◆ ANSWER KEY

Blackline Master #1, Pre-Test

1. True
2. False
3. True
4. True
5. False
6. False
7. True
8. True
9. False
10. False

Blackline Master #2b, Use the Right Word

1. acid
2. base
3. acid rain
4. electrolytes
5. litmus or indicator
6. neutralization
7. pH
8. positive
9. H^+
10. OH^-

Blackline Master #2c, Word Match

acid- can donate a hydrogen atom

anion- negatively charged ion

base- can accept a hydrogen ion

cation- positively charged ion

electrolytes- good conductors of electricity

H^+ ion- positive hydrogen ion

litmus paper- acids turn it red, bases turn it blue

proton- positively charged particle

strong base- solution with a pH between 10 and 14

weak acid- solution with a pH between 4 and 6

is 10-7 mole per liter, or one ten-millionth of a mole per liter. Although these are incredibly small amounts, they are measurable and determine whether a solution is an acid or a base.

In 1909, a Danish biochemist, Søren Sørensen, proposed a way of measuring the concentration of H_3O^+ ions in solutions, and in the process, measure their acidity and basicity. It is known as the potential hydrogen or, pH scale. This is the pH scale. Some common solutions and products are listed above, the pH scale is in the center, and the measure of H_3O^+ is shown below.

The pH scale is a measurement of the amount of H_3O^+ ions in the solution. Water is 10^{-7} mole. The others range from 10^{-1} to 10^{-14}. The pH number comes from the exponent. Notice that water with a pH of 7 is right in the middle of the scale. All of the solutions lower than 7 are acids, and all those higher than 7 are bases. Lemon juice, for example, is an acid. It has a measure of about $10^{-2.5}$ H_3O^+ ions in the solution. On the pH scale, lemon juice measures 2.5. Bleach, on the other hand, is a strong base and measures 12.5 on the pH scale. It has about $10^{-12.5}$ H_3O^+ ions in the solution.

At first glance, the pH scale seems complicated, but it is really an ingenious measurement of the acidity and basicity of compounds and a very useful chemistry tool.

THE pH IN THE CHEMISTRY OF NATURE

The acidity and basicity of compounds is at the heart of chemistry, and many people from farmers to medical personnel must know about the impact of pH levels if they are going to be effective in their work. Many substances act as acids or bases and they react with other substances all of the time.

Plants generally prefer neutral soil with pH ranging from 6 to 8, but each plant species is a little different. Roses, for example, prefer a slightly acidic soil of between pH 5.8 and 6.2. Peonies, on the other hand, may not flower if the soil is too acidic. Gardeners interested in having the most vibrant colors and

Name _____

2a

ACIDS, BASES, AND SALTS from the *Elements of Chemistry Series* Vocabulary Definitions

The following words and terms used in the program may be unfamiliar to you. Try to listen for these terms while viewing the program, pay close attention so you can later include them in your scientific descriptions, observations, and creative writing assignment activities.

acid - According to the Brønsted-Lowry definition, an acid is any substance that can donate a hydrogen ion.

acid rain - Rainfall that is acidic, below 5.6 on the pH scale.

anion - Negatively charged ion.

Arrhenius, Svante (1859-1927) - Swedish chemist.

atom - The fundamental unit of matter in the universe, made up of a nucleus of protons and neutrons and orbiting electrons.

atomic number - The number of an element determined by the number of protons in its nucleus.

base - According to the Brønsted-Lowry definition, a base is any substance that can accept a hydrogen ion.

Boyle, Robert (1627-1691) - English chemist. Boyle is often called the father of modern chemistry.

Brønsted, Johannes (1879-1947) - Danish chemist.

cation - Positively charged ion.

chemical reaction - A change in the chemical composition of a substance.

conjugate acid-base pair - An acid and a base that differ by only one H^+ ion.

compounds - When valence electrons of elements are lost, gained, or shared between different atoms to create substances with unique chemical properties.

electrolytes - Substances that are good conductors of electricity.

electrons - Negatively charged particles that orbit the nucleus of atoms.

element - An atom with a unique number of protons.

hydrogen - Element with the atomic number 1. Hydrogen is the most common element in the universe.

