Eagle Farm Stand just received a huge shipment of pineapples. In an effort to use them up before they spoil, they decided to cut them and add them to Jell-O to make fruit cups for the local parks. They prepared the Jell-O as directed on the box, added the chunks of pineapple, and placed them in the fridge to set overnight. The next morning they were shocked! The Jell-O was still a liquid and their hopes of delivering a refreshing, summer treat to the parks were halted. What happened?

**The History of Jell-O**

The sweet, colorful treat that we know as Jell-O is actually made of bones, hides, and connective tissues. Hard to believe? In fact, it is true!

All gelatin, both food and laboratory grade, is made using a similar process. It starts with discarded animal products – bones and skin. All of these tough parts are made of proteins. (In fact, gelatin is a protein). We can extract gelatin from any animal, but pigs and cows are the most common. Commercial gelatin starts by grinding up the bones and then soaking those bones in a strong base solution to soften them. This mixture passes through progressively stronger acid solutions until the product does not resemble bones at all! Finally, hours of boiling extract the gelatin, after which it is skimmed off the top and dried into a powder. From here, manufacturers can add sugar, colors, and flavorings that will turn gelatin into the jiggly dessert we all know.

In 1845, an engineer, Peter Cooper developed the process of extracting gelatin. Sometime later, in 1895, a cough syrup manufacturer, Pearl B. Wait, purchased the patent from Cooper and adapted the gelatin recipe into a prepackaged form, which his wife, Mary, named Jell-O. The rest is history!

**A little about Pineapple**

The pineapple plant (*Ananas comosus*) is a monocot, or grass-like plant, that belongs to the bromeliad family. It is thought to have originated in Brazil. In the 1950s, pineapple became the United States’ second most important fruit and Hawaii led the world in both quantity and quality of pineapples. However, times have changed and now, all canned pineapple comes from overseas, largely from the Philippines. As with some other tropical fruits, the pineapple fruit contains an enzyme that breaks down, or digests, protein. The protease (protein-digesting) enzyme in pineapple is **bromelain**, which is extracted and sold in products like meat tenderizer. Papaya, another tropical fruit, also contains an enzyme, called **papain**, which digest protein. It can also be found in meat tenderizer.

**How does this sweet fruit and its enzymes affect Jell-O? We are about to find out!**

**PROCEDURE**

In this lab, you will be given an array of materials and you will be asked to **design your own experiment** to test the effect of pineapple on gelatin. The goal is to understand what is actually going on in the pineapple-gelatin mix at a chemical level as well as understanding what affects the function of enzymes.

**MATERIALS AVAILABLE**

* Fresh pineapple, canned pineapple, freshly cooked pineapple
* Other tropical fruits such a papaya, kiwi
* Jell-0 (any flavor)
* Cold water
* Hot water/hot water bath
* Small containers such as disposable, plastic cups or petri dishes
* Spoons, stirring rods
* Refrigerator
* Knife
* Paper towels

**STUDENT TASK**

Design a controlled experiment that shows the effect of raw pineapple on gelatin. Make sure your experiment description includes the following:

a. A hypothesis. Remember hypotheses are written as “If…then” statements.

b. A detailed experimental design that includes:

1. The effect of fresh pineapple on gelatin.

2. The effect of frozen pineapple on gelatin.

3. The effect of canned pineapple on gelatin.

4. The effect of freshly cooked pineapple on gelatin.

5. A test to determine how gelatin behaves without any additives.

c. A data table

d. Write up a detailed experimental plan on the accompanying sheet of paper.

1. Identify your controls, independent, and dependent variables

2. State/list your procedural steps clearly.

e. You will be able to perform your experiment once you receive approval of your experimental design from your teacher.

f. Conduct your experiment.

g. Analyze your results using the following questions as a guide.

1. Clearly describe the results of your experiment. In which test tubes did the gelatin jell, which did not.

2. Clearly explain the results of your experiment. Why did some test tubes of gelatin jell, why did others not. Be specific!

3. What is the enzyme in your experiment?

4. What is the substrate in your experiment?

5. What is (are) the product(s) in your experiment?

6. What type of organic molecule is gelatin?

7. What type of organic molecule is bromelain?

8. Why were the results of the freshly cooked pineapple different than the results of the fresh, raw pineapple? Be specific!

**PUT IT ALL TOGETHER**

After discussing your results with your lab group, develop an argument that explains what happened with the Eagle Farm Stand and their fruit cups. Organize your thoughts in a claim, evidence, reasoning (CER) format.