Settle Down! A History of New York’s Pioneering Settlers

Science Unit
(Grades 3-5)

Teacher’s Guide

Overview:
In a videoconference program with educators at the New York State Historical Association, students will learn about the lives of Central New York’s pioneering settlers. How did pioneers make maple sugar, and why was it so important for their survival? Students will learn about the physical science behind maple sugaring, while reviewing the importance of the sweet food in the New York pioneer economy.

Objectives:
Use information from primary source material to learn about the life of pioneers in the 1790s.
Explain and illustrate how pioneers made maple syrup and sugar, and why it was important to their survival.
Teach the physical and chemical science involved in the manufacture of maple syrup and sugar.

Before the Videoconference Program:
Print out the Videoconference Planning Guide and keep it handy. Be sure to review the “What is a Videoconference?” section with your students before the program.

Videoconferences are most effective when your students have been exposed to the subject ahead of time. To this end, we have prepared background information in the form of fact sheets and primary source excerpts, as well as a list of essential vocabulary to help guide your pre-program lessons.
Please prepare students for the program’s historical context by reviewing this information with your students. Attention should be given to the natural features that pioneers were looking for when settling in a new land, the physical hurdles they had to overcome, and the role of the general store in pioneer life.
The basic physical science concepts involved with maple sugaring should be reviewed. Lastly, an excerpt from a memoir of an early Otsego County pioneer and a fact sheet on maple sugaring have been included to provide context on the main topic.

As part of your pre-program packet, you also received samples of maple sugar and maple syrup. You will need to provide:
small bathroom-sized paper or plastic cups (enough for each student to use three)
measuring spoons
3 cups of water
spoon for stirring
pitcher

Students will be invited to taste the different phases of maple sugaring during the program. We ask that the following pre-work be completed before the program to avoid any delays during the videoconference.
Sap: Dissolve 3.5 teaspoons of maple sugar in 3 cups of water. This simulates the proper sugar content of sap. Put approximately 1 Tablespoon of sap water in each of the first set of cups.
Syrup: Put approximately 1/2 Tablespoon of syrup in each of the second set of cups.
Sugar: Put approximately 1 teaspoon of maple sugar in each of the third set of cups.

Students can be seated in any arrangement for the program.

Background Information:
Pioneer Life Fact Sheet:
After the Revolutionary War, the thirteen new American states were becoming very crowded. Land was expensive and farms were small. Many Americans looked to the western frontier for cheap land and a new life.

At this time the frontier was actually Central and Western New York State! The land was very mountainous, and covered in a thick forest of trees.

Pioneers from Connecticut, Massachusetts, Pennsylvania, and other new states packed up their belongings to move to the wilderness of Central and Western New York.

In selecting land to move to, pioneers looked for three natural features: good land, water, and trees. It was important to the pioneer's survival that he found all three where he chose to settle. They were all important for many reasons.

**Land:** A lot of land in the hills of New York is filled with rocks and poor soil that make crops hard to grow. A pioneer had to be careful about where he chose his land. Land was important for:
- Providing place to build a house and farm buildings.
- Planting crops.
- Grazing animals.

**Water:** A water source on or near the land was very important. Lakes, rivers, streams, and natural springs were all good sources of water for the pioneer family. Water was important for:
- Survival. People and animals need water to live.
- Plants and crops. They need water to grow.
- Cooking.
- Bathing.
- Transporting farm goods to the market.

**Trees:** Trees were important for:
- Giving food such as fruit, nuts, and maple sugar and syrup.
- Providing shade.
- Building houses and furniture.
- Building fires to cook food and stay warm in the winter.

In 1786 William Cooper, a pioneer from Pennsylvania, bought thousands of miles of land in the center of New York State. He was one of the first people to try to get pioneers to come to Central New York.

Cooper broke up his land into small farms and sold them to pioneer families from Connecticut, Vermont, and Massachusetts.

Cooper also decided to build a village at the foot of the Otsego Lake. He called his village Cooperstown.

