

8. (a) Prove that the moment of inertia of a uniform circular disc, of mass m and radius r , about an axis through its centre perpendicular to its plane is $\frac{1}{2} m r^2$.

2010

Let M = mass per unit area

$$\text{mass of element} = M\{2\pi x dx\}$$

$$\text{moment of inertia of the element} = M\{2\pi x dx\} x^2$$

$$\text{moment of inertia of the disc} = 2\pi M \int_0^r x^3 dx$$

$$= 2\pi M \left[\frac{x^4}{4} \right]_0^r$$

$$= 2\pi M \frac{r^4}{4}$$

$$= \frac{1}{2} m r^2$$

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