



## Tropical Fruit Gelatin Lab

By Eva McLanahan

This lesson explains the science behind the fresh pineapple warning on JELL-O boxes. The warning advises against the use of certain fresh or frozen fruits because they will not allow the gelatin to solidify. Students will explore the differences when fresh, frozen, and canned pineapple are used to make gelatin. This lesson may be taught as a hands-on activity or as a classroom demonstration.

### Primary Learning Outcomes

Students will see first hand the difference between the use of fresh, frozen, and canned pineapple in gelatin. They will develop a hypothesis as to why the fresh and frozen pineapple did not allow the gelatin to solidify. Ultimate learning outcome is that of enzyme denaturation at high temperatures, which occurs during the canning process, and the idea of optimum temperatures for enzyme function.

### Additional Learning Outcomes

Students will implement the scientific method at varying levels depending on the modifications chosen for the experiment.

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### Assessed Georgia Performance Standards:

#### Habits of Mind

SCSh1. Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.

SCSh2. Students will use standard safety practices for all classroom laboratory and field investigations.

SCSh3. Students will identify and investigate problems scientifically.

SCSh4. Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

SCSh6. Students will communicate scientific investigations and information clearly.

#### The Nature of Science

SCSh8. Students will understand important features of the process of scientific inquiry.

SCSh9. Students will enhance reading in all curriculum areas.

#### Co-Requisite – Content

**SB1. Students will analyze the nature of the relationships between structures and functions in living cells.**

b. Explain how enzymes function as catalysts.

c. Identify the function of the four major macromolecules (i.e., carbohydrates, proteins, lipids, nucleic acids).

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## Procedures/Activities

*Step: 1 Duration: 40 minutes to 60 minutes depending on difficulty*

Lab procedures should be conducted as stated in the Tropical Fruit Gelatin Lab attached. Modifications can be made based on experimental design capabilities of your class and their level of enzyme knowledge. (*Note: The students can each prepare gelatin at their lab station or the teacher can prepare several packs of gelatin to save time. Prepare gelatin as stated on package. Prepared gelatin can be kept hot on a hot plate until ready for use.*)

### Web Resources for Step 1

**Title:** Dole Plantation -- Hawaii

**URL:** <http://www.dole-plantation.com/>

**Annotation:** This website will help with background information on pineapple processing should you choose to describe this process in your classroom.

**Title:** Everything about digestive enzymes

**URL:** <http://www.enzymestuff.com/index.htm>

**Annotation:** This website will help with explaining the specifics of digestive enzymes and background information to supplement textbooks.

**Title:** Bromeliflorae Background and Information

**URL:** <http://www.ucmp.berkeley.edu/monocots/bromeliflorae.html>

**Annotation:** University of California, Berkeley informative website on the Bromeliaceae family.

### Attachments for Step 1

**Title:** Tropical Fruit Gelatin Lab Handout (pages 4-5 of this file)

**Description:** This is the lab handout to complete the Tropical Fruit Gelatin Lab. Students will find background, materials, procedure, results table, and discussion/conclusion questions to answer.

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## Materials and Equipment (Student)

4 test tubes, fresh pineapple, frozen pineapple, canned pineapple (chunky), powdered gelatin, water, beaker or glass measuring cup, ice water bath, test tube rack, plastic knife, Sharpie, 50 mL beaker

## Materials and Equipment (Teacher)

hot plate or microwave for gelatin preparation, 2-400mL beakers, water, spoon

## Total Duration

40-60 minutes

## Assessment

Lab report and/or discussion questions.

### **Extension**

This lab can be modified based on the amount of time available to execute the lab and the amount of information to disclose to the students before completing the exercise. Many may wish to perform this experiment as a simple demonstration and lead into a discussion about enzymes. Others may wish to either use the lab as appears in this lesson plan, or provide the students with a list of materials they may use and have them develop an experiment to test different types of fruit on the solidification of the gelatin. Some other fruits that may be used that also contain digestive enzymes that break apart gelatin are papaya (enzyme: papain) and kiwi (enzyme: actinidin). A good inquiry exercise is to provide students with a variety of fruits to test and see if they can determine why only some fruits allow the gelatin to solidify. Suggestion of fruits include: grapes, peaches, pears, apples, blueberries, kiwi, papaya, and pineapple. See lab worksheet at the end of this document (pages 6-8): **Tropical Fruit Gelatin Lab\_Adapted for AP**

Name \_\_\_\_\_ Block \_\_\_\_\_ Date \_\_\_\_\_

## Tropical Fruit Gelatin Lab

Have you ever noticed the warning on a JELL-O package about pineapple?  
Today you will learn the science behind that food warning.

