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Date _____ Period _____

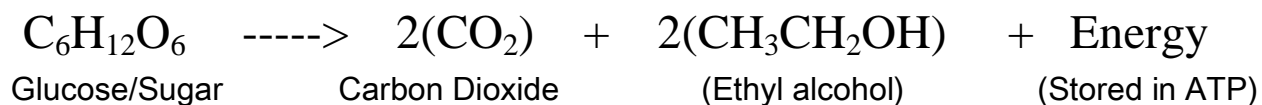
Root Beer Lab: Demonstration of Fermentation

Respiration: The breakdown of sugar (glucose) to form ATP (a form of energy for an organism). There are two types, aerobic and anaerobic (also called fermentation).

History of Root Beer: Root beer was made by our fore fathers by soaking sassafras (a type of tree) root in water, and adding sugar and yeast (yeast for carbonation). In the early 1900's however, scientists discovered that safrole, a chemical found in sassafras root, was a carcinogen (which means it is a cancer causing agent.) Now, a mixture of other herbs and spices makes up "root beer extract" which is what we now use to make homemade root beer.

Background Information: There are two types of respiration: aerobic (requiring oxygen) and anaerobic (without oxygen.) Yeast cells (a type of fungus) obtain energy from glucose (sugar) by a specific anaerobic process called fermentation. There are two types of fermentation, lactic acid fermentation (which occurs in muscle cells when they are oxygen deprived), and alcoholic fermentation, which is involved in the making of food products. Alcoholic fermentation begins after glucose diffuses into the yeast cell. The glucose is broken down into 2, 3 carbon molecules called pyruvic acid. The pyruvic acid is then converted to CO₂, ethanol, and energy for the yeast cell. Don't get excited, students, there is very little ethanol in this root beer. :) Fermentation is used to make a variety of food products, including the making of beer, wine, bread, cheese, sauerkraut, and baked goods. It is the carbon dioxide produced by the yeasts that give root beer its "fizz." This fizz is produced in store bought root beer by a carbonation machine that forces carbon dioxide into the root beer mixture, without the aid of our little yeast friends.

Alcoholic Respiration Equation:



Purpose: To produce a root beer by the Fermentation of sugar.

Materials:

clean, empty, 2 liter plastic bottles + caps
large bowl, funnel, mixing spoon
water (preferably spring water)
bakers yeast (the dry kind)
root beer extract
cane sugar
measuring teaspoons, tablespoons and cups
rule with inches

Procedure:

1. Dissolve 1/8 teaspoon of yeast in 1/2 cup of very warm water. Let stand for 5 minutes. Being in warm water activates the yeasts, and wakes them up from being dried out. Spring water, incidentally, makes better root beer than tap water.
2. Using the bowl, combine 1 1/2 - 2 tablespoons of Root beer extract with 1 1/8 cups of sugar in warm water, to dissolve the sugar.
3. Add the two mixtures to the bottle and add warm water to bring the level of the liquid up to two liters. (Be sure to use very warm water).
4. Fill sterilized bottles within 1 1/2 to 2 inches to the top. Close tightly and hold upside down to check for leaks. Make a label out of plain white paper, and put your names on it. Tape the label to the bottle.
5. Age root beer for 3 or 4 days in a warm, dark place. Then store in a cool, dark place for 2 more days. Refrigeration will stop the fermentation process and kill the yeast. Total aging of at least one week is recommended. Two weeks will improve the flavor. Be sure to check the bottles every day for tightness, if they get too pressurized, they will explode. Never use glass bottles!
6. Chill root beer and taste. Students may be surprised at how different this root beer is from store bought root beer.

Answer the following Questions (1-5) on day 1. (the day root beer is made)

1. List the needed ingredients to make root beer.
2. Why was the sugar necessary?
3. Why were the yeasts necessary in this experiment?
4. Why did we put the yeasts in the warm water for 5 minutes?
5. Describe the appearance of the root beer during the bottling process.

Answer the following Questions (6-12) after the root beer has fermented.

6. Describe the appearance of the root beer after fermentation. How is it different from #5?

7. Explain how the root beer came to be carbonated.

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

9. What is fermentation?

10. Write a balance equation for Photosynthesis.

11. Write a balance equation for Respiration.

12. Explain why knowing about photosynthesis and respiration is important in your life.