

Lesson Name: Acid Chemistry Elementary

Lesson Type: Exploration and Project

Author: Seema

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Materials:

Group size: 20-30 students [1 classroom]

Part 1: Testing the pH of different household liquids

Part 2: Experimenting with acids and bases

- Red cabbage juice collected from 1 red cabbage
- Approximately 60 clear cups (10 cups per group; total 6 groups)
- Approximately 4 ounces of the following liquids:
 - Vinegar
 - Household detergent
 - Baking soda
 - Lime juice or lemon sprite
 - Water

Part 3 (optional): Dissolving penny and acid reactivity

- 20-30 dull pennies (6 groups * 5 pennies)
- 1.5 cups white vinegar (6 groups * $\frac{1}{4}$ cup white vinegar per bowl)
- 6 teaspoons salt (6 groups * 1 teaspoon salt per bowl)
- 6 clear plastic bowls (6 groups * 1 bowl)

Agenda:

- Introduction to pH and chemical reactions (10 minutes)
- Testing the pH of different liquids (15 minutes)
- Experimenting with acids and bases (20 minutes)
- Concluding thoughts (5 minutes)



Introduction

- What does a lemon taste like?
- Why is it sour?
- What is an acid? What is a base? Where do we see examples of acids?
- What is the pH scale?
- Why are acids unique? (Explain how acids are reactive.)

Activities

Part 1: Testing the pH of different household liquids

1. Pour about 1 ounce red cabbage juice into 5 clear cups.

2. Add about a tablespoon of each individual liquid () into the cups filled with red cabbage juice.
3. Use the worksheet to aid in understanding the color changes. (Acids turn the solution red, bases turn the solution green, and neutral solutions keep the solution purple.)

Part 2: Experimenting with acids and bases

1. Mix different household liquids in new cups filled with cabbage indicator to see how bases and acids can be neutralized.
2. See if a gradient of colored cups can be created by making solutions of weak acids and bases.

Part 3 (optional): Dissolving penny and acid reactivity

1. Pour 1 teaspoon salt and $\frac{1}{4}$ cup vinegar into plastic bowl.
2. Stir until salt dissolves into the vinegar.
3. Dip penny halfway into liquid. Hold for 30 seconds. Half the penny should be visibly shinier.
4. Put the rest of the pennies into the solution.
5. Wait for 5 minutes. Cleaning action should be visible.
6. Remove pennies. They should be shiny now.

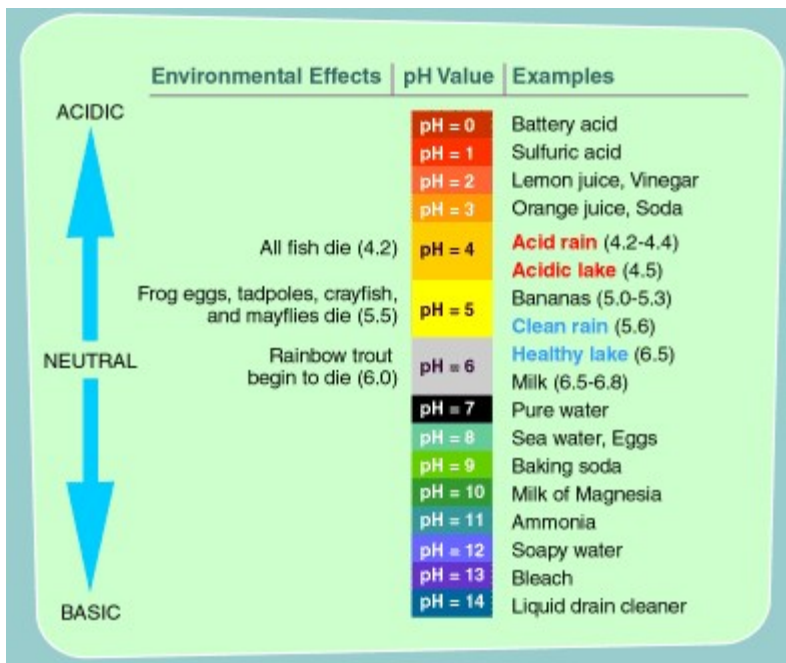
Discussion:

How is chemistry related to engineering? Answers are flexible. Mentors can give their own experience.

Background:

pH is a measure of the acidity or basicity of a solution. Solutions with a pH less than 7 are acidic, while solutions with a pH greater than 7 are basic. Pure water at room temperature (25°C) is neutral with a pH of 7. pH is equal to the negative logarithm of $[H_3O^+]$ or the molar concentration of free hydronium ions. Thus, a high concentration of hydronium ions indicates a low pH and an acidic solution, and a low concentration of hydronium ions indicates a high pH and a basic solution.

Acids play an expansive role- from toilet cleaners to essential biological molecules. Acids are often used to remove rust and other corrosion from metals. They are used extensively in mineral processing and fertilizer production. Acids are often additives of food, for example phosphoric acid in Coke, or are natural ingredient of fruits, for the example the citric acid in lemons and oranges. In our body, amino acids are the basic building blocks of our proteins, nucleic acids are the building blocks of our hereditary material (DNA), and fatty acids are



integral factors to growth and tissue repair. Lastly, acids play a role in our environment, notably the problem of acid rain.

In this lesson plan, acetic acid (vinegar) is used to remove the corroded layer of dull copper pennies. Pennies become dull over time as the copper layer reacts with oxygen in the air to form the solid copper oxide. When the pennies are immersed in the acid, the acid dissolves the copper oxide leaving only the copper layer of the penny behind. The penny then appears shiny and relatively new.

pH scale compares various liquids and shows the environmental impact of acid rain

Worksheet:

See below

***Alternative to worksheet: Write the chart on the board and fill out as a class.*

Websites:

<http://chemistry.about.com/cs/demonstrations/a/aa022204a.htm>

http://www.saskschools.ca/curr_content/science9/chemistry/lesson11t.html





Acids and Bases

Color Key:

Acids = red

Bases = green

Neutral = purple

Household Liquid	pH	Color	Acid or Base?
Vinegar 			
Household detergent 			
Baking soda 			
Lime Juice or lemon sprite 			
Water 