Sugar: Friend or Foe

GRADE LEVELS:
Grades 5th - 8th

CONCEPT:

- Examine a simple food chain to understand how photosynthetic cells convert solar energy into chemical energy in food.

OBJECTIVES: Participants will be able to:

- Learn how plants utilize CO2 produced by other living organisms to produce sugar for all others to use.
- Learn how carbon dioxide is produced by humans for plants to use in the food chain.
- Match up the amount of sugar in each food using a model.
- Use a laboratory test to discover how much sugar is in different foods.

ACADEMIC CONTENT STANDARDS:

- Science: Life Science: 5.1, 5.2, 5.3, 5.4, 7.7
- Science: Scientific Inquiry: 4.1, 5.1, 6.2, 6.3, 7.3, 7.4, 8.1
- Science: Scientific Ways of Knowing: 5.2, 6.3, 6.4, 7.3

VOCABULARY WORDS:
Acid - A compound usually having a sour taste and capable of neutralizing alkalis.
Base - A compound usually having a bitter taste and capable of reacting with an acid to form a salt.
Calorie - The amount of heat required at a pressure of one atmosphere to raise the temperature of one gram of water one degree Celsius.
Glucose - A naturally occurring sugar in many fruits and animal tissues.
Indicator - A substance that indicates the presence or concentration of a specific component.
Photosynthesis - The process by which plants make sugar for energy from carbon dioxide, water, and inorganic salts, using sunlight as the source of energy and with the aid of chlorophyll and associated pigments.

EXTENSIONS AT COSI:

Life

- Visit Labs in Life and view information about nutrition.

ADDITIONAL RESOURCES:
http://www.educationworld.com/a_lesson/lesson/lesson054.shtml
http://www.lifeclinic.com/focus/nutrition/sugar.asp
http://www.askdrsears.com/html/4/T045000.asp

SAMPLE TEST QUESTIONS:

1. _________is the body's primary source of energy.
    a. Fructose
    b. Sucrose
    c. Lactose
    d. Glucose
2. A student sets up an experiment with two identical plants. The plants use the same container and soil. Both plants receive 10mL of water daily. Plant A is placed on a sunny window ledge. Plant B in placed in a dark corner. Which question is this investigation trying to answer?
    a. Does location change the way a plant will grow?
    b. How tall will Plant B grow in 10 days?
    c. Does the amount of sunlight that each plant receives affect its rate of growth?
    d. All of the above.
3. A calorie measures:
    a. Energy
    b. Sugar
    c. Carbohydrates
    d. Fat

Sugar: Friend or Foe Pre Visit Activities

Running on Empty!

Objective: Students will learn that food is the fuel that powers them to have fun during their recess time while also learning that exercise is fun and active fun is exercise.

Materials:

- Poster board
- Marker
- Calculators
- Student worksheets
- Scale

Procedure:

1. At the beginning of the week create a chart on poster board with the students' names across the side and the recess periods across the top.
2. At the beginning of the week distribute worksheets to students.
3. Allow students to weigh themselves (discreetly) and record their weight so as to provide accurate readings.
4. After each recess period have the students use the worksheets to figure out how many calories they burned during that period.
5. Chart how many calories the students burned and tabulate at the end of the week.

What Happened?

Our bodies need fuel to do everything; walking, running, jumping, even things as simple as breathing! The fuel our bodies use is called calories and we obtain them from eating food. By eating healthy, nutrient-rich foods, our bodies become properly fueled to do the activities that we love to do every day. The bigger a person is, the more calories their body burns. The more active we are, the better our bodies burn calories.

Extension:

See how many calories each of the students' favorite foods has and how long that would power each student.

