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

(a) A car with wheels of diameter 28.0 inches is traveling at 60.0 mi/hr. Calculate the angular velocity of the wheels in rad/s.

\[ \omega = \frac{v}{r} = \frac{60 \text{ mi/hr} \times \frac{1 \text{ hr}}{3600 \text{ s}} \times \frac{2200}{1 \text{ mi}}}{14 \text{ in} \times \frac{1 \text{ in}}{12 \text{ in}}} = 75.4 \text{ rad/s} \]

(b) Two cars are each traveling with a speed of 30.0 mi/hr. They collide head on. The cars each have a mass of 1500 kg. The collision is completely inelastic. What percentage of the initial kinetic energy is lost in this collision?

\[ 100 \pi \theta \]

(c) Two solid spheres of radius 5.25 cm and mass 0.560 kg, are touching. Calculate the moment of inertia for rotation about the axis that goes through the point that they touch and is tangent to the spheres at that point.

\[ I = I_{cm} + mR^2 \text{ for one sphere} \quad I_{cm} = \frac{2}{5} mR^2 \text{ for both spheres} \]

\[ I = \frac{2}{5} m R^2 + mR^2 = \frac{7}{5} mR^2 = \frac{7}{5} (0.560 \text{ kg})(0.05 \text{ m})^2 = 0.041 \times 10^{-2} \text{ kgm}^2 \]

(d) A solid sphere of mass 1.25 kg and radius 3.00 cm is rotating at 72.0 rad/s about an axis through its center of mass. It slows to a complete stop in exactly 175 revolutions. Assuming the acceleration is constant, what is the torque acting on the sphere?

\[ -1.0 \times 10^{-2} \text{ Nm} \]

(e) For the object shown the rod is massless and the masses are small. Take \( a = 1.25 \text{ m} \). Calculate the moment of inertia for rotation about the axis shown.

\[ I = \sum m_i r_i^2 = (3 \times 0.01 \text{ kg})(2 \times 0.025 \text{ m})^2 + (2 \times 0.01 \text{ kg})(0.125 \text{ m})^2 + (4 \times 0.01 \text{ kg})(2 \times 0.025 \text{ m})^2 = 4.6 \times 10^{-2} \text{ kg} \text{ m}^2 \]

(f) A cannon is fired horizontally with a velocity of 750 m/s from a cliff on the moon. Find the distance \( x \) from the base of the cliff that the cannon ball lands. Ignore any curvature of the moon's surface.

\[ L = \left( \frac{1}{2} m \right) x - \left( \frac{1}{2} \mu (m \theta)^2 \right) \text{ where for } x \]

\[ x = \sqrt{\frac{2V_0^2 - \mu_0}{g}} = 1.433 \times 10^4 \text{ m} \]