

Year 1 Applied Chapter 9: Constant Acceleration – Exam Questions
Velocity Time Graphs - Two Vehicles (Total Marks 49)

Q1.

Two cars P and Q are moving in the same direction along the same straight horizontal road. Car P is moving with constant speed 25 m s^{-1} . At time $t = 0$, P overtakes Q which is moving with constant speed 20 m s^{-1} . From $t = T$ seconds, P decelerates uniformly, coming to rest at a point X which is 800 m from the point where P overtook Q . From $t = 25 \text{ s}$, Q decelerates uniformly, coming to rest at the same point X at the same instant as P .

(a) Sketch, on the same axes, the speed-time graphs of the two cars for the period from $t = 0$ to the time when they both come to rest at the point X .

(4)

(b) Find the value of T .

(8)

(Total 12 marks)

Q2.

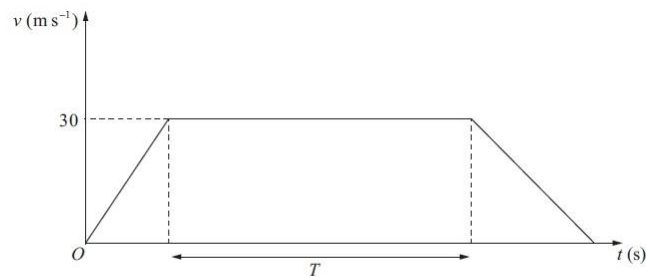


Figure 4

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)

(Total 15 marks)

Q3.

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)

(Total 11 marks)

Q4.

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)

(Total 11 marks)