

Yeast Fermentation

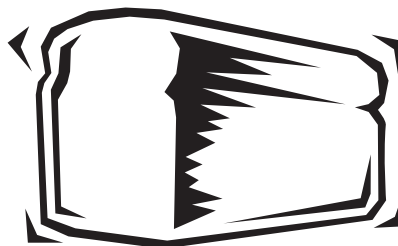
Activity Summary

- In this activity, students will:
- ♦ Investigate yeast fermentation
 - ♦ Write a lab report using a report template
 - ♦ Complete an **Essential Skills** Self- and Peer Assessment
 - ♦ Present an **Essential Skills** Certificate of Excellence to their lab partner



Prior Knowledge

- **Essential Skills**
- Awareness of food products for which yeast is used
- Concepts such as hypothesis; independent, dependent and controlled variables; quantitative and qualitative observations
- The life cycles of representative bacteria, protists, viruses, and fungi



Teaching Planning Notes

- Review assignment including prior knowledge required and assessment and evaluation tools
- Find out if anyone is allergic to yeast
- Set up a water bath to maintain a constant temperature of water and juice
- Stress to students thorough hand washing at the end of the activity
- Have a supply of **Essential Skills** Certificates of Excellence

Assessment of Student Achievement

Task	Tool / Type
Lab Report	How to Make the Most Dough With the Yeast Bread! Lab Report Rubric (Summative)
Self- and Peer Assessment of Essential Skills	Essential Skills Self- and Peer Assessment Tools (Formative)

Activities and Assessment Materials

- Yeast Fermentation Assignment Sheet and Lab Activity
- Lab Report Template
- **Essential Skills** Self-Assessment Tool
- **Essential Skills** Peer Assessment Tool
- Lab Report Rubric
- **Essential Skills** Certificate of Excellence Form

FOCUS ON LEARNING

Essential Skills:

Reading Text

Conducting Lab Activity

Writing

Recording Observations

Completing Report Template

Numeracy

Conducting Lab Activity

Oral Communication

Conducting Lab with Partner

Presenting Certificate to Partner

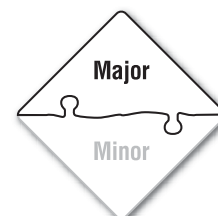
Thinking Skills

Completing Worksheets

Completing Assessment Tools

Working with Others

Conducting Lab with Partner



Curriculum Linkages For Ontario Educators

Essential Skills truly are everywhere and as teachers we are always teaching students the **Essential Skills!** As subject teachers and specialists, we know that many of the curriculum expectations we are accountable to teach and assess, also address the **Essential Skills** and while the linkages are not always readily apparent, the linkages exist nonetheless.

While this activity connects to a variety of courses, it is most closely aligned to the following course(s):

- Science, Grade 11, Workplace Preparation, SNC 3E

To assist you, the teacher, in making more transparent linkages, we have identified the following curriculum linkages for this activity.

Science, Grade 11, Workplace Preparation, SNC 3E

Scientific Investigation Skills

SIS.03 - demonstrate the skills required to plan and carry out investigations using laboratory equipment safely, effectively, and accurately (e.g., investigate the effects of pollutants on a local ecosystem);

SIS.06 - compile, organize, and interpret data, using appropriate formats and treatments, including tables, flow charts, graphs, and diagrams (e.g., in a table, present data on the beneficial effects of algae ponds, or of consumer reports on appliances);

SIS.07 - communicate the procedures and results of laboratory investigations and research for specific purposes, using data tables and laboratory reports (e.g., describe in a laboratory report the procedures used to investigate the behaviour of bacteria);

Coded Overall Expectations

MOV.01- describe the characteristics of some micro-organisms, including ways in which they reproduce and grow in the home, school, and workplace;

MOV.02 - investigate the growth and uses of microbes through laboratory activities;

MOV.03 - analyse the role of microbes in technology, and their impact on society and the environment.

