Motion 5 - Momentum

In physics there is a super special set of rules that rule over all of physics. They are the **Laws of Conservation**. In chemistry you met two of them, 'Conservation of Mass' and 'Conservation of Energy'. Today you meet a new **Law of Conservation**, and in your next and final unit, you will meet yet another.

Laws of Conservation are so important because they form the basis of nearly everything we know about science.

Conservation of Momentum

<u>Momentum</u> is simply mass times velocity, $p = mv$, where p is momentum, m is mass, and v is velocity. Conservation of momentum says that the momentum of a <u>system</u> is constant IF there are no forces acting on the system. The most common example of the 'Conservation of Momentum' is pool.

Example

If you have a ball that weighs 1 kg, and is rolling at 1 m/s, then the balls momentum is:

$$\text{Momentum} = \text{Mass} \times \text{Velocity}$$
$$p = mv = (1\,\text{kg})\,(1\,\text{m/s}) = 1\,\text{kgm/s}$$

Definitions

Momentum - Mass times velocity. $p = mv$

System - A group of stuff that is interacting.

Activity

You are going to check to see if the **Conservation of Momentum** is true. To test this you will analyze 3 different collisions using the 'Tracker' program.

Setup - Procedure

- Get a length of foam track, two steel balls, and a wooden ball, two short pieces of tape, and a meter stick.
- Tape the track to the floor, and place the meter stick next to the track.
- Record a video of the two steel balls colliding.
    - Make sure you hold the camera still
    - Make sure that you can see the meter stick in your video
- Record a video of a steel ball and the wood ball colliding.
    - Make sure you hold the camera still
    - Make sure that you can see the meter stick in your video
- Weigh the steel ball and the wooden ball on the balance.
- Return all of the items.
- Get two balls.
- Record a video where you drop both balls at the same time, one on top of the other.
    - Hold the camera still
    - Make sure you can see the meter stick in the shot.
- Process all three videos using the tracker program.

Questions for Labbook

For **EACH** of your three collisions sketch the following graph into your lab notebook.

- On one graph plot:
    - The total momentum (p, not px, or py) of the first object.
    - The total momentum (p, not px, or py) of the second object.
    - The sum of the two momentums.

Of note; ask me how to show two data lines on one graph, and you will have to do the sum of the momentums by hand.