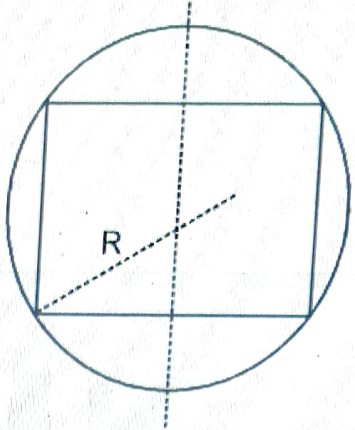
From a solid sphere of mass M and radius R a cube of maximum possible volume is cut. Moment of inertia of cube about an axis passing through its center and perpendicular to one of its face is: **[JEE MAIN 2015]**

(A) $\frac{MR^2}{16\sqrt{2}\pi}$ (B) $\frac{4MR^2}{9\sqrt{3}\pi}$ (C) $\frac{4MR^2}{3\sqrt{3}\pi}$ (D) $\frac{MR^2}{32\sqrt{2}\pi}$

Sol. $AB = 2R$

$a\sqrt{3} = 2R$

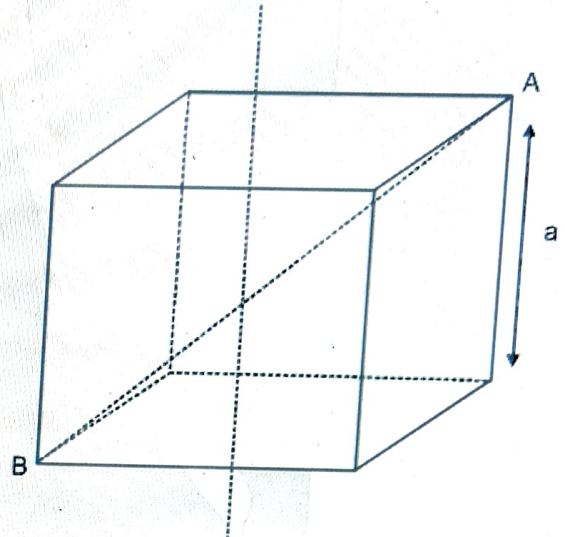
$$a = \frac{2R}{\sqrt{3}}$$



Mass of cube $$= \frac{M}{\frac{4}{3}\pi R^3} \times \left(\frac{2R}{\sqrt{3}}\right)^3$$

$$= \frac{3M}{4\pi R^3} \cdot \frac{8R^3}{3\sqrt{3}} = \frac{2M}{\sqrt{3}\pi}$$

Moment of inertia of cube about given axis is



$$= \frac{ma^2}{6}$$

$$= \frac{2M}{\sqrt{3}\pi} \cdot \frac{4R^2}{3} \cdot \frac{1}{6} = \frac{4MR^2}{9\sqrt{3}\pi}$$