

Problems with Mixed Units

Starter

1. **(Review of last lesson)** Annabel ran a road race at an average speed of 10 km/h. She completed the race in 2 hours 15 minutes. What was the distance of the road race?

Notes

Converting units

Converting from **hours and minutes** to just **hours** — divide the minutes by 60 (this is the fractional or decimal part of the hours).

$$\text{E.g. } 8 \text{ hour } 20 \text{ minutes} \equiv 8\frac{20}{60} = 8\frac{1}{3} \approx 8.33\text{h}$$

It is better to leave the minutes as a fraction because this is an exact answer

Converting from **hours** to **hours and minutes** — multiply the decimal or fraction part of the hours by 60.

$$\text{E.g. } 5.9\text{h} \equiv 5\text{h } (0.9 \times 60)\text{m} = 5\text{h } 54\text{m}$$

E.g. 1 Convert 1 hour 35 minutes to just hours.

E.g. 2 Convert 2.7 hours to hours and minutes.

Converting speeds (1 unit)

Using 1 mile \approx 1.6 km, we can convert between mph and km/h.

Converting **mph to km/h**: multiply by 1.6

$$\text{E.g. } 40 \text{ mph} \approx (40 \times 1.6) \text{ km/h} = 64 \text{ km/h}$$

Converting **km/h to mph**: divide by 1.6

$$\text{E.g. } 48 \text{ km/h} \approx (48 \div 1.6) \text{ mph} = 30 \text{ mph}$$

E.g. 3 Given that 1 mile \approx 1.6 km, convert:

(a) 56 miles to km

(b) 56 km/h to mph

$$\text{Working: } (a) \quad 56 \text{ miles} \equiv 56 \times 1.6 = 89.6 \text{ km}$$

Converting speeds (2 units)

When converting speeds involving two units, say from m/s to km/h, it is best to do it one unit at a time. In addition, ask yourself questions like “If I can travel this far in one second, will I travel further or less far in one minute?”

E.g. Convert 7 m/s to km/h.

Working: 7 m/s means 7 metres in 1 second

m/s to m/min: Will I travel further or less far in one minute?

I will travel further so multiply by 60: $7 \text{ m/s} = (7 \times 60) = 420 \text{ m/min}$

m/min to m/h: Will I travel further or less far in one hour?

I will travel further so multiply by 60: $420 \text{ m/min} = (420 \times 60) = 25200 \text{ m/h}$

Now convert to km: $25200 \text{ m/h} \equiv 25.2 \text{ km/h}$

So $7 \text{ m/s} \equiv 25.2 \text{ km/h}$

The full calculation could look like:

$$7 \text{ m/s} = 7 \times 60 \text{ m/min} = 7 \times 60 \times 60 \text{ m/h} = \frac{7 \times 60 \times 60}{1000} \text{ m/h} = 25.2 \text{ km/h}$$

E.g. Convert 85 km/h to m/s. Give your answer to 3 s.f..

Working: 85 km/h means 85 km in 1 hour

km/h to km/min: Will I travel further or less far in one minute?

I will travel less far so divide by 60: $85 \text{ km/h} = \frac{85}{60} \text{ km/min}$

km/min to km/s: Will I travel further or less far in one second?

I will travel less far so divide by 60: $\frac{85}{60} \text{ km/min} = \frac{85}{60 \times 60} \text{ km/s}$

Now convert to m: $\frac{85}{60 \times 60} \text{ km/s} = \frac{85}{60 \times 60} \times 1000 \approx 23.6 \text{ m/s}$

So $85 \text{ km/h} \equiv 23.6 \text{ m/s}$ (3 s.f.)

The full calculation could look like:

$$85 \text{ km/h} = \frac{85}{60} \text{ km/min} = \frac{85}{60 \times 60} \text{ km/s} = \frac{85 \times 1000}{60 \times 60} \text{ m/s} \approx 23.6 \text{ m/s}$$

E.g. 4 Convert 19 m/s to km/h.

E.g. 5 Convert 4 km/h to m/s. Give your answer to 3 s.f..

Video: [Converting km/h to m/s](#)

Video: [Converting m/s to km/h](#)

Video: [Converting times](#)

[Solutions to Starter and E.g.s](#)

Exercise

p118 Ex 18.3 Qu 1-4 (converting units)

p118 Ex 18.3 Qu 5-10 (converting speeds)

Summary

Hours and minutes to just **hours** — divide the minutes by 60

Hours to **hours and minutes** — multiply the decimal or fraction part of the hours by 60.

Converting **mph to km/h**: multiply by 60

Converting **km/h to mph**: divide by 60

When converting speeds involving two units, say from m/s to km/h, it is best to do it one unit at a time. In addition, ask yourself questions like “If I can travel this far in one second, will I travel further or less far in one minute?”

