

Tennis Ball Distillation

Introduction

Tennis balls are used to illustrate a variety of phase changes and distillation.

Concepts

- Kinetic molecular theory
- Distillation
- Evaporation
- Phase changes
- Condensation
- Melting

Materials

Methyl alcohol, 1 mL

Water

Balance

Plastic tub, large, clear

Syringe, large, with needle

Tennis balls, two different colors or brands are best, approximately 24



Safety Precautions

Make sure that you are aware of your surroundings when shaking the tub. The flying tennis balls could cause damage. Wear safety goggles while performing this demonstration.

Preparation

Using a large syringe with a needle, inject water (with a couple of drops of methyl alcohol added) into a few tennis balls of one color. Make sure you get as much water as possible into the ball. There is no need to seal the ball; the latex in the ball does an excellent job of holding the water in. It is best if about one-half of the tennis balls are “heavy.” Don’t let the students know this was done. Optional: This demonstration can be done without filling any tennis balls.

Procedure

1. Place the 24 tennis balls in the plastic tub. Tilt the tub to show the students that the tennis balls are touching. They are now in a simulated solid state.
2. Start putting energy into the tennis balls by gently shaking the tub sideways. This represents the particles gaining energy and melting. They are now in a simulated liquid state. Point out that if energy is not continually added to the tub, the tennis balls will lose energy as they collide and will slow down and “solidify or freeze” again.
3. Shake the tub even harder and the tennis balls will begin flying out of the tub! This represents them becoming a simulated “gas!” Continue shaking the tub until about half of the balls have “evaporated.”
4. If two different colors or brands of tennis balls have been used, it will be quite obvious that only one type of tennis ball has “evaporated.” Distillation has been demonstrated. The balls injected with water will remain in the tub. The students will almost always ask how this happened. After letting the students suggest a cause, mass the tennis balls remaining in the tub one at a time on a balance and compare them with the “evaporated” tennis balls.
5. Have the students pick up the tennis balls that have “evaporated” and toss them back into the tub. (What a chance to throw something at the teacher—this may be a good time to put on safety goggles!) Catch the tennis balls in the tub to represent “condensation.” Point out that if the students throw the balls too hard, they will have too much energy, and will not condense.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12

Systems, order, and organization
Evidence, models, and explanation

Content Standards: Grades 5–8

Content Standard B: Physical Science, properties and changes of properties in matter, transfer of energy

Content Standards: Grades 9–12

Content Standard B: Physical Science, structure of atoms, structure and properties of matter, motions and forces, conservation of energy and increase in disorder, interactions of energy and matter

Tips

- Different colored tennis balls work better to demonstrate how one substance had a lower boiling point and evaporated first.
- At the beginning of the demonstration, when the tennis balls are “condensed,” show students that the atoms are in a close-packed lattice.
- The tub may have to be tilted a little bit to “assist” the evaporation process. Remember, evaporation requires a lot of energy—the tub must be vigorously shaken. Any of the tubs listed below work well.
- There are many variations and other possible points for discussion that may arise out of this model of the kinetic molecular theory.
- Talk to your tennis coach about saving old, flat tennis balls for science demonstrations.

Acknowledgment

Special thanks to Doug De La Matter, retired teacher from Madawaska Valley District High School, Barry’s Bay, Ontario, for providing Flinn Scientific with this idea.

Reference

De La Matter, D. *Chem 13 News*, Oct. 1999, p 27.

Materials for *Tennis Ball Distillation* are available from Flinn Scientific, Inc.

Catalog No.	Description
AP5415	Sterilizing Tray, 190 × 10½0 × 50
AP1149	Syringe with Needle
AP9171	Clear Plastic Pan
AP5909	Storage Container with Lid

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.