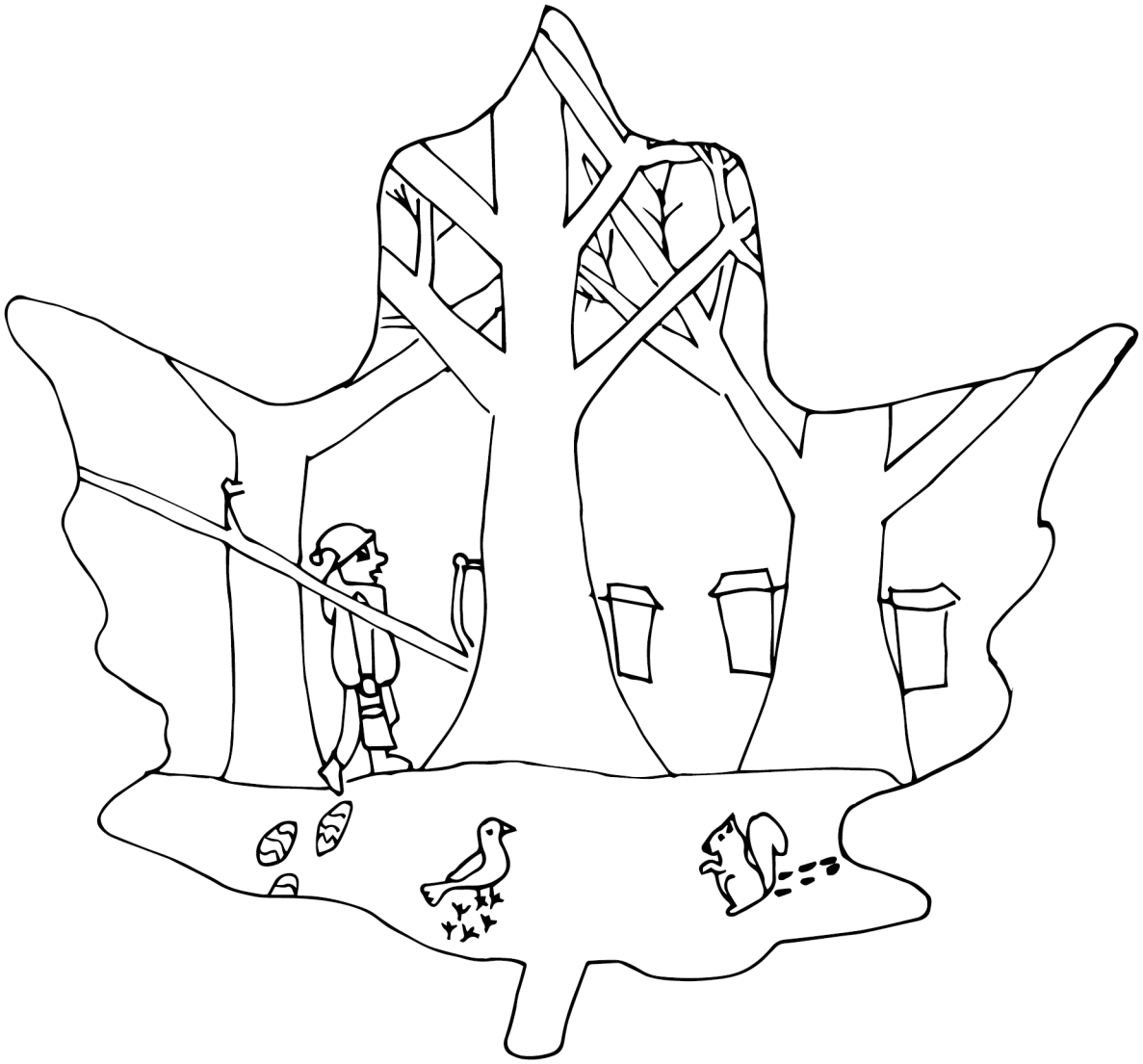
