**Blow Up a Balloon with Cellular Respiration**

**Introduction:** Yeasts are unicellular microorganisms of the fungi kingdom. They are facultative anaerobe, which means that they can respire or ferment depending upon environmental conditions. In the presence of oxygen, respiration takes place (aerobic respiration). Without oxygen present, fermentation occurs (anaerobic respiration). Both processes require sugar to produce cellular energy. Here is the chemical reaction of fermentation, which produces ethanol and carbon dioxide as metabolic waste products.



**Objective:** In this lab, students will use the respiration powers of yeast to blow balloons. This activity will reinforce the basic principles of respiration as a fundamental metabolic process for living organisms using yeast as a model. It will also explore how humans use this biological knowledge in everyday life.

**Procedure:**

1. Set up four test tubes in a test tube rack.
2. Label each tube with a number, 1-4. Test tubes 1 and 2 will both have yeast, sugar and water. Test tubes 3 and 4 will both have only yeast and water, with no sugar.
3. Fill each test tube with 25 mL of warm tap water. Add 1.0 g of dry yeast to **each** test tube gradually, mixing the yeast in thoroughly before adding more (**Do NOT dump it in all at once!**). Mix by putting your hand or thumb over the top of the test tube and shaking.
4. Repeat step #3 for each of the four test tubes.
5. **Read step #6 before doing this step!** Add 2.0 g of sugar to test tube 1 and 2. These tubes will be your experimental group. Do not add sugar to tubes 3 and 4.
6. Immediately cover the opening of each test tube with a balloon after adding the sugar to catch any gas that is formed. Using the balloon to seal the end of the tests tube, hold a finger over the end of each test tube and shake it **vigorously** to thoroughly mix the contents.

Observe the test tubes and record your observations carefully in the table on the next page. Then, every 10 minutes for 50 minutes, observe what occurs in the test tubes and any changes in the balloons, which cover each test tube, and record your observations.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 0 minutes | 10 min. | 20 min. | 30 min. | 40 min. | 50 min. |
| Test tube 1 |  |  |  |  |  |  |
| Test tube 2 |  |  |  |  |  |  |
| Test tube 3 |  |  |  |  |  |  |
| Test tube 4 |  |  |  |  |  |  |

**Conclusion:**

The yeast uses the sugar and warm water to grow. Warm water provides heat to the yeast reaction and accelerates it. As yeast grows it expands and gets bubbly. By being “bubbly” the yeast gives off carbon dioxide, the same gas that your body produces when you breathe, and the gas inflates the balloon. The yeast also produces ethanol. Respiration provides organisms with the energy to do cellular work that helps them grow, function, and live. People use yeast to bake because during fermentation carbon dioxide forms bubbles in the dough and expand it. Since baking is done at high temperatures, yeast ultimately dies and nearly all the ethanol evaporates. Ethanol fermentation is used to produce alcoholic beverages. People also use yeast fermentation to make ethanol for fuel.

**Analysis:**Record your observations below. Include a brief explanation of WHAT you saw occur in the balloons and WHY.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_­

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_