

The background features two ball-and-stick molecular models. On the left is a water molecule (H2O) with a central yellow oxygen atom bonded to two red hydrogen atoms. On the right is a methane molecule (CH4) with a central black carbon atom bonded to four white hydrogen atoms. The models are set against a light grey background with a red circular glow around them.

Online and Home Chemistry Tuition

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Extension
Topics for A
level
Chemistry

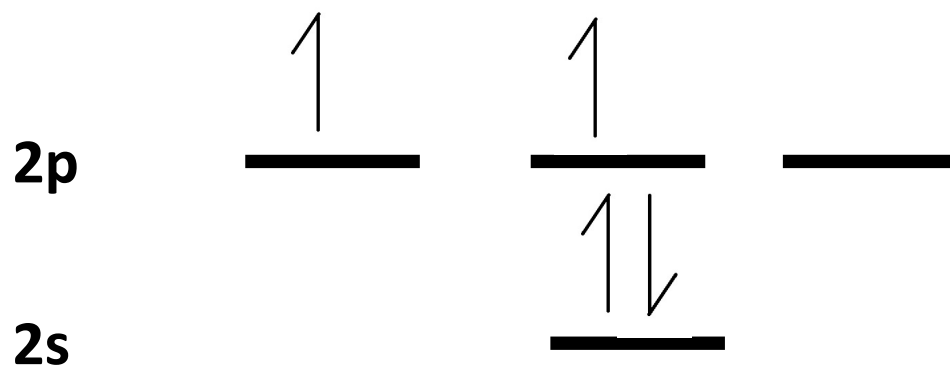
Extending Bonding theory – Orbital Hybridisation Part 1

This resource may be downloaded for free at
<https://www.chemistrytuition.net/> - GCSE to A level Resources

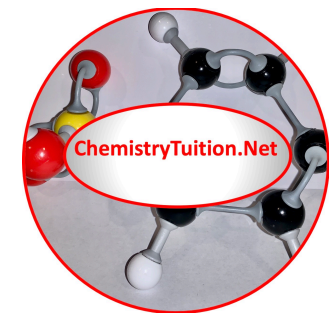
Hybridisation of Orbitals

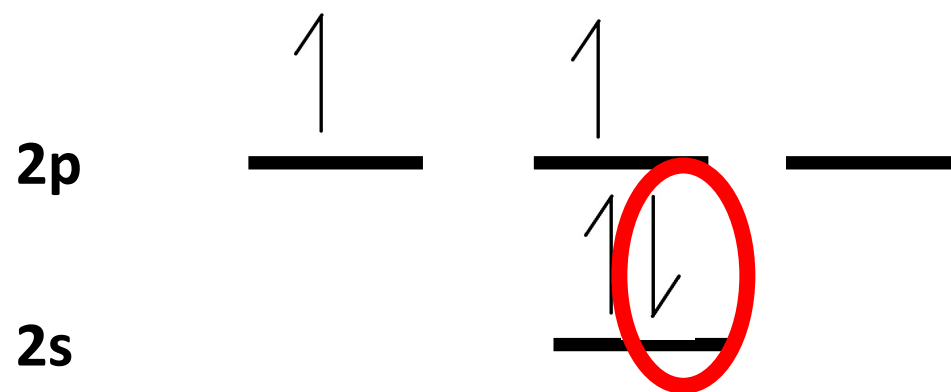
Carbon's electronic structure is $1s^2 2s^2 2p^2$

