Foundation Check In - 10.01 Units and measurement

1. The maximum speed on UK roads is 70 mph.
   Convert this speed into km/h using 1 mile = 1.6 km.

2. Convert a density of 2.5 kg/m^3 into g/cm^3.

3. An average speed is given as $\frac{3x}{5}$ km/h. What is this in m/s?

4. This is the formula for pressure.

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

   A cuboid with a base area of 85 cm^2 applies a force of 170 N to the floor. What is the pressure that the floor is under in N/cm^2?

5. The density of the air around us is 1.3 kg/m^3. What is the volume of a balloon that can hold 4.55 g of air?

6. A map has a scale of 1 : 25 000, and a road marked on this map is 7 cm long. The same road is marked on a different map and measures 3.5 cm long. Explain how you could use this information to work out the scale on the second map.

7. Platinum has a density of 21.4 g/cm^3 and silver has a density of 10.5 g/cm^3.
   Without calculating their weights explain which is heavier, 50 cm^3 of platinum or 100 cm^3 of silver.

8. It takes a snail one week to travel 1 kilometre. Calculate the approximate speed at which the snail is travelling and justify your choice of units.

9. A cuboid block of concrete applies a force of 4500 N to a table so the pressure exerted on the table is 90 N/cm^2. One side of the base of the cuboid block is 5 cm. What is the length of the other side of the base? *(Note: you may use the formula provided in question 4)*

10. A map has a scale of 1 : 10 000. On the map, a post office is directly north of a school and a museum is directly east of the same school. The buildings are linked by three straight roads. Ahmed measures these roads on his map. The distance between the post office and the museum is 15 cm, and the distance between the post office and the school is 9 cm. How far is it from the school to the museum in kilometres?

Extension
A crane needs to lift a steel joist.
The joist is a cuboid with dimensions 2.5 m by 0.2 m by 0.2 m.
Steel has a density of 8.05 g/cm^3.
The crane can lift a maximum load of 1.5 tonnes.
Can the crane be used to lift the joist? Show your working.

Answers

1. 112 km/h
2. $0.0025\,\text{g/cm}^3$
3. $\frac{x}{6}$ m/s
4. $2\,\text{N/cm}^2$
5. $0.0035\,\text{m}^3$
6. The road is half as long on the new map so the scale must be double, or 1 : 50 000
7. The platinum is heavier; it has half the volume, but more than double the density.
8. 0.165 cm/s or 9.92 cm/min. The most commonly used unit for speed, km/h, would be too large a unit for the answer to be meaningful; even m/s is slightly too large for the numerical values given.
9. 10 cm
10. 1.2 km

Extension

Volume of joist $= 0.2 \times 0.2 \times 2.5 = 0.1\,\text{m}^3$
Mass of joist = density × volume; density is g/cm^3 so need to convert to kg/m^3, $8.05\,\text{g/cm}^3 = 8050\,\text{kg/m}^3$
Mass of joist $= 8050 \times 0.1 = 805$ kg
1.5 tonne $= 1500$ kg

Yes, the crane can lift the joist.

GCSE (9–1) MATHEMATICS

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AO1	2	Convert other compound units (density)			
AO1	3	Convert compound units in an algebraic context (speed)			
AO1	4	Use compound units			
AO1	5	Know and apply density = mass ÷ volume			
AO2	6	Use the scale of a map			
AO2	7	Apply knowledge of density = mass ÷ volume			
AO2	8	Use and convert standard units or simple compound units (speed)			
AO3	9	Solve a problem using density = mass ÷ volume			
AO3	10	Use the scale of a map to solve a problem			

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