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H R HS Physics May 1, 2020

①

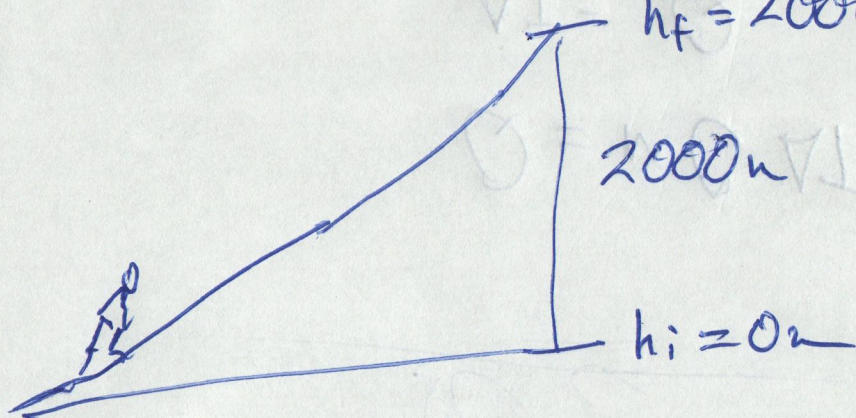
$$a) \Delta E_p = mgh_f - mgh_i$$

$$h_f = 2000 \text{ m}$$

$$= (70 \text{ kg})(9.8 \text{ m/s}^2)(2000 \text{ m})$$

$$\Delta E_p = 1.372 \times 10^6 \text{ J}$$

$$\Delta E_p = 1,372 \text{ kJ}$$



$$(E_{\text{tot}})(25\%) = \Delta E_p$$

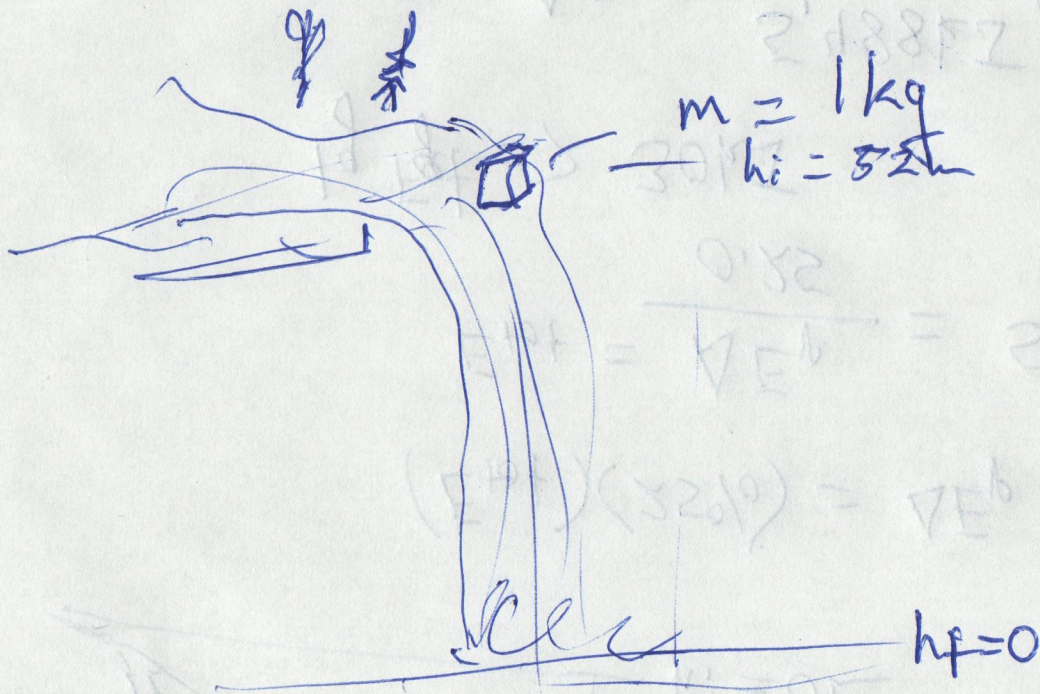
$$E_{\text{tot}} = \frac{\Delta E_p}{0.25} = 5,488 \text{ kJ}$$

$$1 \text{ g Fgt} \Rightarrow 30 \text{ kJ}$$

$$\Delta m = 5,488 \text{ kJ} \left( \frac{1 \text{ g}}{30 \text{ kJ}} \right) \approx 183 \text{ g}$$

