



Chemistry Lab

Teacher Resource Guide

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CHEMISTRY LAB

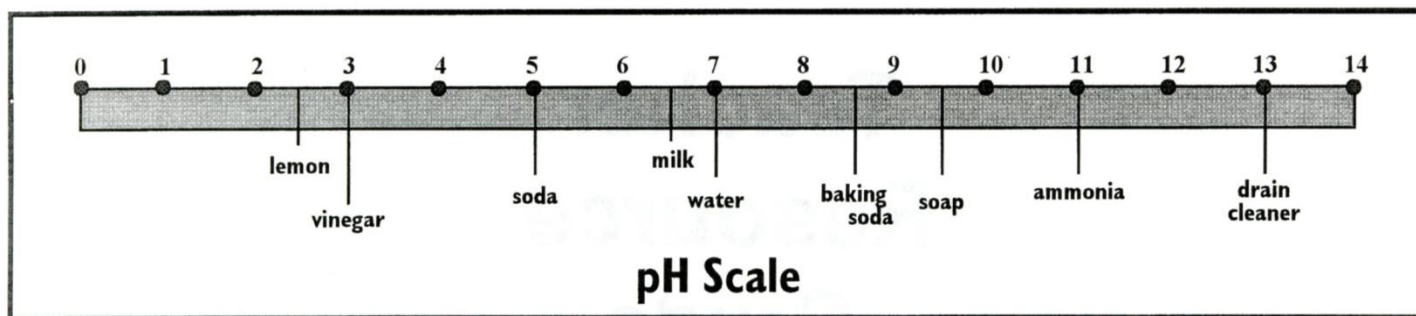
A chemical reaction occurs when two or more ingredients combine to produce a substance that is different from the original ingredients. Examples of chemical reactions are everywhere. Detergents react with grease to clean dishes. Oxygen and fuel combine to produce flames and heat. Determining and describing the properties of a substance through observation is a scientific skill particularly relevant to chemistry.

Making Turmeric Powder Indicator Paper

Indicators change color in the presence of certain chemicals, producing easily observed reactions. The indicators we use will show whether a substance is an acid or not. (Turmeric will not indicate the presence of a base.)

Acids and bases have many different definitions. For our purposes, we address how these substances react when combined with water. An acidic substance is one which, when added to water, will produce positively charged hydrogen ions (H^+). A base, when combined with water, will produce negatively charged hydroxide ions (OH^-). The more acidic the substance, the more positively charged ions it has. The more basic the substance, the more negatively charged hydroxide ions it has. When acids and bases of equal strengths react, they "neutralize" one another, because the H^+ and OH^- ions combine to form water (H_2O).

The strength of acids and bases are measured on the pH scale, which quantifies the power of the concentration of hydrogen ions able to react in any given substance. The pH scale ranges from zero to fourteen. Water has a pH of 7, which is neutral on the pH scale, with H^+ and OH^- ions present in equal amounts. Substances with a pH less than 7 are acidic, and those with a pH greater than 7 are basic. Most foods are acidic while most cleansers are basic. A pH scale looks like this and we can test whether common kitchen materials are acids or bases with the indicator paper we make.



Materials

turmeric powder
water
mixing bowl
coffee filters
scissors
baking soda
vinegar
clear plastic cups
plastic spoons
eyedroppers

Procedure

1. Mix $\frac{1}{2}$ cup water with 1 tablespoon turmeric powder in a bowl.
2. Soak coffee filters in turmeric mixture for 10 minutes or more.
3. Remove coffee filters and rinse with water.
4. Allow filters to dry.
5. Cut filters into strips.

6. Mix $\frac{1}{2}$ cup water and 1 teaspoon baking soda in a plastic cup to make the baking soda solution.
7. Use an eyedropper or dip a strip of turmeric paper into baking soda solution. It will turn reddish because baking soda is basic.
8. Use an eyedropper or dip the other side of strip in vinegar. Nothing will happen because vinegar is an acid and turmeric reacts only with bases.
9. Dip reddish side of strip in vinegar. It will turn back to yellow because acids and bases neutralize each other.

Extension

Dip some of the strips of dried turmeric paper in baking soda solution to turn them completely reddish. Take the dried red and yellow strips home and test household products to determine which are acids or bases. Acids turn reddish paper yellow. Bases turn yellow paper reddish.

Red Cabbage Juice Indicator and Grape Juice Indicator

Red cabbage and grape juice are indicators of both acids and bases. Cabbage juice is recommended, although making it requires more equipment. Cabbage juice more effectively shows whether an item is an acid or a base, as well as the relative strength of the acid or base.