Coded Specific Expectations

MO1.01 - describe the basic characteristics of representative bacteria, protists, viruses, and fungi;

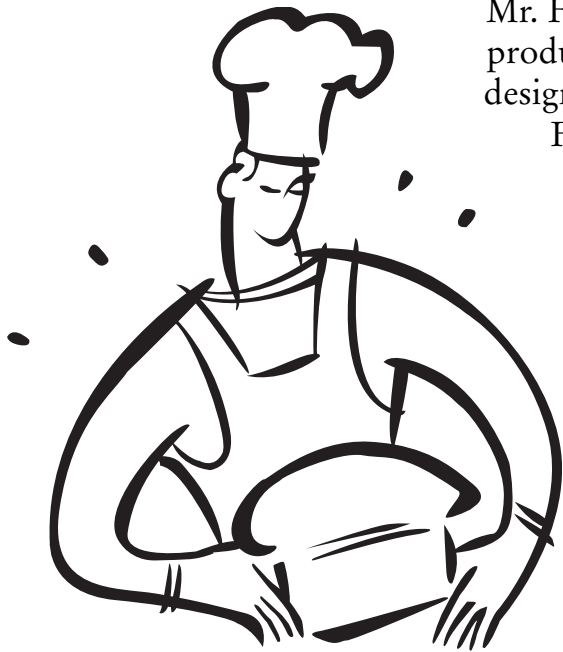
MO2.02 - formulate scientific questions about practical problems and issues related to micro-organisms (e.g., How do the differences among bacteria, protists, viruses, and fungi affect the ways in which they can be used or controlled?);

MO2.03 - investigate the behaviour of micro-organisms, identifying and controlling major variables and using safe laboratory procedures (e.g., using plating techniques, show how various antibiotics kill bacteria but not other microbes; compare the effectiveness of different mouthwashes in killing bacteria; demonstrate where microbes live in a classroom by taking swabs);

MO3.01 - working cooperatively with team members, compile, display in an appropriate format, and report on information/evidence gathered concerning the benefits and/or costs to society of micro-organisms (e.g., industrial use of microbes, such as in the making of yogurt and in the clean-up of oil spills; microbes and sexually transmitted diseases [STDs]; the potential for biological warfare; drug-resistant bacteria; microbes and the history of hygiene; mouldy-building syndrome; food poisoning; microbes and forensic science; microbes and allergies; the role of microbes in soil and in home composting);

How to Make the Most Dough With the Yeast Bread!

Did you know that living microscopic organisms play a significant role in the production of breads, doughnuts, beer and wine. These single-celled microscopic organisms are better known as yeast. When the yeast grows, it uses sugar as a source of energy, and in the process converts the sugar to alcohol and a gas called carbon dioxide is produced. This process is called fermentation. Fermentation has been used for thousands of years to make bread, as well as other products. The level of yeast activity in bread dough is essential to the texture and quality of bread. The carbon dioxide produced causes the dough to rise to make a light, slightly spongy loaf of bread. The greater the growth of yeast, the more carbon dioxide produced.



Mr. Freydoe, President of the Freydoe Baking Company, produces and sells breads geared for the teenage market. He has designed rainbow coloured bread for teens. Currently, Mr.

Freydoe is interested in producing a calcium fortified bread for young athletes and teenagers that do not like drinking milk. Mr. Freydoe would like to use powdered skim milk as a source of calcium. Powdered skim milk also contains vitamins, is low in fat and contains certain sugars for the yeast to ferment. Mr. Freydoe has decided to hire this class as a research team to investigate if skim milk will produce enough carbon dioxide to produce a light, spongy loaf of bread.

Mr. Freydoe's company is a successful organization. He contributes this success to the ongoing interest his employees have in effectively using and further developing their **Essential Skills**. In fact, Mr. Freydoe has most recently created an employee **Essential Skills**

recognition award program. This program is based solely on peer evaluations. The recipients of this award receive an **Essential Skills** Certificate of Excellence.

How to Make the Most Dough With the Yeast Bread!

