Reading Essentials in Science

Chemistry Clues

Acids and Bases

Jenny Karpelenia

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For the Teacher

CHEMISTRY CLUES

Acids and Bases

Genre

Expository

Text Features

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Vocabulary

acid	base	compound	corrosive
indicator	ion	molecule	neutral
neutralization	pH	pigment	reactive
salt	scaling	solution	

Overview

A "tour" introduces many of the acids and bases found in most homes. Background information on atoms and ions is provided for a better understanding of how acids and bases are defined. An ion is an atom with a positive or negative charge.

Acids are compounds that release hydrogen ions. They are proton donors. Acids taste sour, turn blue litmus paper red, conduct electricity in solution, form gases during certain reactions, and react with bases to form a salt and water. Hydrochloric, sulfuric, carbonic, ascorbic, and citric acids are common acids.

Bases are compounds that release hydroxide ions or accept hydrogen ions. They are proton acceptors. Bases taste bitter, feel slippery, turn red litmus paper blue, conduct electricity in solution, and react with acids to form a salt and water. Sodium bicarbonate, sodium hydroxide, and ammonia are common bases.

Indicators are materials that determine whether a substance is an acid, a base, or neither (neutral). Litmus paper, bromothymol blue, phenolphthalein, and many plant pigments are indicators.

The measure of the strength of an acid or base is called *pH*. The pH scale is a range of pH values from 0 to 14. Neutral substances are a 7. Substances with pH levels below 7 are acids. Substances with pH levels above 7 are bases.

Acids and bases are at work in the ground, in the air, and in the water. They perform important jobs in the human body. Many foods and products wouldn't exist without acids and bases. Examples of these everyday acids and bases are featured.

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CHAPTER 1

A Tour of Acids and Bases

The tour bus is now departing. Please climb aboard for a home tour. We will peek inside cabinets. We will read labels. What are we looking for? We're searching for **acids** and **bases**.

Acids and bases are very useful around the house. You'll find them in baking products, medicines, cleaning agents, and more.

But be careful. These substances can be very dangerous. Strong acids and bases can burn your skin. Many of them are not edible and can make you sick. But if you're willing to risk the danger, hop on the bus for an acid and base tour of your home.

FIRST STOP: THE KITCHEN

The first stop is the kitchen. Open some of the cabinets and you'll find a variety of acids and bases. Baking powder and baking soda contain chemical bases. Vinegar is made from acetic acid. The loaf of whole grain wheat bread is a good source of folic acid.

Check the refrigerator. Vinegar-and-oil salad dressings are acidic. Soda tastes tart because it has carbonic acid. Lactic acid gives yogurt and buttermilk its sour taste. Reach in the back for that jar of pickles. The pickle juice contains acetic

acid. Open up the fruit and vegetable drawer. Many fruits, such as apples and oranges, contain citric acid. Look at the labels of real fruit juices. You'll notice that citric acid is a common ingredient. It gives the juices their tangy flavor.

Now search around and under the kitchen sink. Bases in dish soap and dishwasher detergent give them their cleaning power. Window and floor cleaners often contain bases. The oven cleaner you use to get the burned food off the bottom of your oven does too.

NEXT STOP: THE BATHROOM

Climb back on the bus. The next stop is the bathroom. Look at all the tubes and bottles sitting around the sink and in the shower. Toothpaste, shampoo, and hand and body soaps all contain bases.

Open the cabinets under the sink. Toilet bowl cleaner contains a weak acid. The drain cleaner that breaks up all the hair that clogs your drains has a strong base.

The medicine cabinet is another storage area for acids and bases. Aspirin is an acid. Antacids are bases used to calm an upset stomach.

FINAL STOPS: THE LAUNDRY ROOM AND THE GARAGE

The final stop on the tour is the garage. On the way to the garage, we pass by the laundry room. The laundry detergent sitting next to the washing machine is a base. The spot removers in the cabinet may be too.

We reach the garage. A very strong acid is stored in the battery under the hood of the family car. Two bags of lawn fertilizers sit on a garage shelf. These strong bases help the grass grow thick and green.

THE END OF THE TOUR

The tour bus is now unloading. Thank you for traveling with us and being safe during the tour. Watch your step as you continue to learn more about acids and bases.

CHAPTER 2

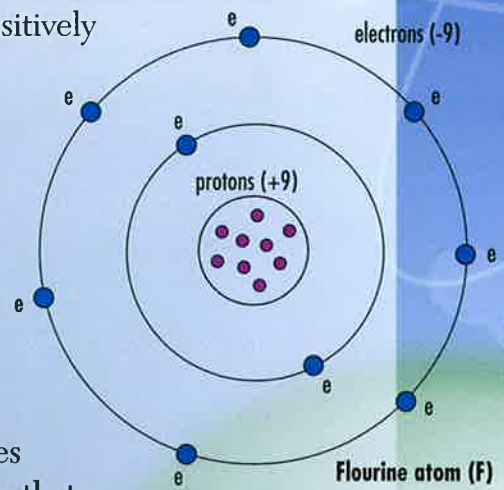
Background Information for Acids and Bases

