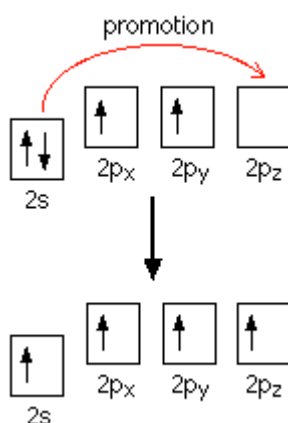


## Chemguide – answers

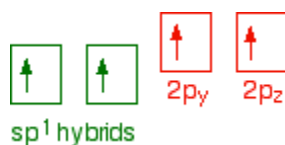
### BONDING IN ETHYNE

1. Carbon has the electronic structure  $1s^2 2s^2 2p_x^1 2p_y^1$ . Hydrogen is  $1s^1$ .

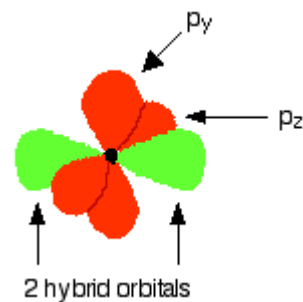
One of the 2s electrons is promoted by moving it into the slightly higher energy  $2p_z$  orbital to give the structure  $1s^2 2s^1 2p_x^1 2p_y^1 2p_z^1$ .



Each carbon atom in ethyne has to join to two other things (a hydrogen atom and another carbon atom). It reorganises 2 of its s and p electrons into 2 orbitals with the same shape and energy. These are called  $sp^1$  hybrids. The other two p orbitals are left unchanged.

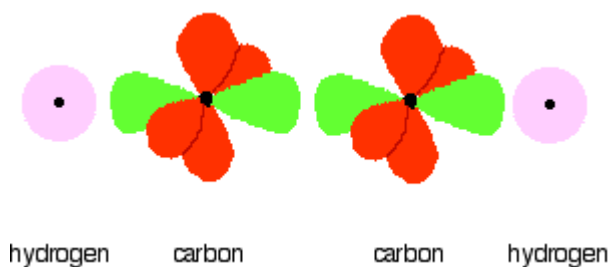


The  $sp^1$  hybrids arrange themselves as far apart as possible with the remaining p orbitals at right angles to them.



The hybrid orbitals overlap in space with the  $1s^1$  orbital on a hydrogen atom and with one of the  $sp^1$  orbitals on the other carbon atom to form molecular orbitals containing both electrons.

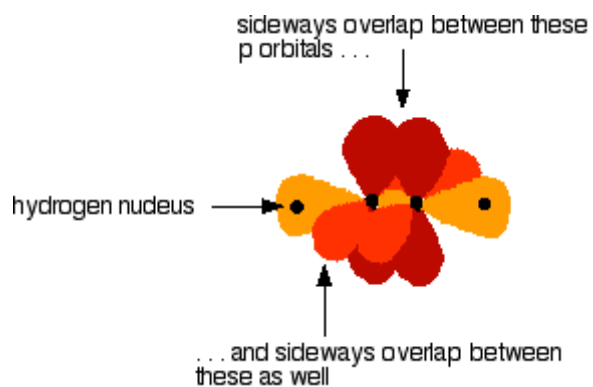
Lined up just before overlap:



## Chemguide – answers

The end-to-end overlap gives sigma bonds.

The remaining p orbitals overlap sideways to give two pi bonds.



Giving:

