Units, time and scale

Leaving Certificate · Ordinary Level

Understand the idea

How to start

A measurement needs a number and a unit. One metre is the same length as 100 centimetres.

1. Write the starting unit and the unit you need.
2. Use a known conversion such as $1m = 100$ cm.
3. Check the size: the same length has more centimetres than metres.

Key terms & definitions

Scale
The ratio of a drawing length to the corresponding actual length.

Capacity
The volume a container can hold.

Duration
The amount of time between two events.

Key ideas

• Convert all lengths to compatible units before calculating.

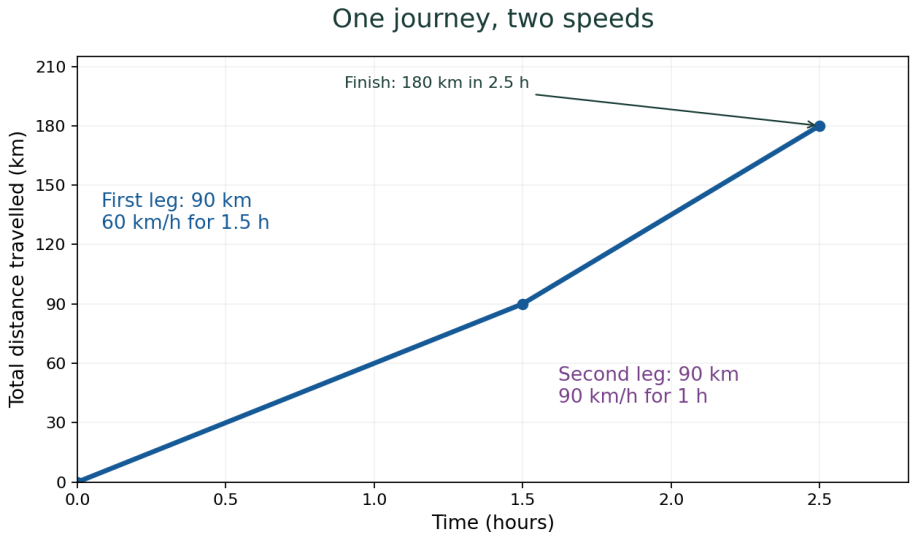
• Area conversions square the length scale factor: $1\text{m}^2 = 10000\text{cm}^2$. Volume conversions cube it.

• $1\text{litre} = 1000\text{cm}^3$ and $1\text{m}^3 = 1000\text{litres}$.

• A decimal part of an hour is not minutes. Multiply the fractional hour by 60.

• A scale of $1 : 500$ means one unit on the diagram represents 500 of the same units in reality.

• Average speed is total distance divided by total time. Convert every part of the journey to the same time unit before adding.



The steeper second segment shows the faster leg. Overall average speed uses the finish totals : 180 km divided by 2.5 hours, giving 72 km$/h$.

Quick reminder

• Use compatible units before calculating.

• Area scale factors are squared; volume scale factors are cubed.

• Multiply a fractional hour by 60 to convert it to minutes.

Worked examples

Example 01 · Converting units of length

Convert 4 cm to mm.

Why this method?

Identify the starting unit and the required unit. Use the conversion factor in the direction that gives the required unit.

4 cm $= 40$ mm

Step 1

Use the ratio between the two units

Think about it: Before moving on: why does a number of centimetres become a bigger number of millimetres?

Example 02 · Converting units of mass and capacity

Convert 5 kg to g.

Why this method?

Identify the starting unit and the required unit. Use the conversion factor in the direction that gives the required unit.

$1\text{kg} = 1000\text{g}$	**Step 1** One kilogram contains one thousand grams.
$5 \times 1000 = 5000$	**Step 2** There are 5 lots of 1000 grams.
$5\text{kg} = 5000\text{g}$	**Step 3** The unit is smaller, so the number of units is larger.

Think about it: Before moving on: when you convert millilitres to litres, why is the answer a smaller number?

Example 03 · Hours, minutes and days

How many minutes are there in 3 hours and 25 minutes?

Why this method?

