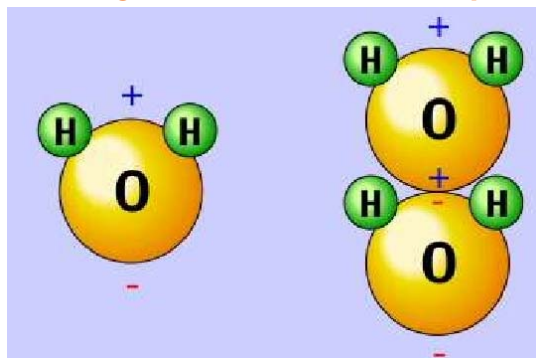


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Polarity Power: How It Shapes Molecule Magic



Have you ever wondered why some substances dissolve easily in water, while others do not? Or why certain molecules stick together, while others repel each other? The secret lies in the polarity of molecules.

Polarity in molecules is like a game of tug-of-war between atoms for shared electrons. Atoms in a molecule may have different electronegativities, which means they have different abilities to

attract electrons. When atoms with different electronegativities come together to form a covalent bond, they share electrons, but not equally.

Let's break down the key aspects of polarity:

- **Electronegativity:** Electronegativity is a measure of an atom's ability to attract electrons. Elements like oxygen and fluorine are highly electronegative, while elements like hydrogen and carbon are less electronegative.
- **Polar Covalent Bond:** In a polar covalent bond, electrons are not shared equally between atoms. The more electronegative atom pulls the electrons closer to itself, creating a partial negative charge (δ^-) and a partial positive charge (δ^+) on the atoms.
- **Nonpolar Covalent Bond:** In a nonpolar covalent bond, electrons are shared equally between atoms, resulting in no significant charge differences.

Now, let's explore how the polarity of a molecule affects its physical and chemical properties:

- **Solubility:** Polar molecules tend to dissolve in polar solvents, while nonpolar molecules dissolve in nonpolar solvents. This principle is often summarized by the phrase "like dissolves like." For example, sugar (a polar molecule) dissolves readily in water (a polar solvent), but oil (a nonpolar molecule) does not.
- **Boiling and Melting Points:** Polar molecules generally have higher boiling and melting points than nonpolar molecules of similar size. This is because polar molecules have stronger intermolecular forces that require more energy to break.
- **Surface Tension:** Polar molecules, such as water, have higher surface tension due to the cohesive forces between their polar ends. This property allows some insects, like water striders, to "walk on water."
- **Chemical Reactivity:** Polar molecules can participate in hydrogen bonding, a strong type of dipole-dipole interaction. This affects their chemical reactivity, making them more prone to forming hydrogen bonds with other polar molecules.
- **Electrical Conductivity:** A solution containing polar molecules can conduct electricity because these molecules can ionize or dissociate into ions, carrying an electric charge. Nonpolar molecules do not conduct electricity because they lack charged regions.
- **Polarity in Biology:** Polarity plays a crucial role in biological systems. For example, the polarity of water molecules allows them to form hydrogen bonds with biomolecules like proteins and DNA, influencing their structures and functions.

