

# EXPLORING

## Science

### Maple Syrup



#### PURPOSE

This badge will help boys discover how God has given us food through His creation, but sometimes He requires us to work in order to make it edible. It will also teach boys to care for the trees when they are finished getting the syrup.

#### LEARNING

- There are thousands of species of maple trees in the world. Don't expect the boys to know all of them. These are maples that are native to North America. Boys should know which of them are prevalent in their area.

Maple Species	Area
Sugar Black	Northeast USA and Southeast Canada
Red Silver	Eastern USA and Southeast Canada
Boxelder	Eastern and Central USA and Canada
Mountain Striped	Northeast USA and Southeast Canada
Bigleaf Vine	Pacific Coast USA and Canada
Chalk	Southeast USA
Canyon	USA Rocky Mountains
Rocky Mountain	Western USA
Florida	Southeast USA Coastal Plain and Piedmont

The sugar maple and black maple are hard maples and are particularly good sources for maple syrup. In fact, the sugar maple is the primary source of maple syrup and is the tree referred to in the rest of this merit badge.

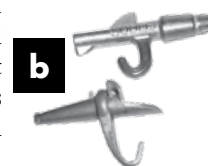
- Sugaring (as collection is called) usually begins in late February and runs through early April, depending on the weather. Night temperatures around 25°F (-4°C) and daytime temperatures of 40–50°F (4–10°C) seem to be ideal for tap flow.

- Identify the following tools and explain what each is used for.

- Brace and bit — used to drill a hole into the maple tree for tapping.



- Tap — allows the sap to flow from the tree into a collection bucket. Taps can be obtained from a local nature center. In the event a tap cannot be found, it is possible to use PVC pipe and flexible tubing.



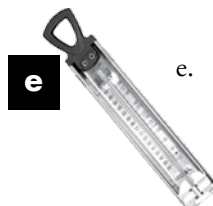
- Collection bucket — collects the sap flowing from the tree.



- Large tub or roasting pan — used for evaporating the sap.



- Candy thermometer — measures the heat of the liquid during the boiling process.



- Heat source — a fire, gas grill, or stove (later stage) heats the sap in order to boil it for syrup or sugar production.



- Canning jars (glass) — needed for storing the syrup.



#### DOING

**WARNING:** Working with hot sap is dangerous. Work only with adult supervision.

To tap a tree, drill a 5/8" (16 mm) hole one to two inches (2.5 to 5 cm) deep, about two to four feet (.5 to 1.5 meters) above the ground. On a large tree, you may drill two or three holes around the trunk. Gently drive a tap or pipe into each hole. The sap collection bucket can hang on each tap or be set on the ground if you are using tubing.

You may run tubes from several taps into the same bucket. During normal sap flow, it may be necessary to empty the bucket daily.

Since sap averages two or three percent sugar content, it will take 35–50 gallons (155–220 liters) of sap to make one gallon (44 liters) of maple syrup or about eight pounds (3.6 kg) of maple sugar. “Pure maple syrup” contains 65% sugar. It will ferment and sour if there is less sugar content, and it will turn to sugar at about 67%.

Making syrup requires boiling the sap outside on an open fire because of the huge amounts of steam given off during the boiling process. Boiling it inside the house may cause wallpaper to come off walls. A large flat-bottomed metal tub works best for holding and boiling the sap. It takes about one day to evaporate enough sap to make a gallon (44 liters) of syrup.

When you have reduced the sap to about 20 to 1 (this means that if you had 20 units — gallons or liters — to begin with, you now have one), it is amber colored, extremely sweet, but still water-thin. You may use your kitchen stove to do the final boiling in a smaller container. At this point, it takes only two units of this concentrated sap to make one unit of syrup. As the syrup approaches the proper consistency, it will boil over if not carefully watched. A few drips of cream or a little butter dripped into the pot will help to keep it under control. When the liquid reaches

exactly 219°F (104°C) on your candy thermometer, you have syrup of perfect consistency.

*Optional:*

1&2: If you want to make maple sugar or Jack Wax, do the above and keep it cooking a bit longer. The boiling temperature will rise faster now, so watch the thermometer. When it reaches exactly 236°F (113°C), remove it from the fire or stove. Stir and beat it until it begins to thicken and you notice sugar around the edges of the pan. Pour it into greased molds as quickly as possible. You may use cups, bowls, leaf pans, or muffin tins. Or it may be spooned over cracked ice or snow and eaten immediately. When cooled, the sugar can be removed from the molds by lightly heating the molds in hot water.

Maple syrup should always be stored in glass containers. If stored in tin containers, the syrup will take on the taste of the container. It is also very common for stored syrup to mold over. This does not make the syrup useless; simply skim the mold off and then boil the syrup.

After sap collection time, your equipment must be cleaned and put away. Also, the trees you used must be given care. A dowel or an old branch cut down to the diameter of the hole and about six to seven inches (15–18 cm) long can be gently tapped into the hole and cut off even with the tree trunk. This will keep bugs and insects out of the tree and will keep the sap from oozing out.