1 **(a)** A bus travels at a constant speed. It stops for a short time and then travels at a higher constant speed.

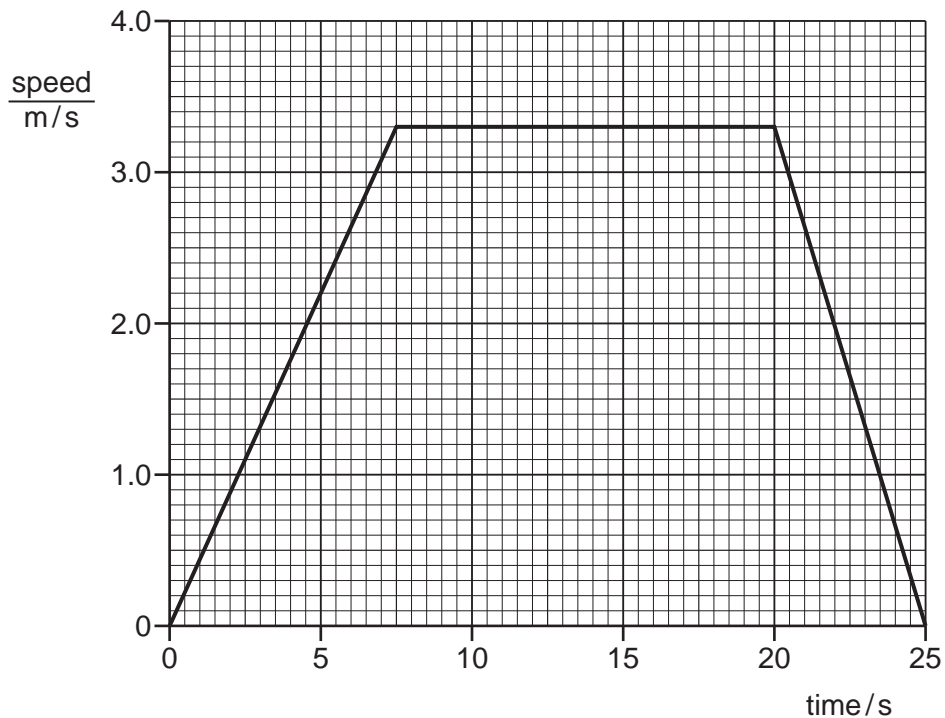Using the axes in Fig. 1.1, draw a distance-time graph for this bus journey.

Fig. 1.1

[3]

(b) A lift (elevator) starts from rest at the ground floor of a building.

Fig. 1.2 is the speed-time graph for the motion of the lift to the top floor of the building.

Fig. 1.2

Use the graph to determine the distance from the ground floor to the top floor of the building.

distance = ...   [4]

[Total: 7]

