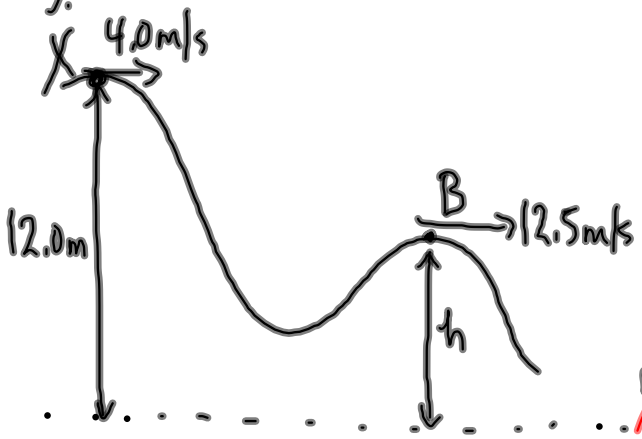
From HW (pp 287)

3.



Law of Conservation of Mech. Energy

$$E_{total} = E'_{total}$$

(X) → (B)

$$E_{g_X} + E_{k_X} = E_{g_B} + E_{k_B}$$

$$mgh_X + \frac{1}{2}mv_X^2 = mgh_B + \frac{1}{2}mv_B^2$$

$$gh_X + \frac{v_X^2}{2} = gh_B + \frac{v_B^2}{2}$$

$$(9.81\,m/s^2)(12.0\,m) + \frac{(4.0\,m/s)^2}{2} = (9.81\,m/s^2)(h) + \frac{(12.5\,m/s)^2}{2}$$

Solve for h

Elastic Potential Energy + Kinetic Energy

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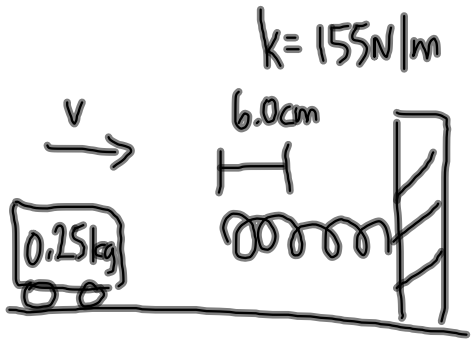

$E_{total} = E'_{total}$

(before cmp) (max compression)

$E_e + E_k = E_e' + E_k'$

$0 + \frac{1}{2}mv^2 = \frac{1}{2}kx^2 + 0$

$\frac{1}{2}mv^2 = \frac{1}{2}kx^2$

$v^2 = \frac{kx^2}{m}$

$v^2 = \frac{(155N/m)(0.060m)^2}{0.25kg}$

$\boxed{v = 1.5 m/s}$

$\frac{N}{m} \cdot m^2$ / kg

$\frac{kg \cdot m}{m s^2} \cdot m^2$ / kg

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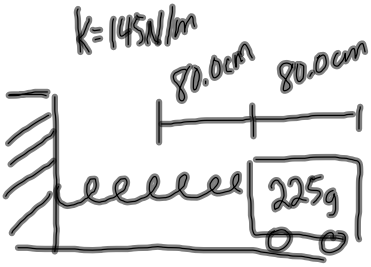

a) V_{max} occurs when passing through the equilibrium position ($x=0$)

$E_{total} = E'_{total}$

(max stretch) (equilibrium)

$E_e + E_k = E_e' + E_k'$

$\frac{1}{2}kx^2 + 0 = 0 + \frac{1}{2}mv^2$

$\frac{1}{2}kx^2 = \frac{1}{2}mv^2$

$v^2 = \frac{kx^2}{m}$

$v^2 = \frac{(145N/m)(0.800m)^2}{0.225kg}$

$v = \pm 20.3 m/s$

a) $\therefore V_{max} = ?$

b) $x = ?$ when $\frac{1}{2}(V_{max})$

$\frac{1}{2}(20.3 m/s)$

$10.15 m/s$

b) $E_{total} = E'_{total}$

(max stretch) (partial stretch)

$E_e + E_k = E_e' + E_k'$

$\frac{1}{2}kx_1^2 = \frac{1}{2}kx_2^2 + \frac{1}{2}mv^2$

$\frac{1}{2}(V_{max})$

$kx_1^2 = kx_2^2 + mv^2$

$(145N/m)(0.800m)^2 = (145N/m)x_2^2 + (0.225kg)(10.15m/s)^2$

$92.8J = (145N/m)x_2^2 + 23.2J$

$69.6J = (145N/m)x_2^2$

$x_2^2 = 0.48m^2$

$x_1 = \pm 0.693m$

The spring would compressed/stretched by 69.3cm when the cart was travelling @ $\frac{1}{2}V_{max}$

TO DO

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