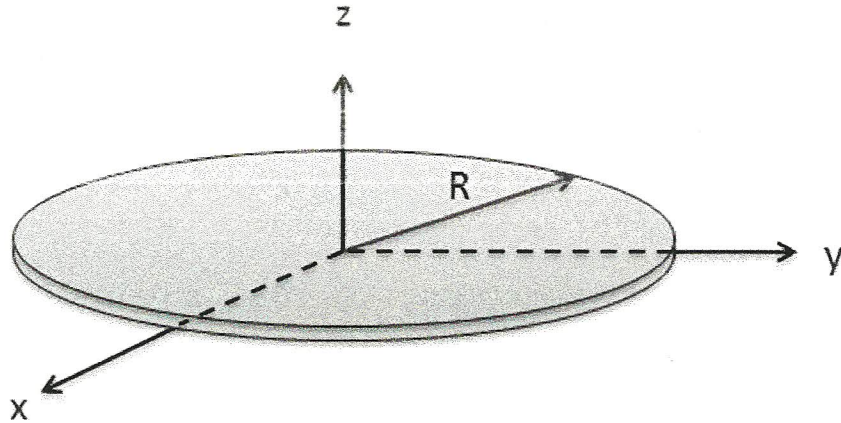A thin circular disc has a mass of 6 kg and a radius of .3 meters.
Determine the mass moment of inertia for the disc about the z axis.

$$I_{zz} = \rho \int_V r^2 \, dV$$

$$I_{zz} = \rho \int_0^R r^2 (2\pi r)(t) \, dr$$

$$I_{zz} = \rho \, 2\pi t \int_0^R r^3 \, dr$$

$$I_{zz} = \rho \, 2\pi t \left| \frac{1}{4} r^4 \right|_0^R$$

$$I_{zz} = \rho \, (2\pi t)\left(\frac{1}{4} R^4\right)$$

$$I_{zz} = \rho \underbrace{(\pi R^2 t)}_{\substack{\text{Volume} \\ \text{mass}}}\left(\frac{1}{2} R^2\right)$$

$$I_{zz} = \frac{1}{2} m R^2$$

$$I_{ZZ} = \frac{1}{2}(6h_s)(.3m)^2$$

$$\boxed{I_{ZZ} = .27 \, h_s \, m^2}$$