

SOLE
Sciences of Life Explorations:
Through Agriculture
Grades 4 and 5



Teacher Guide
Unit: Sugar Maple Days

UNIT PLAN

UNIT TITLE

Sugar Maple Days

MONTH

January

GOAL

Students will learn about maple sugaring in the Northeast. They will be able to identify the maple tree family and learn that Sugar Maple and Black Maple are the two favored species for maple production. Students will learn how different maple products are made from maple tree sap. They will be exposed to the physics of hydraulic lift and sap flow.

OBJECTIVES

Students will :

1. Describe the the work involved in making maple syrup, and the changing roles of men and women in the sugar maple industry, and explore possible career options. (NYS Learning Standard 1: Career Development, Elementary 1)
2. Develop and interpret information displayed in a classroom maple syrup comparison chart. (NYS Learning Standard 1: Language for Information and Understanding, Elementary 1 Listening and Reading and Elementary 2 - Speaking and Writing)
3. Illustrate their thoughts and views clearly through writing. (NYS Learning Standard 4: Language for Social Interaction, Commencement 1)
4. Restate the main idea and some detail of informative materials on the sugar maple. (NYS Learning Standard 1: Communication Skills, Checkpoint A -- Modern Languages)
5. Recognize similarities and differences between different species of maple trees. (NYS Learning Standard 4: Science, Elementary 1)
6. Paraphrase the traditions and practices associated with making products from maple sap that were passed from one generation of sugarmakers to the next. (NYS Learning Standard 1: History of the United States and New York, Elementary 2)
7. Compute information by adding, subtracting, multiplying or dividing. (NYS Learning Standard 3: Mathematics, Elementary 3)
8. Differentiate between real maple syrup and artificial by using real items from their home pantry. (NYS Learning Standard 1: Analysis, Inquiry, and Design, Elementary 3 -- Mathematical Analysis)
9. Analyze using simple quantitative methods, such as ratios, to make comparisons. (NYS Learning Standard 6: Interconnectedness Common Themes, Elementary 6 Optimization)
10. Distinguish between past, present, and future time periods of the sugar maple industry. (NYS Learning Standard 2: World History, Elementary 2)

11. Explain how people live, work, and utilize natural resources (such as trees) in the sugar maple industry. (NYS Learning Standard 3: Geography, Elementary 1)
12. Explain that scarcity requires individuals to make choices that involve cost. (NYS Learning Standard 4: Economics, Elementary 1)
13. Name tools and machines used to produce products from maple trees and sap (Food and Fiber Systems Literacy: III Science, Technology and Environment, D. K-1) 14.
14. Summarize how technological advancements enhanced the efficiency of making maple syrup. (Food and Fiber Systems Literacy: I Understanding Food and Fiber Systems, E. 4-5 and III, Science, Technology and Environment, D. 4-5)
15. Identify basic food nutrients on a label and evaluate syrups based on nutritional content by interpreting the nutritional labels (Food and Fiber Systems Literacy: V Food, Nutrition, and Health, B. 4-5 and B. 6-8)

TERMS

Vocabulary words are highlighted in boldface throughout the student lesson pages.

Dilute - to make thinner by adding liquid to the mixture

Evaporation - the process by which liquid becomes gas, and moisture goes into the air

Hydraulic lift - the process by which water is pulled upward from a lower area. Sugar maples' roots bring water from deep soil layers to upper soil layers at night.

Sap - the watery fluid in a plant that carries food and other substances and can get sticky as it dries

Spile - a spout that is put through the bark of a sugar maple and used to get sap

Sugarmaker - the farmer of the sugar maple trees, who gets the sap from the trees for syrup

Tapping - the process in which the sugarmaker drills into the trunk of the maple tree and places a spout where the sap will run out into a bucket

Integrated Pest Management is a specialized form of environmental management wherein scientific research and real-world application work together to reduce pests such as insects, diseases or weeds.

- 1. Properly identify pests*
- 2. Learn the pest/host biology*
- 3. Sample the environment for pests*
- 4. Determine an action threshold*
- 5. Choose the best tactic*
- 6. Evaluate results*

SAFETY

General classroom safety practices.

Kitchen safety and handwashing for Mock Maple Syrup activity.

Standards Matrix for this Lesson:

Standards:										
Month	Unit	Math/Science/and Technology	English Language Arts	Social Studies	HEALTH	ARTS	Food & Fiber Literacy	CDOS	Other Languages	Interconnectedness
1	Sugar Maple Days	4:10, e1	1:3, e1	1:14, e2			III D K-1			1:1, e1
		3:9, e3	1:3, e2	2:15, e2			I E 4-5			
		1:7, e3	4:5, c1	3:16, e1			III D 4-5			
		6:12, e6	1:6, A	4:17, e1			V B 4-5			
							V B 6-8			

Matrix Key:

NYS Learning Standards arranged by Standard: Category, Level

e = elementary i = intermediate c = commencement

Categories:

- | | |
|---|--|
| 1 Career Development | 10 Science |
| 2 Universal Foundation Skills | 11 Technology |
| 3 Language for Information and Understanding | 12 Interconnectedness: Common Themes |
| 4 Language for Literary Response and Expression | 13 Interdisciplinary Problem Solving |
| 5 Language for Social Interaction | 14 History of the United States and NY |
| 6 Communication Skills | 15 World History |
| 7 Analysis, Inquiry, and Design | 16 Geography |
| 8 Information Systems | 17 Economics |
| 9 Mathematics | |

ADDITIONAL RESOURCES

http://ohioline.osu.edu/b856/b856_9.html

<http://www.massmaple.org/>

<http://www.nysaes.cornell.edu/pubs/press/2004/040301maple.html>

SUPPLIES AND EQUIPMENT

Crayons or colored pencils

Loose-leaf paper (optional)

Leaves from the sugar, black, red, and silver maple trees (optional)

Sugar (brown and white)

Water (for cooking)

