

HARD ROCK CANDY

PRE LAB DISCUSSION

This is an experiment in controlling crystal growth. Rock candy, like most candy, is made primarily from sugar. The candy can be anything from large single crystals to an amorphous solid. In this experiment the students will produce each end of this spectrum.

Making fudge is an excellent follow-up to this experiment. The key to making good fudge is controlling crystal growth in a supersaturated solution. Most fudge recipes use both chemical and mechanical means to reduce the size of the sugar crystals in order to have a creamy texture. It is difficult to make fudge in most classrooms, however. An analysis of fudge recipes will extend the appreciation of how chemical principles are used in candy making.

Students may wish to make fudge at home and have the class evaluate their results.

This experiment will take several days to complete.

PART I

OBJECTIVE: To make sugar crystal rock candy.

CHEMICALS/ EQUIPMENT: cane sugar, 250 ml beaker, Bunsen burner, ring, screen, ring stand, string, glass rod, weight [a nail will do]

PROCEDURE:

1. Boil 125 ml of water in a very clean beaker. Turn off the burner.
2. Add sugar until no more sugar will dissolve. Be sure that all the crystals have dissolved. It may be necessary to re-heat the solution.
3. Tie a weight on a piece of string. Suspend the string in the supersaturated sugar solution using a glass rod or pencil to support it.
4. Place the beaker where it will not be disturbed for a few days. Make and record daily observations of crystal growth.

PART II

OBJECTIVE: To make amorphous rock candy.

CHEMICALS/EQUIPMENT: cane sugar, corn syrup, candy thermometer, non-stick spray [Pam] or solid shortening [Crisco], large beaker, stirring rod or spoon, aluminum foil, *optional wooden splints, food coloring, flavoring such as mint, orange, lemon etc.*

PROCEDURE:

1. Place 1/2 cup of sugar, 1/8 cup of corn syrup, and 1/8 cup of water into the beaker and stir.
2. Heat the beaker while stirring gently to prevent burning. Continue heating until the mixture boils. Record the temperature at which it begins to boil. Observe and record any changes in the clarity of the liquid.
3. Continue to gently boil the solution 285° F. Then turn off the burner and allow it to cool.
4. Prepare aluminum foil molds for your candy or lollipops. Lightly grease the foil molds so that the candy will not stick to the foil. Position wooden splints in the mold to make lollipops.
5. Optional: - When the solution has cooled to about 200° F stir in one drop of food coloring and a drop of flavoring.
6. Pour the solution into the molds. Allow the solution to cool to room temperature without being disturbed. Make and record the observations of the resulting solid.

PART III

OBJECTIVE: To determine the effect of "seeding" at various temperatures on sugar crystal growth.

CHEMICALS/ EQUIPMENT: cane sugar, beaker, Bunsen burner, ring, screen, ring stand, stirring rod or spoon, candy thermometer, 4 evaporating dishes

PROCEDURE:

1. Place 25 ml of water and 50 grams of sugar in the beaker.
2. Heat gently while stirring until the sugar has dissolved.
3. Continue heating until the mixture boils and reaches a temperature of approximately 240° F
4. Using beaker tongs, pour equal amounts of the hot liquid into four evaporating dishes. *BE VERY CAREFUL NOT TO GET ANY OF THIS HOT STICKY LIQUID ON YOUR SKIN.*
5. Using a strong stirring rod or spoon, beat one portion of this now.
6. Beat another portion when it reaches 160° F.
7. Beat the third portion when it reaches 140° F.
8. Beat the last portion when it reaches 100° F.
9. Examine each portion to determine crystal size using a low power microscope or magnifying glass. Record your observations.
10. Feel each portion to determine which has the smoothest texture. Record your observations.

PART IV

OBJECTIVE: To determine the effect of chemical additives on the growth of sugar crystals.

CHEMICALS/EQUIPMENT: cane sugar, corn syrup, cream of tartar, glycerin, vinegar, beakers, Bunsen burner, Candy thermometer, ring, screen, ring stand, stirring rod or spoon.

PROCEDURE: [*The teacher should divide the class into 5 groups, a control group and a group for each of the 4 additives*]

1. Place 25 ml of water and 50 grams of cane sugar into a beaker.
2. Add the following according to your group assignment:
 - i. control group.....add nothing
 - ii. group one.....add 0.1 gram of cream of tartar
 - iii. group two.....add 4 ml of vinegar
 - iv. group three.....add 10 ml of corn syrup
 - v. group four.....add 3 ml of glycerin
2. Heat the mixture gently while stirring until it reaches a temperature of 240° F.
3. Allow the solution to cool to 140 ° F and then beat it with a spoon or stirring rod.
4. Using a microscope or magnifying glass, observe the crystal size of each of the five portions.
5. Touching the sugar, determine the texture of the sugar.

OBSERVATIONS
PART I

Day one observations

Day two observation

Day three observations

Day four observation

Day five observations

PART II

Observations of the clarity or crystal structure of the candy

PART III

Crystal size and texture of:

Portion I [beating at high temperature]

Portion II [beating at 160 ° F]

Portion III [beating at 140 ° F]

Portion IV [beating at 100° F]

PART IV

Crystal size and texture of:

Control

With cream of tartar

With vinegar

With corn syrup

With glycerin

THINKING SCIENTIFICALLY

Cooking and candy making are often described as an "art". Many famous chefs have secret recipes. Other times recipes become "family secrets" that are passed from mother to daughter. These recipes were often developed over years by trial and error. The cooks often do not know why certain ingredients are used or why something must be stirred only at a certain temperature.

Large-scale commercial food preparation is not an art. It is a science. The company has a sound reason for each ingredient used and cooking times and temperatures are computer controlled.

Write an essay comparing the methods of the alchemists and the modern chemists, chefs using secret recipes, and to the methods of the modern commercial food industry.