Rate Your Reaction

sead : stem

Subjects

Chemistry

Topics

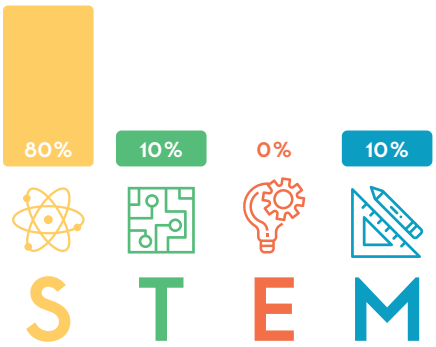
Chemical Reaction | Environment | Properties of Solvent | Rate of Reaction | Scientific Inquiry

Key Words

Acidity | Alkalinity | Rate of Reaction

Connection to SDG

STEM Chart



Time for Activity

3 hours

Introduction

Our world evolves a lot around the acidity and alkalinity of a material. From the food we eat, the products we use and the solutions we consume. If wrongly consumed, they may cause health problems and even death.

Thus, the behavior of each element has to be understood as both acids and bases play major roles in our life. Chemical reactions between an acid and a base have lots of applications in what we do. For instance, in the field of medicine, the chemical reaction between both elements are crucial in the pharmaceutical industry. A person may eat food that takes longer time to digest such as pizza, thus encouraging the excretion of hydrochloric acid within the stomach. Overflooding of hydrochloric acid may then cause heartburn to the person, which is then resolved through the consumption of antacids (a base) to neutralize that.

In this activity, we will investigate the behavior of each component, the reaction rate and the outcome of the chemical reaction between both components.

Key Objectives

1. Identifying the properties of an acid and a base.
2. Understanding the outcome of different reactions from different pH levels of a solvent.
3. Understanding the reaction rate.
4. Acknowledging the application of the concept in daily life.

Materials Task A & B

1. Measuring beaker
2. One small red / purple cabbage
3. pH paper
4. 500 ml of hot water
5. Strainer
6. Two large bowls
7. Paper cups
8. Grater
9. Goggles
10. Rubber gloves
11. Protective
12. Table spoon
13. Dropper

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Solvents

1. Apple juice
2. Lime juice
3. Vinegar
4. Distilled water
5. Sodium bicarbonate
6. Shampoo
7. Clothing detergent

Materials Task C

1. Balloon(s)
2. Small bottle (i.e. a clean glass beverage bottle)
3. Small funnel
4. Vinegar
5. Measuring beaker

Safety

1. Be careful while handling the hot water. Please wear protective gloves and goggles when handling it.
2. Be careful while using any sharp instrument. Adult supervision is required when using them.
3. Care is needed when handling vinegar as it may irritate the eyes or skin when in contact, do use the provided gloves.
4. Please handle the glass bottles with care.

Guiding Questions

1. What is the color of your indicator solution?
2. What color did every indicator solution take when tested using different solutions?
3. Based on its color, what is the predicted pH value for each solution?
4. What are the properties of a base and an acid?
5. What is the chemical reaction between a base and an acid?
6. What is the by-product of acid base reaction?
7. What makes the balloon inflate?

Task A

1. Grate a small red cabbage. If you do not have a grater, please use a knife and cut the cabbage into smaller pieces. Put the fine, pulpy or chopped grated cabbage into a large bowl.
2. Boil water. Pour the boiling water into the bowl with the cabbage pulp until the water covers the cabbage fully.
3. Let the cabbage mixture rest and stir occasionally until the liquid is room temperature. This will take roughly 30 minutes.
4. The liquid will become red or purplish-red in color.
5. Place a strainer over another large bowl and pour the cabbage mixture through the strainer to remove the cabbage pulp.

Teacher Tip

The colors of the solution should be an indicator solution to test the pH of different liquids.

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6. Pour 20 ml of the solution into a paper cup.
7. By using pH paper, record the pH of lime juice in a table.
8. Add drops of lime juice to the solution in the paper cup until you see the solution changes in color.
9. Gently stir the solution and observe the change.
10. Label the paper cup with "lime juice" and keep it.

1. Repeat steps No. 6 and No. 8 using different solvents. Label the paper cups accordingly and place them next to each other.
2. Apple juice
3. Vinegar
4. Distilled water
5. Sodium bicarbonate
6. Shampoo
7. Detergent

Study the different pH values of the solvents used

Compare the color of the pH paper with the color scale and enter the pH level in the table.

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Solvents / tests	Lime juice	Apple juice	Vinegar	Distilled water	Sodium bicarbonate	Shampoo	Detergent
pH value by pH paper							
Red cabbage indicator color							

Task B

Study the reaction of acid and bases

The students will create a table shown below.

Base / Acid	Sodium bicarbonate		Shampoo		Detergent	
Lime juice						
Apple juice						
Vinegar						

pH paper test Red cabbage test

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1. Pour 20 ml of lime juice into a measuring beaker.
2. Add 20 ml of sodium bicarbonate solution to the same measuring beaker.
3. Put a pH paper into the solution and observe the color change.
4. By using a dropper, add few drops of the mixture into 10 ml of the red cabbage indicator and observe the color change.
5. Record the observation, and repeat steps No. 1 through 4 with the different combinations of acids and bases.
6. Describe how the pH values of the two individual solutions in the mixture change based on the results.
7. Enter the terms "acidic", "neutral", "basic" accordingly in the following diagram. Distilled water, btw, is "neutral", it is neither acidic nor basic.

Task C

To study the rate of acid base reaction (by-product)

1. Please add 2 table spoons of baking soda to each balloon, using a funnel.

Teacher Tip

This step may require two people to do it; one person to keep the balloon open and the other person to fill the baking soda into the balloon.

2. Pour 100 ml of vinegar into the bottle.
3. Fit the balloon carefully over the bottle opening. Do not drop the baking soda into the vinegar yet.
4. Once the balloon is fitted perfectly on the nozzle, hold up the balloon and add the baking soda to the vinegar.
5. Observe the chemical reaction and effect on the balloon.
6. Record the time it takes for the balloon to inflate.
7. Repeat steps No. 1 through 6 by increasing the number of baking soda to 4 table spoons and 6 table spoons, respectively.
8. For a more challenging task, replace soda bicarbonate with the detergent, while the vinegar is replaced with lime juice.
9. Start with two tablespoons of apple juice and gradually increase to 4 and 6 table spoons of detergent.
10. Observe the time it takes for the balloon to inflate.

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Assessment

Evaluation Criteria	4	3	2	1
Procedures	Procedures are listed in clear steps. Each step is numbered and is a complete sentence.	Procedures are listed in a logical order, but steps are not numbered and/or are not in complete sentences	Procedures are listed but are not in a logical order or are difficult to follow.	Procedures do not accurately list the steps of the experiment.
Scientific Concepts	Students are able to describe the concept of pH value coherently and clearly	Students are able to describe the concept of pH value but unable to deliver it in an articulate manner	Students understand the basic concept of pH values	Students having troubles to explain about the concept of pH value