Butter

Vanilla

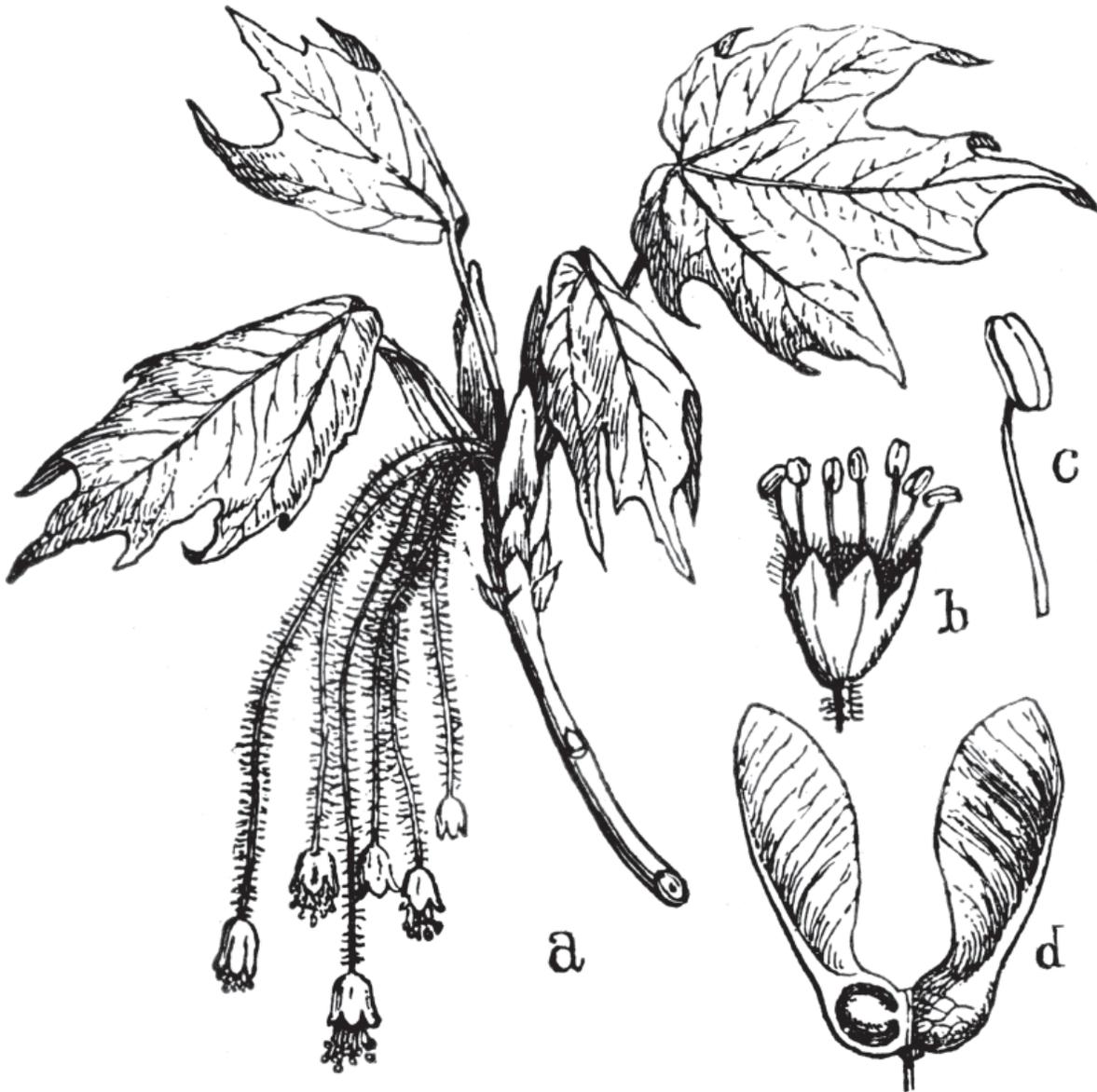
Plastic teaspoons

1 pint light maple syrup

1 pint amber maple syrup

1 pint dark maple syrup

1 container of artificial maple syrup (pancake syrup)



BACKGROUND FOR TEACHERS

Maple sugaring was not new to America when the Pilgrims landed at Plymouth Rock in 1620. Native Americans had been making sugar from the sweet sap of the maple tree for many years. From the journals of early explorers we know that the Native Americans had a process for making maple sugar as early as 1600.

One Haudenosaunee legend tells how Chief Woksis had thrown his tomahawk into a maple tree one late winter evening. After he removed it the following morning, the weather turned sunny and warm. Sap began to flow from the cut and drip down into a container which was at the base of the tree. Chief Woksis' wife used the sap to boil the meat for dinner. As the water in the sap boiled away, a sweet maple taste was left with the meat. Maple sugar became an important commodity for the early settlers of the United States. They used it to trade until the prices and taxes on cane sugar went down. Maple syrup production became popular after that.

Traditionally, maple syrup was harvested by tapping a maple tree through the bark and into the phloem, then letting the sap run into a bucket. More sophisticated methods have superseded this. Once trees have a diameter of 10 inches at chest height and are at least 40 years old, holes are bored into them and tubes called spiles are inserted. These drip sap into buckets or into plastic pipes. Modern use of plastic tubing with a partial vacuum has enabled increased production. A new hole must be drilled each year, as the old hole will produce sap for only one season due to the natural healing process of the tree (walling-off).

In the late winter, when nights are still frosty but the days are warming, sugarmakers tap into Sugar Maple or Black Maple trees and gather the sap. Production is concentrated in February, March, and April, depending on local weather conditions. The change in temperature causes the sap to move through the tree, and it is caught on its way past the tap.

The sap is fed automatically from the storage tank, through a valve, to a flat pan, where it is boiled down into a sweet syrup. Boiling the sap reduces water content and creates syrup, cream, or candy depending on the temperature and length of time it is cooked. The process is slow, because most of the water has to boil out of the sap before it is the right consistency. It takes approximately 40 gallons of sap to make one gallon of syrup.

Maple syrup, and its artificial imitations, are the preferred toppings for pancakes, waffles, and French toast in North America. Maple syrup can also be put to a variety of other uses, including: biscuits, fresh donuts, fried dough, fritters, ice cream, hot cereal, and fresh fruit. It is also used as a sweetener for many baked goods, candies, and drinks.

The Sugar Maple is the state tree of New York and is very popular for its red leaves in fall. The beauty of the Sugar Maple in fall and the lure of maple syrup time in late spring contributes to tourism throughout the state. New York State ranks third in volume of maple production behind Maine and Vermont, and second in the cash value of its maple crop. Maple trees are a unique example of trees that we collect food from; instead of picking fruit from its branches, we collect its sweet sap from its trunk.

