Conservation of Energy:

Law of conservation of Mechanical Energy

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

(before) (after)

$E_g + E_k + E_e = E_g' + E_k' + E_e'$

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4.

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

(lowest) (highest)

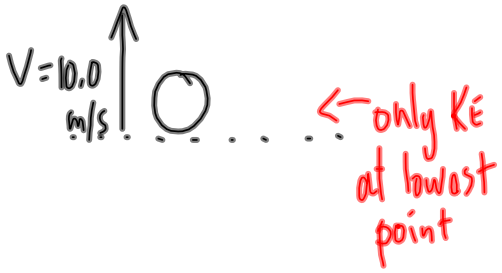
$\cancel{E_g}^{0} + E_k = E_g' + \cancel{E_k'}^{0}$

$\frac{1}{2}\cancel{m}v^2 = \cancel{m}gh$

$h = \frac{v^2}{2g}$

$h = \frac{(10.0\,m/s)^2}{2(9.81\,m/s^2)}$

$h = 5.10\,m$



Using Kinematics:

$V_1 = 10.0\,m/s$

$V_2 = 0$

$a = -9.81\,m/s^2$

$\Delta d = ?$

$V_2^2 = V_1^2 + 2a\Delta d$

Elastic Potential Energy & Kinetic Energy

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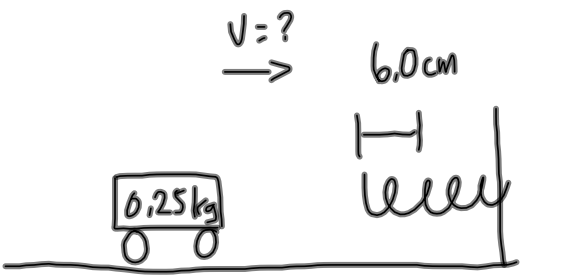

$E_{total} = E'_{total}$

(cart) (max compression)

$E_k + E_e = E'_k + E'_e$ ($E_k = 0$, $E'_k = 0$)

$E_k = E'_e$

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

$mv^2 = kx^2$

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

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

$v^2 = 2.232\ \frac{m^2}{s^2}$

$v = \pm 1.5\ m/s$

use the negative since it is a compression

$v = -1.5\ m/s$ (compression)

(1.5 m/s toward the spring)

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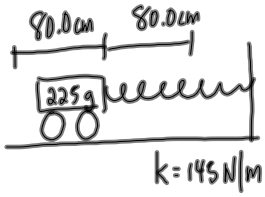

a) $V_{max} = ?$

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

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

(equil'b) (max stretch/compress)

$E_e + E_k = E'_e + E'_k$ (0 and 0)

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

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

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

$v^2 = 412.4\ \frac{m^2}{s^2}$

$V = \pm 20.3\ m/s$

b) $\frac{1}{2}$ of $V_{max} = 10.15\ m/s$

$x = ?$

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

(equilibrium) (partial stretch)

$E_e + E_k = E'_e + E'_k$ (0)

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

$(0.225kg)\left(20.3\frac{m}{s}\right)^2 = \left(145\frac{N}{m}\right)x^2 + (0.225kg)\left(10.15\frac{m}{s}\right)^2$

$92.7J = \left(145\frac{N}{m}\right)x^2 + 23.2J$

$69.5J = \left(145\frac{N}{m}\right)x^2$

$x^2 = \frac{69.5J}{145N/m}$

$\frac{N \cdot m}{\frac{N}{m}} = \cancel{N} \cdot m \cdot \frac{m}{\cancel{N}} = m^2$

$x^2 = 0.479\ m^2$

$x = \pm 0.692\ m$

69.2cm stretch (+)
compression (−)

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