

# A comparative study of lactase supplements

## Teacher guidelines

### **Purpose:**

To allow students to test the efficiency of laboratory grade lactase versus traditional store bought lactase supplements

### **Background:**

Lactose sugar is a disaccharide that breaks down into glucose and galactose, in the presence of the enzyme, lactase. People who suffer from Lactose Intolerance are not able to break down lactose sugar properly, which leads to gastro-intestinal discomfort.

### **Materials:**

Lactase enzyme (liquid or tablet form...but choose the same form as the store brands)

Several brands of lactase replacement supplements (I.e. Lactaid) of the same concentration

Milk

Glucose Test Strips

Test Tubes (5)

Sucrose solution (to use as the control)

Beakers (400 ml) (4)

Stir Rods 4 (to avoid cross contamination)

Hot plate

Water

Wax Pencil to label test tubes

Test Tube Rack

Stir Plate (glass stir rods can be used)

**Procedure:**

1. Show the engagement video: <https://www.youtube.com/watch?v=1Pe5a4C6KmY>
2. Conduct the lactose intolerance demonstration lab
3. Assign students to lab groups (of 2)
4. Ask students to develop their hypothesis (which version of lactase do they think will work best?)
5. Label the test tubes as follows:

Test Tube 1	Test Tube 2	Test Tube 3	Test Tube 4	Test Tube 5
Glucose Solution	Lactase Supplement 1	Lactase Supplement 2	Lactase Supplement 3	Sucrose Solution

6. Heat water to 77 degrees F or 25 degrees C.
7. Label 4 beakers as follows:

Beaker 1	Beaker 2	Beaker 3	Beaker 4
Glucose Solution	Lactase Supplement 1	Lactase Supplement 2	Lactase Supplement 3

8. Place 100 mL of heated water into each beaker
9. Add the following to the water in each beaker:

Beaker 1	Beaker 2	Beaker 3	Beaker 4
Glucose Solution	Dose suggested on the bottle for Lactase Supplement 1	Dose suggested on the bottle for Lactase Supplement 2	Dose suggested on the bottle for Lactase Supplement 3

10. Stir each beaker to ensure that the materials are dissolved
11. Add 50 mL of each solution to the corresponding test tube (using a clean pipette for each sample in order to avoid cross contamination)
12. Add 20 ml of milk to each test tube.
13. Allow the reaction to run for 10 minutes
14. Using a clean glucose strip for each sample, test the amount of glucose produced in each test tube and record this data in a data table. The sucrose solution acts as the control in this lab

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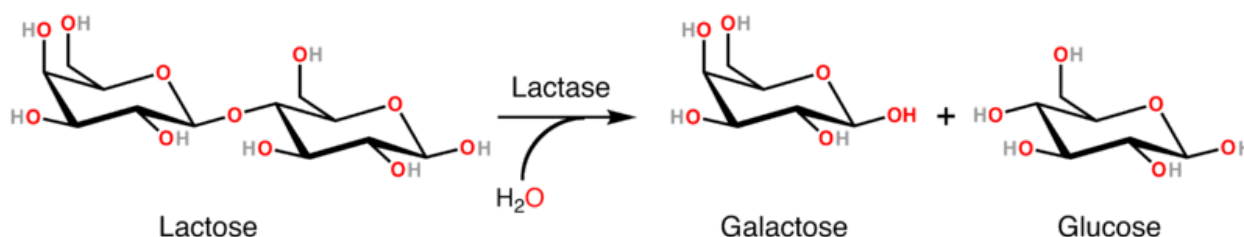
## Student Handout

### **Purpose:**

To test the efficiency of store bought Lactase supplements and to see how enzymes play a role in our daily lives.

### **Background:**

Lactose sugar is a disaccharide that breaks down into glucose and galactose, in the presence of the enzyme, Lactase. People who suffer from Lactose Intolerance are not able to break down Lactose sugar properly, which leads to gastro-intestinal discomfort.



Source: <http://commons.wikimedia.org/wiki/File:Lactase.png>

### **Pre-Lab Questions: Place your answers in your lab notebook**

1. Explain what an enzyme substrate is:
2. What is a catalyst?
3. What does it mean when scientists say that an “Enzyme is substrate specific”?

### **Materials:**

Several brands of Lactase replacement supplements (i.e. Lactaid) of the same concentration  
Milk  
Glucose Test Strips  
Test Tubes (5)  
Sucrose solution (to use as negative control)  
Glucose solution (to use as positive control)  
Beakers (400 ml) (4)  
Stir Rods 4 (to avoid cross contamination)  
Hot plate  
Water  
Wax Pencil to label test tubes  
Test Tube Rack  
Stir Plate (glass stir rods can be used instead of the stir plate)



**WARNING: REMEMBER TO FOLLOW ALL LAB SAFETY RULES!**



**Procedure:**

1. Develop your hypothesis (which version of lactase do they think will work best?). Remember, it is ok to have a different hypothesis than your lab partner. Write your hypothesis in your lab notebook, with your pre-lab questions.
2. Label the test tubes as follows:

Test Tube 1	Test Tube 2	Test Tube 3	Test Tube 4	Test Tube 5
Glucose Solution	Lactase Supplement 1	Lactase Supplement 2	Lactase Supplement 3	Sucrose Solution

3. Heat water to 77 degrees F (25 degrees C).
4. Label 4 beakers as follows:

Beaker 1	Beaker 2	Beaker 3	Beaker 4
Glucose Solution	Lactase Supplement 1	Lactase Supplement 2	Lactase Supplement 3

5. Place 100 mL of heated water into each beaker
6. Add the following to the water in each beaker:

Beaker 1	Beaker 2	Beaker 3	Beaker 4
Glucose Solution	Dose suggested on the bottle for Lactase Supplement 1	Dose suggested on the bottle for Lactase Supplement 2	Dose suggested on the bottle for Lactase Supplement 3

7. Stir each beaker to ensure that the materials are dissolved (or use a stir plate)
8. Add 50 mL of each solution to the corresponding test tube (using a clean pipette for each sample in order to avoid cross contamination)
9. Add 20 to 30 ml of milk to each test tube
10. Allow the reaction to run for 10 minutes, stirring periodically
11. Using a clean glucose strip for each sample, test the amount of glucose produced in each test tube and record your results in a data table.
12. Clean up, dispose of all solutions as directed by your instructor



**POST Lab Questions:** Place your answers in your lab notebook

1. Was your hypothesis correct? Explain why or why not
2. Identify sources of error that you may have had during your experiment. Could those errors have affected your results? If so, how
3. Identify the following variables in this lab:
  - a. Control Variable
  - b. Independent Variable
  - c. Dependent Variable
4. Based on your lab results, if you were lactose intolerant, which route would you take to treat your disorder? (use data from your experiment to support your answer)
5. How could you use this lab to test other dairy products for the presence of lactose sugar?
6. Research 2 other enzyme disorders that occur in the human body and briefly explain each.