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

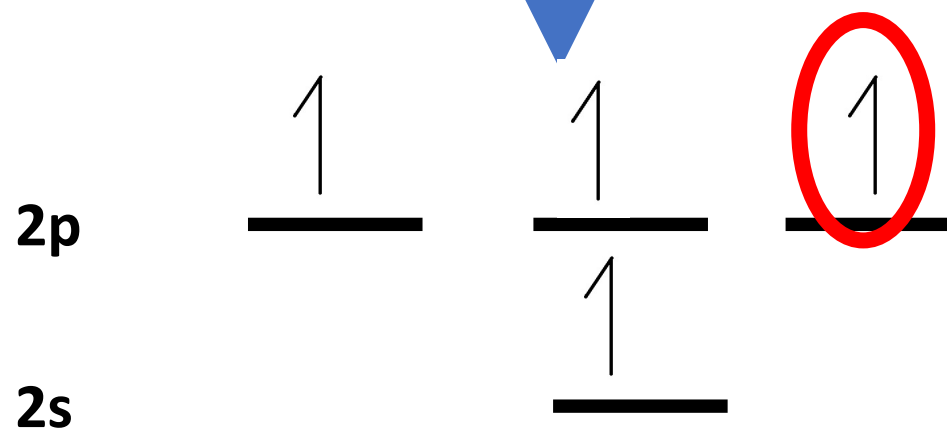


There are only two orbitals which can form bonds but we know carbon forms 4 bonds.

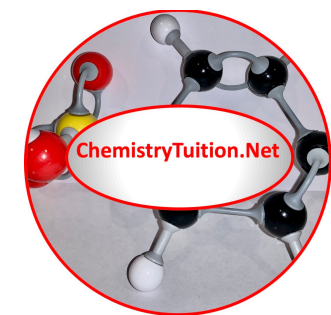




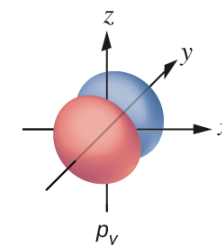
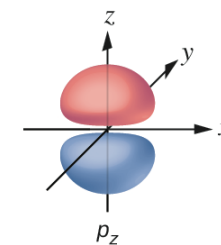
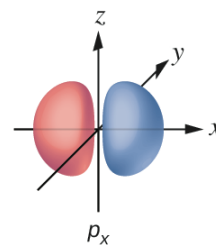
An electron in 2s is promoted to the empty 2p orbital



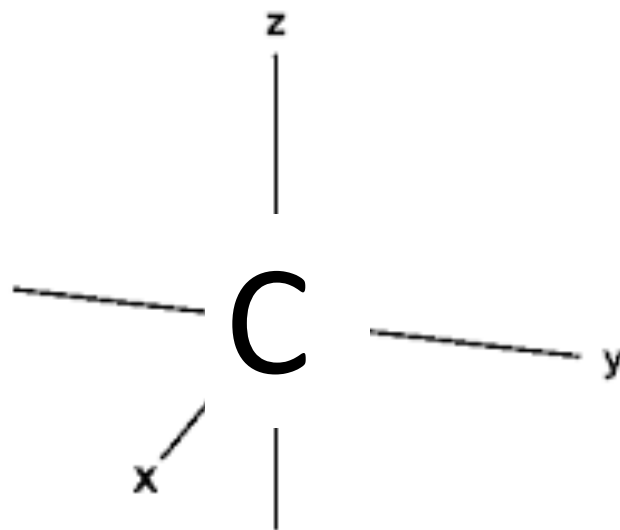
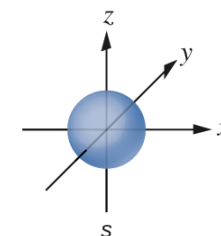
There are now four orbitals available.



