2A 10-8-12

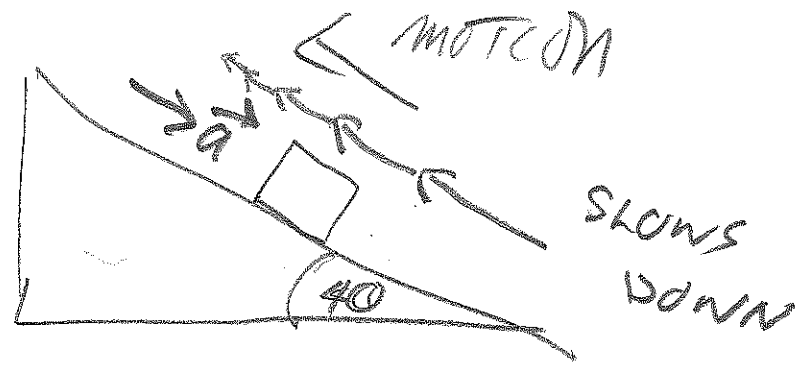
1

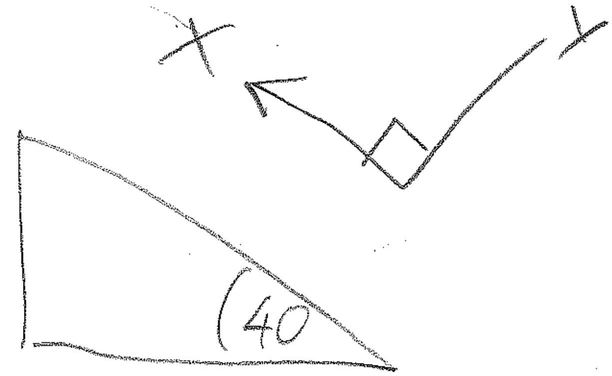
46 a

Test 2 review
Oct 26th 2012

motion

x (pos)





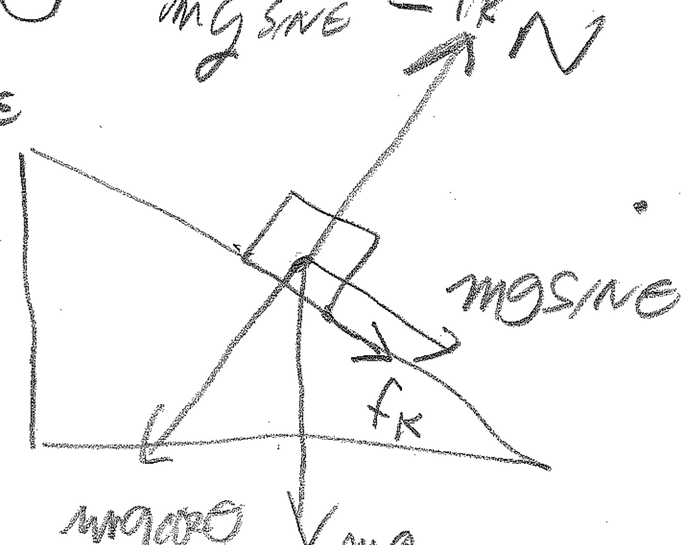
$\sum F_x = pos - neg$

$a_x = 0 \qquad ma_x = 0 - mg\sin\theta - f_k$

$\sum F_y = 0 = N - mg\cos\theta$

$ma_y = 0 = N - mg\cos\theta$

$N = mg\cos\theta$



$$\boxed{f_k = \mu_k \cdot N}$$

Law of kinetic friction

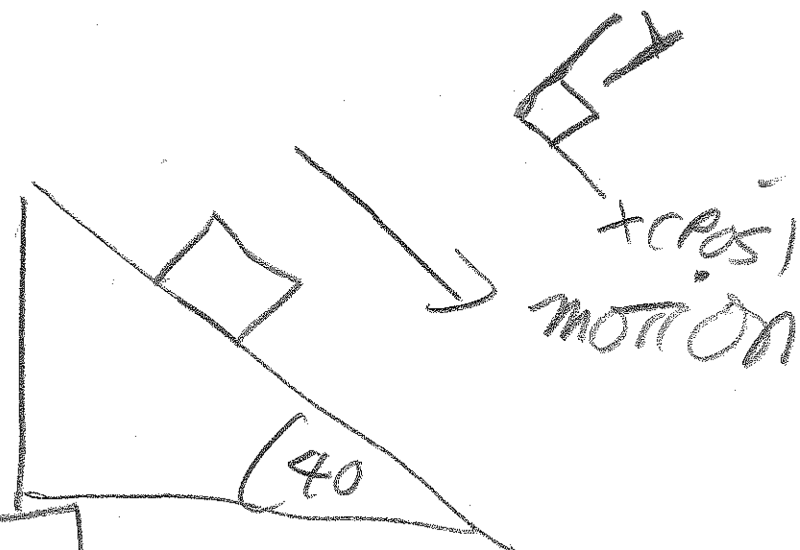
(46) – CH 5 $N = mg\cos\theta$

$ma_x = 0 = mg\sin\theta - \mu_k \cdot mg\cos\theta$

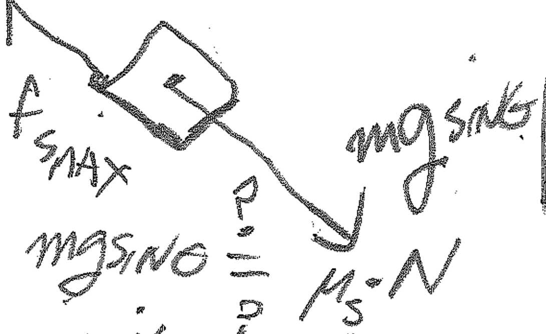
(a.) $\boxed{a_x = g\sin\theta - \mu_k g\cos\theta}$

PLUGIN #S: $\mu_k = 0.30$

(b.)



CHECK THE TOP: $v_x = 0$



$mg\sin\theta \overset{?}{=} \mu_s \cdot N$

$mg\sin\theta \overset{?}{=} f_{SMAX}$

$mg\sin\theta \overset{?}{=} \mu_s \cdot mg\cos\theta$

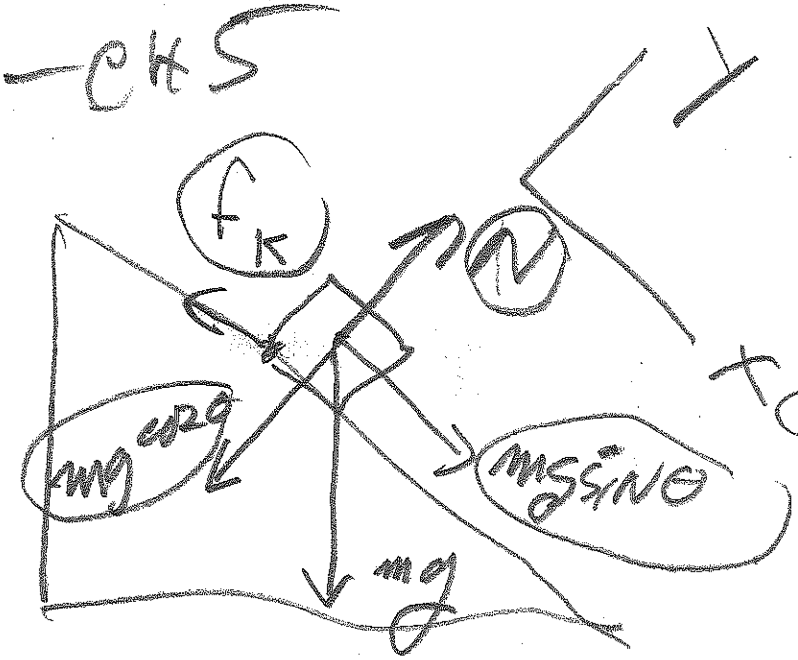
$6.299 \overset{?}{=} (0.4)(9.8)\cos 40 = 3$

check at top ← #46, ch5

$mg\sin\theta > \mu_s N = f_{s\,max}$?

