1. PERIODIC MOTION

When a body or a moving particle repeats its motion along a definite path after regular intervals of time, its motion is said to be **Periodic Motion**.

2. OSCILLATORY MOTION

If a particle moves back and forth (to and fro) over the same path periodically then its motion is said to be **oscillatory or vibratory** e.g., motion of a pendulum.

Note : Every oscillatory motion is periodic but every periodic motion is not oscillatory. For example, motion of earth around the sun is periodic but not oscillatory, and the motion of pendulum is oscillatory as well as periodic.

3. SIMPLE HARMONIC MOTION

If the restoring force/torque acting on the body in oscillatory motion is directly proportional to the displacement of body/particle and is always directed towards equilibrium position then the motion is called Simple Harmonic Motion (SHM).

Linear SHM – When a particle moves to and fro about an equilibrium point, along a straight line.

Angular SHM – When body/particle is free to rotate about a given axis executing angular oscillations.

4. EQUATION OF SIMPLE HARMONIC MOTION (SHM)

The necessary and sufficient condition for SHM is $\boldsymbol{F = -kx}$ where k = positive Force constant

SOLUTION : $x = Asin(\omega t + \varphi)$ where φ is the initial phase.

Example – When the particle starts from extreme position and not equilibrium position, we will have $x = A \; at \; t = 0$ so which will give $\varphi = \pm 90°$ so the equation becomes $x = \pm Acos(\omega t)$

5. CHARACTERISTICS OF SHM

(a) **Amplitude (A)** – Maximum value of displacement of the particle from its equilibrium position. It depends on energy of the system.

(b) **Time Period (T)** – Smallest time interval after which the oscillatory motion gets repeated.

$$T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{m}{k}}$$

(c) **Phase Constant (φ)** – Depends on the initial position and direction of velocity.