Conservation of Momentum

Activity Review

- Elastic Collisions
  - Momentum Conserved?
  - What happened to the objects after the collision?
- Inelastic Collisions
  - Momentum Conserved?
  - What happened to the objects after the collision?
  - If one cart collides with another with the same mass, how will the velocity after compare to the velocity before?

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Activity Review

- Explosions
  - Momentum Conserved?
  - If the objects involved in an explosion are different masses, how will the velocities of the objects compare?

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Law of Conservation of Momentum

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- The momentum of any one object can change but the momentum lost by one object must be gained by the other objects
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Types of collisions

- Elastic
  - An elastic collision is one in which momentum is conserved and the objects move separately after the collision.
- Inelastic
  - An inelastic collision is one in which momentum is conserved and the objects combine after the collision.

Law of Conservation of Momentum

- In both cases, momentum is conserved.
- So the following is true:
- total momentum before collision = total momentum after collision
- $p_{initial} = p_{final}$
- $(p_1 + p_2)_{initial} = (p_1 + p_2)_{final}$
- $(mv_1 + mv_2)_i = (mv_1 + mv_2)_f$

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Inelastic Collisions

- When using the conservation of momentum with an inelastic collision, the two masses before the collision are combined after the collision and they both move together with the same velocity.
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Example

- A 2100 kg car is traveling with a velocity of 15 m/s. A 3450 kg truck is traveling toward the car with a velocity of 13 m/s. After they collide, the truck continues to move in the same direction at 2 m/s. What is the velocity of the car after the collision?

Example (cont.)

Initial	**Final**
m_1:	**m_1:**
v_1:	**v_1:**
m_2:	**m_2:**
v_2:	**v_2:**

Example 2

- A 30 g bullet is shot into a stationary 6 kg wood block. The bullet embeds itself into the block and they both travel with a velocity of 0.80 m/s. What is the original velocity of the bullet?
- What type of collision?
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Example (cont.)

Initial

m_1:
v_1:
m_2:
v_2:

Final

m_1:
m_2:
v_f: