Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Hour\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Momentum Bashing**

**Essential Quesiton:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Background information:** Science is a process that is performed not only by individuals but by a “scientific community”. One of the first groups to represent the scientific community was the Royal Society of London for Improving Natural Knowledge, founded in 1660. The group evolved from informal meetings where the members discussed and performed simple scientific experiments. Led by a soon-to-be-famous member named Isaac Newton, they began to explore the topic of motion and collisions. Drawing on previous work from the “scientific community” and his own observations, Newton deduced his three simple laws of motion.

Newton’s Second Law of Motion states that if you wish to accelerate something, you must apply force to it. Newton’s First Law of Motion then says, once an object is moving it will remain moving (unless friction or another outside force, like a wall, stops it). This is inertia of motion, or momentum.

The momentum of a moving object is related to its mass and velocity. A moving object has a large momentum if it has a large mass, a large velocity, or both. A marble can be stopped more easily than a bowling ball. Both balls have momentum. However, the bowling ball has more momentum than a marble. Momentum changes if the velocity and/or mass changes.

**Materials**

-Ruler with center groove -4 marbles -5 ounce paper cup

-Scissors -meter stick -book

**Pre-lab questions**

1. Momentum is often used by sports commentators or political analysts to describe a team’s or candidate’s performance, yet in physics it has a specific meaning. What is the difference in the two meanings?

2. What determines if one car has more momentum than another in a two-car collision?

**Procedure**

1. Cut a 3 cm square section from the tip of the paper cup

(this may already be done for you)

2. Set up your ramp like the following picture.

(bottom of the page)

3. Roll one marble down the ramp into the paper cup and measure how far the paper cup goes.

4. Repeat step two three more times but increase the number of marbles you roll down your ramp each time.

|  |  |  |  |
| --- | --- | --- | --- |
| Number of Marbles | Trial 1 (cm) | Trail 2 (cm) | Trial 3 (cm) |
| 1 |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |

**Analyze your data (Complete the following using complete sentences with a restate):**

1. Please graph your data on the graph paper provided.

2. Describe the relationship between the number of marbles hitting the cup and the distance the cup moves.

3. Explain why an 80,000 pound big rig traveling 2 mph has the same momentum as a 4,000 pound sport utility vehicle (SUV) traveling 40 mph.

4. Explain in your own words the Law of Conservation of Energy.