6 The mass of a solid metal cuboid is 4 kg. The volume of the cuboid is 600 cm³.

Calculate the density of the metal, giving your answer in **g/cm³**.
[Density = mass ÷ volume]

4 kg = 4000 g

$$density = \frac{4000}{600}$$

$$= 6.67 \text{ g/cm}^3$$

...........6·67........... g/cm³ [2]

3 A car travels 300 metres in 20 seconds.

Find the average speed of the car in

(a) metres per second,

$$Speed = \frac{300}{20}$$

$$= 15$$

............15............ m/s [1]

(b) kilometres per hour.

300 m = 0.3 km

×3 (0.3 km in 20 s) ×3
    0.9 km in 1 min) ×60
×60 (54 km in 1 hour

............54............ km/h [2]

(e) A stone has volume 45 cm³ and mass 126 g.
Find the density of the stone, giving the units of your answer.

[Density = mass ÷ volume]

$$density = \frac{126}{45}$$

$$= 2.8 \text{ g/cm}^3$$

.....2·8..... g/cm³ [2]

11 A bronze sphere has radius 3.6 cm.
The density of bronze is 8.05 g/cm^3.

Find the mass of the sphere.
Give your answer **in kilograms**, correct to the nearest gram.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

[Density = mass ÷ volume.]

Volume $= \frac{4}{3} \times \pi \times 3.6^3$

$= 195.432$ cm^3

Mass $=$ density $\times$ volume

$= 8.05 \times 195.432$

$= 1573$ g (to the nearest g)

.... 1.573 .... kg [4]

4 A train journey takes 5 hours 54 minutes.

(a) The journey starts at 09 15.

Find the time that the journey ends.

09:15   10:00   15:00   15:09
45 mins   5 hrs   9 mins
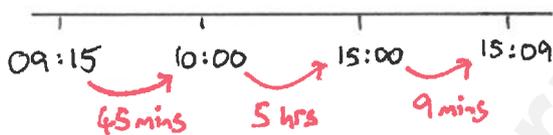
.... 15:09 .... [1]

(b) The average speed of the train for this journey is 80 km/h.

Calculate the distance travelled.

54 mins in hours:

$54 \div 60 = 0.9$

so 5 hrs 54 mins $= 5.9$ hours

distance $=$ speed $\times$ time

$= 80 \times 5.9$

$= 472$ km

.... 472 .... km [2]

7 Kendra jogs 7 km in 45 minutes. ①
She then runs at 12 km/h for 30 minutes. ②

Find her average speed in km/h for the whole journey.

$$\text{Average speed} = \frac{\text{Total distance}}{\text{Total time}}$$

① time = 0.75 hrs , distance = 7km
(45÷60)

② time = 0.5 hrs , distance = S×t
= 12×0.5
= 6km

$$\text{speed} = \frac{7+6}{0.75+0.5}$$

$$= \frac{13}{1.25}$$

............10.4............ km/h [3]

7 Lee cycles for 60 km at an average speed of 30 km/h. ①
He then returns along the same route at an average speed of 20 km/h. ②

Find Lee's average speed for the whole journey.

① time = $\frac{d}{S}$ distance = 60km

= $\frac{60}{30}$

= 2 hrs

② time = $\frac{60}{20}$ distance = 60km

= 3 hrs

$$\text{speed} = \frac{60+60}{2+3}$$

$$= \frac{120}{5}$$

$$= 24$$

............24............ km/h [3]

8 Beatrice walks 1 km at a speed of 4 km/h ① and then 2 km at a speed of 4.5 km/h. ②

Work out Beatrice's average speed for the whole journey.

① time = $\frac{d}{S}$ distance = 1 km

= $\frac{1}{4}$ hr

② time = $\frac{2}{4.5}$ distance = 2km

= $\frac{4}{9}$ hr

$$\text{speed} = \frac{1+2}{\frac{1}{4}+\frac{4}{9}}$$

$$= \frac{3}{25/36}$$

$$= 4.32$$

............4.32............ km/h [3]

8 Jasmine drives a distance of a km at a speed of 50 km/h. ①
She then drives a distance of b km at a speed of 60 km/h. ②
She takes a total time of T hours for this journey.

