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CH151 2016

Penny Polishing

Teacher's Instructions

ACTIVITY: Students will experiment with various solutions to determine the best way to clean a penny. Students will learn how the acidity of the solution chosen has an effect on its ability to clean.

LEARNING GOALS:

- Students will test the pH of various substances. They will also test the ability of these substances to polish pennies.
- Students will observe how the substances in their everyday life are arranged on the pH scale.
- Students will understand the connection between pH and penny polishing ability.

RECOMMENDED GRADES: Depending on how in depth into pH the lesson goes, anywhere from Grade 3 to Grade 8. Younger grades can still benefit from this activity by cleaning the pennies and categorizing each of the cleaning options as "acidic" or "basic".

KEY CONCEPTS, DEFINITIONS OF TERMS

Acidic- a substance with a pH less than 7

Basic- a substance with a pH greater than 7

Chemical reaction- A change in which one or more chemical elements or compounds (the reactants) form new compounds (the products)

Control- The part of an experiment that acts as a standard by which to compare experimental observations

pH- The hydrogen ion concentration of a substance; a measure of its acidity or alkalinity

MATERIALS NEEDED

Consumables: Solutions: lemon juice, vinegar, water, soap, soda, baking soda, salt, other desired solutions; pH paper, 2 cups per student, 4 pennies per student

Non-Consumables: pH meter (optional), chalkboard/whiteboard/poster paper to display pH scale

ESTIMATED COST: Approx. $30

APPROXIMATE TIME:

Preparation time: 5 minutes

Activity run-time: 30 minutes. This time can be extended by measuring the pH of various substances in the room or other substances of your choice.

PROCEDURE

Each student chooses two solutions to test. Pour the solutions into cups. Match two pennies with two other pennies of similar dirtiness. One is placed into the cup of solution and the other is left out as a control. Let the pennies sit for at least 20 minutes.

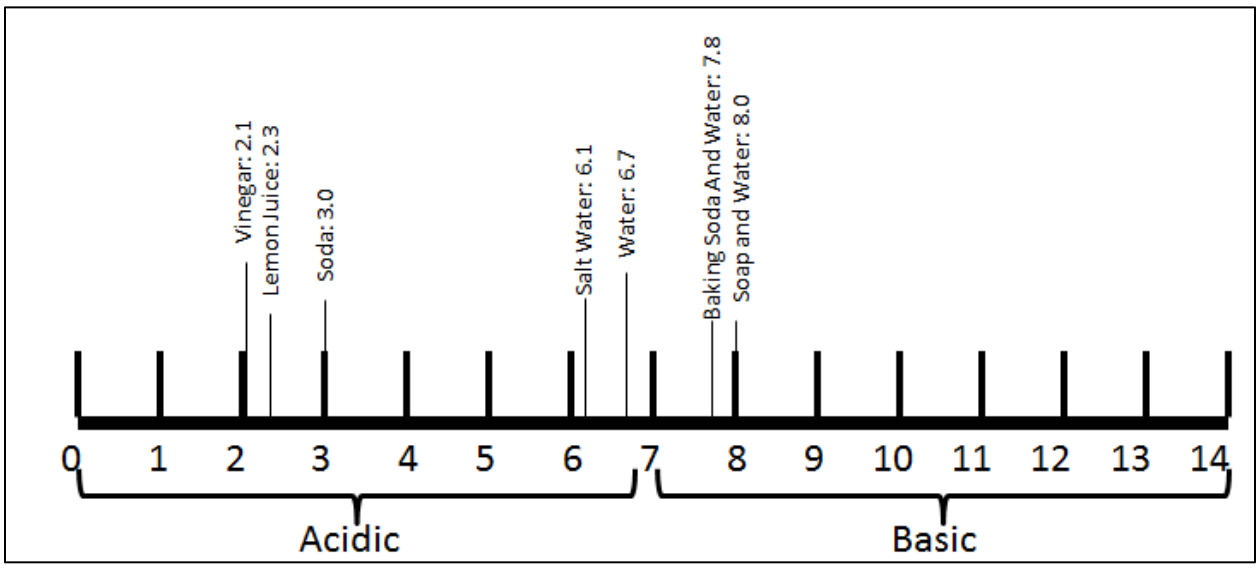
In the meantime, test the pH of each of the solutions as well as any other desired liquid. Plot each of these on a large pH scale to compare to one another. Indicate the acidic and basic sides.

After 20 minutes, remove the pennies from the solutions and rub dry. Note whether the penny is cleaner by comparing it to the control penny. Find each of the solutions used on the scale and see how their pH compares to their ability to polish.

WHAT HAPPENED AND WHY

Acid reacts with the copper on the penny to create a new solid on the surface of the penny. This new product comes off when rubbed. The resulting penny is often discolored as the acid actually corrodes the penny. Students should notice a correlation between acidity and polishing ability.

Below is an example pH scale. These pH values were found in the laboratory.



WORKSHEET: Below are two worksheets. The first would be suitable for younger age groups in grades 3-5. The second is better for older grades 6-8

REFERENCES:

All terms defined from: http://www.oxfordreference.com/ (Accessed 14 January 2016, 20 January 2016)

pH scale (from second worksheet) from: https://lsc9osciblog.files.wordpress.com/2010/09/ph-scale.jpg (Accessed 19 January 2015)

Name _____

1. **Hypothesis**: Which solutions do you think will clean the pennies most successfully? Circle two.

Vinegar	Soda
Salt Water	Water
Soap and Water	Baking Soda
Rubbing Alcohol	Lemon Juice
Glass Cleaner	Cornstarch and Water

2. **Observations**: Which substances did you choose and what were the pH levels of each of your substances?

   Substance _____ pH _____

   Substance _____ pH _____

3. **Results**:
   a. Which substances cleaned the pennies most successfully?

      _____

4. Do Acids or Bases clean pennies better? _____

Name: _____

Cleaning Pennies

QUESTION: Write a question that you are going to answer in this experiment.

_____

_____

_____

HYPOTHESIS:

Rate each substance how you think they will clean. 1=best penny cleaner, 10=worst penny cleaner.

_____ Vinegar

_____Soda

_____Salt Water

_____Water

_____Soap and Water

_____Baking Soda and Water

_____Rubbing Alcohol

_____Lemon Juice

_____Glass Cleaner

_____Cornstarch and Water

EXPERIMENT:

Why did you keep one of the matching pennies out of the solution?

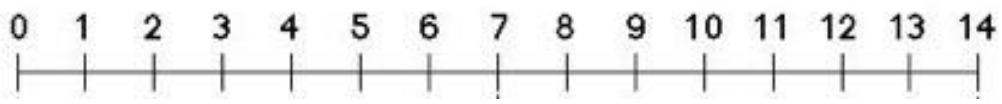
_____

_____

_____

OBSERVATIONS:

Place each of the 10 solutions on the pH scale below.



RESULTS: Once again, rate each substance on how well they cleaned: 1= best cleaner, 10= worst cleaner

_____ Vinegar _____Soda

_____Salt Water _____Water

_____Soap and Water _____Baking Soda and Water

_____Rubbing Alcohol _____Lemon Juice

_____Glass Cleaner _____Cornstarch and Water

CONCLUSIONS: What can you conclude based on the results of the experiment? Come up with three different conclusions.

1. _____

2. _____

3. _____

FURTHER QUESTIONS: What new questions did you come up with during this experiment?

_____

_____

_____