Thus, it slides back down.

#46-ch5



→ motion

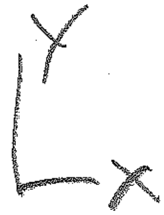
test 2 review

$\sum F_x = pos - neg$

$ma_x = mg\sin 40 - (0.3)mg\cos 40$

$a_x = g\sin 40 - (0.3)g\cos 40$

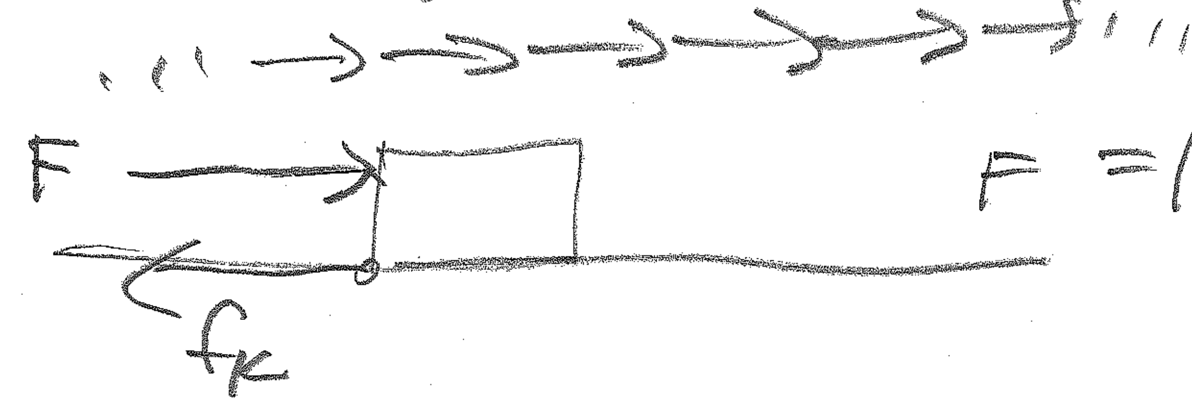
Plug in #5.



4 IMPLICATION

(3a) (a)

constant $\vec{V} \Rightarrow a_x = 0$

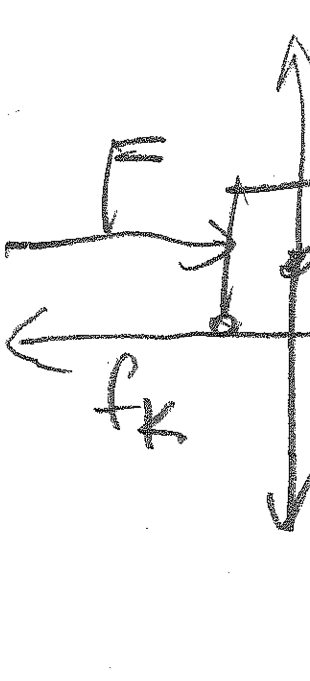


$F = |\vec{F}_{push}|$

$\sum F_x = pos - neg$

$ma_x = 0 = F - \mu_K \cdot N$

$F = \mu_K \cdot mg$



$\sum F_y = 0 = N - mg$

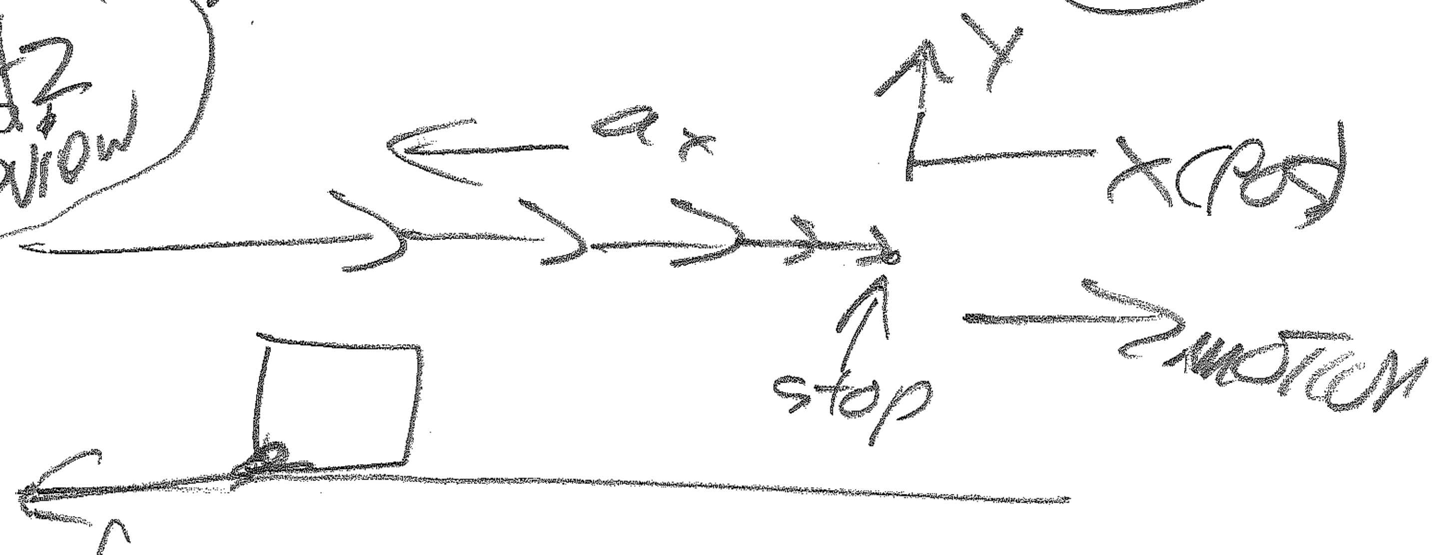
$mg = mg\cos 0 \Rightarrow N = mg$

$\cos 0 = 1$

$F = (0.2)(11.2)(9.8)\ (N)$

39(b) $\longleftrightarrow$ 46(a)

Test 2 Review



$$\sum F_x = ma_x = \text{pos} - \text{neg}$$

$$ma_x = 0 - f_k$$

$$ma_x = -f_k$$

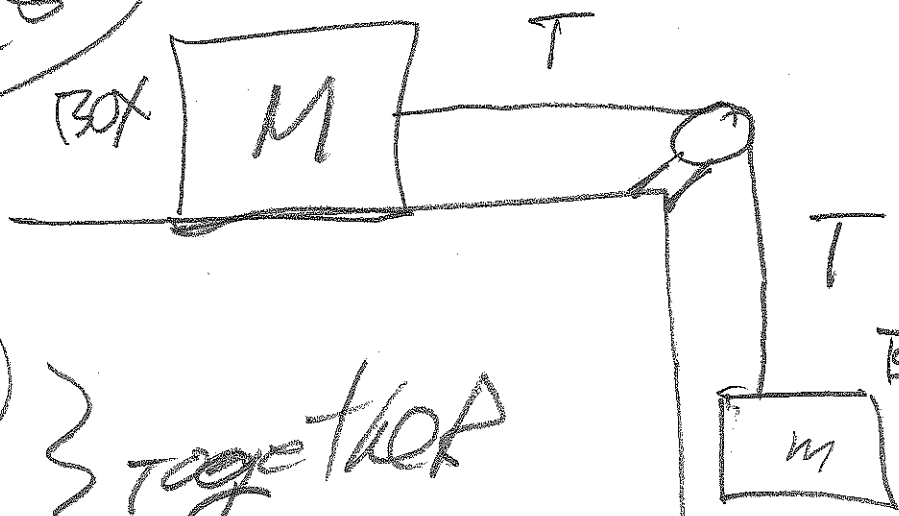
$$a_x = \frac{-f_k}{m}, \quad f_k = \mu \cdot N$$

Plug in formulae, and #5.

