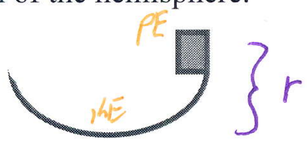
Level I Key Pd 1

# WORK & ENERGY

### AT WORK AND ENERGY (12)

Directions: Solve the following problems. Each is worth 5 points. Show all work and circle your answer.

1) A block is at rest on the upper edge of a hemisphere of radius 0.5 m. The block is released to slide down the side of the hemisphere. Determine the speed of the block at the bottom of the hemisphere.




$PE = KE$

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

$gh = \frac{1}{2}v^2$

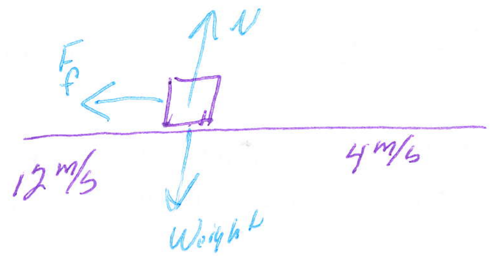
$h = r$

$gr = \frac{1}{2}v^2$

$\sqrt{2gr} = v$

$\sqrt{(2)(9.8\,m/s^2)(.5\,m)} = v = 3.13\ m/s$

2) Determine the coefficient of friction for a 14 kg cart that was initially sliding along at 12 m/s and slows to a speed of 4 m/s after sliding a distance of 8 m.




$\Sigma F_y = N - W = 0$

$N = W$

$N = mg$

$W = \Delta KE$

$F_f = \mu N$

$-Fx = KE - KE_o$

$F_f = \mu mg$

negative Work; Slowing; KE Being "Lost"

$-Fx = \frac{1}{2}mv^2 - \frac{1}{2}mv_o^2$

$-\mu mgx = \frac{1}{2}m(v^2 - v_o^2)$

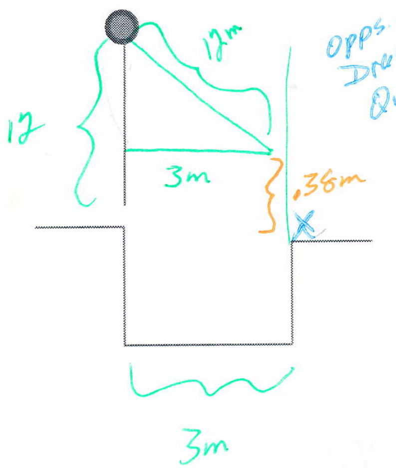
$-\mu = \frac{(v^2 - v_o^2)}{2gx}$

$\mu = \frac{-(v^2 - v_o^2)}{2gx} = \frac{-((4\,m/s)^2 - (12\,m/s)^2)}{2(9.8\,m/s^2)(8\,m)}$

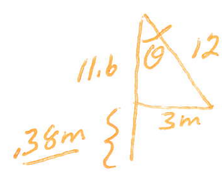
~~$\mu = 1.63$~~ ~~(Wow!!)~~

$\mu = .815$

3) There is a ravine that is 3 m wide. Both sides of the ravine are at the same height. A rope 12 m long rope hangs from the near side of the ravine, directly aligned with the leading edge. Determine how fast a person would need to run, grab the rope and swing across the ravine?




Opps... I Didn't Draw the Rope Quite Right... The End of the Rope Should Be About point "x"




$\theta = \sin^{-1}\left(\frac{3m}{12m}\right)$

$\theta = 14°$

then

$(12m)(\cos(14°)) = 11.6m$

which means the person gains .38m of height.

$PE = KE$

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

$gh = \frac{1}{2}v^2$

$\sqrt{2gh} = v$

$\sqrt{(2)(9.8 m/s^2)(.38m)} = v = 2.73 m/s$

4) A biker can roll down a level road at 20 mi/hr while generating 0.25 hp. Knowing there are 746 W=1hp, determine the total resistive force acting on the biker at 20mi/hr.

$P = \frac{W}{t} = \frac{Fx}{t} = Fv$

($\frac{x}{t}$ → $v$)

$P = Fv$

$\frac{P}{v} = F = \frac{186.5W}{8.89 m/s} = 20.9N$

Conversions

$\left(\frac{20 mi}{hr}\right)\left(\frac{1600m}{1mi}\right)\left(\frac{1hr}{3600s}\right) = 8.89 m/s = 20 mi/hr$

$(.25 h.p.)\left(\frac{746W}{1 h.p.}\right) = 186.5 W$

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5) Determine the ideal force exerted by a simple machine where 343 N are applied to the machine for a distance of 0.5 m, and the output of the machine moves a distance of 0.002m.

