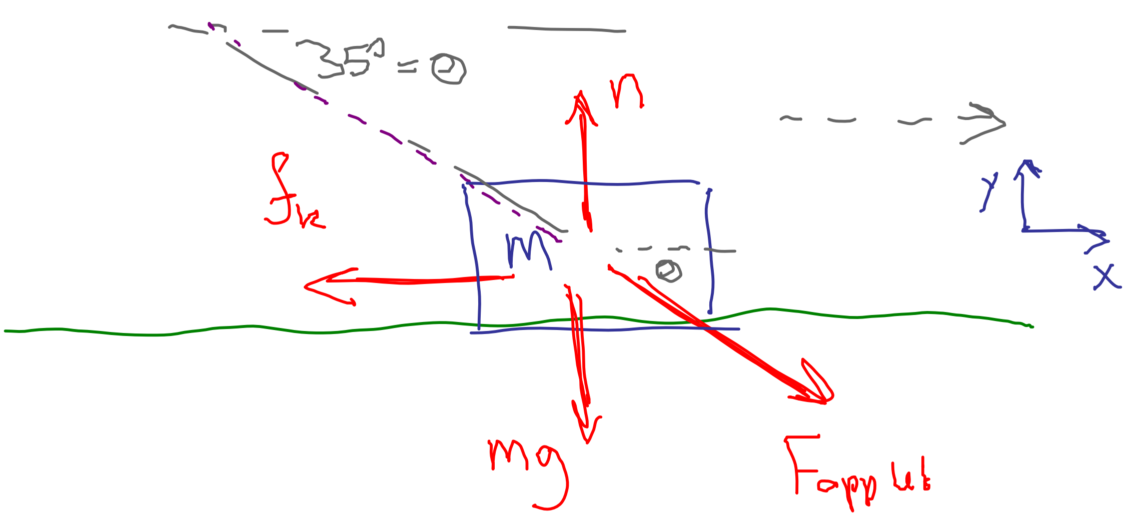
Phys 2110-4 10/5/11

Note Title 10/5/2011

5.44 Handle of 22 kg lawnmower makes a 35° angle w/ the horizontal. If coeff of friction between mower & ground is 0.68, what mag of force applied in dir of handle is required to push mower at constant velocity? (Compare w/ mower's wt.)

Const velocity



y dir :

$$n - mg - F_{app} \sin\theta = 0$$

$$n = mg + F_{app} \sin\theta$$

X dir :

