Describing motions

1 - Word definitions

The table below contains nine definitions about some words connected with how we describe movement: speed, distance, motion, decelerate, metre, gradient, calculate, equation, accelerate. Use each word in the correct space in the table to make a definition.

An ..... equation ..... is a formula	that shows how two or more quantities are related.
To ..... calculate ..... is a verb	which means to work out a numerical value
The ..... gradient ..... is a noun	that tells us how steep a graph is
A ..... meter ..... is a noun	that is a unit of distance
Distance ..... is a noun	which tells us how far something has moved
Speed ..... is a noun	which tells us how fast something is moving
To ..... decelarate ..... is a verb	that means to slow down
To ..... accelarate ..... is a verb	which means to go faster
Motion ..... is a noun	which is another word for movement

2 – The average speed

Give the definition and the formula of the average speed:

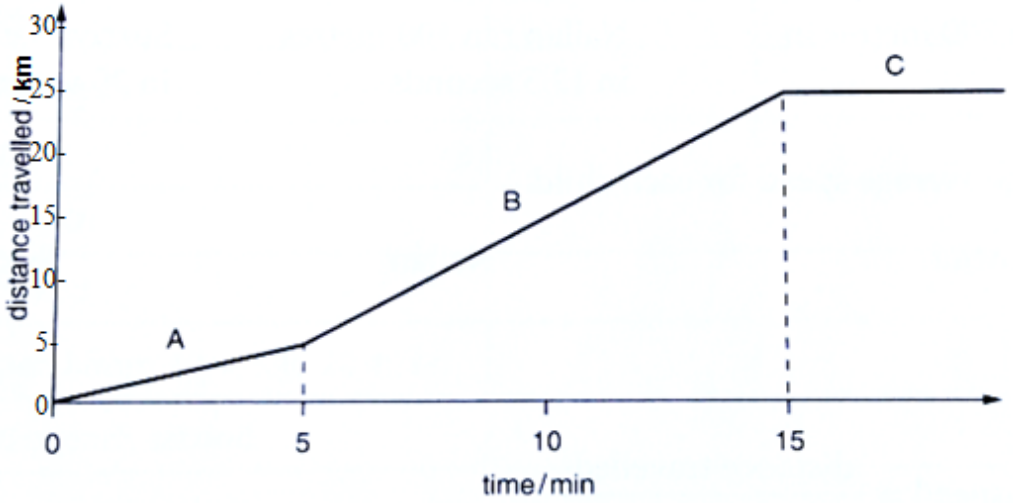
The average speed is the distance travelled in the time taken, calculated in **m/s** in SI Units.

$$v = \frac{\text{distance travelled}}{\text{time of travel}}$$

Convert 36 km/h into m/s: .. $\frac{36\ \text{km}}{1\ \text{h}} = \frac{36 \times 1000\ \text{m}}{1 \times 3600\ \text{s}} = 10\ \text{m/s}$ .....

3 - Interpreting the shape of a graph

A distance-time graph is a useful way of representing how an object moves. In this exercise, you will use words which describe a graph as well as words which describe motion. This distance-time graph represents a car's journey along a road.



Complete these descriptions of sections A, B and C, using words from §**1-**.

In section A, the distance between the car and at its starting point is ..... **increasing** ..... slowly. So the shape of the graph is ..... **a straight line not very steep** ..... and the gradient ..... **is small** ..... This shows that the car is travelling ..... **slowly.** .....

Calculate its average speed to 2 significant digits: $v = \frac{5000}{5 \times 60} \approx 17$ m/s = 61 km/h (= 17 * 3.6)

In section B, compared to section A, the distance travelled in a given time (5min) is ..... **bigger.** .....

So the gradient of the graph ..... **bigger as well.** ..... This shows that the car is travelling **faster than in section A.**

Calculate its average speed to 2 significant digits: $v = \frac{25000-5000}{(15-5) \times 60} = \frac{20000}{10 \times 60} \approx 33$ m/s =>

the speed in section B is two times bigger than in section A.

In section C, the gradient of the graph ..... **is zero.** ..... This shows that the car is ..... **stationary.** .....

4 – Exercise: a journey by coach

In this exercise, you will interpret information describing a journey by coach, and present the information in a table and as a graph.

Read this description of a coach journey:

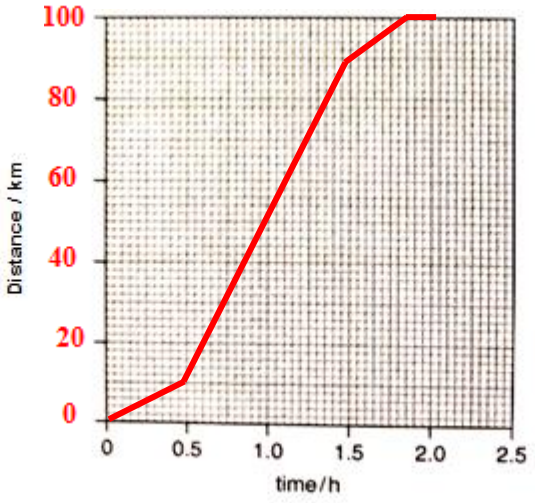
The coach left the bus station at 13:00 pm. It drove slowly at first, reaching the edge of town after 30 minutes. It had travelled 10 km. Next, it travelled along the motorway, covering 80 km in one hour. It left the motorway and travelled 10 km along a country road. At 14:50 pm, it arrived in a village square where it waited for 10 minutes before setting off back to the town.

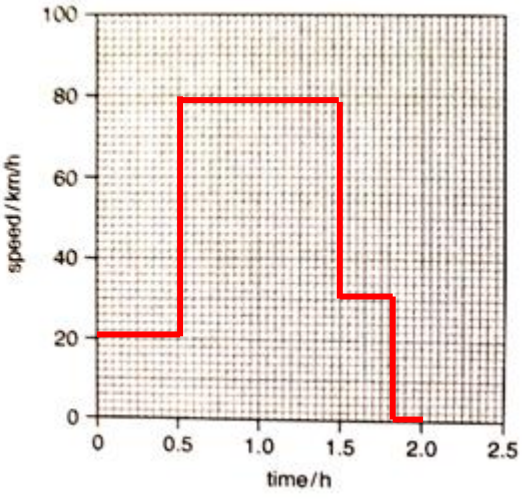
a. The coach journey was in four sections. Complete the table to show the times and distances for each section of the journey. The first row has been done for you

Section	Clock time at the end	Time taken (h)	Distance travelled (km)	Average speed (km/h)
A- Bus station to edge of town	13:30	0.5	10	10/0.5 = 20
B- Motorway	**14:30**	**1**	**80**	**80**
C- Country road	**14:50**	**0.33**	**10**	**30**
D- Village square	**15:00**	**0.17**	**0**	**0**

b. Now complete the last column of the table by calculating the coach's average speed for each section of this journey.

c. On the grids besides, draw a distance-time graph and a speed-time graph for the journey. Label the four sections of the journey.





5 – Exercise: using a chronophotography

Chronophotography is an old technique which captures the position of the ball at different times in a single image.

The chronophotography besides shows a ball falling. Its position is plotted every 0.1 s.

a. On the chronophotography, label the positions of the ball from its start (B_0 , B_1 , B_2 …)

b. Explain how you can tell that the ball is accelerating as it falls.

It travels bigger distances in the same time interval so the speed is increasing.

c. Now, thanks to a double headed arrow, show the distance travelled from the start to 0.5 s.

d. The scale of the chronophotography is **1 cm on the sheet ↔ 24 cm in reality**. What is the real distance travelled by the ball from the start to 0.5 s?

d = 5 cm on the sheet meaning $\frac{24 \times 5}{1}$ = 120 cm = 1.2 m in reality.

e. Calculate the average speed of the ball over the first 0.5 s:

$v = \frac{1.2}{0.5}$ = 2.4 m/s