V/T GRAPHS : EQUATIONS OF MOTION

(1) (CONSTANT ACCELERATION)

M1 JUNE 2001

1. A vehicle is initially at rest at point A on a straight line $ABCD$. It moves from A to B with uniform acceleration and reaches B with velocity $18\,\text{ms}^{-1}$ after 6 seconds. It moves from B to C with a uniform acceleration of $0{\cdot}25\,\text{ms}^{-2}$ and 12 s after passing through B it passes through C. It moves from C to D with uniform retardation coming to rest at D 14 s after passing through C.

(a) Draw a velocity-time graph for the motion of the vehicle. [4]

(b) Find the acceleration of the vehicle when travelling from A to B and its retardation when travelling from C to D. [2]

(c) Calculate the total distance AD. [4]

M1 JUN 2002

2. The track between station A and station B is straight and horizontal. A train starts from rest at station A and accelerates at a constant rate of $4\,\text{ms}^{-2}$ until it reaches a speed of $24\,\text{ms}^{-1}$. It travels at this constant speed for 100 s before decelerating at a constant rate of $6\,\text{ms}^{-2}$ to stop at station B.

(a) Sketch a v-t graph to illustrate the journey from A to B. [4]

(b) Find the total time for the train to travel from A to B. [3]

(c) Calculate the distance between A and B. [2]

M1 JUNE 2006

3. 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 $0{\cdot}4\ \text{ms}^{-2}$ until it reaches a speed of $16\ \text{ms}^{-1}$. It then maintains this speed of $16\ \text{ms}^{-1}$ 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]

JAN 2004 M1

4. A train moves along a straight horizontal track between two stations. It starts from rest from station A and accelerates at a constant rate for 45 s until it reaches a speed of $18\,\text{ms}^{-1}$. It then travels at this constant speed of $18\,\text{ms}^{-1}$ for 5 minutes before decelerating uniformly to rest at station B in $1\frac{1}{2}$ minutes.

(a) Sketch a v-t graph to illustrate the journey. [4]

(b) Find the magnitude of the acceleration of the train, stating your units. [2]

(c) Calculate the distance between A and B. [3]

M1 MAY 2002

5. In a relay race, a sprinter receives the baton 100 m from the finish when his speed is 8·8 ms^{-1}. He then accelerates uniformly for 2 s until he reaches his top speed, which he maintains for the remainder of the race. His time for the 100 m is recorded as 10·6 s.

(a) Draw a sketch of the v-t graph for the sprinter's motion for the last 100 m of the race. [4]

(b) Calculate the sprinter's top speed. [3]

(c) Determine the uniform acceleration of the sprinter. [2]

M1 JUNE 2005

6. A train, travelling along a straight horizontal track, has a steady speed of 18 ms^{-1} as it passes the point A. Fifteen seconds later, it begins to slow down at a uniform rate for 30 s until its speed is 10 ms^{-1}. The train then increases its speed uniformly for 45 s until it reaches a speed of 20 ms^{-1} as it passes the point B.

(a) Draw a sketch of the v-t graph for the motion of the train between A and B. [4]

(b) Calculate the acceleration of the train just before it reaches B. [2]

(c) Find the distance from A to B. [4]

JAN 2014 M1

7. A vehicle travels on a straight horizontal road. As it passes a point A at time $t = 0$, it is moving with a constant velocity of 18 ms^{-1}. It continues travelling at this velocity for 48 seconds. It then decelerates at a constant rate for the next 12 s until it passes a point B with velocity 3 ms^{-1}.

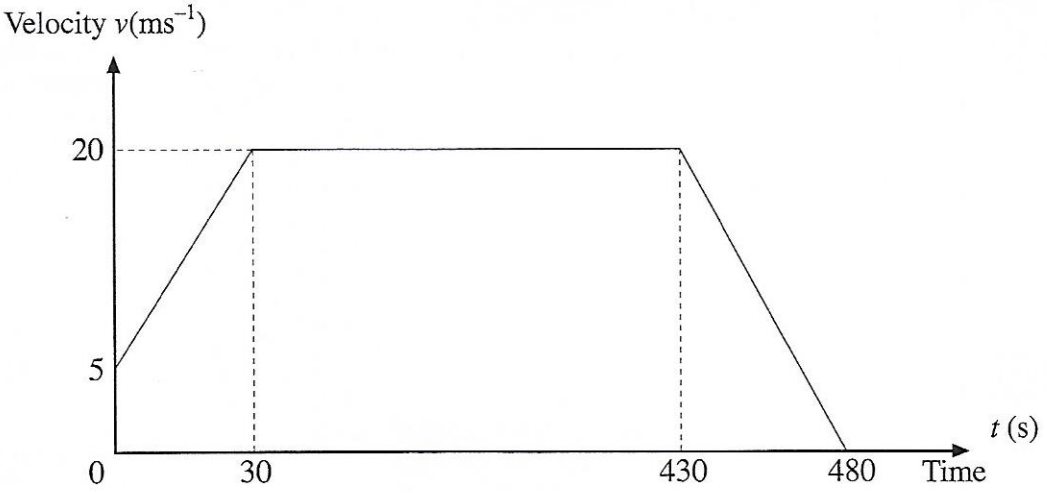
(a) Sketch a velocity-time graph for the motion of the vehicle between A and B. [2]

(b) Find the magnitude of the deceleration of the vehicle. [2]

(c) Determine the distance between A and B. [3]

JUNE 2009 M1

8.



The diagram, which is not drawn to scale, is a sketch of the velocity-time graph of a train over a period of 480 s.

(a) Find the acceleration of the train at $t = 10$ and at $t = 420$. [3]

(b) Find the velocity of the train at $t = 20$. [2]

(c) Calculate the distance travelled from $t = 0$ to $t = 480$. [4]