Problem 2) CofLM conditions: 2 block system is isolated.

$$P_{Tot} = P'_{Tot}$$

$$m_A v_A + m_B v_B = m_A v_A' + m_B v_B'$$

$$0 = m_A v_A' + m_B v_B'$$

$$-mv = MV$$

$$V = \frac{-mv}{M}$$ stop!

CofME conditions: frictionless, ⊥ normal forces, weights are conservative

$$E_{Tot} = E'_{Tot}$$

$$U_A + K_A + \cancel{U_B}^{0} + K_B = \cancel{U_A'} + K_A' + \cancel{U_B'}^{0} + K_B'$$

$$mgy + \cancel{\tfrac{1}{2}mu^2}^{0} + \cancel{\tfrac{1}{2}MV^2}^{0} = \tfrac{1}{2}mv^2 + \tfrac{1}{2}MV^2$$

$$mgR = \tfrac{1}{2}mv^2 + \tfrac{1}{2}\cancel{M}\left(\frac{-mv}{\cancel{M}}\right)^2$$

$$\cancel{m}gR = \tfrac{1}{2}\cancel{m}v^2 + \tfrac{1}{2}m^{\cancel{2}}v^2\frac{1}{M}$$

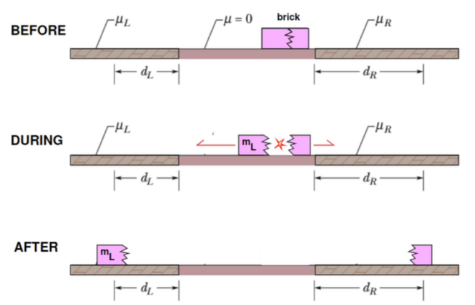
$$2gR = v^2 + \frac{m}{M}v^2$$

$$2gR = v^2\left(1 + \frac{m}{M}\right)$$

$$v^2 = \frac{2gR}{1 + \frac{m}{M}}$$

$$\boxed{V = \frac{2gR}{1 + \frac{m}{M}}}$$

SI Q2)



CofLM conditions: isolated system from 'before' and 'during'

$$P_{Tot} = P'_{Tot}$$

$$m_L v_L + m_R v_R = m_L v_L' + m_R v_R'$$

$$0 = m_L v_L + m_R v_R$$

$$m_R = -\frac{m_L v_L}{v_R}$$ stop!

Work Eng Thm. 'during'->'after'

Left: $W_{Tot} = \Delta K$

$$W_f = \Delta K$$

$$fd\cos\theta = \tfrac{1}{2}mv_f^2 - \tfrac{1}{2}mv_i^2$$

$$\mu_L N d_L(-1) = -\tfrac{1}{2}m_L v_L^2$$

$$2\mu_L \cancel{m_L} g d_L = \cancel{m_L} v_L^2 \qquad v_L = \sqrt{2\mu_L g d_L}$$

Right: $W_{Tot} = \Delta K$

$$W_f = \Delta K$$

$$fd\cos\theta = \tfrac{1}{2}mv_f^2 - \tfrac{1}{2}mv_i^2$$

$$\mu_R N d_R(-1) = -\tfrac{1}{2}m_R v_R^2$$

$$v_R = \sqrt{2\mu_R g d_R}$$

v_L ← − v_R → +

$$m_R = -\frac{m_L(-\sqrt{2\mu_L g d_L})}{\sqrt{2\mu_R g d_R}} = m_L\left(\sqrt{\frac{\mu_L d_L}{\mu_R d_R}}\right)$$

$$\boxed{M = m_L + m_L\sqrt{\frac{\mu_L d_L}{\mu_R d_R}}}$$