Academic Standards:

- Life Sciences: 1.1, 2.1, 2.5
- Scientific Inquiry 2.7, 3.3, 3.5, 4.5
- Scientific Ways of Knowing: 4.2, 4.4

Food Groups

Key Words:
Nutrition
Food Pyramid

Materials:
- Newspapers, circulars, magazines
- Construction Paper
- Scissors
- Glue
- Paper
- Writing utensil

Instructions:
1. Discuss all the parts of the food pyramid.
2. Have the students create a meal by cutting out pictures of food from the magazines, newspapers, etc.
3. Have them glue the meal onto a piece of construction paper (placemat).
4. Students will write about their meal and identify the parts of the food pyramid present in the meal

What's Going On?

The goal of this activity is to have each student understand the importance of a balanced meal. Students should be able to take what they have learned from the food pyramid and create a healthy balanced meal.

Academic Content Standards:
- Science: Scientific Ways of Knowing: 5.2

Which Foods Contain Sugar?

Key Words:

Sugar	Syrup
corn syrup	dextrose
maltose	glucose
sucrose	lactose
fructose	molasses
corn sweetener	

Materials:

- Bin of empty, clean food containers with labels intact. One per group.
- Pencils and markers
- Paper
- Chart paper

Procedure:

1. Write a list of the foods that your food containers represent. Put a check mark beside each food on your list that you think contains sugar.
2. Select one of the food containers. Write the name of the food on a chart.
3. Look at the list of contents on the container. Does the list include sugar? If so, write the type(s) of sugar used. Here are some types of sugar that might be included: sugar, syrup, corn syrup, dextrose, maltose, glucose, sucrose, lactose, fructose, molasses, corn sweetener.
4. The food contents are listed in order of quantity used. If one or more types of sugar are listed, indicate on the chart whether they are listed first, second, third, and so forth.
5. Repeat the steps for all of the food containers.
6. Now go back to the list you made and put an "X" beside those foods you found that do contain sugar. Compare these with your predictions. Are you surprised?

What is Happening?

Most of the foods we eat contain some form of sugar. By reading the labels and becoming aware of the different forms of sugar, students gain a better nutritional understanding of the foods they eat.

Sugar: Friend or Foe Post Visit Activities

In Proportion

Objective: To have students understand how big serving sizes should be.

Materials:
- 1 matchbook
- 1 tennis ball
- 1 deck of cards or bar of soap
- 1 blank compact disk
- 4 dice
- 1 computer mouse
- 1 ping pong ball
- 1 hockey puck

Procedure:
1. Spread out materials on a table or desk.
2. Ask the students to guess which item is closest in size to a serving of the foods listed below:
    - 3 oz. of fish or chicken = deck of cards or bar of soap
    - 2 table spoons of peanut butter = a ping pong ball
    - 1 oz. of meat = 1 matchbook
    - 1 oz. of cheese = 4 dice
    - Medium potato = a computer mouse
    - Bagel = hockey puck
    - ½ cup of pasta = tennis ball
    - 1 cup of vegetables = a compact disk

What happened?

When people look at a serving size on nutritional information grids, measurements like 8 oz., ½ cup, or 2 tablespoons may not mean a lot to them. This activity shows the students a method of estimating serving size.

Academic Standards:

- Doing Scientific Inquiry K.10, 1.7, 2.2, 3.2

Breathing Yeasties

Objective: Demonstrate the interaction of microorganisms and the carbon cycle with yeast, sugar and water, and discover how organisms are dependent on water and energy flow through some type of food chain.

Materials:

- Four (4) quart-sized Ziploc bags
- 4 packets of activated dry yeast
- sugar
- 1 teaspoon
- 1 cup measuring cup
- about 6 cups warm water (about 46oC or 115oF)
- large bowl
- marking pen (permanent ink)
- thermometer
- piece of cardboard (or notebook with a stiff back)
- ruler
- pen or pencil

Procedure:

1. Pour one packet of activated dry yeast into each Ziploc bag.
2. Add 1 teaspoon of sugar to one of the bags and label the bag '1 tsp'.
3. Add ½ teaspoon of sugar to another bag and label it as '½ tsp'.
4. Add ¼ teaspoon of sugar to the fourth bag and label it as '¼ tsp'.
5. Mark '0' on the outside of the last bag and do not add any sugar to it.

