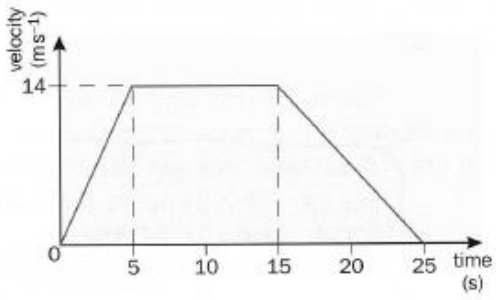
Motion Graphs

1.

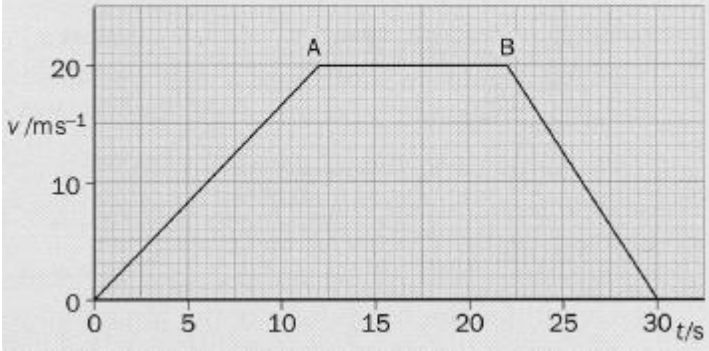
The graph shows the motion of a car travelling along a straight road:



a) What is the initial acceleration of the car?
b) What is the deceleration produced by the brakes?
c) How far does the car travel in the first 5 s?
d) How far does the car travel in total?

2.

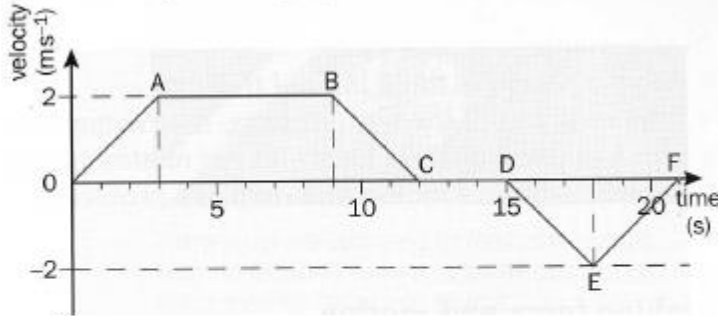
A car of mass 800 kg travels along a straight level road. The graph shows its speed against time.



Use the graph to find:
a) the initial acceleration [1]
b) the total distance travelled [2]
c) the average speed for the journey. [1] (OCR)

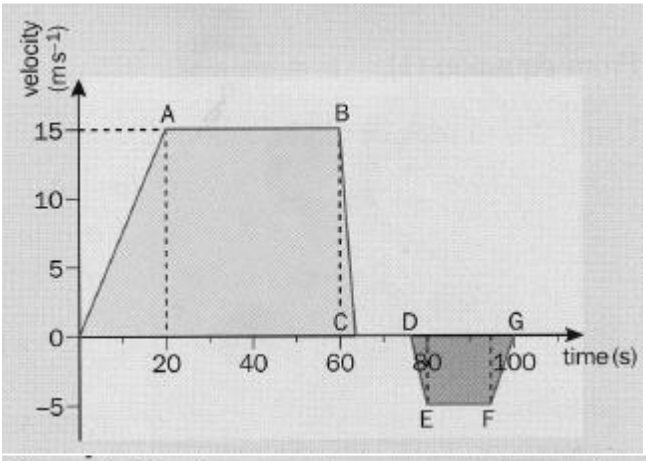
3.

The graph shows the motion of a lift starting at rest and initially moving upwards:



a) What is the acceleration of the lift between O and A?
b) What happens to the lift between B and C?
c) How high is the lift above its starting point at C
d) What happens between D and F?
e) What is the overall displacement from the starting point by the end of the motion?