②

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$$\Delta E_{gp} = mgh_f - mgh_i$$

$$= -(1 \text{ kg})(9.8 \text{ m/s}^2)(52 \text{ m})$$

$$\Delta E_{gp} = -509.6 \text{ J} =$$

$$Q = 509.6 \text{ J}$$

$$Q = mC \Delta T$$

$$\Delta T = \frac{Q}{mC} = \frac{509.6 \text{ J}}{(1 \text{ kg})(4186 \text{ J/kg} \cdot ^\circ\text{C})}$$

$$\Delta T = 0.122 ^\circ\text{C}$$

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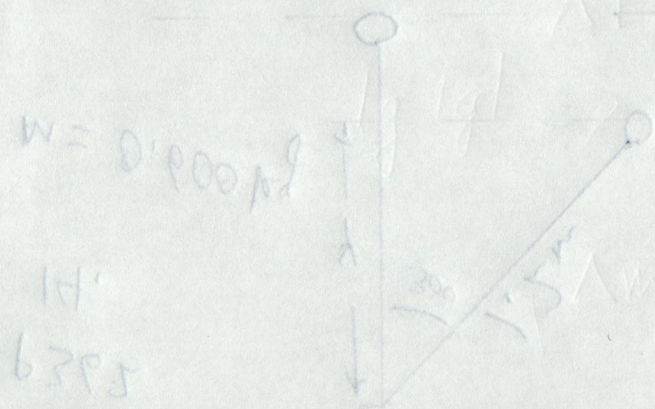
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$$Q = mgh_i = m C \Delta T$$

$$\Delta T = \frac{gh_i}{C}$$

$$C = 4.186 / g \cdot ^\circ C \left( \frac{1000g}{1kg} \right) \left( \frac{1000g}{1kg} \right)$$

$$C = 4186 / kg \cdot ^\circ C$$

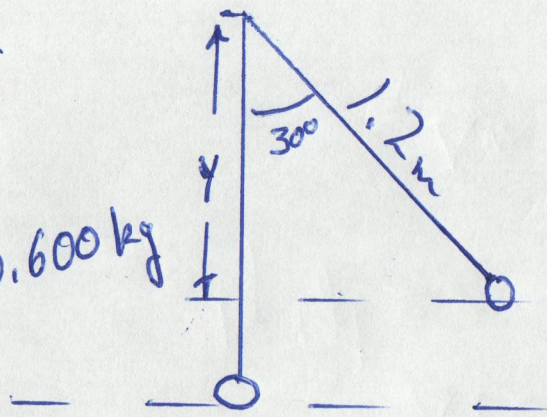


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14.

$m = 0.600 \text{ kg}$



$l = 1.20 \text{ m}$

$y + h_i = 1.20 \text{ m}$

$h_i = ? \quad v_i = 3.00 \text{ m/s}$

$h = 0$

CAH

$\cos 30^\circ = \frac{y}{1.20 \text{ m}}$

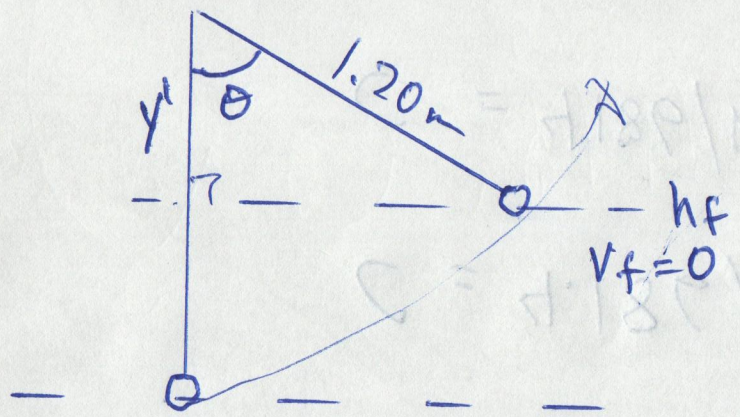
$y = (1.20 \text{ m}) \cos 30^\circ$

$y = 1.0392 \text{ m}$

$h_i = 1.20 \text{ m} - y = 1.20 \text{ m} - 1.0392 \text{ m}$

$h_i = 0.1608 \text{ m}$

a)



