

Conservation of Momentum

Mr. Sudbury

Law of Conservation of Momentum

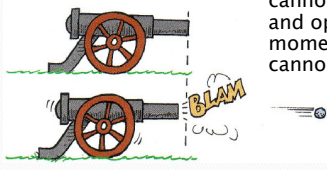
- ▶ Law of CoM – In the absence of an external force, the momentum of a system remains unchanged.
- ▶ Proved by Newton’s 3rd Law (Action/Reaction)
- ▶ In a collision, the momentum entering the collision **MUST** equal the momentum coming out of the collision.

Conservation of Momentum

- ▶ Newton’s 2nd Law
- ▶ To accelerate an object, you must apply a force.

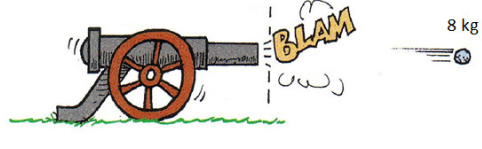
- ▶ Momentum
- ▶ If you wish to change the momentum of an object, you must exert an impulse on it.

- ▶ The momentum of the cannon recoil is equal and opposite to the momentum of the cannon ball



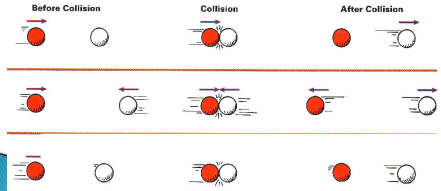
Recoil – Momentum Must Be conserved!!!

$P = mv$ $P = P$
 $mv = mv$

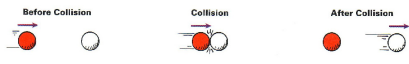


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- ▶ An **elastic collision** is when 2 objects collide without being permanently deformed and without generating heat.
- ▶ In an elastic collision, momentum is *transferred* from one object to another.



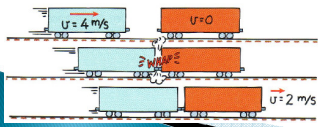
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- ▶ **Inelastic collision** occurs whenever colliding objects become tangled or coupled (Stick) together.
- ▶ Momentum is conserved.

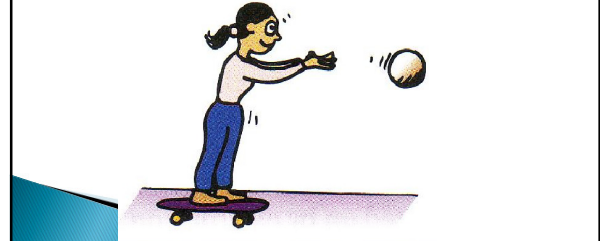
net momentum before collision = net momentum after collision



Conservation of Momentum

$$60 \text{ kg} * \text{????? m/s} = 10 \text{ kg} * 2 \text{ m/s} + 20 \text{ kg} * \text{m/s}$$

$(mv)_{\text{before}} = (mv)_{\text{after}}$
 $20 \text{ kg} * \text{m/s}$



Conservation of Momentum

- ▶ Summary with Air Track
- ▶ Elastic & Inelastic collisions