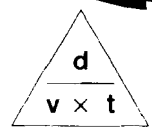
pages 130–134

Distance and speed graphs

Extension Sheet

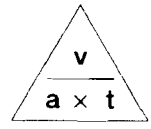
On a **distance–time graph** the speed is shown by the slope (gradient).
A straight line shows a constant speed.
If the slope curves upwards it is accelerating.

$$\text{average speed} = \frac{\text{distance travelled}}{\text{time taken}}$$



On a speed–time or **velocity–time graph**, the acceleration is shown by the slope.
A straight line shows a constant acceleration.
The area under the graph shows the distance travelled.

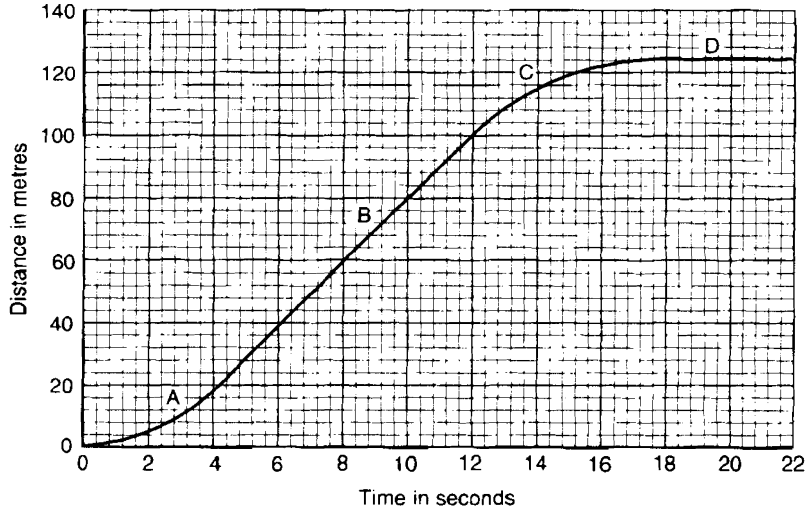
$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$



Questions

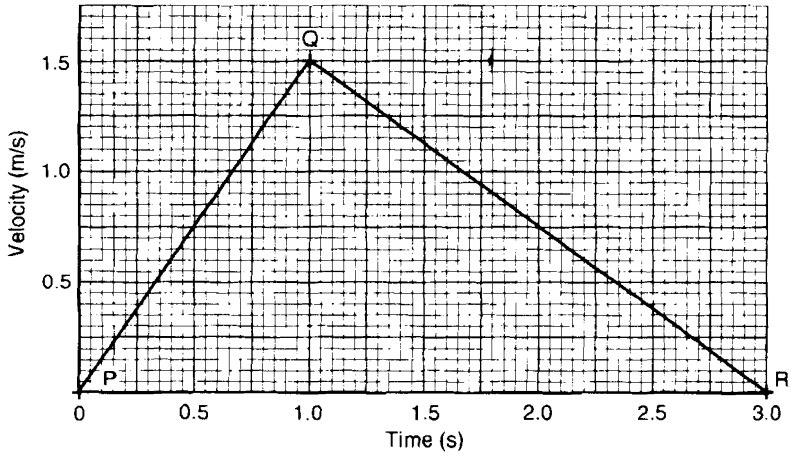
1. A sprinter ran in a 100 m race.
The graph shows what happened:

a) What was the runner's time for the 100 m race?
b) Calculate the runner's average speed for the race.
c) Describe how the runner's speed was changing at each of the points A, B, C, D.
d) At which point was the speed greatest? Explain your choice.
e) What distance was needed to stop at the end of the race?



2. Here is a graph for a toy car moving in a straight line:

a) What is the maximum speed of the car?
b) How long does it take to reach maximum speed from rest?
c) Calculate the acceleration of the car from P to Q.
d) What is the distance travelled by the car,
   i) from P to Q?
   ii) from Q to R?
e) What is the average speed of the car from P to R?



3. A car starting from rest accelerates uniformly to reach a speed of 20 m/s after 10 s. It continues at this speed for 10 s.
It then accelerates again to reach 35 m/s after a further 15 s.
a) Plot a speed–time graph for the car.
b) What is the total time for the journey?
c) What is the speed of the car after 5 s?
d) Calculate the acceleration of the car during the last 15 s.
e) Calculate the distance travelled by the car in the first 20 s.