Reminders 10-06-10:

-I Won't be Here Friday.

-Turn in "Work" Worksheet Today

-Quiz Today on Work and Conservation of Energy

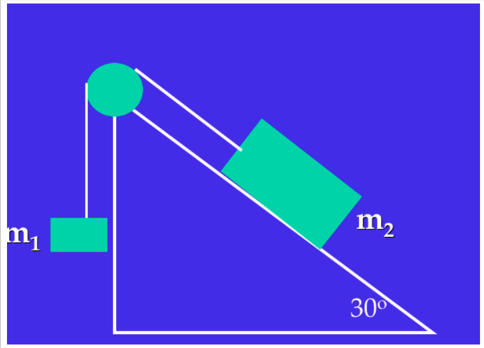
-Exam 2 Ch 4-6 Mon. Oct. 18

Objectives:

-Conservation of Energy

-Conservative and Non-Conservative Forces

-Quiz



$$\Delta KE + \Delta PE = 0$$

$$\frac{1}{2}(m_1+m_2)v_f^2 + m_1 g x - m_2 g x \sin 30 = 0$$

$$\frac{1}{2}(m_1+m_2)v_f^2 = m_2 g x \sin 30 - m_1 g x$$

$$\frac{1}{2}(m_1+m_2)\,v_f^2 = g x\,(m_2 \sin 30 - m_1)$$

$$v_f^2 = \frac{2x\,g(m_2 \sin 30 - m_1)}{m_1+m_2}$$

$$v_f = \sqrt{2x\left[\frac{g(m_2 \sin 30 - m_1)}{m_1+m_2}\right]}$$

* from Kinematics we can see

$$a = \frac{(m_2 \sin 30 - m_1)g}{m_1+m_2}$$

$$v_f = \sqrt{\frac{2(1.25\,m)[5 \sin 30 - 2]\,kg\,(9.80\,\frac{m}{s^2})}{7.0\,kg}}$$

$$= 1.32\ m/s$$

Consider the track sport of the high jump. Assuming a running start of 10m/s and a maximum standing vertical jump of 60cm, estimate the maximum height that can be achieved in the high jump.

Convert all KE into P.E.

$$\frac{1}{2} m v^2 = m g H$$

$$H = \frac{v^2}{2g} = \frac{100 \frac{m^2}{s^2}}{2\left(9.80 \frac{m}{s^2}\right)} = \underline{5.10\,m}$$

$$H_{TOTAL} = 5.10\,m + 0.6\,m = 5.70\,m$$

Because high jumper rotates body then we need to add 1.0m to H_{TOTAL}

Max height = $\underline{6.70\,m}$

Close to Pole vault record. Rod increase the efficiency of converting KE_i to PE.

Forces that conserve mechanical energy, W_c

Conservative forces

work done in closed path $= 0$

Forces that don't conserve mechanical energy, W_{nc}

Non-conservative forces

Work done in closed path $\neq 0$

$$W_{net} = \Delta KE$$

$$W_c + W_{NC} = \Delta KE$$

$$W_c = -\Delta PE$$

$$-\Delta PE + W_{NC} = \Delta KE$$

$$\boxed{W_{NC} = \Delta KE + \Delta PE}$$

$$W_{nc} = KE_f - KE_i + PE_f - PE_I$$

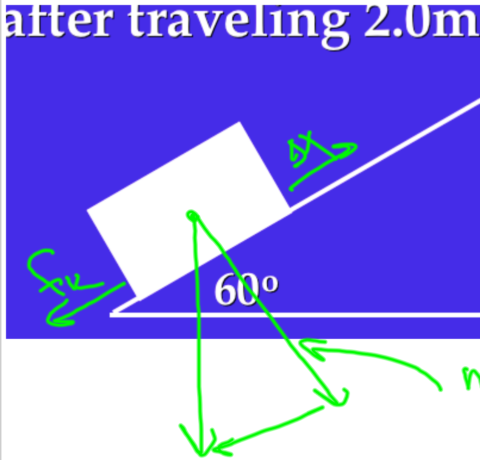
$$= KE_f + PE_f - (KE_i + PE_i)$$

$$W_{nc} = TE_f - TE_i$$

$$\uparrow$$

$$= \Delta TE$$

Title: Oct 6-1:04 PM (5 of 8)



$W_f = \mu_k N \Delta x \cos 180$

$W_f = \mu_k (mg \cos 60) \Delta x \cos 180$

$= (.3)(2.0\,kg)(9.80\,\frac{m}{s^2})(\cos 60^\circ)\,2.0\,m$

$= -5.9\,J$ going uphill

$W_{f_{downhill}} = -5.9\,J$

$W_{closed} = -5.9\,J + -5.9\,J = -11.8\,J$

Non conservative force

- Two railroad cars, each of mass 6500 traveling at 95km/hr, collide head-o and come to rest. How much energy lost? where does it go? Hint:You mu consider both cars.

Energy lost is $E_f - E_i$

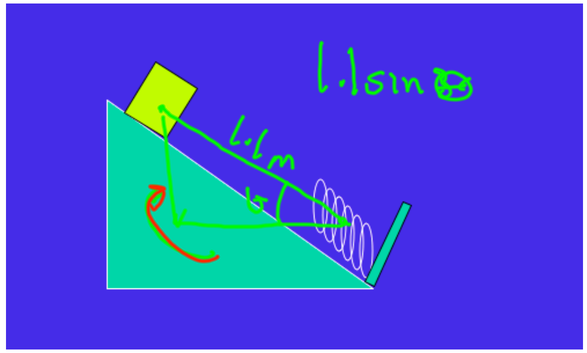
$$\Delta E = 0 - \frac{1}{2} m_1 v_{1i}^2 - \frac{1}{2} m_2 v_{2i}^2$$

$$\Delta E = -\frac{1}{2}(m_1 + m_2) v_i^2$$

$$= -\frac{1}{2}(6500\,kg + 6500\,kg)\left(95 \frac{km}{hr} \cdot \frac{1000\, m/km}{3600\, s/hr}\right)^2$$

$$= -4.5 \times 10^6\, J$$

Energy lost is $\underline{4.5 \times 10^6\, J}$



$N = mg\cos\theta$

$$W_{nc} = \Delta KE + \Delta PE$$

$$\mu_k N(1.1m)\cos 180° = \frac{1}{2}mv_f^2 - mg(1.1\sin\theta) + \frac{1}{2}k(0.1)^2$$

$$-\mu_k mg\cos\theta\,(1.1m) = \frac{1}{2}mv_f^2 - mg(1.1\sin\theta) + \frac{1}{2}k(.1)^2$$

$$-\mu_k mg\cos\theta\,(1.1) + mg(1.1\sin\theta) - \frac{1}{2}k(.1)^2 = \frac{1}{2}mv_f^2$$

$$v_f = \sqrt{\frac{-\mu_k mg\cos\theta(1.1) + mg(1.1\sin\theta) - \frac{1}{2}k(.1)^2}{\frac{1}{2}m}}$$

$k = 100\,N/m \quad m = 1\,kg \quad \theta = 30°$

$$= \underline{2.46\,m/s}$$