

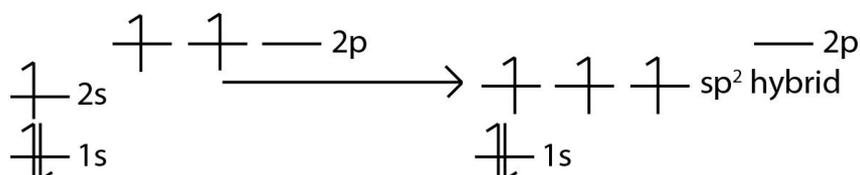
Question # 58854, Chemistry / Inorganic Chemistry | for completion

Briefly explain how sp^2 hybridised orbitals are formed. use diagrams to illustrate your answer. Clearly indicate the number, type and geometry of all orbitals involved

Answer

sp^2 hybridization can explain the trigonal planar structure of molecules. In it, the 2s orbitals and two of the 2p orbitals hybridize to form three sp^2 orbitals, each consisting of 67% p and 33% s character. The frontal lobes align themselves in the trigonal planar structure, pointing to the corners of a triangle in order to minimize electron repulsion and to improve overlap. The remaining p orbital remains unchanged and is perpendicular to the plane of the three sp^2 orbitals.

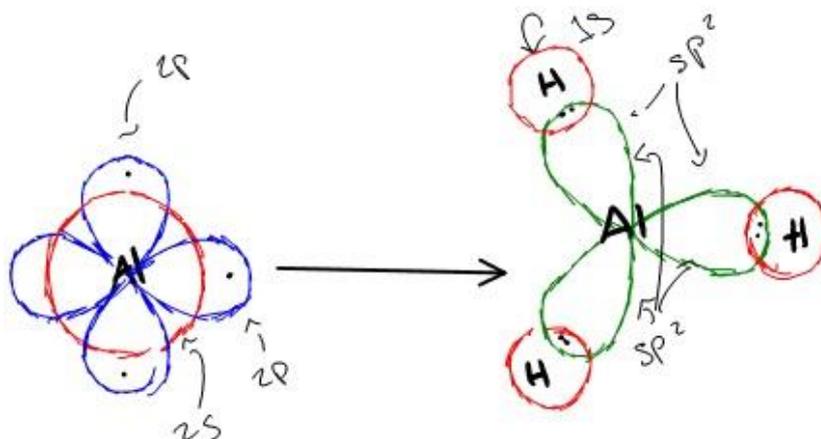
Energy changes occurring in hybridization



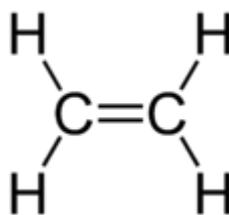
Hybridization of an s orbital with two p orbitals (p_x and p_y) results in three sp^2 hybrid orbitals that are oriented at 120° angle to each other. Sp^2 hybridization results in trigonal geometry.

Example; sp^2 Hybridization in Aluminum Trihydride

In aluminum trihydride, one 2s orbital and two 2p orbitals hybridize to form three sp^2 orbitals that align themselves in the trigonal planar structure. The three Al sp^2 orbitals bond with with 1s orbitals from the three hydrogens through sp^2 -s orbital overlap.

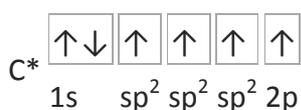


Other molecules may be explained in a similar way. For example, **ethene** (C₂H₄) has a double bond between the carbons.

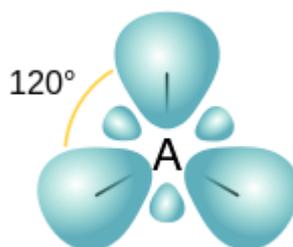


Ethene structure

For this molecule, carbon sp² hybridises, because one π (pi) bond is required for the **double bond** between the carbons and only three σ bonds are formed per carbon atom. In sp² hybridisation the 2s orbital is mixed with only two of the three available 2p orbitals,



forming a total of three sp² orbitals with one remaining p orbital. In ethylene (**ethene**) the two carbon atoms form a σ bond by overlapping two sp² orbitals and each carbon atom forms two covalent bonds with hydrogen by s–sp² overlap all with 120° angles. The π bond between the carbon atoms perpendicular to the molecular plane is formed by 2p–2p overlap. The hydrogen–carbon bonds are all of equal strength and length, in agreement with experimental data.



Three sp² orbitals.