Density and Compound Measures

Maths | Level 2 | Exam-style practice · 10 questions · 28 marks · Calculator allowed

Remember

Density = mass ÷ volume. Mass = density × volume. Volume = mass ÷ density. Same triangle as speed: M on top.

Units: g/cm³ or kg/m³. 1 g/cm³ = 1,000 kg/m³. Water is 1 g/cm³ – things with a higher density sink.

Any rate works the same way: total = rate × amount; rate = total ÷ amount. Flow: litres per minute. Pay: pounds per hour. Population density: people per km².

Volume first: many density questions make you find the volume of a cuboid (l × w × h) before you can use the formula.

Section A – Density

1. A block of metal has a mass of 540 g and a volume of 200 cm³. Find its density. (2 marks)

2. Oak has a density of 0.75 g/cm³. A wooden beam is 200 cm long, 15 cm wide and 10 cm thick. What is its mass in kilograms? (3 marks)

3. A gold bar has a density of 19.3 g/cm³ and a mass of 1 kg. What is its volume, to the nearest cm³? (2 marks)

4. A 250 ml bottle of olive oil has a mass of 230 g. A 250 ml bottle of honey has a mass of 355 g. Which is denser, and will the oil float on the honey? (3 marks)

5. Concrete has a density of 2,400 kg/m³. A path is 12 m long, 1.5 m wide and 0.1 m deep. What mass of concrete is needed, in tonnes? (3 marks)

Section B – Other compound measures

6. A tap fills a 90-litre paddling pool in 12 minutes. What is the flow rate in litres per minute? How long would it take to fill a 300-litre tank? (3 marks)

7. A town has a population of 86,400 and an area of 24 km². A second town has 52,000 people in 20 km². Which is more crowded? Give both population densities. (3 marks)

8. A car uses 38 litres of fuel to travel 520 km. (a) How many km per litre is that? (b) How much fuel will a 780 km trip need? (3 marks)

9. A printer prints 22 pages per minute. A report is 340 pages and 25 copies are needed. How long will the printing take, in hours and minutes? (3 marks)

10. A pump moves 0.8 m³ of water a minute. A pond holds 12,000 litres. How long does it take to empty? (1 m³ = 1,000 litres) (3 marks)

Density and Compound Measures – Answers

Level 2 · Working shown so you can check your method, not just the final number.

Section A

1. 540 ÷ 200 = **2.7 g/cm³**.
2. Volume = 200 × 15 × 10 = 30,000 cm³. Mass = 0.75 × 30,000 = 22,500 g = **22.5 kg**.
3. 1,000 ÷ 19.3 = 51.8 → **52 cm³**.
4. Oil: 230 ÷ 250 = 0.92 g/cm³. Honey: 355 ÷ 250 = 1.42 g/cm³. **Honey is denser**; **yes**, the oil floats (lower density on top).
5. Volume = 12 × 1.5 × 0.1 = 1.8 m³. Mass = 2,400 × 1.8 = 4,320 kg = **4.32 tonnes**.

Section B

6. 90 ÷ 12 = **7.5 litres per minute**. 300 ÷ 7.5 = **40 minutes**.
7. Town 1: 86,400 ÷ 24 = 3,600 people/km². Town 2: 52,000 ÷ 20 = 2,600 people/km². **Town 1** is more crowded.
8. (a) 520 ÷ 38 = **13.7 km per litre**. (b) 780 ÷ 13.68 = **57 litres**.
9. 340 × 25 = 8,500 pages. 8,500 ÷ 22 = 386.4 min = **6 h 26 min** (accept 6 h 27 min).
10. 12,000 litres = 12 m³. 12 ÷ 0.8 = **15 minutes**.

Where Level 2 students lose marks on this topic

- Dividing the wrong way round – volume ÷ mass. Density is mass per unit volume, so mass goes on top.
- Forgetting to find the volume of the cuboid first, or mixing cm and m when doing so.
- Leaving the answer in grams when the question asks for kilograms or tonnes.