks)

A block of ice has volume 1500 cm^3

The density of ice is 0.92 g/cm^3

Work out the mass of the block of ice.

Mass = density $\times$ volume

$$0.92 \times 1500 = 1380$$

Answer: 1380 g

Tip: Density is mass **per** cm^3 , so to find the mass you multiply. Dividing ($1500 \div 0.92$) is a common mistake.

Marks: 1 mark for 0.92×1500 . 1 mark for 1380.

3 (3 marks)

A solid cuboid measures 5 cm by 4 cm by 3 cm.

Its mass is 162 g.

Work out the density of the cuboid.

Volume of a cuboid = length $\times$ width $\times$ height

$$5 \times 4 \times 3 = 60 \text{ cm}^3$$

Density = mass $\div$ volume

$$162 \div 60 = 2.7$$

Answer: 2.7 g/cm^3

Marks: 1 mark for 60. 1 mark for $162 \div 60$. 1 mark for 2.7

4 (2 marks)

A concrete paving slab has mass 12.6 kilograms.

The density of the concrete is 2.1 g/cm^3

Work out the volume of the paving slab.

Give your answer in cm^3

The density uses grams, so change kg to g first.

$$1 \text{ kg} = 1000 \text{ g, so } 12.6 \text{ kg} = 12.6 \times 1000 = 12\,600 \text{ g}$$

Volume = mass $\div$ density

$$12\,600 \div 2.1 = 6000$$

Answer: 6000 cm³

Tip: There are 1000 g in 1 kg, not 100. Change the mass to grams before you divide, because the density is in g/cm³.

Marks: 1 mark for $12\,600 \div 2.1$. 1 mark for 6000.

5 (3 marks)

Two pieces of wood, P and Q, are cut from the same plank.

They have the same density.

Piece P has mass 45 g and volume 60 cm³

Piece Q has mass 78 g.

Work out the volume of piece Q.

State the units of your answer.

Density of P = mass $\div$ volume

$$45 \div 60 = 0.75 \text{ g/cm}^3$$

Q has the same density, 0.75 g/cm³

Volume of Q = mass $\div$ density

$$78 \div 0.75 = 104$$

The mass is in g and the density is in g/cm³, so the volume is in cm³.

Answer: 104 cm³

Tip: You can also use proportion: Q's mass is $78 \div 45$ times P's mass, so its volume is $60 \times 78 \div 45 = 104 \text{ cm}^3$. Remember to write the units.

Marks: 1 mark for 0.75. 1 mark for 104. 1 mark for cm³ as the units.

6 (1 mark)

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

Cube X and cube Y have the same mass.

The volume of cube X is 2 times the volume of cube Y.

Complete the sentence. Circle your answer.

The density of cube X is _____ the density of cube Y.

Options: 4 times, 2 times, the same as, half

Density = mass ÷ volume

The masses are the same.

X has 2 times the volume, so you divide the same mass by a number 2 times bigger.

So the density of X is half the density of Y.

Answer: half (the density of X is half the density of Y)

Tip: Test it with numbers. Mass 12 g; Y with volume 3 cm³ has density 4; X with volume 6 cm³ has density 2.

7 (1 mark)

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

A block of metal has mass 40 g.

A second block is made from the same metal.

The volume of the second block is 3 times the volume of the first block.

Circle the mass of the second block.

Options: 13.3 g, 43 g, 80 g, 120 g

The blocks are made from the same metal, so they have the same density.

Mass = density × volume

The volume is 3 times bigger and the density is the same, so the mass is 3 times bigger.

$$40 \times 3 = 120$$

Answer: 120 g

8 (3 marks)

Ravi makes a paperweight from solid bronze.

The volume of the paperweight is 450 cm^3

density of bronze = 8.8 grams per cubic centimetre

Ravi says,

‘The mass of my paperweight is less than 4 kilograms.’

Is Ravi correct?

You must show your working.

Mass = density $\times$ volume

$$8.8 \times 450 = 3960 \text{ g}$$

Change to kilograms (divide by 1000): $3960 \text{ g} = 3.96 \text{ kg}$

3.96 kg is less than 4 kg.

So Ravi is correct.

Answer: Yes, the mass is 3.96 kg (3960 g), which is less than 4 kg

Tip: Compare like with like: change 3960 g to kg (or 4 kg to 4000 g) before you decide. Then answer the question: yes or no.

Marks: 1 mark for 8.8×450 . 1 mark for 3960 g or 3.96 kg. 1 mark for Yes with 3.96 kg (or 3960 g compared with 4000 g).

9 (3 marks)

The table shows information about two islands.

	Population	Area (km^2)
Island A	12 400	31
Island B	20 900	55

$$\text{Population density} = \frac{\text{number of people}}{\text{area}}$$

Which island has the greater population density?

You must show your working.

Population density = number of people $\div$ area

Island A: $12\,400 \div 31 = 400$ people per km^2

Island B: $20\,900 \div 55 = 380$ people per km^2

400 is more than 380

So Island A has the greater population density (more people in each km^2).

Answer: Island A (400 people per km^2 , compared with 380 for Island B)

Tip: Island B has more people, but it also has a bigger area. Work out the number of people per km^2 for each island before you compare.

Marks: 1 mark for one correct division. 1 mark for 400 and 380. 1 mark for Island A with both values.

10 (3 marks)

A city is in the shape of a rectangle 8 km long and 3.5 km wide.

The population density of the city is 6200 people per square kilometre.

Work out the number of people who live in the city.

Area of the rectangle: $8 \times 3.5 = 28 \text{ km}^2$

6200 people live in each km^2 .

Number of people: $6200 \times 28 = 173\,600$

Answer: 173 600

Marks: 1 mark for 28. 1 mark for 6200×28 . 1 mark for 173 600.

11 (2 marks)

Some oil has

a mass of 460 g

a density of $920\,000 \text{ g/m}^3$

$1 \text{ m}^3 = 1000$ litres

Work out the volume of the oil.

Give your answer in litres.

Volume = mass $\div$ density

$$460 \div 920\,000 = 0.0005 \text{ m}^3$$

Change m^3 to litres (multiply by 1000):

$$0.0005 \times 1000 = 0.5 \text{ litres}$$

Answer: 0.5 litres

Tip: Divide the mass by the density (not the other way round). The density is in g/m^3 , so your volume is in m^3 . Then change it to litres.

Marks: 1 mark for $460 \div 920\,000$. 1 mark for 0.5
