Work - recap!

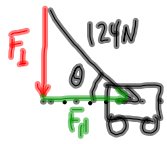
$W = F_{\parallel} \Delta d$ (when the force is in the same dir as the motion)

$W = F \Delta d \cos\theta$ (when the force is not in the same dir as the motion)

W is the area under a F-d graph.

From HW (PP/235)

18.



$\Delta d = 77.0\,m \rightarrow$

$W = 7314\,J$

or $W = F_{\parallel} \Delta d$

$F_{\parallel} = \frac{W}{\Delta d}$

$F_{\parallel} = \frac{7314\,J}{77.0\,m}$

$F_{\parallel} = 95.0\,N$

$\cos\theta = \frac{F_{\parallel}}{F}$

$\cos\theta = \frac{95.0\,N}{124.0\,N}$

$\theta = \cos^{-1}\left(\frac{95.0}{124.0}\right)$

$\theta = 40.0°$

$W = F \Delta d \cos\theta$

$\cos\theta = \frac{W}{F \Delta d}$

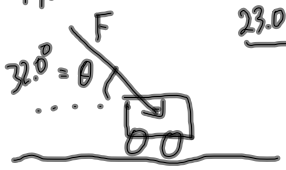
$\cos\theta = \frac{7314\,J}{(124\,N)(77.0\,m)}$

$\cos\theta = 0.766$

$\theta = \cos^{-1}(0.766)$

$\theta = 40.0°$

17.



$\Delta d = 23.0\,m \rightarrow$

$W = 2690\,J$

$\theta = 32.0°$

$W = F \Delta d \cos\theta$

$F = \frac{W}{\Delta d \cos\theta}$

$F = \frac{2690\,J}{(23.0\,m)(\cos 32.0°)}$

$F = 138\,N$

§6.2 Kinetic Energy + Work

Kinetic energy is the energy that a moving object has.

Kinetic energy is directly related to the object's mass.

Kinetic energy is proportional to the square of the velocity

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

where E_k is the kinetic energy (J) (scalar)

m is the mass (kg)

v is the velocity (m/s)

mp 237

$m = 0.200\ kg$

$v_1 = 0\ m/s$

$v_2 = 27.0\ m/s$

a) $E_{k_1} = ?$

b) $E_{k_2} = ?$

a) $E_{k_1} = \frac{1}{2}mv_1^2$

$E_{k_1} = \frac{1}{2}(0.200kg)(0)^2$

$\boxed{E_{k_1} = 0\ J}$ ← objects at rest have no KE.

b) $E_{k_2} = \frac{1}{2}mv_2^2$

$E_{k_2} = \frac{1}{2}(0.200kg)(27.0m/s)^2$

$\boxed{E_{k_2} = 72.9\ J}$

$kg \cdot \frac{m^2}{s^2}$

$= kg \cdot \frac{m}{s^2} \cdot m$

$= N \cdot m$

$= J$

Kinetic Energy & Work

Recall: $W = F_{\parallel} \Delta d$ $(F = ma)$

recall: $v_{ave} = \frac{\Delta d}{\Delta t}$, $\Delta d = v_{ave} \Delta t$

$W = ma\Delta d$

$W = m\left(\frac{\Delta v}{\Delta t}\right)(v_{ave}\Delta t)$

$W = m(\Delta v)(v_{ave})$

$W = m(v_2 - v_1)\left(\frac{v_1 + v_2}{2}\right)$

$W = \frac{1}{2}m(v_2 - v_1)(v_1 + v_2)$

$W = \frac{1}{2}m\left(v_1v_2 + v_2^2 - v_1^2 - v_1v_2\right)$

$W = \frac{1}{2}m\left(v_2^2 - v_1^2\right)$

$W = \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2$

$W = E_{k2} - E_{k1}$

$\boxed{W = \Delta E_k}$

WORK-ENERGY THEOREM

The work done on an object is equal to its change in Kinetic Energy.

increase in E_k => + work

decrease in E_k => - work.

no change in E_k => no work!

MP 12.2

$m = 2.5\ kg$

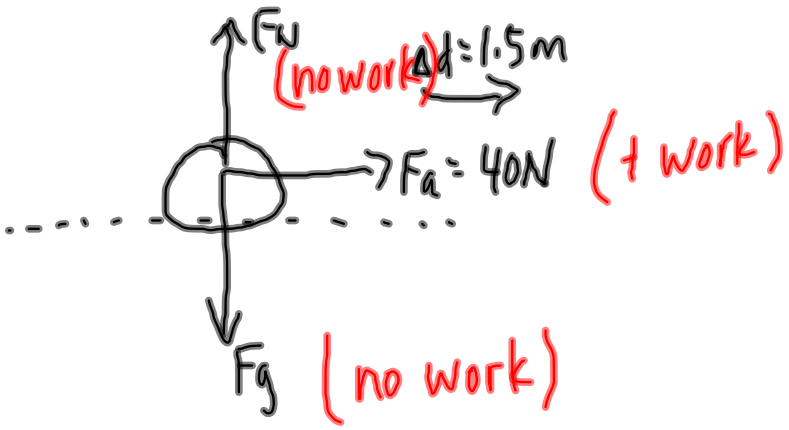
$F_a = 4.0 \times 10^1\ N$

$\Delta d = 1.5\ m$

$v_1 = 0\ m/s$

a) $W = ??$

b) $v_2 = ?$



a) $W = F_{||} \Delta d$

$W = (4.0 \times 10^1\ N)(1.5\ m)$

$W = 6.0 \times 10^1\ J$

b) $W = \Delta E_k$ (work-energy theorem)

$W = E_{k_2} - E_{k_1}$ ($E_{k_1} = 0$)

$W = \frac{1}{2} m v_2^2$

$\frac{2W}{m} = v_2^2$

$v_2^2 = \frac{2(6.0 \times 10^1\ J)}{2.5\ kg}$

$v_2 = 6.9\ m/s$

MP|244

$m = 75\,kg$

$v_1 = 8.0\,m/s$

$F_a = 2.00 \times 10^2\,N$ } W

$\Delta d = 5.0\,m$

$E_{k2} = ?$

$W = \Delta E_k$

$F_{//} \Delta d = \Delta E_k$

$F_{//} \Delta d = E_{k2} - E_{k1}$

$E_{k2} = F_{//} \Delta d + E_{k1}$

$E_{k2} = F_{//} \Delta d + \frac{1}{2} m v_1^2$

$E_{k2} = (2.00 \times 10^2\,N)(5.0\,m) + \frac{1}{2}(75\,kg)(8.0\,m/s)^2$

$E_{k2} = 1000\,J + 2400\,J$

new energy — work done — start with

$E_{k2} = 3.4 \times 10^3\,J$

TO DO

1. PP|238
2. PP|245-246
3. Assignment: p275|15-22 (DUE THURS)
4. Quiz (FRI)

#15 => Draw a FBD showing all forces + tell me which forces do +|-|no wor