

CONCEPTUAL PHYSICS**Activity***8.2 Momentum: Impulse Changes Momentum*

EGG TOSS

Purpose

In this activity, you will investigate the effect that stopping time has on stopping force when momentum changes.

Required Equipment and Supplies

raw egg
2 garbage bags
access to masking tape
safety glasses or goggles
a playing field (soccer, football, baseball, softball, etc.)
trundle wheel or long tape measure (optional)

**Procedure**

One person in the group is going to throw a raw egg to another person in the group. The second person must catch the egg without letting it break. When the thrower and catcher are close to each other, the task is fairly simple. As the distance increases, the task becomes more difficult.

Step 1: Prepare for the activity by choosing a thrower and a catcher. The thrower will throw the egg to the catcher. The catcher will catch the egg. Both thrower and catcher must use only their bare hands to handle the egg.

Step 2: The catcher must wear the safety goggles and plastic clothing protection. Use the garbage bags and masking tape to construct plastic ponchos and skirts (or kilts). When the egg breaks, it can make a mess. Make sure the plastic protective garments cover any part of your clothes that should be protected from raw egg white and yolk.

Step 3: Go to the field and line up according to your instructor's directions. The throwers and catchers should be facing each other and should start about three meters apart from each other. Throwers should also be about two meters from each other. If possible, line up so that the sun is not shining in the eyes of the throwers or the catchers.

Step 4: When the instructor gives the signal, the thrower throws the egg to the catcher.

If the catcher catches the egg and the egg remains intact, the group may proceed to the next toss.

If the egg is not properly caught but remains intact, the group must repeat the toss.

If the egg breaks, step on the remains and grind them into ground. If a trundle wheel or long tape measure is available, use it to determine the distance between the thrower and catcher when the egg broke.

The thrower (or someone else in the group) must retrieve the egg from the catcher. The catchers should move back three meters, and the throwers should return to their original throwing line.

Step 5: Repeat step 4 until the last group breaks their egg.

Summing Up

1. How far did your thrower and catcher get from each other before the egg broke? What was the longest distance achieved in the class? (Use an estimate if you didn't measure it.)

2. What was the trick to making a successful catch? What does this have to do with stopping time?

3. Compare a sudden-stop catch with a gradual-stop catch.
 - a. In which case is the mass of the egg greater? Or is it the same either way?

- b. In which case is the change in velocity of the egg greater? Or is it the same either way? (Be careful!)

- c. In which case is the change in momentum ($m\Delta v$) of the egg greater? Or is it the same either way?

- d. In which case is the stopping time greater? Or is it the same either way?

- e. In which case is the stopping force greater? Or is it the same either way?

4. Use your findings from this activity to explain the purpose of airbags in cars. Don't use words like "cushion," or "absorb." Do use terms like "stopping time," and "stopping force."

5. What are some other examples of changing stopping time to change stopping force?
