

BACKGROUND INFORMATION:

The yeast that you buy in the store contains living organisms—invisible small one celled, micro-organisms. As long as they are kept dry, they are inactive. When they are given food, moisture and warmth, they become active and carry out many of the life activities larger organisms do.

Molasses, which you can also buy, is a mixture of substances that are obtained from sugar cane. Though the substances are not alive, they were made by living organisms, the sugar cane plants. Therefore, they are called organic substances. Organic substances as well as organisms themselves are important to the work of biologists. The organic substances in molasses can be used as food by the yeasts.

INTRODUCTION:

When we observe the results of feeding molasses to yeasts we may think of many biological questions. One of these has to do with the relationship between the amount of food provided and the rate of yeast activity. We might think that the less the amount of food, the less active yeasts there would be, or, stated in the form needed for an experiment, If we reduce the amount of food given to yeasts, then they will be less active.

To test this hypothesis we need to set up a number of yeast cultures—groups of yeasts growing under conditions that are known to be favorable for them. The cultures must all be set up in the same way except for one thing—a variable. Our hypothesis tells us what the variable must be: We must vary the amount of food.

But how are we to make meaningful observations on yeast activity? We must have some way to measure the activity. Among the activities that all organisms carry on is the production of waste. From actively growing yeasts, one of these waste products is a gas that can be easily collected. By measuring the amounts of gaseous waste, a biologist can determine how rapidly the invisible organisms are carrying on their activities. This is an indirect measure of the activity of yeasts. The amount of waste gas produced by the yeast increases and decreases in response to the increase or decrease of yeast activity.

MATERIALS AND EQUIPMENT:

Each lab group of 2 students will need the following equipment.

test tubes, large (5)	test tube cleaning brush
test tubes, small (5)	medicine dropper (1)
test-tube rack	yeast suspension
6 labels	aluminum foil squares (5)
100 ml graduated cylinder	250 ml beaker (or larger) (2)
25 ml graduated cylinder	lab book (with graph paper pages)
molasses solution (25% stock solution)	ruler (with metric measurements)

PROCEDURE:

Carefully wash the large test tubes in water using the brushes to clean the inside. Rinse well and dry **OUTSIDE ONLY**. Using the labels number the 5 large test tubes from 1-5. (place labels about 1/3 of the way down the side of the test tubes) Make one label with your lab table and team number

identification number and attach it to the test tube rack.

Using the 25 ml graduated cylinder measure 15 ml of stock molasses solution and pour into test tube No. 1. Then using the 100 ml graduated cylinder measure 25 ml of stock molasses solution and add to it 25 ml of water. (it is best to put water in a beaker and carefully pour it into the molasses solution) Mix the 50 ml of diluted molasses solution thoroughly by holding the palm of your hand over the top of the cylinder and shaking it carefully. Pour 15 ml of the 1st dilution into tube No. 2. Pour some of the remaining diluted solution into an empty beaker until only 25 ml is left in the 100 ml graduated cylinder. Add 25 ml of water to the cylinder and mix as before. Pour 15 ml of this 2nd dilution into tube No. 3. Again, discard some of the remaining solution until 25 ml is left in the 100. ml graduated cylinder. Repeat this procedure for tubes Nos. 4 and 5.

Into each tube place a small test tube upside down. Note: the next step is crucial. Since the results of this experiment are based upon the amount of gas is produced by the yeast in the various tubes a method must be devised to collect the gas produced. As the yeast metabolize the molasses they will be producing a gas. This gas will collect in the upside down tubes. Therefore, all air must be removed from the small tube before the experiment can be successful. Remove all air bubbles from the small tubes by tilting the tubes back and forth allowing the air in the small tube to escape. (Instructor will demonstrate.)

Use a square of aluminum foil and cover each tube.

The next step of the procedure will be done by the instructor. Into each tube 10 drops of yeast suspension will be added. The tubes will be allowed to incubate for 48 hours and then will be inspected by the students.

Do everything in the order listed in the lab. Do not skip steps and go back to them later.

The next class session examine the small tubes for the presence of gas. (Look for an air bubble in the small tube) 1. What kind of gas is this? 2. What produced this gas? Using a millimeter ruler, measure the length of the column (bubble) of gas in each small tube. In a chart in your lab book record the amount of gas in each tube identifying each by the number on tube. (Measure the length of the air bubble in millimeters)

STUDYING THE DATA:

The stock molasses solution you used in tube No. 1 had been diluted by your instructor so that it was a 25% solution. 3. Remembering the way you made your dilutions, what was the percentage of molasses in each of your tubes? Record the % of molasses of each tube beside the bubble measurements. (you will have a chart with the tube number, the bubble size and the % of molasses) 4. Why was it important to stir the yeast suspension just before you add some to the tubes? Millimeters are units of length, but gas occupies volume. 5. Why are millimeters acceptable in this case to measure amounts of gas? Scientists often put their numerical data into a graph. On a page in your lab book, make a line graph of your data showing the bubble size in relation to the concentration of molasses. On the chart provided by your instructor record YOUR team data. Make a similar chart in your lab book and record the data of all teams in your class. Average all the tube No. 1 data, all the tube No. 2 data and so on. Put a second line on your graph representing the class average data using a different color pen or pencil.

CONCLUSION:

Write down the hypotheses upon which this experiment was based. This is not a question but should be written in your lab book following question 5.

Data from an experiment can do one of three things:

- (1) support the hypothesis
- (2) fail to support the hypothesis

(3) not do neither clearly

6. Which of these best describes your data from this experiment? 7. What is the variable in this experiment? 8. How can you obtain verification for you data? 9. If you were reporting this experiment to other students what information would you include?

* The answers to all questions are to be written in your lab book. Number each answer to correspond to the question. Write each answer incorporating part of the question in the answer. Write a complete sentence that will allow the reader to understand the information without having read the question. You are to answer all lab questions using this method. Skip a line between the answers to each question.

Things to remember in lab:

- cleanliness during lab
- no fooling around
- no laughing
- never pour back into stock container unless instructed to
- stay close to your station
- use materials close to you
- use one beaker for getting molasses from the large flask
- take just what you need don't waste materials
- clean up