Temperature Effects on Ball Bounceability

FYI...

If you wish to do the experiment in a single session, you can gather two of each kind of sports ball and place one of each in the freezer the day before you'll do the activity.

Ball bounceability is an important element of many sports. Tennis and ping-pong balls must meet certain bounce criteria to be used for regulation play. Golfers want balls with sufficient elasticity to be driven long distances, and a tightly wound baseball jumps off the bat faster and travels farther than a loosely wound, "dead" ball. In this activity, you'll investigate how ball bounceability varies with temperature.

Stuff You'll Use:

▸various sports balls, such as ping-pong balls, tennis balls, baseballs, and golf balls ▸access to a freezer ▸uniform hard surface such as table top or linoleum or wood floor ▸meterstick ▸graph paper

What to Do:

1. Look at and feel each of the sports balls but don't bounce them yet. *What variables do you think might affect how high a ball will bounce? Which ball do you think will be the best bouncer? Which ball the worst? Why?*
2. As a group, design an experiment to determine which ball is the best bouncer.
3. Test each ball for bounceability. Measure only the first bounce upon dropping and include at least three trials per ball.
4. Create a table to record your data. Record the results in your data table and make a graph of your results.
5. Place the balls in the freezer for 24 hours.
6. Repeat steps 3–4 with the balls from the freezer.
7. *How did the colder temperature affect each ball's ability to bounce?*
8. *Why do you think the cold had the effect it did on each ball? In particular, how do you think the air inside the hollow balls is affected by the decrease in temperature? Relate this to the bouncing behavior you observed.*

How It Works:

In general, cold balls bounce less than warm ones. For balls with solid interiors, temperature affects the elasticity of the material inside. For example, cold rubber is less flexible than warm rubber. This lack of flexibility causes more of the bounce energy to go into making the molecules vibrate and less into elastic potential energy.

In the air-filled balls, the lower temperature causes the air pressure in the ball to decrease, resulting in a less bouncy ball. (Think of a partially deflated basketball.) The direct relationship of changing gas pressure with temperature is called Charles' Law.

More Fun?

Learn more about the physics and chemistry of bouncing balls. Terrific Science Press (www.terrificscience.org/sciencestore) offers the following books that include activities involving bounceability and elasticity:

- *Chain Gang: The Chemistry of Polymers*
- *Teaching Physics with TOYS EASYGuide Edition*