

Food Explorations Lab: Cooking with Acids & Bases

STUDENT LAB INVESTIGATIONS

Name: _____

Lab Overview

In this investigation, you will compare and contrast physical and chemical properties of raw vegetables and vegetables cooked in acidic or basic solutions. You will also view an onion skin cell under a microscope and reflect on the effects an acid or base has on the cell's structure.

Lab Objectives

In this lab, you will learn how to...

1. Observe the effect of acids and bases on vegetables during the cooking process.
2. Prepare a wet mount slide of an onion and draw the organelles of the onion cell.
3. Infer how acids and bases affect a plant cell's structure.

Lab Safety: Before beginning ANY investigation you should put on your safety goggles and apron (optional). It is important to avoid getting chemicals on your hands. Always wash your hands following completion of an investigation. When handling food, you should also wash your hands prior to beginning an investigation.

Lab Question

How will the physical properties (e.g. color, texture) of raw vegetables (broccoli, carrot, and onion) change when cooked in an acidic solution and when cooked in a basic solution?

The vegetables cooked in an acidic solution will become dull and mushy. The vegetables cooked in a basic solution will become bright and soft.

Predictions: I predict ...

Example: Broccoli will become bright green when cooked in a basic solution.

Broccoli in Acidic Solution: _____

Broccoli in Basic Solution: _____

Carrot in Acidic Solution: _____

Carrot in Basic Solution: _____

Onion in Acidic Solution: _____

Onion in Basic Solution: _____

MATERIALS (FOR CLASS)

Pre-cooked vegetable samples in labeled plastic sandwich bags

MATERIALS (PER STATION)

Safety goggles

Aprons (optional)

Plastic bag with pre-cut vegetables (broccoli, carrots, onion)

2 paper plates

1 black permanent marker

PROCEDURE

1. Obtain and observe each piece of raw vegetable. Take note of color, texture, and structure.
2. Record your observations in Table A.
3. Label one paper plate acid and one paper plate base.

4. Divide each paper plate into three sections. Label the sections onion, broccoli, and carrot.
5. Your teacher has already boiled broccoli, carrots, and onion in two large pots. While cooking, vinegar (acid) was added to one pot and baking soda (base) to the second pot.
6. As the sample bags of broccoli, carrots, and onion are passed around the room, place the samples on the appropriate plate and section.
7. Record your observations of each vegetable cooked in the acidic and basic solution in Table A.

Table A: Vegetable Observations

Vegetable	Raw Vegetable	Vegetable in Acid	Vegetable in Base
Broccoli	Dark Green	Yellowish Green	Mushy Bright Green
Carrot	Dark Orange	Orange No big change	Mushy Orange
Onion	White	Opaque White	Mushy

Conclusion

1. Compare and contrast the raw, cooked in acid, and cooked in base vegetables.

All the vegetables softened when cooked. The vegetables cooked in the acid become dull. The vegetables cooked in the base become bright and mushy.

2. Using your observations, explain how the results compared to your original responses.

Student responses will vary.

3. In the following chart, write “acid” or “base” depending on which will give the anticipated result:

Table B:

Desired Result	Broccoli	Onion	Carrot
Color change	Both	Acid	None
No color change	None	Base	None
Crisp	Acid	Acid	None
Soft	Base	Base	Base

4. Describe a situation when an acid and when a base would be appropriate to use in cooking.

You would use an acid when you want to add flavor through a marinade. You would use a base to have a more visually appealing vegetable, add “however the addition of the base may affect quality (e.g. mushy texture).”

Student Investigations Lab Extension

MATERIALS

Thin onion slices
Microscope slide and cover slip/Microscope
Cell stain
2 droppers
Cup of water

