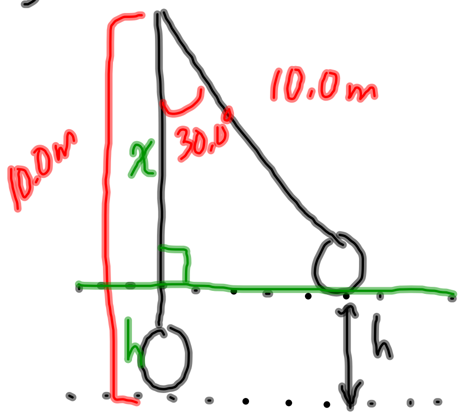
FROM HW (PP|287)

5.



To find h:

$\cos\theta = \frac{adj}{hyp}$

$\cos 30.0° = \frac{x}{10.0\,m}$

$x = (10.0\,m)(\cos 30.0°)$

$\boxed{x = 8.66\,m}$

$x + h = 10.0\,m$

$h = 10.0\,m - x$

$h = 10.0\,m - 8.66\,m$

$\boxed{h = 1.3\,m}$

a) $E_g = mgh$

b) $E_k = ?$ (bottom)

c) $v = ?$ $\left(E_k = \frac{1}{2}mv^2\right)$

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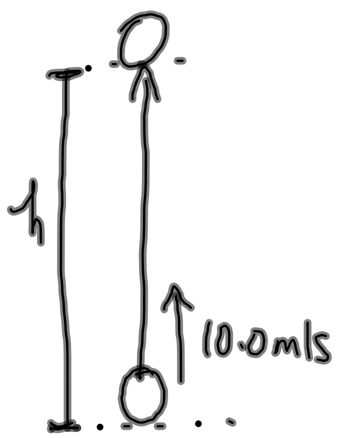
4.

$v = 10.0\ m/s$

$h = ?$



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

(bottom) (top)

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

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

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

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

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

$\boxed{h = 5.10\ m}$

<u>OR</u> using kinematics

$v_1 = +10.0\ m/s\ (v)$

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

$v_2 = 0$

$\Delta d = ?\ (h)$

$v_2^2 = v_1^2 + 2a\Delta d$

$0 = v^2 - 2gh$

$2gh = v^2$

$h = \frac{v^2}{2g}$ ← same as above.

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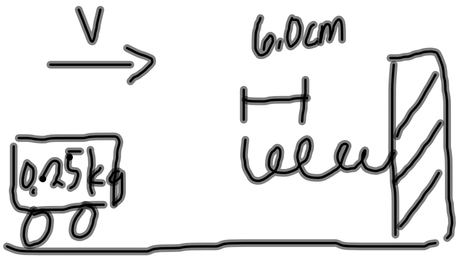
$k = 155\,N/m$



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

(before compress) (fully compressed)

$E_e + E_k = E_e' + E_k'$

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

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

$mv^2 = kx^2$

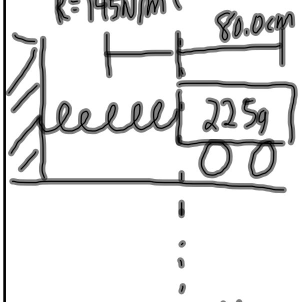
$v^2 = \frac{kx^2}{m}$

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

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

MP|294

$k = 145 N/m$.



equilibrium position.

(max KE ⇒ max v)

a) $V_{max} = ?$

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

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

$\boxed{v = 10.15 \, m/s}$

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

(fully stretch) (equilibrium)

$E_e + E_k = E_e' + E_k'$

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

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

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

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

$\boxed{v = \pm 20.3 \, m/s}$

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

(fully stretched) (partial stretch)

$E_e + E_k = E_e' + E_k'$

$\cancel{\frac{1}{2}}kx_1^2 + 0 = \cancel{\frac{1}{2}}kx_2^2 + \cancel{\frac{1}{2}}mv^2$

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

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

$92.8 J = 145 x_2^2 + 23.2 J$

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

$\boxed{x_2 = \pm 0.693 m}$

If the cart is 69.3 cm from the equilibrium it will be travelling at $\frac{1}{2} V_{max}$

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