Names: _____

Investigation of Yeast Populations Dynamics

Introduction

Yeast is a single-cell fungus that produces carbon dioxide as a byproduct of cellular respiration. The release of carbon dioxide by yeast causes bread dough to rise. Yeast are small and reproduce rapidly making them useful organisms for studying populations. Various factors such as food availability, temperature change and a shift in pH may influence the rate at which a population of yeast can grow. During this laboratory investigation you will take advantage of the production of carbon dioxide gas as a way to measure the relative number of living yeast organisms in your experimental populations.

Your Task

Your lab group will grow yeast in a molasses solution (food for the yeast) and investigate how one factor influences the change in yeast population growth as measured by the amount of carbon dioxide produced.

To calculate the volume of gas in a test tube (a cylinder) use the formula: **Volume= Π r^2 h**

Available materials:

prepared yeast suspension	test tube rack
prepared 25% molasses solution	pH paper
several 1 ml graduated dropping pipettes	clean test tubes (18 mm x 150 mm)
100 ml graduated cylinder	clean test tubes (25 mm x 150 mm)
metric ruler	safety goggles
weak acid/base	lab aprons
refrigerator/microwave	electronic balance (optional)

Designing and Conducting Your Experiment

1. In your own words, state the problem you are going to investigate. Write a hypothesis using an "If … then … because …" statement that describes what you expect to find and why. Include a clear identification of the independent and dependent variables that will be studied.

Before Designing Your Experiment Review the General Procedure For Growing Yeast:

1. Place 35 ml of 25% molasses solution into a small test tube.
2. Stir the yeast suspension and then place 1 ml of the yeast suspension into the same test tube.
3. Place the test tube in the rack.
4. Wash and rinse your hands. Place your palm over the end of the small test tube and invert it five times.
5. Hold the test tube with the yeast mixture upright
6. Have your partner carefully slide a larger tube down over the smaller tube.
7. Use your finger to support the bottom of the yeast test tube while holding the outer (larger) test tube.
8. Quickly invert (flip) the tubes so that the tube with the yeast mixtures is upside down and the mouth of the large tube is facing up.
9. Using a metric ruler measure the height of the air bubble (mm or cm) in the smaller tube and record on your data table.
10. Carefully place the test tubes in the rack. Do not disturb the air bubble
11. Incubate these samples for 24 hours at 30 degrees Celsius.
12. Measure the bubble and record the **change in the size due to carbon dioxide gas production** on your data table. (Subtract the initial gas bubble size from the total bubble size. Remember you will need this data to calculate the total **volume of carbon dioxide each day over five days**.)
13. Repeat steps 6-8 for five days.

2. Design an experiment to investigate your problem. Your experimental design should match your statement of the problem and should be clearly described so that someone else could easily replicate your experiment. Include a control group if appropriate and state which variables need to be held constant.

Design your data tables and describe what observations you will need to make.

You will need to establish a schedule for collecting data even on drop days.

When you have completed your design and data tables call your teacher to check your work for possible safety violations.

4. Conduct your experiment. While conducting your experiment, take notes and organize your data into tables.

Safety note: You must wear approved safety goggles and follow all safety instructions.

When you have finished, your teacher will give you instructions for cleanup procedures, including proper disposal of all materials

Communicating Your Findings – The Lab Report

Working as individuals, summarize your work in a laboratory report that includes the following:

- **A statement of the problem you investigated. A hypothesis ("If ... then … because …" statement) that described what you expected to find and why.** Include a clear identification of the independent and dependent variables.

- **A description of the experiment you carried out.** Your description should be clear and complete enough so that someone could easily replicate your experiment.

- **Data from your experiment.** Your data should be organized into tables, charts and/or graphs as appropriate.

- **Your conclusions from the experiment.** Your conclusions should be fully supported by your data and address your hypothesis.

- **Discuss the reliability of your data and any factors that contribute to a lack of validity of your conclusions**. Include ways that your experiment could be improved if you were to do it again.

- Complete the evaluation rubric on the next page and include it as the last page of your lab report

Curriculum-Embedded Laboratory Investigation - Scoring Rubric

Statement of Problem and Hypothesis

3 The problem and hypothesis are stated clearly and completely. Clear identification of independent and dependent variables.

2 The problem and hypothesis are stated adequately. Adequate identification of independent and dependent variables.

1 The problem and/or hypothesis are poorly stated. Poor identification of independent and dependent variable.

0 The statement of the problem and/or hypothesis is very limited or missing altogether. No identification of independent and dependent variables.

Experimental Design

3 The experimental design matches the stated problem. Variables are held constant. The procedures are clear, complete and replicable. A control is included when appropriate.

2 The experimental design generally matches the stated problem. Attempt at holding variables constant is made. Procedures are generally complete. Minor modifications or clarifications may be needed.

1 The experimental design matches the stated problem to some extent. Little attempt to hold variables constant. Procedures are incomplete. Major modifications or clarifications may be needed.

0 The experimental design does not match the stated problem, is very incomplete or missing. There is no attempt to hold variables constant.

Data Presentation

3 Data are well organized and presented in an appropriate manner.

2 Data are organized and presented in an appropriate manner. Minor errors or omissions may be present.

1 Data are poorly organized or presented in an inappropriate manner. Major omissions or errors may be present.

0 Data are very poorly organized or presented in an inappropriate manner or missing altogether.

Conclusions

3 Conclusions are fully supported by data and address the hypothesis. Reliability of data and validity of conclusions are thoroughly discussed.

2 Conclusions are generally supported by data and address the hypothesis. Minor errors in interpretation of results may be present. Discussion of reliability of data and validity of conclusions is limited.

1 Conclusions are supported by data and address the hypothesis to a limited extent. Major errors in interpretation of results may be present. There is little discussion of the reliability of the data or validity of conclusions.

0 Conclusions are not supported by data, do not address the hypothesis or are missing. There is no discussion of the reliability of data or validity of conclusions.

	Statement of Hypothesis	Experimental Design	Data Presentation	Conclusions	Total
Student Score					
Teacher Score					