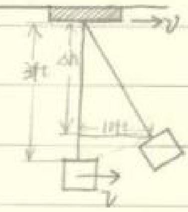
1. $g \cdot m_B S = F_A \cdot S + \frac{1}{2} m_A v^2 + \frac{1}{2} m_B v^2$

$S = 2m$. $F_A = m_A g \cdot m_k = 490N$

hence $v = 4.43 \, m/s$

1.



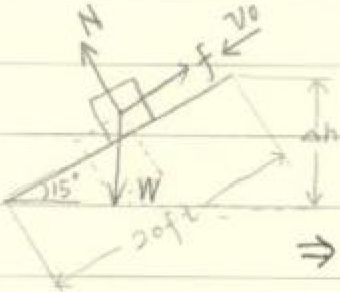
The initial velocity of the bucket equals to the velocity of the crane.

For bucket: $U_{1\to2} = -mg\cdot\Delta h$

$T_1 = \frac{1}{2}mv^2$ $T_2 = 0$.

$\Rightarrow -m(32.2\,ft/s^2)\left[30ft - \sqrt{(30ft)^2 - (10ft)^2}\right] = 0 - \frac{1}{2}mv^2$

$\Rightarrow v = 10.51\,ft/s$.



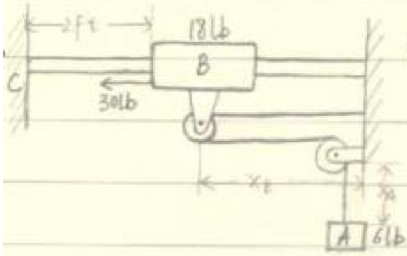
$U_{1\to2} = W\cdot\Delta h - f\cdot x$

$= mg\cdot x\sin 15° - mg\cos 15°\cdot \mu_k \cdot x$.

$U_{1\to2} = T_2 - T_1$

$\Rightarrow mgx\sin 15° - mg\mu_k\cos 15° x = 0 - \frac{1}{2}mv_0^2$

$\Rightarrow v_0 = 12.82\,ft/s$.



(a). $x_A + 2x_B = c$

$\Rightarrow \Delta x_A = 2\Delta x_B$. $\quad v_A = 2v_B$.

$\Delta x_B = 2ft \quad \Delta x_A = 4ft$.

$T_1 = 0 \quad T_2 = \frac{1}{2} m_A v_A^2 + \frac{1}{2} m_B v_B^2 = (21\,lb)\, v_B^2$.

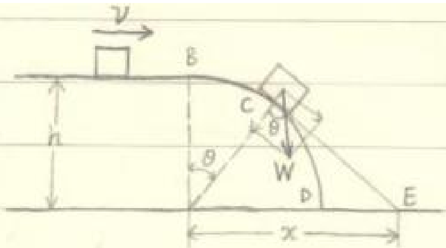
$U_{1\to2} = (30\,lb)(2ft)(32.2ft/s^2) - (6\,lb)(32.2ft/s^2)(4ft) = (21\,lb)\, v_B^2$

$\Rightarrow v_B = 7.43\,ft/s$.

(b) In this case. $T_1 = T_2 = 0$.

$U_{1\to2} = (30\,lb)(32.2ft/s^2)\,x - (6\,lb)(32.2ft/s^2)(4ft) = 0$

$\Rightarrow x = 0.8\,ft$.



At C: $\frac{m v_c^2}{h} = mg\cdot\cos 30^\circ$

$v_c^2 = gh\cos 30^\circ$

B→C: $mg(h - h\cos 30^\circ) = \frac{1}{2} m v_c^2 - \frac{1}{2} m v^2$

$\Rightarrow \frac{1}{2} v^2 = \frac{1}{2} gh\cos 30^\circ - mg(h - h\cos 30^\circ)$

$\Rightarrow v = 2.3\,m/s$.