Work

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

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

Max work when $\theta = 0^\circ$

No work when $\theta = 90^\circ$

Neg work $\theta = 180^\circ$

$F \cdot d \Rightarrow$ work is the area

§6.2 Kinetic Energy & Work-Energy Theorem

Any moving object has kinetic energy

$$E_k = \frac{1}{2} m v^2$$

where E_k is the kinetic energy (J)

m is the mass (kg)

v is the velocity (m/s)

UNITS: $1\,J = 1\,kg \cdot \frac{m^2}{s^2} = N \cdot m$

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) $E_{k_1} = 0$ (not moving)

b) $E_{k_2} = \frac{1}{2} m v_2^2$

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

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

Work + Kinetic Energy

$W = F_{//}\Delta d$ and $F_{//} = ma$

$W = ma\Delta d$

$W = m\left(\frac{\Delta V}{\Delta t}\right) V_{ave}\,\Delta t$

$W = m\left(\frac{V_2 - V_1}{\Delta t}\right)\left(\frac{V_1 + V_2}{2}\right)\Delta t$

$W = \frac{1}{2}m(V_2 - V_1)(V_1 + V_2)$

$W = \frac{1}{2}m(V_1V_2 + V_2^2 - V_1^2 - V_1V_2)$

$W = \frac{1}{2}m(V_2^2 - V_1^2)$

$W = \frac{1}{2}mV_2^2 - \frac{1}{2}mV_1^2$

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

$\boxed{W = \Delta E_k}$ ← Work-Energy Theorem

* Work must be done in order to change an objects' kinetic energy

+ work ⇒ increase in KE

- work ⇒ decrease in KE

MP 12.42

$m = 2.5\,kg$

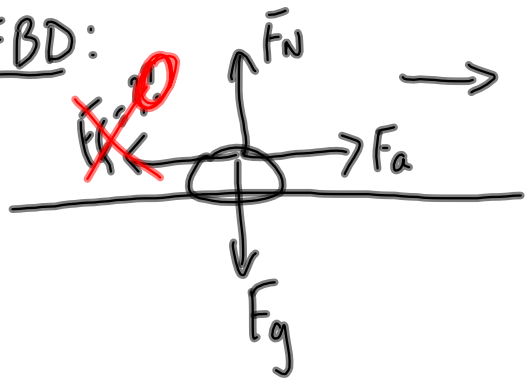
$F_a = 4.0 \times 10^1\,N$

$\Delta d = 1.5\,m$

a) $W = ?$

b) $v_2 = ?$ if $v_1 = 0$

FBD:



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

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

$\boxed{W = 6.0 \times 10^1\,J}$

b) Using the Work-Energy Theorem:

$W = \Delta E_k$

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

$W = E_{k_2}$

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

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

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

$\boxed{v_2 = 6.9\,m/s}$

MP|244

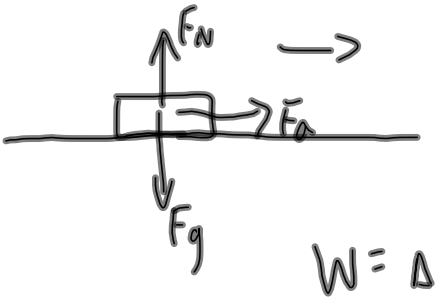
$m = 75\,kg$

$v_1 = 8.0\,m/s$

$F_a = 2.0 \times 10^2\,N$

$\Delta d = 5.0\,m$

$E_{k2} = ?$



$W = \Delta E_k$

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

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

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

$E_{k2} = (200N)(5.0m) + \frac{1}{2}(75kg)(8.0m/s)^2$

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

$E_{k2} = 3400J$

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

TO DO:

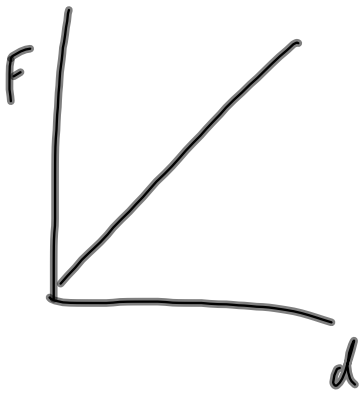
① PP|238

② PP|245-246

③ Assignment (due Wed)
p275|15-22

Note about #15 - a) Draw a FBD + name forces
b) Tell me which forces do positive/negative/zero work.

13.



12.