Density

Worked solutions

GCSE science calculations

This topic online

1 A block of aluminium has a mass of 5.4 kg and a volume of 0.002 m^3.

Calculate the density of aluminium. (2 marks)

Density = mass ÷ volume

$\rho = 5.4 \div 0.002$

$2700\ kg/m^3$

2 A bottle contains 0.0005 m^3 of olive oil. The mass of the olive oil is 0.46 kg.

Calculate the density of the olive oil. (2 marks)

Density = mass ÷ volume

$\rho = 0.46 \div 0.0005$

$920\ kg/m^3$

3 Kofi finds a pebble on a beach in Cornwall. The pebble has a mass of 39 g and a volume of 15 cm^3.

Calculate the density of the pebble in g/cm^3. (2 marks)

Density = mass ÷ volume

$\rho = 39 \div 15$

$2.6\ g/cm^3$

4 The density of copper is 8.96 g/cm^3.

1 g/cm^3 = 1000 kg/m^3

Write the density of copper in kg/m^3. (2 marks)

$1\ g/cm^3 = 1000\ kg/m^3$

$8.96\ g/cm^3 = 8.96 \times 1000$

$8960\ kg/m^3$

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5 A wooden block measures 20 cm by 10 cm by 5.0 cm. Its mass is 0.60 kg.

Calculate the density of the wood in kg/m^3. (3 marks)

Volume of a block = length x width x height

$V = 20 \times 10 \times 5.0 = 1000 \text{ cm}^3$

$1 \text{ m}^3 = 1\,000\,000 \text{ cm}^3$

$V = 1000 \div 1\,000\,000 = 0.001 \text{ m}^3$

Density = mass ÷ volume

$\rho = 0.60 \div 0.001$

600 kg/m^3

6 In a Year 10 practical, Sofia finds the density of a small stone.

- The mass of the stone is 60.0 g.
- The water in a measuring cylinder is at 50 cm^3.
- When the stone is lowered into the water, the level rises to 74 cm^3.

Calculate the density of the stone in kg/m^3.

1 g/cm^3 = 1000 kg/m^3 (3 marks)

Volume of stone = volume of water pushed up

$V = 74 - 50 = 24 \text{ cm}^3$

Density = mass ÷ volume

$\rho = 60.0 \div 24$

$\rho = 2.5 \text{ g/cm}^3$

$\rho = 2.5 \times 1000$

2500 kg/m^3

7 A fish tank holds 0.12 m^3 of water. The density of water is 1000 kg/m^3.

Calculate the mass of the water in the tank. (2 marks)

Density = mass ÷ volume

$1000 = m \div 0.12$

Multiply both sides by 0.12

$m = 1000 \times 0.12$

120 kg

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8 A builder buys a 25 kg bag of dry sand. The density of the sand is 1600 kg/m^3.

Calculate the volume of the sand.

Give your answer to 2 significant figures.

(3 marks)

Density = mass ÷ volume

$1600 = 25 \div V$

Rearrange: volume = mass ÷ density

$V = 25 \div 1600$

$V = 0.015625\ m^3$

$0.016\ m^3$

9 A lab technician needs 250 g of ethanol. The density of ethanol is 0.79 g/cm^3.

Calculate the volume of ethanol needed in cm^3.

Give your answer to 3 significant figures.

(2 marks)

Density = mass ÷ volume, so volume = mass ÷ density

$V = 250 \div 0.79$

$V = 316.45...\ cm^3$

$316\ cm^3$

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10 Mr Okafor gives his class a metal block that measures 4.0 cm by 3.0 cm by 2.5 cm. The mass of the block is 267 g.

Metal	Density in kg/m^3
aluminium	2700
iron	7900
copper	8900
lead	11 300

a. Calculate the density of the block in kg/m^3. 1 g/cm^3 = 1000 kg/m^3. Show your working.

b. Use the table to identify the metal.

(4 marks)

a)

Volume of a block = length x width x height

$V = 4.0 \times 3.0 \times 2.5 = 30 \text{ cm}^3$

Density = mass ÷ volume

$\rho = 267 \div 30$

$\rho = 8.9 \text{ g/cm}^3$

$\rho = 8.9 \times 1000$

8900 kg/m^3

b)

8900 kg/m^3 matches the table

copper

11 A classroom is 8.0 m long, 6.0 m wide and 3.0 m high. The density of air is 1.2 kg/m^3.

Calculate the mass of air in the classroom.

Give your answer to 2 significant figures. Show your working.

(3 marks)

Volume of the room = length x width x height

$V = 8.0 \times 6.0 \times 3.0 = 144 \text{ m}^3$

Density = mass ÷ volume, so mass = density x volume

$m = 1.2 \times 144$

$m = 172.8 \text{ kg}$

170 kg

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12 Haruto lowers a rock into a eureka can full of water. The water that overflows is collected in a measuring cylinder. 135 cm^3 of water is collected.

The mass of the rock is 0.351 kg.

a. Write the volume of the rock in m^3, in standard form.

b. Calculate the density of the rock in kg/m^3. Show your working. (4 marks)

a)

Volume of rock = volume of water displaced

$V = 135\ cm^3$

$1\ m^3 = 1\,000\,000\ cm^3$

$V = 135 \div 1\,000\,000 = 0.000135\ m^3$

$\boxed{1.35 \times 10^{-4}\ m^3}$

b)

Density = mass ÷ volume

$\rho = 0.351 \div 0.000135$

$\boxed{2600\ kg/m^3}$

13 Ana finds the density of salt water.

- The mass of an empty beaker is 112 g.
- She pours 250 cm^3 of salt water into the beaker.
- The mass of the beaker and the salt water is now 370 g.

Calculate the density of the salt water in g/cm^3. (3 marks)

Use the mass of the salt water only, not the beaker

$m = 370 - 112 = 258\ g$

Density = mass ÷ volume

$\rho = 258 \div 250$

$\boxed{1.032\ g/cm^3}$

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14 A concrete paving slab measures 0.60 m by 0.60 m by 0.050 m. The slab has a mass of 41.4 kg and a weight of 406 N.

Calculate the density of the concrete. Show your working. (3 marks)

Density uses the mass (41.4 kg), not the weight (406 N)

Volume of a block = length × width × height

$V = 0.60 \times 0.60 \times 0.050 = 0.018\ m^3$

Density = mass ÷ volume

$\rho = 41.4 \div 0.018$

2300 kg/m³

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