

Acids and Bases

FRAMEWORK

- I. Scientific and Engineering Practices
 - 1. Asking questions and defining problems
 - 4. Analyzing and Interpreting Data
- II. Cross-Cutting Concepts
 - 3. Scale, proportion, and quantity
- III. Disciplinary Core Ideas
 - EES 3: Earth and Human Activity

SKILLS/OBJECTIVES

- Learn the definition of the terms acidic, basic, and neutral
- Make hypothesis about the pH of different liquids
- Test the pH of different liquids
- Comprehend the arrangement of the pH scale and the placement of solutions on this scale

MATERIALS

- Red Cabbage Juice
- Disposable glass test tubes
- Plastic pippettors
- Test Tube racks
- Liquids of varying pH (Ex. Lemon juice, bleach, vinegar, soap, milk, soda, water, baking soda solution.)
*Note: you will want to dilute some of the solutions such as the soap (to make it easier to dispense with the pipettor) and the bleach (to make it less concentrated).

NOTES

- Make sure the students know they should not eat or drink anything in this activity, nor should not touch their faces at anytime (to avoid ingesting liquids or getting their in their eyes). Have students wash their hands promptly after clean up.

BACKGROUND

- Discuss acidity, basicity and pH
 - Who knows what an acid or base is?
 - Has anyone heard of the pH scale?
 - Can you name some common acids or bases?
- Key Points
 - All liquids are acidic, basic or neutral. Acidic liquids are on the low end of the pH scale (0 to 6) while basic liquids are on the high end of the pH scale (8 to 12). Neutral liquids have a pH of 7.
 - Acids and bases on the far ends of the scale are called strong and can be very dangerous. They can eat through your skin, and even through metal. (If a blackboard is available, draw the pH scale).
- What we are going to do:
 - We will be using an **indicator** made from red cabbage to determine if solutions are acids or bases. An indicator changes to one color when a base is added and to a different color when an acid is added.
 - Demonstrate how a basic solution (such as baking soda) changes the color of the indicator solution, and how an acidic solution (such as lemon juice) changes the color of the solution).
 - List the different liquids that we will be testing the pH of and have the kids guess whether they think the solution will be acidic or basic.

Activity #1	Testing the pH
Materials	<ul style="list-style-type: none">○ Red Cabbage Juice○ Disposable glass test tubes○ Plastic pipettors○ Test Tube racks
Worksheet	Yes, image of the pH scale

1. Give each student or pair of students a test tube rack with five test tubes, each filled about 1/3 of the way with indicator solution
2. Provide the solutions of varying pHs in plastic cups with pipettors.

3. Allow the students to experiment by adding the different liquids to a test tube.
 - a. **Add a few drops of one of the liquids to the test tube with the red cabbage indicator.**
 - i. What happens to the color? Based on this color, is the solution acidic or basic?
 - b. **Do the same thing with another one of the liquids. Add a few drops to a few test tube with indicator and observe what happens.**
4. Allow the students to continue to explore with mixing the liquids and the indicator.
 - a. Can you change a basic solution to an acidic one? Can you change an acidic solution to a basic one?
 - b. Can you tell which solutions might be strong acids/bases and which are weak?
5. Have all of the students come back together and fill in the pH scale with the tested liquids. Ask the kids for their observations:
 - a. Ex. What color did the indicator turn when you added lemon juice? What does this tell you about lemon juice? Is it more or less acidic than milk?

NOTE: A pH chart with common acids/bases is shown below as a reference.

CONCLUSIONS

- After completing the pH scale together as a group, ask students if the results match their hypotheses about the pH of different liquids.
 - What are some other liquids you think would be acidic? (maybe ask about some of the ones that you didn't choose) What are some that you think would be basic?
- Discuss how the pH of certain liquids is very important.
 - For example, fish can only live in water that has a certain pH: if it is too acidic or basic they will die. When we pollute the water with certain chemicals, it can change this pH, which can be detrimental to the fish.
 - Also the blood in our bodies needs to maintain a certain pH so that we stay healthy.