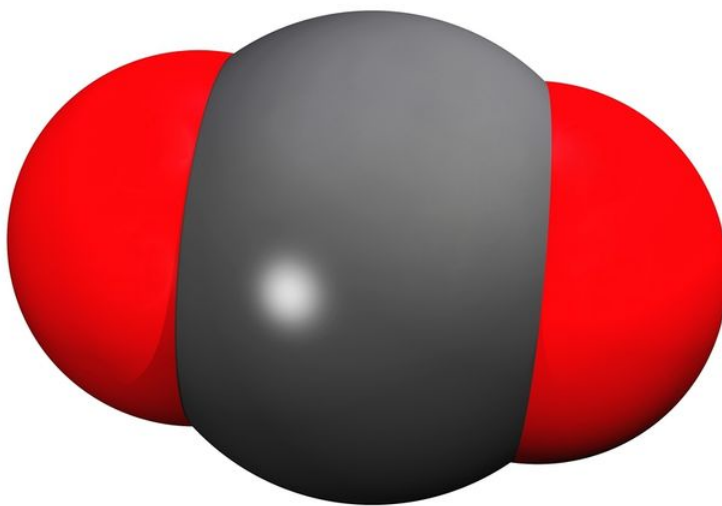


CONCEPT

1

Compounds and Chemical Formulas-SWS

- Define compound, and give examples of compounds.
- Contrast the properties of compounds and the properties of the elements that form compounds.
- Describe crystals and molecules.



What is this strange-looking object? Can you guess what it is? It's a model of a certain type of matter. Some types of matter are elements, or pure substances that cannot be broken down into simpler substances. Many other types of matter are compounds. The model above represents a compound. The compound it represents is carbon dioxide, a gas you exhale each time you breathe.

What Is a Compound?

A **compound** is a unique substance that forms when two or more elements combine chemically. For example, the compound carbon dioxide forms when one atom of carbon (grey in the model above) combines with two atoms of oxygen (red in the model). Another example of a compound is water. It forms when two hydrogen atoms combine with one oxygen atom. You can learn more about compounds and how they form by watching the video at this URL:

<http://www.youtube.com/watch?v=-HjMoTthEZ0> (3:53)



MEDIA

Click image to the left for more content.

Q: How could a water molecule be represented?

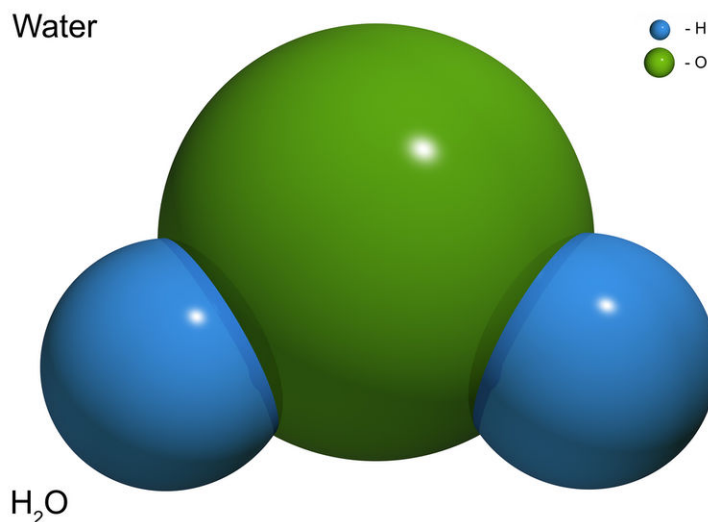


FIGURE 1.1

A: It could be represented by a model like the one for carbon dioxide above. You can see a sample **Figure 1.1**.

Two things are true of all compounds:

- A compound always has the same elements in the same proportions. For example, carbon dioxide always has two atoms of oxygen for each atom of carbon, and water always has two atoms of hydrogen for each atom of oxygen.
- A compound always has the same composition throughout. For example, all the carbon dioxide in the atmosphere and all the water in the ocean have these same proportions of elements.

Q: How do you think the properties of compounds compare with the properties of the elements that form them?

A: You might expect the properties of a compound to be similar to the properties of the elements that make up the compound. But you would be wrong.

Representing Compounds

In a **chemical formula**, the elements in a compound are represented by their chemical symbols. When there is more than one atom of a particular element in a compound, a small number called a subscript is added after the chemical symbol. Consider the compound water as an example. Each water molecule contains two hydrogen atoms and one oxygen atom. Therefore, the chemical formula for water is:



The subscript 2 after the H shows that there are two atoms of hydrogen in the molecule. The O for oxygen has no subscript. When there is just one atom of an element in a molecule, no subscript is used in the chemical formula.

Properties of Compounds

The properties of compounds are different from the properties of the elements that form them—sometimes very different. That's because elements in a compound combine and become an entirely different substance with its own

unique properties. Do you put salt on your food? Table salt is the compound sodium chloride. It contains sodium and chlorine. As shown in the **Figure 1.2**, sodium is a solid that reacts explosively with water, and chlorine is a poisonous gas. But together in table salt, sodium and chlorine form a harmless unreactive compound that you can safely eat.

**FIGURE 1.2**

Sodium and chlorine combine to form sodium chloride, or table salt.

Q: The compound sodium chloride is very different from the elements sodium and chlorine that combine to form it. What are some properties of sodium chloride?

A: Sodium chloride is an odorless white solid that is harmless unless consumed in large quantities. In fact, it is a necessary component of the human diet.

Compounds such as carbon dioxide and water form molecules instead of crystals. A **molecule** is the smallest particle of a compound that still has the compound's properties. It consists of two or more atoms bonded together. You saw models of carbon dioxide and water molecules above.

Summary

- A compound is a unique substance that forms when two or more elements combine chemically. A compound always has the same elements in the same proportions.
- Compounds are represented by chemical formulas. Elements in a compound are represented by chemical symbols, and the ratio of different elements is represented by subscripts.
- The properties of compounds may be very different from the properties of the elements that form them.
- Some compounds form individual molecules. A molecule is the smallest particle of a compound that still has the compound's properties.

Vocabulary

- **compound:** Unique substance that forms when two or more elements combine chemically.
- **chemical formula:** Symbol of a chemical compound using element symbols and subscripts to represent the ratio of atoms in the compound.
- **subscript:** The small number that follows the chemical symbol for an element in a chemical formula and represents the number of atoms from that element
- **molecule:** Smallest particle of a compound that still has the compound's properties.

Review

1. What are compounds? List three examples.
2. How do the properties of compounds compare with the properties of the elements that form them?

3. What chemical formula is created when 2 Hydrogen atoms bond with 1 Oxygen atom?

Compound

Chemical Formulas

Atom

Element

References

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2. Sodium: Image copyright Andraž Cerar, 2012; Chlorine: Greenhorn1; Salt: Image copyright cardiae, 2012. . Sodium: Used under license from Shutterstock.com; Chlorine: Public Domain; Salt: Used under license from Shutterstock.com

Compounds and Chemical Formulas-SWS

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