6. Pour warm water into the large bowl so it is about 2/3 full. Check the temperature of the water with the thermometer. The water should be about 46oC (115oF). Add hot or cold water to bring the water to this temperature.
7. Use the measuring cup to dip ¼ cup of warm water from the bowl into each of the bags. Gently squeeze each bag between your fingers to mix the contents thoroughly. Make sure that there are no dry pockets of yeast or sugar in the bags.
8. Squeeze most of the air out of the bags and seal them. Set the bags in the bowl of warm water in a warm place so it will not cool down rapidly.
9. Wait 30 - 40 minutes.
10. Take the bag marked 0 out of the water, dry it, and place it on a flat table. Put the cardboard or notebook on top of the bag, holding the tablet level. Use the ruler to measure the distance from the table to the bottom of the cardboard.
11. Record your measurements.
12. Repeat step #10 with the remaining bags.
13. Calculate the approximate volume of carbon dioxide in each bag: measure the length of the bag (a); measure the width of the bag (b); distance from table to cardboard (c). a x b x c will give you the volume in each bag.

What's Going On?

Many scientists are interested in the effects of natural recycling that takes place in the Earth's biosphere. Recycling biodegradable material often requires the presence of moisture for the microorganisms (creatures responsible for the biological breakdown of trash) to be activated.

The yeast in this experiment consists of living organisms that break down (decompose) the substrate (sugar and water) and produce carbon dioxide gas. Although it's hard to see microorganisms without a microscope, you can see evidence (the carbon dioxide) of them "eating", which is how they break down food sources (in this case sugar) that provide energy for their tiny systems and help recycle materials. The bags contain various amounts of carbon dioxide because more decomposition took place in the bags with larger amounts of sugar; the yeast in the bag marked 0 had no sugar to "eat", so no carbon dioxide was produced.

Scientists are also interested in microorganisms in outer space; does life exist out there? One example is the search for life on Mars. Life forms aren't readily visible on the surface, but scientists look for other kinds of evidence that microorganisms might exist. What kinds of experiments could be designed to identify life? Could the above experiment (or part of it) apply?

Solar Energy

Objective: Demonstrate that energy from the sun can be collected and stored in many ways.

Materials:

- Plastic bottle painted white
- Plastic bottle painted black
- Several small balloons

Procedure:

1. Place the open end of one small balloon on the mouth of the white bottle and do the same for the black bottle. Make sure the balloon forms an air tight seal.
2. Now place both bottles in bright sunlight. Within a few minutes the students will notice that the balloon on the black bottle will start to expand. The balloon on the white bottle will remain limp.
3. Have a student touch the black bottle to observe that it is warm. Then have the same student touch the white bottle to notice that it is much cooler than the black bottle.

What is going on?

The black bottle will absorb the sun's energy much better. The white bottle reflects away most of the sun's energy. As the bottle absorbs energy, the air inside the bottle warms up and expands making the balloon fill with air.

Background:

Our sun is an average sized star and it has been burning for about 4.5 billion years. Few people think of the sun as a nuclear furnace and fewer still realize this is a source of nuclear energy that does not pollute. About four million tons of the sun's matter turns into energy every second and only one-billionth of the sun's light ever strikes the Earth.

At the equator the Earth receives about one kilowatt per square meter of solar energy. A kilowatt is 1000 watts, or the amount of energy needed to light 10 one-hundred watt bulbs. If humans could take full advantage of solar energy, almost every house in the world could be energy independent. Only a few households would have to be dependent on the electric company and this would reduce the pollution problem greatly. The consumption of gas, oil, or coal would be reduced and this would also help reduce the level of pollution. Automobiles could be powered by the sunlight during the day and use battery power at night. This would also reduce pollution and help prevent global warming.

Unfortunately, turning solar energy directly into electricity is not very efficient as of yet. Today solar energy can be best collected as heat.