Early travel to Cooperstown was difficult because there weren’t many roads or bridges. Many pioneers who left their family farms in Connecticut or Massachusetts never saw their families again because the travel was too long and hard. Once they reached their new land, pioneers were very isolated from the rest of the country.

The pioneer and his family could not bring many belongings with them, and what they did bring had to be important for survival. They usually only had a few clothes, small amounts of food, an axe and other small tools, a team of oxen, and an ox cart.

A pioneer had a busy job on his new land. He had to cut down trees to make a place to build his house,
which was made out of logs from the cut trees.

Cutting down trees to make way for farmland was hard and long work. Oftentimes the pioneer didn’t have enough free space to plant his crops until a few years after he arrived.

Many early settlers would make maple syrup and sugar from the trees because they could sell them for money while they were making space for farming. Also, a pioneer could sell the wood from the trees he cut.

In order to sell his wood and sugar, the pioneer needed someone to buy them. If he was lucky, the pioneer lived near a village with a general store that would buy his goods.

In pioneer time, paper money was very rare, if it existed at all. Instead, they used coin money. However, out in the wilderness most pioneers didn’t have any coin money.

Pioneers usually bought items at the general store on credit. In other words, they took the items they need, and promised to pay for them later.

Most of the time, pioneers paid for our purchases with other things that were valuable. It worked like a trade. Many of the pioneers brought in maple sugar they made, or wood boards they cut. They were worth money because Mr. Cooper could sell them to people in New Jersey or Pennsylvania.

Items such as sugar and wood work like money in pioneer villages, and pioneers used them to pay bills instead of actual coin money.

**Pioneers and Maple Sugar:**


"It was not uncommon to make sugar in the spring, on a piece of forest land, and then clear it off for a crop of corn the same season. Several acres of my father's lands, where he afterwards planted his orchard, were thus used, and cleared off; the small brush had been cut the proceeding autumn. When the time arrived for making sugar, the trees were tapped and a large quantity made. As the season advanced, we cut the small timber, heaped the brush, and got everything ready to cut the large trees, as soon as sugar making was over; that being past, we cut and burned all the timber, and cleared the land for crop. . . .

The sugar-making season was always hailed with rapture by the boys. No one, brought up in a new country, but can realize how exciting it was, and how eager and industrious the boys were to commence tapping the trees. This used to be done by cutting a notch in the sugar maple, and putting a spout under it, inserted by driving in a partly rounded, sharp iron instrument, called a tapping gouge, to cut a place for the spout that led the sap to the trough. Sap buckets were not then introduced, nor did they use an auger, as they do now, for tapping trees.

Troughs were generally made from the butternut, and would hold about a pailful [sic], and some nearly two. The season having arrived, boys with their hand sleds would soon distribute the troughs to the trees that were to be tapped, by drawing them in the morning on the snow crust. Then the master of ceremony would follow with his axe, spouts, and tapping gouge; the sharp ringing of the iron, as he drove the gouge into the tree, kept all advised where he was. The trees being tapped and troughs set, the next thing was to shovel away the snow, and prepare a place to hang kettles for boiling.

I have frequently found the ground covered two or three feet deep with snow, entirely free from frost, and the young leeks already pricking up through the ground and reaching the snow that lay on it. The gathering of sap, which had to be done generally with pails, was hard work while the snow lasted, as we frequently sunk into the snow up to our knees. When the boiling was commenced, a small piece of pork was thrown in the kettle, to prevent the sap, as it boiled, from running over. The little chickadee birds are always attracted to where one is at work in the woods, and they would generally find the spare piece of pork and pick and eat it up, unless concealed. The sugaring off, gave great delight to the parties present, as everyone knows; and this sugar making, in a new country, is always to boys a delightful employment. When we had a good run of sap, as it was called, that is, when it ran freely, I have frequently
remained in the camp, and tended the kettles late in the evening. The atmosphere being clear and delightful in springtime, the dropping of the sap into the troughs could be heard in all directions; and for a considerable distance; and then the hooting and screaming of owls, often very near, being attracted by the fire, would, to an unpracticed ear render the night hideous, discordant [sic] and melancholy.