Lab Activity

Purpose:

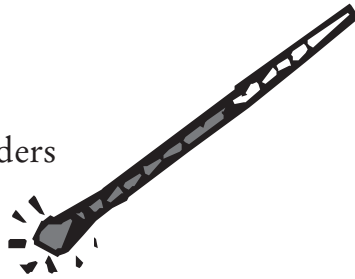
To compare the growth of yeast with skim milk, table sugar, and juice. The higher the level of foam produced, the greater the growth and population of yeast.

Safety Precautions

- Chemical safety glasses
- Wash hands thoroughly after completing the lab

Materials:

- Freeze-dried active yeast
- Three 100 mL graduated cylinders
- Thermometer
- Warm water (about 35°C)
- Warm apple juice or grape juice (about 35°C) (glucose & fructose)
- Table Sugar (sucrose)
- Powdered skim milk
- Stop Watches



ROLE OF THE TIMER:

Working with Others, Oral Communication and Numeracy are the **Essential Skills** required for this role.

- 1) Collect the materials required for the experiment.
- 2) Time the reaction and inform the Scientist to measure at 5, 10 and 15 minutes.
- 3) Return the materials.

ROLE OF THE SCIENTIST:

Reading Text, Oral Communication, Writing, Numeracy and Working with Others are the **Essential Skills** required for this role.

- 1) Read the procedure to the Timer.
- 2) Write the hypothesis, independent, dependent and controlled variables.
- 3) Perform steps 4 to 13 in the procedure.
- 4) Record the observations.

How to Make the Most Dough With the Yeast Bread!

Procedure

1. Flip a coin to decide who is the Timer and who is the Scientist.
2. The Scientist must read the lab to the Timer.
3. After reading the procedure, collaborate on
 - a. a hypothesis and write it in the space provided on the Report Template.
 - b. identify the independent variable, dependent variable and list four (4) controlled variables and write your answers in the space provided.
4. Label the graduated cylinders as follows:
 - a. Cylinder #1 = table sugar
 - b. Cylinder #2 = powdered milk
 - c. Cylinder #3 = juice
5. Add 50 mL of warm water and 5 mL of sugar to Cylinder #1
6. Add 50 mL of warm water and 5 mL of powdered milk to Cylinder #2
7. Add 50 mL of warm juice to Cylinder #3
8. Open the package of dry yeast and examine it and describe it in the space provided.
9. Add 2 mL of yeast to each of the three cylinders. The Timer should start the stopwatch and alert the Scientist when 5, 10 and 15 minutes have passed.
10. Make quantitative observations on the height of the foam produced in each of the cylinders after 5 minutes, 10 minutes and 15 minutes. Record them in Table 1 – Quantitative Observations Chart.
11. Make Qualitative observations on the reactions in each cylinder, including the odour produced. Record them in Table 2 – Qualitative Observations Chart.
12. Pour the contents of each cylinder down the drain, rinse and repeat a second time.
13. Switch roles.
14. Wash your hands.
15. Complete the Applying Your Knowledge Questions.
16. Complete the Self- and Peer Evaluations.
17. Present the **Essential Skills** Certificate of Excellence to your partner.



How to Make the Most Dough With the Yeast Bread!

Lab Report Template

Hypothesis: _____

Independent Variable: _____

Dependent Variable: _____

Controlled Variables

1. _____
2. _____
3. _____
4. _____

Description of Dry Yeast: _____

Table 1: Quantitative Observations

TYPE OF FOOD SOURCE	HEIGHT OF FOAM IN CENTIMETERS (cm)								
	AFTER 5 MINUTES			AFTER 10 MINUTES			AFTER 15 MINUTES		
	Trial 1	Trial 2	Avg.	Trial 1	Trial 2	Avg.	Trial 1	Trial 2	Avg.
Sugar									
Powdered Milk									
Juice									

How to Make the Most Dough With the Yeast Bread!