2   Fig. 1.1 shows the speed-time graph for a car travelling along a straight road.

The graph shows how the speed of the car changes as the car passes through a small town.
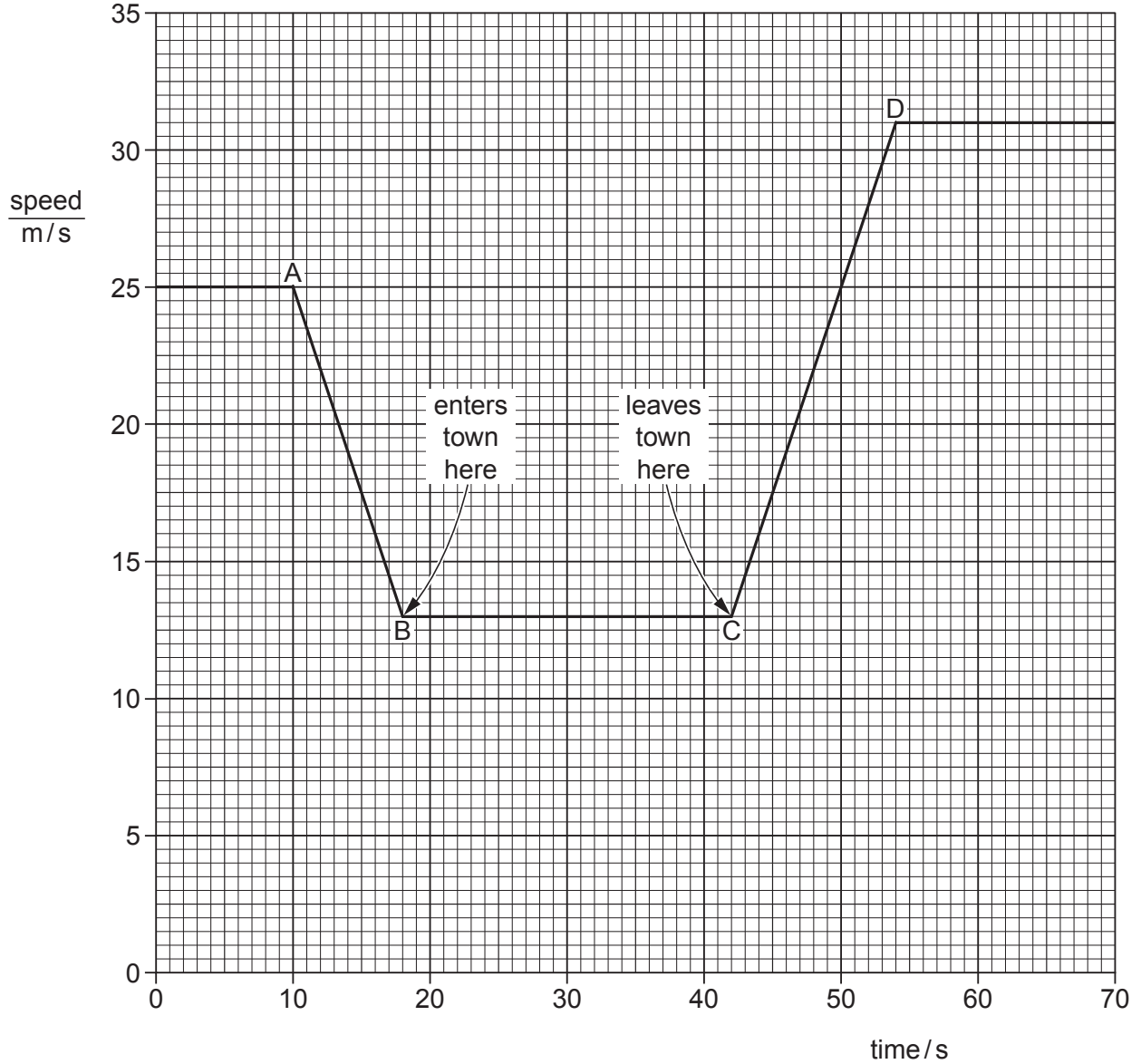

Fig. 1.1

(a) Calculate the distance between the start of the town and the end of the town.

distance = ... [3]

(b) Calculate the acceleration of the car between C and D.

acceleration = ... [3]

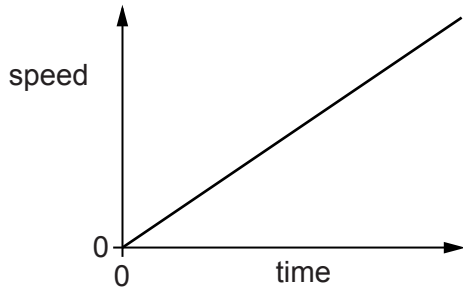**(c)** State how the graph shows that the deceleration of the car has the same numerical value as its acceleration.

....