**Maple Syrup and Sugar Fact Sheet:**
The genus and species name of the sugar maple tree is *Acer Saccharinum*.

The sugar maple is the state tree of New York.

Today, New York State is the third largest producer of maple syrup and sugar in the United States. (Vermont is first, and Maine is second.)

A maple tree is usually at least 45 years old and 12 inches in diameter before it is tapped.

Tapping does not damage the tree. Only about 10% of the sap is collected each year from a tree.

Each tap provides an average of 10 gallons of sap per season.

Warm sunny days (above 40 degrees F) and frosty nights are perfect for sap flow.

The maple season may last 4 to 6 weeks, but sap flow is heaviest for a period of 10 to 20 days.

The harvest season ends when the spring nights become warm and buds begin to develop on the trees.

Around 40 gallons of sap make one gallon of syrup.

Maple syrup is boiled even further to produce maple cream, sugar and candy.

A gallon of pure maple syrup weighs 11 pounds.

It takes 1 gallon of syrup to produce 8 pounds of sugar.

Sap is about 2.5% sugar, while syrup is about 66.5% sugar.

**Science Fact Sheet:**
Matter is the word for the substance that makes up everything in the world. All matter is made of atoms and molecules.

There are five states of matter. The three most common are solids, liquids, and gases.

All matter can move from one state to another when special physical forces are present. Temperature and pressure are two examples of physical forces that can influence the change of matter.

The difference between solids, liquids, and gases is the amount of energy in the molecules of the matter. Solids have molecules that are packed very tightly together. They can't move around very easily, and therefore tend to make the solid stiff and hard. The molecules in liquids have more energy, and can move around more easily. This allows liquids to flow. However, liquids stay the same volume no matter what container they are placed in. The molecules in gases move very quickly because they have a lot of energy. Gases can expand or contract depending on the container they are in.

When many different types of molecules are mixed together evenly in liquid, they are called solutions. Solutions can consist of solids mixed in liquids, two or more liquids mixed together, or even gases mixed into liquids.

A simple solution occurs when two substances are mixed together. One of the substances is called the solute. A solute is the substance that will be dissolved (for example, sugar). The solute can be a solid, liquid, or gas. The other substance is a solvent, and it almost always a liquid. The solvent is the one doing the dissolving (for example, water). Generally, there is usually more solvent than solute.

Sometimes a liquid, like water, will lose some of its molecules when they break away to become a gas. This is the process called evaporation. It can happen when liquids are cold or when they are warm.
It happens more often with warmer liquids. For example, if you put a pan of water on a hot stove, the water will turn into steam more quickly than if you left the pan on the counter.

When the substance that is being evaporated is a solution made from solids and liquids, only the liquid solvent is evaporated. The solid solutes are left behind and become thicker when the liquid is removed.

**Key Vocabulary:**

**Revolutionary War:** *n.* the war between the American colonies and Great Britain (1775-1783), which ended with the creation of the independent United States.

**Frontier:** *n.* an area just beyond, or at the edge of, a settled area.

**Pioneer:** *n.* a person who ventures into unknown or new territory to settle.

**William Cooper:** *n.* the pioneer from Pennsylvania who first settled in Cooperstown, NY. He bought a lot of land, which he broke up into many farms. He then sold the farms to other pioneers.

**Cooperstown:** *n.* the rural village that William Cooper created for his pioneer settlers. It was where Cooper built the first general store.

**General Store:** *n.* a store created in a new settlement that was usually filled with a many different items, including farm tools, food, kitchen and household items, and cloth and sewing supplies.

**Credit:** *n.* a formal way of borrowing, where a store keeper allows a person to take something without paying for it. Instead, the store keeper will make a note of how much the item cost. The buyer can then pay for the item at another time, either with money, or with another item that costs the same amount.

**Sap:** *n.* The watery fluid that circulates through maple trees in the spring. It carries sugars, minerals and other nutrients to all parts of the tree to help it grow.

