# Conservation of Momentum

IB PHYSICS | ENERGY & MOMENTUM

# What is Momentum??

"Inertia in Motion"

# Which has more Momentum??

**20000 kg**

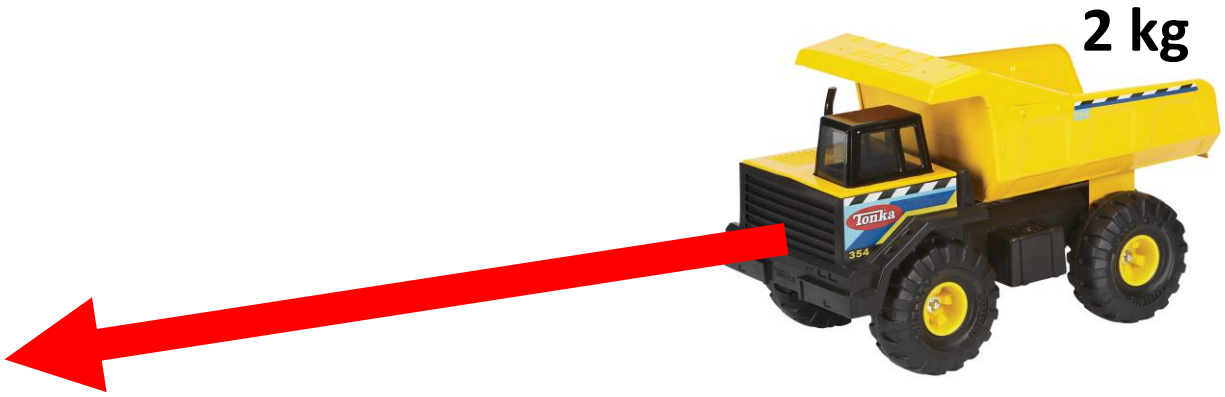
**10 m/s**

**2 kg**

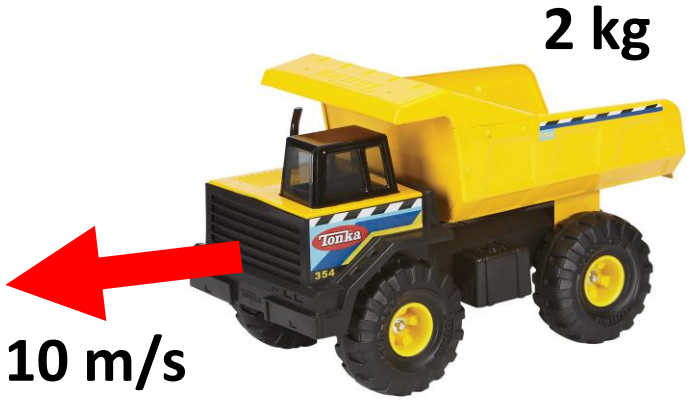

**10 m/s**

Why?

# Which has more Momentum??




Why?



# Momentum Equation

Momentum = mass × velocity

| | | | |
|---|---|---|---|
| Symbols | = | × | |
| Units | = | × | |

# IB Physics Data Booklet

**Sub-topic 2.4 – Momentum and impulse**

$$p = mv$$

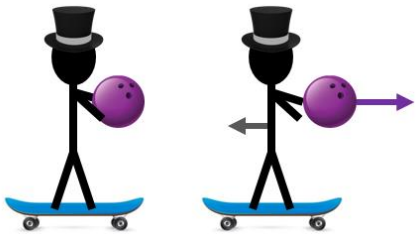
$$F = \frac{\Delta p}{\Delta t}$$

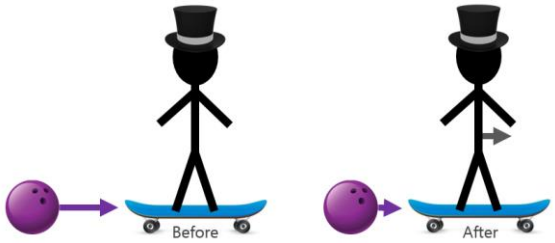
$$E_{\mathrm{K}} = \frac{p^2}{2m}$$

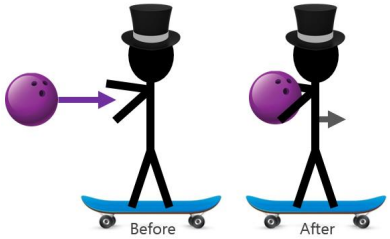
$$\text{Impulse} = F\Delta t = \Delta p$$

