

Activity Template

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Subject Area(s) measurement, chemistry

Associated Unit

Yellow highlight = required component

Associated Lesson

Activity Title Invisible Ink

Header



Image 1[left justified]

ADA Description: _Everyday acidic substances_?

Caption: _none_?

Image file name: __acidic.jpg_?

Source/Rights: Copyright © ___?

Grade Level _5_ (_4_-_6_)

Activity Dependency

Time Required 45 minutes to an hour

Group Size 2

Expendable Cost per Group US\$_2_

Summary

Students get an introduction to pH including the pH scale, properties of an acid and base, and pH indicators. This is related to substances they see everyday and how it can affect their environment. They learn a little about weather and become aware of environmental engineering. In pairs, they determine if a couple of substances are an acid or base, using a pH indicator, and they make invisible ink with the same substances.

Engineering Connection

Environmental engineers use their science and engineering knowledge to help improve the environment. Acid rain is a worldwide environmental problem that has been addressed by environmental engineers. It can change the pH of water and soil and have negative effects on

plants and aquatic animals. The problem becomes worse and more widespread as the population and industry grows. Environmental engineers conduct studies to evaluate the significance of environmental hazards, advise on treatment and containment and can help develop regulations to improve or prevent conditions.

Engineering Category

(1) relates science concept to engineering

Keywords pH, acid, base, pH indicator, weather, environment, acid rain

Educational Standards

- Texas science (2008): 4A, 2B

Pre-Requisite Knowledge

Learning Objectives

After this activity, students should be able to:

- Identify the correct pH classification (acid, base, neutral) of a substance.
- Place a substance correctly along the pH scale.
- Understand the connection between the pH scale, acid rain and environmental engineers.

Materials List

Each group needs:

- plastic spoon
- eye dropper
- small paint brush or q-tips (2)
- white sheet of paper (2)
- 250 mL beaker (2)
- plastic cup/ small container

To share with the entire class:

- vinegar
- baking soda
- red cabbage juice

Introduction / Motivation

Acids and bases are the two most common chemical compounds found in everyday life. The orange juice you might drink with breakfast is an acid and the soap you use to wash your hands is a base. (Write on board: neutral in the middle with arrows pointing to acidic on the left and basic on the right. Underneath write orange juice and soap in the correct category) Can anyone name any other acids? (Answers include: lemon juice, soda, vinegar, battery acid; write

the answers on board as given) How about any other bases? (Answers include: ammonia, bleach, liquid drain cleaner, baking soda, milk of magnesia; write answers on board as given) They have different properties that you use to tell them apart. Acids taste sour and if you get an acid in a cut or on your skin it can burn. Acids also react with metals causing them to dissolve. Bases taste bitter and feel slippery to the touch. Every substance you can think of is an acid or base! The only exception is pure water or salts because they are neutral. (Write on board: pure water and salts underneath neutral)

The pH scale is used to indicate how acidic or basic a substance is. Does anyone know what the range of the pH scale is? (Answer: 0 to 14) What number from the pH scale represents a neutral? (Answer: 7; Write on board above neutral) How about an acid? (Answer: less than 7; write 0 above acid) And an base? (Answer: greater than 7; write 14 above base) How can we figure out if the substance is an acid or base? Any ideas? (Answers include: pH indicator) If you add a pH indicator to an acid or base it will react and change color. Cabbage juice can be used as a pH indicator. It will turn red or pink if it comes in contact with an acid and blue or green if it comes in contact with a base. (Write on board: red or pink above acid and blue or green above base)

Can anyone come up with some ideas on how acids or basics could affect the environment? (Answers include: acid rain, pH of soil or water can effect animals or plants) Does anyone know what acid rain is? (Answer: rain or any type of precipitation that is unusually acidic) What types of people would study and try to solve the problem of acid rain? (Answer: scientists and environmental engineers) Acids and bases are important not only because they are everywhere in our lives but also because they can affect our environment.

Vocabulary / Definitions

Word	Definition
pH scale	Measures how acidic or basic a substance is; ranges from 0 to 14
pH indicator	Shows through a color change if a substance is an acid or base.
acid	Substance described by a pH less than 7.
base	Substance described by a pH greater than 7.
neutral	Substance described by a pH of 7.
compound	Substance made up of two or more elements.
Engineer	A person who applies science and mathematics to create for the benefit of society.
Environmental engineering	The application of science and engineering principles to improve the environment.

Procedure

Background

Before the Activity

- Make cabbage juice by boiling 4-5 leaves of a red cabbage in 4-quarts of water for 45 minutes. Let cool and refrigerate until use.
- Gather remaining materials

With the Students

1. Split into pairs.
2. Clean and dry beakers after the first part of the activity: Acid or Base?

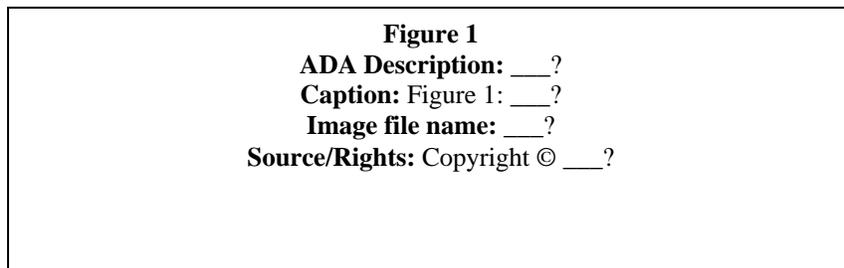
Acid or Base?

- 1) From what you have learned today predict which substance, vinegar or baking soda, is an acid or base. Explain your answer.
- 2) Measure 100mL of cabbage juice for each of the beakers.
- 3) Put a couple of drops of vinegar in the first beaker. Observe and record the color change.
- 4) Put a spoonful of baking soda in the other beaker. Observe and record the color change.
- 5) From the color changes determine if the substances are an acid or base.
- 6) Were your predictions correct?

Invisible Ink

- 1) Mix 50mL of water with 50mL of baking soda in plastic cup or small container.
- 2) Use a paintbrush or q-tip to write a message on a piece of paper with the baking soda ink.
- 3) Let the ink completely dry.
- 4) While the ink is drying predict what will happen when if you paint over your message with cabbage juice. Record your answer and explain.
- 5) When the ink is fully dry paint over the message with cabbage juice. Record what happens. Was your prediction correct?

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Attachments

Safety Issues

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Troubleshooting Tips

Investigating Questions

Assessment

Individually or in pairs have the students draw their own pH scale and label where an acid, base and neutral fall. Also have them add some everyday substances under each category. Have them come up with some other substances they could use to make invisible ink.

Pre-Activity Assessment

Title: ___?

Activity Embedded Assessment

Title: ___?

Post-Activity Assessment

Title: ___?

Activity Extensions

Activity Scaling

- For lower grades, ___?
- For upper grades, ___?

Additional Multimedia Support

References

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http://en.wikipedia.org/wiki/Environmental_engineering

Other

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