**Maple sugar:** *n.* a sugar made by boiling down maple sap until all the water has been removed. The remaining sugar becomes a solid, which is a type of sugar.

**Tapping trees:** The process of drilling a hole into the bark of a maple tree, and placing a wooden or metal spout in the hole where the sap can drain out and into a bucket or trough.

**Auger:** *n.* a hand tool used by pioneers as a drill. It was used to make holes in to trees during maple sugaring time.

**Spile:** *n.* a wooden or metal spout that is hammered into a hole in a maple tree and helps direct the flow of the sap into the collection bucket or trough.

**Trough:** *n.* a long, narrow and often shallow container used by farmers for many purposes, including holding water or food for feeding animals. Troughs made of hollowed-out tree trunks were used by early pioneers to collect maple sap.

**Solution:** *n.* a mixture of two or more substances, often in liquid form. Sap is a solution of water, sugar, and minerals which have been combined to create one uniform liquid.

**Solute:** *n.* the substance in a solution that is dissolved. It can be a solid, liquid, or gas. In sap, the solute is sugar and minerals, which are solids.

**Solvent:** *n.* the substance in a solution that does the dissolving. It is usually a liquid. In sap, the solvent is the water.

**Dissolve:** *v.* to cause to break apart (disintegrate) into small molecules. The molecules of sugar disintegrate into water, and become part of a new solution of sugary water.

**Evaporation:** *n.* the process of changing a liquid into a gas in order to remove it wholly or partly from solids dissolved in it.
**Concentrate:** *n.* A substance that has been made more dense or thick due to the removal of a liquid.

**Summary of the Program:**
Students will be welcomed by a museum educator. He or she will review the information from the background section, and introduce some additional information about William Cooper and Cooperstown.

Students will then meet a costumed interpreter playing the role of Mr. Nicholls, one of the first pioneers to settle in the Cooperstown area. Mr. Nicholls will address the differences between the pioneer economy and today’s economy. He will talk about the use of trade instead of money as a way to obtain needed materials. He will explain that he made maple sugar, which he traded to Mr. Cooper for the supplies he needed for his family and his farm.

Together, the educator and Mr. Smith will introduce the students to the process of making maple sugar. They will explain how it was made in pioneer times, from identifying the maple tree to processing the sap until it becomes syrup and sugar. Mr. Nicholls will focus on the science behind maple sugar, from the properties of sap to evaporation and condensation. The students will have the opportunity to see the tools that pioneers used, as well as photographs of them in use at The Farmers’ Museum. The students will have the opportunity to try some mock sap, maple syrup, and maple sugar during the program.

Mr. Nicholls and the educator will then conclude with a more in-depth discussion of the importance of maple sugar in the lives of pioneers. Mr. Nicholls will show a list of items that he purchased with his maple sugar trade. A brief question and answer session will follow. The educator and Mr. Nicholls will then conclude the program.

**After the Videoconference Program:**
Students can work independently or together in groups to create a report on an aspect of maple sugaring. Topics could range from creating a key for identifying the maple tree, to the difference between maple sugaring then and now, to reporting how pioneers used maple sugar in their daily cooking. A list of books that provide additional information on maple sugaring and pioneering are listed below. Also, the internet has several resources for maple sugaring. The report could be in the format of an essay, a poster, or a presentation.

To help students remember and recall key themes and vocabulary from the program, a Pioneer Activity Page has been included with this packet.

**Additional Follow-up Activities:**
**Take a field trip to a local sugar house.** Students will be able to observe how maple syrup and sugar are made in a present day operation. Visit [http://www.roundthebend.com/nyssugr.html](http://www.roundthebend.com/nyssugr.html) to find your nearest sugaring operation.

**Make your own maple sugar candy:**
*With the help of an adult,* you can see how your favorite maple syrup changes into solid maple sugar. This tasty experiment changes syrup into crystal candy!

