UNIFORM CIRCULAR MOTION

When a point object is moving on a circular path with a constant speed, i.e. it covers equal distances on the circumference of the circle in equal intervals of time, then the motion of the object is said to be a uniform circular motion.

Let us consider, a point object moving along a circular path.

For uniform circular motion, when the object completes one revolution, the angle traced at its axis of circular motion is 2π radians, which implies, when $t = T$, $\theta = 2\pi$ radians

$\therefore$ Angular velocity $\omega = \theta / t = 2\pi/T = 2\pi n$ (since $T = 1/n$) where n = frequency of a point object, T = time period,

Relation between linear velocity and angular velocity: $v = R\omega$ where R is the radius of circular path.

Angular acceleration *of an object in circular motion is defined as the time rate of change of its angular velocity.*

If $\Delta\omega$ be the change in angular velocity of the object between the time interval Δt, the angular acceleration $\alpha = \underset{\Delta t \to 0}{\text{Lt}} \frac{\Delta\omega}{\Delta t} = \frac{d\omega}{dt}$

The **S.I. unit** of angular acceleration is rad s^{-2}

Relation between linear acceleration and angular acceleration: $\vec{a} = \vec{\alpha} \times \vec{R}$

The acceleration of an object moving with speed v in a circle of radius R has a magnitude v^2/R and is always directed towards the centre. This acceleration is called **centripetal acceleration** a_c.

Centripetal acceleration $a_c = \frac{v^2}{R} = \omega^2 R = R(2\pi v)^2 = 4\pi^2 R v^2 = \frac{4\pi^2 R}{T^2}$