Exploring Food from Field to Table

MISSION 2

Exploring Food from Field to Table provides information and activities designed to lead students in exploring how the food they eat is grown, transported, processed, and preserved.

Curriculum Connections for Grades 4 - 6

Students will:

1. Understand that different plants rely on different climates to grow.
2. Identify countries, oceans, and the equator on a world map.
3. Use a world map to identify regions where specific foods are grown.
4. Explore the agri-food chain from production to consumer, using natural sugar as an example.
5. Conduct a scientific experiment that involves preparing, observing, and comparing the results of four different test solutions over a period of days.
6. Discover how effectively different solutions work to preserve foods.
7. Observe the process of crystallization by which sugar is purified.

Teaching Background Information

THE EVOLUTION OF FOOD

Primitive people relied on foods that they could pick, hunt, and fish for their survival. As ancient populations began to depend on planted crops for food, they were faced with the challenge of finding ways to preserve their harvest between seasons. As time went on, they also looked for ways to transport food from one part of the world to another without having it spoil. Today, many foods travel a long way from the field in which they were grown to your table.

FOOD AROUND THE WORLD

Over the centuries, extensive trade of foods developed between different regions of the world. Methods of food production, preservation, and distribution have evolved over time. Today, the most exotic foods travel from one continent to another, much to the delight of our taste buds!

CLIMATE AND FOOD PRODUCTION

When ancient populations first began to grow their own food, they relied on a limited selection of crops that would grow in the local climate and soil conditions. Today, the local climate still influences the types of plants and animals that will live in different areas throughout the world. Sugar cane and sugar beet, the two most practical sources of sugar, are examples of plants that require different climatic conditions. Sugar cane resembles bamboo and grows well in tropical regions. Sugar beets are root vegetables that are cultivated in North America and Europe.

HIGH ENERGY PLANTS

All green plants produce and store sugars. However, long ago, people observed that certain plants contained more sugars than others. Thus, they tried to extract these sugars to use them along with other foods in their daily menus. Two plants, sugar cane and sugar beet, proved to be most practical for this purpose. Today, the majority of sugar used in food is derived from these two plants.

THE JOURNEY OF SUGAR

Many foods that we eat every day come from other parts of the world, and they are involved in a series of steps during their journey to our table. This is called the agri-food chain and involves the production, processing, and distribution of food to consumers. Sugar is a good example of the agri-food chain.

Production:

Sugar cane is grown in tropical climates as it requires plenty of water, sunlight and constant high temperatures to grow. When mature, the cane is stripped of its leaves, and the stalk is cut into lengths. These lengths are transported immediately to a local cane mill, so that the sugar in the cane is not broken down as the cane dies. Canada grows sugar beets primarily in Alberta and processes them in Taber, Alberta. They stay fresh because they are protected by the cold Canadian winter. The beets are then transported by truck to the sugar beet processing plant.

Processing:

At the cane mill, the sugar cane is shredded and pressed to extract the cane juice. The juice is then processed and boiled, and crystals begin to form. These crystals are dried to produce what is called "raw sugar", consisting of sugar crystals with impurities and a coating of molasses. The raw sugar is then transported on a cargo ship to sugar refineries in Canada. Refining is a process of purification that removes bits of plant material, soil, and colour compounds to produce the clean, pure white sugar we use at home. In this process, the raw sugar is first blended with a solution of molasses and water, and washed in a centrifuge. The clean, raw sugar is then boiled, filtered, and concentrated to a clear, colourless liquid. This liquid is then re-crystallized to make pure sugar crystals, which are dried and sold to consumers and food processors for use in other food products. Some liquid sugar is also sold directly to the food industry consumers for use in beverages and other food products.

At the sugar beet processing plant, the beets are washed, sliced, and soaked in hot water to remove the juice, which is full of sugar (sucrose). The juice is purified, filtered, concentrated, and dried in a series of steps similar to sugar cane processing. There is very little waste in the production of sugar from sugar cane or sugar beets. The crushed cane stalks are used as fuel to provide power for machinery. The by-products from sugar beets are made into animal feed.

