



Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

## UNDERSTANDING CAR CRASHES: IT'S BASIC PHYSICS ACTIVITY

### MOMENTUM BASHING

#### MATERIALS NEEDED

For each group of 3-4 students

- » One 30.5 cm (1 foot) wooden or plastic ruler with center groove
- » Four marbles, all the same size
- » One 5-ounce (148 ml) paper cup
- » One pair of scissors
- » Two meter sticks or metric measuring tapes
- » One book to support the ruler track (3-4 cm thick)
- » One calculator

#### Per Student

- » One copy of the "Momentum Bashing" Student Activity Sheet

#### Key Questions

- » What determines if one car has more momentum than another in a two-car collision?
- » Does increasing an object's mass increase its momentum or "bashing power?"

#### Purpose

- » To determine if increasing an object's mass increases its momentum
- » To explain how two vehicles of different masses can achieve the same momentum

#### Did You Know?

To better understand what happens in a vehicle crash, it helps to see how force, inertia, and velocity are related to a property called momentum. In physics, the amount of momentum an object has is often referred to as "oomph" or "bashing power." In this activity you will investigate how an object's mass affects its momentum.

#### Procedure

1. Use scissors to cut a 3.0 cm square section from the top of the paper cup.
2. Place the grooved ruler with one end on a textbook (approximately 3.0 cm high) and the other end resting on the table top or floor.
3. Place the 3.0 cm square opening of the cup just over the end of the ruler resting on the desk/floor.
4. Place a meter stick or measuring tape alongside the cup with the "zero" end of the meter stick or tape lined up with the opening in the cup to measure the distance it moves when struck by the released marbles.
5. Position ONE marble in the groove at the end of the ruler resting on the book. (See Figure 1 for completed set-up.)

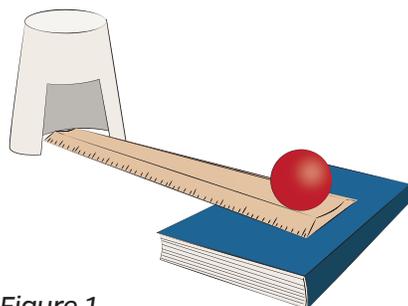


Figure 1

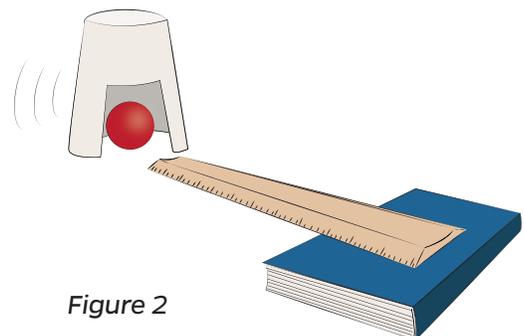


Figure 2



## MOMENTUM BASHING

### Procedure (continued)

6. Release the marble and observe the collision between the marble and the cup (Figure 2).
7. Use the meter stick/tape to measure and record the distance the cup moved (to the nearest 0.1 cm).
8. Repeat and perform three trials each using 1, 2, 3, and 4 marbles while keeping the height of the grooved ruler constant.
9. Use a calculator to compute the average distance traveled by the cups for each number of marbles and record all measurements in the data table below.

MOMENTUM BASHING DATA TABLE

NUMBER OF MARBLES	DISTANCE CUP MOVES (CM)			AVERAGE DISTANCE CUP MOVES (CM)
	TRIAL 1	TRIAL 2	TRIAL 3	
1				
2				
3				
4				

### Analysis Questions

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

---

---

---

---

---

2. As the marbles collided with cup, did you encounter any problems with the marbles staying in the cup? If yes, describe what happened.

---

---

---

---

---

STUDENT ACTIVITY  
**2**

**MOMENTUM BASHING**

*Analysis Questions (continued)*

3. Explain how marbles escaping the cup during the collision affected your results. In other words, is evidence of this experimental error reflected in your data?

---

---

---

---

---

4. How could you revise this activity to increase the momentum of the collision with the cup using only ONE marble?

---

---

---

---

---

5. 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.

---

---

---

---

---

