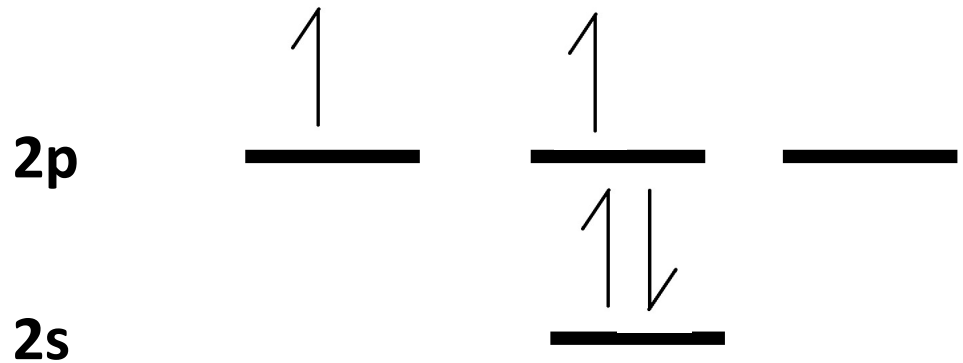
Extension Topics for A level Chemistry

Extending Bonding theory – Orbital Hybridisation Part 1

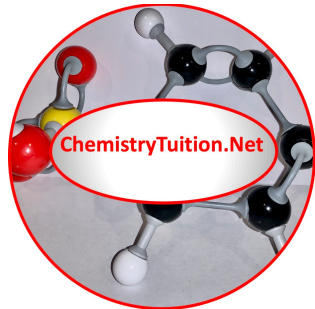
Hybridisation of Orbitals

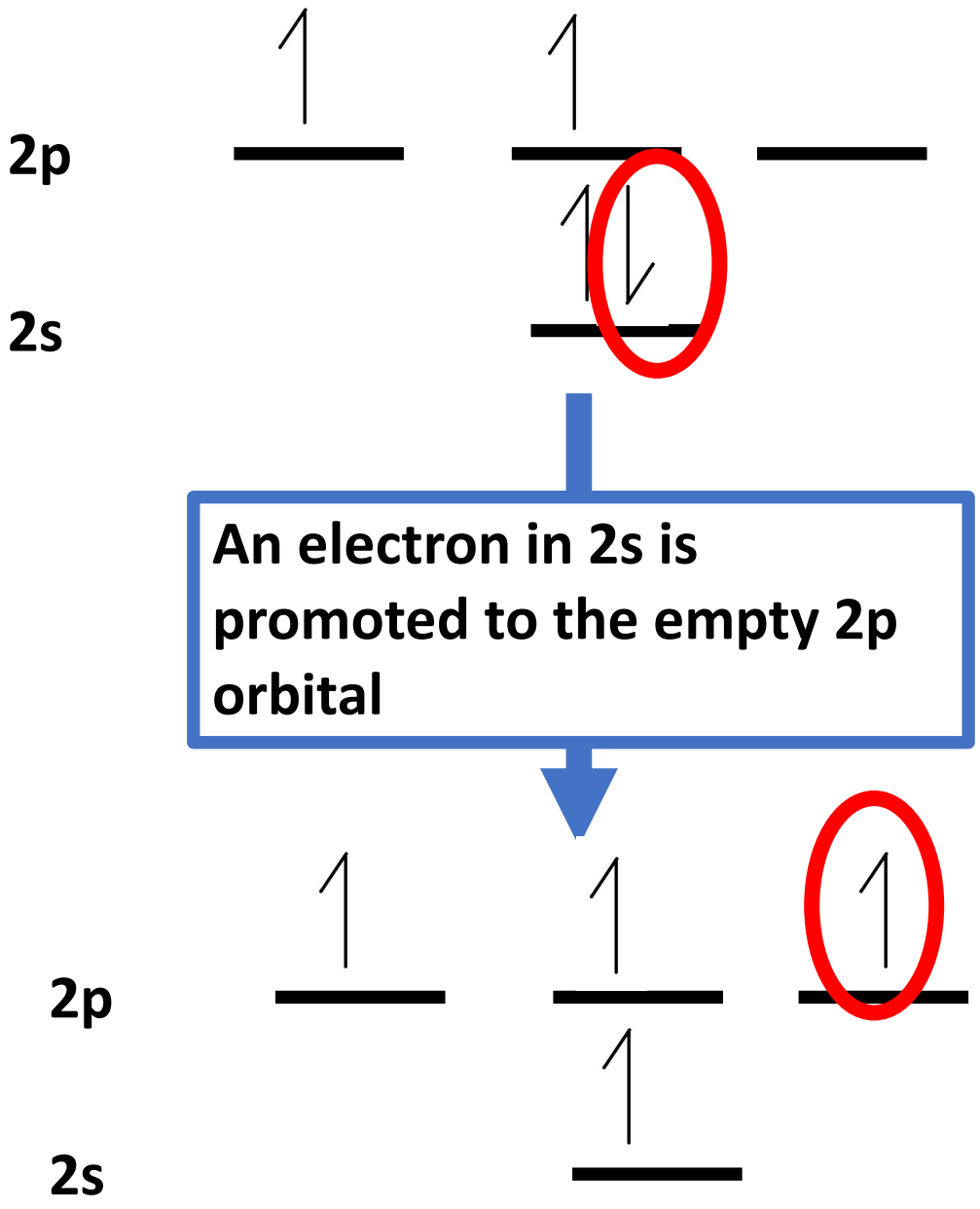
Carbon's electronic structure is $1s^2 2s^2 2p^2$