Find a formula for T in terms of a and b.

① time $= \dfrac{d}{s}$ distance $= a$
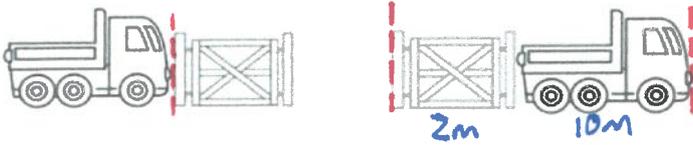
$= \dfrac{a}{50}$

② time $= \dfrac{d}{s}$ distance $= b$

$= \dfrac{b}{60}$

Total time $= \dfrac{a}{50} \times \dfrac{6}{6} + \dfrac{b}{60} \times \dfrac{5}{5}$

$= \dfrac{6a}{300} + \dfrac{5b}{300}$

$T = \dfrac{6a + 5b}{300}$ [2]

4 A truck of length 10 m passes a gate of length 2 m.
The speed of the truck is 8 m/s.

Find the time the truck takes to completely pass the gate.

$$\text{time} = \frac{\text{distance}}{\text{speed}}$$

$$= \frac{12}{8}$$

$$= 1.5s$$

Distance travelled: $2 + 10 = 12m$

2m   10m

.... 1.5 .... s [2]

9 A train is travelling at a speed of 30 m/s.
The length of the train is 70 m.
The train passes through a station of length 170 m.

Find the time the train takes to pass completely through the station.

170m   70m

Distance travelled: $170 + 70 = 240m$

$$\text{time} = \frac{d}{s}$$

$$= \frac{240}{30}$$

$$= 8s$$

.... 8 .... s [2]

14 A train, 1750 metres long, is travelling at 55 km/h.

Calculate how long it will take for the whole train to completely cross a bridge that is 480 metres long.
Give your answer in seconds, correct to the nearest second.

480m
1750m

Distance: $480 + 1750 = 2230m$
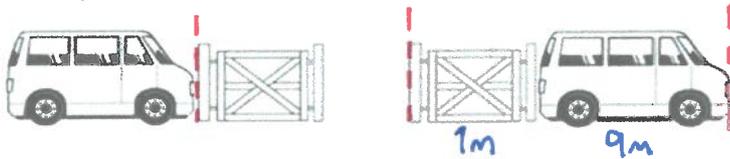
Convert speed to m/s:

$55 \text{km/h} = 55\,000 \text{ m/h}$ $\Big\} \div 60$

$= 916.67 \text{ m/min}$ $\Big\} \div 60$

$= 15.28 \text{ m/s}$

$$\text{time} = \frac{d}{s}$$

$$= \frac{2230}{15.28}$$

$$= 146$$

.... 146 .... s [3]

9 A van has length 9 m.
It takes 1 second for the van to completely pass a gate of length 1 m.

Find the speed of the van.
Give your answer in km/h.

1m   9m

Distance: 1 + 9 = 10m

Speed = $\frac{d}{t}$

  = $\frac{10}{1}$ = 10 m/s

Convert to km/h:

10 m/s = 0.01 km/s)×60
  = 0.6 km/min)×60
  = 36 km/h

_____36_____ km/h [2]

17 A train of length 105 m takes 11 seconds to pass completely through a station of length 225 m.

Calculate the speed of the train in km/h.

225m   105m

Distance: 225 + 105 = 330m

speed = $\frac{d}{t}$

  = $\frac{330}{11}$ = 30 m/s

30 m/s = 0.03 km/s)×60
  = 1.8 km/min)×60
  = 108 km/hr

  = 108 km/h

14 A train passes through a station at a speed of 108 km/h.
The length of the station is 120 m.
The train takes 7 seconds to completely pass through the station.

Work out the length of the train.

120m   d

Convert speed to m/s:

108 km/h = 108 000 m/h)÷60
  = 1800 m/min)÷60
  = 30 m/s

distance = s × t
  = 30 × 7
  = 210m

210 − 120 = 90   90

_____90_____ m [3]