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Acceleration :-

The time rate of change of velocity is called acceleration.

Acceleration (a) = Change in velocity ( $\Delta v$ ) / Time interval ( $\Delta t$ )

Its unit is  $m/s^2$

Its dimensional formula is  $[M^0L T^{-2}]$ .

It is a vector quantity.

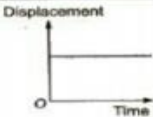
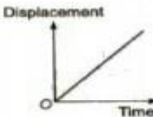
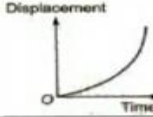
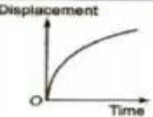
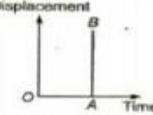
Acceleration can be positive, zero or negative. Positive acceleration means velocity increasing with time, zero acceleration means velocity is uniform while negative acceleration (retardation) means velocity is decreasing with time.

If a particle is accelerated for a time  $t_1$  with acceleration  $a_1$  and for a time  $t_2$  with acceleration  $a_2$ , then average acceleration

$$a_{av} = a_1 t_1 + a_2 t_2 / t_1 + t_2$$

## Different Graphs of Motion

### Displacement – Time Graph

S. No.	Condition	Graph
(a)	For a stationary body	
(b)	Body moving with a constant velocity	
(c)	Body moving with a constant acceleration	
(d)	Body moving with a constant retardation	
(e)	Body moving with infinite velocity. But such motion of a body is never possible.	

**Note** Slope of displacement-time graph gives average velocity.

Velocity -time graph:-

S. No.	Condition	Graph
(a)	Moving with a constant velocity	<p>A graph with Velocity on the vertical axis and Time on the horizontal axis. A horizontal line is drawn at a constant positive velocity value, starting from the vertical axis. The origin is labeled 'O'.</p>
(b)	Moving with a constant acceleration	<p>A graph with Velocity on the vertical axis and Time on the horizontal axis. A straight line starts from the origin 'O' and extends upwards with a constant positive slope.</p>
(c)	Body moving with a constant retardation and its initial velocity is not zero.	<p>A graph with Velocity on the vertical axis and Time on the horizontal axis. A straight line starts from a point 'A' on the vertical axis and slopes downwards towards the time axis, ending at point 'B'. The origin is labeled 'O'.</p>
(d)	Moving with a constant retardation	<p>A graph with Velocity on the vertical axis and Time on the horizontal axis. A straight line starts from a point on the vertical axis and slopes downwards until it meets the time axis. The origin is labeled 'O'.</p>
(e)	Moving with increasing acceleration	<p>A graph with Velocity on the vertical axis and Time on the horizontal axis. A curve starts from the origin 'O' and curves upwards, becoming steeper as time increases.</p>
(f)	Moving with decreasing acceleration	<p>A graph with Velocity on the vertical axis and Time on the horizontal axis. A curve starts from a point on the vertical axis and curves downwards towards the time axis, becoming flatter as time increases. The origin is labeled 'O'.</p>

**Note** Slope of velocity-time graph gives average acceleration.

The area of region between v-t graph and time axis measures the distance covered by the moving body.

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