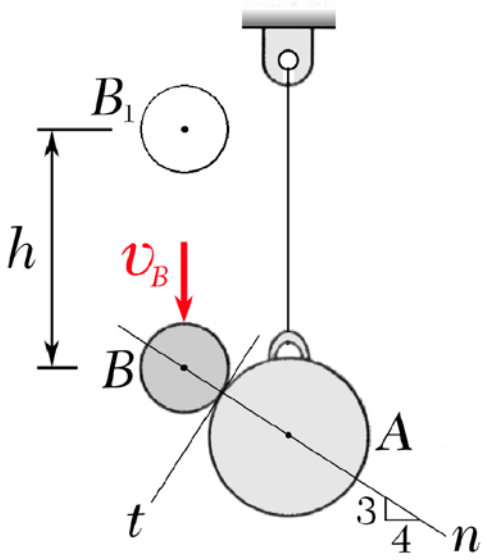
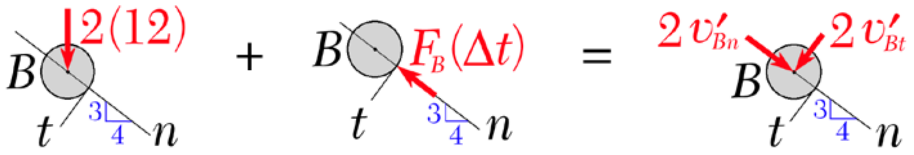
MEEG 2013 Quiz #4.m22

A 2-kg sphere B is released to fall freely from position B_1 to strike with a velocity $\mathbf{v}_B = 12$ m/s ↓ at a 5-kg sphere A that is at rest as shown. If the coefficient of restitution between A and B is $e = 0.65$, determine (*a*) the height h, (*b*) the velocity $\mathbf{v}_A'$ of A just after impact.



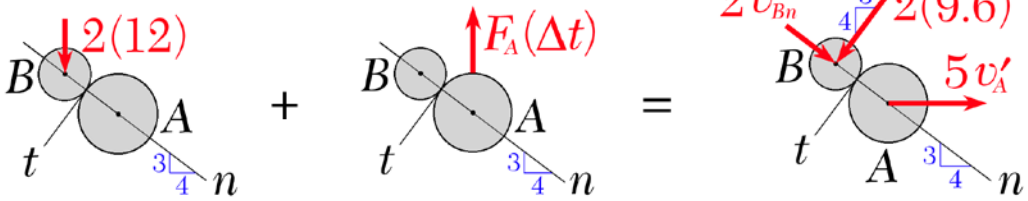
$$T_1 + V_1 = T_2 + V_2: \quad 0 + 2(9.81)h = \tfrac{1}{2}(2)(12)^2 + 0$$

$$h = 7.339 \quad \therefore \quad h = 7.34 \text{ m} \qquad ②$$



①

$$+\swarrow \Sigma V_t: \quad 2(12)(\tfrac{4}{5}) + 0 = 2v_{Bt}' \quad \therefore \quad v_{Bt}' = 9.6 \text{ m/s} \qquad ①$$



①

$$\pm\rightarrow \Sigma V_x: \quad 0 + 0 = 2v_{Bn}'(\tfrac{4}{5}) - 2(9.6)(\tfrac{3}{5}) + 5v_A' \qquad ①$$

$$\text{Impact:} \quad v_{Bn}' - v_A'(\tfrac{4}{5}) = 0.65\left[0 - 12(\tfrac{3}{5})\right] \qquad ②$$

$$v_A' = 3.027 \quad v_{Bn}' = -2.259 \quad \therefore \quad \mathbf{v}_A' = 3.03 \text{ m/s} \rightarrow \qquad ②$$