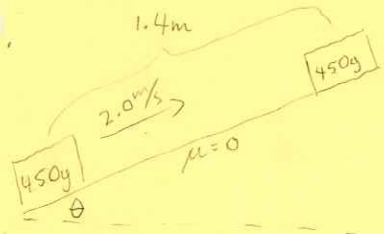
Work and Energy

1.



$W_{net} = \Delta E_k$

$W_g = E_k^{\nearrow 0} - E_{k0}$

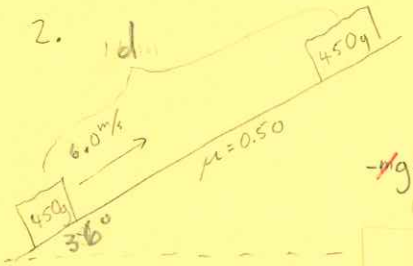
$\vec{F}_{g\parallel}\vec{d} = -\frac{1}{2}mv_0^2$

$-mg\sin\theta(1.4m) = -\frac{1}{2}m(2.0\,m/s)^2$

$\sin\theta = \frac{-\frac{1}{2}(2.0\,m/s)^2}{-g(1.4m)}$

$\theta = 8.4^\circ$

2.



$W_{net} = \Delta E_k$

$W_g + W_f = E_k^{\nearrow 0} - E_{k0}$

$\vec{F}_{g\parallel}\vec{d} + \vec{F}_{f\parallel 0}\vec{d} = -\frac{1}{2}mv_0^2$

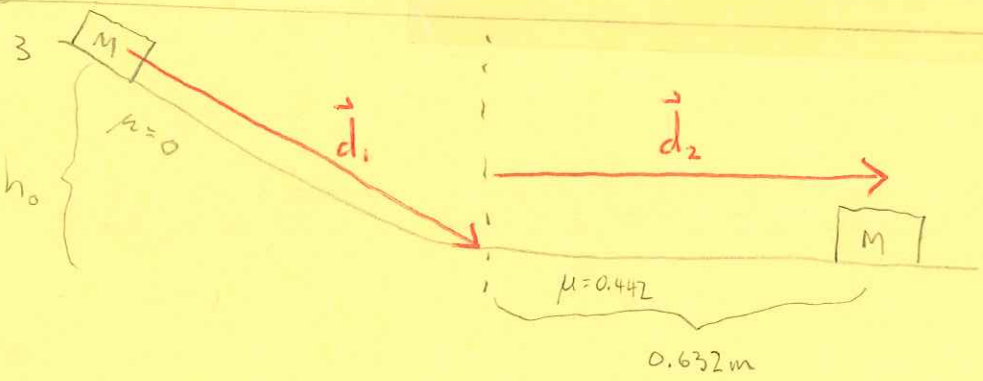
$-mg\sin\theta(d) - \mu(mg\cos\theta)(d) = -\frac{1}{2}mv_0^2$

$g\sin\theta(d) = \frac{1}{2}v_0^2 - \mu g\cos\theta(d)$

$d = \frac{\frac{1}{2}v_0^2}{(\mu g\cos\theta + g\sin\theta)} = 1.850989856\,m$

$= 1.9\,m$

3



$W_{net} = \Delta E_k$

$W_g + W_f = E_k^{\nearrow 0} - E_{k0}^{\nearrow 0}$

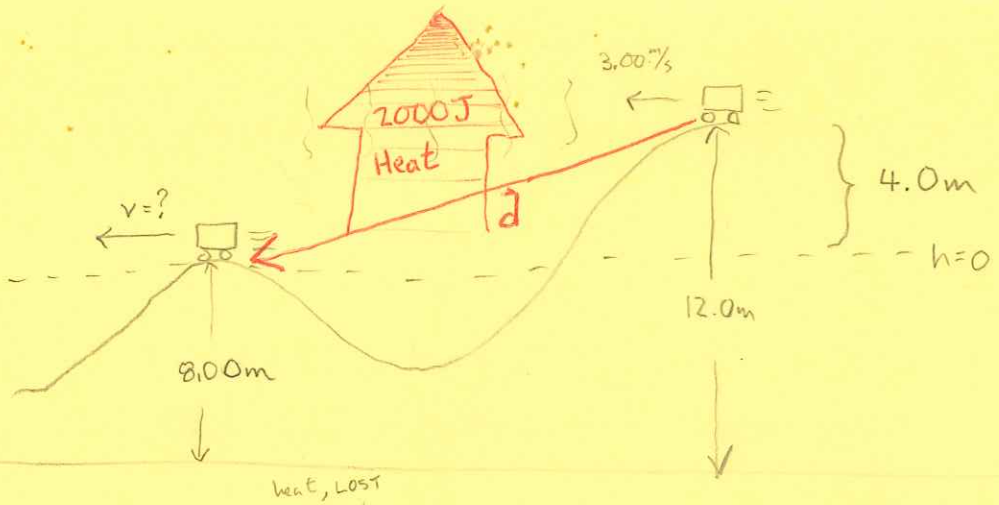
$\vec{F}_g\vec{d}_{1\parallel} + \vec{F}_{f\parallel}\vec{d}_2 = 0$

