1. How will you compare the marbles' stopping distances?
2. Did the two marbles immediately stop as they hit the block of wood? Describe the stopping distance of the two marbles as their point of release increases.
3. What do you think happens to the velocity of the two marbles as the point of release increases?

- **If momentum is a measure of how difficult it is to stop a moving object, which of the two marbles had a greater momentum for the same point of release?**
- **How will it be possible for the two bodies of different masses to have equal**

MOMENTUM

Objective

The learners should able to:

- *Calculate the mass, velocity and momentum of an object.*

Momentum

- *Is a quantity that describes an object's resistance to stopping*

Momentum

- *Momentum is what Newton called the* **"inertia of motion"** *of an object.*
- *For objects moving at the same velocity, a more massive object has a greater inertia in motion therefore a greater momentum.*

Momentum

The ***momentum of an object:***

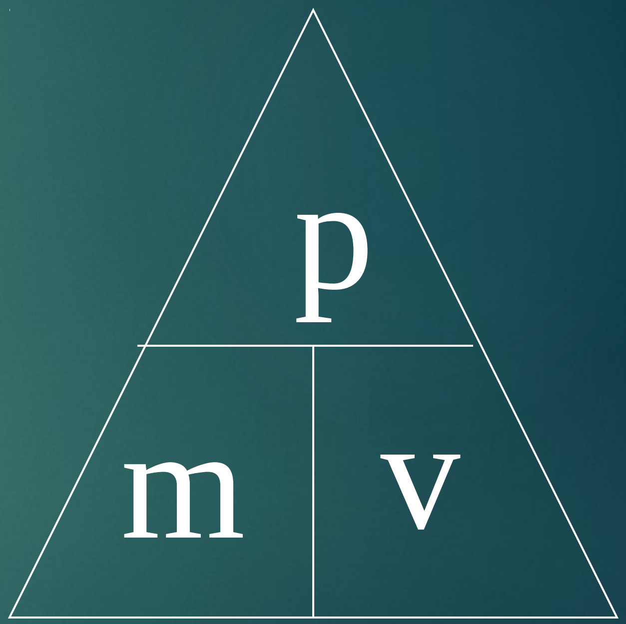
- Depends on the object's ***mass***. Momentum is ***directly proportional*** to mass.

- Depends on the object's ***velocity***. Momentum is ***directly proportional*** to velocity.

Momentum

- *In symbols:*

$$\boldsymbol{p} = \boldsymbol{m}\boldsymbol{v}$$



Momentum

- *Momentum is a* **vector** *quantity.*

Vector is a quantity that has magnitude and direction

Common units of momentum:
kg (m/s)

Example

m=1000 kg

v=20m/s

p=?

Sample problem

Which has more momentum, a truck with a mass of 20000kg moving at 30,000 m/s
or a truck with a mass of 10000kg moving at 30,000 m/s?


ROMA
LONDON
東京
香港

Given

Car A: Mcqueen

$$m = 15{,}000\ kg$$

$$v = 10{,}000\ m/s$$

Car B: Mater

$$m = 10{,}000\ kg$$

$$v = 20{,}000\ m/s$$

Given

Car A: Bumblebee

$$m = 15{,}000\ kg$$

$$v = 20{,}000\ m/s$$

Car B: Optimus Prime

$$m = 30{,}000\ kg$$

$$v = 10{,}000\ m/s$$

Individual Activity

BODY	Mass (kg)	Velocity (m/s)	Momentum (kg.m/s)
Falcon		108	162
Stephen Curry	86		430
Maui	100	2	

1. *Which body has the greatest momentum?*
2. *Rank the body from greatest to lowest momentum.*
3. *Which body has the smallest velocity?*
4. *Which body has the smallest mass?*

Assignment

Draw 2 examples that shows momentum, the first example should be an object with smaller mass having large amount of velocity and the second example should be an object with a bigger mass but small amount of velocity.

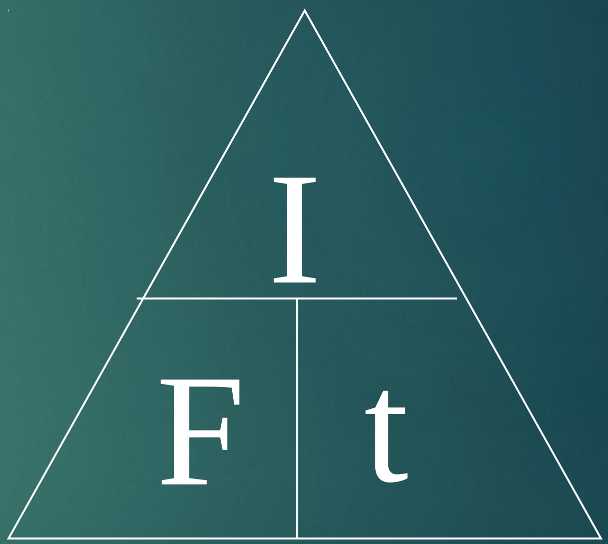
Impulse

- *The* **impulse** *exerted on an object depends on:*
- *The* **force** *acting on the object.*
  - *Impulse is* **directly proportional** *to force.*
- *The* **time** *that the force acts.*
  - *Impulse is* **directly proportional** *to time.*

Impulse

- *In symbols:*

$$I = Ft$$



Impulse

- *Impulse is a* **vector** *quantity.*
- *Common units of impulse: N s*

Impulse & Momentum

- *The* **impulse** *exerted on an object* **equals** *the object's* **change in momentum.**

Impulse & Momentum

- In symbols:

$$\boldsymbol{I} = \Delta \boldsymbol{p}$$

Conservation of Momentum

- *Since* **impulse = change in momentum**, *If* **no impulse** *is exerted on an object, the* **momentum of the object will not change**.

Conservation of Momentum

- *If **no** **external forces** act on a **system**, the **total momentum** of the system will **not** **change**.*
- *Such a system is called an "**isolated system**".*

Conservation of Momentum

- *Momentum is **conserved** in **every** **isolated** system.*

Conservation of Momentum

- *Another way to think about it is:*

Internal *forces can* ***never*** *change the* ***total*** ***momentum*** *of a system.*

Conservation of Momentum

- *In practice, for any event in an* **isolated system***:*

- *$Momentum_{after} = Momentum_{before}$*

The End.