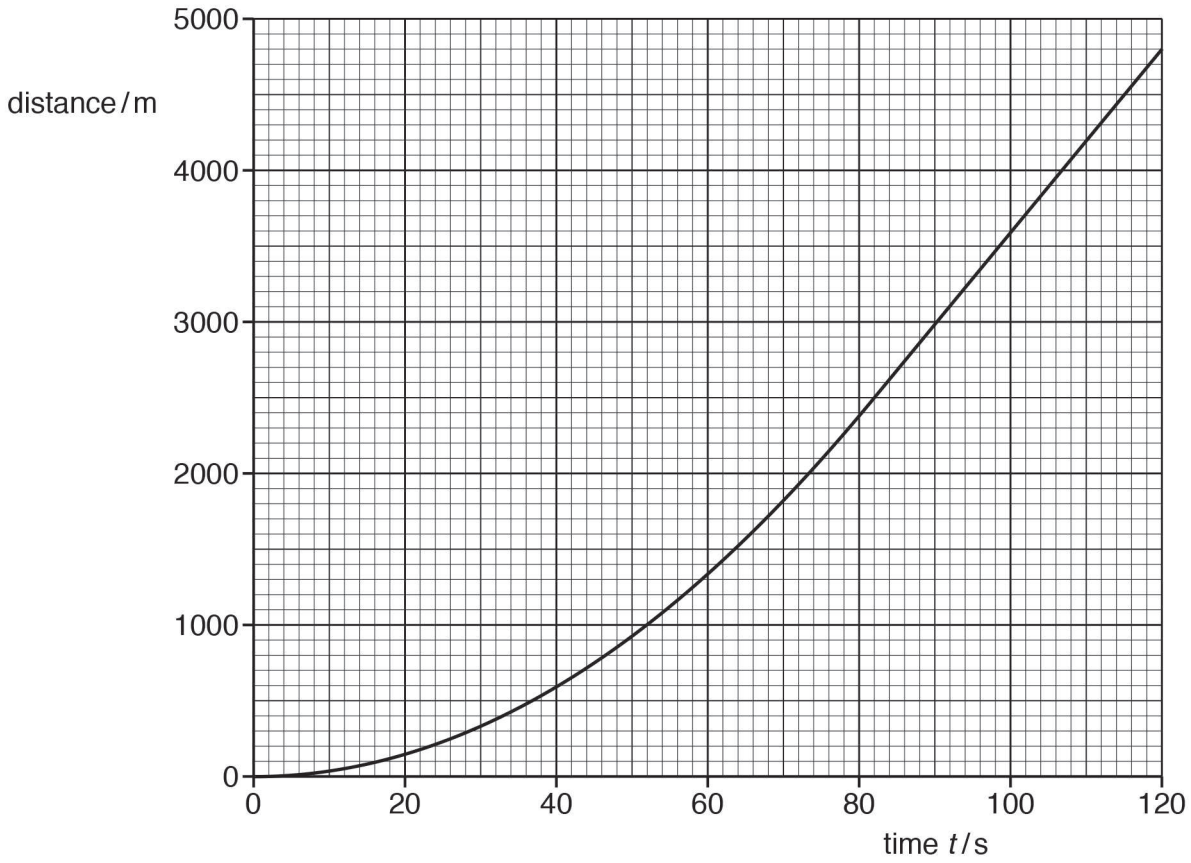
1 A train of mass 5.6×10^5 kg is at rest in a station.

At time $t = 0$ s, a resultant force acts on the train and it starts to accelerate forwards.

The graph is the distance-time graph for the train for the first 120 s.



(a) **(i)** Use the distance-time graph to determine the average speed of the train during the 120 s.

average speed = ... [1]

(ii) Use the distance-time graph to determine the speed of the train at time $t = 100$ s.

speed = ... [2]

(iii) Describe how the acceleration of the train at time $t = 100\,s$ differs from the acceleration at time $t = 20\,s$.

.....

.....

..... [2]

(b) **(i)** The initial acceleration of the train is $0.75\,m/s^2$.

