

## Acceleration

The time rate of change of velocity of an object is called acceleration of the object.

It is a vector quantity. It's direction is same as that of change in velocity (Not of the velocity)

When only direction of velocity changes	When only magnitude of velocity changes	When both magnitude and direction of velocity changes
Acceleration perpendicular to velocity	Acceleration parallel or anti-parallel to velocity	Acceleration has two components one is perpendicular to velocity and another parallel or anti-parallel to velocity
Ex.. Uniform circular motion	Ex..1-D Motion under gravity	Ex.. Projectile motion, Non Uniform Circular Motion

Unit : *metre/second<sup>2</sup>* (S.I.); *cm/second<sup>2</sup>* (C.G.S.)

**Types of acceleration :**

**Uniform acceleration** : A body is said to have uniform acceleration if magnitude and direction of the acceleration remains constant during particle motion.

**Non-uniform acceleration** : A body is said to have non-uniform acceleration, if either magnitude or direction or both of them change during motion.

**Average acceleration** :  $\vec{a}_{av} = \frac{\Delta \vec{v}}{\Delta t} = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t}$

The direction of average acceleration vector is the direction of the change in velocity vector as  $\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$

**Instantaneous acceleration** It's the acceleration at any instant of time.

For a moving body there is no relation between the direction of instantaneous velocity and direction of acceleration.

Ex.. In uniform circular motion  $\theta = 90^\circ$  always

In a projectile motion  $\theta$  is variable for every point of trajectory.

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

For motion of a body under gravity, acceleration will be equal to " $g$ ", where  $g$  is the acceleration due to gravity. Its value is  $9.8 \text{ m/s}^2$  or  $980 \text{ cm/s}^2$  or  $32 \text{ feet/s}^2$ .