You will need:

<table>
<thead>
<tr>
<th>Cookie Sheet</th>
<th>Water</th>
<th>Pure maple syrup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saucepan</td>
<td>Stove or burner</td>
<td>Spoon</td>
</tr>
</tbody>
</table>

Place a cookie sheet of water in the freezer to make a sheet of ice. If you have clean snow on the ground, you can gather some in a bowl instead.

Have an adult boil the maple syrup in the saucepan until it becomes thick. (Make sure they don’t burn it.) Pour some of the hot thick syrup onto the sheet of ice, or on the snow.
When your candy is the same temperature as the ice, take it off and look at it. You will see that it has become stiff like candy. If you look at it under a magnifying glass, you will see that many sugar crystals have formed. Eat and enjoy!

**Make your own maple syrup:**

In order to make your own maple syrup, you *will need the help of an adult*. Together, you can see how evaporation works to turn sugar water into a tasty treat for your breakfast table or on some vanilla ice cream!

**You will need:**

<table>
<thead>
<tr>
<th>Saucepan</th>
<th>Pure maple sugar (available from your local maple sugar manufacturer, or from The Farmers’ Museum.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>Wooden spoon</td>
</tr>
<tr>
<td>Tablespoon</td>
<td>Measuring cups</td>
</tr>
<tr>
<td>Stove</td>
<td>4 baby food jars or juice glasses</td>
</tr>
</tbody>
</table>

In the saucepan, dissolve 4 Tablespoons maple sugar in 5 cups of water. (This is double the concentration of sugar in maple sap, but will quicken evaporation time, and create more syrup at the end.) Spoon 1 tablespoon out and place in a jar or glass.

Have an adult put the pan on the burner and heat to a constant boil on medium-high heat. Stir the liquid occasionally to prevent burning.

When half of the water has evaporated, carefully spoon another tablespoon out, let it cool for a moment, and place in a second jar or glass. Compare the two jars. Do they look the same or different? Why?

Continue to boil the remaining liquid. When the water halves again, spoon another Tablespoon into a third jar. Compare this jar with the first two jars.

As the liquid becomes highly concentrated with sugar, it may begin to foam as it boils. Be careful it does not boil over. If it foams, turn down the heat or add a drop of butter or oil to the pan.

Stir often until the syrup becomes a deep golden or reddish brown color. The syrup will not thicken very much. You will have to taste test until it reaches the desired flavor. But be careful not to burn yourself!

Once the syrup is done, spoon one last Tablespoon out of the pan and put in the fourth jar. Turn off burner and let syrup cool until it reaches room temperature.

As the syrup is cooling, compare the four jars. You will be able to see how the color changed as the water evaporated. You can even taste the liquid in all four jars to notice the differences as the sugar became more concentrated.

You can enjoy your cooled syrup immediately, or save it for 3-5 days in a tight-lidded container.

**Further Readings:**


Explains the migration of homesteaders from the east to the west of the Appalachian Mountains.


Describes, in text and photographs, the making of maple syrup from tapping the tree and collecting the sap to cooking and packaging.


Storybook: Alongside his grandfather, a young boy shares the work of sugaring – using the traditional method of tapping trees and collecting and boiling sap – and is rewarded with a delicious breakfast of pancakes and maple syrup.

Storybook: As winter melts into spring, Rosie and her grandfather collect sap, and then the whole family works together to make maple syrup.


**New York State Education Standards Addressed:**

**Science:**

*Physical Setting*

4.3 Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.

Energy exists in many forms, and when these forms change energy is conserved.

**The Living Environment**

4.6 Plants and animals depend on each other and their physical environment.

4.7 Human decisions and activities have had a profound impact on the physical and living environment.

**Social Studies:**

*History of the United States and New York*

1.1 The study of New York State and United States history requires an analysis of the development of American culture, its diversity and multicultural context, and the ways people are unified by many values, practices, and traditions.

1.3 Study about the major social, political, economic, cultural, and religious developments in New York State and United States history involves learning about the important roles and contributions of individuals and groups.