Calculate the resultant force that acts on the train at this time.

resultant force = ... [2]

(ii) At time $t = 120\,s$, the train begins to decelerate.

State what is meant by *deceleration*.

.....

..... [1]

[Total: 8]

2 A student determines the speed of three cars on a straight road.
The student measured the time for the cars to travel 50 m.

(a) The table shows the measurements.

car	distance travelled / m	time taken / s
A	50	3.2
B	50	4.0
C	50	3.6

(i) Without calculation, identify the fastest car and the slowest car.

Complete the table.

	car
the fastest car	
the slowest car	

[2]

(ii) Calculate the speed of car **B**.

speed = ... m/s [3]

(b) **(i)** Estimate the time, in minutes, for car **C** to travel 5000 m.

estimated time = ... minutes [2]

(ii) Explain why your answer in **(b)(i)** may not be the same as the actual time taken for the car to travel 5000 m.

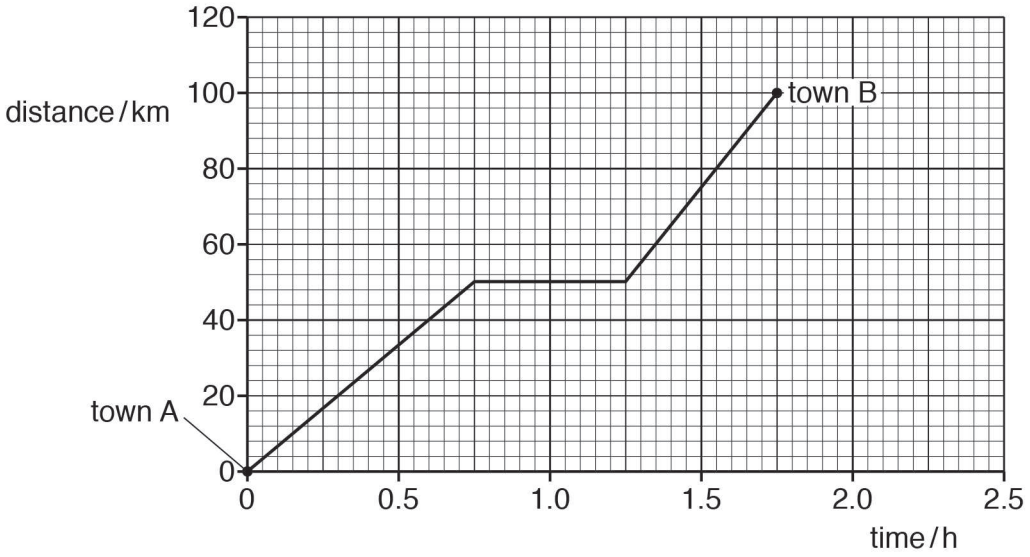
.....

..... [1]

[Total: 8]

3 A woman drives a car from town A to town B. She stops at a garage during her journey.

The distance-time graph for the journey is shown on the graph.



(a) **(i)** Determine the total time for the whole journey.

time = ... h [1]

(ii) Determine the time for which the car is not moving.

time = ... h [1]

(iii) Determine the distance between town A and town B.

distance = ... km [1]

(iv) Calculate the average speed of the car between 0 and 0.75 h.

average speed = ...km / h [3]

(b) The speed of the car before stopping at the garage is different from its speed after stopping at the garage.

Describe this difference in speed and explain how the graph shows it.

.....

.....

..... [2]

[Total: 8]

4 An aeroplane of mass 2.5×10^5 kg lands with a speed of 62 m / s, on a horizontal runway at time $t = 0$. The aeroplane decelerates uniformly as it travels along the runway in a straight line until it reaches a speed of 6.0 m / s at $t = 35$ s.

(a) Calculate the deceleration of the aeroplane in the 35 s after it lands.

deceleration = ... [2]

(b) Calculate the resultant force acting on the aeroplane as it decelerates.

force = ... [2]

(c) Calculate the momentum of the aeroplane when its speed is 6.0 m / s.

momentum = ... [2]

[Total: 6]