$y' = 1.2 \text{ m} - h_f = 1.20 \text{ m} - 0.6200 \text{ m}$

$y' = 0.5800 \text{ m}$

$\cos \theta = \frac{y'}{l} \quad \theta = \cos^{-1} \left( \frac{y'}{l} \right)$

$\theta = 61.1^\circ$

$\theta = \cos^{-1} \left( \frac{0.5800 \text{ m}}{1.20 \text{ m}} \right)$

$\frac{1}{2} m v_i^2 + m g h_i = \frac{1}{2} m v_f^2 + m g h_f + E_{th}$

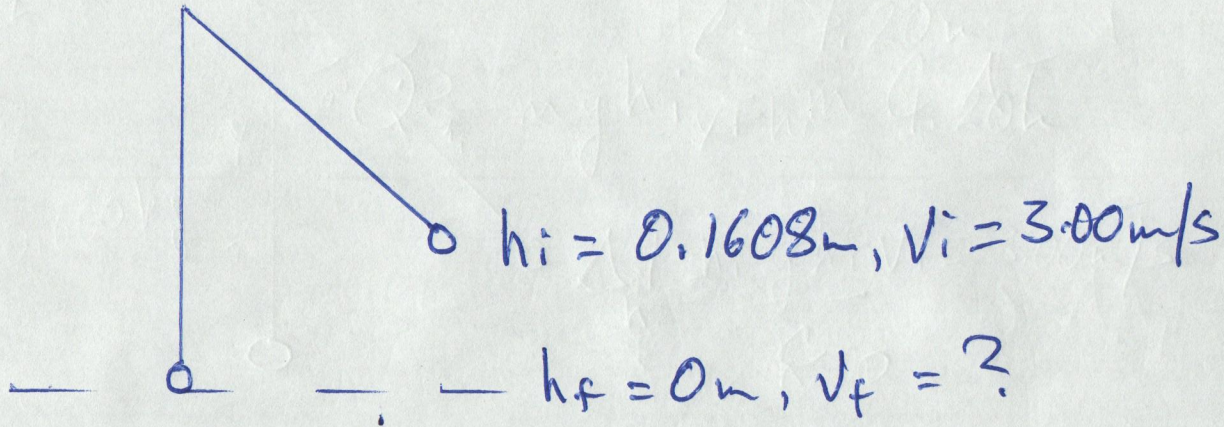
$\frac{1}{2} v_i^2 + g h_i = g h_f$

$h_f = \frac{\frac{1}{2} v_i^2 + g h_i}{g} = \frac{v_i^2}{2g} + h_i$

$h_f = \frac{(3.00 \text{ m/s})^2}{2(9.8 \text{ m/s}^2)} + 0.1608 \text{ m}$

$h_f = 0.6200 \text{ m}$

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$$E_{th} = 0$$

$$\Rightarrow \frac{1}{2} m v_i^2 + m g h_i = \frac{1}{2} m v_f^2 + \cancel{m g h_f} + \cancel{E_{th}}$$

$$\frac{1}{2} v_i^2 + g h_i = \frac{1}{2} v_f^2$$

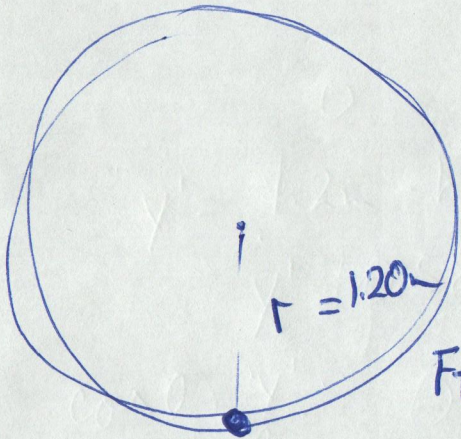
$$v_f^2 = v_i^2 + 2 g h_i = (3.00 \text{ m/s})^2 +$$

