Physics 171  
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REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!  
Use the conversion constants and data given on the front page.

(a) Calculate the moment of inertia of a sphere of mass 7.35 kg and diameter of 0.122 m.  
\[
\frac{2}{5} MR^2 \quad \rightarrow \quad 1.12 \times 10^{-3} \text{ kg} \cdot \text{m}^2  
\]

or \[1.11 \times 10^{-3} \text{ kg} \cdot \text{m}^2\]

(b) The earth rotates on its axis once every 24.0 hrs. Calculate its angular velocity (in rad/s).  
\[
\frac{2\pi \text{rad}}{3600 \text{s}} \quad \rightarrow \quad 7.27 \times 10^{-5} \text{ rad/s}
\]

(c) The speed of a point on the rim of a rotating wheel is 40.0 m/s. The wheel has a moment of inertia of 0.250 kg·m² and a radius of 0.100 m. Calculate its rotational kinetic energy.  
\[
\frac{1}{2} I \omega^2 = \frac{1}{2} (0.250 \text{ kg} \cdot \text{m}^2) (4.0)^2 = 2.00 \times 10^4 \text{ J}
\]

(d) Given a sphere of radius \( R_o \) and mass \( M \), calculate the moment of inertia for rotation about an axis parallel to the diameter at a distance \( R_o/3 \) from the center. (See figure.)  
\[
\frac{2}{5} m R_o^2 + m R_o^2 = \frac{2}{5} m R_o^2 + m \left(\frac{R_o}{3}\right)^2 = \frac{2}{5} m R_o^2 + m \left(\frac{R_o^2}{9}\right) = \frac{23}{45} m R_o^2
\]

\[
= \frac{23}{45} m R_o^2
\]

(e) The speed of a point on the equator of a rotating sphere is 17.0 m/s. The sphere has a mass of 1.25 kg and a diameter of 4.25 cm. Calculate its rotational kinetic energy.  
\[
\frac{1}{2} I \omega^2 = \frac{1}{2} \left(\frac{2}{5} \times 1.25 \text{ kg} \times \frac{4.25 \text{ cm}}{2} \times 17.0 \text{ m/s} \times \frac{10^{-2} \text{ m}}{4.25 \times 10^{-2} \text{ m}}\right)^2 = 7.22 \times 10^4 \text{ J}
\]