

3. A car moves along a horizontal straight road, passing two points A and B . At A the speed of the car is 15 m s^{-1} . When the driver passes A , he sees a warning sign W ahead of him, 120 m away. He immediately applies the brakes and the car decelerates with uniform deceleration, reaching W with speed 5 m s^{-1} . At W , the driver sees that the road is clear. He then immediately accelerates the car with uniform acceleration for 16 s to reach a speed of $V \text{ m s}^{-1}$ ($V > 15$). He then maintains the car at a constant speed of $V \text{ m s}^{-1}$. Moving at this constant speed, the car passes B after a further 22 s .

- (a) Sketch, in the space below, a speed-time graph to illustrate the motion of the car as it moves from A to B .

(3)

- (b) Find the time taken for the car to move from A to B .

(3)

The distance from A to B is 1 km .

- (c) Find the value of V .



(5)



2. A small ball is projected vertically upwards from ground level with speed $u \text{ m s}^{-1}$. The ball takes 4 s to return to ground level.

(a) Draw, in the space below, a velocity-time graph to represent the motion of the ball during the first 4 s.

(2)

(b) The maximum height of the ball above the ground during the first 4 s is 19.6 m. Find the value of u .

(3)



2. An athlete runs along a straight road. She starts from rest and moves with constant acceleration for 5 seconds, reaching a speed of 8 m s^{-1} . This speed is then maintained for T seconds. She then decelerates at a constant rate until she stops. She has run a total of 500 m in 75 s.

(a) In the space below, sketch a speed-time graph to illustrate the motion of the athlete.

(3)

(b) Calculate the value of T .

(5)



5. A car accelerates uniformly from rest for 20 seconds. It moves at constant speed $v \text{ m s}^{-1}$ for the next 40 seconds and then decelerates uniformly for 10 seconds until it comes to rest.

(a) For the motion of the car, sketch

(i) a speed-time graph,

(ii) an acceleration-time graph.

(6)

Given that the total distance moved by the car is 880 m,

(b) find the value of v .

(4)



1.

Figure 1

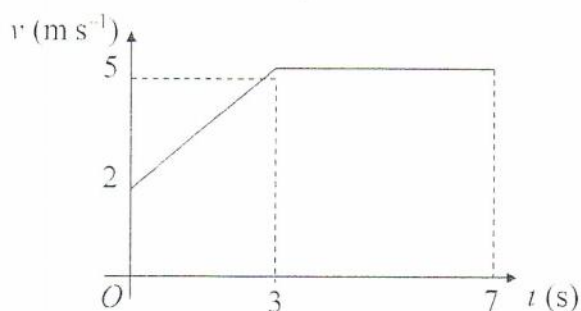


Figure 1 shows the speed-time graph of a cyclist moving on a straight road over a 7 s period. The sections of the graph from $t = 0$ to $t = 3$, and from $t = 3$ to $t = 7$, are straight lines. The section from $t = 3$ to $t = 7$ is parallel to the t -axis.

State what can be deduced about the motion of the cyclist from the fact that

(a) the graph from $t = 0$ to $t = 3$ is a straight line,

(1)

(b) the graph from $t = 3$ to $t = 7$ is parallel to the t -axis.

(1)

(c) Find the distance travelled by the cyclist during this 7 s period.

(4)



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4. A car is moving along a straight horizontal road. At time $t = 0$, the car passes a point A with speed 25 m s^{-1} . The car moves with constant speed 25 m s^{-1} until $t = 10 \text{ s}$. The car then decelerates uniformly for 8 s . At time $t = 18 \text{ s}$, the speed of the car is $V \text{ m s}^{-1}$ and this speed is maintained until the car reaches the point B at time $t = 30 \text{ s}$.

- (a) Sketch, in the space below, a speed–time graph to show the motion of the car from A to B .

(3)

Given that $AB = 526 \text{ m}$, find

- (b) the value of V ,

(5)

- (c) the deceleration of the car between $t = 10 \text{ s}$ and $t = 18 \text{ s}$.

(3)



4. A car is moving along a straight horizontal road. The speed of the car as it passes the point A is 25 m s^{-1} and the car maintains this speed for 30 s . The car then decelerates uniformly to a speed of 10 m s^{-1} . The speed of 10 m s^{-1} is then maintained until the car passes the point B . The time taken to travel from A to B is 90 s and $AB = 1410 \text{ m}$.