Orbitals available for bonding are $2s^2 2p^2$



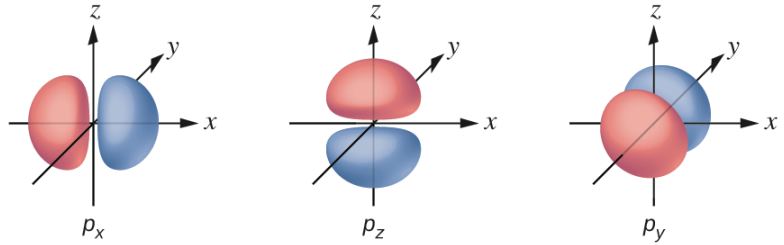
There are only two orbitals which can form bonds but we know carbon forms 4 bonds.



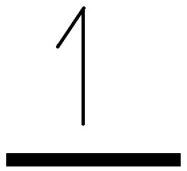


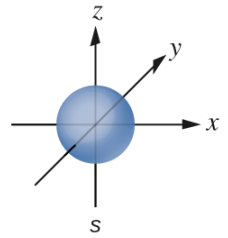
There are now four orbitals available.

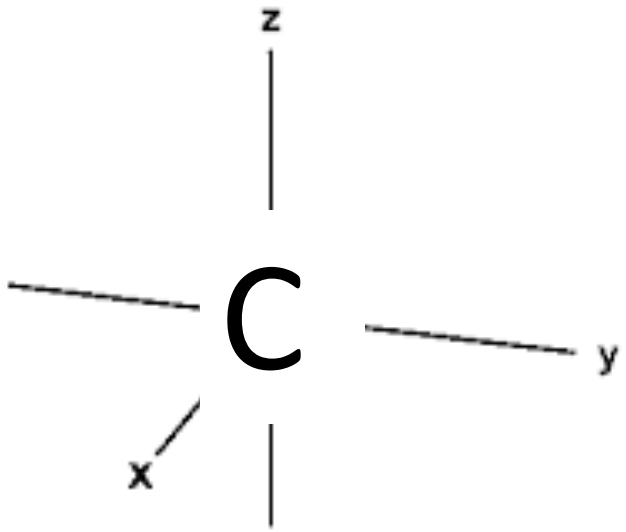
2p



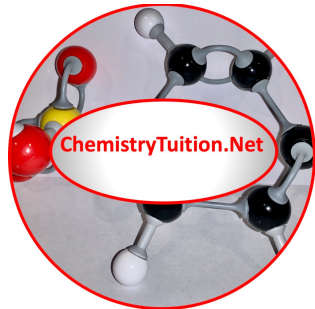
2s



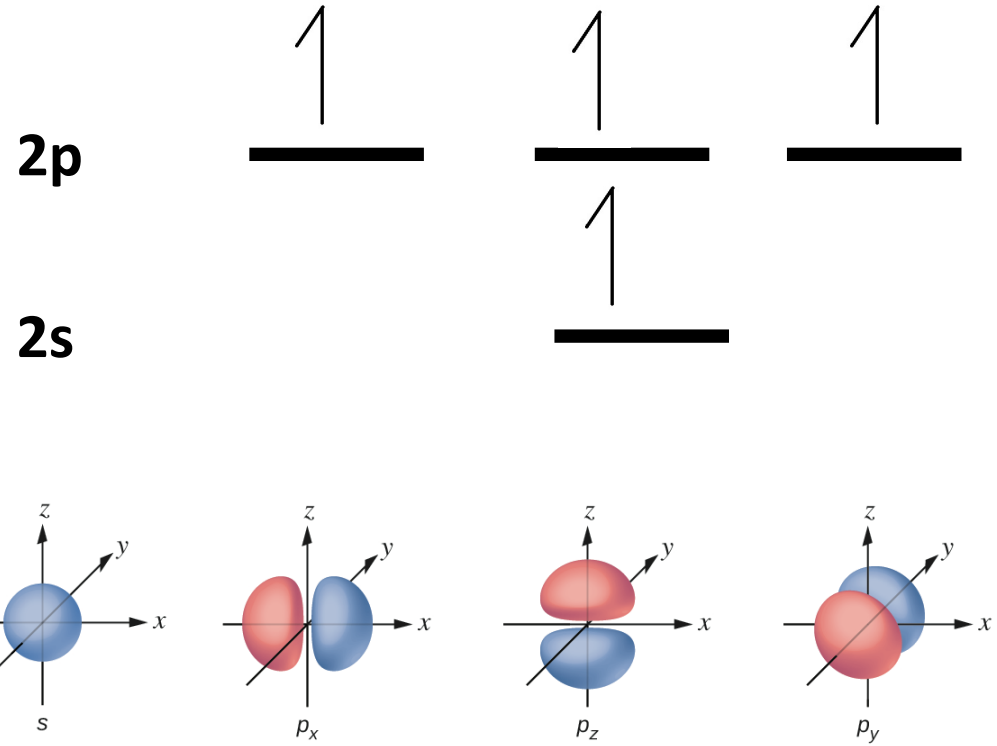


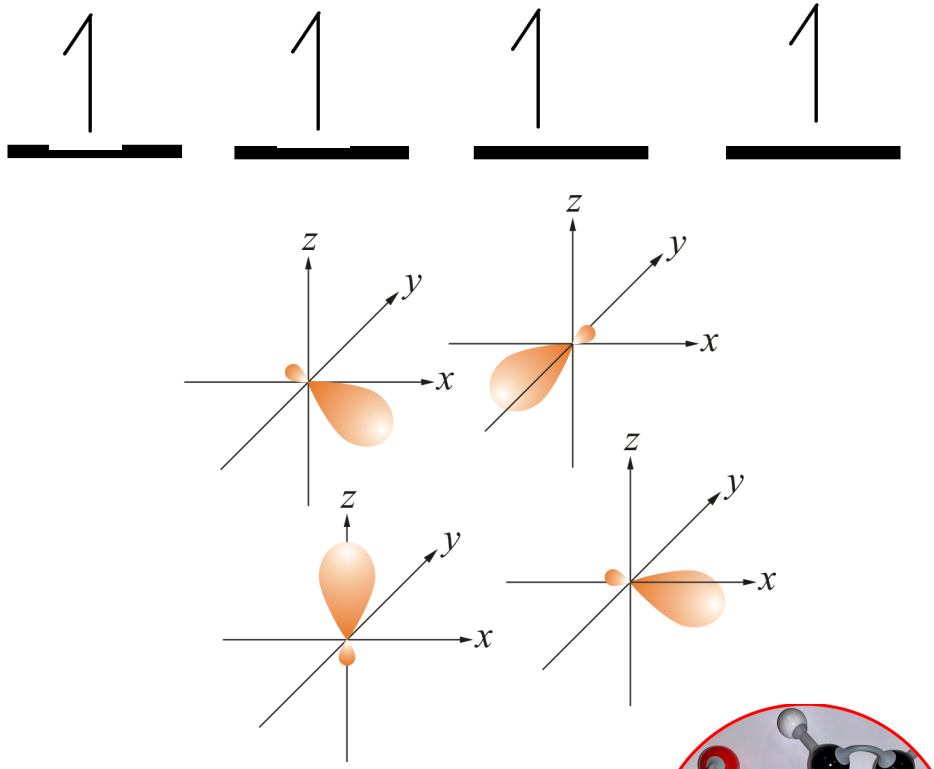


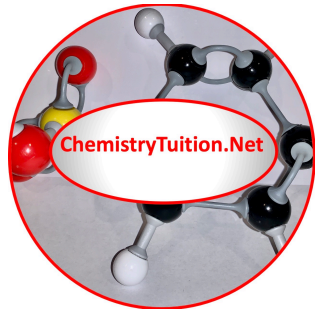
But the bonds around carbon in methane are tetrahedral

