Springs & Potential Energy

① $W_{nc} = \Delta E_k + \Delta E_p$

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

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

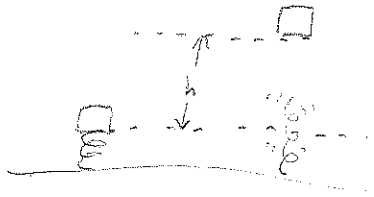
$x = 0.600\,m$

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

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

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

$h_i = 0.75\,m$ (above start position!)



③ $W_{nc} = \Delta E_k + \Delta E_p$

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

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

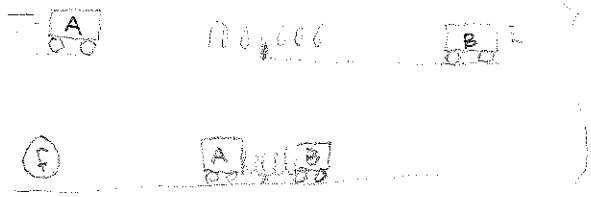
$\frac{1}{2}kx_f^2 = \frac{1}{2}mv_i^2 - 2.6\times10^6\,J$

$k = 8300\,N/m$

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

$x = 0.59\,m$

⑤



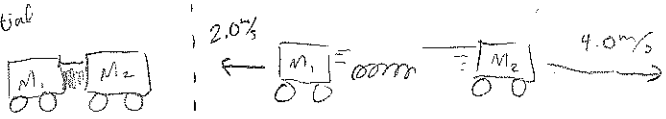
$W_{nc} = 0$

$E_i = E_f$

$\frac{1}{2}m_A v_A^2 + \frac{1}{2}m_B v_B^2 = \frac{1}{2}kx_f^2$

$k = 650\,N/m$

⑥



① Cons of momentum: (0)

$\Sigma \vec{p} = \Sigma \vec{p}_0$

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

$M_1 = 2M_2$

② Energy: $W_{nc} = 0$

$E = E_0$

$\frac{1}{2}M_1v_1^2 + \frac{1}{2}M_2v_2^2 = \frac{1}{2}kx_0^2$

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

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

$M_2 = 0.648\,kg$

$M_1 = 1.3\,kg$

$M_2 = 650g$ (0.65 kg)