Sp 13 Physics 4A

CH 4

newton's 2ND LAW

$$\sum \vec{F} = \vec{F}_{net} = m \cdot \vec{a}$$

m = mass

mass $\propto$ inertia

$$\vec{a} = \frac{\sum \vec{F}}{m}$$

Large m, small $|\vec{a}|$.

Reason: inertia.
inertia = resistance to change of velocity.

$$\text{acceleration} = \frac{\text{change in velocity}}{\Delta t}$$

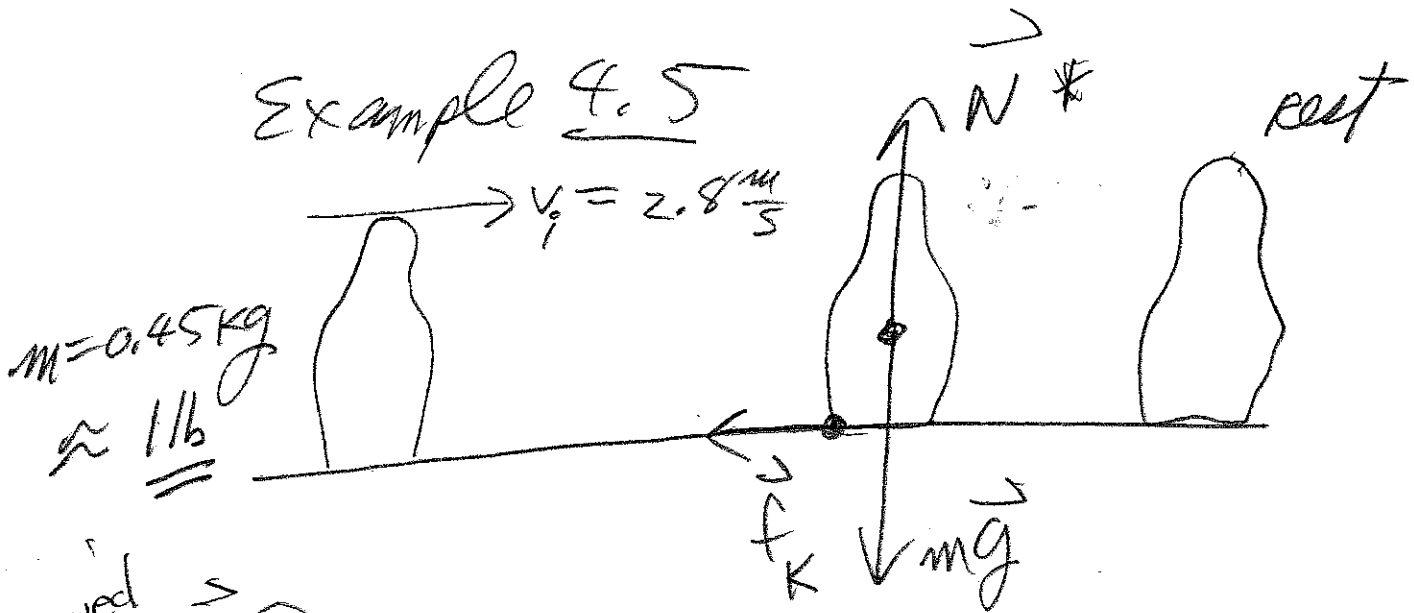
THUS, large mass, small $|\vec{a}|$

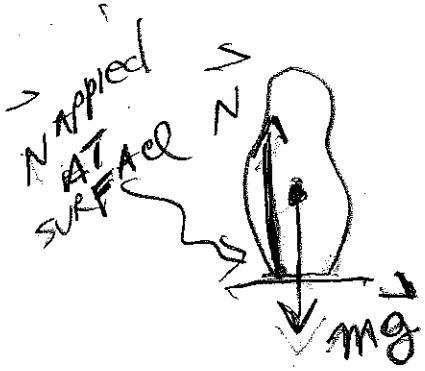
$$\sum F_x = m \cdot a_x$$

$$\sum F_y = m a_y$$

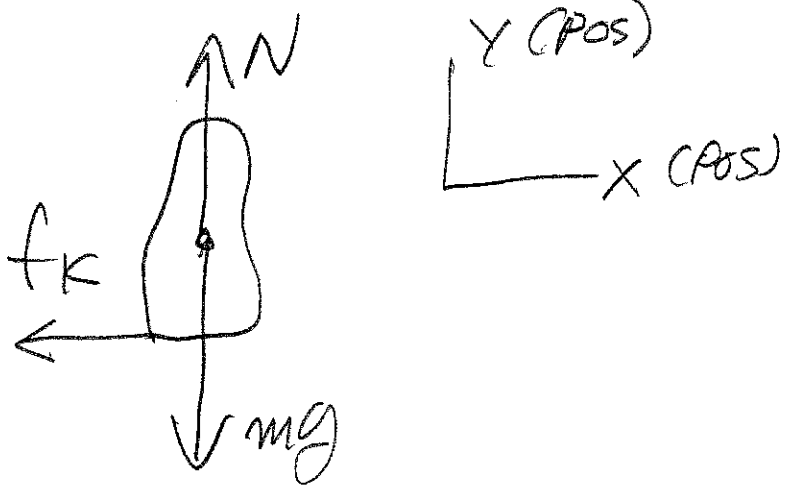
$$\left(\sum F_z = m a_z \right)$$

Example 4.5





Force diagram



$$\sum F_x = ma_x = -f_k$$

$$\sum F_y = ma_y = N - mg$$

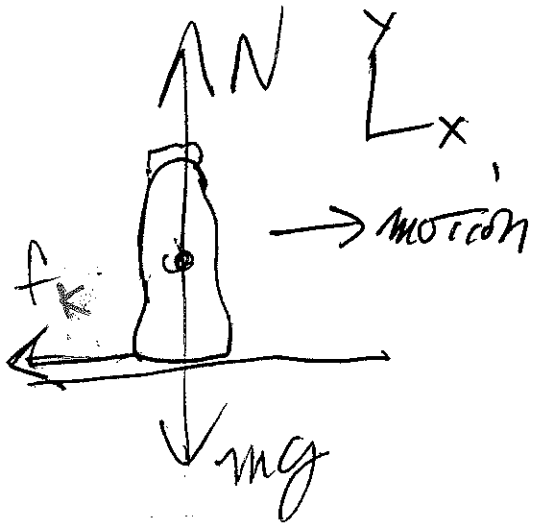
SHORT cut notation

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

$$\sum F_y = ma_y = \text{POS} - \text{neg}$$

POS = sum of magnitudes of positively directed forces

neg = sum of magnitudes of negatively directed forces



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

