

Genetics and Cells Activity Bag

Cellular Respiration: Student Activity Guide

There are organisms all around us that have only one cell. They are called “single-celled.” Many of these eat by absorbing their food from what is around them. When they do this, they take in and give off gases, something like breathing. Yeast is one of these single-celled organisms. In this activity, we give yeast cells food and water so they can eat, multiply, and breathe, and then watch what happens.

These directions will get you started. Your teacher will be in contact to guide you and provide information.

Materials From The Bag

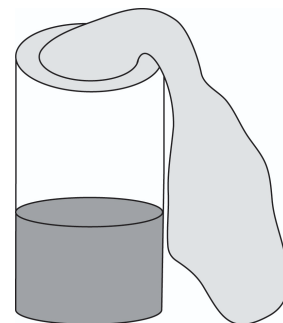
- 2 Plastic Vials
- 2 Balloons
- 1 Graduated Medicine Cup
- 2 Measuring Spoons, 1cc
- Yeast
- 5 Sugar Packets
- 15 Toothpicks
- 1 Foam cup

Part 1: Explore Cellular Respiration

This part of the lesson will compare what happens when yeast is placed in an environment with water and sugar compared to water only.

Prepare a vial with yeast and water:

1. Use the medicine cup to measure out 20 mL of water (between 75°F-80°F) into a vial.
2. Use the measuring spoon to measure out 1 cc of yeast and place it in the vial with the water. Repeat for a **total of 2 cc** of yeast.
3. Stir the yeast and water with a toothpick until the yeast and water are evenly mixed.
4. Place your fingers inside a balloon to stretch it and place its mouth over the vial. The balloon over the vial should look like the picture to the right:



Prepare a vial with yeast, water, and sugar:

1. Use the medicine cup to measure out 20 mL of water (between 75°F-80°F) into another vial.
2. Use **the other measuring spoon** to measure out 1cc of sugar and add to the vial.
3. Swirl the water and sugar until the sugar dissolves.
4. Measure out 1cc of yeast and add to the vial with the water and sugar. Repeat for a **total of 2 cc** of yeast.
5. Stir the yeast using a toothpick until the yeast and water are evenly mixed. Label this vial “sugar.”
6. Stretch a balloon over the mouth of the vial so that it looks like the drawing above.

Set both vials near each other and watch. Check on the vials every 10 minutes for the rest of the class period. Each time you check, write down the time and what you see. Write down what is happening inside the vial and what is happening to the balloon.

At the end of each part, clean and dry all plastic materials to be reused later. Be sure to save the balloons.

What's happening...

The yeast absorbs the sugar and breaks it down into gas (carbon dioxide), water, and energy. This process is called **cellular respiration**. The yeast uses the energy to continue to grow and reproduce.

Part 2: How does Temperature affect Cellular Respiration?

This part of the lesson will explore how temperature affects cell respiration.

Prepare a vial with yeast, sugar, and water:

1. Make a vial with water, yeast, sugar, and a balloon following the directions in part 1. This vial has water (between 75°F-80°F), 2cc of yeast, and 1cc of sugar. When the vial is made, **record the time.**

Prepare a vial with yeast, sugar, and hot temperature water:

1. Turn on the hot water in your tap and let it run until it gets hot. Fill the foam cup with this hot water.
2. Follow directions as before, but replace the 20mL of water with hot water.
3. When this vial is made, **record the time.**
4. Watch both vials for the balloons to become upright with no wrinkles. Record the time when this occurs for each vial.
5. How did water temperature affect cell respiration? Provide evidence to support your answer.

Prepare a vial with yeast, sugar, and hot temperature water in a foam cup:

1. Make a vial the same as above, using hot tap water.
2. Place the vial in a foam cup half-full of hot tap water. Record the time. *What do you predict will happen?*
3. Watch for the balloon to become upright with no wrinkles. Record the time when this occurs.
4. Compare your results to your prediction

Part 3: Cellular Respiration - Speed Challenge

In this part of the lesson you will see how changing the amounts of yeast, water and sugar affect cellular respiration.

1. Challenge: How quickly can you get the balloon to become upright?
2. Use the vial/balloon directions in parts 1 and 2.
3. You will do 4 trials, one at a time, and make changes each time. Your goal is to have the shortest time between when the balloon is placed on the vial and when it becomes upright with no wrinkles.
4. You must use the vial and balloon but you can change:
 - a. Amount of water
 - b. Temperature of water, however, you cannot use any water hotter than the water from your tap.
 - c. Amount of yeast, no more 3cc per trial.
 - d. Amount of sugar, no more than 5cc per trial.
5. For each trial, keep track of the amounts of water, yeast, and sugar you use and always record the time you sealed the balloon around the vial and the time when it became upright.
6. Clean the materials, consider what changes you want for trial 2.
7. Do this 2 more times until you have done 4 trials.
Which trial was the quickest? What amounts of the ingredients did you use?

Part 4: Predict and Test

At this point, we have seen that sugar is necessary for yeast to “eat.” For this part of the activity, you will use different liquids and see if the yeast is able to eat.

1. To do this part, you will continue the vial/balloon directions used above.
2. For each trial, use 2 cc of yeast and 20mL of a different liquid. Liquids between 75°F-80°F work best.
3. Before you test, predict if you think the balloon will inflate.
4. Possible liquid suggestions: milk, clear soda, clear diet soda, sugar substitute (mix 1cc into 20mL of water) *What did you notice? What questions do you have?*