4.



The velocity–time graph represents the motion of a stockcar starting a race, crashing into another car and then reversing.

a) Describe the motion of the car during each labelled section.
b) What is the maximum velocity of the car?
c) At which point does the car crash?
d) Does the car reverse all the way back to the start point?

5.

Figure 1 shows how the velocity of a toy train moving in a straight line varies over a period of time.

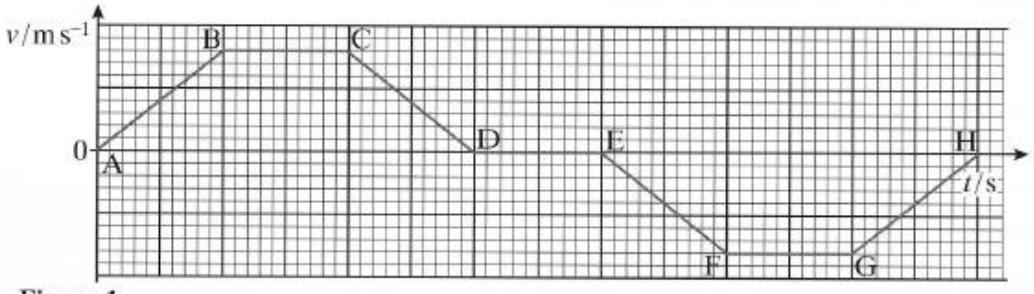


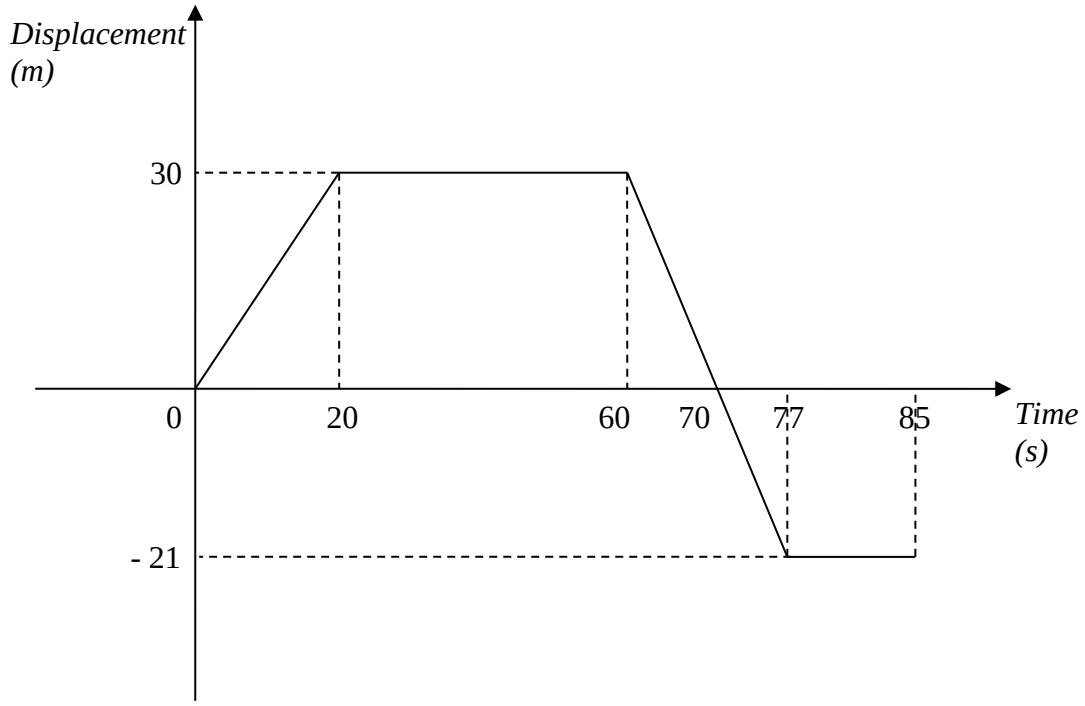
Figure 1

(a) Describe the motion of the train in the following regions of the graph.
AB BC CD DE EF *(5 marks)*

(b) What feature of the graph represents the displacement of the train? *(1 mark)*

(c) Explain, with reference to the graph, why the distance travelled by the train is different from its displacement. *(2 marks)*

6.



