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Organic Chemistry: Current Research

Commentary

Tetravalence of Carbon Shapes of Organic Compounds

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COMMENTARY

Organic chemistry is primarily concerned with the chemistry of carbon, which is only one of over a hundred elements in the periodic table but has become the most important of them all due to its unique position in the table, and it is because of carbon and its unique properties that life as we know it exists. Â Carbon's three most important properties, all of which have overlapping purposes, are as follows:

1. Its dimensions
2. Tetravalency
3. Catenation or the ability to construct lengthy chains with itself.

Because organic substances are so diverse (ranging from acetone in nail polish remover to ethyl alcohol in whisky to complex macromolecules like proteins and nucleic acids, which are monster molecules in contrast), it is critical to have a thorough understanding of how they react. Understanding the molecular profile of different classes of such molecules will not only help us build beneficial small compounds that can combat cancer, but it will also help us understand why a protein folds in a specific way to cause cancer in the first place. This may appear to be a difficult undertaking, yet mechanistic organic chemistry is actually quite well established. Because a wide group of chemicals react in the same way under identical conditions, various generalizations and principles have been developed to reliably predict the reactions. As it is, even a complete novice with a basic understanding of structure, reactivity, and mechanism may confidently claim to understand the chemical mechanism by which DNA is copied!

Hybridization with tetravalent carbon

Carbon's electrical arrangement in its ground state is $1s^2$, $2s^2$, $2p^2$. Because it possesses four valence electrons, it has the greatest chance of forming four bonds. The bonds created by s orbital electrons will be different from those formed by p orbital electrons. As a result, one molecule of CH_4 will include a combination of one C atom and four H atoms.

C(s)-H(s), C(s)-H(s), C(p)-H(s), and C(p)-H(s) are the four types of bonds that can be formed (s). We have two 'directed' C (p)-H(s) bonds and two non-directional C(s)-H(s) bonds out of the four (s). (It should be noted that s orbitals are spherical and have no definite orientation, but p orbitals have three shapes: x, y, and z-axis.) The bond strength will also differ, with the C (p)-H(s) connection being weaker than the C(s)-H(s) bond due to the stronger s overlapping. However, all of the bonds in CH_4 are nearly identical. This is problematic. Hybridization theory has been proposed as a solution to this problem. It is primarily a notion in which atomic orbitals are combined with new hybrid orbitals that are best suited for electron pairing in chemical bonds.

The atomic number 6 indicates that the carbon atom has a total of 6 electrons. Its electrical configuration can be expressed as 2, 4 in a straightforward method. It signifies the outermost shell has four electrons. To achieve a stable electrical state, carbon follows the octet rule and makes four covalent bonds with other atoms. As a result, carbon is tetravalent (meaning its valency is four) and can create four covalent connections with not just other atoms but also other carbon atoms. This is referred to as carbon tetravalency. Carbon has the remarkable property of forming extremely strong covalent bonds, making carbon molecules extremely stable in nature.

Catenation is the capacity of carbon to create covalent connections with other carbon atoms. Carbon may form lengthy straight, branched, and cyclic chains as a result of this characteristic. With other carbon atoms, carbon can create single, double, and triple covalent bonds.

If you look at the electronic configuration of a carbon atom in detail, you will notice that it has the following electronic configuration in ground state: $1s^2$, $2s^2$, $2p^2$.

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