**Momentum**

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| **Equation:** | **Units:** |
|  |  |

**Example 1**: What is the momentum of a .1 kg baseball traveling at 10 m/s?

**Example 2**: Which has more momentum?

1. 1 kg at 50 m/s
2. 10 kg at 30 m/s
3. 100 kg at 2 m/s
4. 1000 kg at rest

Which of the above has more inertia?

**Conservation of Momentum and Collisions**

Momentum is a **vector**. It has magnitude and direction. It can be positive or negative.

Momentum is **conserved** for an isolated system. Meaning, during a collision between two objects, the total momentum of the objects before the collision is equal to the total momentum of the objects after the collision. The momentum lost by one object is the momentum gained by the other.

A system is isolated when no external unbalanced forces act on it.

**Example 3 [explosion-initially at rest]**: A 50 kg girl and a 70 kg boy on carts push off of each other. How fast will the girl move if the boy moves at 4m/s after the collision?

**Example 4:** A .2 kg bullet is fired from a 10 kg rifle. If the bullet leaves the barrel at 300 m/s, what is the recoil velocity of the rifle?

**Example 5:** A 3 kg object traveling East at 2 m/s collides with a 5 kg object traveling West at 3 m/s. After the collision, the 3 kg object travels West at 4 m/s. What is the velocity of the 5 kg object after the collision?

**Example 6:** A 3 kg ball traveling at 2 m/s hits a 4 kg ball traveling at 1 m/s in the opposite direction. The 3 kg ball continues to travel in the original direction at 1 m/s. How fast is the 4 kg ball traveling?

**Example 7 [crash and stick]**: A 4 kg object traveling at 3 m/s collides with a 5 kg object initially at rest. The two objects stick together. How fast will they move?