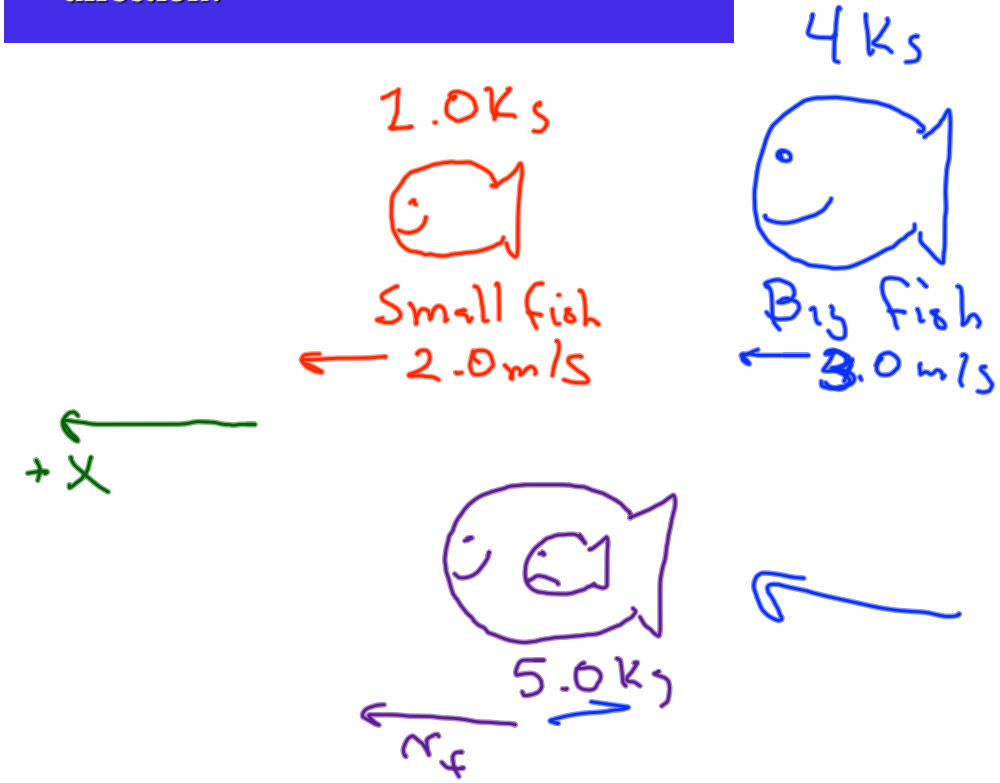
Reminders 10-13-10:
-Exam 2 Ch 4-6 Mon. Oct. 18

Objectives:
-Conservation of Momentum
Examples

- A big 4.0kg fish moving to the left at 3.0 m/s swallows a small 1.0 kg fish moving to the left at 2.0 m/s. What is the final <u>speed</u> of the big fish? What if the fish were moving in the opposite direction?

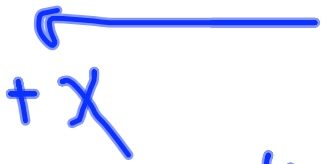


$$\Sigma p_i = \Sigma p_f$$

$$(4.0\,kg)(3.0\,m/s) + (1.0\,kg)(2.0\,m/s) = 5v_f$$

$$14\,kg\,m/s = 5v_f$$

$$v_f = \frac{14}{5}\,m/s = 2.8\,\frac{m}{s}$$



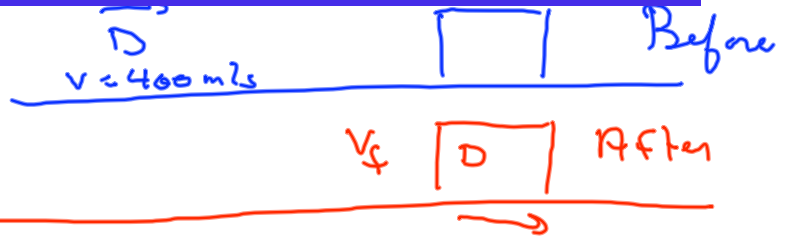
$$(4)(3) + (1)(-2) = 5v_f$$

$$10\ kg\ m/s = 5v_f$$

$$v_f = 2.0\ m/s$$

A gun with a muzzle velocity of 4.0×10^2 m/s horizontally fires a 12 g bullet into a 2.0kg block resting on a frictionless surface. The bullet comes to rest after traveling 15 cm.

- What are the impulse and change in momentum of each object just after the collision?
- What is the work done on the bullet by the block in bringing it to a complete stop?
- What is the force and average power required to stop the bullet?
- What is the average acceleration of the bullet?
- What is the work done on the block in this time.



