Velocity/Time Graphs 2

JAN 2011 M1

1. A train, starting from rest at station A, travels on a straight horizontal track towards station B. On leaving station A, the train accelerates at a constant rate for 60 s until it reaches a speed of 30 ms^{-1} at point X. The train then continues at 30 ms^{-1} to a point Y when a constant deceleration is applied for 40 s, so that the speed of the train as it passes station B is 15 ms^{-1}. The distance between stations A and B is 24 km.

(a) Draw a sketch of the velocity-time graph showing the motion of the train between A and B. [4]

(b) Find the acceleration of the train and the distance travelled whilst the train was accelerating. [4]

(c) Find the total time for the train to travel from A to B. [4]

JUNE 2014 M1

2. A vehicle travels along a straight horizontal road. As it passes point A with speed 10 ms^{-1}, it accelerates at a constant rate for 21 s until it reaches a speed of 24 ms^{-1}. It then travels at this constant speed of 24 ms^{-1} for T s before decelerating at a uniform rate, coming to rest at a point B. The time taken to decelerate to rest is 16 s.

(a) Calculate the magnitude of the acceleration of the vehicle. [3]

(b) Determine the distance taken for the vehicle to decelerate to rest. [3]

(c) Draw a sketch of the velocity-time graph for the motion of the vehicle between A and B. [4]

(d) Given that the distance between A and B is 15 000 m, find the value of T. [4]

JUNE 2011 M1

3. The points A, B and C lie, in that order, on a straight horizontal road. A car travels on the road with constant acceleration a ms^{-2}. When the car is at A, its speed is u ms^{-1}. The distance AB is 10 m and the car takes 2 s to travel from A to B. The car takes 7 s to travel from A to C and its speed at C is 17 ms^{-1}.

(a) Find the value of u and the value of a. [7]

(b) Draw a velocity-time graph for the motion of the car between A and C. [2]

(c) Calculate the distance AC. [2]

JUNE 2006 M1

4. A train, starting from rest from station A, travels along a straight horizontal track until it stops at station B, which is 2400 m from A. Initially, the train accelerates at a uniform rate of 0·4 ms^{-2} until it reaches a speed of 16 ms^{-1}. It then maintains this speed of 16 ms^{-1} for T s, before decelerating uniformly to rest in 20 s.

(a) Calculate the time taken for accelerating. [2]

(b) Draw a sketch of the v-t graph for the journey from A to B. [4]

(c) Find the value of T. [4]

JUNE 2008 M1

5. A train is travelling along a straight horizontal track. As the train passes point A, its speed is $18\,\text{ms}^{-1}$ and immediately after passing point A, it decelerates uniformly for 9 s until its speed is $12\,\text{ms}^{-1}$. The train then accelerates at $0{\cdot}5\,\text{ms}^{-2}$ until it reaches a speed of $22\,\text{ms}^{-1}$. The train maintains the speed of $22\,\text{ms}^{-1}$ for the next 31 s at which time it passes the point B.

(a) Find the time taken for the acceleration. [2]

(b) Draw a sketch of the velocity-time graph for the journey between A and B. [4]

JUNE 2015 M1

6. A bus travels on a straight horizontal road. It leaves bus stop A starting from rest and accelerates at a constant rate for 10 s until it reaches a speed of $20\,\text{ms}^{-1}$. It then continues to travel at this constant speed and, T seconds after it stops accelerating, it passes a point B.

(a) Sketch a velocity-time graph for the motion of the bus between A and B. [3]

(b) Find the acceleration of the bus. [2]

(c) Determine an expression for the distance between A and B in terms of T. [3]

(d) A car leaves A 5 seconds after the bus has left. It starts from rest and travels with a constant acceleration of magnitude $2\,\text{ms}^{-2}$. Given that the car overtakes the bus at the point B, find the distance between A and B. [5]

MAY 2012 M1

7. A skydiver drops from rest from a hot air balloon and falls vertically under gravity for 5 s before his parachute opens. After the parachute has opened, his speed of descent reduces with uniform retardation for a further 10 s until his speed is $4\,\text{ms}^{-1}$. He then continues to travel at a constant speed of $4\,\text{ms}^{-1}$ until he reaches the ground 2 minutes after he left the hot air balloon.

(a) Calculate the speed of the skydiver just before his parachute opens. [3]

(b) Draw a sketch of the velocity-time graph for the skydiver's descent. [4]

(c) Determine the height of the skydiver above the ground when he drops from the hot air balloon. [3]

JUNE 2013 M1

8. A vehicle moves along a straight horizontal road. At time $t = 0$ s, the vehicle passes a point A and is moving with a speed of $20\,\text{ms}^{-1}$. It continues with this constant speed of $20\,\text{ms}^{-1}$ for 8 s. The vehicle then slows down with uniform deceleration for 10 s so that at time $t = 18$ s, the speed of the vehicle is $6\,\text{ms}^{-1}$. This speed is maintained until the vehicle reaches the point B at time $t = 40$ s.

(a) Sketch a velocity-time graph for the motion of the vehicle between A and B. [3]

(b) Find the magnitude of the deceleration between $t = 8$ and $t = 18$. [3]

(c) Calculate the distance AB. [3]