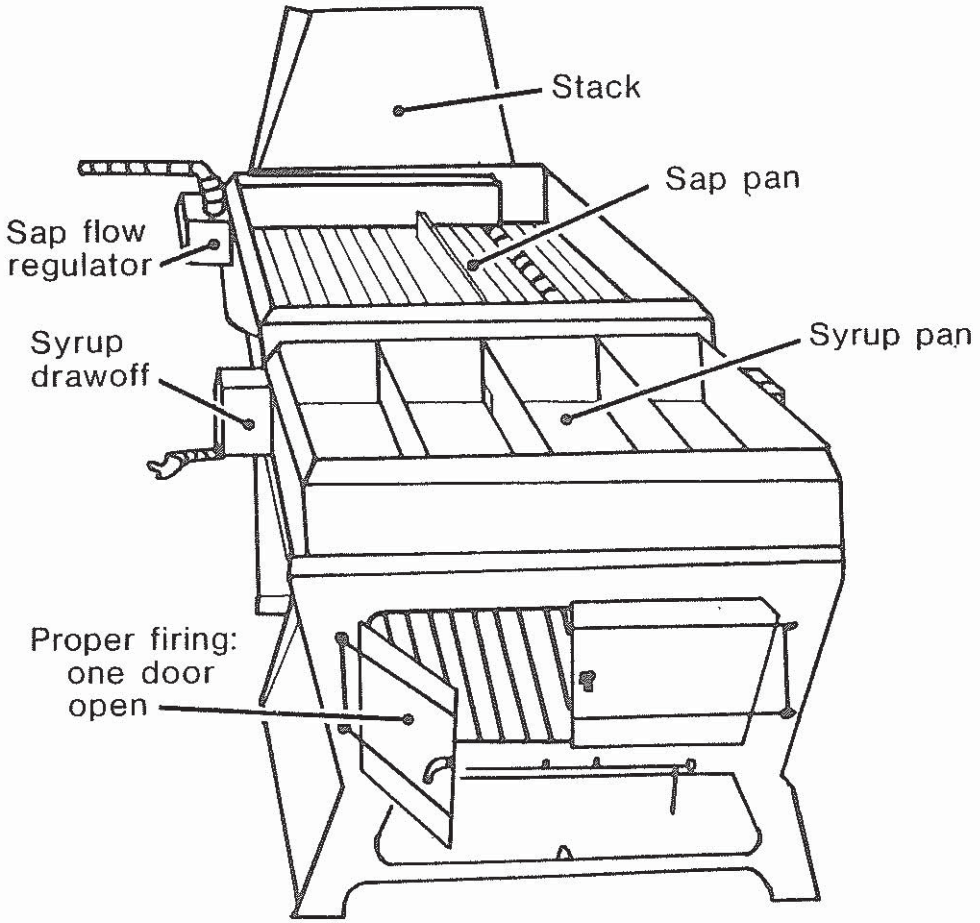