PROCEDURE

Directions to Use a Microscope

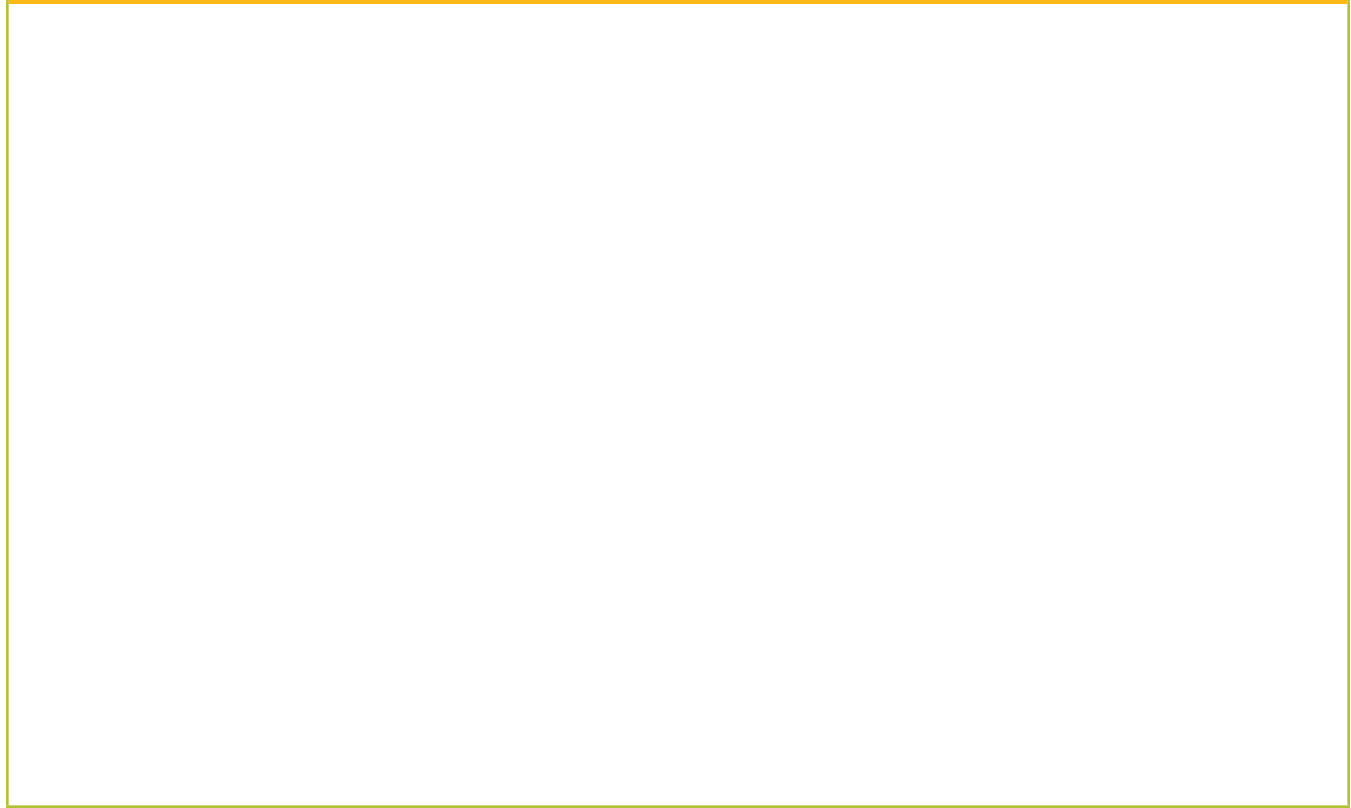
1. Plug the microscope in (if applicable) and turn it on.
2. Adjust the magnification to the lowest power.
3. Make sure the stage is lowered all the way and place the slide on the microscope stage. Slowly raise the stage using the coarse focus knob (large knob) so you can see the object clearly through the ocular lens. Do not let the slide touch the objective lens.
4. Using the fine focus knob (small knob), adjust the focus so the object looks clear.
5. If the object is too dark or too bright, adjust the diaphragm until you can see all the details.
6. Once the object is in focus, you may change to higher powers. However, be sure the lens does not hit the slide.

View Onion Cell under Microscope:

1. Obtain a few thin slices of onion from teacher.
2. Make a wet mount slide. Place a drop of water on a clean slide. Using a different dropper, place a drop of cell stain on the water drop.
3. Place a thin slice of onion on the drop and cover with cover slip.
4. Observe using the microscope under 4X power and then 10X power.
5. Draw your observations in high power (10X). Label the nucleus, cytoplasm, and cell wall.



Onion Cell Drawing



Conclusion:

1. Describe the functions of the plant structures you observed in the onion cell.

The nucleus serves as the "brain" of the cell; it contains the DNA and therefore controls the functions of the cell. The cytoplasm is the fluid that fills the cell; it holds everything in place and supports the cell structure. The cell wall protects and maintains the structure of the cell.

2. What are other structures within a typical plant cell that were not visible?

Chloroplasts

3. Based on your observations of the cooked vegetable samples, infer how the cell wall of an onion cooked in an acidic solution would look under a microscope.

Opaque and thinner because the structure will have been compromised through cooking and the addition of an acid.

4. Based on your observations of the cooked vegetable samples, infer how the cell wall of an onion cooked in a basic solution would look under a microscope.

Darker and thinner because the structure will have been compromised through cooking and the addition of a base.