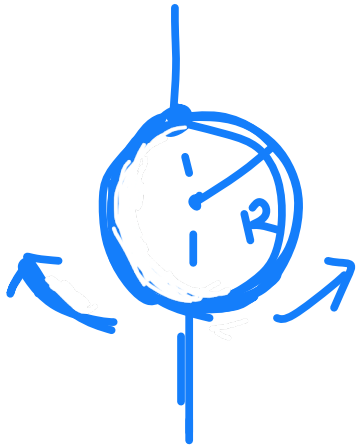
Quiz 7

- A uniform sphere of mass m and radius a is being rotated about an axis passing through its body at a/2 from its center, with an angular speed ω. Find out the angular momentum along the axis of rotation.

Q - 1



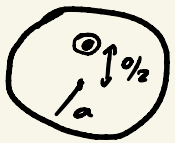
Q - 2

- A thin, circular ring of mass m and radius R is suspended from a point on its periphery. Find out the period of small oscillations.

Q. 7

1. The moment of inertia of the sphere about an axis through its center

$$I_{cm} = \frac{2}{5} m a^2$$



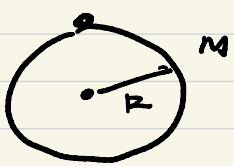
Moment of inertia about the point of suspension

$$I_{\odot} = \frac{2}{5} m a^2 + m \left(\frac{a}{2}\right)^2$$

$$= \frac{2}{5} m a^2 + \frac{m a^2}{4} = \frac{13}{20} m a^2$$

$$\therefore L_{\odot} = \frac{13}{20} m a^2 \omega$$

2. $$I_{CM} = MR^2$$



$$I_{\odot} = MR^2 + MR^2$$

$$= 2MR^2$$

$$I \frac{d\omega}{dt} = -mgR\sin\theta \overset{\text{for small } \theta}{\approx} -MgR\theta$$

$$2MR^2 \frac{d^2\theta}{dt^2} = -MgR\theta$$

$$\frac{d^2\theta}{dt^2} = -\underbrace{\frac{g}{2R}}_{\omega^2}\theta \quad \Rightarrow \quad \omega^2 = \frac{g}{2R}$$

$$T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{2R}{g}}$$