.... [1]
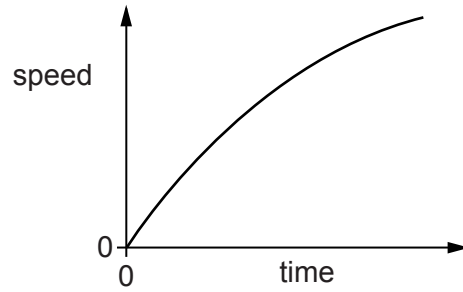
[Total: 7]

3 **(a)** Figs. 1.1 and 1.2 show speed-time graphs for two objects, each moving in a straight line.

Fig. 1.1   **Fig. 1.2**

(i) Describe the motion of the object shown by the graph in Fig. 1.1.

....

....

(ii) Describe the motion of the object shown by the graph in Fig. 1.2.

....

....

[3]

(b) On a day with no wind, a large object is dropped from a tall building. The object experiences air resistance during its fall to the ground.

State and explain, in terms of the forces acting, how the acceleration of the object varies during its fall.
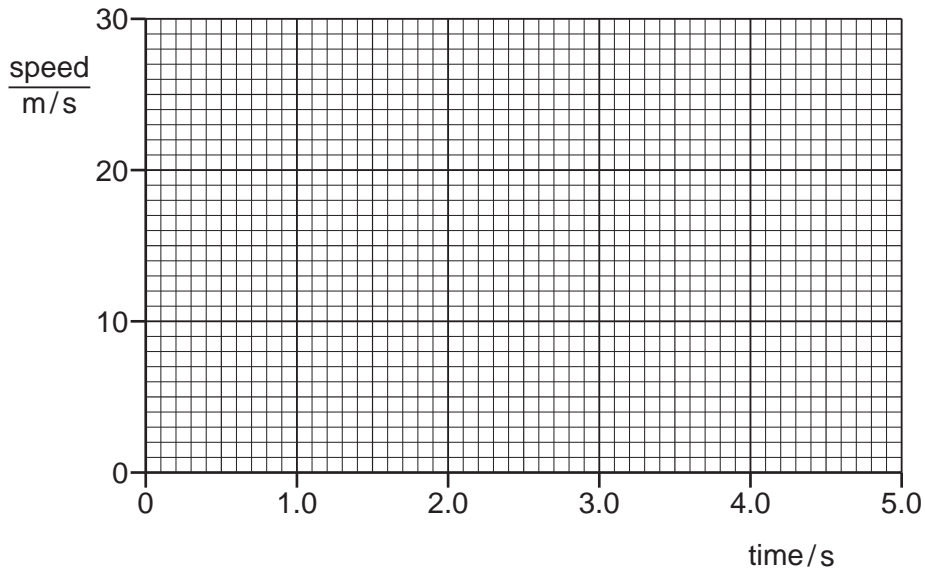
....

....

....

....

....

....

....

.... [4]

[Total: 7]

4 At a sports event, a champion runner and a car take part in a race.

(a) The runner runs at a constant speed of 10 m/s from the start of the race. During the first 5.0 s of the race, the car's speed increases from 0 m/s to 25 m/s at a uniform rate.

On Fig. 1.1, draw

  (i) a graph to show the motion of the runner,   [1]

  (ii) a graph to show the motion of the car.

Fig. 1.1

[1]

(b) Use your graphs to determine

  (i) the distance travelled by the runner in the 5.0 s,

  distance = ...[1]

  (ii) the distance travelled by the car in the 5.0 s,

  distance = ...[2]

  (iii) the time at which the car overtakes the runner.

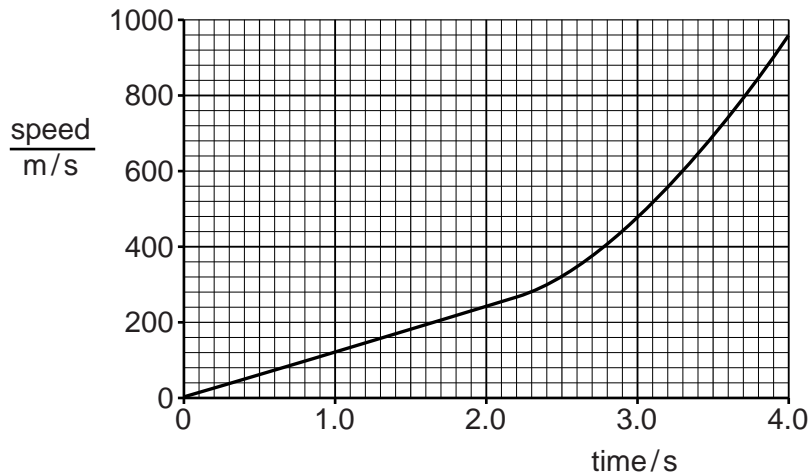 time = ...[2]

