SciTech Activities: Food Chemistry

Time: 4 hours (broken down into 4-1 hour classes)

Standards:
4th Grade Science Content Standards:

I&E6. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.
I&E6a. Differentiate observations from inference (interpretation) and know scientist' explanations come partly form what they observe and partly from how they interpret their observations.
I&E6b. Measure and estimate the weight, length, or volume of objects.

5th Grade Science Content Standards:

PS1a. Students know that during chemical reactions the atoms in the reactants rearrange to form products with different properties.
PS1b. Students know all mater is made of atoms, which may combine to form molecules.
PS1f. Students know differences in chemical and physical properties of substances are used to separate mixtures and identify compounds.
PS1g. Students know properties of solid, liquid, and gaseous substances.
I&E6. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.
I&E6a. Classify objects
I&E6. Plan and conduct a simple investigation based on a student-developed question and write instructions others can follow to carry out the procedure.
I&E6f. Select appropriate tools

6th Grade Science Content Standards:

I&E7. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.
I&E7b. Select and use appropriate tools and technology
I&E7d. Communicate the steps and results from an investigation in written reports and oral presentations.
I&E7e. Recognize whether evidence is consistent with a proposed explanation.

Topical Objectives:

- Students will take on the role of a Food Chemists to examine, predict and draw conclusions about the interaction between various food samples and products.
- Students conduct chemistry experiments to identity starches, chemical reactions and differences in the physical properties of solid, liquids and gases.
- Students will use scientific equipment to gather information about the structure and function of starches, carbohydrates, fats and proteins.
- Students will observe and identify various mixtures, solutions and chemical reactions.

Safety Rules:

Instruct student that some of the food and cooking demonstrations CANNOT be eaten! Remind students that Iodine can stain if spilled on clothing. Remind students to clean up spills and keep materials together.

Materials:
(per group of 3-4 students):

Iodine
Water
Droppers
Wax paper/newspaper
Plastic knives
Various food items to test:
Apples, potatoes, rice, flour,
saltines, Cornstarch
Petri dishes
Duct tape
Rock salt
Sugar
Milk
Vanilla
Ice
Spoons
Small/large plastic baggies
Measuring spoons/cups
Yeast
Sugar
Small water bottles
Balloons
Funnels
Warm water
Hot pot
Baggies
Flour
Salt
Baking soda
Water
Vegetable oil
Bowls
Spoons

Day One

Introduction of a Food Scientist and Sugar Crystals (a.k.a. Rock Candy)

Preparation:

1. Prepare pre/post test
2. Gather materials. (Jars, pipe cleaners, spoons, sugar, etc…)
3. Set up hot pot or microwave
4. Conduct a taste testing- if time permits (jelly beans)

Procedure:

1. Pass out questionnaires for this weeks challenge

Questionnaire:

A. What is a Food Scientist?

B. Sodium Bicarbonate is commonly used in cooking as:
   a. Alum
   b. Baking Powder
   c. Baking Soda
   d. Cream of Tartar

C. The bubbles formed by yeast and water or the bubbles in soda are?
   a. Hydrogen
   b. Oxygen
   c. Carbon Dioxide
   d. Nitrogen

D. What are preservatives used for?

2. What is a food chemist and introduction of Rock Candy

A Food Scientist uses science to design new kinds of food. They often try to make food healthier for people and find new ways to make food taste better and last longer.
Food scientists need to know the different substances in food and how food changes when it is cooked.
In this weeks activities, students will act like a Food Scientist and conduct many experiments on food products to observe physical and chemical changes when manipulating ingredients.

Rock Candy

Sugar crystals or Rock Candy is the process of making a thick solution of sucrose (table sugar) and water to dissolve and form edible crystallized candy. It is a relative simple experiment but takes a little bit of time.

