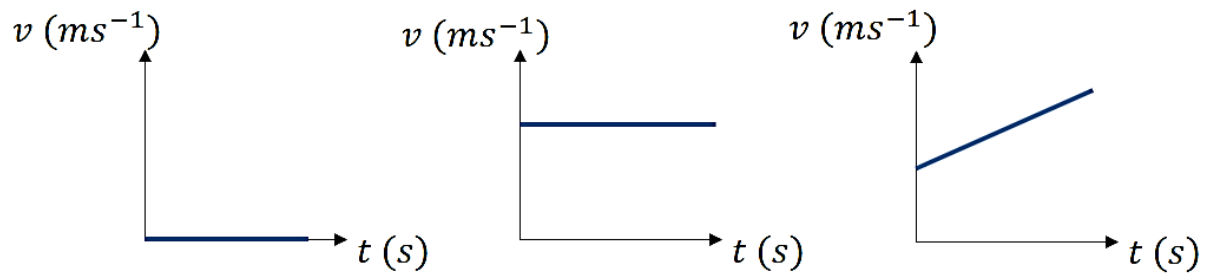


## Velocity-Time Graphs

Describe the motion of each object:



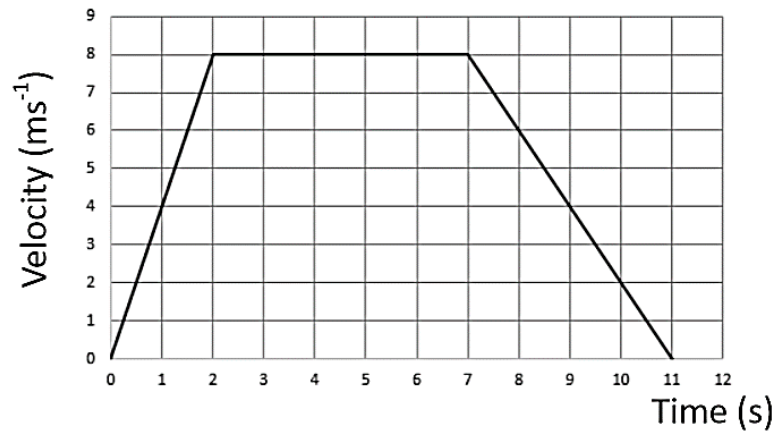
**Acceleration** the rate of change of velocity  
(i.e. gradient of velocity-time graph)

The **area** under a velocity-time graph gives the **distance travelled**.

### Example

The velocity-time graph shown is for a body which starts from rest, accelerates uniformly to a velocity of  $8\text{ms}^{-1}$  in 2 seconds, maintains that velocity for a further 5 seconds then decelerates uniformly to rest. The entire journey takes 11 seconds. Find:

- The acceleration of the body during the initial part of the motion
- The deceleration of the body during the final part of the motion
- The total distance travelled by the body



### **Algebraic Example**

A particle moves along a straight line. The particle accelerates uniformly from rest to a velocity of  $8 \text{ ms}^{-1}$  in  $T$  seconds. The particle then travels at a constant velocity of  $8 \text{ ms}^{-1}$  for  $5T$  seconds. The particle then decelerates uniformly to rest in a further 40 s.

(a) Sketch a velocity-time graph to illustrate the motion of the particle.

Give then the total displacement of the particle is 600m.

(b) find the value of  $T$ .

**Test Your Understanding** (EdExcel M1 May 2013 Q5)

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  $22 \text{ m s}^{-1}$ . 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  $22 \text{ m s}^{-1}$ .

- (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)

