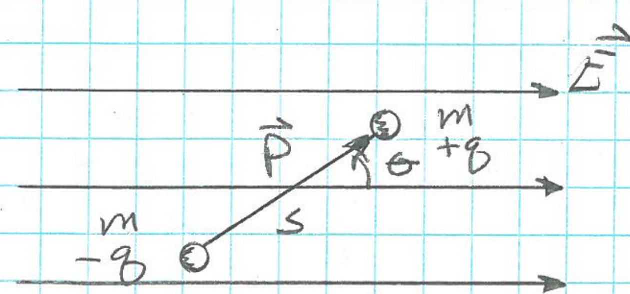

$$\vec{\tau} = \vec{p} \times \vec{E}, \quad \text{so: } |\vec{\tau}| = pE\sin\theta$$

$$\circlearrowleft_{+} \quad \sum \tau_{CM} = -pE\sin\theta = I\alpha = I\frac{d^2\theta}{dt^2}$$

So: $$\frac{d^2\theta}{dt^2} = -\left(\frac{pE}{I}\right)\sin\theta$$

for small angles, $\sin\theta \approx \theta$
So:

$$\frac{d^2\theta}{dt^2} = -\underbrace{\left(\frac{pE}{I}\right)}_{= \omega^2}\theta$$

– Simple Harmonic Oscillator

Now: $p = qs$ and $I = mr^2 + mr^2$

$$= 2m\left(\frac{s}{2}\right)^2 = \frac{1}{2}ms^2$$

So: $$\omega = \sqrt{\frac{pE}{I}} = \sqrt{\frac{qsE}{\frac{1}{2}ms^2}} = \sqrt{\frac{2qE}{ms}}$$

and

Period, $$T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{ms}{2qE}}$$