[Total: 7]

5 Fig. 1.1 shows a rocket-powered sled travelling along a straight track. The sled is used to test components before they are sent into space.
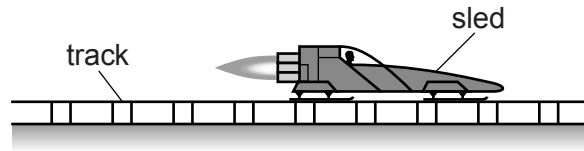
Fig. 1.1

Fig. 1.2 is the speed-time graph for the sled from time $t = 0\,$s.

Fig. 1.2

(a) On Fig. 1.2, mark a point labelled P to indicate a time when the acceleration of the sled is not constant. [1]

(b) (i) Calculate the acceleration of the sled at $t = 1.0\,$s.

acceleration = ...[2]

(ii) Determine the distance travelled by the sled between $t = 1.0\,$s and $t = 2.0\,$s.

distance = ...[2]

(c) The resultant force acting on the sled remains constant during the test.

Suggest why the acceleration of the sled is not constant.

....

....[1]
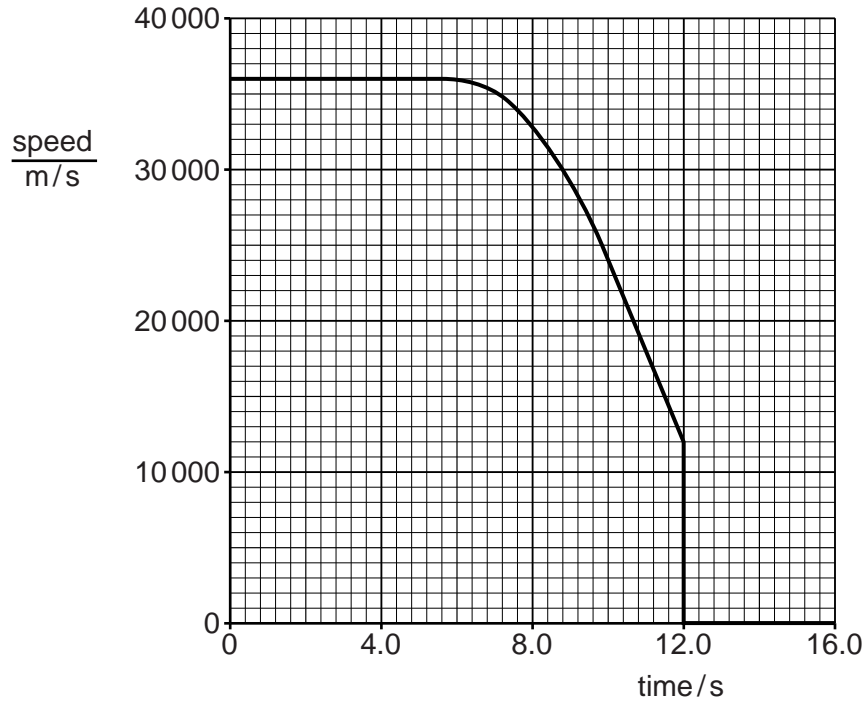
[Total: 6]

6 A comet, travelling in space, enters the atmosphere of a planet.

Fig. 1.1 is the speed-time graph for the comet from time t = 0 s.