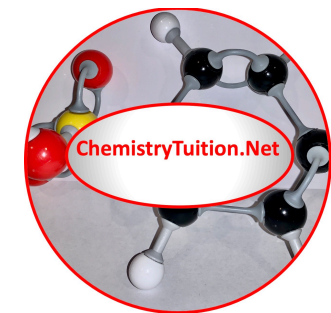
2p



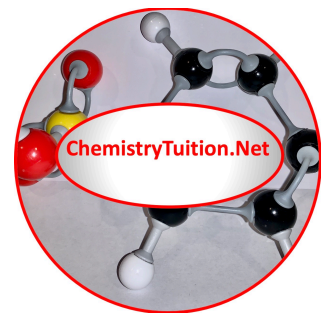
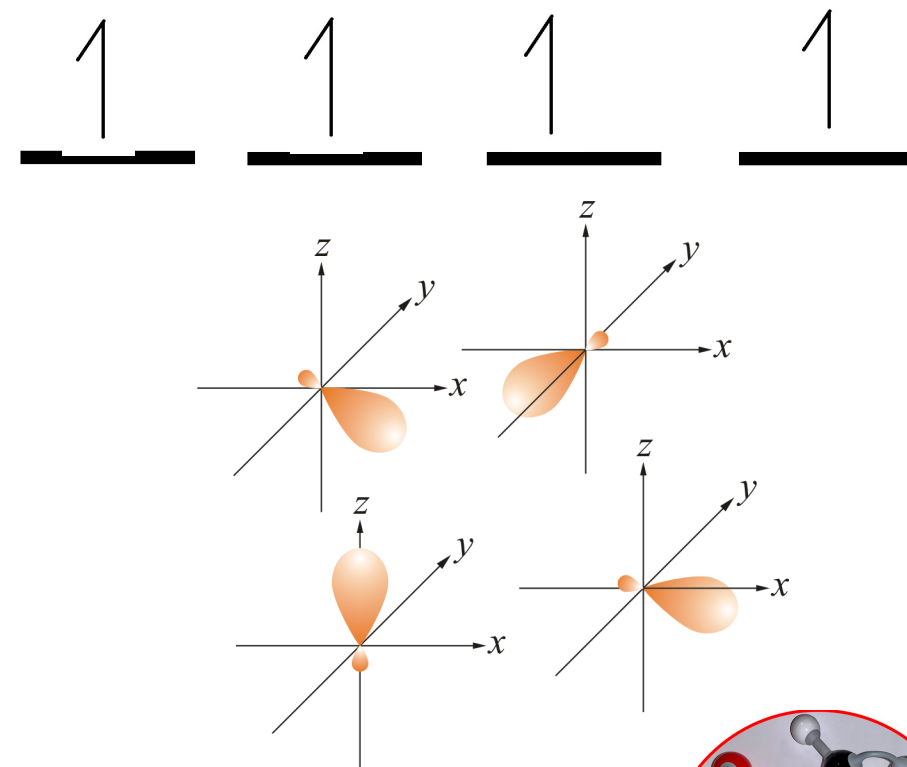
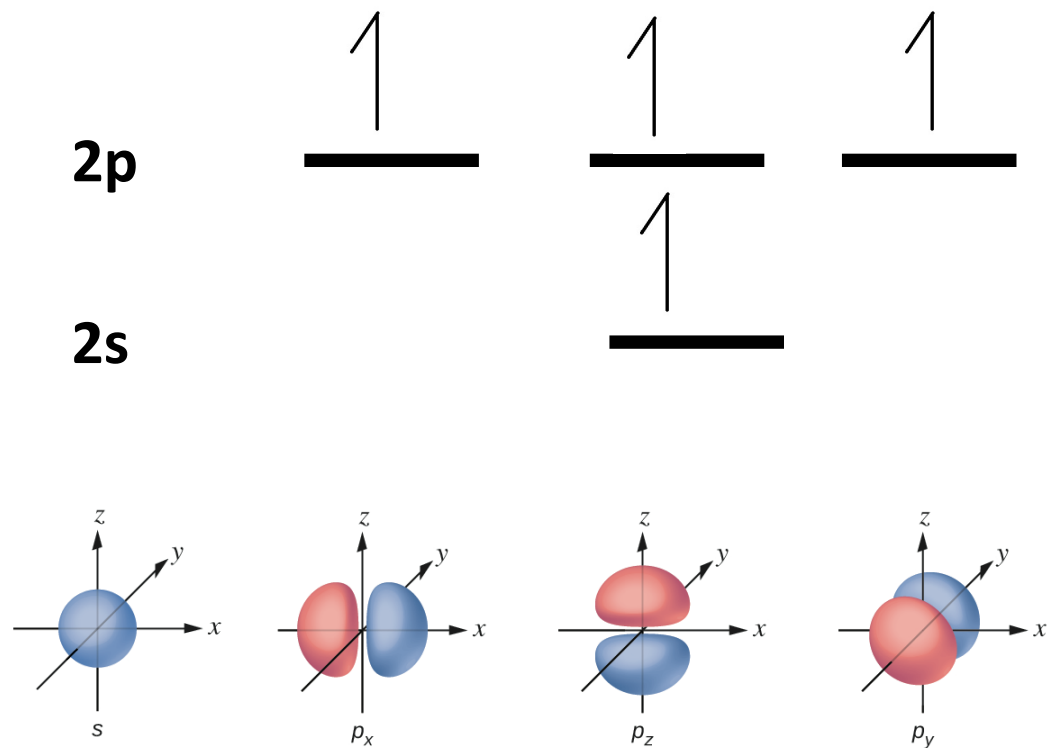
2s

