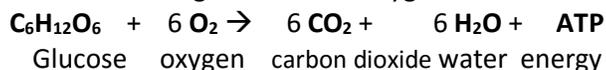


Investigating Yeast Respiration and Carbon Dioxide Production



Background

Yeast is a eukaryotic organism that performs cellular respiration in the presence of oxygen. Yeast is commonly bought at grocery stores and is used to make bread. This yeast consists of little brown grains. The little brown grains of yeast may not seem to be alive, but if you put them in water with sugar, the yeast will carry out cellular respiration and grow. Remember, cellular respiration is the process that cells use to transfer energy from the organic molecules in food to ATP. The following equation summarizes the chemical changes that occur in cellular respiration of the monosaccharide glucose when oxygen is available.



When yeast, humans, and other living organisms use energy, they break down high-energy molecules like sugar to get the energy they need and give off a gas called carbon dioxide as a by-product of this reaction.

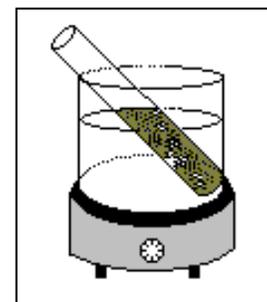
Materials

4 Test Tubes	1 Test Tube Rack	400mL Beaker
Masking Tape	1 Packet of Yeast	4 balloons
Hot Plate	Table Sugar	



Procedure A: The Basics

1. Set up one test tube in a test tube rack. Place a piece of masking tape on the tube. Label it with a letter A.
2. Add 50 mL of warm tap water to test tube A.
3. Weigh out 5 grams of sugar with a balance. Then, add that sugar to test tube A.
4. Weigh out 1 gram of yeast with a balance. Then, add 1 gram of yeast to test tube A.
5. Thoroughly mix contents of the test tube by shaking the test tube mildly. Do not turn the test tube upside down.
6. Cover the opening of the test tube with a balloon to catch any gas that is formed.
7. Place the test tube into a 400 mL beaker of warm tap water (water bath) that is filled $\frac{1}{2}$ way. Make sure the tube does not spill. Then, place the beaker on a hot plate that is set on the low heat setting.
8. Observe the test tube and record your observations carefully in Data Table A. Every 5 minutes for 20 minutes, measure the circumference of the balloon by holding a string at the widest point of the balloon and looping it around. Use a ruler to determine the string's length. Record this data in the data table. After the experiment has ended, clean out the test tube.



Procedure B: Inquiry Time

Using the same basic protocol as in Procedure A, design your own experiment to answer this question: How does sugar concentration affect yeast respiration rates? Record your hypothesis below. Summarize your procedures that your group used to answer this question in the space below. Create your own data table in the Data Table B section below.

Hypothesis for Procedure B: Discuss and develop one hypothesis with your group. Use an "if...then" statement. Write in the space below. (Hint: which amount of sugar do you think will create the most gas?)

Summary of Procedure B:

Data Table A: Circumference of Balloon (cm)

	0 minutes	5 minutes	10 minutes	15 minutes	20 minutes
Test tube A- 5 g of sugar	0 cm				

Data Table B: Inquiry

Conclusion: Answer the questions below using complete sentences.

First Paragraph: Analysis of your data.

Restate **briefly** what you did. What did you observe? What does your observations and data mean? Are you accepting or rejecting your hypothesis(es)? Explain. Are your observations valid? Any systematic (errors on the lab procedure) or operational errors (errors done by your group)?

Second Paragraph: Knowledge Learned.

What did you learn from this lab? Please, make sure to tie in the knowledge gained in the lab to previous knowledge acquired in the classroom setting. What questions might you now want to explore after performing this lab?

Cellular Respiration Assessment

Performance Expectation: HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy. [Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration.] [Assessment Boundary: Assessment should not include identification of the steps or specific processes involved in cellular respiration.]

Background Information:

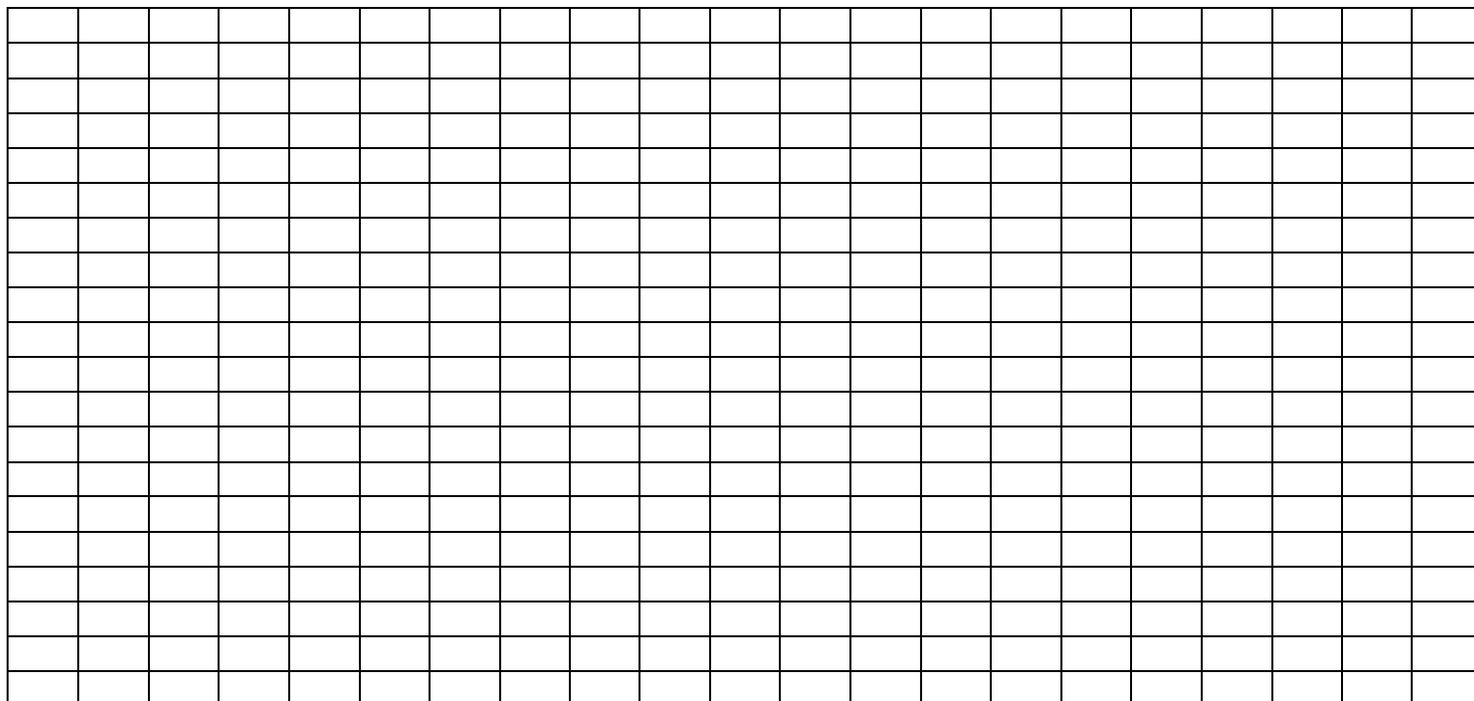
William performed a lab experiment in his science class in which he investigated sugar concentrations and its effect on carbon dioxide concentration in yeast. He set up four test tubes and in each test tube, he placed different amounts of sugar in the test tubes. He then added 1 g of yeast to each tube, placed balloons on the test tubes to collect the carbon dioxide created, and then placed them in a warm water bath. He then measured the circumferences of the different balloons. His results are in the table below.

Test Tube	Amount of Sugar Placed in Test Tube	Initial Circumference of Balloon After 15 minutes	Final Circumference of Balloon After 15 minutes
A	0 g	0 cm	0 cm
B	5 g	0 cm	2 cm
C	10 g	0 cm	6 cm
D	15 g	0 cm	10 cm

Part One: Graph

In the space below, construct a bar graph of William's results. Make sure to label the x and y axis as well as each specific bar. Give the graph a title.

Title: _____



Part Two: Analysis of Data

Answer using complete sentences.

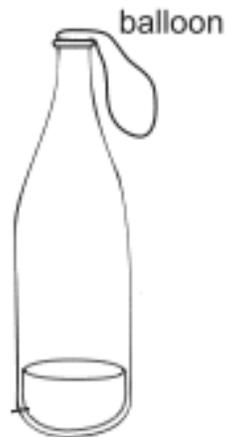
1) What is the relationship between sugar concentration and carbon dioxide amounts, as seen in William's data?

2) Why did William's balloon attached to Test Tube A not inflate?

Part Three: Model of Cellular Respiration

Below is a diagram of William's Test Tube A and Test Tube D. For each of William's test tubes, label the inputs and outputs of the system. What was added into the test tube? What was released from the test tube? Clearly indicate all inputs and outputs, and place arrows to show the movement of materials and energy through the tubes.

Test Tube A- 0 g of sugar



Test Tube D- 15 g of Sugar

