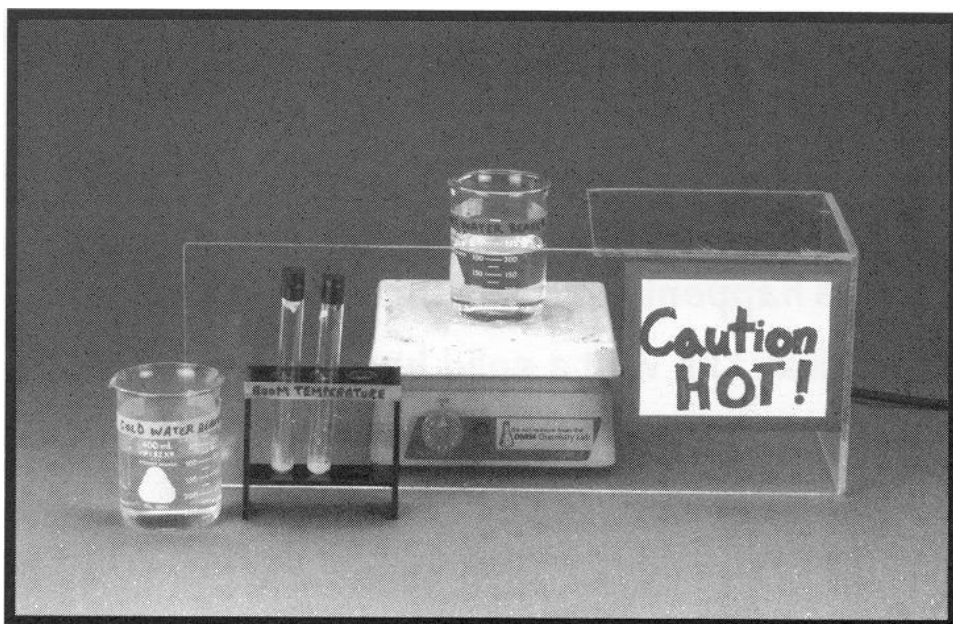


SIDE DISPLAY **Phase Changes**

Visitors observe a sealed test tube containing a small amount of solid stearic acid. They place the test tube into a beaker of hot water and observe the white stearic acid as it melts into a yellowish fluid. They then place the test tube into a beaker of ice water and observe as the stearic acid re-solidifies.

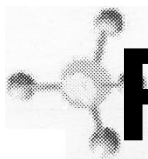


OBJECTIVES:

Visitors learn that matter normally exists in one of three states or phases: solid, liquid, or gas. They learn that changes in temperature cause changes in the movement of the molecules that make up a substance. In turn, changes in molecular motion can cause phase changes in the substance, even though the molecular composition remains the same.

SCIENCE TOPICS	PROCESS SKILLS	VOCABULARY
Properties of Matter	Observing	Atom
Phase Changes	Comparing/Contrasting	Gas
Temperature		Liquid
		Molecule
		Physical State
		Solid



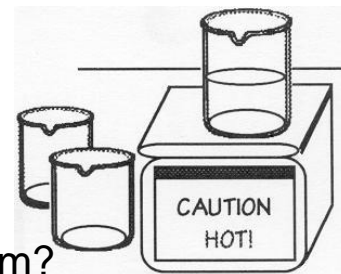


Phase Changes



To do and notice:

(**Caution!** The beaker and the hot plate are **HOT!**)



1. Look at the test tube. What do you see at the bottom?
2. Place the test tube in the beaker of hot water and gently swirl it. What is happening to the material in the test tube?
3. Wait until all the white solid has melted.
Now what color is the liquid in the bottom of the test tube?
4. Place the test tube in the ice water and gently swirl it. Wait a few moments. What happened to the liquid? What color is it?
5. Can you melt the solid again? Try it!
6. Put the test tube back in the room-temperature rack.

What is going on?



Matter takes the form of solid, liquid, or gas—the three physical states. The atoms (or molecules) of solids are very close together and cannot move freely, so solids are rigid (like ice). The atoms (or molecules) of liquids flow freely and conform to the shape of their containers (like water).

The test tube contains stearic acid, a fat. Heating the test tube caused the stearic acid molecules to move more quickly, causing a change from solid to liquid (melting). Cooling caused the molecules to slow down and stick together as a rigid solid.

MATERIALS**(with amounts to have on hand)**

- Two test tubes with rubber stoppers
- Electrician's tape
- Approximately 2-3 g stearic acid
- One hot plate
- One black test-tube rack
- Two 600-ml glass beakers
- Ice

Setup/Takedown Procedures**ORIGINAL SETUP**

- Label the glass beakers "Cold Water" and "Hot Water."
- Label the test-tube rack "Room Temperature."
- Place a small amount of stearic acid in the bottom of each test tube (just enough to fill the curved bottom of the test tube).
- Insert the stopper into the test tube and securely tape the top closed with electrician's tape.
- Prepare and laminate a sign for the hot plate that reads, "CAUTION: HOT!"

WEEKLY SETUP

- Set out the public copy in a Plexiglas stand.
- Set out the two beakers and test-tube rack.
- Note:** When using new test tubes of stearic acid, melt the stearic acid in the tubes in very hot water before setting it out for the public. (The first melting takes much longer than later meltings because the stearic acid is still in powder form.)

DAILY SETUP

- Put the hot plate and the laminated "CAUTION: HOT!" sign on the counter.
- At least one half hour before opening, set the hot plate on 3 or 4. Fill the glass beaker labeled "Hot Water" $\frac{3}{4}$ full of water and heat it on the hot plate. The water needs to be almost boiling.
- Fill the beaker labeled "Cold Water" with ice water.
- Put the two test tubes in the test-tube rack labeled "Room Temperature."

- Check the test tubes periodically for signs of tampering.
- Check the hot water periodically to make sure it has not all evaporated.
- Check the ice water to be sure it is still cold.

DAILY TAKEDOWN

- Turn **off** and **unplug** the hot plate.

WEEKLY TAKEDOWN

- Retain the stearic acid test tubes for reuse.
- Return the test tubes, beakers, and public copy to storage.



RUNNING SUGGESTIONS



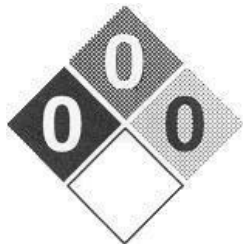
- ◇ Start heating the water at least $\frac{1}{2}$ hour before opening the lab. Check frequently to make sure the beaker is still at least $\frac{1}{4}$ full of water; add more water as needed.



EXTENSIONS

Visitors can relate this process to water melting and freezing.

SAFETY & DISPOSAL



Use of the hot plate requires continuous monitoring; follow the specified safety precautions.