Acids and Bases

Safety Precautions

- Do NOT mix test materials with each other.
- Use only "kid safe" liquids and solutions.
- Be sure to have paper towels available to clean up spills.

Vocabulary

- acid – is a molecule or ion capable of donating a proton or hydrogen ion H+, or capable of forming a covalent bond with an electron pair
- alkalinity - the quantitative capacity of an aqueous solution to neutralize an acid, a measurement of the strength of a base in a solution
- base – substances that, in a solution, are slippery to the touch, taste astringent, change the color of indicators, react with acids to form salts, accept protons from any proton donor, and contain completely or partially displaceable OH^- ions
- ion – an atom or a molecule in which the total number of electrons is not equal to the total number of protons, resulting in an atom or a molecule a net positive or negative electrical charge
- litmus paper – paper that contains a water soluble mixture of different dyes extracted from lichens, which is used to indicate whether a substance is an acid or a base
- lichen - a composite organism that arises from algae and/or cyanobacteria living among filaments of a fungus in a symbiotic relationship
- molecule – an electrically neutral group of two or more atoms held together by chemical bonds
- pH – "potential hydrogen," a numeric scale used to specify the acidity or basicity of a solution or liquid
- proton – a positively charged particle in the nucleus of an atom

Materials and Equipment

- blue litmus paper
- red litmus paper
- small clear plastic cups
- soil solution
- soda
- vinegar
- lemon juice
- tea
- baking soda solution
- milk
- cream of tartar solution
- dish soap solution
- toothpaste solution
- antacid solution
- tonic water
- rain water
- tap water
- other "kid-safe" liquids and solutions (optional)

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Questions

1. Which of the liquids and solutions in this lab are acids?
2. Which of the liquids and solutions in this lab are bases?

Research

Acids are used to manufacture fertilizers, paints, dyes and man-made fibers; bases are used to produce fabrics, cleaning agents and paper. Diluted acids are used in salad dressings and occur in vegetables, giving food a distinctive taste. For example, vinegar contains 3 percent acetic acid. Citrus fruits have citric acid. Aspirin contains acetylsalicylic acid, and wine has tartaric acid.

Acids in stomachs help food digest, but an imbalance of those acids can result in indigestion. Too much acid is dangerous, as it may corrode the stomach lining, but antacids manufactured from bases can be used to neutralize excess stomach acid.

Acid rain includes any form of precipitation with acidic components, such as sulfuric or nitric acid that fall to the ground from the atmosphere, which include rain, snow, fog, hail and acidic dust. Thes particles can cause health problems. Nitrogen oxides cause ground-level ozone which can cause respiratory problems, like pneumonia and bronchitis. Acid rain can be extremely harmful to forests, and if it seeps into the ground, it can dissolve nutrients, such as magnesium and calcium, that trees need to be healthy. Acid rain also causes aluminum to be released into the soil, which makes it difficult for trees to take up water. This increase in acidity and aluminum levels can be deadly to aquatic wildlife, including phytoplankton, fish, frogs, and other creatures part of the food web. Acid rain can damage buildings, statues, monuments, and cars.

Bases have a bitter taste and are not recommended for human consumption. Some substances contain nitrogen-rich bases such as caffeine and nicotine frequently used by humans. Tonic water draws its bitter taste from the alkaloid quinine. Bases are used in cleaning detergents for their characteristic slippery nature.

pH is the measurement given to determining the acidity and basicity of a solution. The pH range is 1-14, where 1 is highly acidic and 14 is highly basic. A neutral pH is 7. Blue litmus paper turns red in an acid, and does not change color in a base. Red litmus paper turns blue in a base, and does not change color in an acid. If neither litmus paper changes color, the liquid or solution is neutral.
(Sources: https://www.reference.com/science/importance-acids-bases-7216aa505865b4a7#, https://www3.epa.gov/acidrain/education/site_students/whyharmful.html)

Hypothesis

What is <u>your</u> hypothesis? Be sure to include your "best guess" answers to the 2 questions above.
1.

2.

Experiment

1. Label a small plastic cups for each of the solutions and liquids.
2. Fill each small plastic cup about 2/3 full of each solution or liquid.
3. Test each solution and liquid with a different blue and a different red litmus paper test strip.
4. Record your observations and data.

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Data and Observations

Liquid or solution	Turns red litmus paper blue? yes or no	Turns blue litmus paper red? yes or no	Acid, base or neutral?
soil solution			
soda			
vinegar			
lemon juice			
tea			
baking soda solution			
milk			
cream of tartar solution			
dish soap solution			
toothpaste solution			
antacid solution			
tonic water			
rain water			
tap water			

Analysis

1. Which acids did you guess correctly?

2. Which basis did you guess correctly?

Conclusions

Testing substances to determine whether they are acids, bases, or neutral is simple and can be done quickly using litmus paper. Acidity and basicity are relevant in nutrition, the environment, industry, and, daily life.

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