Distribution:

Depending on their needs, sugar is packaged in different ways to be distributed to consumers and food manufacturers in Canada. Within Canada, sugar is generally transported by truck or train. Liquid sugar is delivered to food companies in tankers. Other sugars are packaged in bags which contain anywhere from 500 g to 1000 kg of different types of sugars. Refined sugar syrups may be sold to grocery store customers in small bottles.

Consumers:

The consumers of sugar may be:

- Shoppers at a grocery store who buy sugar for use at home;
- Food companies that buy sugar in bulk for the many food products they make;
- Companies that use sugar in unusual ways, including cement making and textile finishing;
- Restaurants that buy sugar to use in their recipes, or in small packages for use at the tables.

PRESERVING FOODS

Over time, several methods of preserving foods have been discovered, including purification. Sugar is an example of a purified substance. The purification process removes undesirable residues to produce a high quality product with a long shelf life that is easy to keep and transport. Sugar can in turn be used to preserve foods because of its ability to absorb and 'tie up' water and, thus, reduce the growth of micro-organisms. Sugar also naturally enhances the flavour of foods while helping to preserve colour and texture. Other common means of preserving foods include the use of temperature (both hot and cold), spices, salt, and acidic substances like vinegar.

Activity 2:1 FOOD AROUND THE WORLD

PURPOSE: To help students understand how the different plants that they rely on for food energy are grown in different regions around the world according to the climate that they require.

CURRICULUM CONNECTIONS:
1, 2, 3

KNOWLEDGE AND SKILL DEVELOPMENT:
Social Studies, Art, English Language Arts

TEACHER NOTES:
Using the map on page 33, students locate countries and shade in the regions where sugar cane and sugar beets are grown. They can label these countries and the equator. Students can then research the climates in the regions where sugar is grown. Ask students to identify where the foods they ate for breakfast came from on their map.

ASSESSMENT AND EVALUATION:
The Student Self-Evaluation Checklist (page 28) will allow individual students to self check their work.

Activity 2:2 FROM FIELD TO TABLE

PURPOSE: To help students understand the journey that foods take from field to table.

CURRICULUM CONNECTIONS:
4, 5

KNOWLEDGE AND SKILL DEVELOPMENT:
Social Studies, Science, Art, English Language Arts

TEACHER NOTES:
This activity provides students with an opportunity to create a report, poster or class mural to illustrate the journey that food takes from field to table, addressing the following: production, processing, distribution, and consumers. As an example, use the journey that sugar cane or sugar beets take from crop production through the purification process to end up with sugar as an ingredient in a food product. Ask students to choose a plant or animal food product for their project. Encourage students to work individually or in small groups to research, illustrate, and present their findings to the class.

ASSESSMENT AND EVALUATION:
Provide students with the list of criteria to include in the creation of their report, poster or mural. It can then also be used to evaluate the final product by involving students in developing a rubric for evaluation. The following words can help students establish the four levels of achievement: **level 1** - limited, somewhat, beginning to show clarity; **level 2** - some, usually, some clarity; **level 3** - considerable, consistently, considerable clarity, **level 4** - high degree of, exceptional, high degree of clarity.

CRITERIA LIST FOR CREATING A POSTER OR MURAL

- ❑ Important features are included (facts, pictures or diagrams, headings).
- ❑ The title is legible and states what the poster/mural is about.
- ❑ Information is accurate and important to the topic.
- ❑ Information is organized, has a logical sequence and is easy to follow.
- ❑ Language is clear and concise; no extra words.
- ❑ Words are correctly spelled.
- ❑ Poster/mural is neat and eye-catching.

Activity 2:3 PRESERVING FOOD ENERGY

PURPOSE: To help students develop their skill in conducting scientific experiments, by following instructions, observing and comparing the changes in different samples over time, and recording their results.

