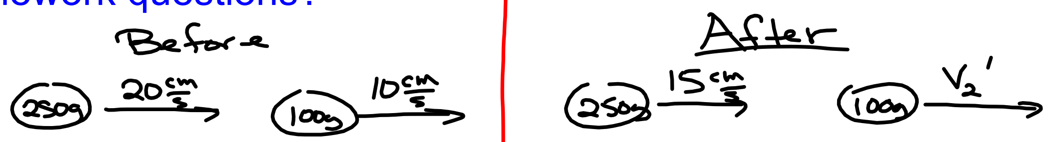
Homework questions?



$$\Sigma \vec{p} = \Sigma \vec{p}\,'$$

$$m_1 v_1 + m_2 v_2 = m_1 v_1' + m_2 v_2'$$

$$(250g)(+20\tfrac{cm}{s}) + (100g)(+10\tfrac{cm}{s}) = (250g)(+15\tfrac{cm}{s}) + (100g)v_2'$$

$$5000\ g\cdot\tfrac{cm}{s} + 1000\ g\cdot\tfrac{cm}{s} = +3750\ \tfrac{g\cdot cm}{s} + (100g)v_2'$$

$$+2250\ g\cdot\tfrac{cm}{s} = (100g)v_2'$$

a) $+22.5\ \frac{cm}{s} = v_2'$

b) $\vec{J}_1 = \cancel{\Sigma F \Delta t} = \Delta\vec{p}_1$ $(p_f - p_i)$

$= \Delta\vec{p}_1 = m_1 v_1' - m_1 v_1$

$= 250g(+15\frac{cm}{s} - {+20}\frac{cm}{s})$ $1\,N = 1\,kg\cdot\frac{m}{s}$

$= -1250\ g\cdot\frac{cm}{s}$

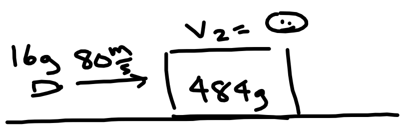
c) $+1250\ g\cdot\frac{cm}{s}$ (Newton's 3rd law)

$\vec{J}_2 = \Delta\vec{p}_2 = m_2(v_2' - v_2)$

$= 100g(+22.5\frac{cm}{s} - {+10}\frac{cm}{s})$

$= +1250\ g\cdot\frac{cm}{s}$

9.



$$\sum \vec{p} = \sum \vec{p}\,'$$

$$m_1v_1 + \cancel{m_2v_2} = (m_1+m_2)v'$$ (☺)

$$(16g)(80\tfrac{m}{s}) = (500g)v'$$

$$\frac{1280\, g\cdot\frac{m}{s}}{500g} = v'$$

$$+2.56\tfrac{m}{s} = v'$$

b) $\vec{J} = \Delta\vec{p}$

$= m(v'' - v')$

$= (0.50kg)(☺ - +2.56\tfrac{m}{s})$

$= -1.28\,\frac{kg\cdot m}{s}$

$= -1.28\ N\cdot s$

Introduction to Work and Energy

Energy: The ability to do work.

So what is work?

Five "experiments"	Work	No Work	
1. Holding textbook	18	1	No $\vec{d}$
2. Holding text, moving a const. speed	18	1	$\vec{d}$
3 Pushing text against the wall	19	☺	No $\vec{d}$
4. Lifting text	16	2	Only one in which work is done $\vec{d}$
5. Spinning mass in horizontal circle	14	4	1 $\vec{d}$

In order to do work, 3 things are required:

1. Force
2. Displacement
3. The force (or a component) must be in the same direction as the displacement

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

W: scalar (work)

$F_{\parallel}$: force parallel to $\vec{d}$

F and d: sizes of $\vec{F}$ and $\vec{d}$

$$W = \vec{F} \cdot \vec{d}$$

dot product or scalar product

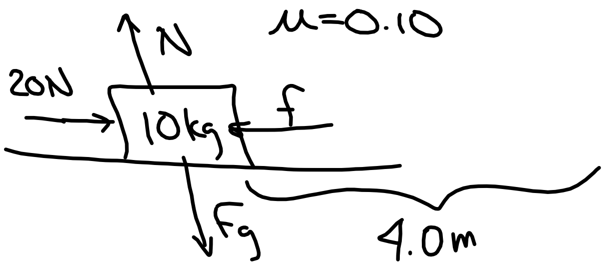
Example 1:

$\mu = $ ☺

$1 N \cdot m = 1 J$
(Joule)

$W = F_{\parallel} d$
$= (20N)(4.0m)$
$= 80 N \cdot m = 80 J$

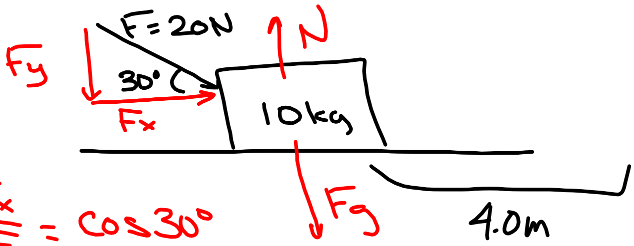
Example 2: Add friction



$W = F_{\parallel} d = 80 J$!

<u>But</u> some of the work done is lost to heat (because of friction)

Example 3: Pushing at an angle



$$\frac{F_x}{F} = \cos 30°$$

$$F_x = 20N \cos 30°$$
$$= 17.3N$$

$$W = F_{\parallel} d$$
$$= F_x d$$
$$= (17.3N)(4.0m)$$
$$= \underline{59.2 J}$$

Example 4: A box of mass 10 kg is pushed with a force of 30 N for 2.0 s. If the coefficient of friction is 0.20, how much work is done?

Homework: Work sheet #1-3