

Physical Change and States of Matter

Adapted from chemsite.lsrhs.net/f_Phase_change/Handouts/sodium_thiosulfate_lab.pdf

Question: What are phase changes?

Core Content

SC-M-1.3.1 “Energy is a property of many substances and is associated with heat, light, electricity, and sound. Energy is transferred in many ways.”

SC-H-1.2.5 “Solids, liquids, and gases differ in the distances between molecules or atoms and therefore the energy that binds them together. In solids, the structure is nearly rigid; in liquids, molecules or atoms move around each other but do not move apart; and in gases, molecules or atoms move almost independently of each other and are relatively far apart.”

Objectives:

Students will be able to:

1. Give an example of physical change.
2. Observe the form of the energy transferred (heat) during phase changes.
3. Determine if energy is given off or absorbed during various phase changes.
4. Infer the relative energy levels (lowest to highest) of the three states of matter.

Materials

Per group of two

- 2 g Sodium Thiosulfate Pentahydrate ($\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$)
- 1 Test tube
- 1 Alcohol burner or candle
- 1 200 ml beaker
- 1 Balance
- 1 Scoop

Procedure/Time

This activity will take approximately 45 minutes.

The first steps can be done by the students or as a demonstration by the teacher. If done as a demonstration, be sure to have students predict what is going to happen in each step.

1. Place about two grams of Sodium Thiosulfate in the test tube. (Students could weigh their own amounts to practice using a balance)
2. Fill the beaker with cool tap water.
3. Using an alcohol burner or a candle, heat the solid very gently for at least five minutes. Move the test tube back and forth above the flame. Never hold it in the flame continuously. Make sure the test tube is evenly heated. Place the test tube in the beaker of water.
4. Ask students the questions under Part 1 on the activity sheet.
5. Take the test tube out of the beaker of water, and dry it.
6. Place a single crystal of the original solid in the test tube.

7. Ask students the questions under Part 2 of their activity sheet.

Assessment

The handout with the questions should be used.

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Interpreting Results

Part 1.

1. What happened to the solid in the test tube?
2. Did you add heat or take away heat?
3. Did you add energy or take away energy?
4. Did the solid absorb heat or give off heat?
5. Did the solid absorb energy or give of energy?
6. Based on your previous answers, would you add energy or take away energy to change a liquid to a gas?
7. Would you add heat or take away heat?
8. How about to change a gas to a liquid?
9. Liquid to solid?
10. What should happen to the temperature of the test tube if the liquid is changed back to a solid?

Part 2

11. What happened to the liquid (give it time)?
12. What happened to the temperature of the test tube?
13. Was your previous hypothesis correct?
14. Do you think water changing to ice gives off heat or absorbs heat?
15. How about ice changing to water?
16. Can you now explain why ice is used to cool your drinks?

Based on what you've learned about whether energy is given off or absorbed by a phase change, can you list the states of matter in order of increasing energy? In other words, which state has molecules moving the slowest (lowest energy), and which state has molecules moving the fastest (highest energy)?