****Note**: Hot water is needed for this experiment. Advice students to use caution when mixing their solution together.

Rock Candy Recipe:

1 cup water
3 cups table sugar (sucrose)

1. Students will tie a string or pipe cleaner (crystals will form on a cotton/wool string or yarn, but not on a nylon line) to a pencil or chop stick and place the string into the jar without touching the sides or bottom. 2 or 3 can be placed in each jar.
2. Boil water in a hot pot or in the microwave. Be careful when pouring the water into student's container.
3. Using a measuring spoon, have the students stir in the sugar. They must keep adding the sugar 1 teaspoon at a time. Stir. Add another teaspoon. Stir etc…Each time the students add the sugar, they must stir it until it dissolves.
4. Keep adding the sugar until it starts to accumulate at the bottom of the container and won't dissolve even with more stirring. This has reached the point of saturation. If you don't use a saturated solution, then the crystals won't grow quickly. If the students add too much sugar, new crystals will grow on the un-dissolved sugar and not on the string. It is a fine solution balance!
5. If the students want colored crystals, they can stir in a few drops of food coloring.
6. Pour the sugar solution into the clear glass jar. If you have un-dissolved sugar at the bottom of your container, avoid getting it in the jar.
7. Last, have the students place their pencil over the jar and allow the string to dangle into the liquid.
8. Place the jar somewhere where it will not be disturbed (top shelve or cabinet)
9. Have the students check their solution during the week, they will be able to see the beginning of crystals to form.

Taste Testing: (If time permits)

Student will taste test a variety of jelly beans and record their flavor analysis in their notebooks.

1. Pass out a certain color of jelly bean (maybe red) and have the students write down what flavor they think it is.
2. Next, pass out a small cup of various jelly beans and have the students predict which flavors they think each jelly bean is.
3. Have the students write down how Food Scientists come up with Popcorn, Jalapeno or Root Beer flavors.

Science Notebooks Ideas:

After the sugar crystals have formed, have the student examine the crystals under a microscope or with hand lenses. A variety of crystals (different sugar crystals, salt, even rock crystals) can be provided for closer examination. Students can record the differences in crystal shape, texture, color and size.

Day Two

Making Ice Cream.

Preparation:

4. Gather Ice Cream materials and keep milk in the refrigerator or cooler until ready to use.
5. Gather a large bag of ice and keep in a cooler.
6. Have mittens and gloves available
7. Supply different objects for making ice cream (zip lock baggies, coffee cans etc…)

Procedure:

In this experiment, students will test changes in the properties of matter. Students will be able to see the consistency of the milk liquid change to a solid.

Ice Cream Recipe:

1 cup Milk
2 Tablespoons sugar
½ teaspoon Vanilla
4 cups Ice
6 Tablespoons Rock Salt
Small and Large Size Zip Baggies

1. Have the students work in groups of two.
2. Students will measure one cup of milk, two tablespoons of sugar, and one-half teaspoon of vanilla extract into a pint-size zip baggie.
3. Squeeze out as much air as you can.
4. Place the small baggie of the milk solution into the gallon size baggie.
5. Next, have the students put about 4 cups of ice and 6 tablespoons of rock salt into the gallon size baggie.
6. Again, have the students squeeze all the air out and SEAL!
7. This is where all the work comes in. Have the students come up with the best way to create their ice cream. (Hint: They will need to vigorously shake the gallon size bag for several minutes). If students use coffee cans, will they roll their ice cream or shake.

8. When the ice cream is the desired consistency, (thick), take the pint-size baggie out of the gallon size baggie and rinse it off to remove the salt. Squeeze the ice cream out of the baggie into a paper cup and eat.

Science Notebooks Ideas:

Students should predict how long it will take for their ice cream to become a solid. What is the purpose of adding the rock salt to the gallon size baggie? Students should predict if rolling their ice cream solidifies faster then shaking it. Have students list which flavors of ice cream they think should be sold at the grocery store.

Day Three

Investigating yeast and Pretzels

Preparation:

1. Gather yeast and pretzel materials.
2. Place newspaper on tables.
3. Have students wash hands before they start making pretzels.

Procedure:

When Food Chemists use yeast, they study the properties and chemical reactions that take place in baking products. Too little yeast--will not allow the bread to rise. Too hot or cold water--will not create a product that is appealing to consumers. When yeast is added with sugar, it produces alcohol and carbon dioxide. The increase in gas causes pretzels, pizza and bread to rise. When you cook the pretzels, pizza or bread, the alcohol that is produced by the yeast is cooked away.
In today's experiment, students will act like Food Chemist and add yeast to several common substances to study the results.

Test 1: Yeast Productions

You will need:
- 1 teaspoon yeast
- 3 to 4 teaspoons sugar
- Balloon
- Water bottle
- Warm water

1. Have students pour (using funnel if necessary) the yeast and sugar into the bottom of a water bottle.
2. Add warm water until the bottle is about half full.

3. Place the balloon over the neck of the bottle.
4. Have students record their results and measure their balloons using a flexible measuring tape every 2 minutes.

