

Momentum
AP Physics 1/2

Center of Mass

$$r_{\text{com}} = \frac{\sum_{i=1}^n m_i r_i}{m_{\text{Total}}}$$

Momentum
 $p = mv$

Impulse

Conservation of Momentum

$$p_{\text{initial}} = p_{\text{final}}$$

$$\sum_{i=1}^n p_i = \sum_{i=1}^n p'_i$$

Constant or Average Force
 $J = F\Delta t$

Momentum
Enduring Understanding
Momentum is transferred when objects interact.

Essential Questions

- 1. Where must the center of mass lay?
- 2. What the relationship between Newton's Second Law and the conservation of momentum?
- 3. Which has a greater impact on the motion of an object: the force applied or the time applied?
- 4. What are the implications of Newton's Third Law of Motion?

Elastic Collision

$$\sum_{i=1}^n p_i = \sum_{i=1}^n p'_i$$

Inelastic Collision

$$\sum_{i=1}^n p_i = \sum_{i=1}^n p'_i$$

Perfectly Inelastic Collision

$$\sum_{i=1}^n p_i = \left(\sum_{i=1}^n m_i\right) v'$$

Recoil Collision

$$0 = \sum_{i=1}^n p'_i$$

Kinetic Energy is Conserved

Energy is Conserved

Momentum is Conserved



Type of Collision Problems

- Step #1**
How can the bullet acquire energy (velocity)?
- o given an initial velocity
 - o an energy transformation
 - o gravitational
 - o elastic

- Step #2**
How might the target and bullet collide?
- o hit and stick
 - o hit and bounce
 - o hit and pass through

- Step #3**
What the situations could be encountered after the collision?
- an energy exchange
 - o swing
 - o loop
 - o hill
 - o curved-vertical path
 - an energy transformation
 - o slides on a rough surface.
 - projectile motion



Bullet (figurative)

Target (figurative)