The sp\(^2\) hybridization is the mixing of one s and two p atomic orbitals, which involves the promotion of one electron in the s orbital to one of the 2p atomic orbitals. The combination of these atomic orbitals creates three new hybrid orbitals equal in energy-level. The hybrid orbitals are higher in energy than the s orbital but lower in energy than the p orbitals, but they are closer in energy to the p orbitals. The new set of formed hybrid orbitals creates trigonal structures, creating a molecular geometry of 120 degrees.

**Introduction**

The combination of an s orbital and two p orbitals from the same valence shell gives a set of three equivalent sp\(^2\) hybridized orbitals that point in directions separated by 120 degrees. The directions of these new, hybridized orbitals are the dictators of the spatial arrangement for bonding. The SP\(^2\) hybridized orbitals are the same in size, energy shape but different in the spatial orientation. This unique orientation is very important and is what characterized an SP\(^2\) hybridized orbital from other hybridized orbitals.

**SP\(^2\) hybridized molecules**

![Diagram of SP\(^2\) hybridized molecules]
References


Problems

1. What is a sp$^2$ hybridized atomic orbital? What is the molecular geometry of an SP$^2$ hybridized atom?

An sp$^2$ hybridized atomic orbital is the mixing of 1 S orbital and 2 P orbitals, a sp$^2$ hybridized atom has 3 sigma bonds so its molecular geometry is trigonal with 120 degree bond angles.

2. What is the importance of correctly identifying the hybridization of atoms with trigonal structures?

It tells you the bond angle. If they are sp$^2$, they would have 120 degree bond angles. sp$^3$ would have 109.5 degree bond angles

3. What is the hybridization of a benzene ring?

Benzene has a sp$^2$ hybridization

4. What is the hybridization of the carbon atom in the following structures: a) ketone, b) aldehydes, c) carboxylic acids, d) alcohols, e) esters, f) ethers?

They all have sp$^2$ hybridization

5. Write the hybridization of an amide for the Carbon atom and for the neighbor Nitrogen atom?

Both atoms have sp$^2$ hybridization

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