

Topic: Acids and Bases

Teacher Information

Time Allowance

90 minutes (at least 2 class periods)

Background

During the Mars mission, students will test the water supply to ensure that it is safe enough for the crew to consume. One of the tests performed on the water supply is a measure of its pH. The pH scale is used to identify and classify compounds as being acidic, basic or neutral.

Scientists use many skills to assist them in their research. Among many things, they need to be able to conduct tests and analyze and classify the data. For example, scientists use the pH scale to identify and classify compounds. The pH scale is a measure of how acidic or basic a sample is.

Acids are nonmetallic chemical compounds that react with some metals to produce hydrogen gas. They have a pH less than 7. An acid will neutralize a base. Bases are metallic chemical compounds that react with water and have a pH greater than 7. A base will neutralize an acid. A substance that is neither an acid nor a base is considered neutral and has a pH of 7. Water is an example of a neutral substance.

An indicator is used to test a solution for its pH. It may be in the form of a liquid or paper that has been soaked in an indicator liquid. For example, one easily prepared indicator is the Cabbage Juice Indicator.

Materials

Small plastic cups (20 mL.)
Eyedroppers (per group)
Large plastic cups (250 mL.)
Test tubes
Safety goggles (per student)
Aprons (per student)
Graduated cylinder (teacher)
Water

Preparation

1. Prepare the red cabbage indicator: Cut a red cabbage into eight parts; place cabbage in a non-aluminum pan; cover with water and boil for 10-15 minutes. (You may wish to use distilled water to ensure a neutral pH.)
2. Pour the pan contents through a strainer and discard the cabbage leaves.
3. Cool the juice and store covered in the refrigerator. (Freeze the juice in ice cube trays for extended use.)
4. Prepare the bleach, ammonia, soap and vinegar solutions by mixing one teaspoon of each liquid with 250 mL of water.

5. Label the small cups 1-9.
6. Label one large cup *water* and the other *indicator*.
7. Fill the nine small cups half full of each solution.
8. Fill one large cup half full of water.
9. Fill one large cup half full of the cabbage juice indicator.
10. Label the test tubes 1-9.

Procedures-Part I

1. Gather materials and assign students to cooperative groups.
2. Have students look at the list of household products on the chart below. For each solution, have students predict and record if they think it is an acid, base or neutral.
3. Students will use an eyedropper to put 10 drops of indicator into the test tube labeled 1. Place this eyedropper back into the cup of indicator.
4. Student will use the other eyedropper to put 10 drops of solution 1 into the test labeled 1.
5. Students will cover the end of the test tube and gently shake the solutions, mixing them together.
6. Students will observe the color and record their observations on the chart below, indicating if the solution is an acid, neutral or base.
7. Students will clean their solution eyedropper in the water cup and repeat steps 13-16 for each of the solutions.
8. Students will clean up testing area.
9. Discuss the results.

IMPORTANT:

Be sure to follow all safety rules for working with chemicals.

Procedures-Part II

1. Students will transfer the readings from the previous experiment to the chart.
2. Students will determine where each compound measured falls on the pH scale.
3. Students will record the name of each compound in the proper position on the chart according to its pH reading.
4. Students will color the pH chart using the results from the tests as a guide.

Transfer/Extension

- Research acid rain.
- Collect water samples from local water sources to test for pH.
- Make paper indicators by cutting white blotting paper into strips and soaking the strips in the red cabbage indicator.
- Use commercially sold synthetic indicators to compare and contrast test results.
- Experiment to find other plants, fruits or vegetables that can be used as indicators for an acid, base or neutral substance.
- Discuss the role of maintaining pH in swimming pools and salt-water aquariums.