H^+ ion - A positive hydrogen ion composed of one proton.

indicator paper - Paper that indicates whether a substances is an acid or a base. Litmus paper is a common type of indicator paper.

ion - Atoms with more electrons than protons or less electrons than protons.

ionic bonds - Two or more ions held together by the electrical attractions between them.

litmus paper - A special type of paper that can determine if a solution is an acid or a base. An acid turns litmus paper red and a base turns it blue.

Lowry, Thomas (1847-1936) - English chemist.

matter - Material that makes up objects. Matter cannot be created or destroyed.

molecules - When electrons are shared between atoms. Molecules are covalent bonds.

negative ion - An ion that has more electrons than protons.

neutral atom - When an atom has an equal number of protons and electrons, its electrical charges are balanced and the atom has a neutral electrical charge.

neutral acid or base - A solution that has a pH of 7 and is both an acid and a base. Pure water, H_2O, has a pH of exactly 7.

neutralization - A process where acids and bases react so that the properties of both are lost to form water and a salt.

OH^- ion - A hydroxide ion composed of an oxygen atom and a negative hydrogen ion.

periodic table - The arrangements of elements according to their atomic number.

pH scale - the potential hydrogen scale is a measurement of the concentration of H_3O^+ ions in solutions to indicate whether the solution is an acid or a base.

positive ion - An ion that has fewer electrons than protons.

proton - Positively charged part of the nucleus of atoms.

Sørensen, Søren (1868-1939) - Danish chemist.

strong acid - An acid with a pH of between 0 and 4.

strong base - A base with a pH of between 10 and 14.

weak acid - An acid with a pH of between 4 and 6.

weak base - A base with a pH of between 8 and 10.

Name _____

2c

ACIDS, BASES, AND SALTS from the *Elements of Chemistry Series*
Word Match

Directions: Connect the word with the proper definition.

acid	positively charged ion
anion	solution with a pH between 10 and 14
base	solution with a pH between 4 and 6
cation	acids turn it red, bases turn it blue
electrolytes	positively charged particle
H^+ ion	negatively charged ion
litmus paper	can accept a hydrogen ion
proton	can donate a hydrogen atom
strong base	positive hydrogen ion
weak acid	good conductors of electricity

Name _____

5

ACIDS, BASES, AND SALTS from the *Elements of Chemistry Series*
Creative Writing Story Ideas

Directions: Choose from one of the ideas listed below and write a story or dramatization. Include plot lines that follow scientific principles and key vocabulary terms.

1. Three students are experimenting with acids and bases. One carelessly spills acid on the hand of another student. Write a story focusing on the characters of the students and explain the incident.

2. It has been five years since a chemist knocked on the door of a remote farmhouse to explain to the farmer that using fertilizer that gives the correct pH level to the soil could dramatically increase the yields of the farm. Describe what has happened to the farmer and his family since that fateful day.

3. A group of students involved in a research project has discovered that acid rain is damaging the forests and aquatic life in a pristine wilderness near their home. They have traced the source of the pollution to a coal-fired power plant generating electricity for a nearby city. An appointment has been made for the students to bring these findings to a political committee responsible for pollution issues. One of the students has been elected the spokesperson for the group. Write the speech that the student will give to the committee.

4. A research chemist has found a very strong acid that is almost 0 on the pH scale. The difficulty is that the acid is so strong, it eats through any container in which it is stored. Describe what happens.

5. An "evil" genius is plotting to take over the world by manipulating acids and bases. The forces of "good" uncover the plot and set in motion plans to neutralize the threatening acids and bases. Write a humorous film script or story that dramatizes the outrageous characters and describe the adventure.

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