CURRICULUM CONNECTIONS:
6, 7

KNOWLEDGE AND SKILL DEVELOPMENT:
Science, English Language Arts

TEACHER NOTES:
Following the directions on page 37, students conduct an experiment to identify the best method for preserving fruit. The results of this experiment will vary according to the type of fruit selected (an apple, pear, or peach work best). The rate of decay and appearance will depend on the individual conditions and on the ripeness of the fruit. Sugar works best as a preservative because it has the ability to "tie-up" water and inhibit the growth of micro-organisms that can spoil food. Because of this quality, sugar is used in making jams, jellies, dairy products, candies, and in preserving fruit. (Tip: Use home canning labels to label the samples for this experiment if possible because they soak off during washing).

ASSESSMENT AND EVALUATION:
Students evaluate themselves on how well they worked in a group using the student rubric (page 29) provided. As well, to complete a personal self-reflection on their learning, students can complete the self reflection questions on page 39.

Activity 2:4 MAKING SUGAR CRYSTALS

PURPOSE: To help students understand the process of purifying sugar by crystallization through exercising their scientific observation skills.

CURRICULUM CONNECTIONS:
8

KNOWLEDGE AND SKILL DEVELOPMENT:
Science

TEACHER NOTES:
This activity provides students with an opportunity to observe the last step involved in the process of extracting and purifying sugar. The sugar dissolves in the hot water. The amount of sugar the water can hold depends on its temperature. Hot water can hold more than cold water. When the solution cools, there is more sugar than can remain dissolved in the solution. Some of the sugar will start to come out of the solution and will form sugar crystals on the paper clip. The sugar molecules that were dissolved in the water participate in the formation of the crystal. This process is called re-crystallization. Other substances are left behind in the syrup.

ASSESSMENT AND EVALUATION:
Use the student response page (page 41) provided with this activity for assessment.

Evaluation Page

ACTIVITY 2:1

Student Self-Evaluation Checklist - Food Around the World

Student Name:_____

✓ Check off

Yes or **No**

☐	☐	I have written the name of different continents and oceans on my map.
☐	☐	I have labelled the Equator, the Tropic of Cancer and the Tropic of Capricorn.
☐	☐	I have marked my home location on the map.
☐	☐	I have labelled the following countries and regions on my map: Africa, Argentina, Australia, Brazil, Canada, China, Columbia, Cuba, France, Germany, India, Italy, Philippines, Poland, Thailand and United States.
☐	☐	I have shaded in these regions of the world where sugar cane and sugar beets are grown on my map (regions are listed above).
☐	☐	I have marked the places of origin of the breakfast foods I ate today on my map.
☐	☐	I have given my map an appropriate title.
☐	☐	My map is legible and neatly completed.

Evaluation Page

ACTIVITY 2:3

My Group Work Assessment

Each time we work in a group we need to think about how well the group worked and our role in the successes of the group. Use the following chart to share your success and the places where you can improve with your teacher.

Give yourself a rating of Level 1, 2, 3 or 4 in the first column; provide a statement to support your rating in the second column; in the final column, suggest a way you could improve for the next time you work in groups.

Quality	Level	Support for My Choice	Ways I Can Improve for Next Time
Participates actively in the assigned task.			
Demonstrates appropriate behaviour during activity.			
Demonstrates persistence.			
Demonstrates cooperation.			

Glossary

MISSION 2

AGRIFOOD CHAIN - the journey that food takes from production, to processing, to distribution, to the consumer.

BY-PRODUCTS - other products produced during the processing of a food.

CENTRIFUGE - a machine that separates solids from liquids, or solid materials of different weights by spinning at very high speeds.

CLIMATE - the temperature, wind, and rainfall conditions typically found in an area.

CONSUMERS - people that use a product.

DISTRIBUTION - the transportation of food to its consumers.

FOOD PRODUCTION - the growing of crops and raising of livestock for food.

PRESERVATION - the processing of foods to prevent them from spoiling.

PROCESSING - the changing of foods into different products.

PURIFICATION - a process to remove undesirable material from a raw product to produce a clean, pure product.

RE-CRYSTALLIZATION - the process by which solid particles that are dispersed in a liquid are linked together to form crystals.

REFINING - a process that removes impurities to produce a high quality product.

