

## Simple Harmonic Motion

**Periodic Motion** : Any motion which repeats itself after regular interval of time is called periodic or harmonic motion. Motion of hands of a clock, motion of earth around the sun, motion of the needle of a sewing machine are the examples of periodic motion.

**Oscillatory Motion** : If a particles repeats its motion after a regular time interval about a fixed point, motion is said to be oscillatory or vibratory. i.e. oscillatory motion is a constrained periodic motion between precisely fixed limits. Motion of piston in an automobile engine, motion of balance wheel of a watch are the examples of oscillatory motion.

**Time period** : Time taken in one complete oscillation is called time period.

Or, Time after which motion is repeated is called time period.

Frequency = Frequency is the no. of oscillations completed by oscillating body in unit time interval. Its SI unit is Hertz.

If  $n$  = frequency,  $T$  = time period, then  $nT = 1$

**Simple Harmonic Motion** : If a particle repeats its motion about a fixed point after a regular time interval in such a way that at any moment the acceleration of the particle is directly proportional to its displacement from the fixed point at that moment and is always directed towards the fixed point then the motion of the particle is called simple harmonic motion.

The fixed point is called mean point or equilibrium point.

### Characteristics of SHM

When a particle executing SHM passes through the mean position :

- (i) No force acts on the particle.
- (ii) Acceleration of the particle is zero.
- (iii) Velocity is maximum.
- (iv) Kinetic energy is maximum.
- (v) Potential energy is zero.

**When a particle executing SHM is at the extreme end, then :**

- (i) acceleration of the particle is maximum.
- (ii) Restoring force acting on particle is maximum.
- (iii) Velocity of particle is zero.

- (iv) Kinetic energy of particle is zero.
- (v) Potential energy is maximum.

**Simple Pendulum** : If a point mass is suspended from a fixed support with the help of a massless and inextensible string, the arrangement is called simple pendulum. The above is an ideal definition. Practically a simple pendulum is made by suspending a small ball (called bob) from a fixed support with the help of a light string.

If the bob of a simple pendulum is slightly displaced from its mean position and then released, it starts oscillating in simple harmonic motion. Time period of oscillation of a simple pendulum is given as

$T = 2\pi \sqrt{l/g}$  where  $l$  is the effective length of the pendulum and  $g$  is the acceleration due to gravity.