$IMA = \frac{.5m}{.002m} = 250$

MA Is A Force Multiplier...

$(343N)(250) = 85,750N$

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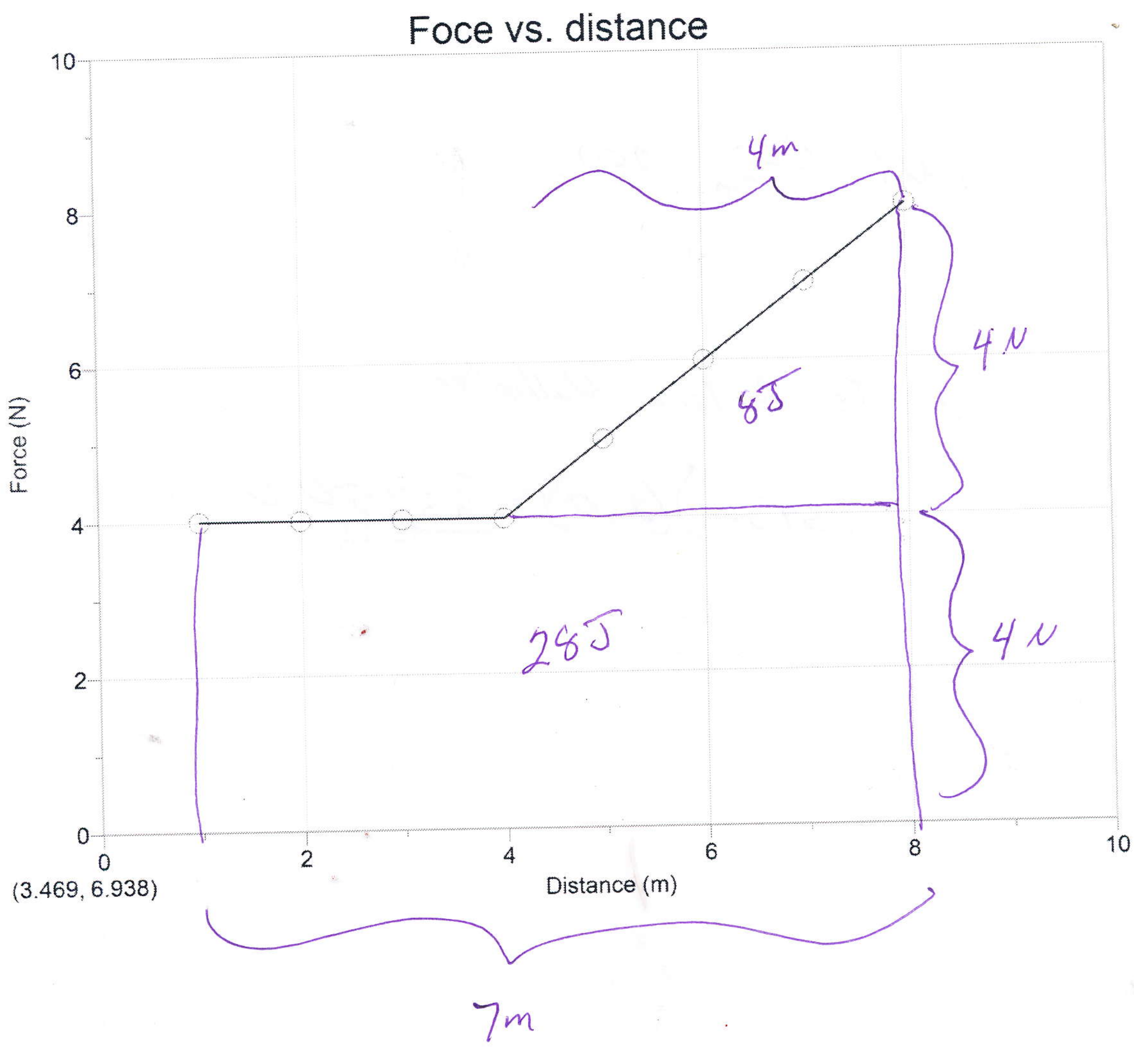
6) Determine the work done in the graph below:




Total work = 36J