Table 2: Qualitative Observations

	SUGAR (SUCROSE)		POWDERED MILK		JUICE (GLUCOSE AND FRUCTOSE)	
	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2
Describe the reaction						
Describe the odour						

Applying Your Knowledge

1. What is your conclusion? What are your recommendations to Mr. Freydoe?

2. What industry(ies) would use fruit juices as a food source for yeast?

3. What are some other practical applications of yeast fermentation? Where or how is it used at home or in workplaces?

4. What advice would you give to someone repeating this investigation?

How to Make the Most Dough With the Yeast Bread!

5. Describe another experiment you could do with this organism in which you investigate another factor that affects its growth.

6. Describe in general, what happened during the 15 minute observation period.



Essential Skills Self-Assessment Tool

During each phase of the investigation, evaluate yourself on how well you demonstrated the *Essential Skills*. Use the following scale as a guideline.

4 - Outstanding	3 - Acceptable	2 - Below Average	1 - Unsatisfactory			
			4	3	2	1
INTERVIEW						
Role as a Timer	• Working with Others					
	• Oral Communication					
	• Numeracy					
Role as a Scientist	• Reading Text					
	• Oral Communication					
	• Writing					
	• Numeracy					
	• Working with Others					
Lab Report	• Reading Text					
	• Document Use					
	• Writing					
	• Thinking Skills					

How to Make the Most Dough With the Yeast Bread!

Essential Skills Peer Assessment Tool

Evaluate how successfully your partner has demonstrated the *Essential Skills* throughout this activity. After completing the evaluation, choose the one *Essential Skill* your partner had the most frequent outstanding rating in. Obtain an *Essential Skills* Certificate of Excellence from your teacher. Explain to your partner why they have been rewarded with the certificate. Celebrate your partner's reward by giving them a gentle pat on the back, a high five, or a handshake. Use the following scale as a guideline.

4 - Outstanding	3 - Acceptable	2 - Below Average	1 - Unsatisfactory		
INTERVIEW		4	3	2	1
Role as a Timer	• Working with Others				
	• Oral Communication				
	• Numeracy				
Role as a Scientist	• Reading Text				
	• Oral Communication				
	• Writing				
	• Numeracy				
	• Working with Others				
Lab Report	• Reading Text				
	• Document Use				
	• Writing				
	• Thinking Skills				

Comments: Please provide one or two statements describing why your partner excelled in the *Essential Skill*.

How to Make the Most Dough With the Yeast Bread!

Lab Report Rubric

CATEGORIES/ CRITERIA	LEVEL 1 (50-59%)	LEVEL 2 (60-69%)	LEVEL 3 (70-79%)	LEVEL 4 (80-100%)
<p>Knowledge and Understanding</p> <p>Understanding of content (Hypothesis clearly linked growth of yeast to the type of food source)</p> <p>(Independent, dependent and controlled variables clearly identified)</p>	Limited Understanding	Some Understanding	Considerable Understanding	Thorough Understanding
<p>(Independent, dependent and controlled variables clearly identified)</p>	Limited Understanding	Some Understanding	Considerable Understanding	Thorough Understanding
<p>Thinking</p> <p>Use of processing skills and strategies for interpreting and forming conclusions</p> <p>Use of critical/creative thinking processes</p>	Limited Effectiveness	Some Effectiveness	Considerable Effectiveness	High Degree of Effectiveness
<p>Use of critical/creative thinking processes</p>	Limited Effectiveness	Some Effectiveness	Considerable Effectiveness	High Degree of Effectiveness
<p>Communication</p> <p>Expression and organization of ideas and information in the Report Template are clear and logical</p>	Limited Effectiveness	Some Effectiveness	Considerable Effectiveness	High Degree of Effectiveness
<p>Application</p> <p>All questions are answered completely, with good workplace connections and applications</p>	Limited Effectiveness	Some Effectiveness	Considerable Effectiveness	High Degree of Effectiveness

Note: A student whose achievement is below Level 1 (50%) has not met the expectations for this assignment or activity.



Essential Skills

CERTIFICATE OF EXCELLENCE

This Certificate is awarded to

Name

For outstanding demonstration in

Essential Skill

Teacher

Peer Evaluator

Date