$Mg = 375\,(N) \Rightarrow M \approx$

$\rightarrow a > 0$

28



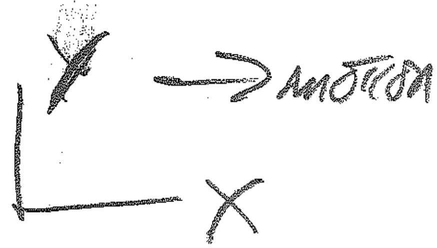
$m = 22.0$ kg

$\downarrow a > 0$

(a)
(b) } together

FIND

BOX

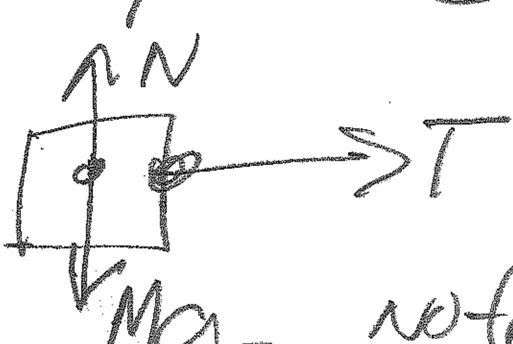


BUCKET

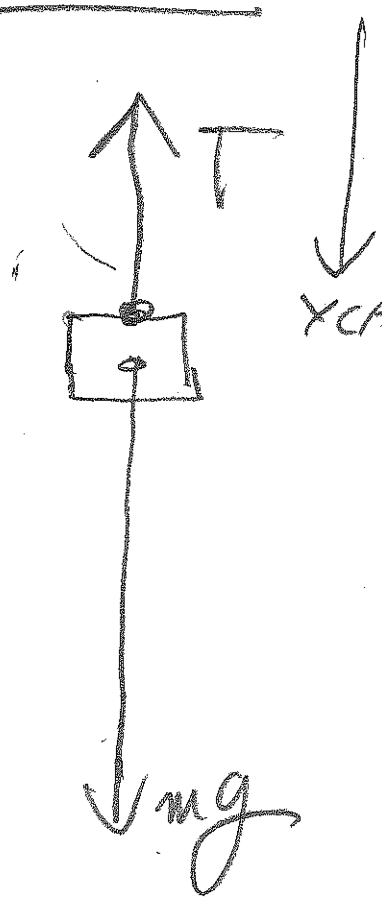
$\sum F_x = \cancel{\mu cos - mg}$

$Ma = T - 0$

not scale:



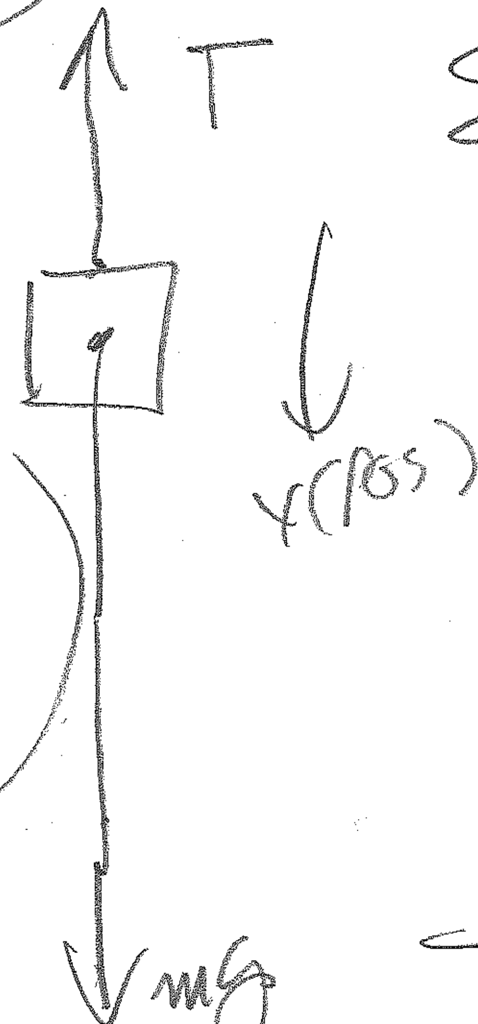
no friction



#38

CH5

Test2 review



$$\Sigma F_y = Pos - neg$$

$$ma = mg - T \quad \mathrm{II}$$

$$Ma = T \quad \mathrm{I}$$

ADD I + II TO ELIMINATE T.

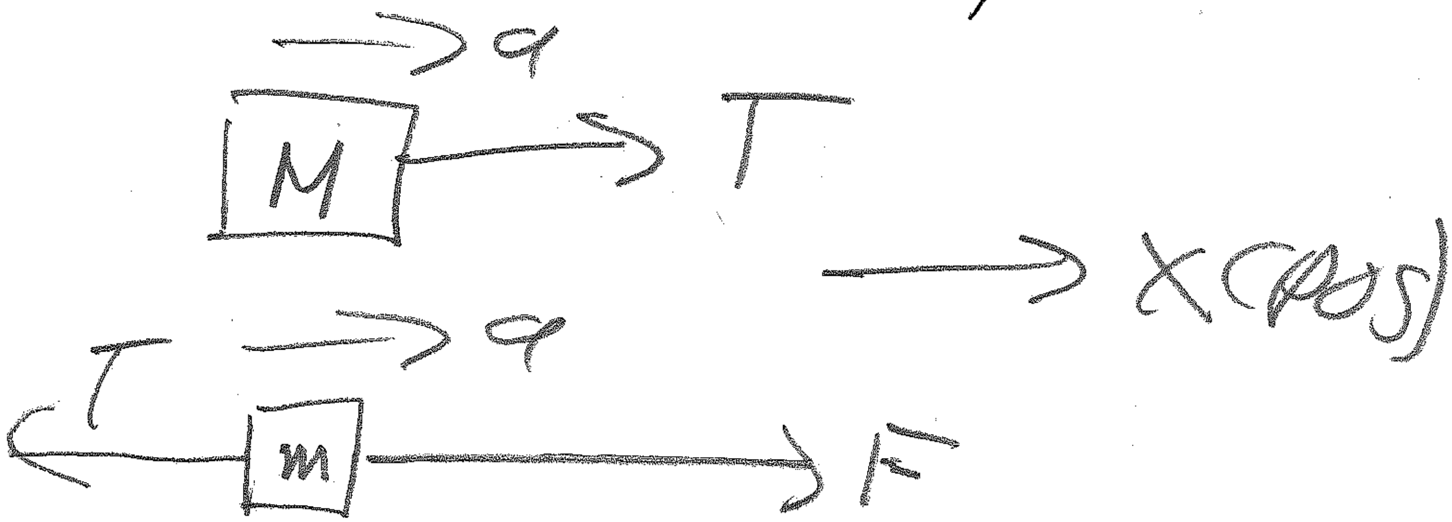
$$ma + Ma = mg$$

$$a = \frac{mg}{(m+M)} = \left(\frac{m}{m+M}\right)\cdot g$$

$\boxed{\text{SOLVE FOR } T \text{ ALSO.}}$

note:

no friction
(horizontal)

