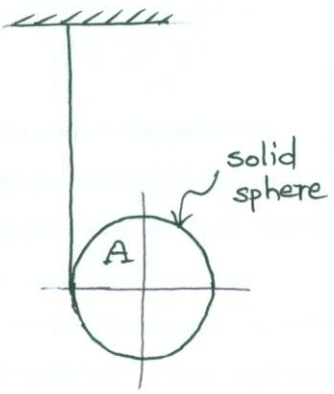
#1443/P.421



$v_{A0} = 0$

$S_A = 15$ ft

$v_{Af} = ?$

$\Delta PE = ?$

Note: Moment of inertia of mass of a sphere about a diameter, $\bar{I} = \frac{2}{5} m r^2$
Example 161/P.231, Art. 167/P.236.

Soln

$$U_{net} = W_A \times 15$$

$$\Delta KE = \frac{W_A}{2g}\left(v_{Af}^2 - v_{A0}^2\right) + \frac{\bar{I}_A}{2}\left(\omega_{Af}^2 - \omega_{A0}^2\right)$$

$$= \frac{W_A}{2g} v_{Af}^2 + \frac{1}{2} \times \frac{2}{5} \cdot \frac{W_A}{g} r_A^2 \times \frac{v_{Af}^2}{r_A^2}$$

$$= \frac{W_A v_{Af}^2}{2g} + \frac{W_A v_{Af}^2}{5g}$$

$$= \frac{7}{10} \cdot \frac{W_A v_{Af}^2}{g}$$

$$\omega_{A0} = \frac{v_{A0}}{r_A} = \frac{0}{r_A} = 0$$

$$\omega_{Af} = \frac{v_{Af}}{r_A}$$

$$\bar{I}_A = \frac{2}{5} m_A r_A^2 = \frac{2}{5} \cdot \frac{W_A}{g} \cdot r_A^2$$

According to principles of work and kinetic energy

$$U_{net} = \Delta KE$$

$$\Rightarrow W_A \times 15 = \frac{7}{10} \cdot \frac{W_A v_{Af}^2}{g}$$

$$\therefore v_{Af} = \left(\frac{15 \times 10 \times 32.2}{7}\right)^{1/2}$$

$$= \boxed{26.26 \text{ fps}}$$

Change in P.E. $= -W_A \times 15 = \boxed{-15 W_A}$
-ve sign means decrease