$$v_f = \pm [v_i^2 + 2 g h_i]^{1/2} = [(3.00 \text{ m/s})^2 + 2(9.8 \text{ m/s}^2)(0.1608 \text{ m})]^{1/2}$$

$$v_f = 3.48 \text{ m/s} \rightarrow 3.49 \text{ m/s}$$

$$v_f = 3.49 \text{ m/s}$$

$$F_T = 6.08 \text{ N}$$



$$F_T = F_c$$

$$F_T = F_c = \frac{m v^2}{r} = \frac{(0.600 \text{ kg})(3.49 \text{ m/s})^2}{1.20 \text{ m}}$$

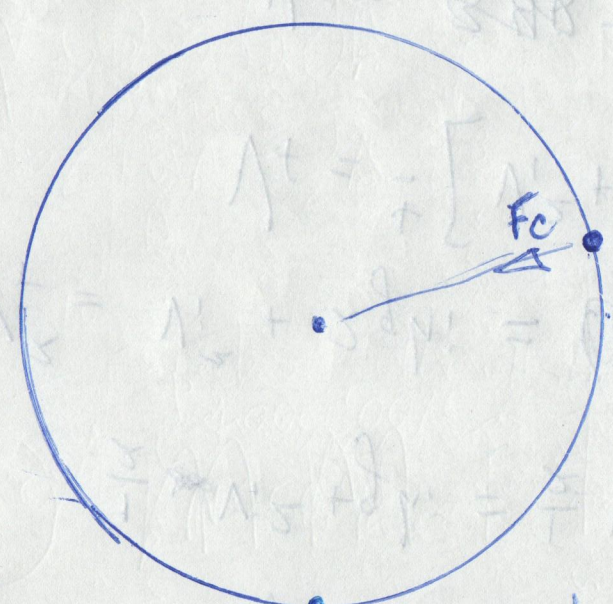
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$$F_c = \frac{L}{mT} = \frac{1.5m}{(0.0009)(3.49m/s)}$$