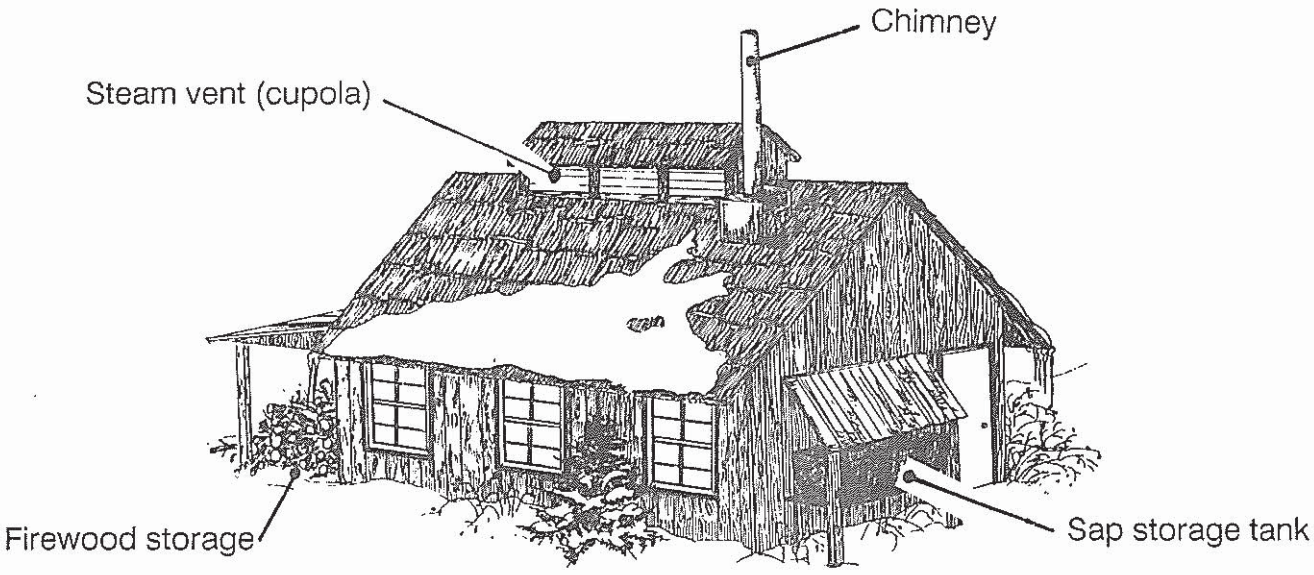
MAPLE
in the classroom

experience LEARNING

NAME: _____



COMPLETE WOOD-FIRED EVAPORATOR



A TYPICAL MAPLE SUGARHOUSE

Massachusetts Maple Producers Association. Retrieved 11 February, 2019. https://www.massmaple.org/about-maple-syrup/education-resources/

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** gallons of syrup x **40** gallons of **sap** for 1 gallon of syrup = _____

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

Science of Life Exploration: Sugar Maple Days. Retrieved 4 February, 2019. https://nysipm.cornell.edu/sites/nysipm.cornell.edu/files/shared/documents/sugar-maple-days.pdf

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?

Science of Life Exploration: Sugar Maple Days. Retrieved 4 February, 2019. https://nysipm.cornell.edu/sites/nysipm.cornell.edu/files/shared/documents/sugar-maple-days.pdf

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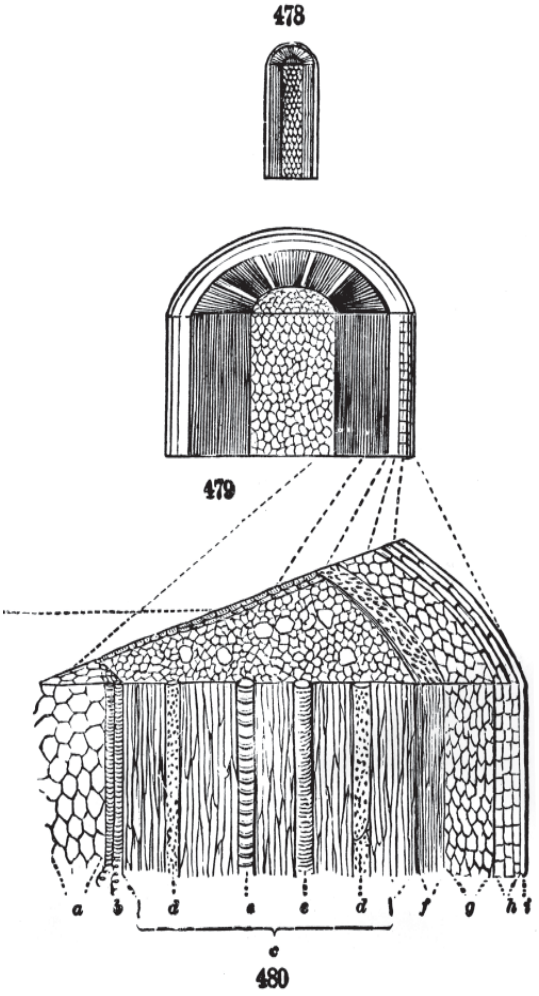
Student Lesson: Sugar Maple Days
The Sugar Maple Tree

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.



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.

