STEM Sims™

Acid-Base Basics

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Do you need an idea for a scientific study?
Try out one of our ideas or make one of your own.

The human body has a relatively strong acid solution of hydrochloric acid in the stomach to aid in the process of digestion. What does it mean to be a strong acid? Take the following brief quiz to see how much you already know about acids and bases. See the bottom of page 4 to check your answers.

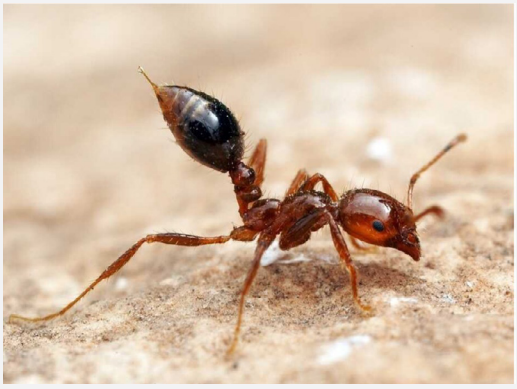
1. When a fire ant stings a person, what are they injecting in the person that causes the pain and burning sensation?
   a. sulfuric acid
   b. sodium hydroxide
   c. formic acid
   d. ammonia

2. Many underground caverns made of limestone were created by the action of:
   a. moles.
   b. tornadoes.
   c. earthquakes.
   d. acid rain.

3. Changing the soil's pH can change the color of the flowers on some species of hydrangeas.
   a. true
   b. false

4. Which substance is most used to unclog a stopped-up drain?
   a. sulfuric acid
   b. sodium hydroxide
   c. formic acid
   d. ammonia

5. All the following have an acid as a critical part *except*:
   a. proteins.
   b. vitamin C.
   c. car batteries.
   d. antacid tablets.



Acid Rain

Acid rain is defined as any type of precipitation that has a pH less than 5.6. Since neutral pH is 7, the less than 7 pH means the substance is an acid. The lower the pH, the stronger the acid. Acid rain is created when certain chemicals move into the atmosphere. Sulfates and nitrates released into air are associated with increases in acid rain. In this activity, you'll investigate the effects of acid rain on various materials. (Water pH = 7.0, Vinegar pH = 3, and Lemon Juice pH = 2.)

Materials

1 – cup distilled water	1 – cup vinegar	1 – cup lemon juice
3 – small green leaves	3 – pieces of chalk	3 – small nails
3 – small jars with lids	masking tape and pen	safety glasses

Procedure

1. Make sure that you get permission before conducting this experiment.
2. Do not eat or drink any materials used in this activity.
3. Place your safety glasses on your eyes!
4. Place one leaf, one piece of chalk, and one nail in each of the three jars.
5. Pour one cup of water in the first jar.
6. Pour one cup of vinegar in the second jar.
7. Pour one cup of lemon juice in the third jar.
8. Use the masking tape and pen to label the lid of each jar with the liquid inside the jar.
9. Record in Table 1 under the "Prediction" column what you think will happen in each jar.
10. Each day for one week, record in Table 1 your observations of each jar.
11. At the end of one week, properly dispose of the materials and liquids in the jars. Make sure to wash your hands after cleaning the materials.

Table 1. Investigation Results

	Water Jar	Vinegar Jar	Lemon Juice Jar
Prediction			
Day 1			
Day 2			
Day 3			
Day 4			
Day 5			
Day 6			
Day 7			

Questions

1. Describe which materials were and were not affected by each of the liquids

2. Provide an explanation of why the changes in each jar occurred over the course of the week.

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A Planter's Guide to Soil pH

Different plants grow best in certain types of soil. The pH of the soil is one factor that determines which plants will thrive and which will not produce as expected. The phrase "soil reaction" is a measure of the acidity or alkalinity of the soil.

Soil pH affects the activity of microorganisms responsible for breaking down organic matter and most chemical transformations in the soil. The type and population densities of microorganisms change with pH. A pH of 6.6 to 7.3 is favorable for microbial activities that contribute to the availability of nitrogen, sulfur, and phosphorus in soils.

Soil pH influences the solubility of nutrients, therefore affecting the availability of several plant nutrients. A pH range of 6 to 7 is generally most favorable for plant growth because most plant nutrients are readily available in this range. However, some plants have soil pH requirements above or below this range.

Soils that have a pH below 5.5 generally have a low availability of calcium, magnesium, and phosphorus. At these low pH's, the solubility of aluminum, iron, and boron is high; and low for molybdenum.

At pH 7.8 or more, calcium and magnesium are abundant. Molybdenum is also available if it is present in the soil minerals. High pH soils may have an inadequate availability of iron, manganese, copper, zinc, and especially of phosphorus and boron.

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Answers: Page 2 Answers: 1) c, 2) d, 3) a, 4) b, 5) d. **Page 3 Answers**: Acid Rain 1) The water jar did not affect the materials inside that jar. The vinegar and lemon juice jars affected the chalk and the leaf, but did not affect the nail. 2) Answers will vary. Might include the acid in the vinegar and lemon juice jars reacted with the substances that made up the leaf and chalk.