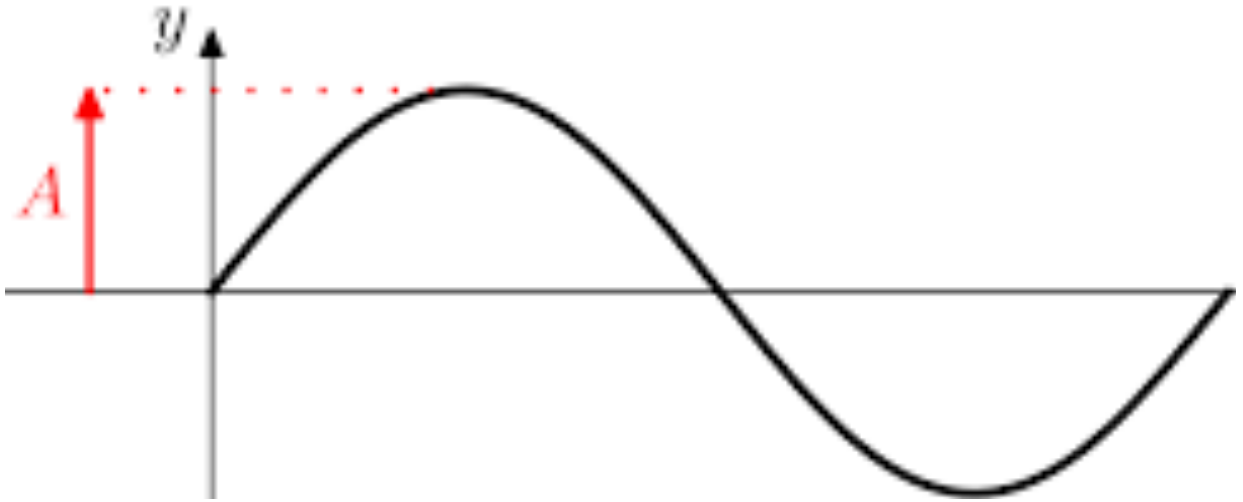


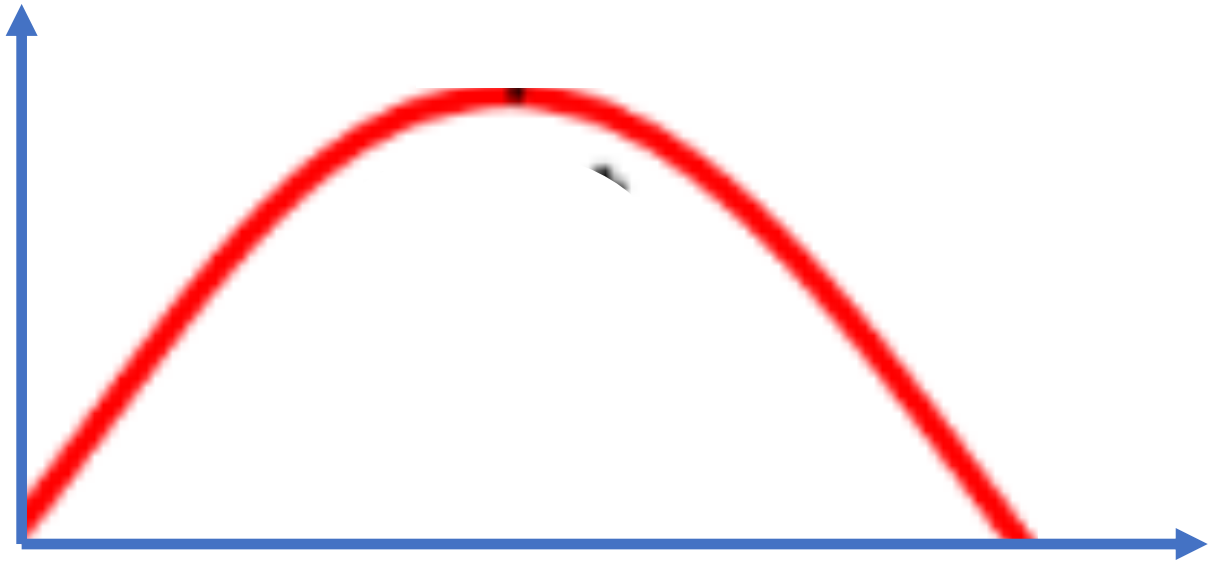
Four sp^3 hybrid orbitals

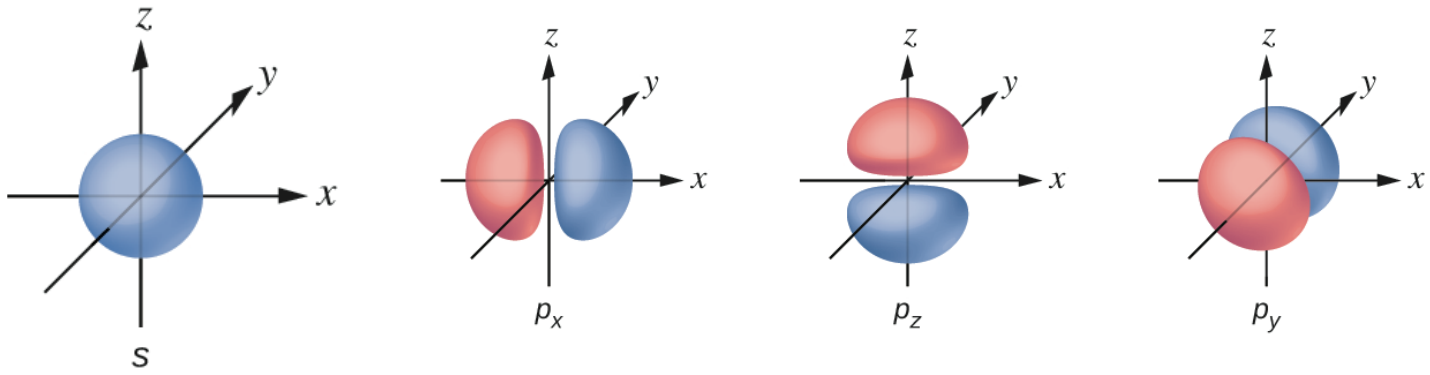


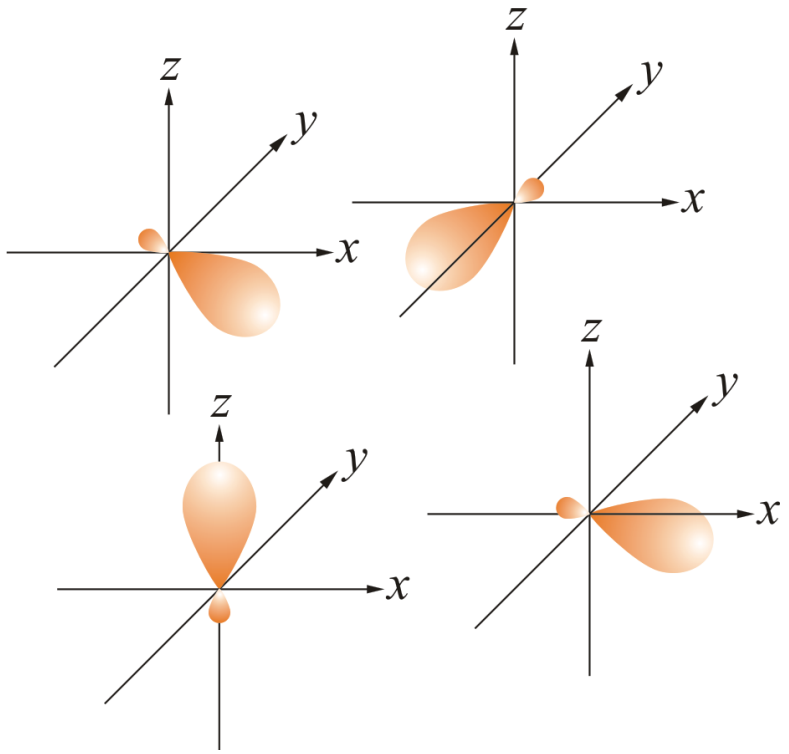




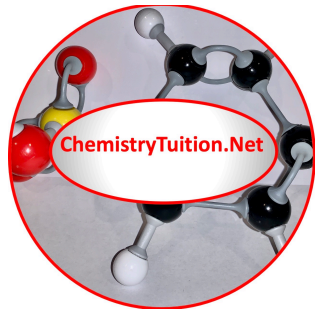