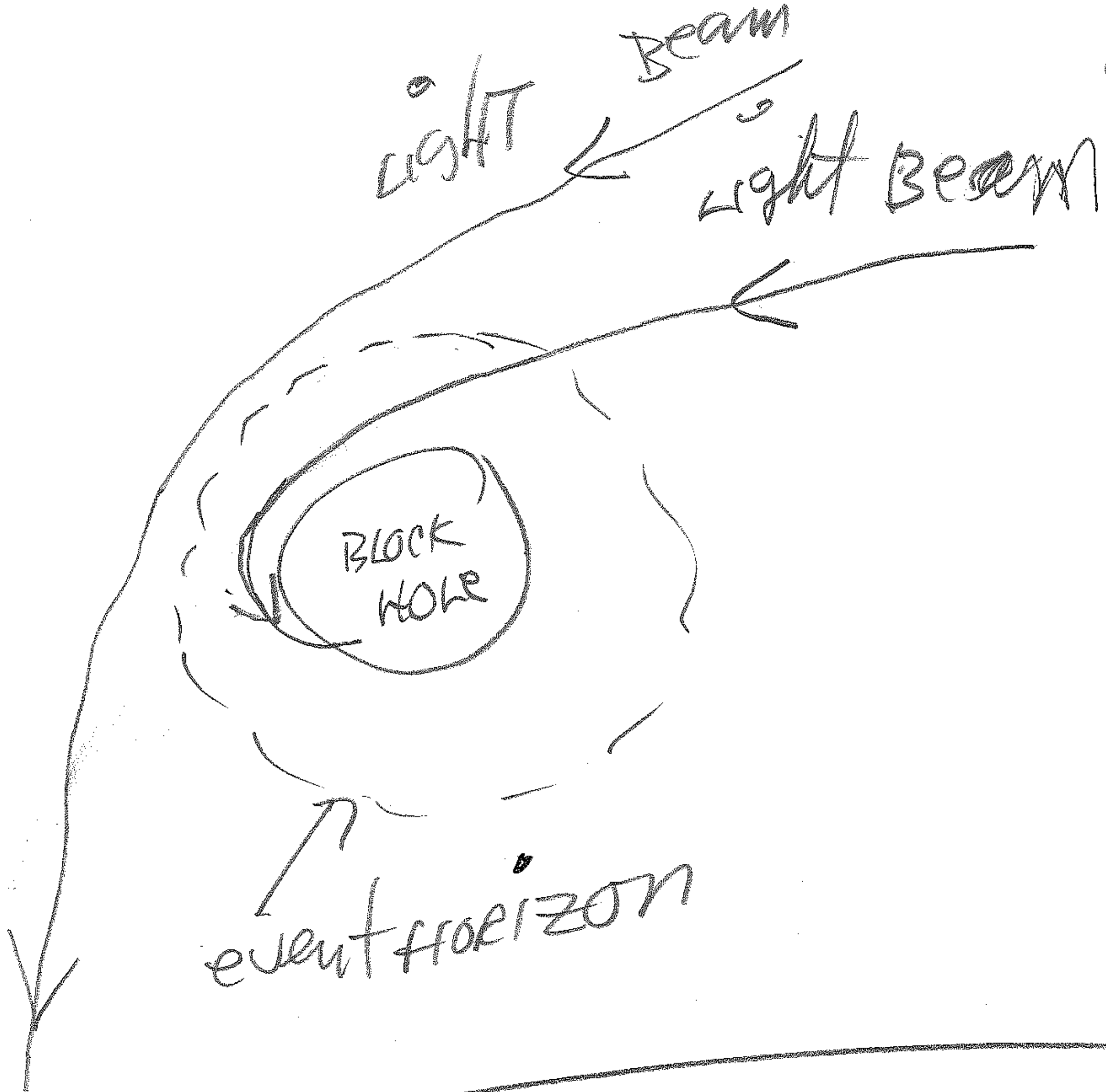


$$Ma = T$$

$$ma = F - T$$

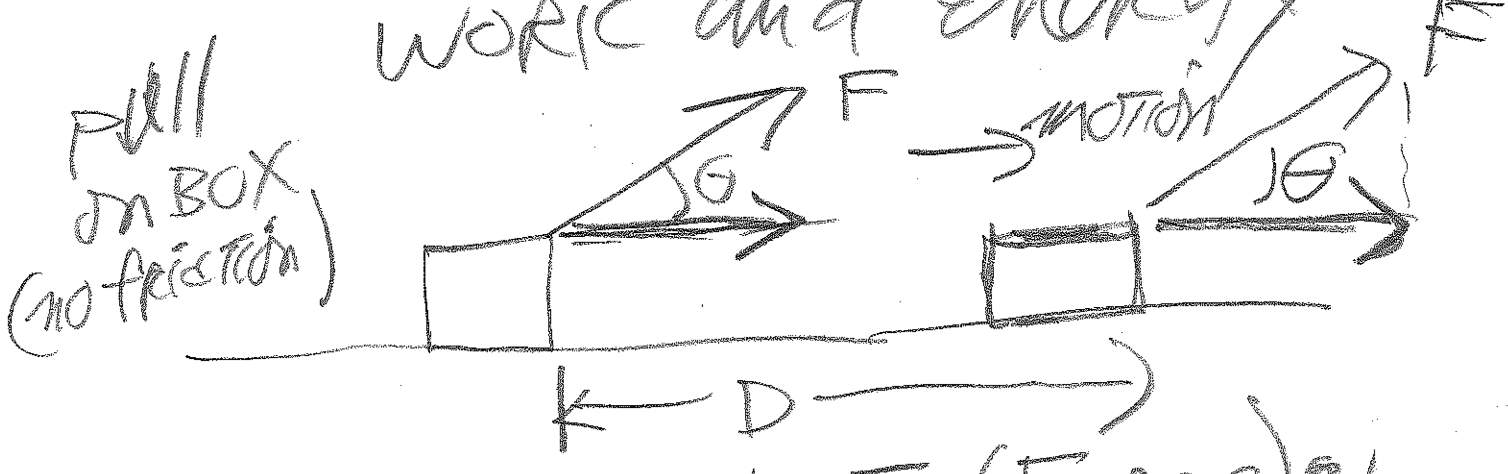
$$(m+M)a = F \Rightarrow a = \frac{F}{(m+M)}$$

(let $F = mg$)