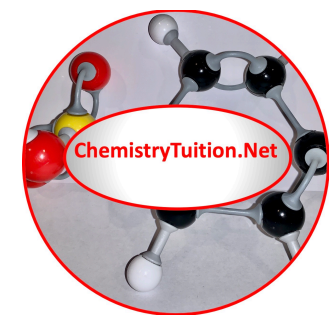
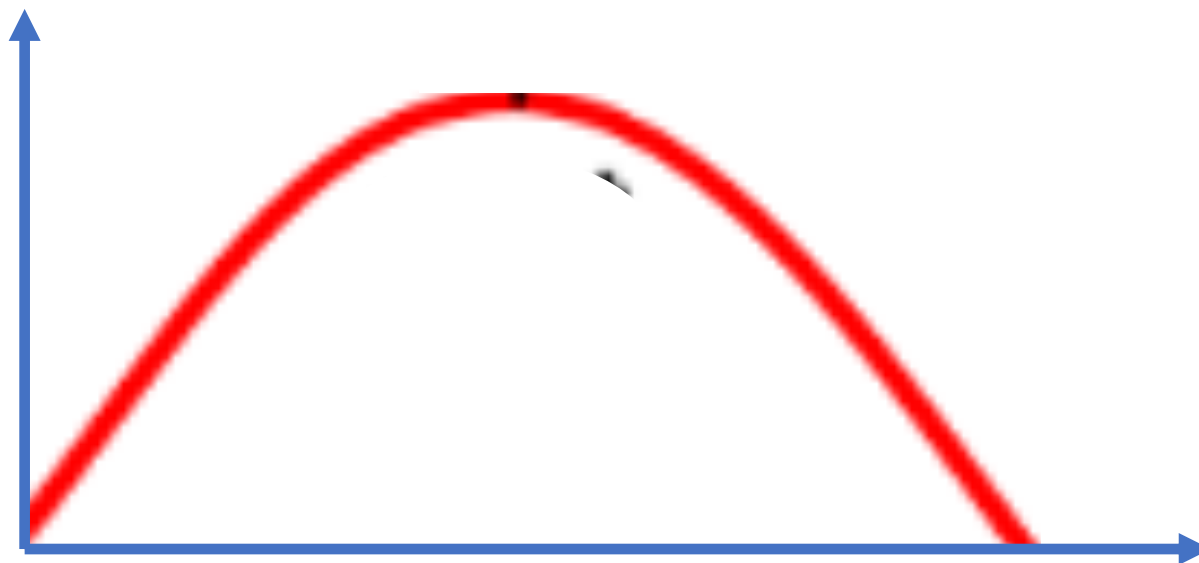
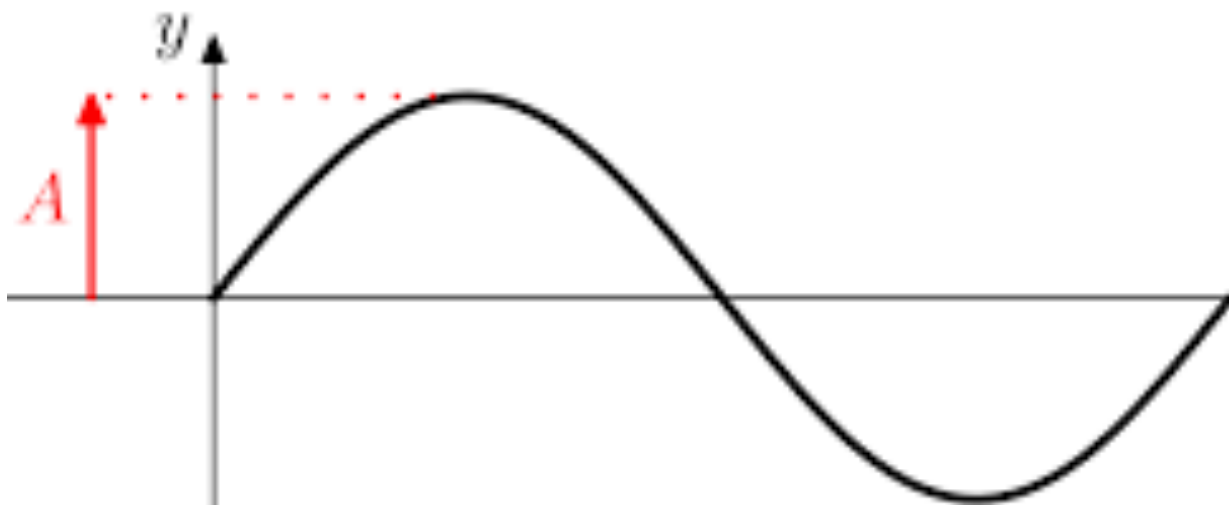