Additional Resources

MISSION 2

Canadian Sugar Institute
www.sugar.ca
Visit the Canadian Sugar Institute Web site to learn more about the history of sugar production in Canada and about Canadian sugar today.

A Taste of Sugar - Recipe Collection from the Canadian Sugar Institute
www.sugar.ca/english/consumers/cookingwithsugar.cfm#4
A Taste of Sugar is a series of recipe fact sheets which includes some sugar and health information and provides concrete examples about the role and function of sugar in recipes.

Redpath Sugar Museum Tours
www.redpathsugars.com/museum_index.htm
Redpath Sugar has established a public museum facility in Toronto at which school classes can receive educational programming related to sugar.

Agriculture in the Classroom
www.aitc.ca/
Agriculture in the Classroom programs across Canada build awareness and an understanding of sustainable agriculture and food systems by providing educational programs and resources to students and teachers.

ACTIVITY 2:1

Food Around the World

Different plants grow in different climates. Sugar cane plants need plenty of water, a lot of sunlight, and constant high temperatures. They are thought to have originated in the South Pacific. Now sugar cane is grown in tropical or sub-tropical climates in the rich, moist soil in countries like Mexico, Australia, Africa, Brazil, Argentina, Colombia, India, Thailand, Philippines, Guatemala, and China. Sugar beets thrive in regions that have moderate temperatures with sunny days and cool nights. They originally grew wild around the coasts of the Mediterranean. Countries where sugar beets are grown today include Canada, United States, Germany, France and Russia.

Student Directions

Use coloured pencils and an atlas or encyclopedia to help you label the following important features on the world map on page 33.

1. Write the name of different continents and oceans on the world map.

2. Label the Equator, the Tropic of Cancer and the Tropic of Capricorn.

3. Identify and mark where you live on the map.

4. Shade in all the regions of the world where sugar cane and sugar beets are grown. Label your world map with the countries listed in the information above.

5. Make a list of all the foods that you ate for breakfast this morning. Then mark these foods on the map according to where they come from.

