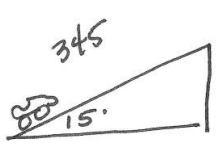
PROBLEM SET 2 ENERGY

① $v_2^2 = v_1^2 + 2gd$

$d = \frac{v_2^2 - v_1^2}{2g} = \frac{0 - (8000 m/s)^2}{2(-9.8 m/s^2)} = \boxed{3.27 \times 10^6 m}$

② $KE = \frac{1}{2}mv^2$ $KE' = \frac{1}{2}mv'^2$ $KE' = \frac{1}{2}m(2v)^2 = 4\frac{1}{2}mv^2$ $\boxed{4x}$

③ $KE_c = KE_T$ $\frac{1}{2}m_c v_c^2 = \frac{1}{2}m_T v_T^2$ $\frac{1}{2}(1500)(30)^2 = \frac{1}{2}(4500)v_T^2$ $\boxed{v_T = 17.3 m/s}$

④ 

$PE = mgh = (2000)(9.8)(345)(\sin 15) = 1.75 \times 10^6 J$

$PE \rightarrow KE$ $KE = \frac{1}{2}mv^2$ $1.75 \times 10^6 J = \frac{1}{2}(2000)v^2$ $\boxed{v = 41.8 m/s}$

⑤ 

$W = F \cdot d$ $KE = \frac{1}{2}mv^2$ $F \cdot d = \frac{1}{2}mv^2$

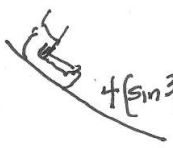
$(350)(.7) = \frac{1}{2}(.1)v^2$

$v = 70 m/s$

$d_x = v_x t = (70 m/s)(.553 s) = \boxed{38.7 m}$

$d_y = v_{y_i} t + \frac{1}{2}gt^2$

$t = \sqrt{\frac{2d}{g}} = \sqrt{\frac{2(1.5m)}{9.8}} = .553 sec$

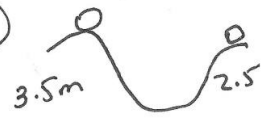
⑥ 

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

$4(\sin 35)(75)(9.8) = \frac{1}{2}(75)(6)^2 + Loss$

$1686 = 1350 + Loss$

$Loss = 336$ $\frac{336}{1686} \times 100\% = \boxed{20\%}$

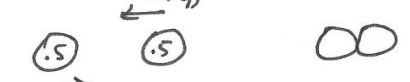
⑦ 

$KE_1 + PE_1 = KE_2 + PE_2$

$\frac{1}{2}mv_1^2 + mgh_1 = \frac{1}{2}mv^2 + mgh_2$

$\frac{1}{2}(0) + (9.8)(3.5) = \frac{1}{2}v^2 + (9.8)(2.5)$

$\boxed{v = 4.42 m/s}$

⑧ 

Ⓐ 

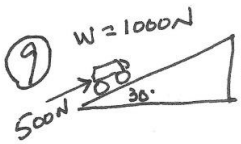
$m_1v_1 + m_2v_2 = (m_1 + m_2)v'_{1+2}$ $\boxed{v'_{1+2} = 1.5 m/s}$

$(.5)(5) + (.5)(-2) = (.5 + .5)v'_{1+2}$

Ⓑ $KE = \frac{1}{2}mv_1^2 + \frac{1}{2}mv_2^2 = \frac{1}{2}(.5)(5)^2 + \frac{1}{2}(.5)(-2)^2 = 7.25 J$

$KE = \frac{1}{2}(m_1 + m_2)v_{1+2}^2 = \frac{1}{2}(.5 + .5)(1.5)^2 = \frac{1.125 J}{6.125}$

$\boxed{Loss = 6.12 J}$

⑨ 

Ⓐ $W = F \cdot d = 500N\left(\frac{1.5}{\sin 30}\right) = \boxed{1500 J}$

Ⓑ $\Delta P = mg\Delta h = (1000N)(1.5m) = \boxed{1500 J}$

Ⓒ $EFF = \frac{WORK}{PE} \times 100\% = \frac{1500 J}{1500 J} \times 100\% = \boxed{100\%}$