Resources:

New York State Department of Agriculture and Markets

www.mapleghensyrup.com

www.massmaple.org

QUESTIONS FOR STUDENTS

What is special about the Sugar and Black maple tree?

What is the wood best used for?

What food products do we get from sugar maples?

How do we get those food products from the sugar maple tree?

How does the watery sap become thick and sugary?

Grades of Maple Syrup

New York Grade A Light Amber

- Lightest of three classifications
- Mild and delicate flavor

New York Grade A Medium Amber

- Darker in color
- Fuller flavor

New York Grade A Dark Amber

- Darkest of three grades
- Strongest maple flavor

New York State Extra Dark for Cooking

New York Grade B

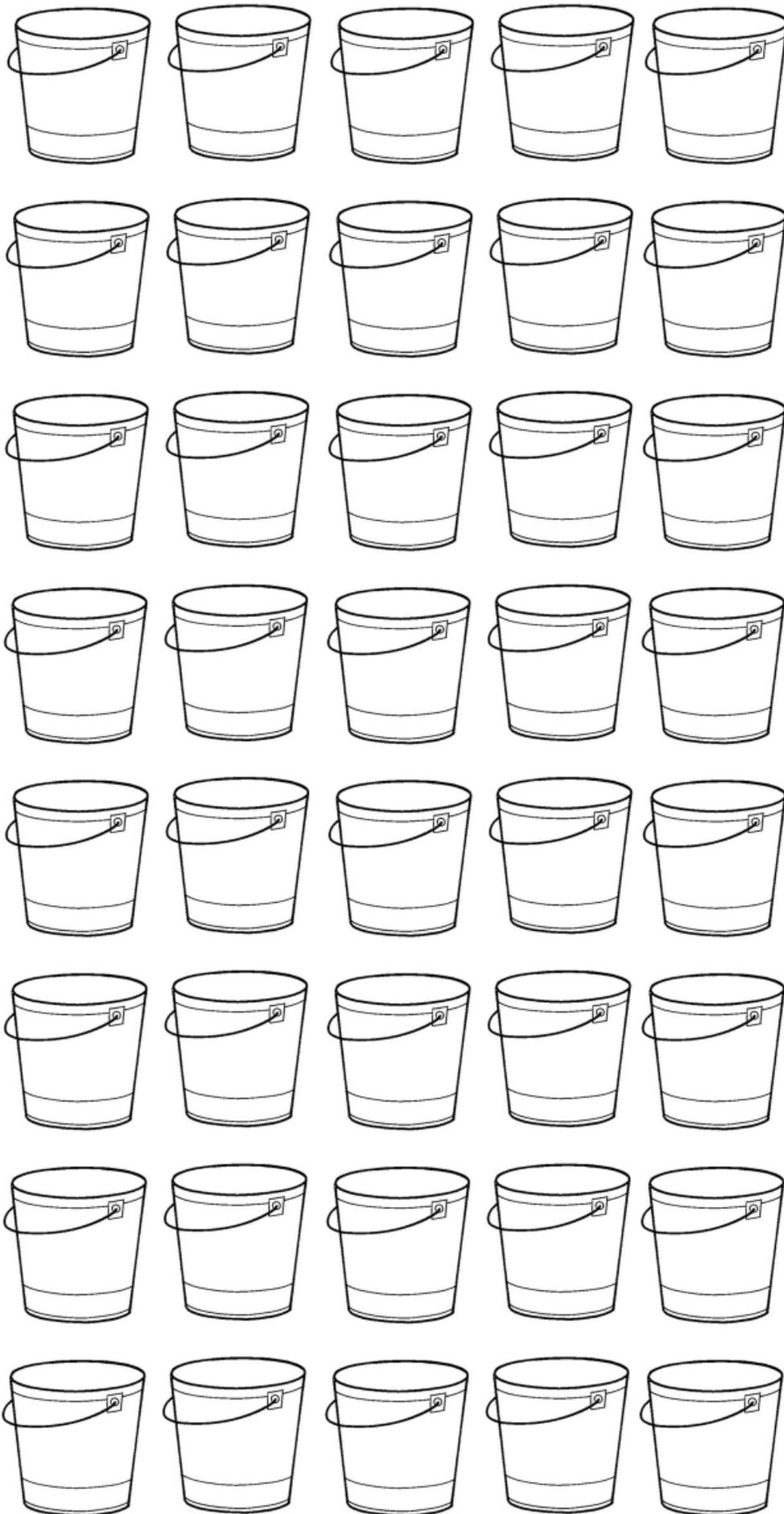
- Sold in bulk for reprocessing and the manufacture of commercial syrups



Oswegatchie Educational Center

Books to compliment the Maple Sugaring Program

- ◆ Marsha Wilson Chall- Sugarbush Spring
- ◆ Connie Crook- Maple Moon
- ◆ Jessie Haas- Sugaring
- ◆ Bruce Hiscock- The Big Tree
- ◆ Marilyn Linton- The Maple Syrup Book
- ◆ Laura Ingalls Wilder- Sugar Snow



