

Subject area/course: Science, Biology

Grade level/band: 9–10

Task source: Stanford Center for Assessment, Learning, and Equity (SCALE)

Making Bread

STUDENT INSTRUCTIONS

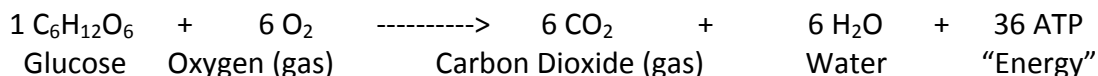
A. Task context

Imagine that you have graduated from college and you work at the world-renowned Milo Bread Company. You didn't realize that your science classes would help you so much in your future career, but it turns out that science is *very important* to the creation of bread. You are on a team of "nutritional engineers," which is a fancy way of saying that you help to create or change the company's bread recipes.

Your Task

The Milo Bread Company's current recipe is very good but recently sales have been dropping. The CEO would like to see how the recipe might be improved to boost sales. Your team is being asked to test adjustments to the recipe to make the bread better tasting. You will research all of the ingredients that are involved in the bread making process and conduct a series of experiments to achieve the best tasting bread. Remember the company is counting on your team to meet the challenge.

It's important to know that when making bread, the active "ingredient" is the single-celled organism known as yeast. Yeast cells are capable of both cellular respiration and fermentation, depending upon the availability of oxygen. In bread making, it is the fermentation and cellular respiration of yeast that is all-important. Yeast cells feed on the sugars in the dough, metabolizing them to release energy, as well as producing the by-products carbon dioxide and water (see below).



It is the carbon dioxide trapped in the dough that causes the dough to "rise," giving it volume. Additionally, this expansion causes stretching of the dough, which gives it structure and texture. Lastly, other by-products of yeast metabolism along with the yeast cells themselves modify and give bread its characteristic flavor.

B. Final products

For this task you will need to work collaboratively with a team of students to:

- Share what you have learned about the fermentation and cellular respiration of yeast to make bread.
- Design and conduct an experiment to determine how the recipe may be improved to make better tasting bread.
- Make an oral presentation to the Milo Bread Company CEO and Board of Directors to share your experimental procedures, analysis, and findings, including your final recommended recipe (see oral presentation criteria). You will also want to provide samples of your bread for the panel.

Individually you will:

- Write a formal lab report that clearly explains the design, implementation, analysis, and findings of your experiment (see lab criteria).
- Reflect and share what you learned from this task.

ANSWERS TO SOME QUESTIONS YOU MIGHT HAVE

C. What do I need to know or do to be successful on this task?

1. On this task, you will show that you know these things:

- How yeast produces CO₂ and how the process can be altered to achieve different results;
- How to apply what you know about the fermentation and cellular respiration of yeast to make bread.

2. On this task, you will show that you are able to do these things:

- Generate a testable question, make a hypothesis, and design procedures that can be replicated by another person;
- Conduct your planned experiment, run multiple trials of the procedure, and record data;
- Represent the data to inform others, analyze the information, construct an explanation using evidence from your experiment, and prepare an oral presentation of your findings;
- Provide constructive feedback to your peers on their draft lab reports and take into consideration feedback they provide you;
- Prepare a lab report that details your findings and recommendations and correctly cite your sources;
- Communicate your recommendations to the Milo Bread Company CEO and Board of Directors clearly, creatively, and effectively using evidence to support your conclusions in a way that will engage the audience.

D. What materials will I need to complete this task?

When designing and planning your experiment, you will provide your teacher with a list of lab equipment that you plan to use. If you need any equipment or materials not normally in your classroom, please ask your teacher if these items can be made available. Your teacher will supply a copy the Milo Bread recipe that you will need for review before you begin your investigation.

E. How long will I have to complete this task?

Your teacher will provide the due dates for completing each portion of the task.

Due Date	What You Need To Do	Product
	Intro: Get familiar with the task requirements, expectations, and due dates	
	Part 1: Research how bread is made and the role of yeast in the bread-making process	Lab Report
	Part 2: Class discussion of variables to 'test'	
	Part 3: Design experiment	
	Part 4: Conduct the experiment	
	Part 5: Analyze and interpret your findings	
	Part 6: Draw your conclusions & write references	
	Part 7: Prepare a draft report for the CEO of the company, get peer feedback on your draft, revise and complete final report for the CEO	
	Part 8: Group Presentation	Oral Presentation
	Part 9: Reflect on learning	Essay

F. How will my work be scored?

Your work will be scored using the Scientific Practices Rubric and the Effective Communication Oral Presentation Rubric (see both rubrics before beginning the project). You should make sure you are familiar with the language that describes the expectations for proficient performance.