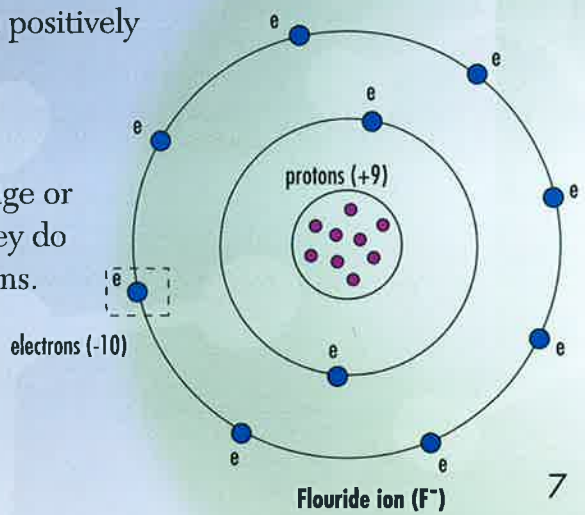
So what *are* all these acids and bases that you found on your tour? They both begin with atoms and **ions**.

Atoms are the tiny pieces of matter that make up all things. Normally atoms are neutral. This means that they have an equal number of positively charged protons and negatively charged electrons. The positive and negative charges balance one another, so the atom has a neutral charge.

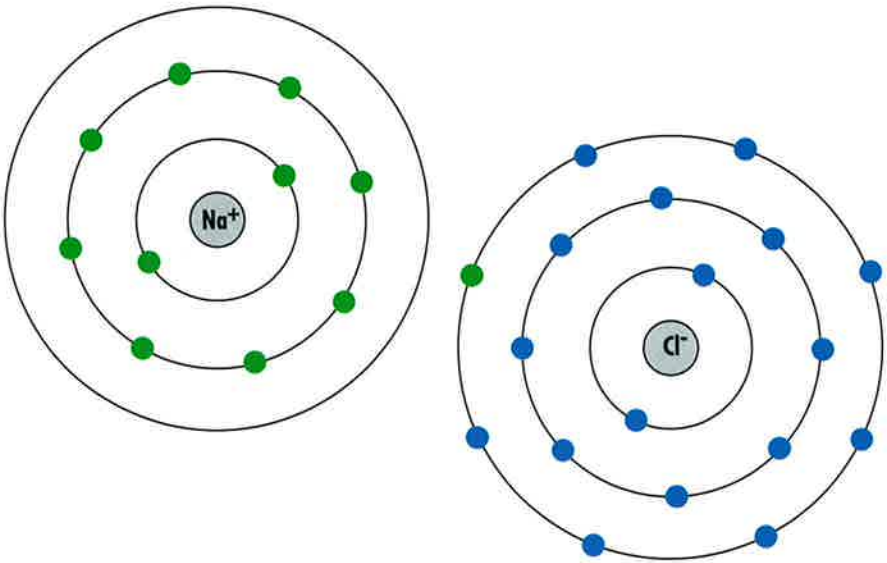
When an atom gains or loses electrons, it becomes an ion. Ions are atoms with a positive or negative charge. An atom that gains electrons becomes a negatively charged ion. An atom that loses electrons becomes a positively charged ion.

When atoms combine with one another to form **compounds**, they exchange or share electrons. When they do this, the atoms become ions.





For example, when sodium and chlorine join together, the sodium atom gives one of its electrons to the chlorine atom. This makes the sodium and chlorine ions because now the sodium has one less electron than protons and the chlorine has one more electron than protons. The sodium now has a charge of +1, while the chlorine has a charge of –1.



Acids and bases are compounds that either gain or lose a specific type of ion when they react with other substances.

Notes on Writing Ions

Every element can be abbreviated. Sodium, for example, is Na and chlorine is Cl. When an element becomes an ion, a positive or negative charge is added to its abbreviation—for example, Na^+ and Cl^-.

If only one electron is gained or lost, just the $^-$ or $^+$ symbol is used. If more than one electron is gained or lost, then the number of electrons exchanged goes before the symbol. For example, when an atom of oxygen gains 2 electrons, it is written like this: O^{2-}.

CHAPTER 3

Answers About Acids

An acid is a compound that releases hydrogen ions when dissolved in water. Hydrogen ions (H^+) are hydrogen atoms that have given away their only electron so they are no longer neutral. The hydrogen ion now has a positive charge. Acids are, therefore, also known as proton donors.

PROPERTIES OF ACIDS

Acids have certain chemical properties that classify them as acids. Acids taste sour. In fact, the word *acid* comes from the Latin word *acere*, which means "sour." If you've ever tasted lemon juice, vinegar, or aspirin (before you swallow it), you've experienced the sour taste of an acid. You should never, however, try to taste nonedible or unknown acids because they may burn or poison you before you have a chance to notice their sour taste.

Another property of acids is their effect on litmus paper. Litmus paper is paper that has been soaked in a blue **pigment** called *litmus*. Litmus turns red when it comes in contact with an acid, so acids turn blue litmus paper red.