The displacement-time graph given above represents the motion of an object along a straight line, starting from a fixed point A on the line. The straight line is on an east-west direction. The direction east is taken as positive when drawing the displacement-time graph.

a) After how many seconds from the beginning does the object return to the starting point, A?

b) What is the velocity of the object during the first 20 seconds of the journey?

c) What is its velocity between time = 60 seconds and time = 70 seconds?

d) What is its velocity between time = 70 seconds and time = 77 seconds?

e) Find the distance traveled during the first 77 seconds of the journey.

7.

A ball is released from rest at a height of 0.9 m above a horizontal surface.

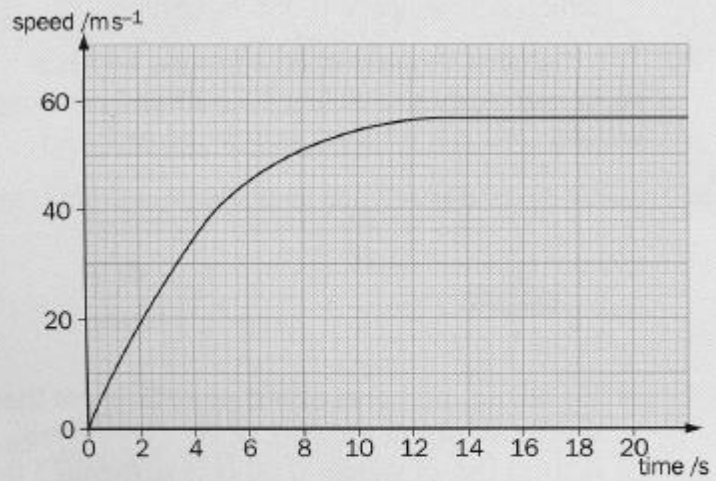
a) Find its speed as it reaches the surface. [2]

b) The effect of the bounce is to reduce the speed of the ball to two-thirds of the value in part (a). Find:
   i) the change in speed in the impact,
   ii) the change in velocity in the impact. [3]

c) Plot a graph of the velocity of the ball from the moment of its release until it reaches the maximum height after its first bounce.
The ball takes 0.43 s to reach the surface.
Assume that the bounce takes a negligible time.
Show all your calculations. [5] (OCR)

8.

A sky-diver jumps from an aircraft and initially falls without using a parachute. The graph shows how the speed of the sky-diver varies during this part of the drop.



a) Determine the terminal speed. [1]
b) The terminal speed is reached 13 s after leaving the aircraft. Estimate the distance fallen before reaching the terminal speed. [2]
c) Say why the speed becomes constant. [2] (AQA)

9.

A swimmer swims 100 m from one end of a swimming pool to the other end at a constant speed of 1.2 m s^{-1}, then swims back at constant speed, returning to the starting point 210 s after starting.

a Calculate how long the swimmer takes to swim from i the starting end to the other end, ii back to the start from the other end.

b For the swim from start to finish, sketch i a displacement–time graph, ii a distance–time graph, iii a velocity–time graph.

10.

A ball is released from a height of 1.8 m above a level surface and rebounds to a height of 0.90 m

a Given $g = 9.8\,m\,s^{-2}$, calculate i the duration of its descent, ii its velocity just before impact, iii the duration of its ascent, iv its velocity just after impact.

b Sketch a graph to show how its velocity changes with time from release to rebound at maximum height.

c Sketch a further graph to show how the displacement of the object changes with time.