Science of Life Exploration: Sugar Maple Days. Retrieved 4 February, 2019. https://nysipm.cornell.edu/sites/nysipm.cornell.edu/files/shared/documents/sugar-maple-days.pdf

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Student Lesson: Sugar Maple Days
The Maple Tree Family

1. What is **hydraulic lift**? _____

_____

_____

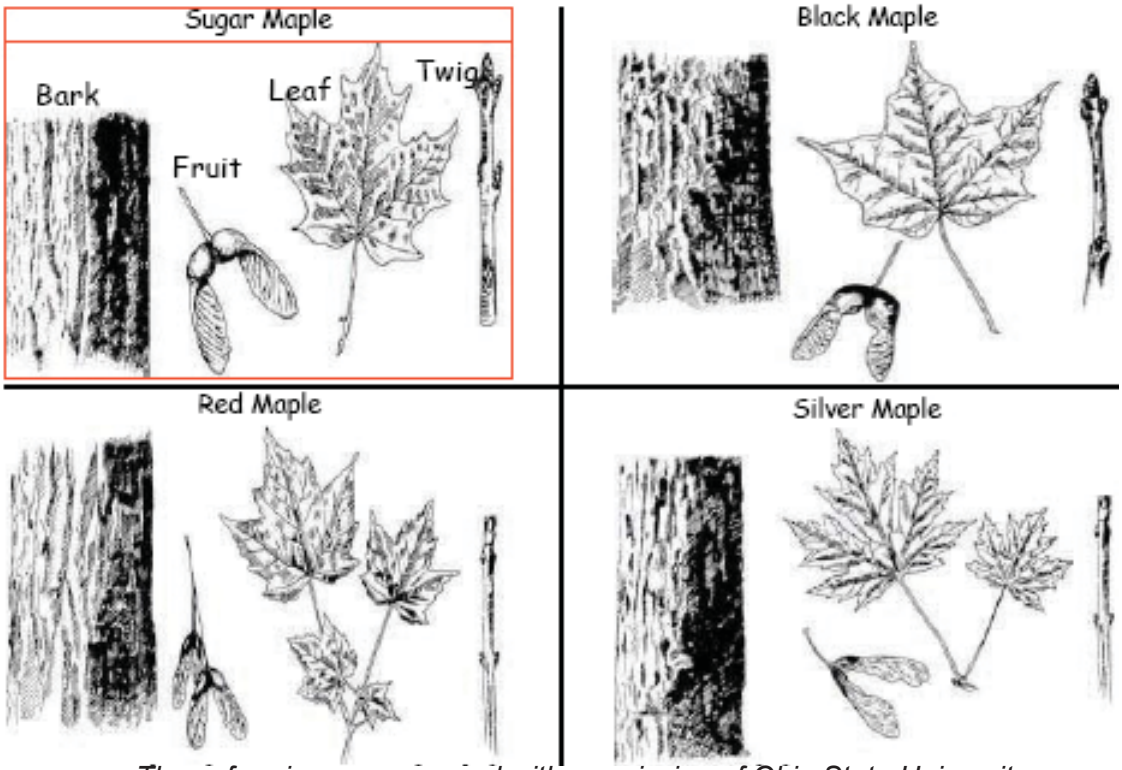
2. Where does **sap** flow to? _____

_____

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.



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name _____

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 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.

Science of Life Exploration: Sugar Maple Days. Retrieved 4 February, 2019. https://nysipm.cornell.edu/sites/nysipm.cornell.edu/files/shared/documents/sugar-maple-days.pdf

name _____

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 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

Science of Life Exploration: Sugar Maple Days. Retrieved 4 February, 2019. https://nysipm.cornell.edu/sites/nysipm.cornell.edu/files/shared/documents/sugar-maple-days.pdf

