Work – Energy Theorem

1. Explain how (+) and (-) work applies to the work – energy theorem.

+W ⇒ increasing energy

-W ⇒ decreasing energy

2. A 50.0 kg sled is sitting still on a flat snowy field. you grab the rope attached to the sled and pull with a constant 50.0 N force directed at 60.0° above horizontal for 20.0 meters. The force of friction acting on the sled is 20.0N.

a) How much work did you do pulling the sled?

$W = Fd\cos\theta = 50N(20m)\cos 60°$

$W_{you} = 5.00\times10^{2}$ J

B) How much work was done by friction?

$W = Fd\cos\theta = 20N(20m)\cos 180°$

$W_f = -4.00\times10^{2}$ J

c) What was the net work done on the sled?

$W_{net} = W_{you} + W_f$

$W_{NET} = 1.00\times10^{2}$ J

d) What was the final E_k of the sled?

$W_{net} = \Sigma E_f - \Sigma E_i$

$E_k = 1.00\times10^{2}$ J

e) What is the final velocity of the sled?

$\Sigma E = \frac{1}{2}mv^2$

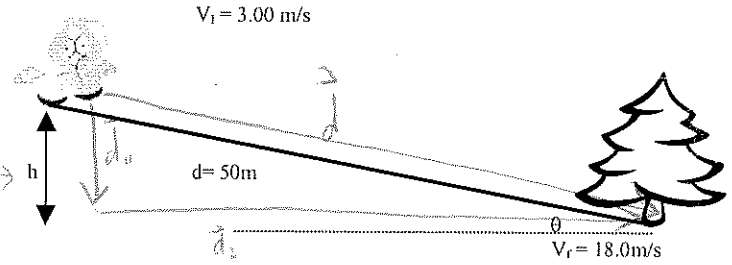
$V_f = 2.00$ m/s

3. Kenny (60.0kg) snowboards over the crest of a hill at 3.00m/s. He hoes straight down slope a distance of 50.0m and hits a tree moving at 18.0m/s (that's Kenny moving at 18m/s, not the tree). The force of friction acting on Kenny's board was 75.0N. Calculate:

a) Kenny's initial KE at the top of the hill.

$\Sigma E_i = \frac{1}{2}mv_i^2$

$KE_I = 2.70\times10^{2}$ J



b) Kenny's final KE just before hitting the tree.

$\Sigma E_f = \frac{1}{2}mv_f^2$

$KE_f = 9720$ J

c) The net work done on Kenny (before he hits the tree).

$W_{net} = \Delta\Sigma E$

$W_{NET} = 9450$ J

d) The work done on Kenny by friction.

$W_F = Fd\cos\theta = 75N(50m)\cos 180°$

$W_f = -3750$ J

e) The work done on Kenny by gravity.

$W_{net} = W_g + W_F$

$W_g = 13,200$ J

f) Find the height of the hill

$W_g = F_g d_y = mgh$; $(d_y = h)$

h= 22.4 m

g) Find θ.

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

$\theta = \sin^{-1}\left(\frac{h}{d}\right)$

θ= 26.7 °