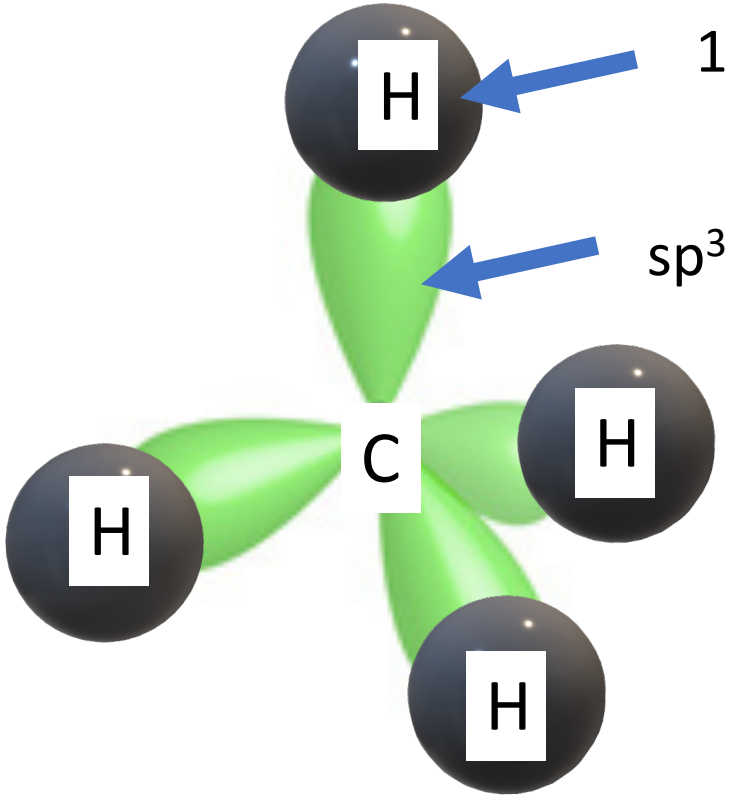


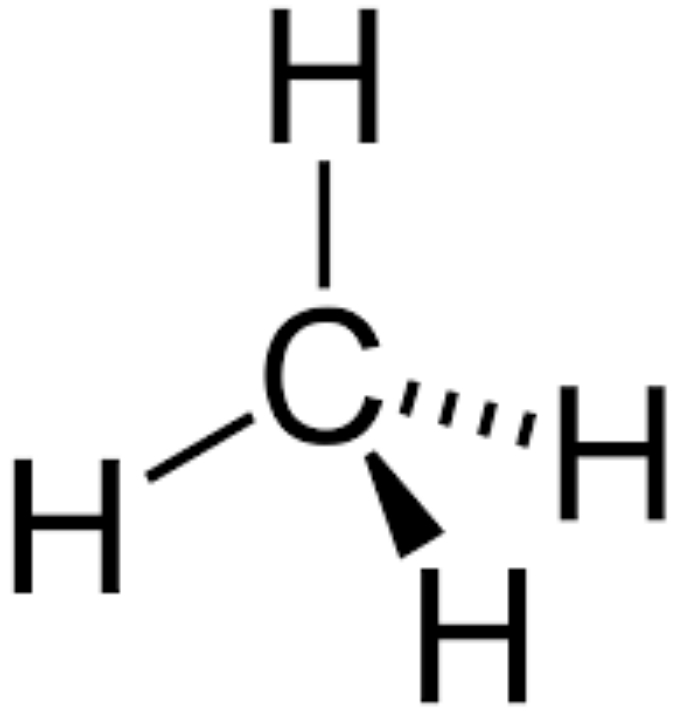


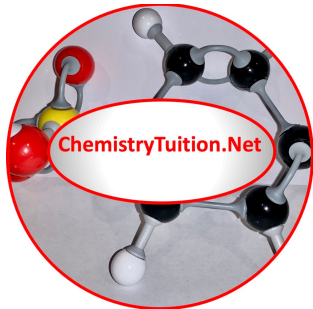


sp^3 hybrid orbitals
tetrahedral




H
1s orbital
sp3 hybrid orbital
C
H
H
H


H
C
H
H