(a) Sketch, in the space below, a speed-time graph to show the motion of the car from A to B . (2)

(b) Calculate the deceleration of the car as it decelerates from 25 m s^{-1} to 10 m s^{-1} . (7)

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- This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

4. A girl runs a 400 m race in a time of 84 s. In a model of this race, it is assumed that, starting from rest, she moves with constant acceleration for 4 s, reaching a speed of 5 m s^{-1} . She maintains this speed for 60 s and then moves with constant deceleration for 20 s, crossing the finishing line with a speed of $V \text{ m s}^{-1}$.
- (a) Sketch, in the space below, a speed-time graph for the motion of the girl during the whole race. (2)
- (b) Find the distance run by the girl in the first 64 s of the race. (3)
- (c) Find the value of V . (5)
- (d) Find the deceleration of the girl in the final 20 s of her race. (2)



4. A car is moving on a straight horizontal road. At time $t = 0$, the car is moving with speed 20 m s^{-1} and is at the point A . The car maintains the speed of 20 m s^{-1} for 25 s. The car then moves with constant deceleration 0.4 m s^{-2} , reducing its speed from 20 m s^{-1} to 8 m s^{-1} . The car then moves with constant speed 8 m s^{-1} for 60 s. The car then moves with constant acceleration until it is moving with speed 20 m s^{-1} at the point B .

(a) Sketch a speed-time graph to represent the motion of the car from A to B .

(3)

(b) Find the time for which the car is decelerating.

(2)

Given that the distance from A to B is 1960 m,

(c) find the time taken for the car to move from A to B .

(8)



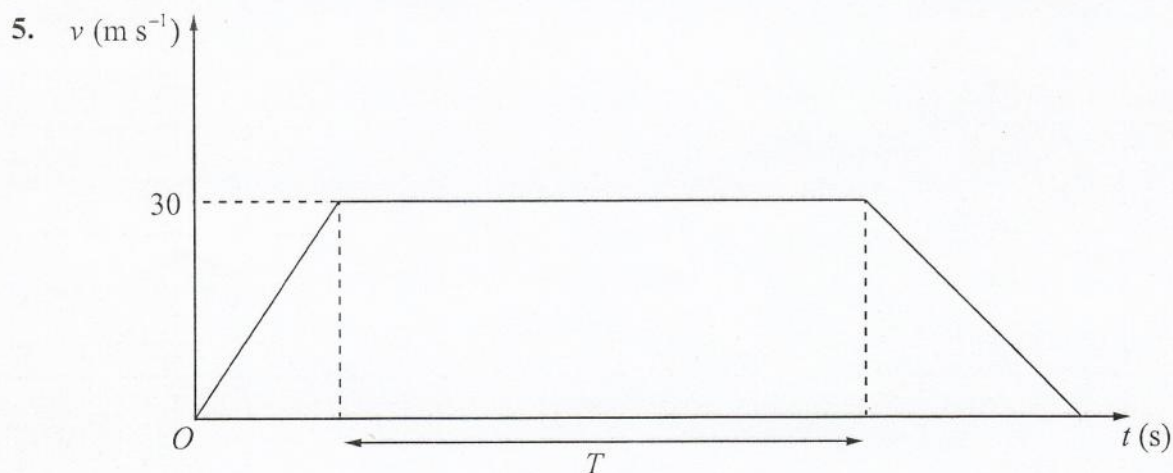


Figure 4

The velocity-time graph in Figure 4 represents the journey of a train P travelling along a straight horizontal track between two stations which are 1.5 km apart. The train P leaves the first station, accelerating uniformly from rest for 300 m until it reaches a speed of 30 m s^{-1} . The train then maintains this speed for T seconds before decelerating uniformly at 1.25 m s^{-2} , coming to rest at the next station.

(a) Find the acceleration of P during the first 300 m of its journey. (2)

(b) Find the value of T . (5)

A second train Q completes the same journey in the same total time. The train leaves the first station, accelerating uniformly from rest until it reaches a speed of $V \text{ m s}^{-1}$ and then immediately decelerates uniformly until it comes to rest at the next station.

(c) Sketch on the diagram above, a velocity-time graph which represents the journey of train Q . (2)

(d) Find the value of V . (6)



5. A car is travelling along a straight horizontal road. The car takes 120 s to travel between two sets of traffic lights which are 2145 m apart. The car starts from rest at the first set of traffic lights and moves with constant acceleration for 30 s until its speed is 22 m s^{-1} . The car maintains this speed for T seconds. The car then moves with constant deceleration, coming to rest at the second set of traffic lights.

(a) Sketch, in the space below, a speed-time graph for the motion of the car between the two sets of traffic lights.

(2)

(b) Find the value of T .

(3)

A motorcycle leaves the first set of traffic lights 10 s after the car has left the first set of traffic lights. The motorcycle moves from rest with constant acceleration, $a \text{ m s}^{-2}$, and passes the car at the point A which is 990 m from the first set of traffic lights. When the motorcycle passes the car, the car is moving with speed 22 m s^{-1} .

(c) Find the time it takes for the motorcycle to move from the first set of traffic lights to the point A .

(4)

(d) Find the value of a .

(2)

