Conservation of Momentum

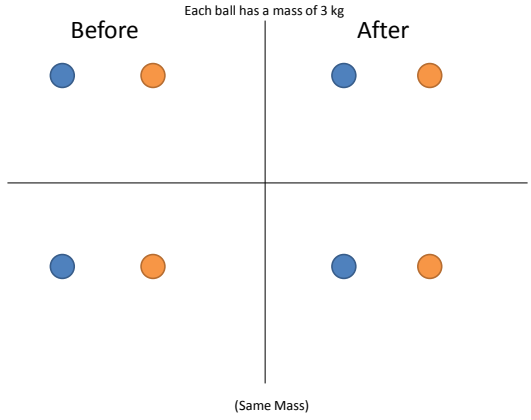
6.2

Objectives

- **Describe** the interaction between two objects in terms of the change in momentum of each object.
- **Compare** the total momentum of two objects before and after they interact.
- **State** the law of conservation of momentum.
- **Predict** the final velocities of objects after collisions, given the initial velocities, force, and time.

Momentum is Conserved

- When object A strikes object B, momentum is transferred and conserved
  - The amount of "p" object A loses is the same amount object B gains
  - What are some example of this happening?



Law of Conservation of Momentum

- The total momentum of all objects interacting with one another remains constant regardless of the nature of the forces between the objects.

$$p_{A,i} + p_{B,i} = p_{A,f} + p_{B,f}$$

- Substitute the mv for p… what do you get?

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

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

A 76 kg boater, initially at rest in a stationary 45 kg boat, steps out of the boat and onto the dock. If the boater moves out of the boat with a velocity of 2.5 m/s to the right, what is the final velocity of the boat?

Givens
m_1 = 76 kg
m_2 = 45 kg
$v_{1,i}$ = 0 m/s
$v_{2,i}$ = 0 m/s
$v_{1,f}$ = 2.5 m/s
$v_{2,f}$ = _____m/s

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

An 85 kg man jumps from a dock into a 135 kg boat at rest. If the man has a speed of 4.3 m/s as he leaves the dock, what is the final speed of the man and the boat?

Givens
m_1 = 85 kg
m_2 = 135 kg
$v_{1,i}$ = 4.3 m/s
$v_{2,i}$ = 0 m/s
v_f = _____m/s