

Lesson Plan - From Sap to Syrup

Grade Level: Grade 7

Learning Objectives:

- to discover the changes of state that occur when boiling sap
- to have the opportunity to see what occurs in the production of maple syrup
- to learn of the effects that heating can have on mixtures

Expectations:

Matters and Materials - Pure Substances and Mixtures

- demonstrate methods of separating the components of mixtures (e.g. evaporation, sifting, filtration, distillation, magnetism) and describe some industrial applications of these methods (e.g. use of evaporation in the production of maple syrup)

Energy and Control - Heat

- explain how heat is transmitted by conduction, convection, and radiation in solids, liquids, and gases (e.g. conduction: a liquid heating in the pot; radiation; the air being warmed by heat from the element)
- describe the effect of heat on the motion of particles and explain how changes of state occur

Materials: Pot, sap, stove

Procedure/activities:

1. Start this lesson by reviewing the methods of separating the components of mixtures (evaporation, sifting, filtration, distillation, and magnetism).
2. Next finds out what the students know about the production of maple syrup. Generate classroom discussion by asking the following questions: Where does sap come from? How do we get it out of a tree? Once it's been removed from the tree what happens with it?
3. Ask the students if any of the methods of separating the components of mixtures occurs in the production of maple syrup. Make sure the students touch on the fact that through evaporation sugar and water in sap can be separated leaving maple syrup or even maple sugar if all the water is evaporated.
4. Make sure students understand that sap consists of 40 parts water and 1 part sugar.
5. Tell the students that today, as a class they will get to make their own sap.
6. First figure out how much syrup you want to end up with. Measure that amount of syrup. Then ask the students how much water we will need. (1 part syrup add 40 parts water) Write a few examples on the board and have them figure it out (i.e. for 1/4 cup syrup, how much water? For 1/8 cup syrup, how much water? For 1/10 cup syrup, how much water?)
7. Mix the water and syrup.
8. After the sap is made, ask the students what process can be used to separate the water from the sap? (Boil the mixture). Have the students comment on what's happening by answering the following questions; How is the water changing state? From what state to what state is the water changing? What effect is the heat having on the motion of particles? Explain how the heat is transmitted by conduction, convection and radiation.
9. The sap should start to turn a light and amber colour. Afterward the sap will start to bubble and foam, this means that the sugar content is getting higher than the water content.
10. Make sure you continuously stir. Boil the syrup until it is thick enough that it will coat a spoon.
11. Talk to students about hydrometers and what their purpose is (To compare the densities of liquid and see how much of the sap still contains water and how much is sugar).
12. Cool the syrup so that the students can try a little bit.
13. Ask the students what will happen if they continue to boil the syrup (produce maple sugar)
14. If there is time, continue to boil the syrup until it turns to small grains in the bottom of the pot.
15. Give the students the opportunity to try some of the maple sugar.
16. While they are eating their maple treats, ask the students to answer the questions on the sheet provided for them.

Assessment:

- Assess their answers to the questions on the attached sheet

Extension Activities:

- Organise a field trip to the maple sugar bush to see the process that takes place there to separate the sugar from the water

From Sap to Syrup

1. How is the water component of the sap changing state?
What state does it start in and what state does it change to?
What change of state can occur to the sugar?

2. What effect does heating the sap have on the motion of particles?

3. Explain how heat is transmitted by
 - a) conduction
 - b) convection
 - c) radiation