**Background:** The enzymes in some tropical fruits can break down proteins. For example, papaya contains the digestive enzyme *papain*, which is often found as a component in meat tenderizers. Pineapple contains a digestive enzyme named *bromelin*.

### Materials:

4 test tubes  
fresh pineapple  
frozen pineapple  
canned pineapple (chunky)  
powdered gelatin  
ice water bath  
test tube rack  
plastic knife  
Sharpie

### Procedure:

1. Using the plastic knife, cut equal sized pieces of fresh, canned, and frozen pineapple. The pieces should be small enough to easily fit inside the test tube and be covered by the hot gelatin.
2. Label the test tubes 1-4
3. Prepare gelatin as stated by your teacher.
4. Pour ~1.5 inches of hot gelatin into each of the four test tubes.
5. Place the piece of fresh pineapple into test tube #2, frozen pineapple into test tube #3, canned pineapple into test tube #4. Make sure that test tube #1 contains only gelatin and no fruit.
6. Slowly mix the contents of the tubes by rolling them upright between the palms of your hands.
7. Place all four test tubes into the ice water bath.
8. Every few minutes check to see if the gelatin in tube #1 has solidified. When test tube #1 has solidified, you can remove all the tubes and compare the consistency.
9. Record all observations in the table provided.

### Extension:

For a comparison, repeat the steps above using another type of fruit. Some suggestions include kiwi, papaya, guava, blueberries, pears, peaches, grapes, and apples.

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**Discussion Questions:**

1. Identify the positive, negative, and control results from the test tubes.
  
2. What could account for the differences in consistency of each of the test tubes?
  
3. How could the preparation processes in each of the types of pineapple change bromelin?
  - a. Fresh:
  
  - b. Frozen:
  
  - c. Canned:
  
4. For the types of pineapple that did not allow the gelatin to solidify, describe what you would need to do in order for that type of pineapple to allow the gelatin to solidify.

**Results**

Tube Contents	Observations
#1: Gelatin	
#2: Gelatin and Fresh Pineapple	
#3: Gelatin and Frozen Pineapple	
#4: Gelatin and Canned Pineapple	

Name \_\_\_\_\_ Block \_\_\_\_\_ Date \_\_\_\_\_

## Tropical Fruit Gelatin Lab AP Biology

Have you ever noticed the warning on a JELL-O package about using fruit in your JELL-O?  
Today you will learn the science behind that food warning.

**Background:** The enzymes in some tropical fruits are classified as proteolytic enzymes. Proteolytic enzymes break apart or digest other proteins. For example, papaya contains the digestive enzyme *papain*, which is often found as a component in meat tenderizers.

**Purpose:** Explore and determine the effects of different types and states of fruit on the solidification of gelatin.

**Materials:**

10 test tubes	3 types of fruit in 3 different states (fresh, canned, frozen)
powdered gelatin	ice water bath
test tube rack	plastic knife
masking tape	pen/Sharpie

(You are to use 3 fruits total for this experiment. One of them must be pineapple, so choose 2 others from the following test fruits: pear, grapes, peach, blueberry, papaya. Obtain these in the following states: raw (fresh), canned (cooked), and frozen.)

**Procedure:**

Design your experiment here.

NOTE: To conserve time, you should not fill your test tube with more than 1 ½ inches of gelatin. This amount will be able to solidify in your ice water bath within a very reasonable amount of time.

CONTROL:

INDEPENDENT VARIABLE:

DEPENDENT VARIABLE:


Name \_\_\_\_\_ Block \_\_\_\_\_ Date \_\_\_\_\_

**Results:**

Design a table here to show your results. (Remember to show tube number, contents, and results!)

**Discussion Questions:**

5. Identify the positive, negative, and control results from the test tubes.
6. What could account for the differences in consistency of each of the test tubes?
7. Does the way the fruit is prepared make a difference in your experiment?

8. What could you do to the fresh pineapple that would allow the gelatin to solidify? 
9. Name at least two kinds of treatments/conditions that inactivate enzymes?
10. Design an experiment to find out at which temperature a meat tenderizer works the best.  
(Use what you have learned in this experiment to answer this question).