

Name _____

Protein Digestion Lab

In this lab, we will use the same chemicals and enzymes our body uses to observe how we digest protein. Proteins start breaking down in our stomach, which has an acidic pH of around 2-3 due to the *hydrochloric acid*. The enzyme in the stomach that cuts up the bonds between the amino acids in the protein we eat is called *pepsin*, and it only works in acidic conditions.

Once the food moves into the small intestine, the pancreas releases sodium bicarbonate (NaHCO_3), which makes the pH change into a slightly basic (alkaline) pH of 8. The pancreas also makes the enzyme called *trypsin*, which works well in these conditions and does a similar job to what pepsin did in the stomach. After being broken down by both enzymes, the protein you ate is pretty much nothing but amino acids now.

The protein we are using in this lab comes from two sources—egg whites and hamburger. Egg whites are composed of 90% water and 10% protein, and the hamburger is just ground-up cow muscle, which has lots of protein too.

Materials

6 small pieces of cooked hamburger OR hard-boiled egg white
6 test tubes
Beaker or test tube rack for holding the test tubes
Parafilm
Water
0.01 M HCl (hydrochloric acid)
2.5% Pepsin solution
2.5% Trypsin solution
Sodium Bicarbonate (NaHCO_3)
Goggles
Lab Apron

Safety

Because we are working with a strong acid in this lab, we need to be extra careful. Write the safety precautions we will take below:

1. _____
2. _____
3. _____
4. _____
5. _____

Procedure

Day One

Today we simulate the first place the protein is digested—the stomach.

1. Put on your goggles and lab apron.
2. Label the test tubes A, B, C, D, E, and F.
3. Your lab group has been assigned either hamburger or egg. Put a small piece of your food into each test tube.
4. Prepare the test tubes according to the following directions and then place each into the beaker or test tube rack:
 - a. Test Tube A—10 mL of water
 - b. Test Tube B—10 mL of the pepsin solution
 - c. Test Tube C—10 mL of the HCl solution
 - d. Test Tube D—10 mL of the pepsin solution with 10 drops of HCl
 - e. Test Tube E—10 mL of the pepsin solution with 10 drops of HCl
 - f. Test Tube F—10 mL of the pepsin solution with 10 drops of HCl
5. Cover the top of each test tube with a small piece of parafilm.
6. Place test tubes in an incubator at 37° C (body temperature).
7. Record your initial observations in the data table.
8. Answer the questions for Day One.

Day Two

Today the food leaves the stomach for the small intestine, with some secretions from the pancreas to help.

1. Put on your goggles and lab apron.
2. Observe the food in each test tube and write your observations in the data table.
3. Do the following to the test tubes:
 - a. Test Tube A—do nothing
 - b. Test Tube B—do nothing
 - c. Test Tube C—do nothing
 - d. Test Tube D—do nothing
 - e. Test Tube E—add 10 drops of the trypsin solution
 - f. Test Tube F—add enough sodium bicarbonate to raise the pH to 8 (checking with litmus paper) then add 10 drops of the trypsin solution
4. Cover test tubes with parafilm and place back into incubator.
5. Answer the questions for Day Two.

Day Three

1. Put on your goggles and lab apron.
2. Observe the food in each test tube and write your observations in the data table.
3. Once your group is ready, carefully dispose of your chemicals according to your teacher's directions.
4. Finish answering all questions.

Data Table

In this data table, tell how much the food is digested, what it looks like, and what the rest of the solution looks like too. Add as much detail as you can.

Test Tube	Initial Observations (Day 1)	Day 2 Observations	Final Observations
A			
B			
C			
D			
E			
F			

Questions

Day One

1. What test tube do you think will digest the food the most? Explain your answer.

2. What test tube do you think will digest the food the least? Explain your answer.

3. Your body only takes a few hours to digest proteins. Why does it take so much longer to digest in a test tube? (Hint: What's going on in your body that's not happening in your test tube?)

Day Two

4. Which test tube digested the food the most? _____

How can you tell? _____

Why do you think these chemicals helped the food digest so well?

5. Which test tube (D, E, or F) do you think will digest the food the most by Day Three? Explain your reasoning.

6. Which test tube (D, E, or F) do you think will digest the food the least by Day Three? Explain your reasoning.

Day Three

7. Which test tube did the best job of digesting the food over the three days? _____

How can you tell? _____

Why do you think these chemicals helped the food digest so well?

8. What test tube had conditions closest to our digestive system? Explain your reasoning.

9. Share your data with other groups. What food broke down more, hamburger or egg? Why do you think this is?

10. After we have broken down the protein we eat into amino acids, what happens to the amino acids?
