Test answers - Speed, density and compound units

Year: Year 8 · Duration: 45 minutes · /20

Answer to Question 1 (4 marks)

a. Average speed = distance ÷ time: $135 \div 1.5 =$**90 km/h**. (1 mark)
b. Write the time in hours as a decimal: 30 minutes is half an hour, so 2 hours 30 minutes = 2.5 hours (1 mark). Distance = speed × time: $14 \times 2.5 =$**35 km** (1 mark).
c. 1 km/h means 1 000 m in 3 600 s, so divide by 3.6 to change km/h into m/s: $54 \div 3.6 =$**15 m/s**. (1 mark)

A frequent mistake in (b) is writing 2 h 30 min as 2.3 hours; there are 60 minutes in an hour, not 100. Check (c) the long way: $54\,000$ m in $3\,600$ s gives $54000 \div 3600 = 15$ m each second.

Answer to Question 2 (4 marks)

a. Density = mass ÷ volume: $360 \div 450 =$**0.8 g/cm³**. (1 mark)
b. An object floats when its density is less than that of the liquid. Since $0.8 < 1$, the wood **floats**. (1 mark)
c. Rearrange the formula: mass = density × volume (1 mark). So $7.8 \times 250 =$**1 950 g**, which is 1.95 kg (1 mark).

The formula triangle with mass on top, density and volume underneath helps choose the right operation. Check (c) the other way: $1950 \div 250 = 7.8$ g/cm³. Every cubic centimetre of this metal weighs 7.8 g, so it is almost eight times as heavy as the same volume of water and sinks straight away.

Answer to Question 3 (4 marks)

a. The total time is $40 + 30 = 70$ minutes. Divide by 60 to change to hours: $\frac{70}{60} = \frac{7}{6} \approx$**1.17 hours**. (1 mark)
b. The total distance is $6 + 2 = 8$ km (1 mark). Average speed = total distance ÷ total time $= 8 \div \frac{7}{6} = \frac{48}{7} = 6.857\ldots$, which is **6.9 km/h** to 1 decimal place (1 mark).
c. The walk is 2 km in 30 minutes, which is half an hour: $2 \div 0.5 =$**4 km/h**. (1 mark)

The jogging speed is $6 \div \frac{40}{60} = 9$ km/h. Averaging 9 and 4 to get 6.5 km/h is wrong,

because more time is spent on one part than the other.

Answer to Question 4 (4 marks)

a. The pool is a cuboid: $20 \times 8 \times 1.5 =$**240 m³** (1 mark). Each cubic metre holds 1 000 litres, so it holds **240 000 litres** (1 mark).
b. Time = volume ÷ rate of flow: $240\,000 \div 4\,000 = 60$ (1 mark). The rate is in litres per minute, so the answer is **60 minutes**, or exactly 1 hour (1 mark).

Check with a smaller unit: in one minute the pump delivers 4 m³, which raises the water in the 160 m² pool by $4 \div 160 = 0.025$ m, or 2.5 cm. Reaching 150 cm needs $150 \div 2.5 = 60$ minutes, which agrees. This is a compound unit question, just like speed but with litres instead of kilometres.

Answer to Question 5 (4 marks)

a. Change 1 h 30 min to 1.5 hours. First part: $90 \div 1.5 =$**60 mph** (1 mark). Second part: $120 \div 2 =$**60 mph** (1 mark).
b. Total distance $90 + 120 = 210$ miles and total time $1.5 + 2 = 3.5$ hours (1 mark). Average speed $= 210 \div 3.5 =$**60 mph** (1 mark).

Here the average is also 60 mph because Jade drove at the same speed throughout. If the two speeds had been different, the average would have to be found from the totals, never by averaging the two speeds. Check: at 60 mph she covers 1 mile each minute, and 210 miles take 210 minutes, which is 3 hours 30 minutes.