Name: KEY

Date:

Section C D F

The Masters School DOBBS
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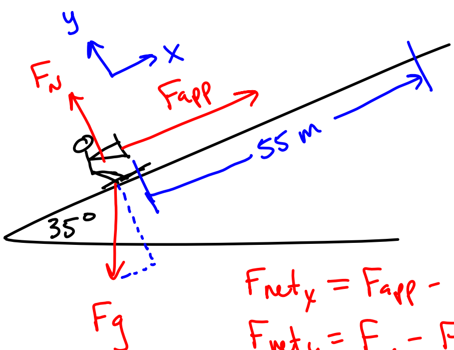
Physics

Work II

1. A skier of mass 70.0 kg is pulled up a slope by a motor-driven cable. How much work is required to pull the skier 55.0 m up a 35° slope (assumed to be frictionless) at a constant speed of 2.0 m/s?

$F_{net} = 0$



$W_{cable} = F_{app} \cdot d \cdot \cos\theta$

$W_{cable} = 309.5 \cdot 55 \cdot (\cos 0°)$

$\boxed{W_{cable} = 17{,}021\ J}$

$F_{net_x} = F_{app} - F_{g_x} = 0$

$F_{net_y} = F_N - F_{g_y} = 0$

$F_{app} = F_{g_x} = mg\sin\theta = 309.5\ N$

2. A 0.65 kg rubber ball has a speed of 2.0 m/s at point *A* and kinetic energy of 7.0 J at point *B*.
   a. Determine the ball's kinetic energy at *A*.
   b. Determine the ball's speed at *B*.
   c. Determine the total work done on the ball as it moves from *A* to *B*.

a) $KE_A = \frac{1}{2} m v_A^2$

$KE_A = \frac{1}{2}(.65)(2)^2$

$\boxed{KE_A = 1.3\ J}$

b) $KE_B = 7.0\ J$

$7.0 = \frac{1}{2} m v_B^2$

$\boxed{4.64\ m/s = V_B}$

c) $W = \Delta KE$

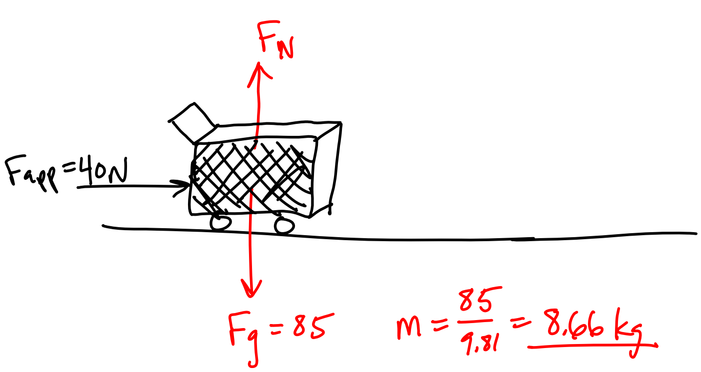
$= KE_f - KE_i$

$= 7 - 1.3$

$\boxed{W = 5.7\ J}$

3. An 85.0 N grocery cart is pushed 11.0 m along an aisle by a shopper who exerts a constant horizontal force of 40.0 N. If all frictional forces are neglected and the cart starts from rest, what is the grocery cart's final speed?

$V_i = 0$



$m = \frac{85}{9.81} = 8.66\ kg$

① $W = F d \cos\theta$

$W = F_{app} \cdot d \cdot (\cos 0°)$

$W = 40 \cdot 11 \cdot (1)$

$\boxed{W = 440\ J}$

② $W = \Delta KE$

$440 J = KE_f - \cancel{KE_i}$ 0

$440 J = \frac{1}{2} m v_f^2$

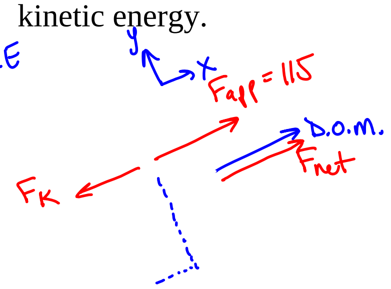
$440 = (.5)(8.66) V_f^2$

$\boxed{V_f = 10.08\ m/s}$

4. A 70.0 N box of clothes is pulled 21.0 m up a 30.0° ramp by a force of 115 N that points along the ramp. If the coefficient of kinetic friction between the box and ramp is 0.22, calculate the change in the box's kinetic energy.

