

8.4 Changes in Matter: Hot Ice and the Carbon Snake

Grade 8 Activity Plan



Reviews and Updates

- Hot Ice and Carbon Snake Activity add by Fola Akpan in July 2017

8.4 Changes in Matter: Hot Ice and the Carbon Snake

Objectives:

1. To know the science behind, and be acquainted with, natural and artificial occurrences of phase changes.
2. To understand the differences between physical changes and chemical changes
3. To understand combustion, supercooling and supersaturation

Keywords/concepts: combustion, phase change, heat, temperature, supercooling, supersaturation

Take-home product: A piece of hot ice

Segment	Details
African Proverb and Cultural Relevance (5 min.)	"Don't take another mouthful before you have swallowed what is in your mouth." Madagascar
Pre-test (5 min.)	Ask probing questions on students' knowledge of heat, water, and steam together? Define and illustrate key concepts where applicable.
Background (15 min.)	What is heat energy, how it is produced, harnessed and used in everyday life.
Activity 1	Students will get to see how supersaturation and supercooling can create a reaction that causes Hot Ice
Activity 2	Make a carbon snake using sugar and baking soda
Post-test (10 min.)	Oral Question and answer session

Suggested interpretation of proverb: One needs to always have their priorities right. It is not good to rush. Concentrate on what is present and necessary. As seen in the activity, the engine would eject steam before sucking in more water into it.

BACKGROUND INFORMATION

Heat energy is the energy produced by the moving atoms or molecules. Heat is produced from the movement of molecules. The faster the molecules move the more heat is produced. The heat energy created can be used to produce other forms of energy, such as steam energy, kinetic energy or chemical energy.

For more information on heat energy see activity 7.7

When heat is applied to a water molecule, the atoms begin to move very rapidly around it. The change of state from a liquid to a gas takes place when the energized, moving molecule of water takes to the air because of its quickly moving electrons.

Physical changes of matter are changes in the form of a substance, but not the chemical composition

Chemical changes of matter are changes in the chemical composition of matter

In the hot ice experiment, the sodium acetate is used to show how supercooling and supersaturation work together. A **supersaturated** is a solution in which the solute is more than the solvent. In this case the solute is the Sodium Acetate and the solvent is the water. A **supercooled** solution is a liquid is chilled below its freezing point. This experiment is an example of a physical change and a phase change.

In the black carbon snake experiment, the sugar and baking soda demonstrate the concept of combustion. **Combustion** is the process of burning matter. When the sugar and baking soda in the experiment combusts, they is chemically changed into water vapour, sodium carbonate and carbon dioxide. The pressure created by the carbon dioxide pushes the sodium carbonate out, which creates the black carbon snake. This reaction is referred to as the dehydration of sugar.

Both experiments are examples of **exothermic reactions**, which produce heat. In the hot ice experiment, bond formation causes the exothermic reaction. In the carbon snake experiment, combustion causes the exothermic reaction because energy is released.

Additional Information

<https://www.sciencedaily.com/terms/supercooling.htm>

<https://www.thoughtco.com/make-black-snakes-or-glow-worms-605964>

<https://eic.rsc.org/exhibition-chemistry/hot-ice/2000049.article>

Activity 1- Hot Ice: Sodium Acetate

Source: <http://www.livestrong.com/article/251878-an-explanation-of-sodium-acetate-hot-ice/>

Purpose: To understand the science behind, and be acquainted with, natural and artificial occurrences of phase changes, supersaturation and supercooling

Note: It is advised that the mentor prepare and test the solution beforehand

Item	Quantity (10 students)
Baking Soda	3 Tablespoons
Vinegar	1 Liter
Hot Plate	1
Pot	1
Mason Jar	2
Gloves	10

Procedure:

NOTE: Make sure that all of your equipment is clean since other particles can affect the outcome of the solution

1. Measure out 3 tablespoons of Baking Soda and put it into the pot
2. Measure out 1 Liter of Vinegar and pour it slowly into the pot
3. Stir the baking soda and vinegar together until there are no undissolved baking soda particles

(NOTE: It is very important that the mixture is completely clear)

4. Boil the solution until the first trace of film appears on the surface of the solution, then take the pot off heat immediately (**NOTE:** It is very important that the mixture is not overcooked and does not burn but there is a way to fix the solution if a problem does occur)
5. As the water is boiling, scrape off the crystals that form on the side of the pot. These crystals will be used to activate the hot ice
6. Pour the solution into a mason jar and seal the mason jar
7. Chill the solution in the fridge or in an ice water bath until the temperature is slightly below room temperature
8. Place the crystals into the solution. This is when the hot ice starts to form.

NOTE: If the hot ice doesn't form, then the solution was made incorrectly. To fix this, add more vinegar to your original solution and redo steps 4 -8.

Additional Information

<https://www.youtube.com/watch?v=Yxk3OZWq9Ls>

Contains Hot Ice troubleshooting information

Activity 2 – Carbon Snake

Source: https://www.youtube.com/watch?v=Hibxz9_ZW18
<https://melscience.com/en/experiments/sugar-snake/>

Purpose: To understand combustion, exothermic reactions and dehydration reactions

Suggested Format: Have the kids work in groups of 2 or three

Item	Quantity (10 students)
Powdered Sugar	1 package
Baking Soda	1 package
Bowl or Foil Pan	5
100% Ethanol	250 mL
Safety Goggles	10
Lighter	1
Sand	20 cups
Gloves	11

Procedure:

1. Fill the bowl about 4/5th with sand
2. Mix together 1 tsp of baking soda and 4 tsp of powdered sugar
3. Make a hole in the sand and put about 50 mL of ethanol into the bowl
4. Place the sugar mixture into the hole in the sand
5. Light it on fire and watch the carbon snake form!