

## 17 - Circular Motion

Q-1) Define the radian.

- > The angle subtended at the centre of a circle by an arc length equal to the radius of a circle is one radian.

Q-2) What is angular displacement?

- > It's the angle through which an object moves as it performs circular motion.

$$s = r\theta \quad \text{angular displacement.} \quad \rightarrow [s = \text{arc length}]$$

in one round  $\theta = \frac{2\pi r}{r} = 2\pi = 360^\circ$

Q-3) What is angular velocity.

- > It's the rate of change of angular displacement.

$$* \omega = \frac{\Delta\theta}{\Delta t} = \frac{2\pi}{t} = 2\pi n.$$

$$* v = \omega r$$

\* For UCM,  $\omega$  is constant.

Q-4) What is uniform circular motion?

- > UCM is the motion of a particle along a circular path with constant speed.

It's accelerated motion; although speed is constant, velocity changes as direction changes.

Q-6) What is centripetal force?

- > It's the force acting on an object in circular motion. It acts along the radius of the circular path and towards the centre of the circle.

It's responsible for keeping the body moving along the

circular path.

Force :

$$* F = \frac{mv^2}{r} = m\omega^2 r = mv\omega$$

Acceleration :

$$* a = \frac{v^2}{r} = \omega^2 r = v\omega$$

Proof for centripetal acceleration :

$$\Delta\theta = \frac{\Delta v}{v}$$

→ acceleration is the rate of change of velocity.

$$a = \frac{\Delta v}{\Delta t} = \frac{v\Delta\theta}{\Delta t} = \underline{\underline{v\omega}}$$

- \* The centripetal force is the resultant force acting on a body.
- \* Horizontal component is the centripetal force.

Q-1) Orbital speed.

> equate  $\frac{mv^2}{r} = mg$ .

$$\therefore v = \sqrt{rg}$$