1.4 The skills of historical analysis include the ability to: explain the significance of historical evi-
dence; weigh the importance, reliability, and validity of evidence; understand the concept of multiple causation; understand the importance of changing and competing interpretations of different historical developments.

*Economics*

4.1: The study of economics requires an understanding of major economic concepts and systems, the principles of economic decision making, and the interdependence of economies and economic systems throughout the world.
**Pioneer Activity Page**

**Maple Sugar**

Pioneer Richard Smith placed 1,000 taps in 500 trees in 1790. He decided to boil all of his sap down into maple syrup and sugar.

If each tap gave Mr. Smith 10 gallons of maple sap, how much sap did he make from his trees?

It takes 40 gallons of sap to make one gallon of maple syrup. If Mr. Smith decided he wanted to make 150 gallons of syrup, how many gallons of sap does he need?

If he made all 150 gallons of syrup, how much sap does he have left?

Mr. Smith wants to use the rest of his sap to make maple sugar. It takes 1 gallon of maple syrup to make 8 pounds of maple sugar. How many pounds of maple sugar can he make from the rest of his sap?

What would a pioneer use to make maple sugar?

Take a look at the list below.

Circle the items you think a pioneer needed to make maple syrup and sugar.

- Chainsaw
- Trough
- Auger
- Iron Kettles
- Maple Tree
- Spile
- Cooperstown
- Metal Bucket
- Thermometer
- Land
- Plastic Jug
- Microwave
- Axe
- Auger
- Frontier
- Land
- Credit
- Trees
- Sugar
- Pioneer
- General Store
- Sap
- Spile
- Cooperstown

**Fit the words into the puzzle!**

<table>
<thead>
<tr>
<th>Maples</th>
<th>Syrup</th>
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Exposition, Trough, Sap, Maples, Sugar, Pioneer, Frontier, Credit, Solution, Dissolve, Cooper, concentrate, Revolution, War, Trench, Pioneer.
Fit the words into the puzzle!

- Axe
- Auger
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Maple Syrup

What would a pioneer use to make maple sugar?

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   - Pioneer Richard Smith placed 1,000 taps in 500 trees in 1790. He decided to boil all of his sap down into maple syrup and sugar.
   - If each tap gave Mr. Smith 10 gallons of sap to make one gallon of maple syrup, how much sap does he need?
   - If he made all 150 gallons of syrup, how much sap does he have left?
   - If Mr. Smith wants to use the rest of his sap to make maple sugar, it takes 1 gallon of maple syrup to make 6 pounds of maple sugar. How many pounds of maple sugar can he make from the rest of his sap?

2. Pioneer Activity Page

Take a look at the list below. Circle the items you think a pioneer needed to make maple syrup and sugar.

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- Iron Kettles
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- Metal Bucket
- Thermometer
- Axe
- Maple Tree
- Ladle
- Fire
- Sap
- Land
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- Microwave
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- Fire
- Sap
- Land
- Plastic Jug
- Microwave
- Metal Bucket
- Axe
- Thermometer
- Auger
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Maple Sugar Math!

- Pioneer Richard Smith placed 1,000 taps in 500 trees in 1790. He decided to boil all of his sap down into maple syrup and sugar.

What would a pioneer use to make maple sugar?

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   - Pioneer Richard Smith placed 1,000 taps in 500 trees in 1790. He decided to boil all of his sap down into maple syrup and sugar.
   - If each tap gave Mr. Smith 10 gallons of sap to make one gallon of maple syrup, how much sap does he need?
   - If he made all 150 gallons of syrup, how much sap does he have left?
   - If Mr. Smith wants to use the rest of his sap to make maple sugar, it takes 1 gallon of maple syrup to make 6 pounds of maple sugar. How many pounds of maple sugar can he make from the rest of his sap?

2. Pioneer Activity Page

Take a look at the list below. Circle the items you think a pioneer needed to make maple syrup and sugar.

- Chainsaw
- Trough
- Auger
- Iron Kettles
- Elm Tree
- Metal Bucket
- Thermometer
- Axe
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