$mgh_0 + (-\mu mg)d_2 = 0$

$mgh_0 = \mu mgd_2$

$h_0 = \mu d_2 = 0.279\,m$

(4)



$W_{net} = \Delta E_K$ → $-2000\,J + \vec{F}_g \vec{d}_{\parallel} = \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2$

$W_f + W_g = E_K - E_{K0}$ → $-2000 + mg(4.0m) = \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2$

heat, LOST from system

Heat!

$-2000\,J + 250kg(9.8\,m/s^2)(4.0m) + \frac{1}{2}(250kg)(3.00\,m/s)^2 = \frac{1}{2}250kg\,v^2$

$v = 8.4\,m/s$

(5)

$80\frac{km}{h} \times \left(\frac{1000m}{km}\right) \times \left(\frac{1h}{60min}\right) \times \left(\frac{1min}{60s}\right)$

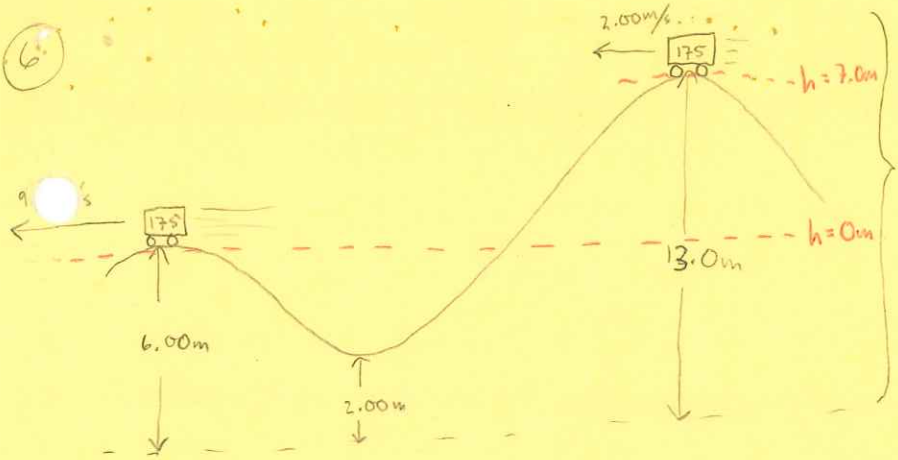
$= 22.2\,m/s$

$W_{net} = \Delta E_K$ → $-9650J + W_E + \vec{F}_g \vec{d} = \frac{1}{2}mv^2$

$W_f + W_E + W_g = E_K - E_{K0}$ ($E_{K0} \to 0$) → $-9650J + W_E + (-mg\sin 11°)(500m) = \frac{1}{2}m(22.2)^2$

$W_E = 1.9 \times 10^6\,J$

(6)



$$\sum W_{nc} = \Delta K + \Delta U$$

$$\sum W_{nc} = K - K_0 + \cancel{U}^{0} - U_0$$

$$\sum W_{nc} = \tfrac{1}{2}mv^2 - \tfrac{1}{2}mv_0^2 - mgh_0 \quad (h_0 = 7.0\,m)$$

$$\sum W_{nc} = -5045.285\ J$$

5050 J lost

(7) Same diagram as above! This time we are given "lost energy" this can be thought of as "work by friction and other resistive forces"

$$\sum W_{nc} = \Delta K + \Delta U$$

$$-2005\ J = K - K_0 + \cancel{U}^{0} - U_0$$

VERY IMPORTANT!

$$\tfrac{1}{2}mv^2 = -2005 + \tfrac{1}{2}mv_0^2 + mgh_0 = 10\,350\ J$$

$$v = 10.87592361\ m/s$$

$v = 10.9\ m/s$