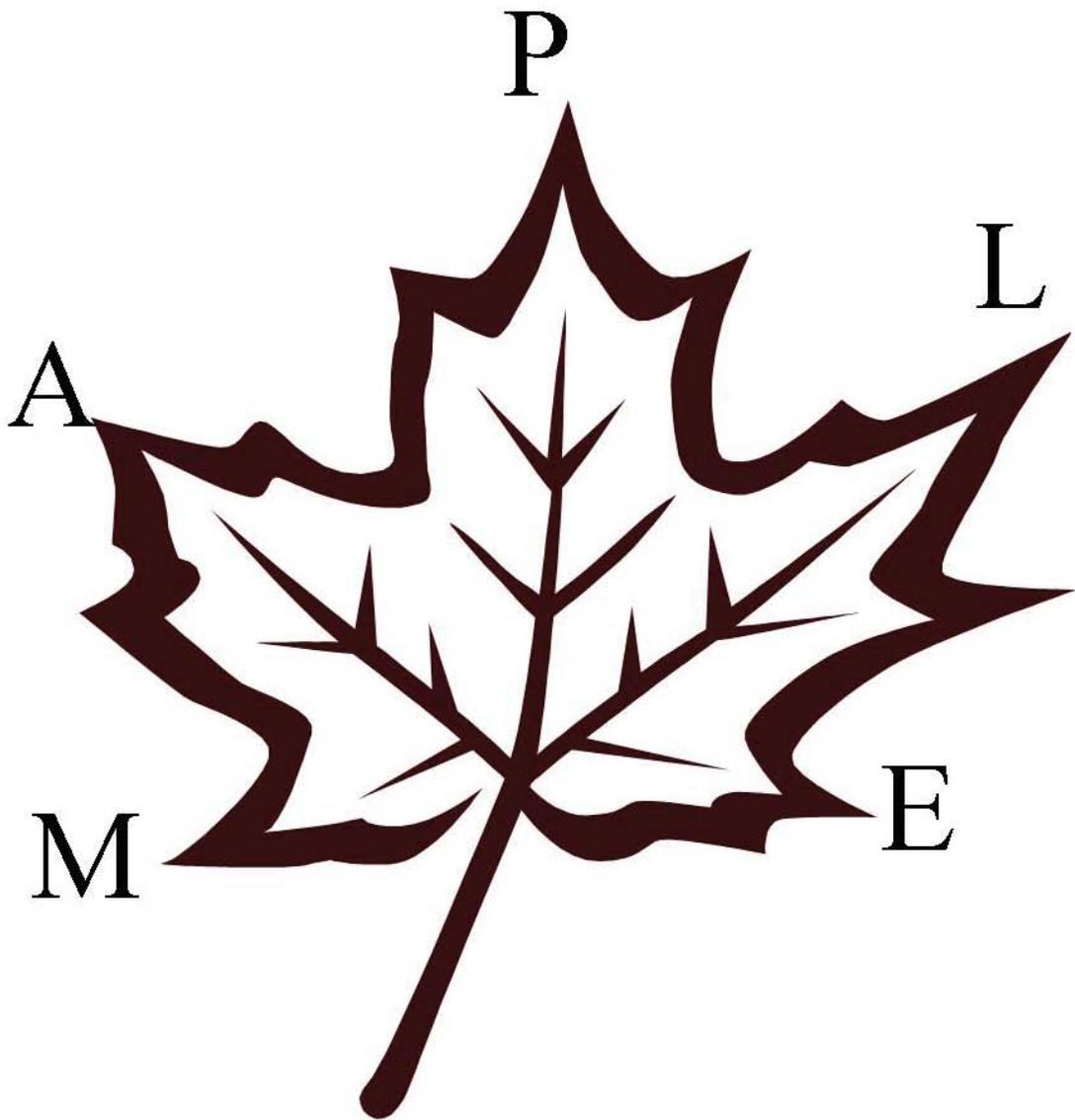
**40 GALLONS
OF SAP**



**1 GALLON
OF SYRUP**

Sugar Maple Leaf Identification

A sugar maple leaf has five lobes. You can remember this by thinking of the word "maple," which has five letters.



INTEREST APPROACH ACTIVITIES

IDENTIFYING A SUGAR MAPLE

The sugar maple is the official state tree of New York, and is abundant throughout the state, except for Long Island. Combined, these trees yield hundreds of thousands of gallons of maple syrup every year. They have high-grade wood that is used for furniture, flooring, and fuel, and they display spectacular red, yellow, and crimson fall foliage.

In order to make it easier to identify a sugar maple, you may wish to look for one in the fall, while the leaves are still on the trees and seeds can be found. The tree can then be marked for easy identification in the winter.



- Bark: dark to light gray on large branches and the trunk, firm, narrowly ridged with long, deep furrows, sometimes becoming scaly
- Twigs: slender, shiny when young, smooth, gray to brown in color
- Buds: brown, terminal bud is sharply pointed
- Leaves: simple (one complete leaf per stem) with five main lobes; leaves are arranged opposite one another along the branch, 3-5" in length, dark green in summer with a pale silvery green underneath; leaf edges are not serrated

(For related activities, refer to student worksheets #1,#2, #3, & #6)

MAPLE SYRUP COMPARISON TEST

Materials:

Plastic teaspoons

1 pint light maple syrup

1 pint amber maple syrup

1 pint dark maple syrup

1 container of artificial maple syrup (pancake syrup)

Optional: mock syrup from recipe

**Note: For pure maple syrup, the lighter the color, the higher the sugar content. The darker the syrup is, the lower the sugar content and more "maple" the sugar will taste.*

Procedure:

Part A: Taste Test

1. Draw a large chart that includes color, cleanliness, thickness, smell and taste, and a column for each sample. Or, give each student a chart on a worksheet.
2. Give each student a teaspoon of the light maple syrup to taste.
3. Either record the number of students who say they like/don't like the syrup for each of the categories, or have students keep track of their own responses.
4. Students could also rate each sample on a scale of 1 to 5, 1 being the lowest ranking and 5 being the highest.

5. Repeat the taste test for each of the different syrups.
6. If voting, add up the numbers to come up with a total for each sample. Do the same if ranking on a 1 to 5 scale.
7. Use these numbers to calculate the fraction of the class that liked each sample, and then the percentage.
8. Discuss the differences observed between real and artificial maple syrup.
9. Which characteristics seemed to be the most important?
10. Which sample did the class like most? The least?

Part B: Label Comparison

1. Look at the labels of the different types of syrups used in the taste test.
 - A. What are their ingredients?
 - B. Does the list actually contain “maple?”
 - C. Sample ingredient list for pancake syrup: corn syrup, high fructose corn syrup, water, cellulose gum, caramel color, salt, preservatives, artificial and natural flavors
 - D. Retail maple products may not be labeled but range from 66-67% sugar content for syrup.
 - E. A serving size = 4 Tablespoons (60 ml). Calories: 200; total fat 0 g, sodium 7 mg, total carbohydrates 53 g, protein 0 g
2. Answer the following:
 - A. What is the serving size for each?
 - B. How many calories are in a serving?
 - C. How much sodium is in a serving?
 - D. How many carbohydrates are in a serving?
 - E. How much sugar is in a serving of each?
 - F. Which type of syrup seems better for you and why?
 - G. Is it the syrup you liked most?

