

# 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, 30 mL
- 2 measuring spoons, 1cc
- Yeast
- Sugar
- Toothpicks
- 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. Fill a foam cup with water and let it rest until the water is the same temperature as the room. This takes about an hour.
2. Use the medicine cup to measure out 20 mL of this room temperature water into a vial.
3. Use the measuring spoon to measure out 1 cc of yeast and place it in the vial with the water.
4. Stir the yeast and water with a toothpick until the yeast and water are evenly mixed.
5. Place your fingers inside a balloon to stretch it and place its mouth over the vial. The balloon over the vial should look like this:



### Prepare a vial with yeast, water, and sugar:

6. Use the medicine cup to measure out 20 mL of room temperature water into another vial.
7. Use the other measuring spoon to measure out 1cc of sugar and add to the vial.
8. Swirl the water and sugar until the sugar dissolves.
9. Measure out 1cc of yeast and add to the vial with the water and sugar.
10. Stir the yeast using a toothpick until the yeast and water are evenly mixed. Label this vial “sugar.”  
Again, 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. The yeast cells will quickly activate and continue to grow and reproduce for over an hour. Check on the vials every 20 minutes for at least 3 hours. 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.

## **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 room temperature water:**

1. Make a vial with water, yeast, sugar, and a balloon following the directions in part 1. This vial has room temperature water, 1cc 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 room temperature 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.

**\*TRY THIS\*** Make a vial the same as above, using hot tap water. This time place the vial in a foam cup half-full of hot tap water. Record the time. *What do you predict will happen?*

## **Part 3: Cellular Respiration - Speed Challenge**

This part of the lesson you will see how changing the amounts of yeast, water and sugar affect cell 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 you tap.
  - c. Amount of yeast, no more 2cc 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 1cc of yeast and 20mL of a different liquid. Room temperature liquids 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?*