Materials for Cabbage Juice Indicator Paper

1 small red cabbage
hot water
sharp knife
cutting board
blender
strainer
mixing bowl
coffee filters

Procedure

1. Cut cabbage into quarters and roughly chop one of the quarters.
2. Put chopped cabbage into the blender.
3. Add 4-5 cups hot water.
4. Blend on high for 10 seconds.
5. Strain pulp and collect juice in a bowl.
6. Soak coffee filters in red cabbage juice for 5 minutes or more.
7. Allow filters to dry.



Materials for Grape Juice Indicator Paper

grape juice
water
coffee filters
mixing bowl

Procedure

1. Soak coffee filters in grape juice for 10 minutes or more.
2. Allow filters to dry.
3. Cut filters into strips.

Materials for Experiments with Cabbage/Grape Juice Indicator Paper

clear plastic cups
plastic spoons
water, lemon juice, vinegar, lemon-lime soda (Sprite or 7-Up), baking soda and water solution, diluted ammonia, dish or hand soap, crushed Tums or Roloids dissolved in water

Experiments with Cabbage/Grape Juice Indicator Paper

1. Dip a strip of cabbage/grape indicator paper into each “chemical” listed above.
2. Observe the color change on the indicator paper.
3. Can you determine which chemicals are acidic and which are basic?

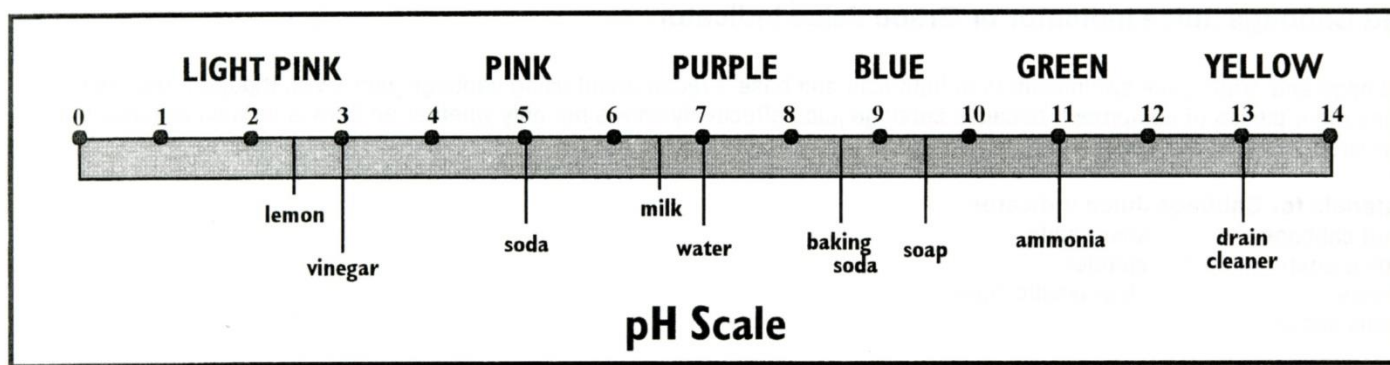
Acids turn cabbage/grape juice indicator paper pink. Bases turn cabbage/grape juice indicator paper green or blue.

Experiments with Red Cabbage Juice

1. Prepare the red cabbage juice.
2. Fill each cup (as needed) with 1/4 cup of red cabbage juice.
3. Add a different “chemical” from the above list to each cup.
4. Observe the color change in each cup.
5. Can you arrange the cups in a line resembling the pH scale? Start with the strongest acid on one end, neutral in the center, and the strongest base on the other end.

Extension

Make acid/base art using indicator papers, baking soda solution, and vinegar. Q-tips, eyedroppers, or paintbrushes work well for applying the “chemicals.”



Penny Polish Activity

In this chemical reaction, one chemical disappears (dissolves), and then reappears on another object.

Materials

tarnished pennies
small plastic container with tight-fitting lid
vinegar
salt
steel washers
paper towel

Procedure

1. Put 3-5 tarnished pennies into a container.
2. Add enough salt to cover the pennies.
3. Add vinegar to fill the container about half full.
4. Shake the container vigorously for one minute per penny.
5. Remove the pennies and observe. They should be shiny.

Extension I

Repeat the procedure without salt. Are the pennies as shiny? The acetic acid from the vinegar alone will not remove the tarnish from the penny. When salt is added to the vinegar, the tarnish (copper oxide), bonds with the dissolved salt, and is removed from the penny.

Extension II

Put a steel washer or nail in the salt and vinegar mixture after using it to clean pennies. The copper oxide from the tarnished pennies is still present, though invisible. This dissolved copper oxide will plate onto the steel. You can begin to see the results in 5 minutes, but will really notice copper on the washer after soaking it about an hour.

Resources:

Print Resources

- *Why Chemistry Matters: Acids and Bases*, Lynette Brent, Crabtree Publishing, 2008

Online Resources

- <http://www.finishing.com/faqs/pennies.html>
- <http://chemistry.about.com/cs/demonstrations/a/aa022204a.htm>