Part C: Homework assignment:

1. Go home and ask your parents what type of syrup you use, or check at a local restaurant.
2. Is it pure maple syrup or artificial (corn syrup based)?
3. Write down the brand name or where you got it from.
4. Compare your findings with your classmates' answers.



Resources:

www.uwsp.edu/education/pcook/unitplans/syrup.htm



THE COST OF A GALLON



It takes 40 gallons of maple sap to produce 1 gallon of maple syrup. The other 39 gallons are water that is boiled off in the process of making the syrup. Boiling sap to make syrup takes a lot of time, energy, and work, which is why it costs so much to buy pure maple syrup (\$31.70 per gallon).

1. If 253,000 gallons of syrup were produced in New York State last year, how many gallons of sap did sugarmakers have to collect? $253,000 \text{ gallons of syrup} \times 40 \text{ gallons of sap for 1 gallon of syrup} = \underline{\hspace{2cm}}$
2. One tap in a mature tree usually produces 10 gallons of sap. This year Iverson's farm has put in 200 taps. How many gallons of sap will they collect?
3. If it takes 40 gallons of sap to make 1 gallon of syrup, how much syrup can they produce?
4. It takes 5 cords (a cord is a way to measure a quantity of wood) of medium weight dry wood to produce 100 gallons of syrup. Using your answer to #3, how much wood will Iverson's farm need to produce their syrup?
5. If a gallon of pure maple syrup costs \$31.70 and the Levin's daughter Rachel buys 3 gallons, how much will she have to pay?

(For related activities, refer to student worksheets #4 & #5)

Resources:

New York State Maple Producers' Association

SUMMARY OF CONTENT

- I. Introduction
 - A. Introduces the Sugar Maple
 - B. Questions may be used to stimulate discussion.
- II. The Sugar Maple Tree
 - A. The sugar maple and black maple are used most for syrup and candy.
 - B. Sugar maples use hydraulic lift to pull water through the soil.
 - C. Sugar maple wood is used for furniture and flooring.
 - A. Sap is moved through the tree because of pressure, and is released through the point of lowest pressure.
- III. The Maple Tree Family
 - 1. Questions that refer to the reading “The Sugar Maple Tree.”
 - 2. Identify similarities and differences between maple tree species.
 - 3. You may wish to find leaves from these maples to bring into class.
- IV. From Treats to Sweets (2 pages)
 - A. This reading describes the process of tapping maple trees to get sap and converting the sap into syrup, cream, toffee, candy, and sugar. A sequencing exercise is included.
- V. Review
 - A. Covers the main points about sugar maples, sap, and making syrup and candy.
- VI. Test Your Knowledge
- VII. Vocabulary
 - A. Provided for student reference
- VIII. Lesson Supplements

TEACHING-LEARNING ACTIVITIES

- I. Introduction
 - A. This page may be read individually or aloud with group discussion.
- II. The Sugar Maple Tree
 - A. This page may be read aloud
 - B. Introduces the terms hydraulic lift and sap flow.
- III. The Maple Tree Family
 - A. Refer to “The Sugar Maple Tree” reading to answer the questions provided.
 - B. Describe a similarity or difference between the Sugar Maple and another maple.
- IV. From Treats to Sweets (2 pages)
 - A. Read these pages individually or as a class.
 - B. Complete the sequencing exercise individually or in teams.
- V. Review
 - A. Read this page individually or as a class.
- VI. Test Your Knowledge
 - A. Complete this page individually.
- VII. Vocabulary
- VIII. Lesson Supplements

name _____

Student Lesson: Sugar Maple Days Introduction



The official state tree of New York is the sugar maple!

The sugar maple tree's scientific name is *Acer saccharum*. It is a hardwood tree that grows mainly in eastern North America.

The wood from sugar maple trees can be used for furniture and lumber, just like many other trees. The unique thing about sugar maples is the sweet sap we can collect from them to make all sorts of delicious foods.



What do you know about sugar maple trees?

What is special about the Sugar and Black maple trees?

What is the wood best used for?

What food products do we get from sugar maples?

How do we get those food products from the sugar maple tree?

How does the watery sap become thick and sugary?

Student Lesson: Sugar Maple Days

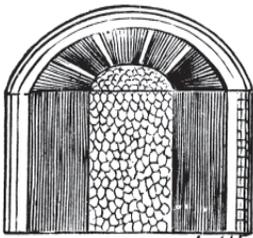
The Sugar Maple Tree

The sugar maple tree is one of almost 200 kinds of maple trees. Maple products, such as syrup, can be made from the sap of some maple trees.

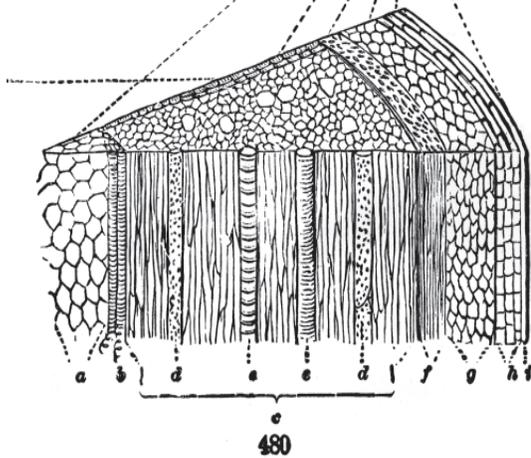
The sugar maple and the black maple are used the most in maple syrups, candies, and other treats. Red maple can be used for syrup but its sap is not very good for making maple sugar.



478



479



480

Sugar maples help the plants around them through hydraulic lift. Hydraulic lift is when the tree's roots pull water up from the lower soil layers to the upper, drier soil layers where other plants are growing.

The wood of the sugar maple tree (seen at left) is one of the hardest maple tree woods. People like to use it to make furniture and wood floors. Sugar maple wood is even used to make some bowling alleys and bowling pins.

How does sap flow inside the tree?

All trees have a kind of plumbing, sort of like the water pipes in a house.

Think of it like a water balloon. When you squeeze one end of the balloon, the water is pushed to the other end. Your hand is applying pressure on the water. The water has no choice but to move away from where your hand is squeezing.

