

SOURCE Lesson Plans Detail

Acids and Bases

Topic	Acid-Bases Chemistry
Program	Science Center Outreach
Developed by	Oludurotimi Adetunji
Developer Type	Brown faculty

Overview / Purpose / Essential Questions

Why do acids and bases behave the way they do?

Identify which solutions are acidic, neutral and basic based?

Understand the pH scale and what the value and color on a litmus paper mean?

Performance / Lesson Objective(s)

Introduce students to the chemistry of acids and bases. Students will be able to identify solutions which are acidic, neutral or basic based from the their pH values.

Lesson Materials

Fruits such as lime and lemon taste sour. They taste sour because they are acidic. Acids are corrosive to metals and they change the color of the litmus paper to red. However, bases feel slippery and change the litmus paper to blue. Acids dissolve in water releasing hydrogen ions while bases dissolve in water releasing hydroxide ions. When acids and bases are mixed hydrogen atom from the acids and the oxygen molecules from the hydroxide ion combine to form water. The mixture of acids and bases makes the solution neither acidic nor basic. When the solution is neither acidic nor basic, the solution is in a neutral state. The process of mixing acids and bases reduces the strength of the acids and bases when their strength is completely reduced the system reaches a neutralization state.

A number scale which spans from 0 to 14 called a pH scale, is used to determine if a solution is acidic, neutral, and basic based. For example, a pH value of 7 corresponds to the neutral condition, neither acidic nor basic. Pure water formed from the combination of the hydrogen ions and oxygen molecule is neutral.

A universal indicator (pH = 1-14)

10mL glass vials with caps

Buffer solution at pH=1,2,4, 7, 6.8,10, 12, 14

Test solutions (lime juice, lemon juice, milk, vinegar, tomato juice, pineapple juice, water from different sources, antacid, milk of magnesia, household hydrogen peroxide, baking soda solution, toothpaste, vitamin C, scouring powder, detergent, shampoo and conditioner)

Lesson Motivation

There are many household substances including cleaners and foods that are either acidic or basic based. This lesson will give students an understanding of what they are and how they can be classified in chemistry.

Lesson Activities

We will use a universal indicator which is a pH indicator that easily shows color transitions over a pH value ranges from 1-14 to determine whether an aqueous solution of interest are acidic, basic or neutral.

Procedure

Observe the color of the buffer solutions with known pH values.

Take a glass vial and fill it with a test solution, add two drops of universal indicator and cap the vial. Shake the vial and observe the resulting color change.

To determine the pH of the test solution, compare the color of the test solution with the colors of the buffer solutions with known pH values. Estimate the pH of the test solution by matching the colors of the buffer solutions with the color of the test solution.

Repeat these procedures for all the remaining test solutions and estimate the pH of the test solutions.

Wrap up / Conclusion

Students will be able to see the transition of color from red indicating highly acidic solution to orange-yellow color as the solution approaches neutral pH with color green. As solutions become more basic the color transition from green to blue and then approaches bright violet color for highly basic solutions. Therefore, test solutions can be grouped into acidic, neutral or basic based solutions.

Follow up

Is there a trend among food samples and other solutions?

Supporting Web Information

<http://www.auetute.com.au/indicata.html>

<http://antoine.frostburg.edu/chem/senese/101/acidbase/faq/universal-indicator.shtml>

Pre Assessment Plan

Why do some food taste sour?

What is a pH scale?

What is an universal indicator?

What happens when acids is dissolve in water?

What happens when bases is dissolve in water?

What happens when acids and bases are mixed?

Post Assessment Plan

Why do some food taste sour?

What is a pH scale?

What is an universal indicator?

What happens when acids is dissolve in water?

What happens when bases is dissolve in water?

What happens when acids and bases are mixed?

Alignment Info

Audience(s)	Elementary students
STEM Area(s)	Chemistry
Standard(s)	<i>Physical Sciences (RI GSE) PS1.K–2.1a</i> Students demonstrate an understanding of characteristic properties of matter by ... identifying, comparing, and sorting objects by similar or different physical properties (e.g., size, shape, color, texture, smell, weight). <i>Physical Sciences (RI GSE) PS1.K–2.1b</i> Students demonstrate an understanding of characteristic properties of matter by ... recording observations/data about physical properties. <i>Physical Sciences (RI GSE) PS1.3–4.1a</i> Students demonstrate an understanding of characteristic properties of matter by ... identifying, comparing, and sorting objects by similar or different physical properties (e.g., size, shape, color, texture, smell, weight, temperature, flexibility).
Activity Type(s)	Hands-on Lecture
Grade Level(s)	1 2 3
Version	1

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Brown University

Providence, Rhode Island 02912, USA

Phone: 401-863-1000

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