

# Y10 Maths Knowledge Organiser Higher Tier: Ratio and Proportion

<b>What must I be able to do?</b>	<b>Key vocabulary</b>	
<b>New content:</b> □ Be able to solve problems involving compound measures such as speed, density, rates of pay and pressure. ➤ Sparx U151 (speed) ➤ Sparx U910 (density) ➤ Sparx U527 (pressure)	<b>Rates of Pay</b>	An amount of money paid in a given time, e.g. per week or per year
	<b>Pressure</b>	The force per unit of area. The pressure exerted by a solid object onto another solid surface is the weight of the object divided by the area of the object's surface

### Speed

Speed = distance ÷ time

Speed is usually measured in:

Kilometres per hour	km/h
Miles per hour	mph
Metres per second	m/s

The formula can also be rearranged to give:

Time = distance ÷ speed

Distance = speed x time

Questions involving speed will often talk about 'average speed'. Objects rarely travel at a constant speed and instead speed up and slow down during the journey. To get around this we often use the average speed of the journey instead.

Average speed = total distance ÷ total time

### Converting units of speed

This is usually best done in stages.

e.g. Convert 60 km/h into m/s

1000m in a km	60 km/h = 60,000 m/h	(x 1000)
60 minutes in an hour	60,000 m/h = 1000 m/min	(÷ 60)
60 seconds in an hour	1000 m/min = 16.67 m/s (2d.p.)	(÷ 60)

### Problem solving with speed

On the first part of the journey a car travels 160 km in 3 hours. On the second part of the journey the car travels at 70km/h for 2 hours. What is the average speed of the journey?

During the second part of the journey the car travels:

Distance = speed x time = 70 x 2 = 140km.

So total distance = 140 + 160 = 300km.

And total time = 3 + 2 = 5 hours.

Average speed = total distance ÷ total time = 300 ÷ 5 = 60 km/h.

### Density

Density is mass ÷ volume

Density is usually measured in:

Kilograms per metre cubed	kg/m <sup>3</sup>
Grams per centimetre cubed	g/cm <sup>3</sup>

The formula can also be rearranged to give:

Volume = mass ÷ density

Mass = density x volume

### Problem solving with density

Material A has a density of 5.8g/cm<sup>3</sup>.

Material B has a density of 4.1g/cm<sup>3</sup>.

377g of Material A and 1.64kg of Material B form Material C.

Work out the density of Material C.

Density is in grams per cm<sup>3</sup> so all mass needs to be in grams  
1.64kg = 1640g

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Volume of Material A = 377 ÷ 5.8 = 65 cm<sup>3</sup>

Volume of Material B = 1640 ÷ 4.1 = 400 cm<sup>3</sup>

Total volume of Material C = 65 + 400 = 465 cm<sup>3</sup>

Total mass of Material C = 377 + 1640 = 2017 g

Density of Material C = 2017 ÷ 465 = 4.34 g/cm<sup>3</sup> (2d.p.)

### Pressure

Pressure is force  $\div$  area

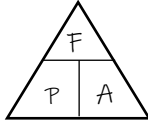
Pressure is usually measured in:

Newtons per square metre  $\text{N/m}^2$

The formula can also be rearranged to give

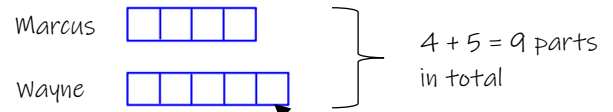
Force = pressure  $\times$  area

Area = Force  $\div$  pressure



### Sharing in a ratio

e.g. Marcus and Wayne share £4500 in the ratio 4 : 5



£4500 split into 9 parts is

$$£4500 \div 9 = £500 \quad \text{Each part is worth } £500$$

So Marcus gets  $£500 \times 4 = £2000$

And Wayne gets  $£500 \times 5 = £2500$

### Best value using a unitary method

For these questions, scale the quantity down to 1 (also known as the unitary method) then compare.

Brand A	Brand B
400g	750g
£2.56	£5.10

Brand A  $£2.56 \div 400 = £0.0064$       Brand B  $£5.10 \div 750 = £0.0068$

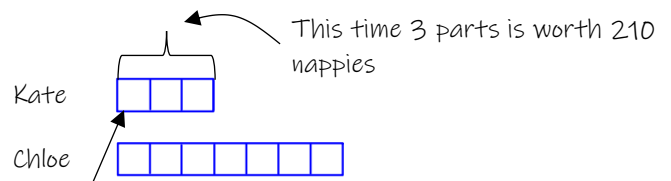
This is cost per 1g

£0.0064 is smaller than £0.0068 so Brand A is better value

e.g. Kate and Chloe both have young children and have bought a large quantity of nappies in the ratio 3 : 7

Kate has bought 210 nappies.

How many has Chloe bought?



So one part is worth  $210 \div 3 = 70$  nappies

Chloe has 7 parts so has a total of  $70 \times 7 = 490$  nappies

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