H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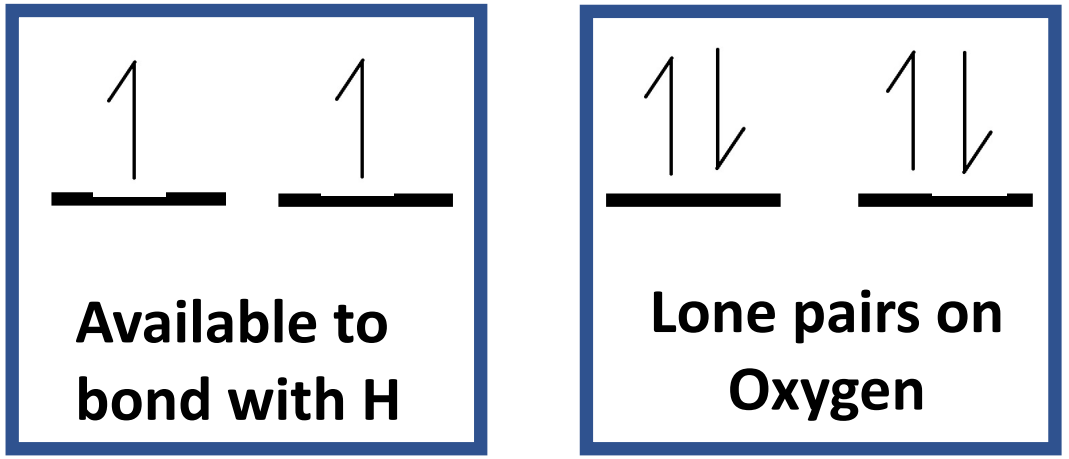
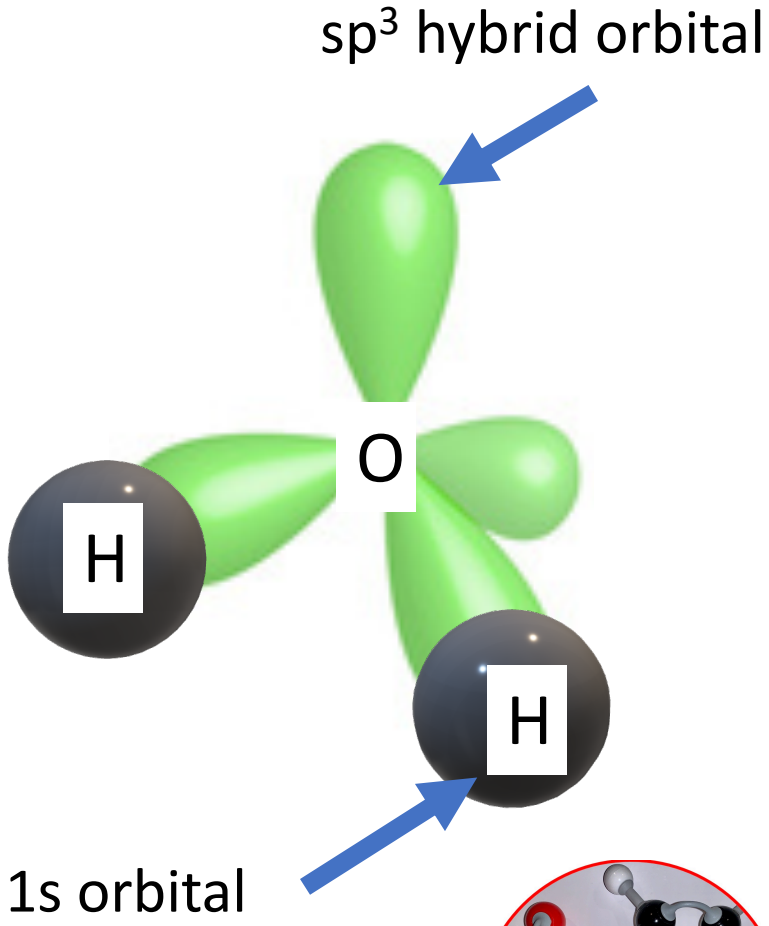
sp^3 hybrid orbitals are formed by nitrogen and oxygen when their geometry is based upon a tetrahedron.