name _____

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. _____

_____

_____

_____

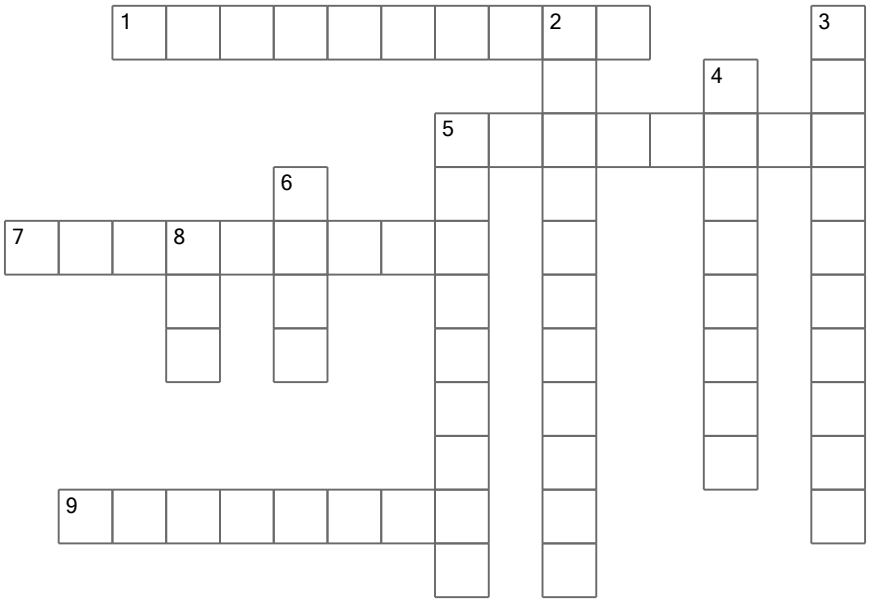
Science of Life Exploration: Sugar Maple Days. Retrieved 4 February, 2019. https://nysipm.cornell.edu/sites/nysipm.cornell.edu/files/shared/documents/sugar-maple-days.pdf

Name:

Date:

Maple Syrup Crossword

Complete the activity.



ACROSS

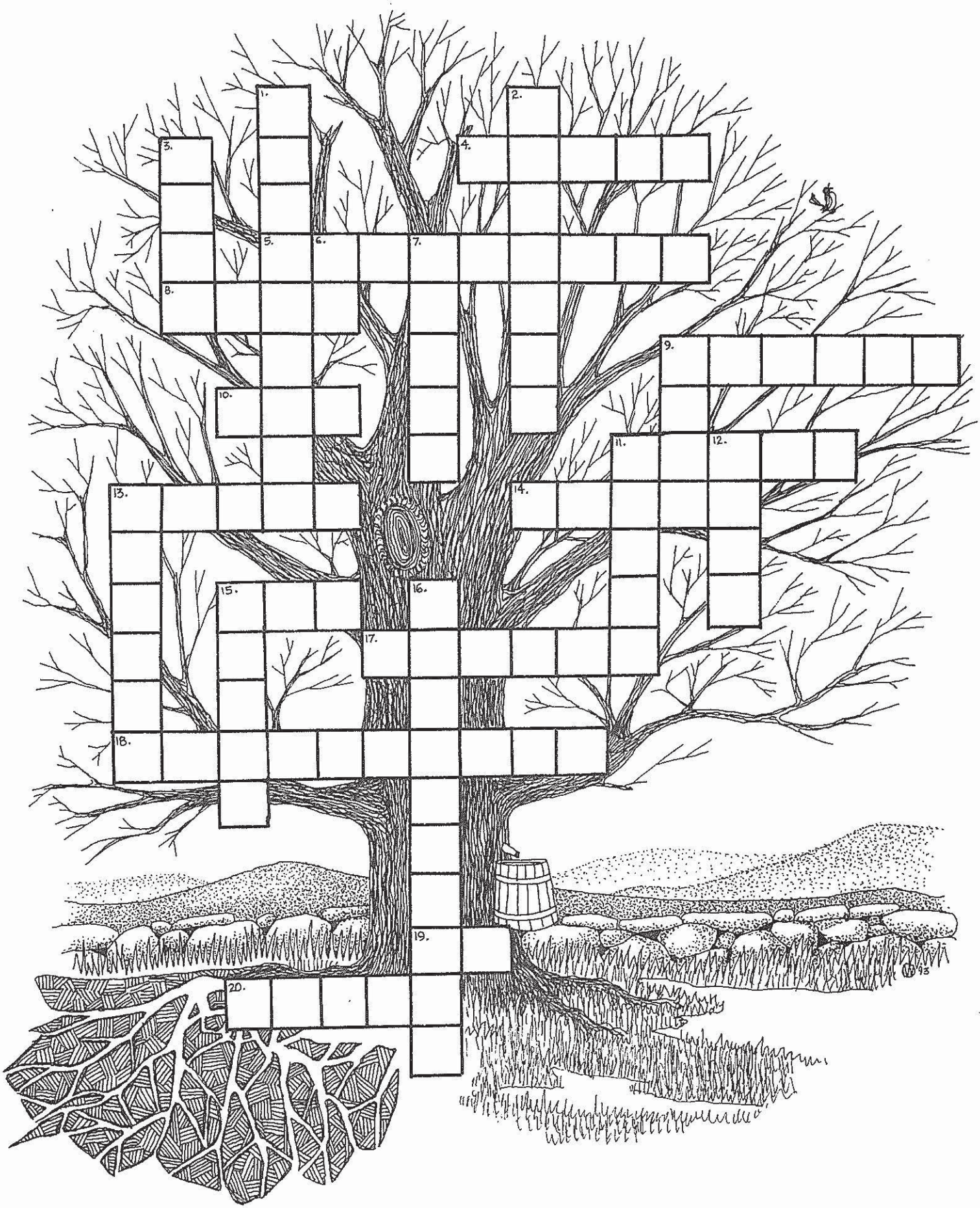
1. The building where maple water is transformed into maple syrup
5. Making maple syrup
7. Removes impurities that could affect appearance and flavor
9. Small holes drilled in maple trees, usually just 5/16” in diameter and only about 2” deep

