Velocity-Time Graph|EDUInput

It is often helpful to show the motion of the object by drawing a graph. Velocity-time graphs are used to study the variation of the velocity of an object with time.

The velocity-time graphs of an object, traveling on three different journeys

Along a straight road, are:

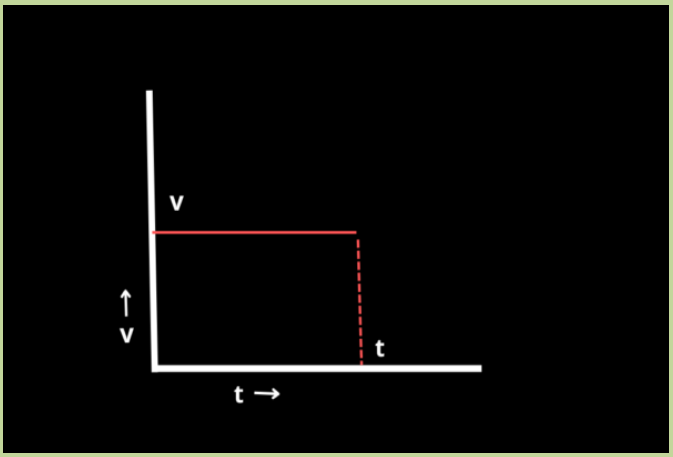
a) Constant Velocity

b) Constant Acceleration

c) Variable Acceleration

Constant Velocity:

When the velocity of the body is constant then its velocity-time graph is a horizontal straight line.

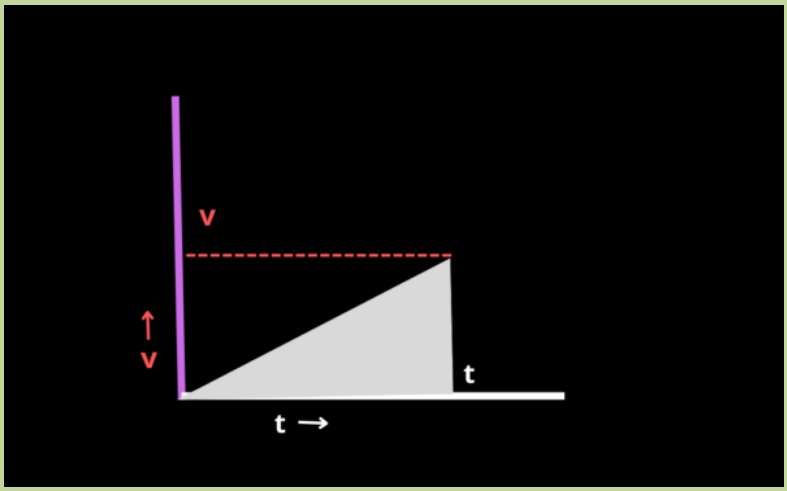


Acceleration of the body is zero.

$$\vec{a} = \frac{\Delta v}{\Delta t} = \frac{0}{\Delta t} = 0$$

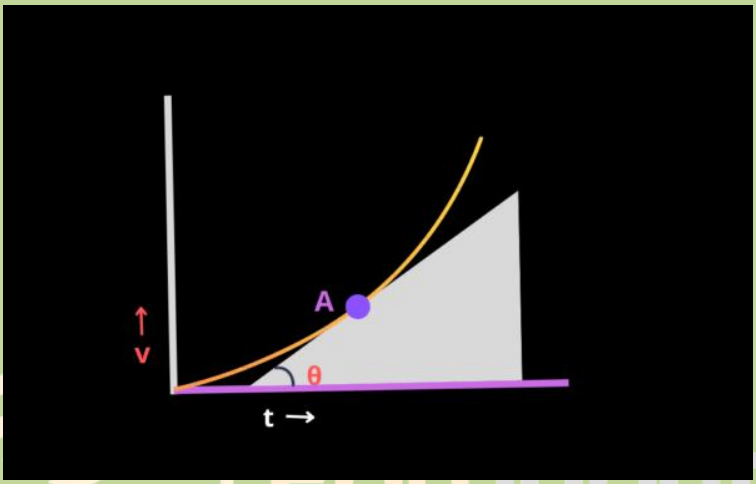
Constant Acceleration:

If equal velocity changes occur in equal intervals of time then the velocity-time graph is a straight line that raises the same height for equal intervals of time. The car moves with constant acceleration.



Variable Acceleration:

If the velocity of the body changes unequally in equal intervals of time. Then the acceleration of the body will not be uniform. The body moves along any arbitrary curved path (graph). Point A on the graph corresponds to the time t.



The slope of the tangent at point A on the velocity-time graph is equal to the instantaneous acceleration.

Determination of Distance by velocity-time graph

The distance moved by an object can also be determined by using a velocity-time graph.

The area between the velocity-time graph and the time axis is numerically equal to the distance covered by the object.

(a) Constant Velocity:

Consider if the body moves with constant velocity for time t then the distance covered by the body will be

$$S=vt$$

The same can be calculated from the graph directly by calculating the area under the curve.

In this case, the area under the velocity-time graph is rectangular. So the area under the curve is equal to the area of the rectangle.

Distance covered =Area under the curve=length x breadth

Distance moved = S = vt

Constant Acceleration:

The graph is a straight line and the area under the graph is triangular so

Distance moved =S= Area of a triangle

S=1/2xbasex height

S=1/2xvxt

Alternative method:

The same can be obtained, as the velocity of the body starts from 0 to v in time t then the average velocity will be

$$V_{av}=\frac{0+v}{2}=\frac{1}{2}V$$

Distance covered = Average velocity x time

$$S=1/2xvxt$$