SECTION

2.1 Atoms, Ions, and Molecules

Student text pages 36–39

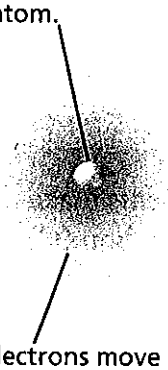
KEY CONCEPT All living things are based on atoms and their interactions.

Living things consist of atoms of different elements.

Every physical* thing that you can think of, living or not living, is made of very small particles called atoms. An **atom** is the smallest basic unit of matter, or of any physical substance*. A frog, a car, and your body are all made of atoms.

Atoms

An atom is made up of three types of smaller particles: protons, neutrons, and electrons. Protons and neutrons form the center of an atom, called the nucleus. Electrons are much smaller and form the outer part of the atom. Protons have a positive electrical charge, and electrons have a negative electrical charge. Neutrons have no charge; they are neutral. Atoms have an equal number of protons and electrons, so they are electrically neutral.



Elements

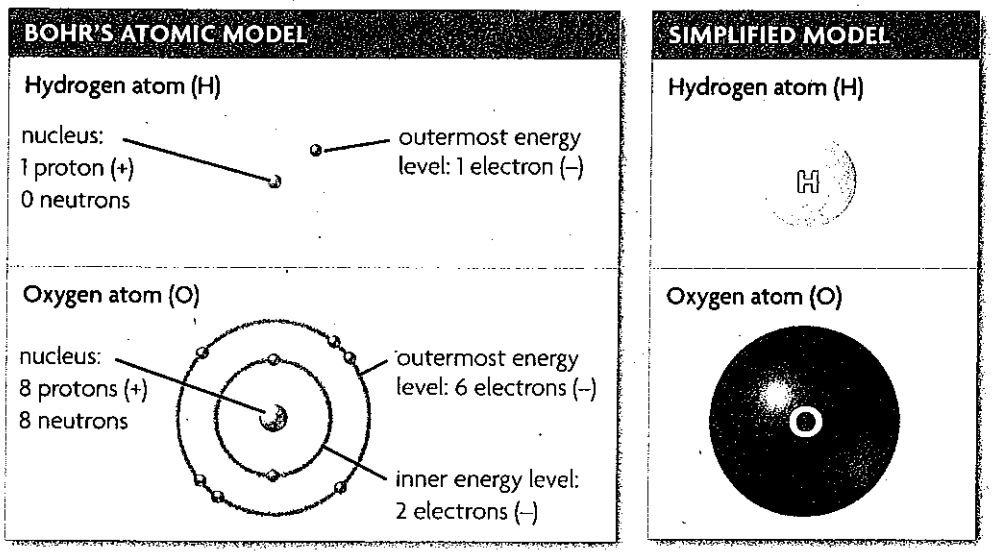
An **element** is one particular type of atom. An element cannot usually be broken down into a simpler substance. Hydrogen, oxygen, aluminum, and gold are all familiar elements. But what makes one element different from other elements? The atoms of each element have a unique number of protons. There are 91 elements that occur naturally on Earth. Only about 25 of those elements are found in living things.

Imagining something as tiny as an atom can be hard. Scientists have come up with different models to try to show what an atom looks like or to show how atoms interact. In the figure on the next page, Bohr's atomic model shows that electrons surround the nucleus in regions called energy levels. Each energy level can hold a different number of electrons. The simplified model shows atoms as balls that differ in size and color.

* ACADEMIC VOCABULARY

physical related to something real, that can be touched or seen, not an idea

substance something physical, or a kind of matter



Just 4 elements make up 96 percent of the human body's mass*. These elements are carbon (C), oxygen (O), nitrogen (N), and hydrogen (H). The other 4 percent of your body consists of mostly calcium (Ca), phosphorous (P), potassium (K), sulfur (S), sodium (Na), and iron (Fe).

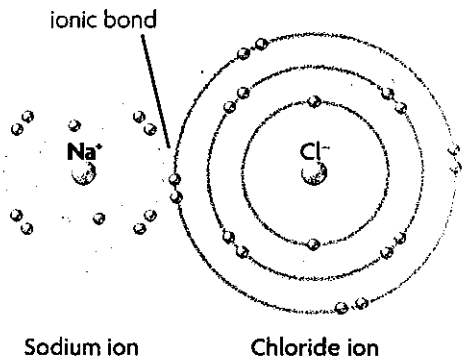
Compounds

The atoms of elements found in organisms are often linked, or bonded, to other atoms. A **compound** is a substance made of atoms of different elements bonded together in a certain ratio. Water (H_2O) is a compound of two hydrogen atoms and an oxygen atom. The properties of a compound can be different from the properties of the elements that make up the compound. For example, hydrogen and oxygen are both gases on Earth, but together they can form water. Similarly, a diamond is made of the element carbon, but carbon can also be part of sugars, proteins, and millions of other compounds.

INSTANT REPLAY How are atoms, elements, and compounds related?

Ions form when atoms gain or lose electrons.

An **ion** is an atom that has gained or lost one or more electrons. Some ions have a positive charge ($^+$) and some ions have a negative charge ($^-$). The charge gives the ion special properties.



The positive sodium ion (Na^+) and negative chloride ion (Cl^-) attract each other and form an ionic bond.

* ACADEMIC VOCABULARY

mass the total amount of matter in an object

Ions are important in living things. For example, calcium ions (Ca^{2+}) are needed for every muscle movement in your body. Chloride ions (Cl^-) are important for a type of chemical signal in your brain.

Positive ions, such as sodium (Na^+), are attracted to negative ions, such as chloride (Cl^-). An **ionic bond** forms between a positively charged ion and a negatively charged ion. Salt, or sodium chloride (NaCl) is held together by an ionic bond.

INSTANT REPLAY How does an atom become an ion?

_____

Atoms share pairs of electrons in covalent bonds.

Some atoms do not easily gain or lose electrons. Instead, the atoms of many elements will share pairs of electrons. A **covalent bond** forms when atoms share a pair of electrons. A **molecule** is two or more atoms held together by covalent bonds. For example, oxygen (O_2) and water (H_2O) are molecules.

INSTANT REPLAY What kind of bond unites the atoms in a water molecule?

_____

2.1 Vocabulary Check

atom
element
compound
ion
ionic bond
covalent bond
molecule

Mark It Up

Go back and highlight each sentence that has a vocabulary word in **bold**.

1. Name two types of bonds. _____
2. The smallest basic unit of matter is called a(n) _____.
3. One type of atom, such as hydrogen, is called a(n) _____.
4. A(n) _____ is an atom that has gained or lost an electron.
5. _____ and _____ are two words that mean a substance made of atoms that are bonded together.

2.1 The Big Picture

6. What is the difference between an ion and an atom?

_____

7. Name five elements that make up the molecules in living organisms.

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