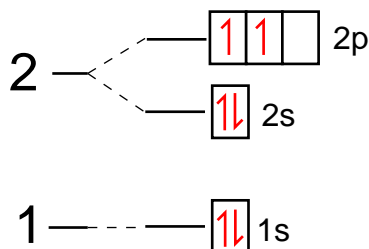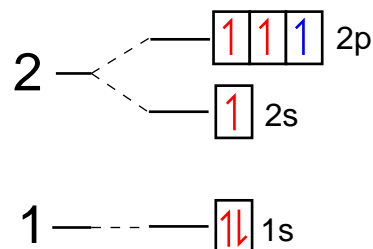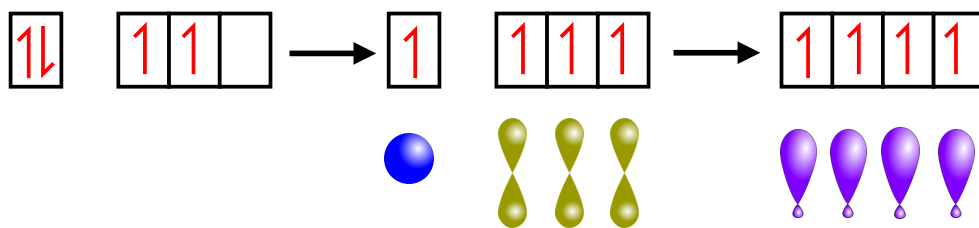# HYBRIDISATION IN CARBON

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 $1s^2 2s^1 2p^3$
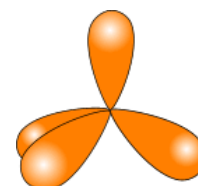
The process is **favourable** because of the arrangement of electrons; four unpaired means **less repulsion** and therefore **more stability**.
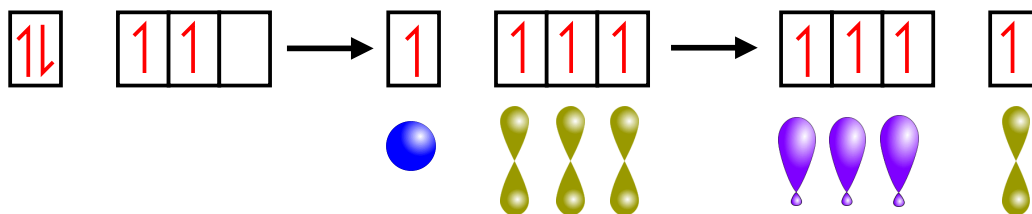
sp³

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

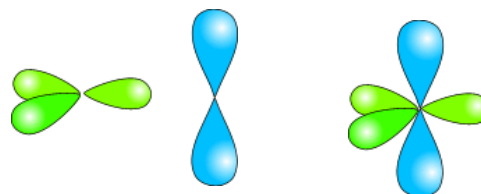In ALKANES, the four sp³ orbitals repel each other into a tetrahedral arrangement.

sp²

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 sp² orbitals repel each other into a planar arrangement and the 2p orbital lies at right angles to them

Bond formation in alkanes

- Covalent bonds are formed by overlap of orbitals
- Each sp³ orbital from carbon overlaps with a hydrogen s orbital
- The resulting bond C-C bond is called a SIGMA (σ) bond
- The four σ bonds repel each other to give a tetrahedral shape
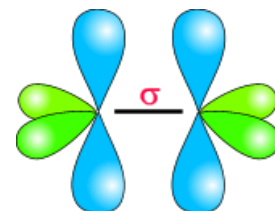
s orbital of hydrogen

4 sp³ orbitals in carbon
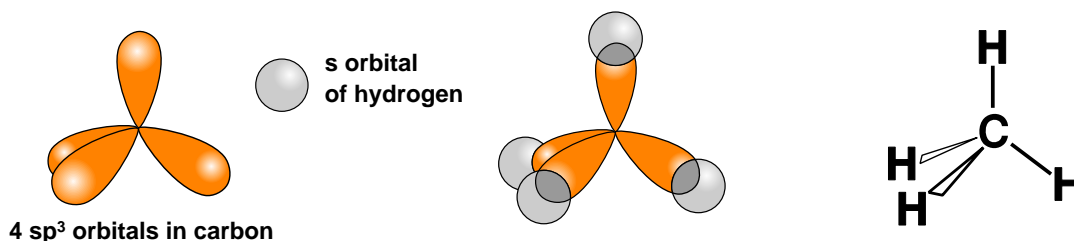
Bond formation in alkenes
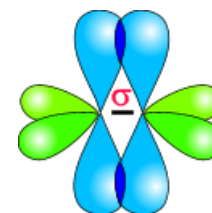
- An sp² orbital from each carbon overlaps to form a single C-C bond
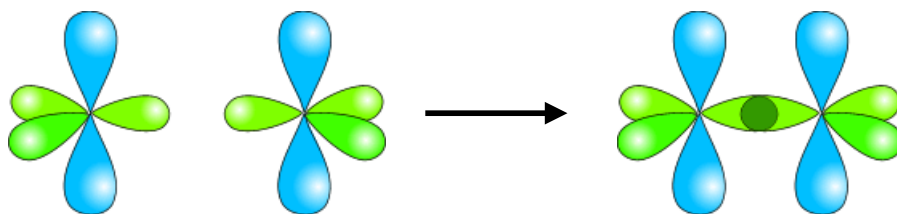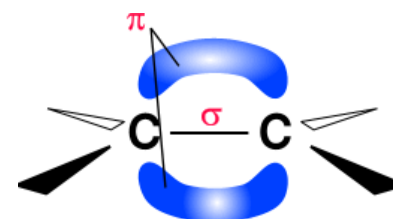
The resulting bond is called a SIGMA (σ) bond.

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.
This gives **RESTRICTED ROTATION**.

To complete the structure of ethene, the remaining sp² orbitals overlap with four hydrogen 1s orbitals to form four C-H bonds.