DOWN

2. Maple producers
3. It takes 40 years to be ready for one tap
4. The maple season
5. All the tapped trees of a sugarmaker
6. Sap flowing in high volumes
8. To pierce in order to draw off liquid

Tap	Filtering	Tapholes
Sugarbush	Sugar Maple	Sugarmakers
A Run	Sugaring	Six weeks
Sugarhouse		

Maple Word Puzzle I



Massachusetts Maple Producers Association. Retrieved 11 February, 2019. https://www.massmaple.org/about-maple-syrup/education-resources/

Maple Word Puzzle I

ACROSS

4. A piece of ____ can be made from maple syrup.
5. The first settlers of Massachusetts learned about maple sugar from the Native _____.
8. To boil maple sap you need a hot _____.
9. On a _____ of a maple tree is where you will find the leaves.
10. In the springtime, the maple farmer will _____ his trees in order to get the sap.
11. An older way to spell syrup.
13. Sap is a colorless liquid that looks just like _____.
14. Maple syrup can only be made from this type of tree.
15. The liquid that flows from a tapped maple tree at the end of winter.
17. A metal or wooden _____ is hung on a maple tree to collect the sap.
18. The metal pan used to boil and evaporate the sap is called an _____.
19. The sap in the roots flows ____.
20. These take in water and nutrients from the soil for the tree.

DOWN

1. The Native American Indians made their maple sugar into a cakelike block called a _____.
2. Maple syrup is often poured over a waffle or a _____.
3. Part of the maple tree that turns a beautiful red or orange in the fall.
6. The person who loves pure maple syrup the most.
7. The Native Americans evaporated their maple sap by heating _____ in a fire and dropping them into a container of sap.
9. To evaporate maple sap into maple syrup, it must _____ for a long time.
11. After a taphole is drilled into a maple tree, a maple sugar farmer puts a _____ into the hole.
12. Artificially flavored syrup never tastes as yummy as _____ maple syrup.
13. Some people like their syrup on a pancake, some like it on a _____.
15. Maple sap is slightly sweet because it contains a little bit of _____.
16. The farm building where maple syrup is made.

MAPLE - TODAY'S STORY

Maple sugaring today has its roots in the methods learned from the Native American Indians by the early settlers. Much of today's sugaring is the same as it was three hundred years ago. The syrup is still made from the sap of the sugar maple. The sap is boiled over a heat source of some type until the proper amount of water has been removed. The biggest changes from old methods are in the ways that the sap is gathered from the trees. Now, instead of hanging thousands of buckets on the trees, most sugarmakers use a system of approved food-grade plastic tubing that connects all the trees to larger pipelines that eventually run downhill to a sap storage tank. In this way, as the sap runs out of the tree, it will flow eventually into a tank in one place, and the sugarmaker can collect sap from many trees at one central location. With the old bucket method it required much more time and labor to go from tree to tree to gather the sap.

The great amount of time and labor involved in maple syrup manufacturing has not diminished much over the years. Although modern boiling equipment makes the process somewhat faster and the use of tubing instead of buckets saves time in the woods, the process is still very labor intensive, and involves much hard work. All the equipment must be set up every winter, and taken down, cleaned, and put away each spring. Work has to be done in the woods, fallen trees have to be cleared out of the way, damage to the tubing systems must be repaired. Squirrels and other small animals are notorious for chewing holes in the tubing. Much of the work in the woods must be done during the cold weather, and often on snowshoes in deep snow. The sugarmaker can never predict ahead of time what kind of crop he will have. The maple business is, after all, farming. Just as any field crop farmer is dependent on the weather, so is the maple farmer. The catch is that the maple crop is just about fully dependent on the weather that occurs in a 5-6 week period in early spring.

Once the sap starts to flow, it must be collected and boiled as soon as possible. Because sap has sugar in it, sap can spoil if not processed quickly. The sugarmaker must be prepared to gather his sap quickly and regularly. He must boil it down into maple syrup right away. Sometimes this requires boiling many long hours into the night. Some sugarmakers use a new technology called reverse osmosis to speed up their work. This process is used before the sap is boiled. By passing the sap through a series of special membranes, much of the water in the sap can be separated from the sugar, thereby giving the sugarmaker a much more concentrated sap to boil in his evaporator. This saves both boiling time and the amount of fuel required to make the maple syrup.

As soon as the syrup is made, it must be filtered to remove what is called "sugar sand", the gritty mineral deposits that occur naturally and precipitate out when the sap is boiled. After filtering, the syrup is graded according to the Federal standards for color and taste, and then is canned or bottled while still at least 180 degrees. At this point the sugarmaker can be proud of his skills as an accomplished sugarmaker, as his finished product is a sure sign of much hard work leading to a job well done.

TEACHER NOTE: The student may be assigned the following as a reading project. The student should complete the answers to the questions. A teacher may read this story to their class or ask different students to read the paragraphs. After reading aloud, students can provide a written or verbal answers to the questions.

MAPLE - TODAY'S STORY

QUESTIONS ABOUT THE STORY

_____
NAME

Answer the following questions after reading, Maple - Today's Story.

1. Who taught the early settlers the process of maple sugaring?

   _____

2. The early settlers used buckets to collect sap from the trees. How do today's farmers collect sap?

   _____

   _____

3. Is maple sugar production hard work? _____

   Can you describe some of the chores of the farmer? _____

   _____

   _____

   _____

4. What is one of the most important influences on maple sugar production?

   _____

5. What happens if sap is not boiled soon after collection? _____

   _____

   _____

6 A. Is there a method to reduce the time required for boiling sap? _____

   B. What is this process called? _____

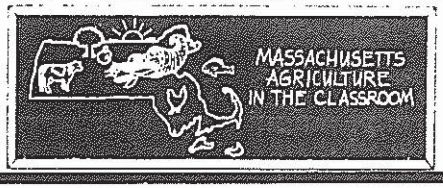
   C. What are one of the side benefits to this process? _____

   _____

7. After the syrup is filtered, it must be graded. What are the two factors which influence the grade of syrup?

   A. _____

   B. _____



Maple Units of Measure I

Pint 

Quart 

Gallon 

1 Pint + 1 Pint = ____ Pints or 1 Quart

1 Quart + 1 Quart = _____ Quarts or 1/2 Gallon

1 Quart + 1 Quart + 1 Quart + 1 Quart = _____ Quarts or 1 Gallon

---

1 Gallon
-1 Quart
__ Quarts

1 Pint
\- 1 Pint
__ Pints
or
1 Quart

1 Quart
+ 1 Quart
__ Quarts
or
1/2 Gallon

1 Quart
1 Quart
1 Quart
+1 Quart
__ Quarts
or
1 Gallon

Teacher Note: Use examples of representative units of measure to bring to life the visualization.

Maple Words

Unscramble the Scrambled Words.

TAKN ____

SUPOT _____

GUARS _____

PAMLE _____

KUCTEB ______

SURHAOUGES _____ _____

ROTEPARVAO _____ _____

Choose from these words:

MAPLE	SUGARHOUSE
SUGAR	SPOUT
TANK	BUCKET
EVAPORATOR	SYRUP

Select three (3) and use them in a complete sentence. Underline the word you select.

1. _____

_____

_____

2. _____

_____

_____

3. _____

_____

_____

MASSACHUSETTS AGRICULTURE IN THE CLASSROOM