_____

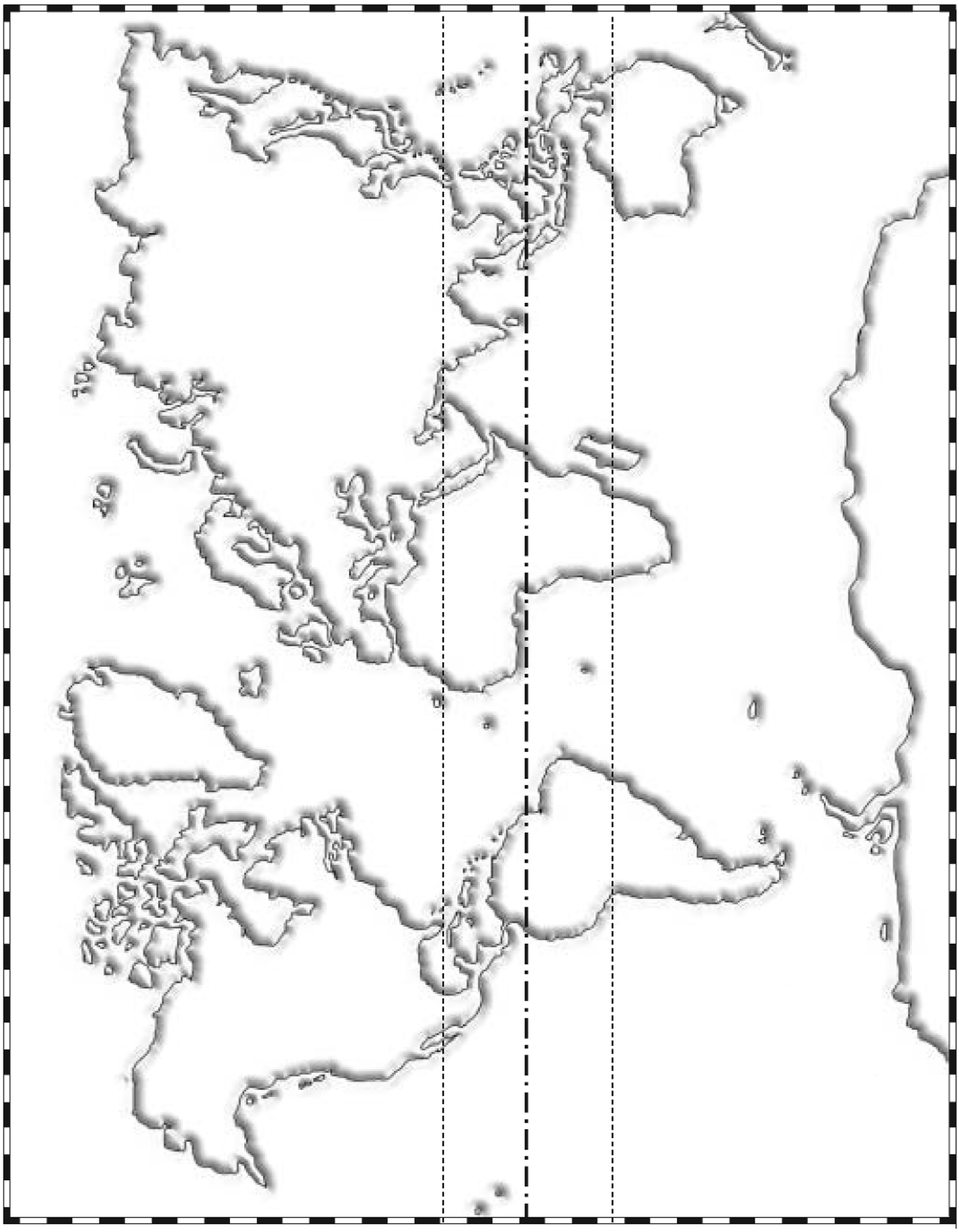
_____

_____

_____

6. Give your map an appropriate title.

7. Complete the Student Self-Evaluation Check-list provided by your teacher.



Exploring Food from Field to Table

ACTIVITY 2:2

From Field to Table

Most foods that you eat travel a long way from the field in which they were grown to your table. Many foods come from different parts of the world and are involved in a series of different steps during their journey to you. For example, sugar cane and sugar beets grow in fields in countries around the world. Sugar cane is harvested and used to make raw sugar in the countries where it is grown. The raw sugar is transported to refineries in Canada where it is purified so that we can enjoy it in our food. Sugar beets are processed into sugar near the fields where they are grown.

Student Directions

Choose a plant or animal food. Prepare a report, poster or a class mural of the journey the food takes from the field to your table. Show the following steps: production, processing, distribution, consumers.

Student Responses

Make some notes under the following headings to help you get started.

1. Name of the food:

_____

_____

2. Production (producing crops and raising livestock):

Is the food an animal or plant product?

_____

_____

_____

Where is it produced?

Describe the climate needed by the animal or plant.

3. Processing (changing the food into different products):

Describe how the food is processed.

What form is it in when it is sold to the consumer?

4. Distribution (transporting the food to consumers):

How is the food transported to the consumer?

_____

_____

_____

Is it available all year round?

_____

Can it be stored?

_____

_____

_____

5. Consumers (food is ready to buy and eat or use in cooking):

Who buys this food?

_____

_____

_____

How do they use it?

_____

_____

_____

_____

ACTIVITY 2:3

Preserving Food Energy

Over the centuries, people discovered several ways to preserve food by trying different methods. Some of the things they tried were very successful, while others did not work so well. A good way to find the best method for preserving foods is to compare different methods.

Student Directions

Try this experiment to see how well fresh fruit can be preserved with different solutions.

