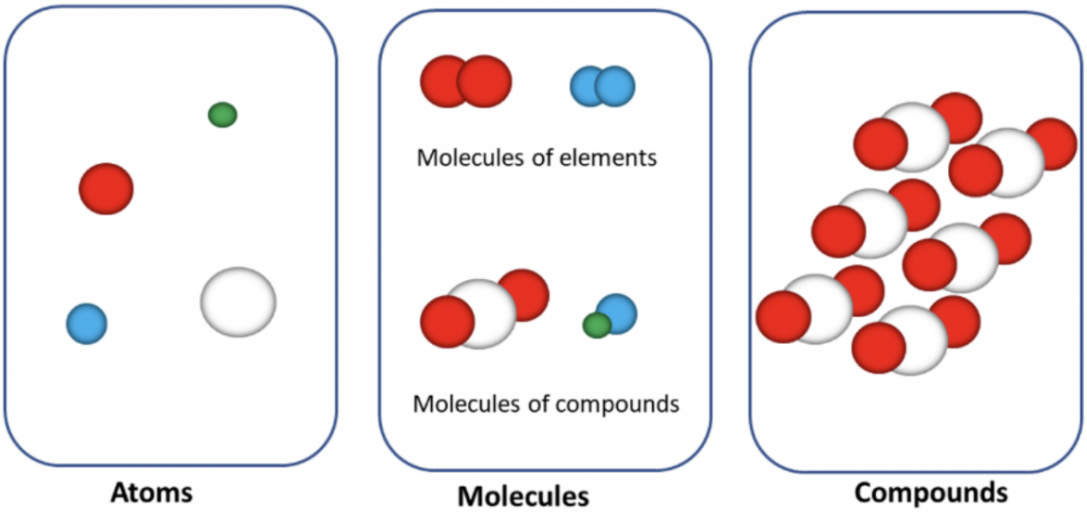
E3. Chemical Compounds & Atoms

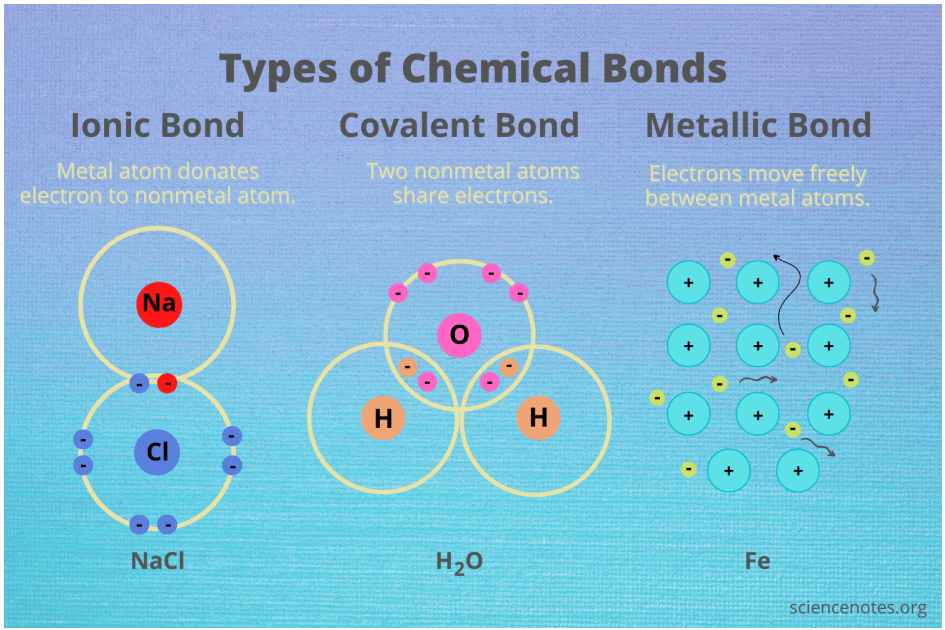
Chemical Reactions: Uniting Atoms into Compounds

Have you ever wondered how the elements that make up our world come together to form the countless substances we encounter in our daily lives? The answer lies in the fascinating world of chemical reactions, where atoms of different elements combine to create compounds. Let's dive into the details of this fundamental process.



Reactants and Products

Chemical reactions involve the transformation of one set of substances, called reactants, into a different set of substances, called products. It's like rearranging the pieces of a puzzle to create something entirely new. In these reactions, the atoms are the puzzle pieces, and they come together to form compounds.



Compounds: Atoms Unite

A compound is a substance made up of two or more atoms of different elements chemically bonded together. Think of it as a fusion of different elements into a unique substance with its own distinct properties. Water (H2O) is a well-known compound composed of two hydrogen atoms

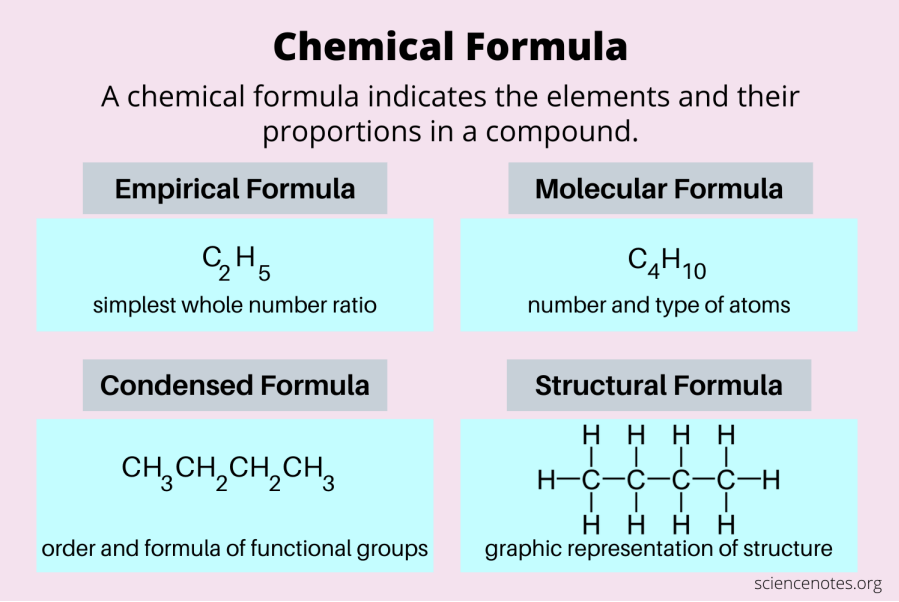
and one oxygen atom bonded together.

