Ch. 5 – Energy Practice

1) Use Hooke's Law!

$M = 0.3\,kg$
$x = 0.278\,m$

$F = kx$ $\quad mg = kx$ $\quad k = \frac{mg}{x}$

$= \frac{0.3\,kg(9.8\,m/s^2)}{0.278\,m}$

$k = 10.6\,N/m$ OR * see note at end

2)

$h_1 = 25\,m$ $\quad v_i = 10\,m/s$
$h_2 = 29\,m$ $\quad v_{f1} = \_\_\,m/s$
$v_{f2} = \_\_\,m/s$

$K_i + U_{gi} = K_f + U_{gf}$

$\frac{1}{2}mv_i^2 + mgh_1 = \frac{1}{2}mv_f^2$

$v_f = \sqrt{v_i^2 + 2gh_1}$

$= \sqrt{(10\,m/s)^2 + 2(9.8\,m/s^2)(25\,m)}$

a) $v_{f1} = 24.3\,m/s$

$K_i + U_{gi} = K_f + U_{gf}$

$\frac{1}{2}mv_i^2 + mgh_1 = \frac{1}{2}mv_f^2 + mgh_2$

$v_f = \sqrt{v_i^2 + 2g(h_1 - h_2)}$

$= \sqrt{(10\,m/s)^2 + 2(9.8\,m/s^2)(25\,m - 29\,m)}$

b) $v_f = 4.65\,m/s$

3)

$m = 6\,kg$
$h = 100\,m$
$E_{OUT} = 120\,J$

$K_i + U_{gi} = K_f + U_{gf}$

$mgh = \frac{1}{2}mv_f^2$

$v_f = \sqrt{2gh}$

$= \sqrt{2(9.8\,m/s^2)(100\,m)}$

a) $v_f = 44.3\,m/s$

$K_i + U_{gi} = K_f + U_{gf} + E_{OUT}$

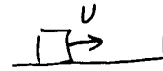
$2mgh = \frac{1}{2}mv_f^2 + E_{OUT}$

$v_f = \sqrt{\frac{2mgh - 2E_{OUT}}{m}}$

$v_f = \sqrt{\frac{2(6\,kg)(9.8\,m/s^2)(100\,m) - 2(120\,J)}{6\,kg}}$

b) $v_f = 43.8\,m/s$

4)



$m = 0.8\,kg$ $\quad$ If $x = 0.435\,m$
$v_i = 4\,m/s$ $\quad v_f = \_\_\,m/s$
$v_f = 0\,m/s$
$k = 50\,N/m$
$x = \_\_\,m$

$K_i + U_{si} = K_f + U_{sf}$

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

$x = \sqrt{\frac{mv^2}{k}}$

$= \sqrt{\frac{0.8\,kg(4\,m/s)^2}{50\,N/m}}$

a) $x = 0.506\,m$

$K_i + U_{si} = K_f + U_{sf}$

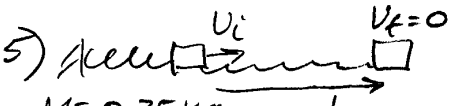
$\frac{1}{2}mv^2 = \frac{1}{2}mv_f^2 + \frac{1}{2}kx^2$

$v_f = \sqrt{\frac{mv_i^2 - kx^2}{m}}$

$= \sqrt{\frac{0.8\,kg(4\,m/s)^2 - 50\,N/m(0.435\,m)^2}{0.8\,kg}}$

$v_f = 2.04\,m/s$

5)



$M = 0.25\,kg$
$k = 150\,N/m$
$x = 0.15\,m$
$\mu_k = 0.35$
$d = \_\_\_\,m$

$K_i + U_{si} = K_f + U_{sf} + E_{OUT}$

$\frac{1}{2}kx^2 = f_k d$

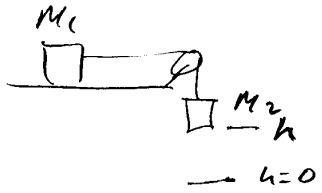
$\frac{1}{2}kx^2 = 2\mu_k mgd$

$d = \frac{kx^2}{2\mu_k mg}$

$= \frac{150\,N/m(0.15\,m)^2}{2(0.35)(0.25\,kg)(9.8\,m/s^2)}$

$d = 1.97\,m$

EC)



$M_1 = 5kg$
$M_2 = 2kg$
$V_f = 2\frac{m}{s}$
$V_i = 0\frac{m}{s}$
$h = \_\_ m$

$K_i^{\nearrow 0} + U_{gi} = K_f + U_{gf}^{\nearrow 0}$

$2M_2gh = \frac{1}{2}(M_1+M_2)V_f^2$

$h = \frac{(M_1+M_2)V_f^2}{2M_2g}$

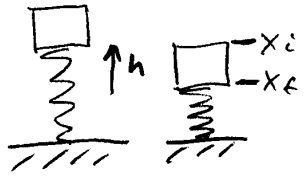
$= \frac{(5kg+2kg)(2\frac{m}{s})^2}{2(2kg)(9.8\frac{m}{s^2})}$

$\boxed{h = 0,714m}$

To do #1 using E. conservation:

$\frac{1}{2}\cancel{M}V_i^{2\,\nearrow 0} + mgh_i + \frac{1}{2}\cancel{k}x_i^{2\,\nearrow 0} = \frac{1}{2}\cancel{M}V_f^2 + \cancel{mg}h_f^{\nearrow 0} + \frac{1}{2}kx_f^2 + E_{LOST}$

important!



$mgh_i = \frac{1}{2}kx_f^2 + Fd$

h and x are equal

$2mgx = \frac{1}{2}kx^2 + 2mg\frac{x}{2}$

$kx^2 = 2mgx - mgx$

$k = \frac{mg}{x}$

$= \frac{0,3kg(9.8\frac{m}{s^2})}{0,278m}$

$\boxed{k = 10,6\frac{N}{m}}$