$$L = 0.08N$$

$$T = 3.49m/s$$

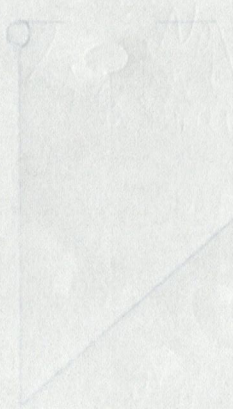
### Circular Motion



$\Rightarrow F_c$

- planet  $F_c : F_g$
- car  $F_c : F_f$
- ball on string :  $F_T$

$$v_f = 3.49 m/s$$

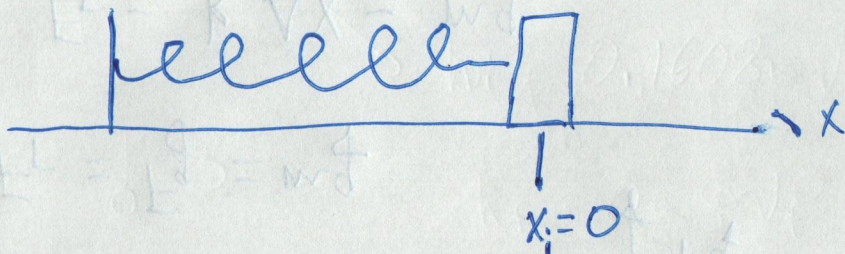


$$\mu = 0.1008 \quad \mu = 3.00 m/s$$

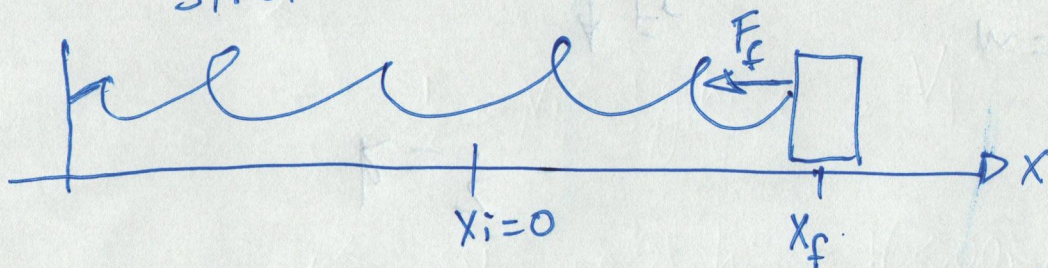
$$E_{tr} = 0$$

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Neutral



stretched

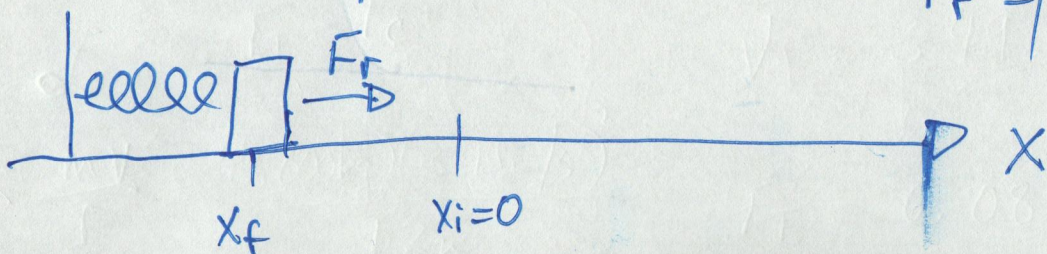


$$F_r = -k \Delta X$$

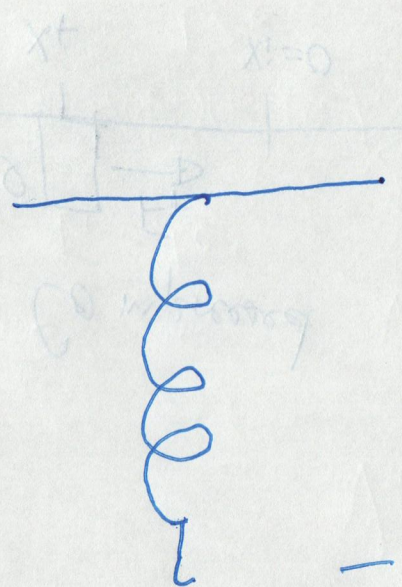
$$F_r = k(x_f - x_i)$$

Magnitude:  $F_r = |k \Delta X|$

Compressed

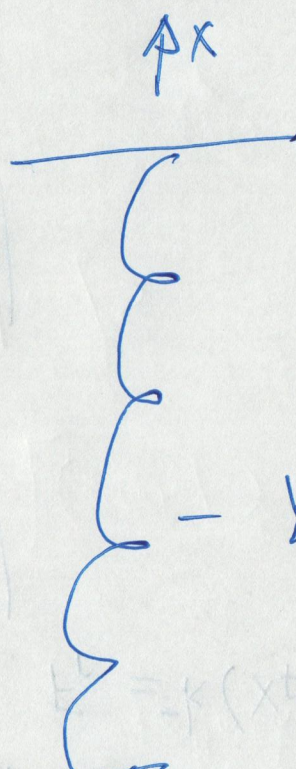


$$F_r = |k \Delta X|$$



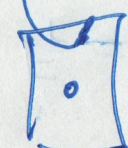
$x_i = 0\text{m}$

$k = ?$



$x_i = 0\text{m}$

$m = 10\text{kg}$

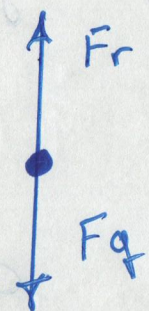


$x_f = 0.500\text{m}$

~~scribble~~

$$F_r - F_g = ma = 0$$

$$F_r = F_g = mg$$



$$F_r = k \Delta x = mg$$

$$k = \frac{mg}{\Delta x} = \frac{(10\text{kg})(9.8\text{m/s}^2)}{0.500\text{m}} =$$

$$k = 196 \text{ N/m}$$