# Conservation of Momentum

The total momentum of a system is constant

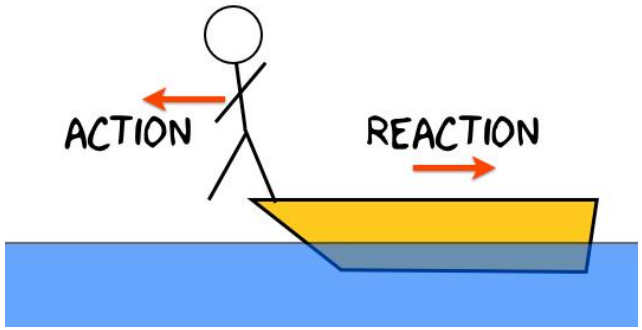




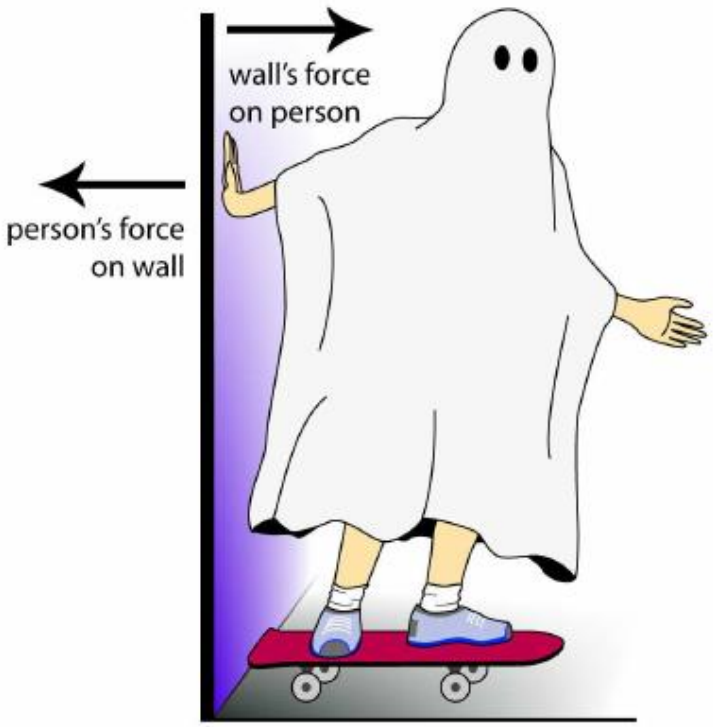



# Newton's Third Law

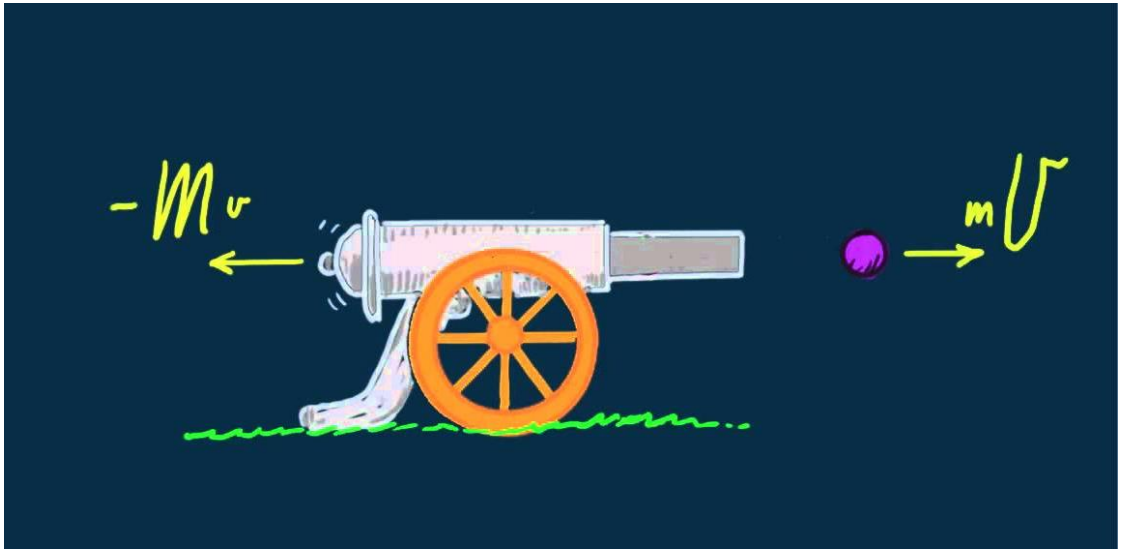
For every action, there is an equal and opposite reaction