In H_2O:

Four sp^3 hybrid orbitals

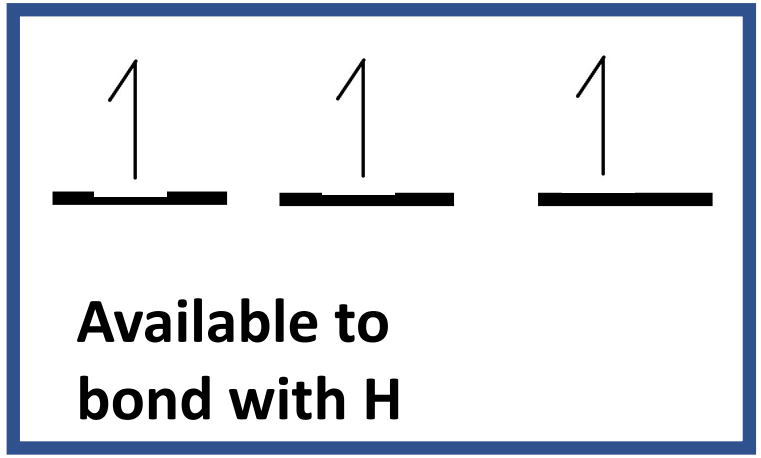


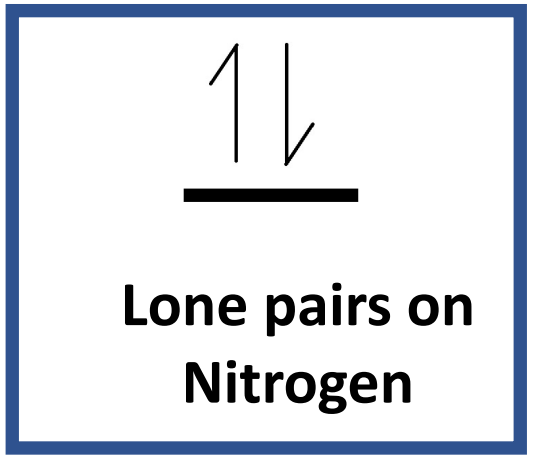
Non-linear shape



Four sp^3 hybrid orbitals

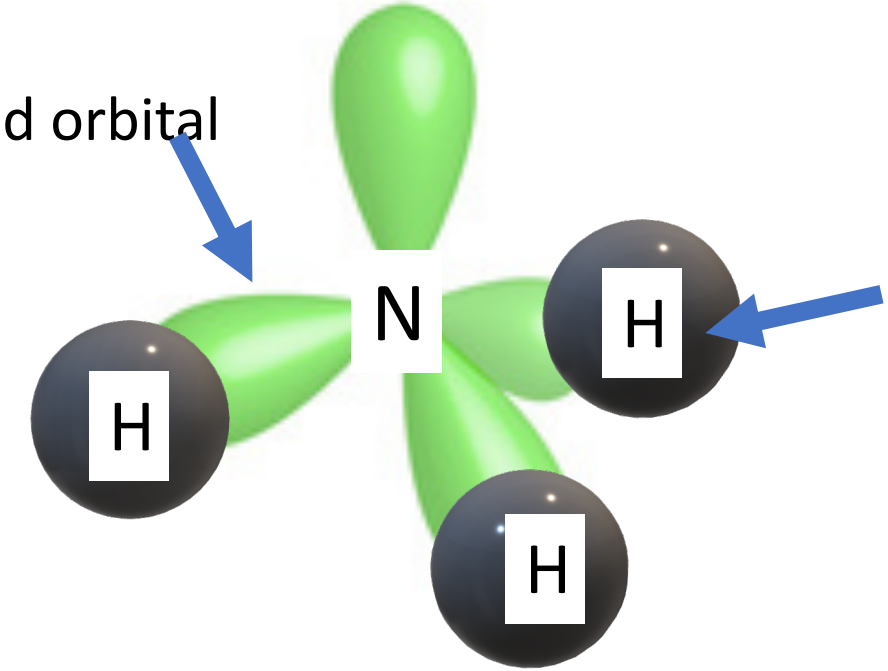
In NH_3:



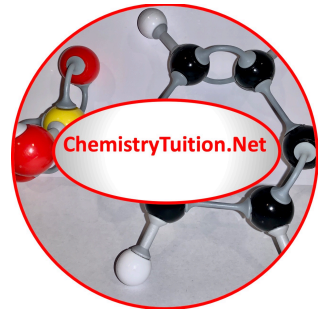


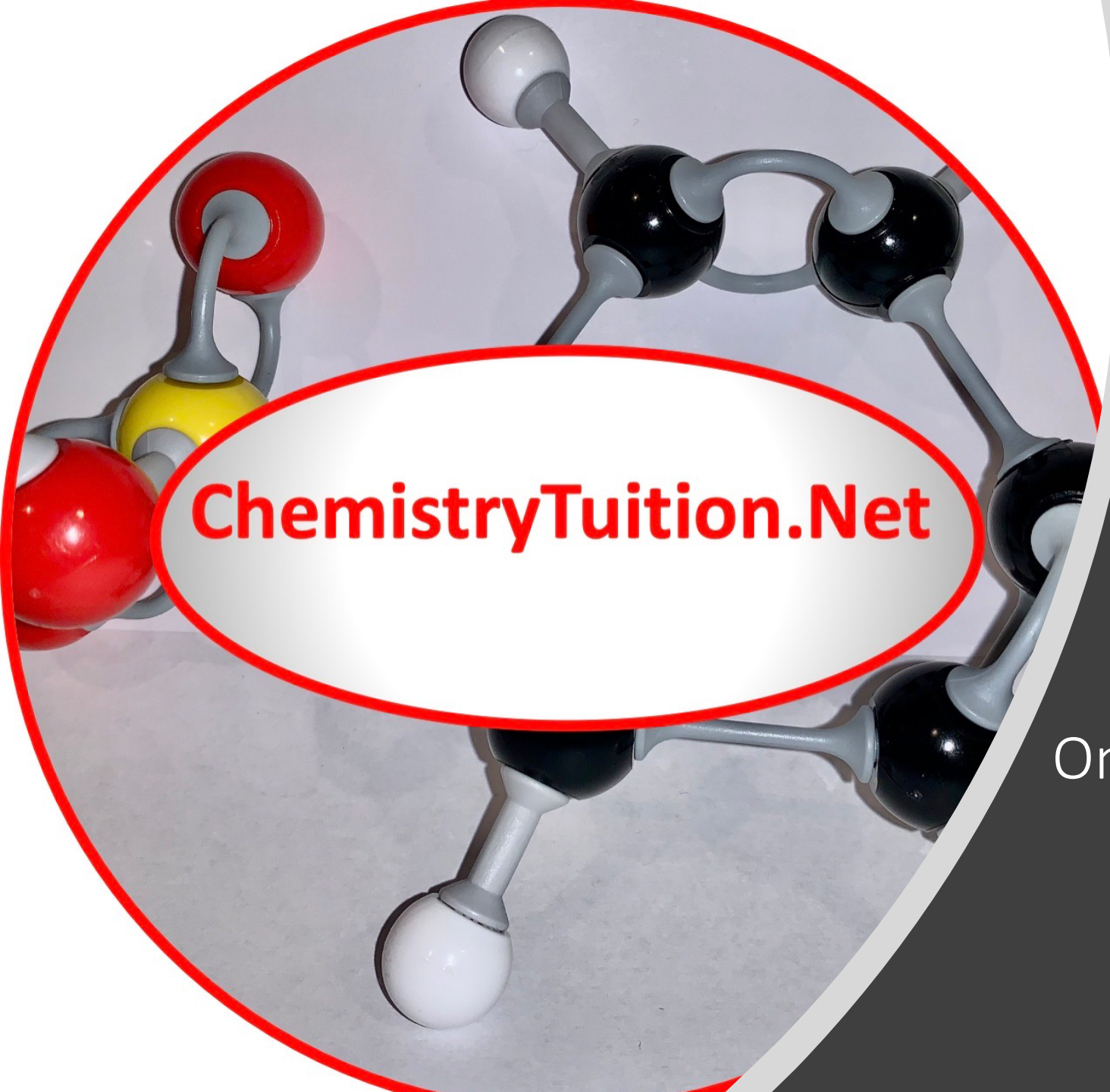
Pyramidal

sp^3 hybrid orbital



1s orbital





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