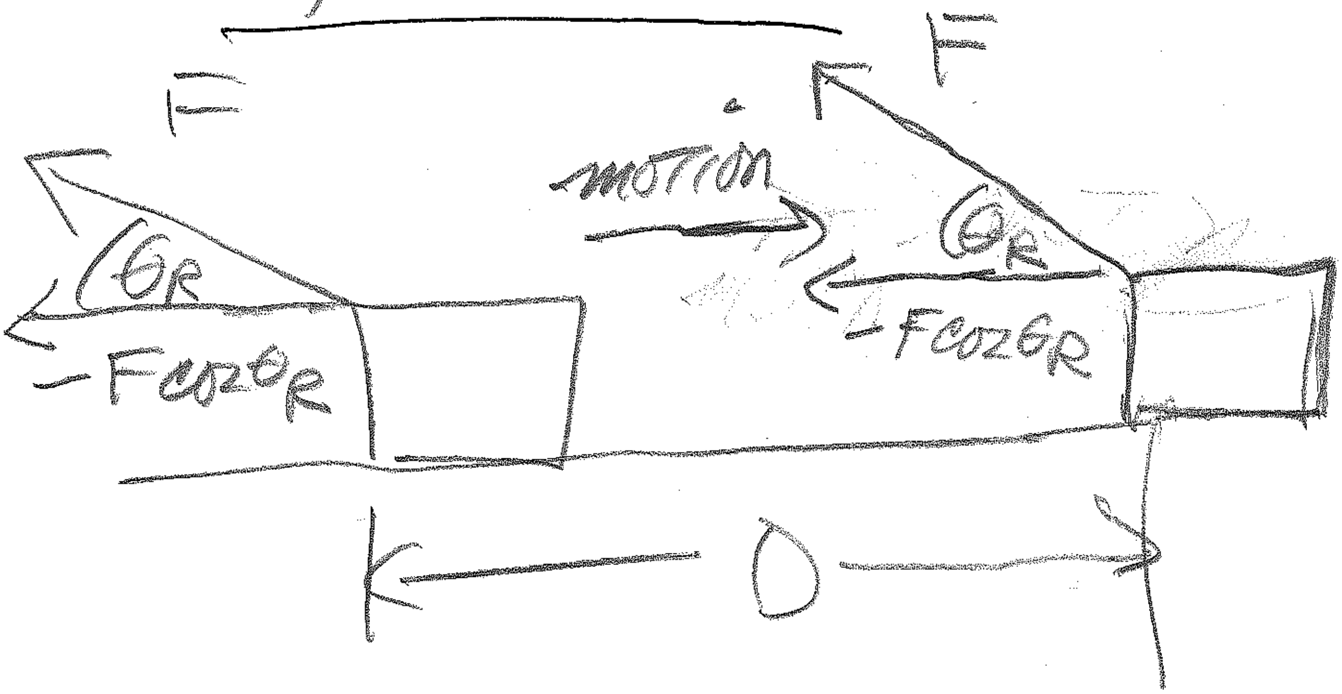
CH 7

WORK and ENERGY



$$\text{WORK} = (F\cos\theta)\cdot D$$

negative work

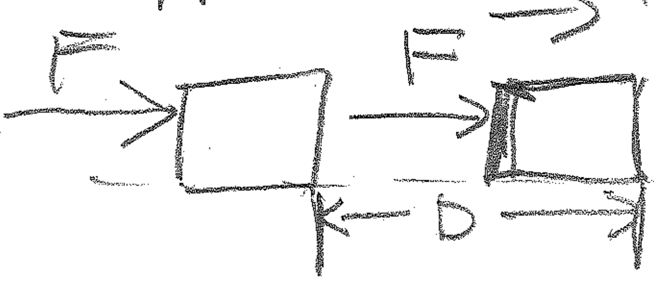


$$W = (-F\cos\theta_R)\cdot D < 0$$

$$0 < \theta_R < 90$$

ΔKE = Net work

PROOF:



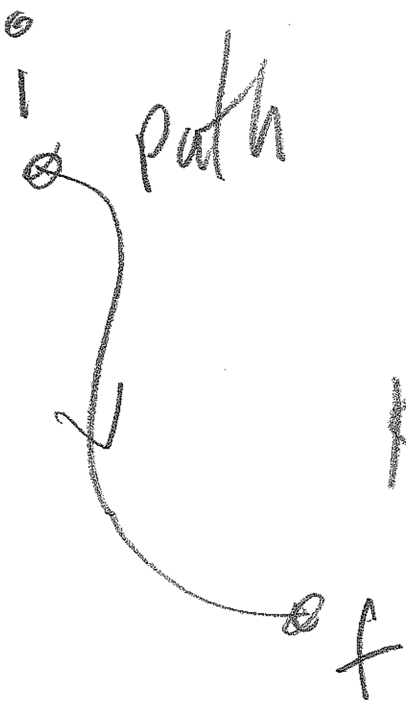
$$F\cdot D = \text{WORK}$$

$$ma\cdot D = \text{WORK}$$

$$m\left(\frac{v_f^2 - v_o^2}{2\cdot D}\right)\cdot D = \text{WORK}$$

re-arrange:

$$\frac{1}{2}mv_f^2 - \frac{1}{2}mv_0^2 = \text{work}$$



$$\Delta KE = \text{work}$$

KE = kinetic energy $= \frac{1}{2}m(\text{speed})^2$

<u>specific types of work.</u>

most useful: W_g and W_s

$\overline{W}_g$

i DROP a BALL

high

$\vec{F}$ = weight

$d = h$

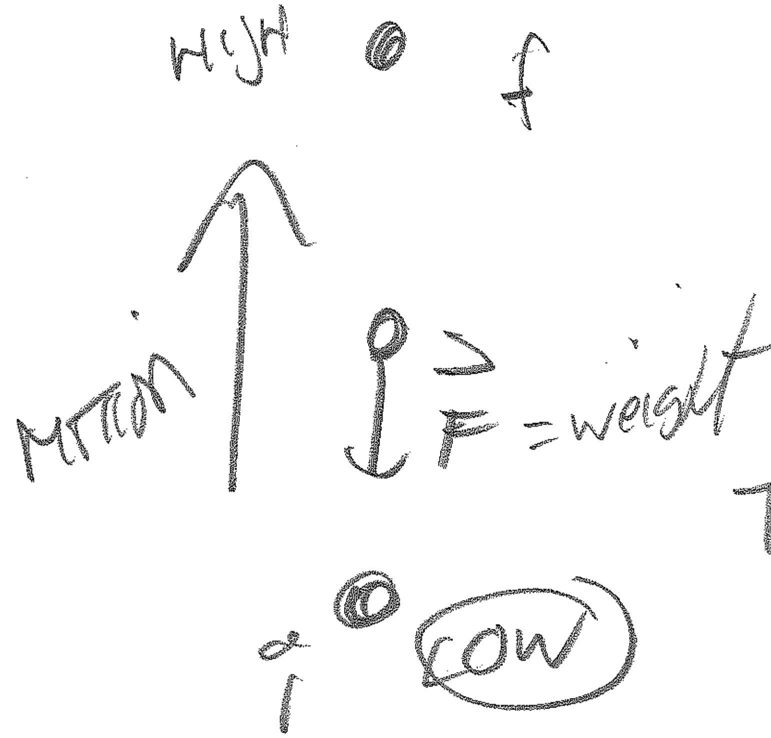
motion

low f

$$\overline{W}_g = F \cdot \cos \underline{0} \cdot d$$

$$= mg \cdot 1 \cdot h$$

$$\overline{W}_g = mgh > 0$$



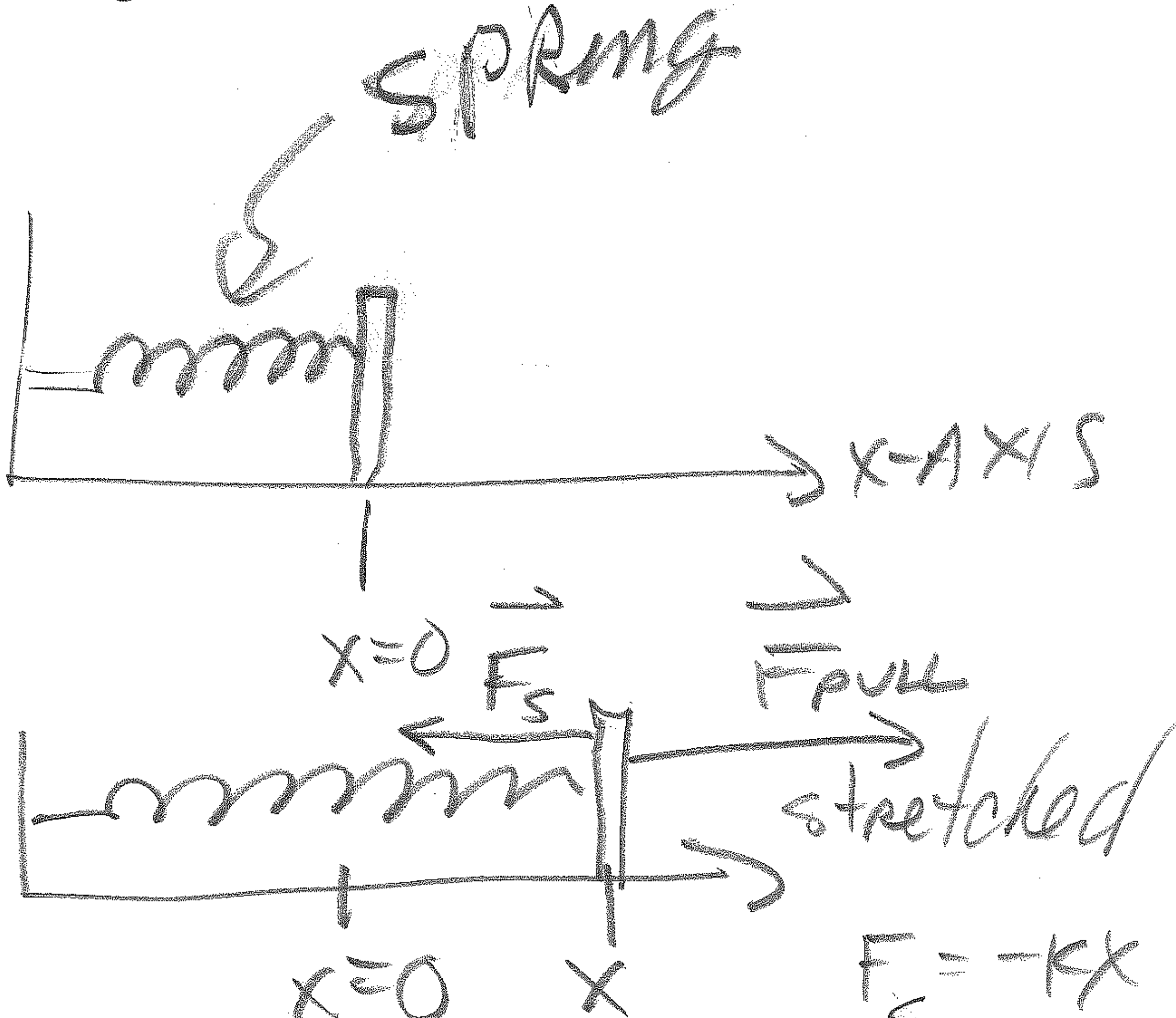
THROW a ball up.

$$W_g = F \cdot \cos \underline{180^\circ} \cdot h$$

$$W_g = F \cdot (-1) \cdot h$$

$$\underline{W_g = -mgh < 0}$$

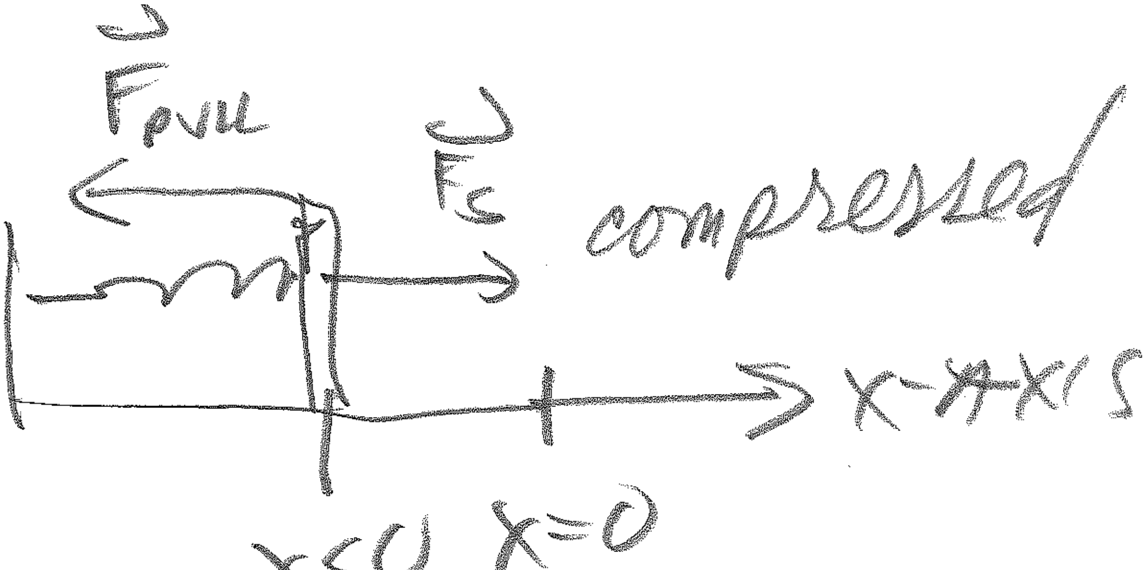
$W_s = ?$



$F_{s_x} = -kx$

$\vec{F}_s = (-kx, 0)$

$\vec{F}_s = (F_{s_x}, 0) = (-kx, 0)$



$$F_{s_x} = -kx > 0$$

$$x < 0$$

calculus:

$$W_s = \int_{x_i}^{x_f} F_{s_x} \cdot dx = \int_{x_i}^{x_f} (-kx)\,dx$$

calculus TRICK*

$$W_s = \boxed{\tfrac{1}{2}kx_i^2 - \tfrac{1}{2}kx_f^2}$$

*NOT REQUIRED

16

conservation of Energy (part I — no friction)

only forces are springs, gravity

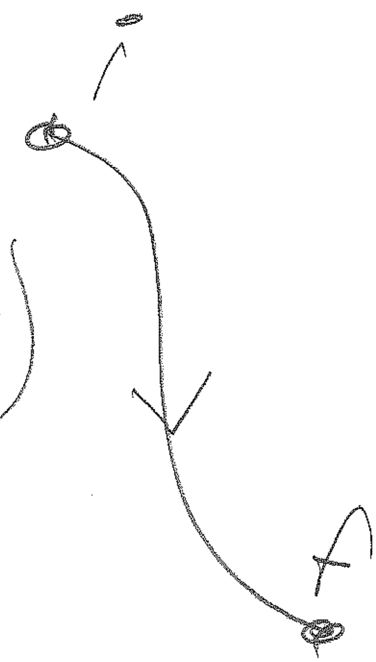
i

f

TODAY N3LAW LAB

REVIEW

CH 7



Y(POS) ↑

$mg(y_i - y_f)$

$W_g = \pm mgh \begin{pmatrix} + \text{ HIGH TO LOW} \\ - \text{ LOW TO HIGH} \end{pmatrix}$

$W_s = \frac{1}{2}kx_i'^2 - \frac{1}{2}kx_f'^2$

i = initial

f = final

x' = spring coordinate

$\Delta KE = W_g + W_s$

$\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 = mg(y_i - y_f) + \frac{1}{2}kx_i'^2 - \frac{1}{2}kx_f'^2$