Fig. 1.1

(a) (i) During the period t = 0 s to t = 6.0 s, both the speed of the comet and the velocity of the comet remain constant.

State what this suggests about the motion of the comet.

....

....[1]

(ii) Determine the distance travelled during the period t = 0 s to t = 6.0 s.

distance = ...[2]

(b) Explain what the graph shows about the motion of the comet during the period $t = 6.0\,\text{s}$ to $t = 10.0\,\text{s}$.

....

....

....[2]

(c) Determine the acceleration of the comet at $t = 11.0\,\text{s}$.

acceleration = ...[2]

(d) Suggest what happens to the comet at $t = 12.0\,\text{s}$.

....

....[1]

[Total: 8]

7 A plastic ball is dropped from the balcony of a tall building and falls towards the ground in a straight line.

Fig. 1.1 is the speed-time graph for the falling ball.
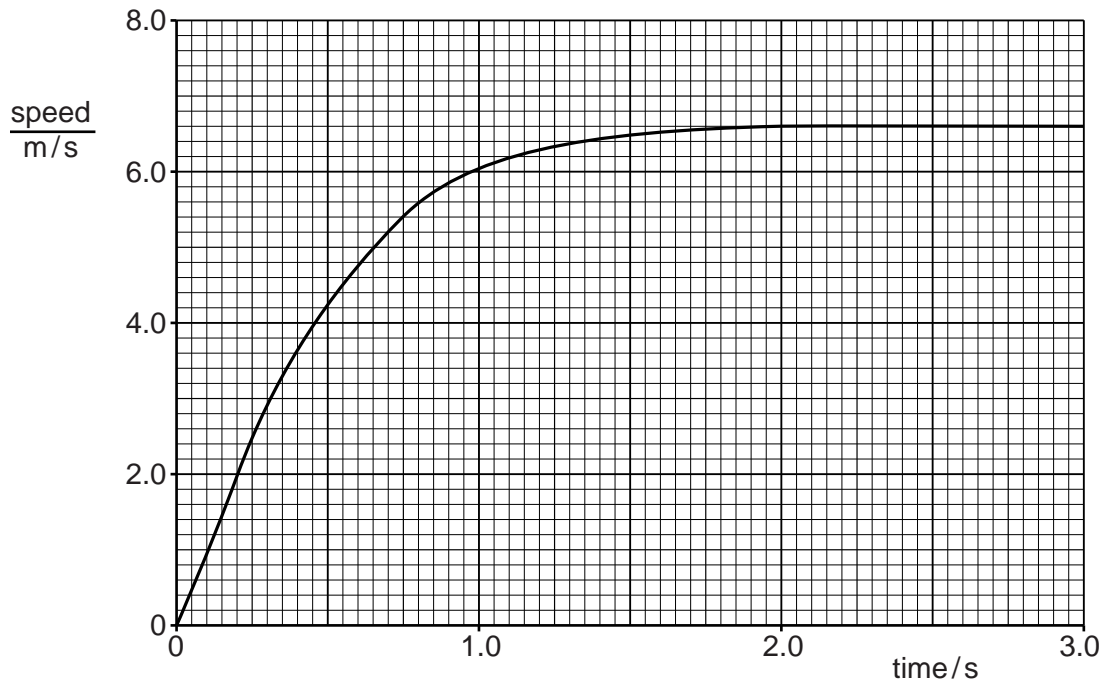
Fig. 1.1

(a) State and explain, in terms of forces, what is happening to the speed of the ball between time $t = 2.0\,\text{s}$ and $t = 3.0\,\text{s}$.

....

....

....[2]

(b) On Fig. 1.1, mark a point P on the line where the acceleration of the ball is not constant.   [1]

(c) Using Fig. 1.1,

    (i) calculate the acceleration of the ball between $t = 0\,\text{s}$ and $t = 0.25\,\text{s}$,

                acceleration = ...[2]

    (ii) estimate the distance that the ball falls in the first 3.0 s.

                distance = ...[2]

                                                 [Total: 7]