Your hand is the *high pressure point*. To get sap out of the tree, you must drill a hole in the trunk. The hole becomes the *point of lowest pressure*. The sap will flow out of that hole.

Student Lesson: Sugar Maple Days The Maple Tree Family

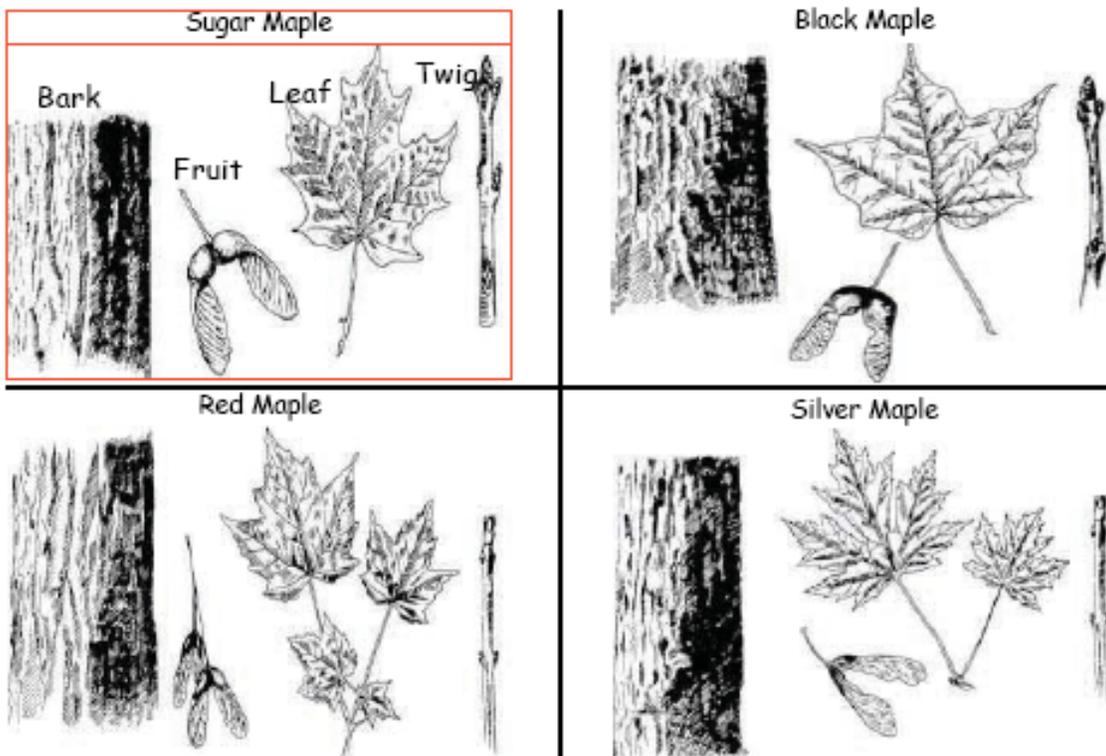
1. What is hydraulic lift? _____

2. Where does sap flow to? _____

3. Name one thing sugar maple wood is used for: _____

4. Look over the pictures below.

On a separate sheet of paper, describe a similarity or difference between the sugar maple and your choice of one of the other three maples shown. The plant parts are labeled in the sugar maple box.



These four images are used with permission of Ohio State University.

Student Lesson: Sugar Maple Days From Trees to Sweets

Here is a story about how we get maple syrup, cream, and sugar from a beautiful tree.

The sweet truth of maple syrup is that it is made from the sugary sap of the sugar maple or black maple trees.

The sugarmaker is the farmer of the maple trees. The sugarmaker watches the weather, waiting for the right temperatures before he or she will start collecting the tree sap. The tree sap will begin to flow in the late winter and early spring, when the nights are below freezing and the days are mild.

When it is time, the sugarmaker will drill a hole $\frac{7}{16}$ of an inch wide and 3 inches deep into the trunk of the maple tree. He will fit a spout, also called a spile, into the drilled hole. This is called tapping. The maple tree should be at least 10 inches wide before it can be tapped.

Then, the sugarmaker attaches a covered bucket to collect the sap as it flows through the tree and out of the spout. Sugarmakers who have many trees to tap will use a rubber tube system instead of the buckets. Sap is vacuumed out of the tree, through the tubes, into a collecting tank at the bottom of a hill.

The sugar collecting season lasts from four to six weeks, depending on how the weather is. Sugarmakers could collect as much as 10 gallons of sap per hole in that time. More holes can be made in one tree if the diameter is big enough!

The sap is clear and watery. In fact, sap is made up of 98% water and only 2% sugar! The sap is taken to the sugar house to be made into syrup. The sap is placed in big evaporation pans on top of a stove heated by a fire.

The heat from the stove causes the water in the sap to become steam, rising out of the sugar house through a vent in the roof. As the water leaves, the sap becomes thicker and sweeter since there is less water to dilute the sugar.

When the sap is 33% water and 67% sugar, it is ready to be filtered and bottled as maple syrup. The syrup can be evaporated further to make a butter-like maple cream, evaporated more to make toffee, and even more to get hard candy and then the grainy sugar itself.

To make toffee, the syrup is boiled to just the right thickness and is poured onto snow where it quickly cools down. The longer it cools, the chewier it gets. Even thicker syrup can be poured into shaped molds.

Maple sugar can be packed into shapes too. Maple sugar can burn easily, so sugarmakers have to be very careful when they heat the sap to make it.