$$-f_k + F_{app} \cos\theta = 0$$

Combine

$$F_{app}\cos\theta = f_k = \mu_k n = \mu_k(mg + F_{app}\sin\theta)$$

Solve for F_{app} Algebra

$$F_{app}(\cos\theta - \mu_k\sin\theta) = \mu_k mg$$

Plug in

$$F_{app} = \frac{\mu_k mg}{(\cos\theta - \mu_k\sin\theta)}$$

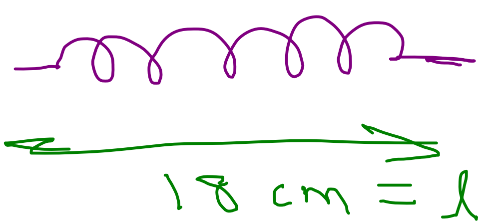
$$= 342\,N$$

$$= W \cdot \frac{\mu_k}{\cos\theta - \mu_k\sin\theta} = W(1.6)$$

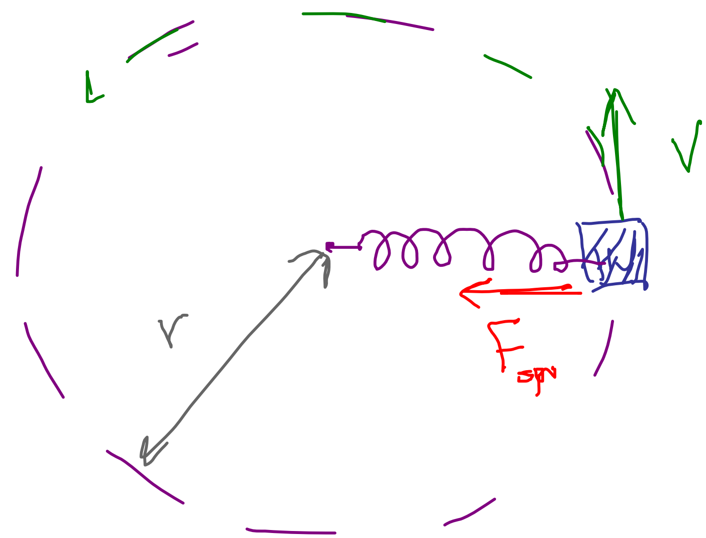
5.65 A 2.1 kg mass is connected to a spring with spr. constant $k = 150\ N/m$ & unstretched length 18 cm.

The two are mounted on a fric'less air table with the free end of the spring attached to a fric'less pivot. The mass is set into circ. motion at $1.4\ m/s$.

Find radius of the path.



$F = kx$ x = extension.