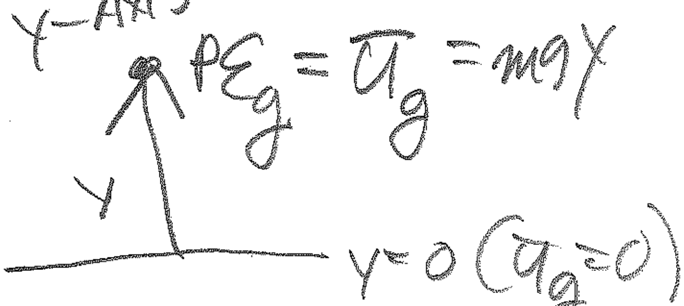
<u>REARRANGE</u>

$$\frac{1}{2}mv_f^2 + mgy_f + \frac{1}{2}kx_f^2$$

$$= \frac{1}{2}mv_i^2 + mgy_i + \frac{1}{2}kx_i^2$$

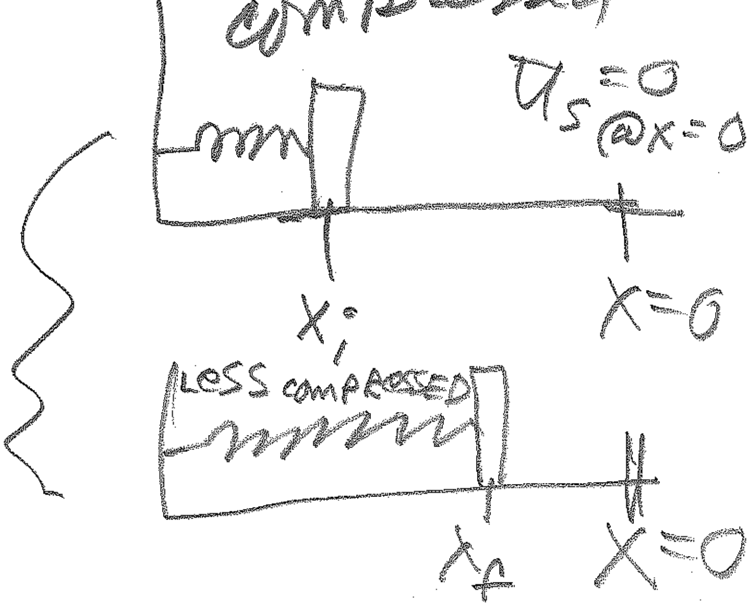
$$KE_i + mgy_i + \frac{1}{2}kx_i^2 = KE_f + mgy_f + \frac{1}{2}kx_f^2$$

$PE_g = U_g = mgy$



$\boxed{PE = \text{POTENTIAL ENERGY}}$

$U_s = PE_s = \frac{1}{2}kx^2$



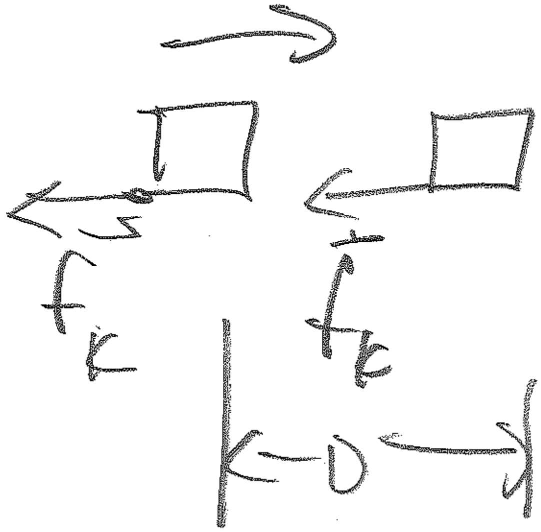
ADD friction 19

$$\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 = mg(y_i - y_f) + \frac{1}{2}kx_i^2 - \frac{1}{2}kx_f^2 + \overline{W}_{f_k}$$