Test 2: Pretzels

You will need:

1 packet active dry yeast (1 tablespoon)
1 cup warm water (115 to 120 F—not boiling)
2-3/4 cups flour
1 Tablespoon sugar
½ teaspoon salt
2 Tablespoons Oil
4 Cups water
2 Tablespoons baking soda
2 Tablespoons coarse salt

1. Add yeast to the warm water and let stand for about 5 minutes.
2. Combine 1-1/2 cups flour, sugar, salt and oil in a large mixing bowl.
3. Add the yeast mixture and stir until the mixture is well-combined.
4. Add the remaining 1-1/4 cups flour.
5. Have the student divide the dough and knead it for about 3 minutes. The mixture should be smooth and elastic.
6. Students are ready to roll and shape their dough into the shape they desire.
7. If the dough becomes sticky, have the students dust their hands with a little bit of flour.
8. After the students shape their pretzel, they will "dip" their pretzel into the water containing baking soda.
9. Place each student's pretzel in a small zip lock baggie with an instruction label (bake at 450 degrees for 8-10) at placed on a bag. Students will have to bake their pretzel at home.

Science Notebooks Ideas:

Students will design a chart and record their observations every 2 minutes for the First Yeast experiment. Students will measure the circumference of the balloon and note any changes in size. Ask the students if they change one of the variables (add cold water, more yeast or different sugar) what would happen? For the Second Experiment, have the students predict what the baking soda and water does for the pretzels. If they left out an ingredient in the pretzel recipe, will the pretzel come out the same?

Day Four

Testing for Starch

Preparation:

3. Prepare iodine solutions.
4. Place several items (potatoes, flour, cornstarch, rice etc…) into individual Petri dishes (enough for each group of students)
5. Place newspaper or wax paper on tables.

Procedure:

Starch plays a vital role in the biochemistry of both plants and animals. It is made in green plants by photosynthesis, and is one of the main forms in which plants store food. Animals obtain starch from plants and store it as glycogen. Both plants and animals convert starch to glucose when energy is needed. Since starch is an inexpensive and widely available food product, it is being used as a food additive in many food products (Commercially, starch is made chiefly from corn and potatoes).

In this experiment, we will use an Iodine solution as a reagent for starch. One drop of this solution on any sample can detect starch by changing the color of the tested area to dark blue or purple.
Remind the students that once they tested their food items, they should **not eat them!

1. Have the students place newspaper or wax paper down on the table.
2. Give each group several Petri dish samples to test (This might include: instant potatoes, rice, cornstarch, flour, apple slices etc…).
3. Students will use the medicine dropper to put 3 drops of iodine solution on each sample. Continue until all samples have been tested.
4. After the students have tested all the samples, have the students hypothesize why some of the samples turned blue and others did not.
5. Discard ALL food items used in today's experiment!

Science Notebooks Ideas:

Have the students analyze their results and come up with possible explanations on why the iodine turned blue for some samples and not others. Did the cornstarch turn a different color then the instant potatoes? Students can make a list and predict what other food samples they could try. Does pizza contain starch?

Extensions:

- Testing Salt Crystals. Students can experiment with salt solutions, saturation points, and rates of evaporation.
- Testing the differences between baking soda and baking powder.

- PH of liquid substances.
- Test differences in products with preservatives and additives. How long will products last with out preservatives? (Bread, processed/real cheese. Etc…)
- Have the students participate in a taste test.
- THE ELECTRIC PICKLE:

Synthesis:

Food/Flavor Scientist
Food chemists develop and improve foods and beverages; analyze methods of cooking, canning, freezing, and packaging; and study the effect of processing on their appearance, taste, aroma, freshness, and vitamin content of the food. They also test samples to make sure foods and beverages meet food laws and experiment with new foods, additives, and preservatives. Food chemistry encompasses activities from agricultural raw materials to consumer end-use products. Flavor chemists develop flavors that contribute to the overall food system. They do this using a combination of natural and artificial ingredients.

Research:

Career in Food Chemistry
http://www.schoolsintheusa.com/careerprofiles_details.cfm?CarID=373

Rock candy recipe and background:
http://www.exploratorium.edu/cooking/candy/recipe-rockcandy.html

Pretzel website with step-by-step picture demonstrations:
http://www.yumsugar.com/640391

Interesting Electric Pickle experiment:
http://www.stevespanglerscience.com/experiment/electric-pickle