Conservation of Energy

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

(before) (after)

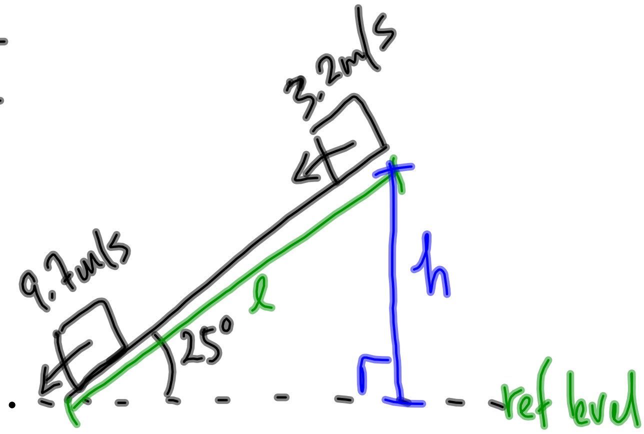
$$E_g + E_e + E_k = E_g' + E_e' + E_k'$$

$$E_g = mgh$$

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

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

Pp|287



m = 32kg

$$\sin\theta = \frac{opp}{hyp}$$

$$\sin 25° = \frac{h}{l}$$

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

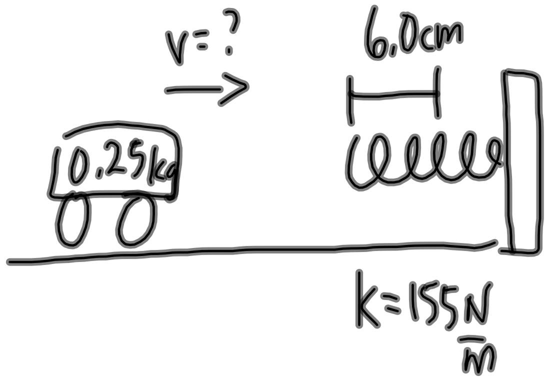
(top) (bottom)

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

? 0

$$\cancel{m}gh + \frac{1}{2}\cancel{m}v_1^2 = \frac{1}{2}\cancel{m}v_2^2$$

mp|292



(before compressed) (fully compressed)

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

$$\cancel{E_e} + E_k = E'_e + \cancel{E'_k}$$

0 0

$$\cancel{\tfrac{1}{2}}mv^2 = \cancel{\tfrac{1}{2}}kx^2$$

$$mv^2 = kx^2$$

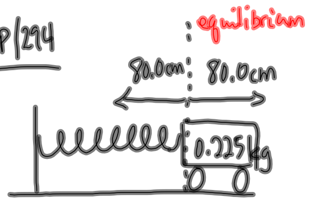
$$v^2 = \frac{kx^2}{m}$$

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

$$v = 1.5\,m/s$$

The cart was travelling at 1.5 m/s before hitting the spring

MP/294



$k = 145\,\frac{N}{m}$

a) $V_{max} = ??$ (passing through the equilibrium position)

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

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

(fully compressed) (equilibrium)

$$E_e + \cancel{E_k}_{\,0} = \cancel{E'_e}_{\,0} + E'_k$$

$$\cancel{\tfrac{1}{2}} kx^2 = \cancel{\tfrac{1}{2}} mv^2$$

$$kx^2 = mv^2$$

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

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

$$V = \pm 20.3\,m/s$$

+ away (stretch)
- toward (compression)

b) $V = 10.15\frac{m}{s}$, $x = ?$

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

(fully compressed) (partially compressed)

$$E_e + \cancel{E_k}_{\,0} = E'_e + E'_k$$

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

$x_2 = ?$

$\frac{1}{2}$ that

$$(145\tfrac{N}{m})(0.800m)^2 = (145\tfrac{N}{m})x_2^2 + (0.225kg)(10.15\tfrac{m}{s})^2$$

$$92.8J = (145\tfrac{N}{m})x_2^2 + 23.2J$$

$$69.6J = (145\tfrac{N}{m})x_2^2$$

PP/296

$$x_2^2 = 0.480\,m^2$$

$$x_2 = \pm 0.693\,m$$

+ stretch
- compression