

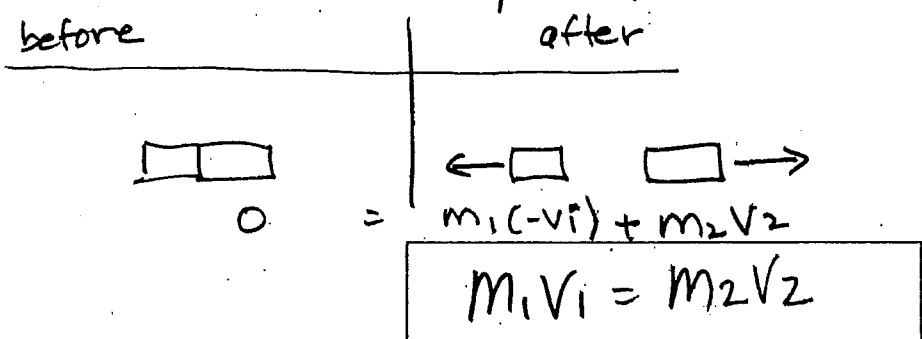
### Conservation of Momentum- Momentum of Collisions

Conservation of momentum: The total momentum of a system remains constant during a collision. (Momentum lost by one object is gained by another)

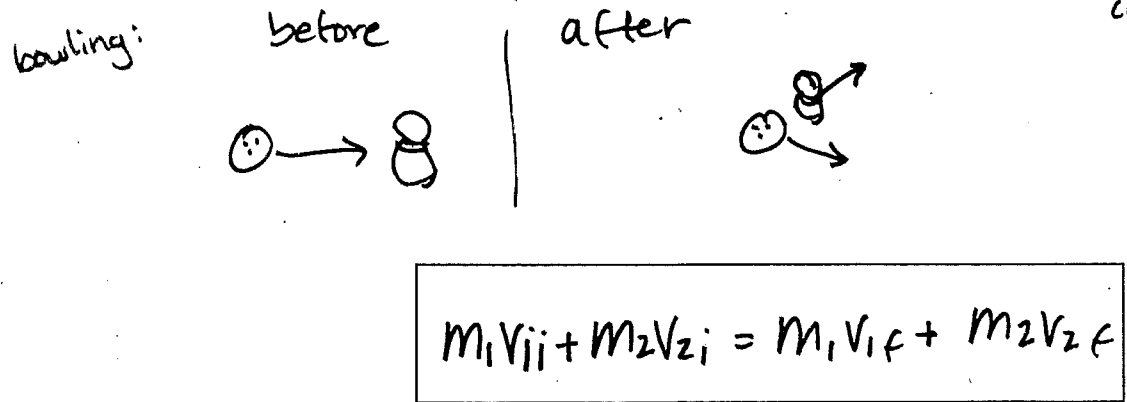
total initial p = total final p  
starting p = ending p

3 Types of Collision:

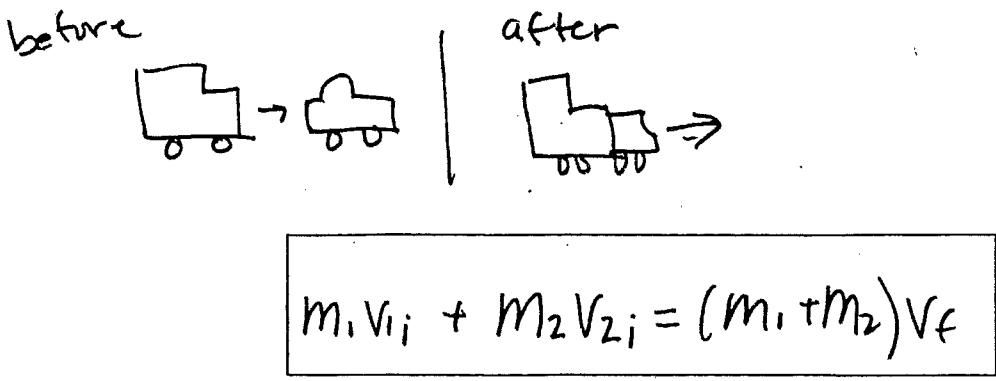
1. Explosion: when two objects start at rest & explode apart



2. Elastic Collision: two objects bounce off each other after collision



3. Inelastic Collision: the two objects stick together after collision



## Conservation of Momentum Example:

P. 218  
sample

1. 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?

Type of collision: explosionEquation:  $m_1 v_1 = m_2 v_2$ 

$$(76 \text{ kg})(2.5 \text{ m/s}) = (45 \text{ kg})v_2$$

$$v_2 = 4.22 \text{ m/s}$$

P. 224 #1

2. A 1500 kg car traveling at 15 m/s collides with a 4500 kg truck that is initially at rest at a stoplight. The car and truck stick together and move together after the collision. What is their final velocity?

Type of collision: inelasticEquation:  $m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_f$ 

$$(1500 \text{ kg})(15 \text{ m/s}) + (4500 \text{ kg})(0) = (1500 + 4500) v_f$$

$$22500 \text{ kg m/s} = 6000 v_f$$

$$v_f = 3.75 \text{ m/s}$$

P. 229 #3a

3. A 4 kg bowling ball moving at 8.0 m/s has a head on collision with another bowling ball (mass = 6 kg) initially at rest. The first ball stops after the collision. Find the velocity of the second ball.

Type of collision: elasticEquation:  $m_1 v_{1i} + m_2 v_{2i} = m_1 v_{1f} + m_2 v_{2f}$ 

$$(4 \text{ kg})(8 \text{ m/s}) + (6 \text{ kg})(0) = 0 + 6 \text{ kg } v_f$$

$$32 \text{ kg m/s} = 6 \text{ kg } v_f$$

$$6 \text{ kg}$$

$$v_f = 5.33 \text{ m/s}$$