Exercise walk-through

3.3.1 Compound Rates

AQA · GCSE · Mathematics

Units and compound measures

- **Converting units.** Learn the metric links: 1 km = 1000 m, 1 m = 100 cm, 1 kg = 1000 g, 1 litre = 1000 cm^3.
- Time is not decimal: 2 hours 36 minutes is $2 + \frac{36}{60} = 2.6$ hours, not 2.36 hours.
- A compound unit combines two units, such as km/h or g/cm^3.
- **Density** tells you how much mass is packed into each unit of volume.
  Pressure is the force on each unit of area, measured in N/m^2.

$$\text{speed} = \frac{\text{distance}}{\text{time}} \qquad \text{density} = \frac{\text{mass}}{\text{volume}} \qquad \text{pressure} = \frac{\text{force}}{\text{area}}$$

Scale, similarity and rates of change

- **Scale drawings.** A map **scale** of $1 : 25\,000$ means 1 cm on the map is 25 000 cm in real life.
- A 4 cm line on the map is $4 \times 25\,000 = 100\,000$ cm, which is 1 km.
- **Length, area and volume.** If two shapes are similar with a length **scale** factor of k, the **area scale factor** is k^2 and the volume scale factor is k^3.
- A square with sides 3 times as long has 9 times the area.

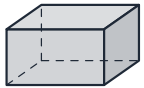
Growth and decay

- **Simple interest** pays the same amount every year. **Compound interest** pays interest on the interest too, so the amount is multiplied by the same number every year:
- where P is the starting amount, r the percentage rate and n the number of years.
- For decay, such as a car losing value, use $1 - \frac{r}{100}$.
- **Worked example 13.** 1000 yuan is saved at 10% a year for 4 years.

$$A = P\left(1 + \frac{r}{100}\right)^n$$

Exercises 2.1·2.2

2.1 A metal has a density of 8 g/cm^3. Work out the mass of 25 cm^3 of the metal. Work out the volume of 120 g of the metal. [2]

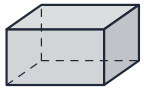


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- $8 \times 25 = \mathbf{200}$ g
- $120 \div 8 = \mathbf{15}$ cm^3

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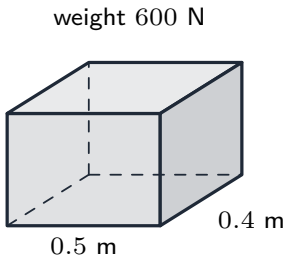


2.2

- $54 \times 1000 \div 3600$
- **15** m/s

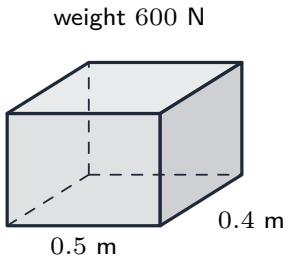
Exercise 3.1

3.1 A box has a weight of 600 N. Its base is 0.5 m by 0.4 m. Work out the pressure on the floor. [3]



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- area $0.5 \times 0.4 = 0.2$ m^2
- $600 \div 0.2$
- **3000** N/m^2

Exercise 3.2 (a)

3.2 A van makes a delivery trip from the depot D to a town T and then to a farm F.

(a) The van travels 84 km from D to T in 1 hour 45 minutes. Work out its average speed. [2]

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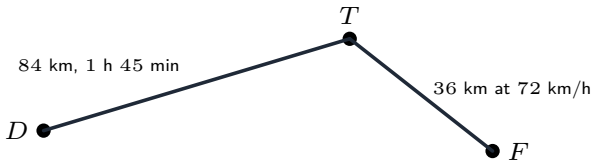
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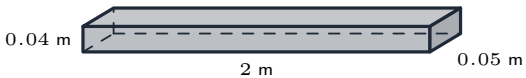
(a) $84 \div 1.75 = \mathbf{48}$ km/h

Exercise 3.2 (b)

3.2 A van makes a delivery trip from the depot D to a town T and then to a farm F.

(b) It then travels 36 km from T to F at 72 km/h. Work out the average speed for the whole trip from D to F. [3]

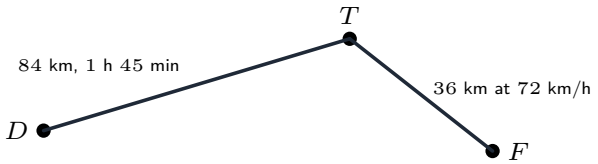


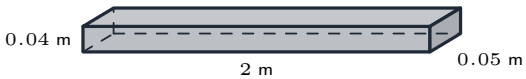


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(b) $36 \div 72 = 0.5$ h; $120 \div 2.25 = \mathbf{53.3}$ km/h

Exercise 3.2 (c)

3.2 A van makes a delivery trip from the depot D to a town T and then to a farm F.

(c) The van carries steel bars. Each bar is 2 m by 0.05 m by 0.04 m. Steel has a density of 7850 kg/m^3. The van can carry 1000 kg. Work out the mass of one bar and the greatest number of bars the van can carry. [4]

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(c) volume $2 \times 0.05 \times 0.04 = 0.004$ m^3; $0.004 \times 7850 = \mathbf{31.4}$ kg; $1000 \div 31.4 = 31.8\ldots$, so **31** bars

Exercise 3.2 (d)

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(d) Station A sells 40 litres of fuel for £58.00. Station B sells 35 litres for £51.45. Which is the better buy? The van uses 8.5 litres of fuel per 100 km. Work out the cost of fuel for the 120 km trip at the better price. [5]

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(d) $58 \div 40 = 1.45$ and $51.45 \div 35 = 1.47$; **station A**; $120 \div 100 \times 8.5 = 10.2$ litres; $10.2 \times 1.45 =$ £**14.79**