Name: _____ Period: _____ Date: _____

The pH Scale Laboratory Activity – Teacher Edition

Red Cabbage Acid-Base Indicator

Background Information:

Scientists use the pH scale to describe the concentration of hydrogen protons in a solution. Acid-base indicators are chemicals used to determine whether an aqueous solution is acidic, neutral, or alkaline. Since acidity and alkalinity relate to pH, they may also be known as **pH indicators**. A pH of 7 means that the solution is neutral, which means it is neither basic or acidic. A pH less than 7 means the solution is acidic while a pH greater than 7 means the solution is basic. The lower the pH, the more acidic a solution is. Some examples of acid-base indicators are litmus paper, phenolphthalein, and red cabbage juice.

Red cabbage contains a water-soluble pigment called anthocyanin that changes color when it is mixed with an acid or base. It is just one of the many indicators that are available to scientists. Some indicators start out colorless and turn different colors when they mix with an acid or base. Some substances do not show any change in color which indicates it is neither acid or base.

In this laboratory activity, you will make your own red cabbage indicator and you will use this to determine the acidity and alkalinity of common household materials.

Name: _____ Period: _____ Date: _____

The pH Scale Laboratory Activity – Teacher Edition

Learning Objectives:

At the end of this laboratory activity, students are expected to:

- Make a red cabbage acid-base indicator.
- Test the acidity and alkalinity of common household materials using the red cabbage indicator.

Pre-lab Prediction:

Look at each of the liquids that will be tested in this activity. Predict whether each of the substance is acidic, neutral, or basic. Put a check (✓) in the correct column to show your answer.

Substance	Acidic	Basic	Neutral
hand sanitizer			
lemon soda			
apple juice			
white vinegar			
baking soda			
shampoo			
conditioner			

Laboratory Proper:

Materials:

- pre-cut red cabbage
- blender
- strainer
- large container
- 1 L beaker
- 7 plastic cups
- 7 plastic spoons
- lemon soda
- white vinegar
- apple juice
- baking soda
- shampoo (preferably clear)
- conditioner (preferably clear)
- hand sanitizer

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Safety Alert! *Some household materials are toxic by ingestion and can cause eye irritation. Avoid contact of all solutions with eyes. Clean up spills immediately. All food-grade items that have been brought into the lab are considered laboratory chemicals and are for lab use only. Do not taste or ingest any material in the lab. Wear safety goggles, gloves, and laboratory apron as you perform this activity. Wash hands thoroughly with soap and water before leaving the laboratory.*

Procedure:

1. Put the cut red cabbage leaves into the blender with 800mL of water.
2. Cover the blender and let it blend at high power for 30 seconds.
3. Once it is blended, pour the mixture onto a large container with strainer on top to filter out its leaves. You can squeeze the leaves to get the remaining extract.
4. Prepare the liquids to be tested by labeling each cup with its name. (Example: vinegar, apple juice, lemon juice, etc)
5. Pour 100 mL of each individual liquid into its respective cup except for the baking soda.
6. Prepare the baking soda mixture by adding 3 tablespoons of baking soda into 100 mL of water.
7. Pour 50 mL of red cabbage juice into each of the cups. **Do this one at a time**.
8. Record the changes in color for each liquid in Table 1. Use the table below to indicate its approximate pH and determine whether it is an acid or a base.

Color	Pink	Dark Red	Violet	Blue	Blue-Green	Green-Yellow
Approximate pH	1 – 2	3 – 4	5 – 7	8	9 – 10	11 – 12
Acid/Base	Acid	Acid	Acid/Neutral	Base	Base	Base

9. Look up the **actual pH** of each substance and see how accurate the red cabbage indicator was.

Name: _____ Period: _____ Date: _____

The pH Scale Laboratory Activity – Teacher Edition

Observations:

Table 1: Result of Red Cabbage Indicator in Common Household Substances.

Household Substance	Color Change	Approximate pH	Actual pH
lemon soda			
white vinegar			
apple juice			
baking soda			
shampoo			
conditioner			
hand sanitizer			

Post-lab Questions:

1. What is in red cabbage that makes it a good acid-base indicator?

   _____

   _____

   _____

2. How does the red cabbage indicator work?

   _____

   _____

   _____

The pH Scale Laboratory Activity – Teacher Edition

3. Based on the actual pH of the household substances you used in this activity, do you think the red cabbage indicator is accurate? Why or why not?

_____

_____

_____

4. Research one fruit or vegetable that can also be used as an acid-base indicator. Write down the substance it contains that can make it a good acid-base indicator.

_____

_____

_____

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The pH Scale Laboratory Activity – Teacher Edition

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Red cabbage contains a water-soluble pigment called anthocyanin that changes color when it is mixed with an acid or base. It is just one of the many indicators that are available to scientists. Some indicators start out colorless and turn different colors when they mix with an acid or base. Some substances do not show any change in color which indicates it is neither acid or base.

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The pH Scale Laboratory Activity – Teacher Edition

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- Make a red cabbage acid-base indicator.
- Test the acidity and alkalinity of common household materials using the red cabbage indicator.

Pre-lab Prediction:

Look at each of the liquids that will be tested in this activity. Predict whether each of the substance is acidic, neutral, or basic. Put a check (✓) in the correct column to show your answer.

Substance	Acidic	Basic	Neutral
hand sanitizer			✓
lemon soda	✓		
apple juice	✓		
white vinegar	✓		
baking soda		✓	
shampoo	✓		
conditioner	✓		

Laboratory Proper:

Materials:

- pre-cut red cabbage
- blender
- strainer
- large container
- 1 L beaker
- 7 plastic cups
- 7 plastic spoons
- lemon soda
- white vinegar
- apple juice
- baking soda
- shampoo (preferably clear)
- conditioner (preferably clear)
- hand sanitizer

Name: _____ Period: _____ Date: _____

The pH Scale Laboratory Activity – Teacher Edition

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Acid/Base	Acid	Acid	Acid/Neutral	Base	Base	Base

9. Look up the **actual pH** of each substance and see how accurate the red cabbage indicator was.

Name: _____ Period: _____ Date: _____

The pH Scale Laboratory Activity – Teacher Edition

Observations:

Table 1: Result of Red Cabbage Indicator in Common Household Substances.

Household Substance	Color Change	Approximate pH	Actual pH
lemon soda	light pink	1 – 2	2.5
white vinegar	dark red	3 – 4	4.5
apple juice	medium pink	3 – 4	3.5
baking soda	blue-green	9 – 10	10
shampoo	red violet	5 – 7	5.5
conditioner	red violet	5 – 7	5.5
hand sanitizer	purple-blue	5 – 7	7.5

Post-lab Questions:

1. What is in red cabbage that makes it a good acid-base indicator?

   Red cabbage contains a water-soluble pigment called anthocyanin that changes color when it is mixed with an acid or base.

2. How does the red cabbage indicator work?

   When the red cabbage juice is added to another liquid substance, it changes its color depending on the acid or base content of the substance.

The pH Scale Laboratory Activity – Teacher Edition

3. Based on the actual pH of the household substances you used in this activity, do you think the red cabbage indicator is accurate? Why or why not?

   Answers may vary depending on the observations gathered by the students. But most of the time, the red cabbage indicator is accurate as the change in color that represents an approximate pH value is close to the actual pH value of the household substance.

4. Research one fruit or vegetable that can also be used as an acid-base indicator. Write down the substance it contains that can make it a good acid-base indicator.

   Plants containing anthocyanins include acai, currant, chokeberry, eggplant, orange, blackberry, raspberry, blueberry, cherry, grapes, and colored corn. All these plants can be used as an acid-base indicator.