

# 7 For the Teacher

## Objective

In this activity, students will use their powers of observation, critical thinking, and problem solving in an attempt to understand why momentum causes the small ball to fly up much faster than it falls down.

## Materials Needed

- 2 balls of unequal size  
(A tennis ball and a basketball will work nicely.)

## Curiosity Hook

Bounce the large ball as students enter the classroom.

## Setup

1. Start by having students observe you holding the two balls, with the small ball on top of the larger ball.
2. Ask students to predict what will happen to this system when you drop both balls at the same time with the smaller ball on top. Have students write their predictions under 1 on the student page.
3. When dropped in this configuration, the smaller ball flies upward with a much greater velocity than it had in falling down. It also flies much higher than the original height from which it was dropped. Have students record this result under 2 on the student page.

## Safety Concerns

1. The smaller ball will fly off the larger ball with surprising speed and force and often at unexpected angles, so position students well back from the drop zone.
2. Consider doing this activity outside or in a large open area like a gymnasium to minimize the possibility of something in your classroom getting broken by flying balls.

## Outcomes and Explanations

1. Why does the small ball fly upward faster than it came down and higher than the height it was dropped from? In one word—*momentum*.
2. As the small ball falls and nears the floor, it collides with the upward-rising large ball. This collision results in the momentum of the larger ball being transferred to the smaller ball.

3. Momentum is a function of mass or size. The larger ball has much more momentum than the small ball, and when this large amount of momentum is transferred to a smaller object (the small ball), the smaller object literally rockets upward.
4. Discuss momentum with students, and have students write the explanation under 2 on the student page.

## Application

Challenge students to consider the following problems:

1. What if we drop two balls of the same size? (There is little or no added velocity or height to the ball on top.)
2. What if we drop more than two balls? (Say you drop four balls of different sizes in a configuration like that illustrated. Ball 1 bounces up with a velocity close to what it had in falling, but ball 2 bounces up much faster, ball 3 even faster, and ball 4 will shoot upward at a tremendous comparative speed to over five times the height from which it was dropped.)



## Take Home

This is an easy activity for students to try at home. Encourage them to try the challenge problems given under the Application section.