1) $v_i = 30\ \frac{m}{s}$ $v_f = 5\ \frac{m}{s}$
$h_i = 0\ m$ $h_f = \_\_\ m$
$h_f = 40\ m$
$v_f = \_\_\ \frac{m}{s}$

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

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

$v_f = \sqrt{v_i^2 - 2gh}$

$= \sqrt{(30\ \frac{m}{s})^2 - 2(9.8\ \frac{m}{s^2})40\ m}$

a) $\boxed{v_f = 10.8\ \frac{m}{s}}$

OR $h_{top} = \frac{v_i^2}{2g}$

$= \frac{(30\ \frac{m}{s})^2}{2(9.8\ \frac{m}{s^2})}$

$h_{top} = 45.9\ m$

$h_f = \frac{2gh_{top} - v_f^2}{2g}$

$= \frac{2(9.8\ \frac{m}{s^2})(45.9\ m) - (5\ \frac{m}{s})^2}{2(9.8\ \frac{m}{s^2})}$

b) $\boxed{h_f = 44.6\ m}$

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

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

$h = \frac{v_i^2 - v_f^2}{2g}$

$= \frac{(30\ \frac{m}{s})^2 - (5\ \frac{m}{s})^2}{2(9.8\ \frac{m}{s^2})}$

b) $\boxed{h_f = 44.6\ m}$

2) $h = 15\ m$
$\theta = 30^\circ$
$v_f = \_\_\ \frac{m}{s}$

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

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

$v_f = \sqrt{2gh}$

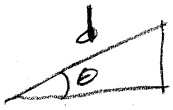
$= \sqrt{2(9.8\ \frac{m}{s^2})(15\ m)}$

a) $\boxed{v_f = 17.1\ m}$

$\mu_k = 0.2$
$v_f = \_\_\ \frac{m}{s}$

$h = d\sin\theta$

$d = \frac{h}{\sin\theta}$



$E_{LOST} = \mu_k F_N d$

$= \mu_k mg(\cos\theta)d$

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

$mgh = \frac{1}{2}mv_f^2 + \mu_k mg\frac{h}{\sin\theta}\cos\theta$

$v_f = \sqrt{2gh\left(1 - \frac{\mu_k}{\tan\theta}\right)}$

$= \sqrt{2(9.8\ \frac{m}{s^2})(15\ m)\left(1 - \frac{0.2}{\tan 30^\circ}\right)}$

b) $\boxed{v_f = 13.9\ \frac{m}{s}}$

3) $m = 0.35\,kg$
$\Delta x = 0.25\,m$
$k = 150\,\frac{N}{m}$
$\theta = 25°$
$d = \_\_\_\,m$

$\mu_k = 0.33$
$d = \_\_\_\,m$

$h = d\sin\theta$

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

$$\tfrac{1}{2}kx^2 = 2mgh$$

$$kx^2 = 2mgd\sin\theta$$

$$d = \frac{kx^2}{2mg\sin\theta}$$

$$= \frac{150\,\frac{N}{m}(0.25\,m)^2}{2(0.35\,kg)(9.8\,\frac{m}{s^2})\sin 25°}$$

$$\boxed{d = 3.23\,m}$$

$E_L = \mu_k F_N d$
$= \mu_k mg\cos\theta\, d$

EC) $K_i + U_{gi} + U_{si} = K_f + U_{gf} + U_{sf} + E_{LOST}$

$$\tfrac{1}{2}kx^2 = 2mgd\sin\theta + 2\mu_k mgd(\cos\theta)$$

$$d = \frac{kx^2}{2mg(\sin\theta + \mu_k mg\cos\theta)}$$

$$= \frac{150\,\frac{N}{m}(0.25\,m)^2}{2(0.35\,kg)(9.8\,\frac{m}{s^2})(\sin 25° + 0.33(\cos 25°))}$$

$$\boxed{d = 1.89\,m}$$