1. Team up with a few classmates and collect the following items for your experiment:

- ✓ 4 large glasses or glass jars (1 cup / 250 mL)
- ✓ 4 labels
- ✓ 1 measuring cup (1 cup / 250 mL)
- ✓ 1 plastic knife
- ✓ 10 mL (2 tsp) of sugar
- ✓ 30 mL (2 tbsp) of concentrated lemon juice
- ✓ 1 fruit, such as an apple, pear or peach
- ✓ 2 wooden stir sticks
- ✓ 4 small pieces of plastic wrap to cover the glasses or jars
- ✓ 600 mL (2.5 cups) of water

2. Label the four glasses as follows:
- Sample #1 - sugar solution
- Sample #2 - lemon solution
- Sample #3 - water
- Sample #4 - air

3. Using the measuring cup, measure and pour 200 mL (3/4 cup) of water into each of the glasses except the glass labelled Sample #4. Leave the glass marked Sample #4 empty.

4. Add the sugar to the glass labelled Sample #1 and stir well with the stir stick until the sugar is dissolved in the water.

5. Add the lemon juice to the glass labelled Sample #2 and stir well with another stir stick.

6. Using the plastic knife, cut the fruit into 4 pieces, and cut each of these pieces in to 4 again.

7. Put 4 little pieces of fruit in each of the glasses. Observe and record their colour and texture in the table provided.

8. Cover the glasses with plastic wrap and put in a warm place (e.g. in the sun, next to a window) for three days. Once you have prepared all of your samples, wash your hands, your work table and the measuring cup carefully.

Student Responses

1. Using the table below, record the colour and texture (using words like firm, soft, mushy) of the fruit at the beginning and after 4, 24, and 72 hours.

CHARACTERISTIC		SAMPLE #1 Sugar Solution	SAMPLE #2 Lemon Solution	SAMPLE #3 Water	SAMPLE #4 Air
At Start	Colour				
	Texture				
After 4 Hours	Colour				
	Texture				
After 24 Hours	Colour				
	Texture				
After 72 Hours (3 Days)	Colour				
	Texture				

2. What can you conclude from this experiment?

_____

_____

_____

_____

When you have finished your experiment, discard your samples in an appropriate place. (Recycle the fruit by adding it to a composting pile if you can).

STUDENT SELF REFLECTION QUESTIONS:

1. What did I learn to do in conducting this experiment?

2. What did I learn well enough to teach a friend?

3. What I am curious about and/or what I am confused about?

ACTIVITY 2:4

Making Sugar Crystals

As ancient populations began to depend on planted crops for food, they had to find ways to preserve their harvest between seasons and to transport food from one part of the world to another without it spoiling. Over time, several methods for preserving foods were discovered. One of these methods involves purifying and drying a substance, such as sugar, so that it is easy to keep and transport.

Student Directions

Discover the last step in the long process used to extract and purify sugar. See how sugar crystals are made by following these instructions:

1. Assemble into groups assigned by your teacher and collect the following on your work table:

- ✓ 1 large glass or bottle (at least 750 ml or 3 cups)
- ✓ 1 piece of string 30 cm long
- ✓ 1 paper clip
- ✓ 1 pencil
- ✓ 1 measuring cup
- ✓ 250 mL (1 cup) of sugar
- ✓ 1 teaspoon or a small wooden stick
- ✓ water

2. Pour the sugar into the glass.

3. With adult assistance from your teacher, collect 250 mL (1 cup) of boiling water in your measuring cup.

4. Place the teaspoon or wooden stick into the sugar.

5. Carefully and slowly, pour a little of the boiling water along the teaspoon or wooden stick, allowing it to run right to the bottom. Gently stir the spoon or stick to dissolve the sugar in the boiling water. Add very small amounts of water, stirring gently each time, until all the sugar is dissolved, using the least water possible. You will have a very thick syrup.

6. Tie one end of the string to the paper clip, and the other end around the pencil.

7. Balance the pencil on the edges of the glass, plunging the paper clip and string into the syrup.

8. Turn the pencil, winding the string around it so that the tip of the paper clip just touches the bottom of the glass.

9. Set the glass aside for at least 10 days in a well-ventilated area where it will stay cool and be undisturbed. To allow the water to evaporate even better, remove the crust that forms on the syrup every day.

Student Responses

1. Record your observations on days 1, 3, 6 and 10 in the chart below using diagrams or pictures.

Day 1	Day 3
Day 6	**Day 10**

2. Describe what happened.