

**THE AMERICAN CHEMICAL SOCIETY
CLEVELAND SECTION &
NASA GLENN RESEARCH CENTER**

As part of the National Chemistry Week celebration
(October 19 - 25, 2008)

Ask students in grades 9 through 12 to investigate:

“Bouncing Balls”

Many balls used in common sporting events bounce when dropped on a hard surface. Do all balls bounce back to the same height? Do the experiment below to compare the ‘bounciness’ of different balls.

Follow the instructions below and answer the questions.

Materials:

- **Tape measure or yardstick (or meter stick)**
- **A table tennis (ping pong) ball**
- **A golf ball**
- **A tennis ball**
- **A baseball**
- **A basketball**
- **A Superball**
- **Any other balls you can find, e.g. a foam ball, Nerf ball, or soccer ball**
- **Masking tape**

An area with a smooth, firm floor made of wood, tile, or concrete is required. An uncarpeted basement floor or garage floor would be suitable. A large board or tile placed on a carpeted floor could be used for the bouncing surface.

Please request the help of an adult to do the experiment below. Please make sure the area to be used is suitable and that tape may be placed on the wall without causing any damage.

You may want to practice bouncing the balls before starting the measurements.

1. Use a few pieces of masking tape to fix the yardstick or tape measure to a wall such that the zero position is at the bottom of the wall, touching the floor. Make sure that the tape or stick is straight and vertical.
2. If a large board or tile is being used for the bouncing surface, place it on the floor, close to the tape measure.
3. Hold the first ball to be tested (e.g. the golf ball) so the bottom of the ball is level with the 100 cm (45.5 in) mark on the tape measure or yardstick.
4. Gently release the ball (without throwing it) straight down and let it bounce on the hard surface (floor) and bounce back up.
5. Place a piece of masking tape on the wall next to the tape measure or yardstick at the highest point reached by the bouncing ball (rebound height). Use the bottom of

the ball to mark the position. You may have to practice a few times to be able to get the masking tape in the correct position.

6. Read and record the rebound height of the bouncing ball using the closest number on the tape measure or yardstick.
7. Repeat steps 3 – 6 five more times and calculate the average rebound height.
8. Repeat steps 3 – 7 for the different balls listed and record all results on your data sheet.
16. Place the table tennis ball on top of the golf ball so that the bottom of the golf ball is level with the 100 cm (45.5 in) mark on the tape measure or yardstick. **Do not attach the balls together in any way.**
9. Repeat steps 3 – 7 and record the highest bounce of the golf ball. (Use the highest bounce point of the bottom of the golf ball.) Make sure that the table tennis ball is directly over the golf ball when they are released.
10. Record your observations on the bounce height of the table tennis ball.
11. Repeat steps 9 – 11 using a tennis ball to replace the table tennis ball and a basketball to replace the golf ball.
12. Determine the average fraction of kinetic energy that is returned for each ball using the ratio of the bounce height to the initial height. For the table tennis / golf ball and tennis / basketball combinations, use the rebound heights of only the lower ball.
13. Create a data chart (in the format shown below) to display the rebound heights (individual and average) and average fraction of kinetic energy returned.

Bouncing Ball	I Initial Height (in/cm)	R Rebound Height (in/cm)	A (average of R) Average Rebound Height (in/cm)	A / I Kinetic Energy - Average Fraction
Golf Ball	100 cm			
Table Tennis Ball	100 cm			

Questions:

- **Based on your results, what would be the requirements for a ball to have a high bounce? For example, weight, elastic outer layer, etc.**
- **What happens to the kinetic energy of the ball that is lost on bouncing? Why does the amount differ for the different balls tested?**
- **Describe the chemical composition of the material used to make a Superball? What makes it 'super'?**

- ***Can you explain why the table tennis ball bounce was different when it was combined with the golf ball compared to when it was bounced by itself? Would you expect a change in the rebound height of the golf ball? Explain your answer.***
- ***Of the medium size balls tested (e.g., the tennis ball and baseball), which ball had the lowest rebound height? Can you explain why?***
- ***Of the small balls tested (e.g., the table tennis ball, golf ball, and Superball), which ball had the lowest rebound height? Can you explain why?***
- ***A golf ball is typically made with a large core surrounded by one or two layers. Can you explain why two or more layers are required for good performance on the golf course?***

To complete your entry send us:

- a. Written answers to all the questions and your data sheet.
- b. Please complete the entry form ([Chemistry Contest Entry Form](#)) and attach it to your entry. Entries should be postmarked by Friday, November 7, 2008.
- c. Send your entry with a self-addressed stamped envelope (refer to [Chemistry Contest General Information](#) for details) to:

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