$$\overline{W}_{f_k} = -f_k \cdot D$$

$$\vec{f}_k = \text{constant}$$

motion



$$\frac{1}{2}mv_i^2 + mgy_i + \frac{1}{2}kx_i^2$$

$$= \frac{1}{2}mv_f^2 + mgy_f + \frac{1}{2}kx_f^2 + f_k \cdot D$$

$$\overline{W}_{f_k} = -f \cdot D$$

20

momentum

USAGE: PREZ campaign
is picking up momentum

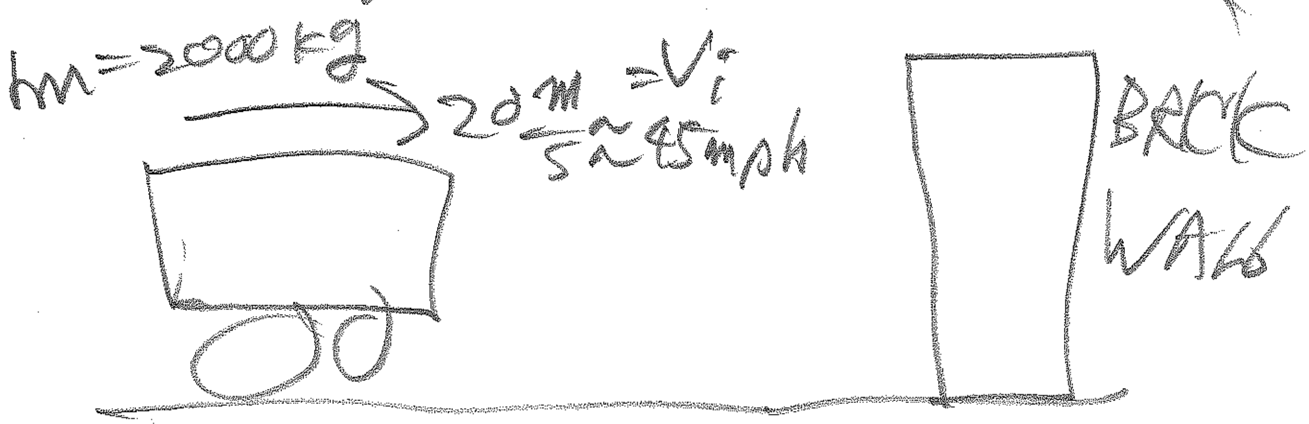
"As" winning streak
is in momentum

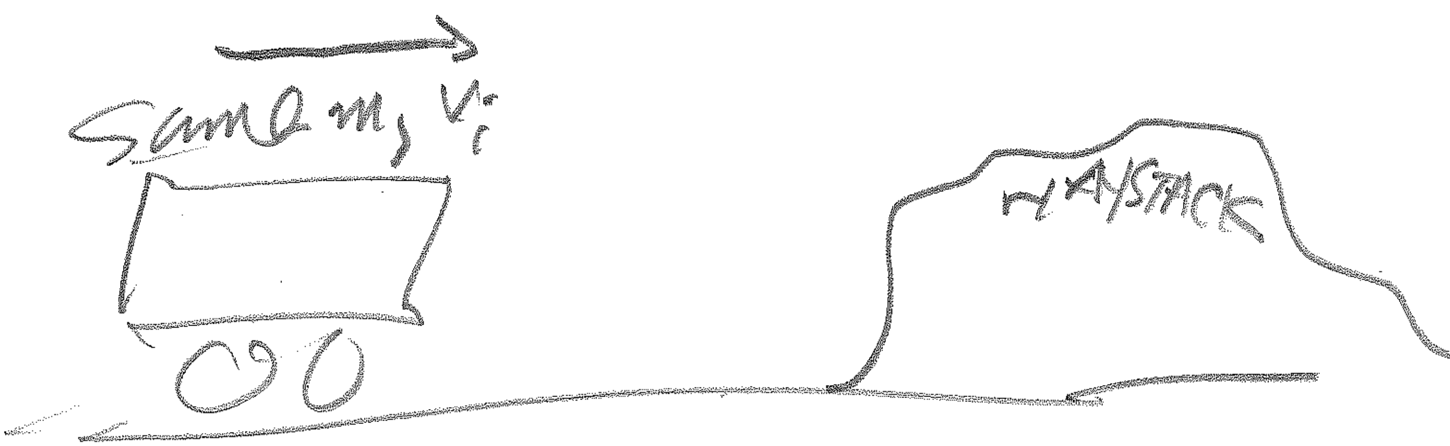
$\vec{p} = m \vec{v}$

conservation of momentum
and lead into review
N3 Lab

SMALL DIGRESSION

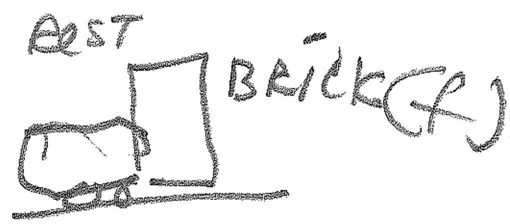
THOUGHT EXPERIMENT





Both cases: come TO REST

Both cases



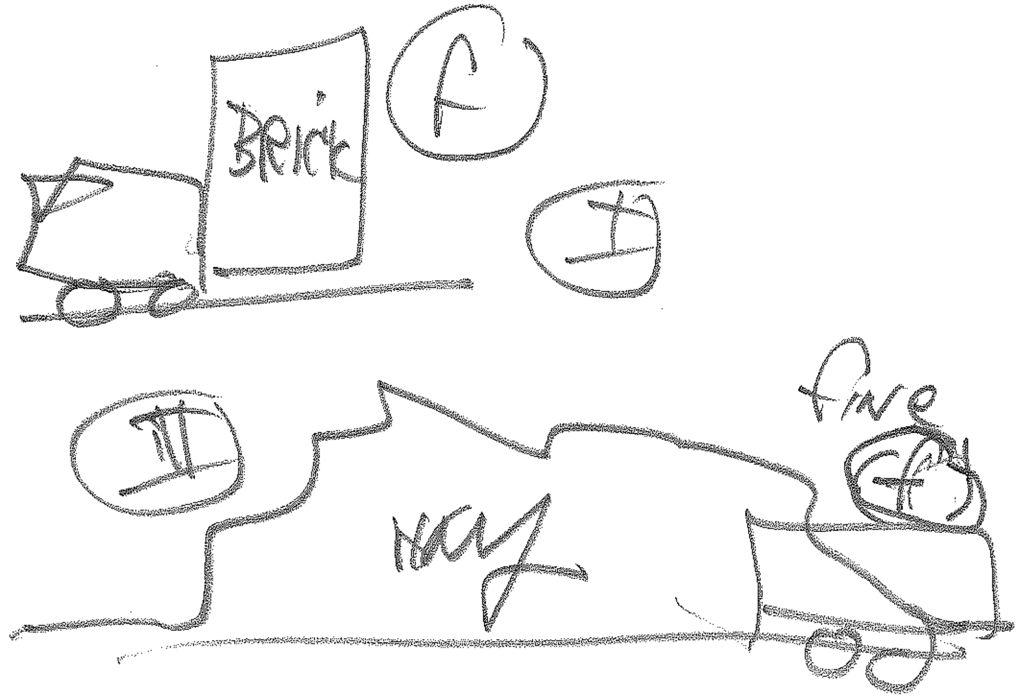
$\Delta P_x = P_f - P_i = 0 - mV_i$

$\Delta P_x = -mV_i$; $\frac{\Delta P_x}{\Delta t} = m\frac{\Delta V_x}{\Delta t} = ma_x = F_x$

IMPULSE

$$\boxed{\Delta p_x = F_x \cdot \Delta t}$$

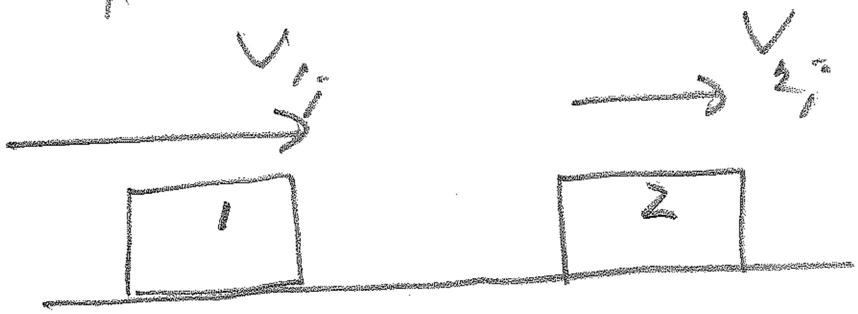
$\Delta p_x = F_x \cdot \Delta t$



I $\quad \Delta p_x = F_{x\,\text{Large}} \cdot \Delta t_{\text{SMALL}}$

II $\quad \Delta p_x = F_{x\,\text{SMALL}} \cdot \Delta t_{\text{Large}}$

final note: CN 8

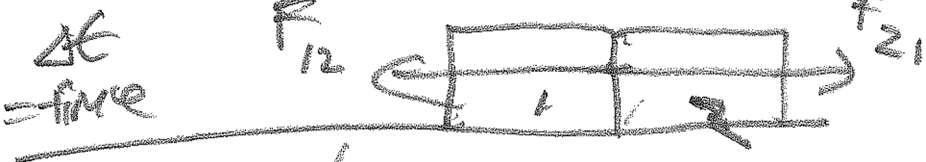


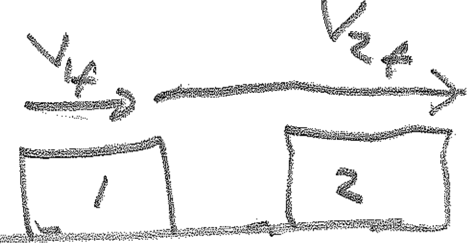
before

during

$F_{12} = F_{21}$

$|\vec{F}_{12}| = F_{21}$





after

<u>quick</u>

during

$$F_{12} = F_{21} \quad \left(\begin{array}{c}\text{closed} \\ \text{system}\end{array}\right)$$

$$m_1 |a_1| = m_2 |a_2|$$

$$m_1 \left| \frac{v_{1f} - v_{1i}}{\Delta t} \right| = m_2 \left| \frac{v_{2f} - v_{2i}}{\Delta t} \right|$$

conservation of Energy

$$m_1 v_{1i} + m_2 v_{2i} = m_1 v_{1f} + m_2 v_{2f}$$

$\longrightarrow$ x (pos)

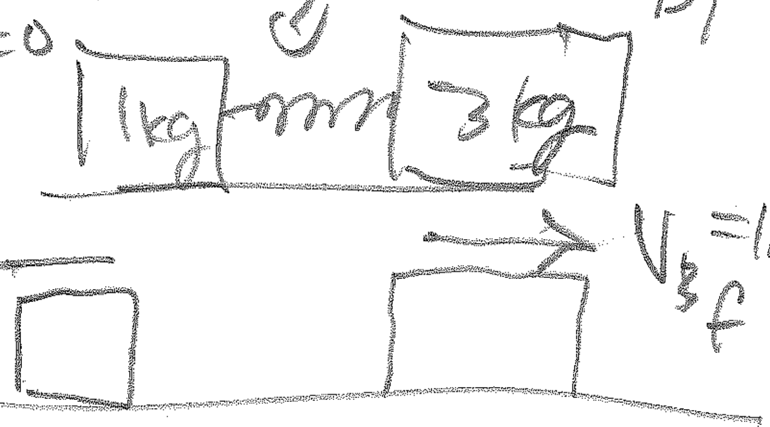
$\longrightarrow v_x > 0$

$\longleftarrow v_x < 0$

compressed

m_A m_B $v_{Bi} = 0$

(14) $v_{Ai} = 0$



(2) $v_{Af} = -3.6\,\frac{m}{s}$

$v_{Af} = -3 \cdot v_{Bf}$

v_{Af}

$v_{Bf} = 1.20\,\frac{m}{s}$

$$\sum_{\text{before}} P_x = 0 = \sum_{\text{after}} P_x = m_A v_{Af} + m_B v_{Bf}$$

$$0 = m_A v_{Af} + m_B v_{Bf} \Rightarrow v_{Af} = -\frac{m_B}{m_A} v_{Bf}$$

(b) $U_s = \frac{1}{2}k\Delta x^2$

25

$$\frac{1}{2}k\Delta x^2 = \frac{1}{2}m_A v_{A_f}^2 + \frac{1}{2}m_B v_{B_f}^2$$

$$U_s = KE_f$$

(no heat)

$$U_s = \frac{1}{2}(1)(3.6)^2 + \frac{1}{2}(3)(1.2)^2$$

test 2 = Q4, Q5, Q6, Q7 (E.C)