Table of Contents

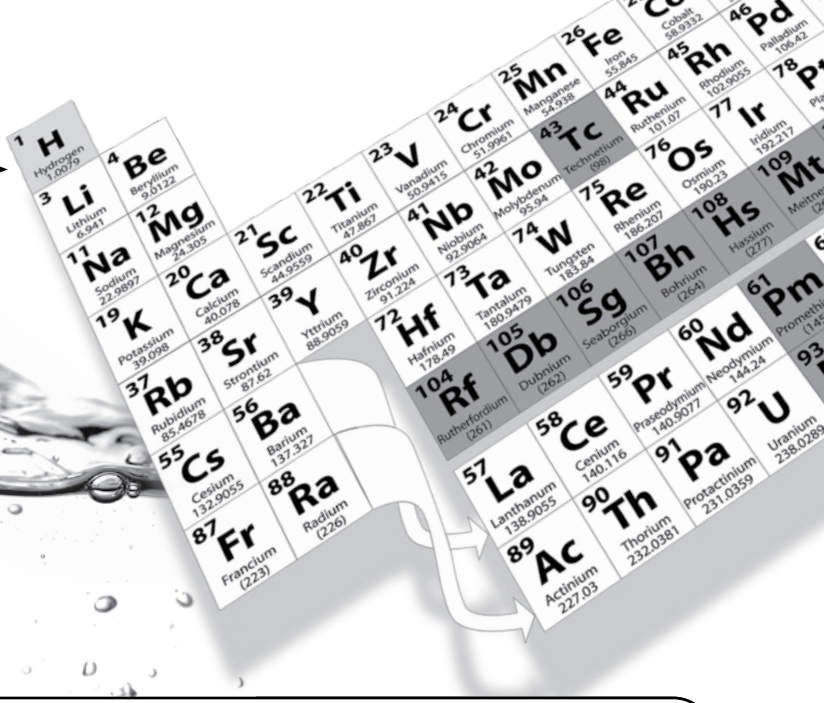
Elements of the Periodic Table

Elements in Action

1
H
1.0079

HYDROGEN: "Forming Water"

"And the Spirit of God moved upon the face of the waters." (Gen. 1:2)



DATA

> Hydrogen is the most abundant element in the universe, making up over 90 percent of it.

> It was discovered in 1766 by the English chemist Henry Cavendish, who later (1781) showed that water was formed by the combustion of hydrogen in air.

> The word hydrogen comes from two Greek words: *hydros* and *genes,* meaning "water forming."

> As a gas, hydrogen is a diatomic molecule with the formula H•H or H_2.

> The formula for water is H_2O.

ANALYSIS

In all of nature, there is nothing quite so beautiful and yet so simple as water. Science gives us a special appreciation for it. Two tiny hydrogen atoms and a single oxygen combine to form the most abundant compound on earth, so common we may be tempted to take it for granted. From a delicate crystal snowflake to the mightiest ocean wave . . . from the clouds of a blazing sunset to a raging waterfall . . . all of these wonders of creation owe their beauty to the unique boomerang shape of the humble little molecule, H_20.

WHAT MAKES WATER UNIQUE? Water, made up of just three small atoms, is considered to be a "light" molecule. Most molecules of similar size (methane [CH_4], ammonia [NH_3], carbon dioxide [CO_2], etc.) are gasses at normal temperatures on earth. But water is a liquid. Why? It is largely due to a phenomenon scientists call the "hydrogen bond," although it is hardly a bond at all. It is just a fleeting attraction among water molecules as they pass each other.

WHAT ARE HYDROGEN BONDS? Although the three atoms in a water molecule share their ten electrons, that sharing is not equal. It is like a very large person and a very thin person sharing a bed on a cold night; the larger one is likely to get more than his share of the blanket. Likewise, in H_20, the oxygen atom "hogs" more than its share of electrons, giving it a slight negative charge and leaving each positively charged hydrogen nucleus partially exposed. This distribution of charge, along with water's boomerang shape, causes a "tug" between the oxygen in one molecule and the hydrogen in another. This causes water to stick together and remain liquid when other light molecules would evaporate. Without hydrogen bonding, water would boil away at about 150°F below zero! This and other unique properties of water caused by hydrogen bonding allow life to exist.

WHY DOES ICE FLOAT? Hydrogen bonds cause water molecules to arrange themselves in a certain way as the temperature nears freezing, making ice lighter than liquid water, causing it to float. (Water is one of the few substances in which the solid form is lighter than the liquid; another is Bismuth, element no. 83.) Without ice's buoyancy, lakes and rivers in cold climates would freeze solid and remain frozen much of the year.

WHY IS WATER BLUE? Hydrogen bonds absorb certain wavelengths of light to make large quantities of water appear blue.

When we experience the coolness of a drink of water or the comfort of a warm bath, the graceful waves of the sea or the beauty of a sunset, let us never cease to marvel at the wisdom of our Maker, the Creator of the hydrogen bond.

REACTION: *LIVING WATER*

Today we have many varieties of water to choose from: bottled water, tap water, mineral water, softened water, imported water, and more. But there is a type of water that will never be bought or sold: living water.

When Jesus met a woman at a well in Samaria, He told her that His followers would receive "living water" that would give them eternal life. He said". . . whoever drinks of this water [Greek: *hydros*] will thirst again, but whoever drinks of the water that I shall give him will never thirst. But the water that I shall give him will become in him a fountain of water springing up into everlasting life" (John 4:10–14).

Later John explains (in John 7:39) that living water is actually the Holy Spirit, the same Spirit that moved upon "the face of the waters" in Genesis 1:2. And at the other end of the Bible, in Revelation, we read that living water is free and available to all, when Jesus invites us to . . .

"Come. And let him that is athirst come. And whosoever will, let him take the water of life freely" (Rev. 22:17; KJV).

Just as physical water is needed for biological life, "living water" is vital for our life and growth as Christians. No athlete can compete without consuming enough water, and we cannot expect to grow and prosper in our Christian lives unless we have a healthy amount of the "water of life" in our spiritual diets. All we have to do is ask.

1. What force causes water molecules to be attracted to each other?

   a. gravity b. magnetism c. hydrogen bonding d. diffusion

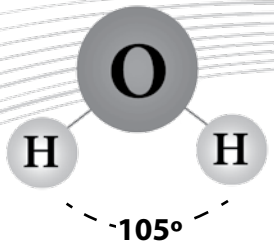
2. Which of the following best describes the shape of a water molecule?

   a. cross b. barbell c. boomerang d. triangle

3. TRUE or FALSE: The hydrogen and oxygen atoms in a water molecule share their electrons equally.

4. The Greek word for "water" is _____. (Fill in the blank.)

5. Hydrogen makes up more than _____ percent of the universe.



The water molecule is shaped like a boomerang.

RESPONSE

"Heavenly Father, thank You for the beauty of our created world. Thank You for the enjoyment we can receive from even the simplest of Your gifts, water itself.

"Give me the gift of living water, so that my soul will be satisfied, and so that I will have the strength each day to do the work You have set before me. Amen."