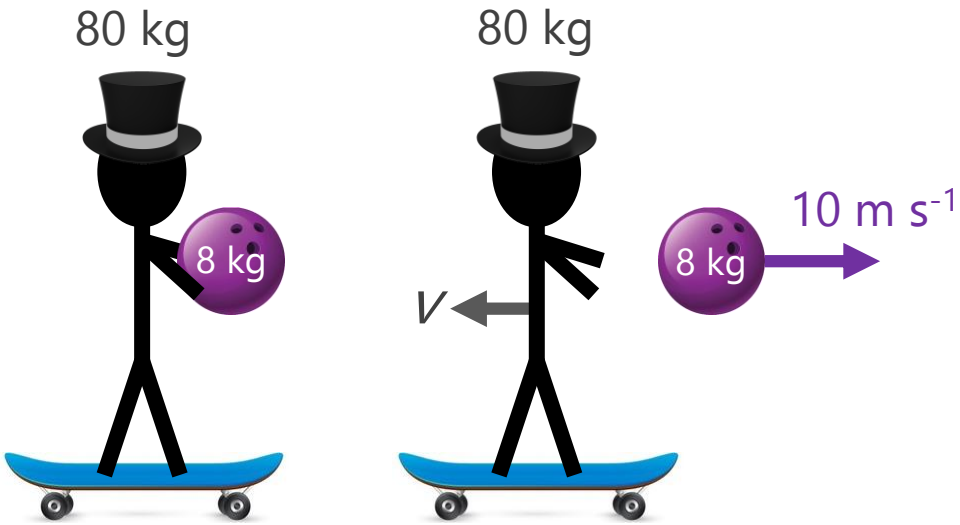


# Conservation of Momentum




When a cannonball is fired out of a cannon, there is a recoil…

# Explosion

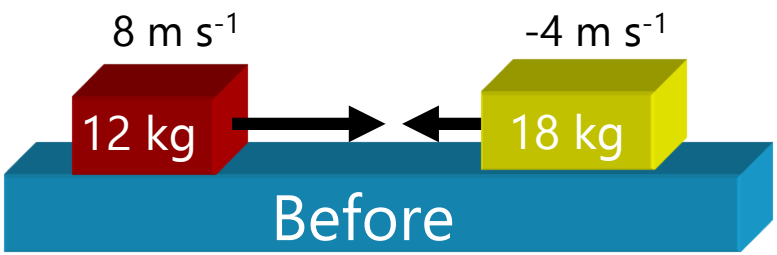


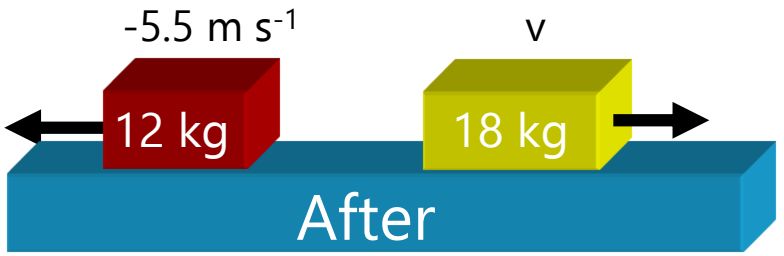
# Hit and Bounce #1


# Hit and Bounce #2

Before

After

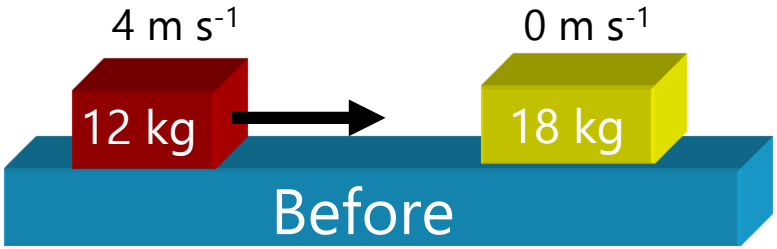


# Hit and Stick

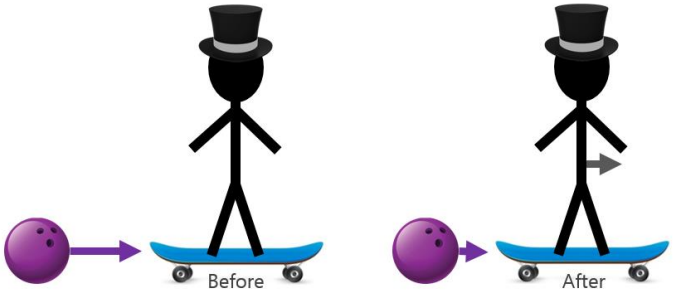
Before

After

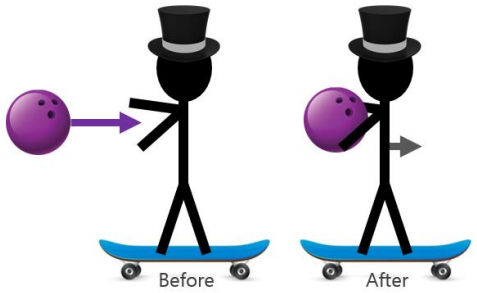



# Elastic vs Inelastic

## Elastic




## Inelastic



# Try This…

A toy railcar of mass 2 kg travelling at 6 m $s^{-1}$ collides with another railcar of mass 3 kg travelling at 4 m $s^{-1}$ in the same direction. If after the collision the two trucks become joined together, what is their resulting velocity?

Compare the total Kinetic Energy before and after:

# Lesson Takeaways

- ❑ I can define and calculate momentum
- ❑ I can use the conservation of momentum to solve for missing variables in linear collisions
- ❑ I can describe the process required for explosion, hit and bounce, and hit and stick scenarios
- ❑ I can describe the difference between elastic and non-elastic collisions
- ❑ I can calculate the amount of energy retained in a non-elastic collision