Spring is stretched, exerts force toward center

$$F_{spr} = F_c$$

$$F_c = F_{spr} = \frac{mv^2}{r}$$

$$\hookrightarrow k(\text{extension}) = k(r - \ell)$$

$$\frac{mv^2}{r} = k(r - \ell)$$

Solve for r

$$\frac{mv^2}{r} = k(r-l)$$

$$mv^2 = k(r^2 - lr) = kr^2 - klr$$

$$kr^2 - klr - mv^2 = 0$$

Solve this $\Longrightarrow$ $r = 0.28\,m$

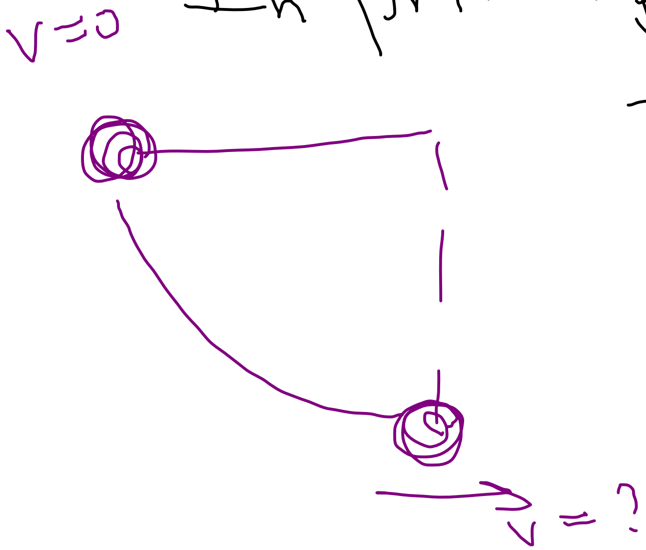
$= 28\,cm$

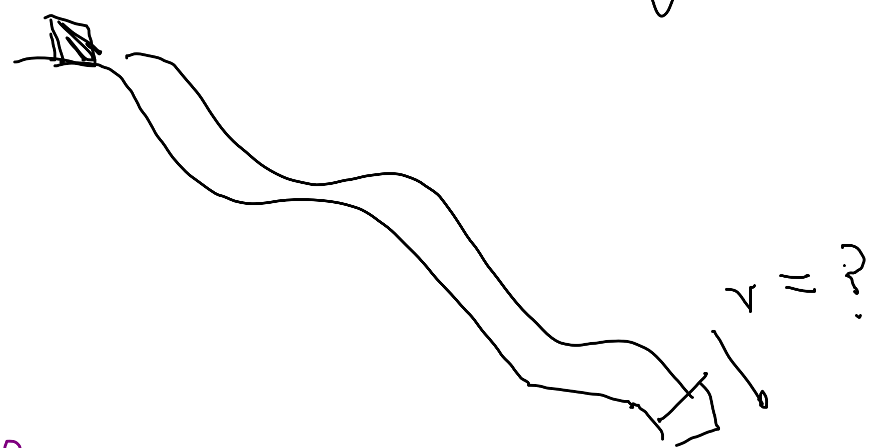
Chap 6

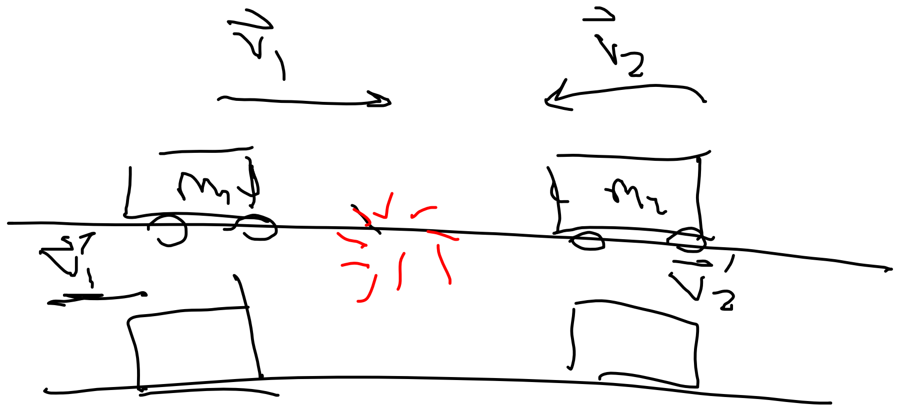
$$\boxed{\vec{F} = m\vec{a}}$$

$$\boxed{\vec{F}_{AB} = -\vec{F}_{BA}}$$

In principle that's enough.







What do we know about final velocities?

Theorems Energy Momentum

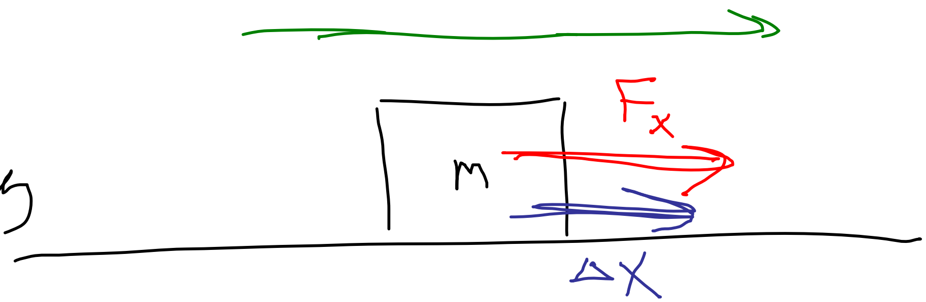
Ch 6 Work, Energy Kinetic Potential

Definitions, Theorems

Work

Work is done by a force $\vec{F}$ which acts on a mass which is moving.

Constant force F_x acts on mass moving in 1-D, through Δx

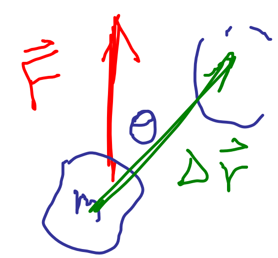


$$W = F_x \Delta x$$

Work is a number, a scalar.

Constant force $\vec{F}$, mass moves through displacement $\Delta \vec{r}$

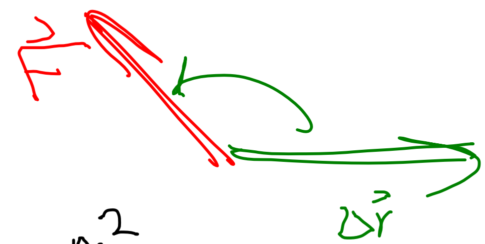
$$W = F|\Delta \vec{r}|\cos\theta = \vec{F} \cdot \Delta \vec{r}$$



$$W = \vec{F} \cdot \Delta\vec{r} = F\,|\Delta\vec{r}|\cos\theta$$

If $\theta < 90°$ W is pos

$\theta > 90°$ W is neg



Units? Units?

$$[W] = N \cdot m = \frac{kg\,m}{s^2} \cdot m = \frac{kg\,m^2}{s^2}$$

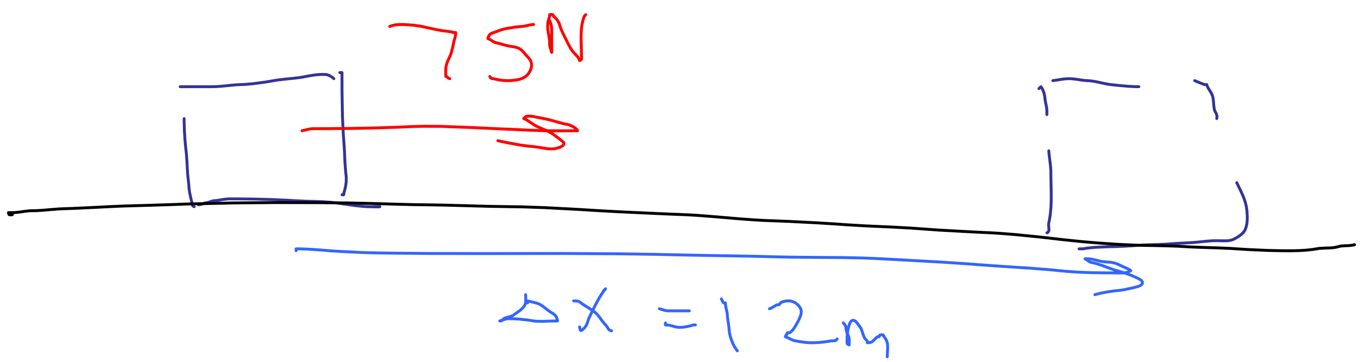
$$= 1 \text{ joule} = 1\,J$$

$1\,Btu = 1.054\,kJ$

Other units: $1\,erg = 1\,\frac{g \cdot cm^2}{s^2} = 10^{-7}\,J$

$1\,\text{calorie} = 4.184\,J$ $\quad$ $1\,eV = 1.602 \times 10^{-19}\,J$

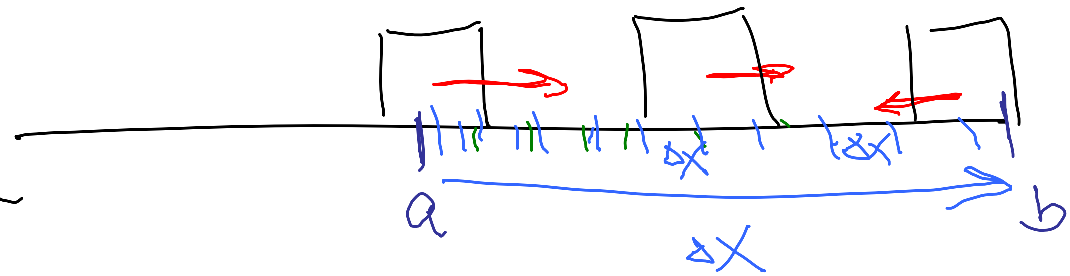
6.1 How much work do you do as you exert a 75-N force to push a shopping cart through a 12-m-long supermarket aisle?



$$W = F_x \Delta x = (75N)(12m) = 900 J$$

What if the force is not constant?

Add up a lot of little pieces of work



i^{th} piece: $F_i \Delta x_i = F(x_i^*) \Delta x_i$

$$\longrightarrow \int_a^b F(x)\,dx = W$$