Student Lesson: Sugar Maple Days

From Trees to Sweets

Label the steps in order from the maple tree to maple sugar below:

_____ Evaporate the water until the syrup is thick enough to be maple sugar

_____ Wait until the nights are below freezing and the days are mild

_____ Evaporate the water until the syrup is thick enough to be maple cream

_____ Evaporate the water until the sap is 33% water (maple syrup)

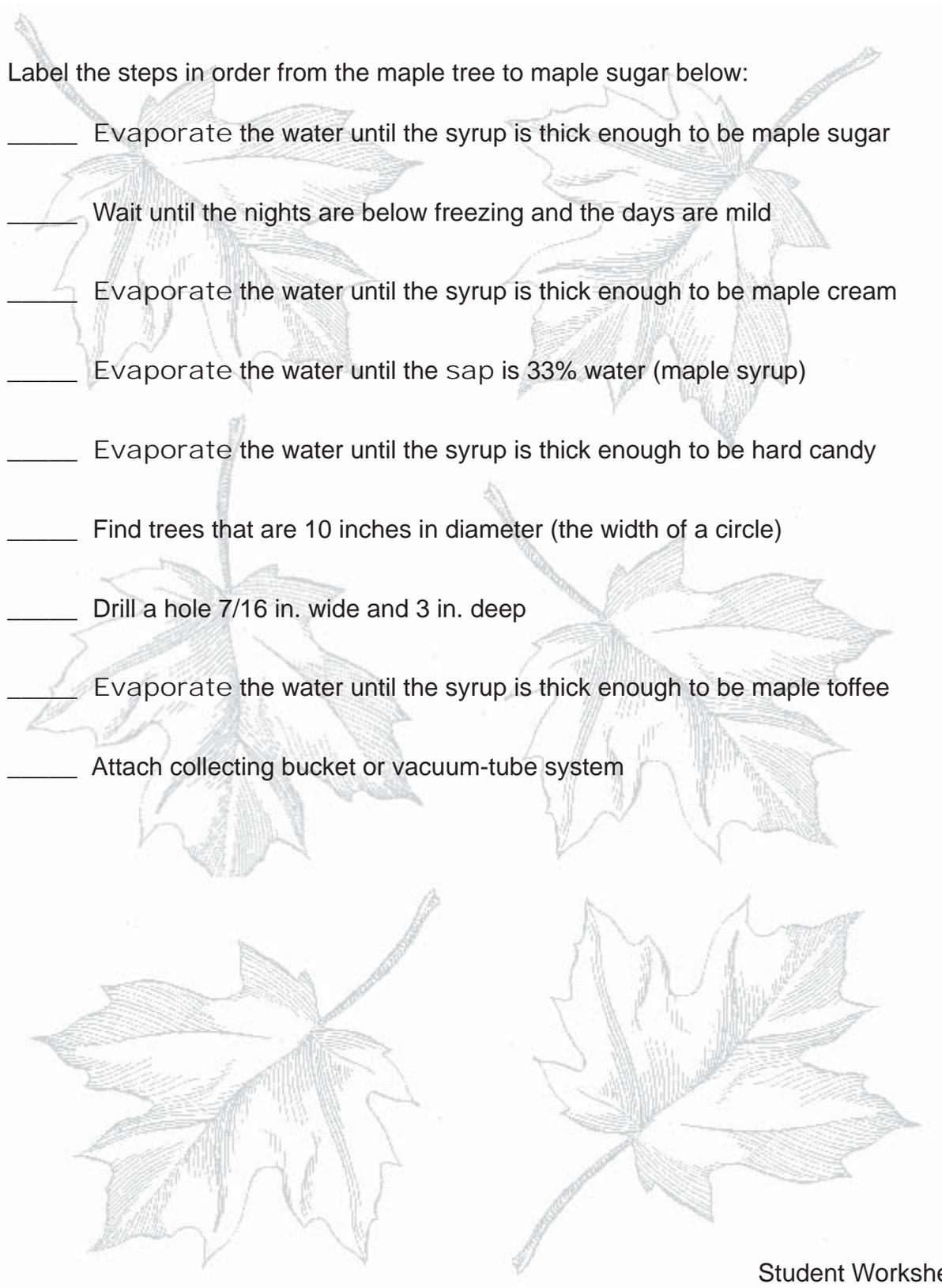
_____ Evaporate the water until the syrup is thick enough to be hard candy

_____ Find trees that are 10 inches in diameter (the width of a circle)

_____ Drill a hole $\frac{7}{16}$ in. wide and 3 in. deep

_____ Evaporate the water until the syrup is thick enough to be maple toffee

_____ Attach collecting bucket or vacuum-tube system



Student Lesson: Sugar Maple Days Review

- Some maple trees can be tapped for their sap to make into syrup.
- Sugar maple and black maple provide the sweetest sap and are better for making maple sugar than other maples.
- Hydraulic lift is when a tree's roots draw water up to the upper, dryer layers of soil from the wet, lower soil layers.
- Sap is collected in buckets or a tube system in the late winter or early spring, whenever the nights are below freezing but the days are mild.
- Sap flows up, down, and across the tree.
- Sap will flow towards the point of lowest pressure. Drilling a hole creates a low pressure point and that's how sap is tapped from the tree.
- The bark, leaves, twigs, and fruit of maple trees are similar but they do have notable differences based on what kind of maple tree they are.
- Sugar maple sap is 98% water and 2% sugar, After it has been evaporated down to syrup, it is 33% water and 67% sugar.
- Maple syrup can be evaporated (boiled down) further to make maple cream, toffee, hard candy, and sugar.
- Maple trees provide some of the more colorful leaves in the autumn. The fall leaves can be any combination of red, orange, and yellow.



Maple seedling (young tree)

Student Lesson: Sugar Maple Days
Test Your Knowledge

1. Which one of these is not a kind of maple tree?
- a. Sugar maple
 - b. Red maple
 - c. Banana maple
 - d. Silver maple

2. Why are sugar maples and black maples used most in making maple products?

3. True or False: Hydraulic lift is when the tree's roots lift the tree out of the ground.

4. What is the percentage of water and sugar in sugar maple syrup?
- a. 34% water and 55% sugar
 - b. 25% water and 75% sugar
 - c. 33% water and 67% sugar

5. After a sugarmaker evaporates all of the water out of the sugar maple tree sap, what will he or she have left?

6. Describe two ways that maple tree sap can be collected. _____

Student Lesson: Sugar Maple Days Vocabulary

Dilute - to make thinner by adding liquid to the mixture

Evaporation - the process by which liquid becomes gas, and moisture goes into the air

Hydraulic lift - the process by which water is pulled upward from a lower area. Sugar maples' roots bring water from deep soil layers to upper soil layers at night.

Sap - the watery fluid in a plant that carries food and other substances and can get sticky as it dries

Spile - a spout that is put through the bark of a sugar maple and used to get sap

Sugarmaker - the farmer of the sugar maple trees, who gets the sap from the trees for syrup

Tapping - the process in which the sugarmaker drills into the trunk of the maple tree and places a spout where the sap will run out into a bucket

Integrated Pest Management is a specialized form of environmental management wherein scientific research and real-world application work together to reduce pests such as insects, diseases or weeds.

