

Name _____ Class Number _____



The Study of Fermentation by Making Root Beer

Background Information: Cellular respiration is the process that all organisms use to break down glucose and other food molecules to obtain usable energy for the cell in the form of ATP. Cellular respiration always begins with glycolysis which produces pyruvic acid, if the cell contains adequate levels of oxygen then a certain series of reactions follows including a transition reaction and then the Krebs Cycle. If there isn't any oxygen present then the cell begins the process of fermentation. Different organisms produce different products as a result of fermentation. Humans have been using the fermentation process under controlled conditions for many years to create a variety of foods. Some of the food produced by fermentation include: sauerkraut, yogurt, cheese, wine, beer, and baked goods.

For this lab we will be utilizing the fermentation process of yeast to create root beer. Root beer has been made for many, many years. Originally it was made by taking the roots from a Sassafras tree and letting them seep into water then sugar and yeast were added to finish the drink. In the early 1900's it was found that a chemical in Sassafras root, safrole, was carcinogenic (it could cause cancer). People began to make root beer using other roots. That is why each location has a different tasting root beer. Today we have an extract made from herbs and spices that is used to make root beer.

Purpose: To utilize the fermentation process of yeast to create root beer.

Materials:

- Yeast
- Sucrose
- Water
- Root beer extract
- Funnel
- Measuring spoon & cup
- Tablecloth
- 2L bottle with lid

Procedure:

1. Assemble all the equipment and supplies.

2. Wash the 2L bottle with a little soap, be sure to rinse VERY well, we don't want the root beer to have a soapy taste.
3. While you are washing the bottle begin to heat 2L of water in the clean pan. We don't want to boil the water, but we do want it warm so the sugar will dissolve more easily later.
4. Using a dry funnel begin to add the ingredients into the bottle.
5. First ingredient to go in should be the 1 level cup of sucrose.
6. Then add $\frac{1}{4}$ tsp. powdered baker's yeast that is fresh & active.
7. Look in the bottle you should be able to see the yeast on top of the sugar.
8. Shake to distribute the yeast grains into the sugar.
9. Swirl the sugar/yeast mixture in the bottom to make it concave (to catch the extract).
10. Add the root beer extract – be sure to use the funnel so that it all makes it into the bottle.
11. Fill half the bottle with warm water and shake to mix all the ingredients. Rinse in any extract that sticks to the spoon or the funnel.
12. Put more warm water into the bottle, be sure to leave 1 $\frac{1}{2}$ - 2 inches of room at the top of the bottle.
13. Close the bottle tightly and check for leaks.
14. Make a label out of plain white paper and tape on with our hour.
15. The root beer will now be aged for 3 – 4 days (until the bottle feels hard) in a warm, dark place. Then we will store it in a cool, dark place for 2 more days. It will then be placed into the refrigerator overnight to chill so that we can drink it the following day.

Questions – Those questions with a ** next to them will be answered today, the questions without the ** will be answered when the root beer is ready.

**1. Explain why following the procedure will produce root beer. In other words, I'm interested in knowing about cellular respiration's role in this process.

**2. Describe the appearance of the root beer during the bottling process.

3. Describe the appearance of the root beer after fermentation.

**4. Why was yeast necessary in this experiment?

**5. Why was sugar necessary?

**6. Explain how commercial (store bought) root beer is carbonated.

7. Explain how our root beer became carbonated.

**8. What is safrole? Why do we not use it anymore?

**9. Write an answer to these questions by creating a document that will be graded using the 6-trait technical rubric. What is cellular respiration? How does fermentation fit into the overall process of cellular respiration? Be sure to include information about fermentation in yeast as well as other organisms including the human. Now do you understand why humans must breathe? Why? Begin by giving an overall description of the process then include specifics.

MAKING GINGER ALE

EQUIPMENT	SUPPLIES
clean 2 liter plastic soft drink bottle with cap	cane (table) sugar [sucrose] (1 cup)
funnel	Freshly grated ginger root (1 1/2-2 tablespoons)
Grater (preferably with fine "cutting" teeth)	Juice of one lemon
1 cup measuring cup	fresh granular baker's yeast (1/4 teaspoon)
1/4 tsp and 1 Tbl measuring spoons	cold fresh pure water

- 1) Lay it out all the listed ingredients and equipment
- 2) Use fresh ginger root (purchasable at most large supermarkets, or Asian food shops).
- 3) Add 1 cup sugar to the 2 liter bottle with a dry funnel. (Leave the funnel in place until you are ready to cap the bottle.)
- 4) Measure out 1/4th teaspoon fresh granular active baker's yeast. (Fleishman's etc. We buy ours in bulk from the health food store.)
- 5) Add yeast through funnel into the bottle, shake to disperse the yeast grains into the sugar granules.
- 6) Grate the ginger root on a fine "cutting" grater to produce 1 1/2 Tablespoon of grated root. (Look at the large picture of the grater. [This style of fine "cutting" teeth](#) works MUCH better than the style with the sharp pointy piece of metal which crumble food. The design is also less likely to shred your knuckles. I have had to look far and wide to find a fine "cutting" grater. Mine says "Stainless Steel Denmark" on its handle...)
- 7) Place grated ginger in the cup measure
- 11) Add the slurry of lemon juice and grated ginger to the bottle. (It may stick in the funnel. Don't worry, the next step will wash it into the bottle.)
- 12) Rinse containers with fresh clean water.
- 13) Add the rinsings to the bottle, cap and shake to distribute.
- 14) Place in a warm location for 24 to 48 hours. (Do not leave at room temperature longer than necessary to feel "hard." The excess pressure may cause an eruption when you open it, or even explode the bottle!)
- 15) Test to see if carbonation is complete by squeezing the bottle forcefully with your thumb. If it dents in as in the picture, it is not ready.
- 16) Once the bottle feels hard to a forceful squeeze (often only 24-48 hours), place in the refrigerator. Before opening, refrigerate at least overnight to thoroughly chill. Crack the lid of the thoroughly chilled ginger ale just a little to release the pressure slowly. You do not want a ginger ale fountain!
- 17) Filter the ginger ale through a strainer if you find floating pieces of ginger objectionable. These are found in the first glass or two poured, and, since most of the ginger sinks to the bottom, the last glass or so may require filtering too. Rinse the bottle out immediately after serving the last of the batch.

Recipes are from:

http://biology.clc.uc.edu/fankhauser/Cheese/Ginger_Ale_Ag0.htm