Identify the starting unit and the required unit. Use the conversion factor in the direction that gives the required unit.

$3 \times 60 = 180$ minutes	**Step 1** There are 60 minutes in each hour
$180 + 25 = 205$ minutes	**Step 2** Add the extra minutes

Think about it: Before moving on: why is 2 hours and 30 minutes not 230 minutes?

Example 04 · A scale plan

A room is $4.8m$ long. Draw its length at a scale of $1:50$.

Why this method?

Identify the starting unit and the required unit. Use the conversion factor in the direction that gives the required unit.

$4.8m = 480$ cm.	**Step 1** Use the same units

$480 \div 50 = 9.6$	**Step 2** Divide by the scale factor
The plan length is 9.6 cm.	**Step 3** State the drawing length

Example 05 · Average speed: one journey

A car travels 150 km in 2 hours 30 minutes. Find its average speed in km/h.

Why this method?

Divide total distance by total time. Convert the minutes to hours before dividing.

$30 \text{ min} = \frac{30}{60} \text{ h} = 0.5 \text{ h}$	**Step 1** There are 60 minutes in one hour.
$\text{Total time} = 2 + 0.5 = 2.5 \text{ h}$	**Step 2** 2 hours 30 minutes is 2.5 hours, not 2.30 hours.
$\text{Average speed} = \frac{150}{2.5} = 60 \text{ km/h}$	**Step 3** Use distance in kilometres and time in hours.

Example 06 · Average speed: combine the whole journey

A car travels 90 km at 60 km/h, then another 90 km at 90 km/h. Find its average speed for the entire journey.

Why this method?

The car spends different amounts of time at the two speeds. Find each time, then divide the total distance by the total time.

$t_1 = \frac{90}{60} = 1.5 \text{ h}$	**Step 1** Time equals distance divided by speed. The slower leg takes longer.
$t_2 = \frac{90}{90} = 1 \text{ h}$	**Step 2** Calculate the time for the faster leg separately.
$\text{Total distance} = 90 + 90 = 180 \text{ km}$	**Step 3** Add the distances.
$\text{Total time} = 1.5 + 1 = 2.5 \text{ h}$	**Step 4** Add the times, not the speeds.

Average speed $= \frac{180}{2.5} = 72$ km/h	**Step 5** The answer is not 75 km$/h$: *a* simple mean of these speeds would ignore their different durations.

Example 07 · Convert area units

A floor covers $2.7m^2$. Express this in cm^2 .

$1\ \text{m}^2 = 100^2\ \text{cm}^2$	**Step 1** Convert each of the two lengths.
$2.7 \times 10,000 = 27,000\ \text{cm}^2$	**Final step** Use the square of the linear conversion factor.

Common mistake

Using the length conversion factor for area. Since $1m = 100$ cm, $1\text{m}^2 = 100 \times 100 = 10000\text{cm}^2$, not 100cm^2.

Exam technique

Write units on every intermediate quantity and check the final unit matches the question.

Try it yourself

Work on paper before checking the answers at the end. These questions are for self-checking, not submitted homework.

Question 1

Convert $13m$ to cm.

Question 2

Convert $15000g$ to kg.

Question 3 · Build confidence

Convert 45 minutes to hours.

Question 4 · Apply or explain

A cyclist travels 24 km uphill at 16 km$/h$ and 24 km back at 24 km$/h$. Find the overall average speed.

Before you move on

Try these without looking at a worked example. Revisit any part that is still difficult.

- Convert minutes to hours.
- Find total time for a journey with several stages.
- Calculate average speed from total distance and total time.

Watch an explanation

Corbettmaths — Units: Metric units (length)

Corbettmaths — Time: calculations

Open the website chapter to load the embedded players. Use the rates and rules in your question for financial examples.

Self-check answers

Question 1

1300

Question 2

15

Question 3

$\frac{45}{60} = 0.75$ hours.

Divide minutes by 60.

Question 4

$t_1 = 1.5$ h; $t_2 = 1$ h; average speed $= \frac{48}{2.5} = 19.2$ km/h.

Use the total distance and total time, rather than the mean of the speeds.

Open the full chapter online