1. *Properly identify pests*
2. *Learn the pest/host biology*
3. *Sample the environment for pests*
4. *Determine an action threshold*
5. *Choose the best tactic*
6. *Evaluate results*



Teacher Information for Student Worksheets

Interest Approach Activity: The Price of a Gallon

Students will be able to practice their math skills while learning about the maple syrup industry.

Answers:

1. 10,120,000 gallons of sap
2. 2000 of sap
3. 50 gallons of syrup
4. 2 1/2 cords of wood
5. \$95.10

Student Worksheet 1

Introduction

This is the introductory page. Students may read to themselves or you may initiate a group discussion around the essential questions.

Student Worksheet 2

The Sugar Maple Tree

Students may take turns reading this page aloud. It discusses the essential concepts of hydraulic lift and sap flow.

Student Worksheet 3

The Maple Tree Family

Students should complete this page individually to reinforce the concepts by re-reading through the material to find their answers. Question 4 requires students to use a separate sheet of paper. A great way to supplement this is to obtain leaves from real maple trees.

Answers:

1. When the tree's roots pull water up to drier soil layers.
2. The point of lowest pressure.
3. Bowling alleys/Bowling pins

Student Worksheet 4-A & 4-B

From Trees to Sweets

Students may read this page individually or as a class. This story describes the process of converting sugar maple sap into syrup, cream, toffee, candy, and sugar. If possible, have them complete the sequencing exercise individually, or as teams.

Answers: 9, 1, 6, 5, 8, 2, 3, 7, 4

Student Worksheet 5

Review:

Students may read this page individually or as a class. Questions follow on the next page.

Student Worksheet 6

Test Your Knowledge:

Students should complete this page individually. You may choose to count it as a test or quiz grade.

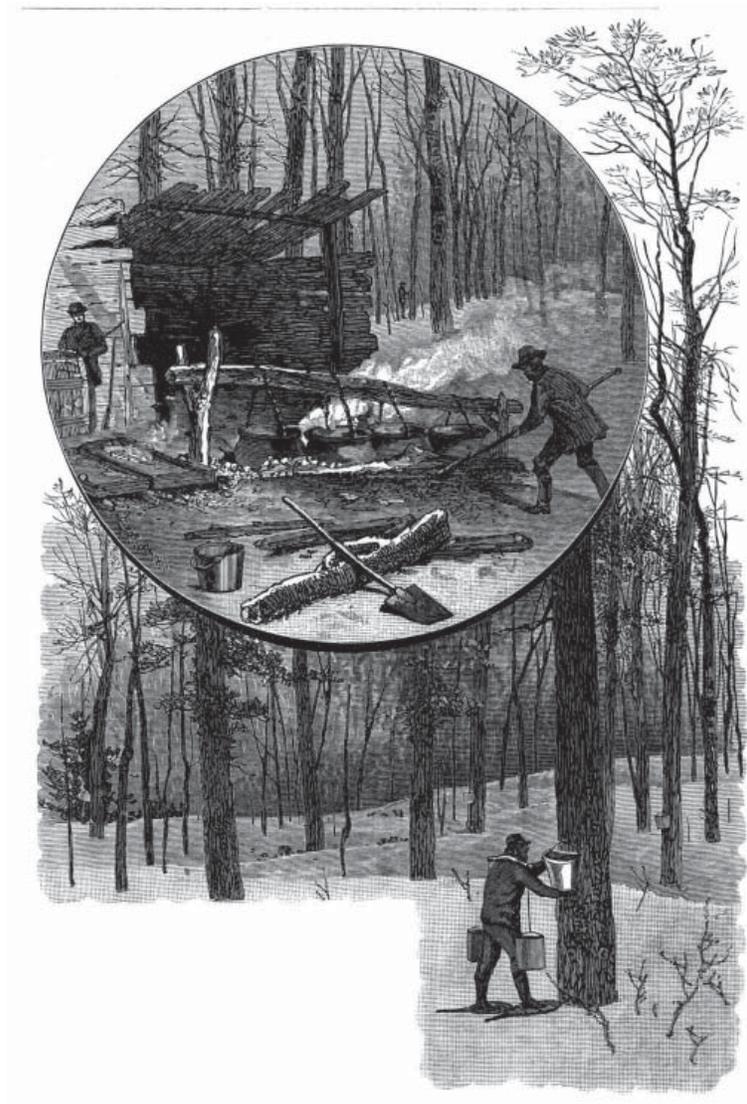
Answers:

1. C
2. They have more sugar in their sap.
3. False
4. C
5. Sugar Crystals
6. It can be collected in covered buckets or vacuum-tubes can be attached to the spiles.

Student Worksheet 7

Vocabulary

Provided for student reference



Lesson Supplements

Other Activities

- I. Contact the nearest sugarmaker and ask if he or she will come speak to your class or give the students a tour of his or her facilities.

II. When it snows outside, make maple toffee!

Materials:

Portable stove top/camping stove

Clean snow kept in a clean bucket or tub outside

Cooking pot

Cooking or candy thermometer

Large spoon

Several bottles of maple syrup (depending on class size)

1. Heat maple syrup to 22 to 28 degrees F. above the boiling point of water.
 - A. Usually heating to about 234° will do the job.
 - B. A higher heat will make a stiffer product.
2. As soon as the syrup reaches the proper temperature, it is poured or drizzled immediately, without stirring, over packed snow or shaved ice.
3. Because it cools so rapidly, the supersaturated solution does not have a chance to crystallize. It will form a thin glassy, chewy, taffy-like sheet over the snow.
4. Twirl it up with a fork and enjoy!
5. Some of your students may have read Laura Ingalls Wilder's *Little House in the Big Woods*, in which the children make maple candy in the same way. You may choose to read that chapter in class.

II. Just for fun!

This might be a good time to play a recording of Scott Joplin's "Maple Leaf Rag," or ask your school's music teacher to arrange a live performance. It's a lively piano piece many young people enjoy, and could be a good lead-in for discussions about American history and music, and preparation for Black History Month in February.

