

Y9 Maths Knowledge Organiser Topic 10: Rates of change

<p>What must I be able to do?</p> <p>You may need to revise the following:</p> <ul style="list-style-type: none"> • Year 7 Topic 9: Working with units <p>New content:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Use the relationship between distance, time and speed <ul style="list-style-type: none"> ➤ Sparx U151 <input type="checkbox"/> Write speed in different units such as km/h, m/min, m/s and cm/s <input type="checkbox"/> Convert from one unit of speed to another (e.g. km/h to m/s) <input type="checkbox"/> Solve word problems involving speed, uniform speed and average speed <input type="checkbox"/> Use the relationship between density, mass and volume to solve problems <ul style="list-style-type: none"> ➤ Sparx U910 	<p>Key vocabulary</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">Speed</td> <td style="padding: 2px;">A measurement of <u>how fast</u> something is travelling. It involves two other measures, distance and time.</td> </tr> <tr> <td style="padding: 2px;">Density</td> <td style="padding: 2px;">A measurement of <u>how heavy</u> an object is for a <u>given amount</u>. If an object is heavy and small it will have a higher density.</td> </tr> <tr> <td style="padding: 2px;">Uniform</td> <td style="padding: 2px;">A value which <u>does not change</u>.</td> </tr> </table>	Speed	A measurement of <u>how fast</u> something is travelling. It involves two other measures, distance and time.	Density	A measurement of <u>how heavy</u> an object is for a <u>given amount</u> . If an object is heavy and small it will have a higher density.	Uniform	A value which <u>does not change</u> .
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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 ³
Grams per centimetre cubed	g/cm ³

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/cm³.

Material B has a density of 4.1g/cm³.

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

Work out the density of Material C.

Volume of Material A = 377 ÷ 5.8 = 65 cm³

Volume of Material B = 1640 ÷ 4.1 = 400 cm³

Total volume of Material C = 65 + 400 = 465 cm³

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

Density of Material C = 2017 ÷ 465 = 4.34 g/cm³ (2d.p.)

← Density is in grams per cm³ so all mass needs to be in grams

1.64kg = 1640g