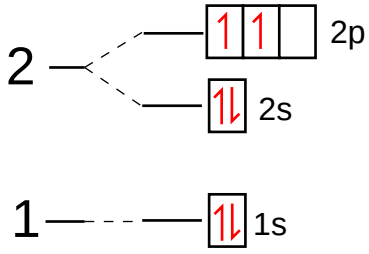
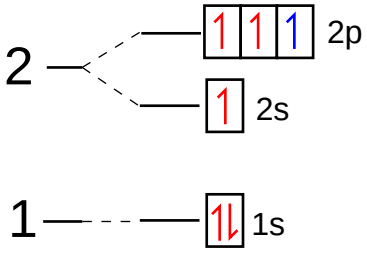
HYBRIDISATION IN CARBON

What happens?



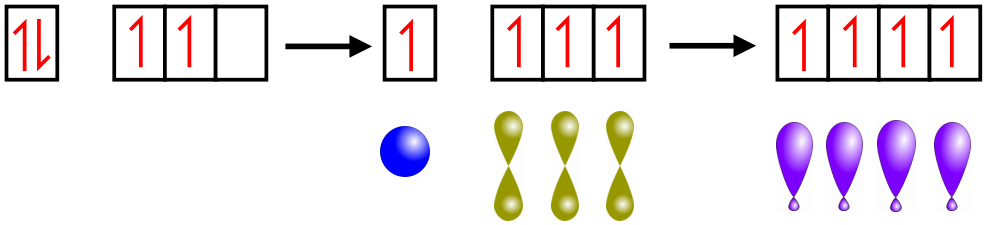
The electronic configuration of a carbon atom is $1s^2 2s^2 2p^2$



If you provide energy you can promote (lift) one of the s electrons into a p orbital. The configuration is now $1s^2 2s^1 2p^3$

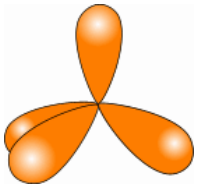
The process is **favourable** because of the arrangement of electrons; four unpaired means **less repulsion** and therefore **more stability**.

sp^3

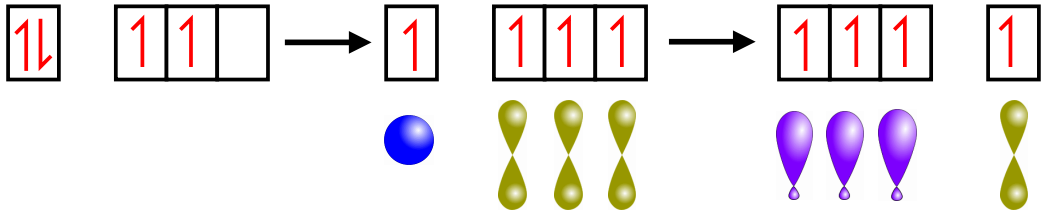


The four orbitals (an s and three p's) combine or HYBRIDISE to give four new orbitals. All four orbitals are equivalent.

In ALKANES, the four sp^3 orbitals repel each other into a tetrahedral arrangement.

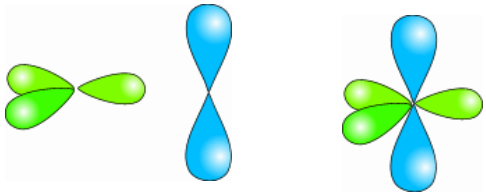


sp^2



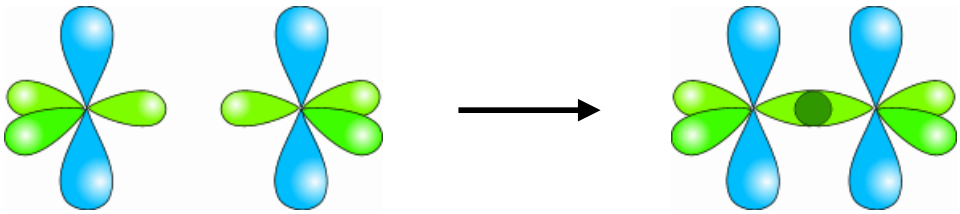
Only three orbitals (an s and two p's) HYBRIDISE to give three new orbitals. All three orbitals are equivalent. The remaining 2p orbital is unchanged.

In ALKENES, the three sp^2 orbitals repel each other into a planar arrangement and the 2p orbital lies at right angles to them

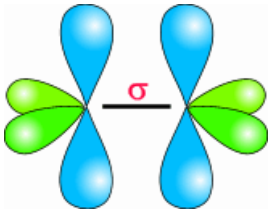


Bond formation in alkenes

- Covalent bonds are formed by overlap of orbitals
- An sp^2 orbital from each carbon overlaps to form a single C-C bond

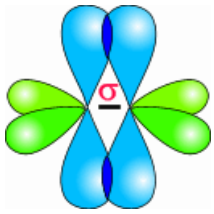


The resulting bond is called a SIGMA (σ) bond.

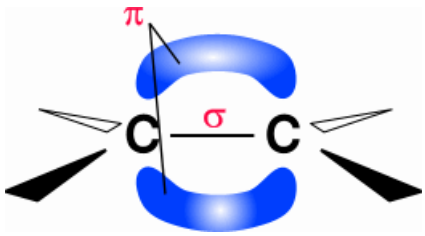


The two 2p orbitals also overlap to form a second bond. This is known as a PI (Π) bond.

For maximum overlap and hence the strongest bond, the 2p orbitals are in line.



This gives rise to the PLANAR arrangement around C=C bonds.



To complete the structure of ethene, the remaining sp^2 orbitals overlap with four hydrogen 1s orbitals to form four C-H bonds.