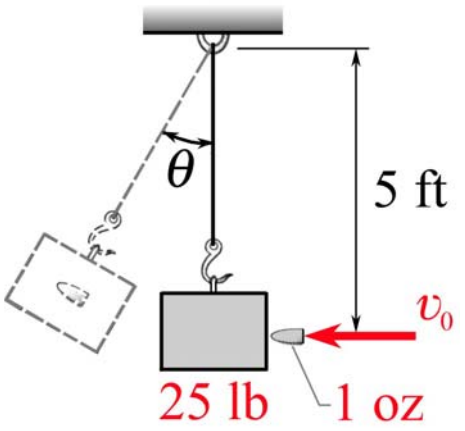
MEEG 2013 Quiz #4.m20

A 1-oz bullet is fired with a speed v_0 into a 25-lb block that is at rest as shown. If $\theta = 30°$ when the block with the embedded bullet swings to the highest position, determine (*a*) the speed v_1 of the block right after impact, (*b*) the speed v_0, (*c*) the percentage of loss of the kinetic energy during impact.



During motion of block with embedded bullet from $\theta = 0$ to $\theta = 30°$, the system is conservative and $T_1 + V_1 = T_2 + V_2$:

$$T_1 = \frac{1}{2}\left(\frac{25+\frac{1}{16}}{32.2}\right)v_1^2 \qquad V_1 = 0 \qquad T_2 = 0$$

$$V_2 = (25+\tfrac{1}{16})(5)(1-\cos 30°) \qquad \therefore \quad v_1 = 6.5681 \text{ ft/s} \qquad ②$$

$$\text{MD}_1 + \text{ID}_{1\to 2} = \text{MD}_2 \quad \text{for block \& bullet} \qquad ②$$

$$\frac{1}{16(32.2)}v_0 + 0 = \frac{25+\frac{1}{16}}{32.2}v_1 \qquad \therefore \quad v_0 = 2633.8 \qquad ②$$

$$v_1 = 6.57 \text{ ft/s} \qquad v_0 = 2.63\times 10^3 \text{ ft/s} \qquad ②$$

$$\Delta \text{KE} = \frac{\frac{1}{2}\left(\frac{25+\frac{1}{16}}{32.2}\right)v_1^2 - \frac{1}{2}\cdot\frac{1}{16(32.2)}v_0^2}{\frac{1}{2}\cdot\frac{1}{16(32.2)}v_0^2} = -0.997506$$

Loss of kinetic energy = 99.8% ②