

Name \_\_\_\_\_

Date \_\_\_\_\_ Period \_\_\_\_\_

### Question 1: How much does pH vary within a piece of fruit?

**Independent Variable** \_\_\_\_\_

**Dependent Variable** \_\_\_\_\_

**Hypothesis:**

If (IV) \_\_\_\_\_,

Then (DV) \_\_\_\_\_.

**Materials:**

1 piece of fruit

1 plastic knife

pH paper



**Procedure:**

1. Place the fruit on its side. You are cutting the fruit crosswise; NOT along the stems.
2. Use the knife to cut the fruit in half. You should be looking at a cross section of the fruit (like the picture above).
3. Choose 4 triangles on each side and test the pH of each triangle. Record your observations below.
4. Glue or tape the pH paper in the box next to your observation.
5. SAVE THE FRUIT FOR PART 2.

Fruit	pH section 1	pH section 2	pH section 3	pH section 4
Half One				
Half Two				

What can you observe from this table?

\_\_\_\_\_

\_\_\_\_\_

Name \_\_\_\_\_

Date \_\_\_\_\_ Period \_\_\_\_\_

## Question 2: How does volume affect pH?

**Independent Variable** \_\_\_\_\_

**Dependent Variable** \_\_\_\_\_

**Hypothesis:**

If (IV) \_\_\_\_\_,

Then (DV) \_\_\_\_\_.

**Materials:**

2 fruit halves from above  
Fruit juicer

Five equal sized containers  
labeled B, A, A1, A2, and A3.

pH paper

**Procedure:**

1. Squeeze the juice from each fruit half using the fruit juicer. One half should be squeezed into container A, and the other half into container B.
2. Use the graduated cylinder to measure the volume of each half. Record your answers below with units.
  - a. Container A= \_\_\_\_\_ Container B= \_\_\_\_\_
3. Container A and B need to have the same volume. Remove excess juice from the larger container to give them an equal volume. Record the volume in the table below under container B.
4. Divide the volume of Juice A by 2, by placing half of the juice into A1.
5. Divide the remaining volume of juice A by 2, by placing half of the remaining volume (1/4 the original volume) into A2.
6. Divide the remaining volume of juice A by 2, by placing half of the remaining volume (1/8 the original volume) into A3.
7. In the table below, record the volume of each container. Include units.
8. Measure the pH of each volume and record your findings.
9. SAVE THE JUICE IN THE CONTAINERS FOR PART 3.

Container	Volume	pH
Container B		
Container A1		
Container A2		
Container A3		
Container A (check)		

What kind of check does container A provide for this experiment? (What do you expect to see and what do you see?)

\_\_\_\_\_

\_\_\_\_\_

Name \_\_\_\_\_

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### Question 3: How does concentration affect pH?

**Independent Variable** \_\_\_\_\_

**Dependent Variable** \_\_\_\_\_

**Hypothesis:**

If (IV) \_\_\_\_\_,

Then (DV) \_\_\_\_\_.

**Materials:**

Fruit Juice in 5 containers from part 2                      Water                      pH paper

**Procedure:**

1. Line up the five containers from largest volume to smallest volume.
2. DO NOT change the volume of container B.
3. Add enough water to Container A1 to give it the same volume as container B.
4. Add water to container A2 until it has the same volume as container B.
5. Add water to container A3 until it has the same volume as container B.
6. Do NOT add water to container A. We are using this container as a check or control.
7. Using the diagram below, find the concentration of each container.
8. Each container should now have the same volume. What is this volume? \_\_\_\_\_
9. You need to solve for the concentration of juice in each container. This is the same as the percentage of juice in each container. Here is the formula:

$$\text{Concentration (\%)} = \text{Volume of Juice} \div \text{Total Volume}$$

10. Find the pH of each of the containers and record the information in the table.

Container	Volume of Juice (from Part 2)	Total Volume	Concentration (%)	pH
B				
A1				
A2				
A3				
A				

What can you observe from this table?

\_\_\_\_\_

\_\_\_\_\_

**You need to save the 100% concentration juice in a labeled container. Be sure to label your juice with your group and period.**

**CLEAN UP ACCORDING TO YOUR TEACHER'S DIRECTIONS!!**

Name \_\_\_\_\_

Date \_\_\_\_\_ Period \_\_\_\_\_

**Summary:**

Question	Yes	No
Does pH vary within a piece of fruit?		
Does Volume affect pH?		
Does concentration affect pH?		

*Use your results and data from the experiment to answer the following questions.*

*Use specific data to answer the questions.*

*Use complete sentences.*

**Part 1: How much does pH vary within a piece of fruit?**

1. What is the average pH for your fruit?

\_\_\_\_\_

2. What was the highest pH? What was the lowest pH?

\_\_\_\_\_

3. How much did the pH vary within the fruit sections?

\_\_\_\_\_

**Part 2: How does volume affect pH?**

4. Did each half of the fruit give the same volume of juice when squeezed? Explain why or why not.

\_\_\_\_\_

5. How did the volume of juice affect the pH of the juice? How does the data show this?

\_\_\_\_\_

What is the explanation for this? \_\_\_\_\_

\_\_\_\_\_

**Part 3: How does concentration affect pH?**

6. How did we change the concentration of the juice?

\_\_\_\_\_

7. How did the different concentrations affect the pH? How does the data show this?

\_\_\_\_\_

\_\_\_\_\_

Name \_\_\_\_\_

Date \_\_\_\_\_ Period \_\_\_\_\_

**We are going to graph the team results for the average pH of each fruit type.**

Complete the chart below:

List each type of fruit used for the experiment.

Record the Average pH from each group that tested that fruit.

\*\*\*\* Depending on the class sizes your chart may have incomplete sections.\*\*\*\*

Fruit	Group 1 pH	Group 2 pH	Group 3 pH	Group 4 pH	Group 5 pH	Group 6 pH	Group 7 pH	Group 8 pH

What type of graph can be used to show the average pH per fruit type? \_\_\_\_\_

What should be on the X-axis? \_\_\_\_\_ (IV) What should be on the Y-axis? \_\_\_\_\_ (DV)

Graph the results on graph paper. Be sure to include the following:

- Title
- Name, Date, Period
- Clearly labeled X and Y axis
- Evenly spaced X and Y axis
- Neat- use a ruler
- Colored

1. How does pH vary between pieces of the same fruit? How does the data show this?

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2. How does pH vary between different pieces of fruit? How does the data show this?

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3. How is pH related to the taste of fruit? (Does a sour taste relate to how acidic or basic a solution is? Does sweetness relate to how acidic or basic a solution is?)

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*Now that we have focused on citric fruits, let's look at a family of vegetables. You are going to design an experiment and test the pH within the pepper family.*

*What kinds of peppers are there?*

*Do you think peppers are acids or bases? Why?*

**Design an experiment to test the following question: How does pH vary within the pepper family?**

Complete the Experimental Design Graphic Organizer for your experiment.