$ma_x = 0 - f_k$

$\Sigma F_y = \text{pos-neg}$

$ma_y = N - mg$

$\boxed{N = mg}$

Note: $a_y = 0$

Since $v_y = 0$

$= \text{constant}$

$a_y = \frac{dv_y}{dt} = 0$

$0 = N - mg \Rightarrow N = mg$

$\Sigma F_x = ma_x = -f_k$

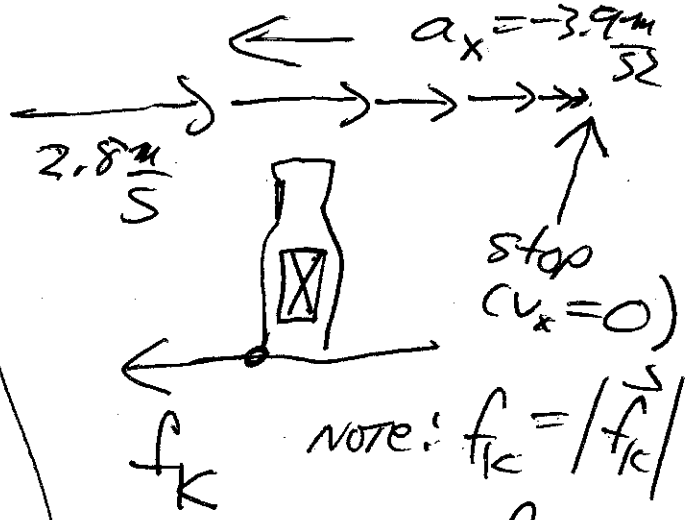
$v_f^2 = v_i^2 + 2a_x \cdot \Delta x$

$0 = \left(2.8\frac{m}{s}\right)^2 + 2 \cdot (a_x) \cdot \Delta x$

$\Delta x = 1.0\,m$

$a_x = \frac{-2.8\frac{m^2}{s^2}}{2 \cdot (1.0\,m)}$

$= -3.9\frac{m}{s^2}$



$ma_x = -f_k$

$(0.45\,kg)\left(-3.9\frac{m}{s^2}\right)$

$= -f_{ic}$

$f_{ic} = +\boxed{1.8(N)}$

weight

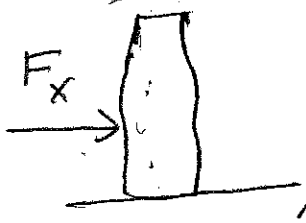
weight = FORCE of GRAVITY

GROUND

NOTE: m = GRAVITATIONAL MASS

NOTE: APPLY THESE IDEAS TO EXAMPLE 4.5

PUSH MILK BOTTLE

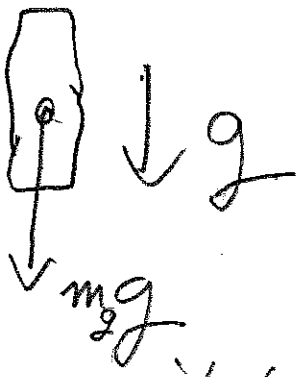


$F_x = m_i a_x$

APPLIED PUSH FORCE

m_i = INERTIAL MASS.

DROP MILK BOTTLE



m_g = GRAVITATIONAL MASS.

Experiments show: $m_i = m_g$;
GRAVITATIONAL MASS = INERTIAL MASS.