Spring & Potential Energy

① $W_{nc} = \Delta E_k + \Delta E_p$

$0 = E_{kf} - E_{ki} + E_{pf} - E_{pi}$ (0, 0)

$0 = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 + \frac{1}{2}kx_f^2$

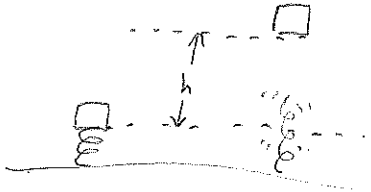
$x = 0.600\text{m}$

② $W_{nc} = \Delta E_k + \Delta E_p$ (0, 0)

$0 = E_{pf} - E_{pi}$

$0 = mgh_f - \frac{1}{2}kx_i^2$

$h_f = 0.75\text{m}$ (above start position!)



③ $W_{nc} = \Delta E_k + \Delta E_p$

$-2.6\times10^6 = E_{kf} - E_{ki} + E_{pf} - E_{pi}$ (E_{kf}: 0, E_{pi}: 0)

$E_{pf} = E_{ki} - 2.6\times10^6\text{J}$

$\frac{1}{2}kx_f^2 = \frac{1}{2}mv_i^2 - 2.6\times10^6\text{J}$

$k = 8300\text{N/m}$

④ Tough one! Careful (Hint. $h_i \neq 1.0\text{m}$ if $h_f = 0\text{m}$ Draw a diagram!)

$x = 0.59\text{m}$

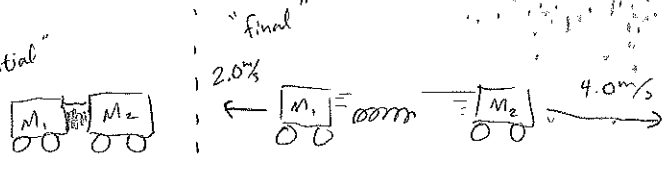
⑤

(i)

$W_{nc} = 0$

$E_i = E_f$

(6)



① Cons of momentum: $\Sigma p_0 \to 0$

$$\Sigma \vec{p} = \Sigma p_0$$

$$M_1 (2.0\ m/s) = M_2 (4.0\ m/s)$$

$$M_1 = 2M_2$$

② Energy: $W_{nc} = 0$

$$\mathcal{E} = \mathcal{E}_0$$

$$\tfrac{1}{2} M_1 V_1^2 + \tfrac{1}{2} M_2 V_2^2 = \tfrac{1}{2} k x_0^2$$

$$\tfrac{1}{2}(2M_2)(2\ m/s)^2 + \tfrac{1}{2}(M_2)(4\ m/s)^2 = \tfrac{1}{2}\, 480\ N/m\, (0.18)^2$$

$$4M_2 + 8M_2 = 7.776\ J$$

$$M_2 = 0.648\ kg$$

$M_1 = 1.3\ kg$

$M_2 = 650\ g\ (0.65\ kg)$