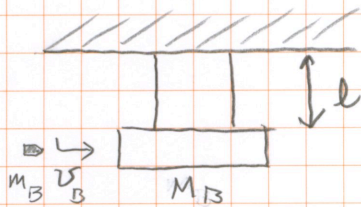


4) T3 5-43 A BULLET IS FIRED INTO A SUSPENDED BLOCK THAT SWINGS TO  $60^\circ$ . FIND  $v_{\text{bullet}} = v_B$

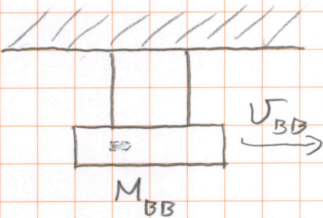


CONSERVE MOMENTUM IN COLLISION

$$p_i = p_f$$

$$m_B v_B = (m_B + M_B) v_{BB}$$

$$v_{BB} = \frac{m_B}{m_B + M_B} v_B$$



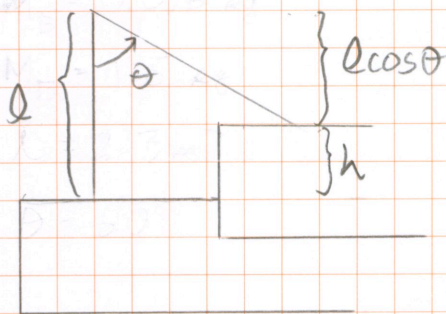
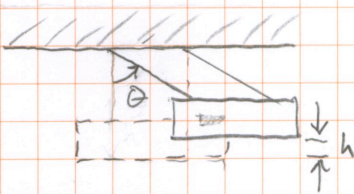
CONSERVE ENERGY IN SWING

$$T_i + U_i = T_f + U_f$$

$$\frac{1}{2} (m_B + M_B) v_{BB}^2 = (m_B + M_B) g h$$

$$\frac{1}{2} v_{BB}^2 = g l (1 - \cos \theta)$$

$$v_{BB} = \sqrt{2 g l (1 - \cos \theta)}$$



SUBSTITUTE TO FIND  $v_B$

$$\frac{m_B}{m_B + M_B} v_B = \sqrt{2 g l (1 - \cos \theta)}$$

$$v_B = \frac{m_B + M_B}{m_B} \sqrt{2 g l (1 - \cos \theta)}$$

$$v_B = \frac{1.516}{0.016} \sqrt{2(9.8)(2.3)(1 - \cos 60^\circ)}$$

$$v_B = 449.8 \frac{\text{m}}{\text{s}}$$

$$m_B = 0.016 \text{ kg}$$

$$M_B = 1.5 \text{ kg}$$

$$l = 2.3 \text{ m}$$

$$\theta = 60^\circ$$