$\sum p_i = \sum p_f$ → +x

$(.012 kg)(400) = (m_b + m_B) v_f$

$v_f = \frac{(.012)(400)}{2.0 + .012} = 2.39 \frac{m}{s}$

$F \Delta t = m_B \Delta v = (2.0 kg)(2.39 - 0)$

Impulse delivered = $4.8 kg\ m/s$ to block by bullet

Impulse delivered to bullet by block $= (.012 kg)(2.39 - 400) = -4.8 \frac{kg\ m}{s}$

$$W_{net} = \Delta KE$$

$$= \frac{1}{2}(.012)\left[(2.39)^2 - (400)^2\right]$$

$$-Fd = -960\,J$$

$$F = \frac{960\,J}{0.15m} = 6400\,N$$

$$P_{avg} = \frac{W}{t} = F v_{avg} = (6400N)\left[\frac{2.39+400}{2}\right]$$

$$= 1.3 \times 10^6 W$$

$$F = ma \qquad a = \frac{f}{m}$$

$$a = \frac{6400\,N}{.012\,kg} = 5.3 \times 10^5 \frac{m}{s^2}$$

$$W_{block} = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2$$

$$= \frac{1}{2}(2.012)(2.39)^2$$

$$= 5.7\,J$$

V_f

$m_b v_b = (m_b + M_B) V_f$

$\Delta KE + \Delta PE = 0$

$\frac{1}{2}(m_b + M_B) V_f^2 - \frac{1}{2}(m_b + M_B) V^2 + (m_b + M_B) g \Delta y = 0$

$-\frac{1}{2}(m_b + M_B) V^2 + (m_b + M_B) g \Delta y = 0$

$-\frac{1}{2} V^2 + g \Delta y = 0$

$V^2 = 2 g \Delta y$

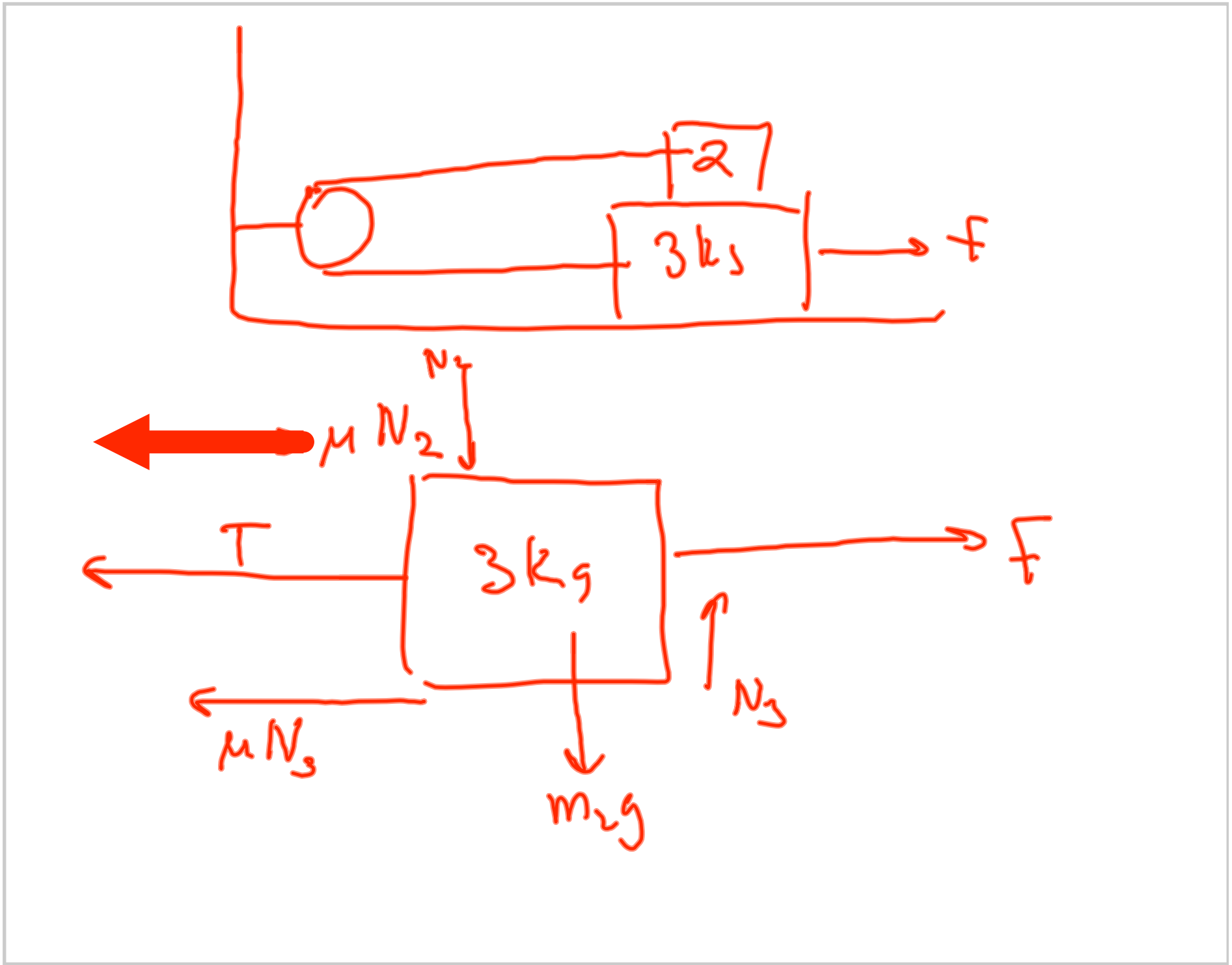
$V = \sqrt{2 g \Delta y}$

$m_b v_b = (m_b + M_B) V$

$m_b v_b = (m_b + M_B) \sqrt{2 g \Delta y}$

$v_b = \dfrac{(m_b + M_B)\sqrt{2 g \Delta y}}{m_b}$

$=$


2
3kg
f
N2
μN2
T
3kg
f
N3
μN3
m2g