Chemical Bonds: The Glue of Chemistry

So, how do atoms from different elements come together to form compounds? The answer lies in chemical bonds, which are like the glue that holds atoms together. These bonds are formed when atoms share or transfer electrons. There are two primary types of chemical bonds:

1. **Covalent Bonds**
   In covalent bonds, atoms share electrons. This sharing creates a strong connection between the atoms, resulting in the formation of molecules. For example, in a molecule of oxygen (O2), two oxygen atoms share electrons to complete their outer electron shells.

2. **Ionic Bonds**
   Ionic bonds form when one atom transfers electrons to another, resulting in the formation of charged ions. For example, in table salt (sodium chloride, NaCl), sodium (Na) donates an electron to chlorine (Cl), creating positively charged sodium ions (Na+) and negatively charged chloride ions (Cl-).



Chemical Formulas: The Language of Chemistry

Chemical formulas are like the language of chemistry, providing a concise way to represent compounds. They consist of element symbols and subscripts that indicate the number of atoms of each element in a compound. For example, the chemical formula H2O represents water, where "H" stands for hydrogen and "O" for oxygen, and the subscript "2" indicates that there are two hydrogen atoms in each water molecule.

Diagrams: Visualizing Chemical Compounds

Sometimes, it's helpful to visualize the structure of a chemical compound. Diagrams, also known as structural formulas or Lewis structures, provide a visual representation of how

atoms are connected within a molecule. These diagrams show the arrangement of atoms and the sharing of electrons, giving us insights into the compound's properties and behavior.

Chemical Reactions in Action

Now, let's see these concepts in action. Consider the combustion of methane (CH_4), a gas commonly found in natural gas. In this reaction, methane combines with oxygen (O_2) to produce carbon dioxide (CO_2) and water (H_2O).

1. What are reactants in a chemical reaction?
    a) The substances formed during the reaction
    b) The substances that initiate the reaction
    c) The substances that result from the reaction
    d) The substances present before the reaction occurs

2. What are products in a chemical reaction?
    a) The substances formed during the reaction
    b) The substances that initiate the reaction
    c) The substances that result from the reaction
    d) The substances present before the reaction occurs

3. What is a compound?
    a) A substance made up of one type of atom
    b) A substance made up of two or more atoms of different elements chemically bonded together
    c) A molecule formed by covalent bonds
    d) A molecule formed by ionic bonds

4. Which type of chemical bond involves the sharing of electrons between atoms?
    a) Covalent bond
    b) Ionic bond
    c) Compound bonds
    d) Hydrogen bond

5. In a molecule of water (H_2O), how many hydrogen atoms are present?
    a) 1
    b) 2
    c) 3
    d) 0

6. What does the subscript in a chemical formula represent?
    a) The number of atoms of each element in the compound
    b) The charge of the compound
    c) The number of molecules in the compound
    d) The weight of the compound

7. What type of chemical bond forms when one atom transfers electrons to another?
    a) Covalent bond
    b) Ionic bond
    c) Metallic bond
    d) Hydrogen bond

8. Which of the following is NOT a type of chemical bond?
    a) Covalent bond
    b) Ionic bond
    c) Hydrogen bond
    d) None of the above

9. What do chemical diagrams or structural formulas represent?
    a) The atomic number of an element
    b) The visual appearance of a compound
    c) The arrangement of atoms and the sharing of electrons in a molecule
    d) The mass of a compound

10. In the combustion of methane (CH_4), what are the products of the reaction?
    a) Carbon and hydrogen
    b) Oxygen and water
    c) Carbon dioxide and water
    d) Methane and oxygen

ANSWERS & EXPLANATIONS

1. d) The substances present before the reaction occurs
   Reactants are the substances present before the chemical reaction occurs.

2. c) The substances that result from the reaction
   Products are the substances that result from the chemical reaction.

3. b) A substance made up of two or more atoms of different elements chemically bonded together
   A compound is a substance made up of two or more atoms of different elements chemically bonded together.

4. a) Covalent bond
   Covalent bonds involve the sharing of electrons between atoms.

5. b) 2
   In a molecule of water (H2O), there are two hydrogen atoms present.

6. a) The number of atoms of each element in the compound
   The subscript in a chemical formula represents the number of atoms of each element in the compound.

7. b) Ionic bond
   Ionic bonds form when one atom transfers electrons to another.

8. c) Hydrogen bond
   Hydrogen bonds are not a primary type of chemical bond.

9. c) The arrangement of atoms and the sharing of electrons in a molecule
   Chemical diagrams or structural formulas represent the arrangement of atoms and the sharing of electrons in a molecule.

10. c) Carbon dioxide and water
    In the combustion of methane (CH4), the products of the reaction are carbon dioxide (CO2) and water (H2O).