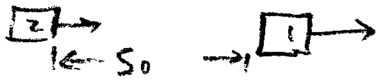
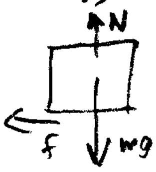


1)



$v_0 = 100\ km/h \cdot \frac{1000\,m}{1\,km} \cdot \frac{1\,hr}{3600\,s} = 27.78\,m/s$

$m_1 = 1200\,kg$ $\qquad \mu_1 = 0.8$ $\qquad f = \mu N = \mu m g$

$m_2 = 1600\,kg$ $\qquad \mu_2 = 0.7$

$v_1 = v_0 - a_1 t$ $\qquad a_1 = \frac{f_1}{m_1} = \frac{\mu_1 m_1 g}{m_1} = \mu_1 g$

$S_1 = v_0 t - \frac{a_1 t^2}{2}$ $\qquad t_1 = v_0/a_1$ to stop

$S_1 = v_0\left(\frac{v_0}{a_1}\right) - \frac{1}{2} a_1 \left(\frac{v_0}{a_1}\right)^2 = \frac{1}{2}\frac{v_0^2}{a_1}$

$= 49.2\ m$

Need $S_2 < S_1$ $\qquad S_2 = S_0' + v_0 t_D + S_0'$

$v_2 = v_0 - a_2 t_2$ $\qquad t_2 = v_0/a_2$ from $a_2 > 0$

$S_2' = v_0 t_1 - \frac{a_2 t_2^2}{2}$

$S_2' = \frac{1}{2}\frac{v_0}{a_2} \qquad = 56.25$

$S_2 = S_2' + v_0(t_D = 0.8s) - S_0$ Constant V part

$= 56.25 - S_0 + 22.224\,m \qquad = 78.47\,m - S_0$

$S_0 = -S_1'$

$S_2 < S_1$

$78.47 - S_0 < 49.2$

$78.47 - 49.2 < S_0$

$29.3\ m < S_0$

2) ~~[illegible]~~ $F = -kx$ $k = 60\ N/m$

$x = 7\ cm = 0.07\ m$

$m = 4\ gm = 0.004\ kg$

$KE = PE$

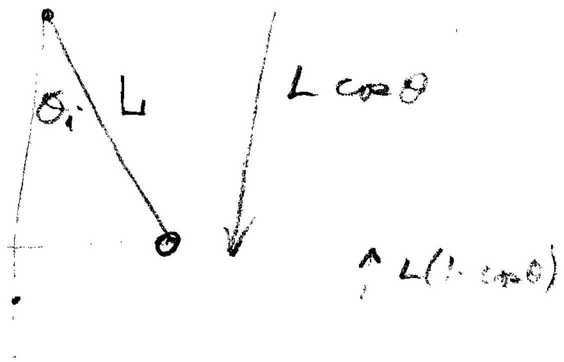
$\frac{1}{2}mv^2 = \frac{1}{2}kx^2$

$v = x\sqrt{\frac{k}{m}} = 0.07\sqrt{\frac{60}{0.004}} = 8.57\ m/s$

3) $U = mgh$

$\Delta U = mgh_f - mgh_i$

$= mg(h_f - h_i)$



$h_f - h_i = L(1 - \cos\theta_f - (1 - \cos\theta_i))$

$= L(\cos\theta_i - \cos\theta_f)$

$W = -\Delta U$

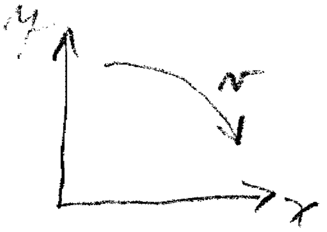
$= mgL(\cos\theta_f - \cos\theta_i)$

at ~~bottom~~ $\theta_f = 0°$

a) $W = mgL(1 - \cos\theta_i) = \frac{1}{2}mv^2$

b) $v = \sqrt{2gL(1-\cos\theta_i)}$

c) $\vec{T}$ is $\perp$ to $\vec{dx}$ So $W = \int \vec{T} \cdot d\vec{x} = 0$

4)  

m

a) $E = KE + PE$
$= \frac{1}{2} m v^2 + \frac{1}{2} k r^2$

b) Uniform Circ.

$$m\frac{v^2}{r} = F_c = kr$$
$$mv^2 = kr^2$$
$$v = r\sqrt{\frac{k}{m}}$$

5) v_0

$W = mg$

a) Energy Conservation

$$\frac{1}{2} m v_0^2 = mgh + fh$$
$$= (mg+f)h = (W+f)h$$

$$h = \frac{\frac{1}{2} m v_0^2}{W+f} = \frac{v_0^2}{2\left(\frac{W}{m} + \frac{f}{m}\right)} = \frac{v_0^2}{2g\left(1+\frac{f}{mg}\right)}$$
$$= \frac{v_0^2}{2g\left(1+\frac{f}{W}\right)}$$

b) $\frac{1}{2} m v_0^2 - 2fh = \frac{1}{2} m u^2$

$$u^2 = v_0^2 - \frac{4fh}{m}$$
$$= v_0^2\left(1 - \frac{4f}{2g\left(1+\frac{f}{W}\right)m}\right)$$
$$u = v_0\sqrt{\frac{2(W+f) - 4f}{2(W+f)}}$$
$$= v_0\sqrt{\frac{W-f}{W+f}}$$