F_g d F_{app}

$W = \Delta KE$



$$\boxed{\begin{array}{l}\text{Find } W = F_{net}\, d \cos\theta, \\ \text{Then } W = \Delta KE\end{array}}$$

1) $F_N = F_{gy} = mg\cos\theta$
$= 70 \cos 30$
$= 60.62\ N$

2) $F_K = \mu_K F_N = (.22)(60.62) = 13.34\ N$

3) $F_{net\,x} = F_{app} - F_K - F_{gx}$
$= 115 - 13.34 - 35$

$$\boxed{F_{net\,x} = 66.66\ N}$$

$= mg$

$F_{net\,x} = F_{app} - F_{gx} - F_K$

$F_{net\,y} = F_N - F_{gy} = 0$

$F_g = 70$

$F_{gx} = 70 \sin\theta = 35\ N$

$F_{gy} = 70 \cos\theta = 60.62\ N$

4) $W = F_{net}\, d \cos\theta$

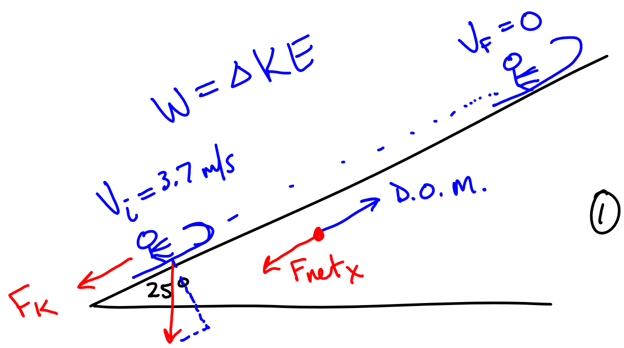
$W = (66.66)(21)(\cos 0°)$

b/c D.O.M in same direction as Fnet

$$\boxed{W_{net} = 1400\ J = \Delta KE}$$

5. In a circus performance, a monkey on a sled is given an initial speed of 3.7 m/s up a 25° incline. The combined mass of the monkey and the sled is 23.0 kg, and the coefficient of kinetic friction between the sled and the incline is 0.20. By the time the monkey comes to rest, how far up the incline does the sled move?

$W = \Delta KE$



$F_g = mg$

$F_g = (23)(9.81)$

$F_g = 226\ N$

$$\boxed{\begin{array}{l}\text{Find } W = \Delta KE \\ \text{Then } W = F d\cos\theta\end{array}}$$

$F_{net\,x} = -F_{gx} - F_K$

$F_{net,y} = F_N - F_{gy} = 0$

$F_N = F_{gy} = mg\cos\theta$

$F_N = 204.5\ N$

$F_K = \mu_K F_N = (.2)(204.5)$

$F_K = 40.9\ N$

$F_{net\,x} = -F_{gx} - F_K$

$F_{net\,x} = -mg\sin\theta - F_K$

$$\boxed{F_{net\,x} = -136.3\ N}$$

1 $\Delta KE = \cancel{KE_f}^{\,0} - KE_i$

$\Delta KE = \cancel{\tfrac{1}{2} m v_f^2} - \tfrac{1}{2} m v_i^2$

$\Delta KE = -\tfrac{1}{2} m v_i^2$

$\Delta KE = -\tfrac{1}{2}(23)(3.7)^2$

$$\boxed{\Delta KE = -157.4\ J}$$

2 $W_{net} = F_{net}\, d\cos\theta$

$-157.4 = F_{net}\, d(\cos 180)$

b/c Fnet x is in the opposite direction to D.O.M.

$-157.4 = (-136.3)\, d$

$$\boxed{1.155 = d}$$