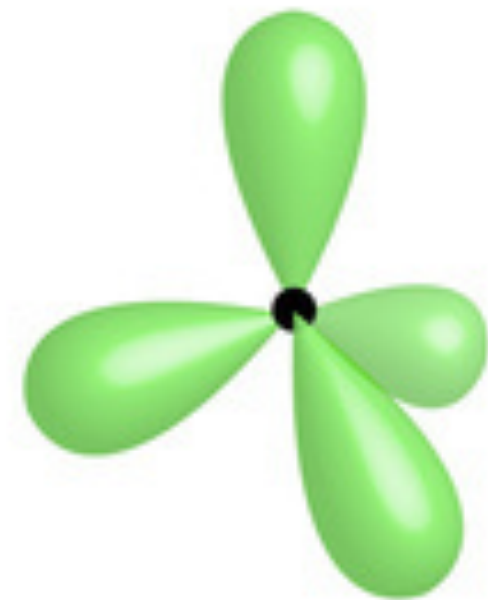
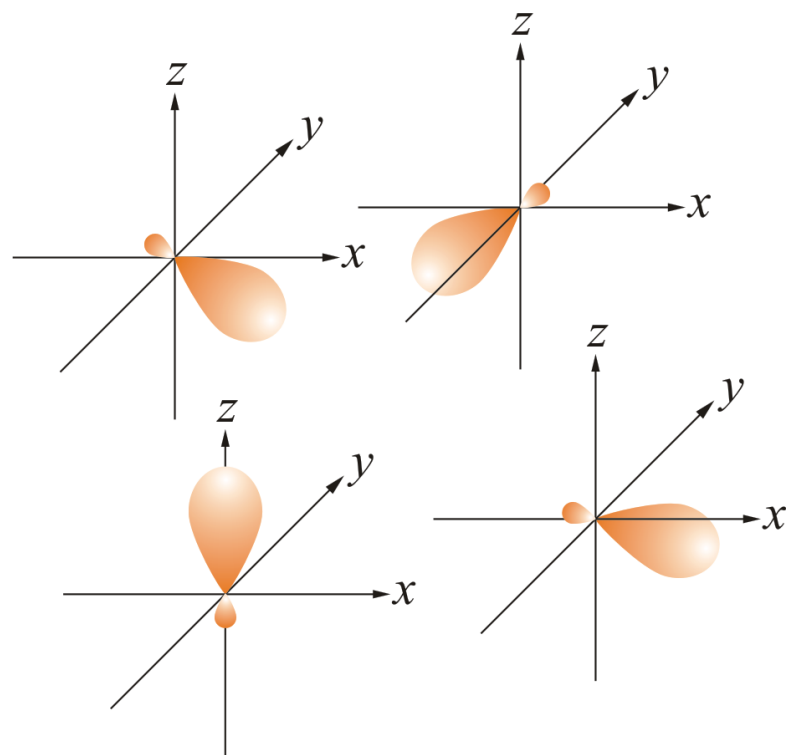
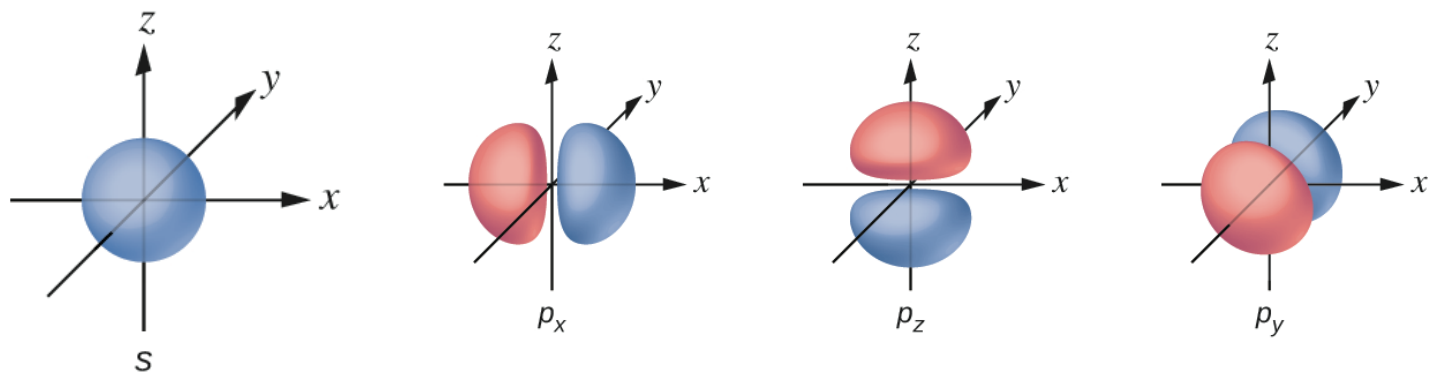
**But the bonds
around carbon
in methane are
tetrahedral**



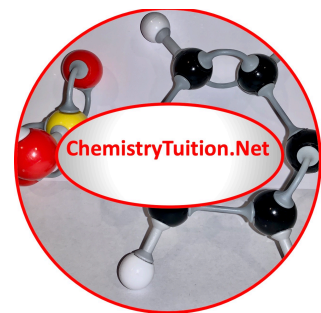
Four sp^3 hybrid orbitals

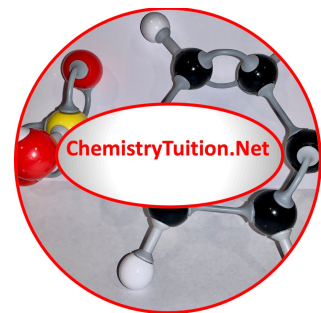
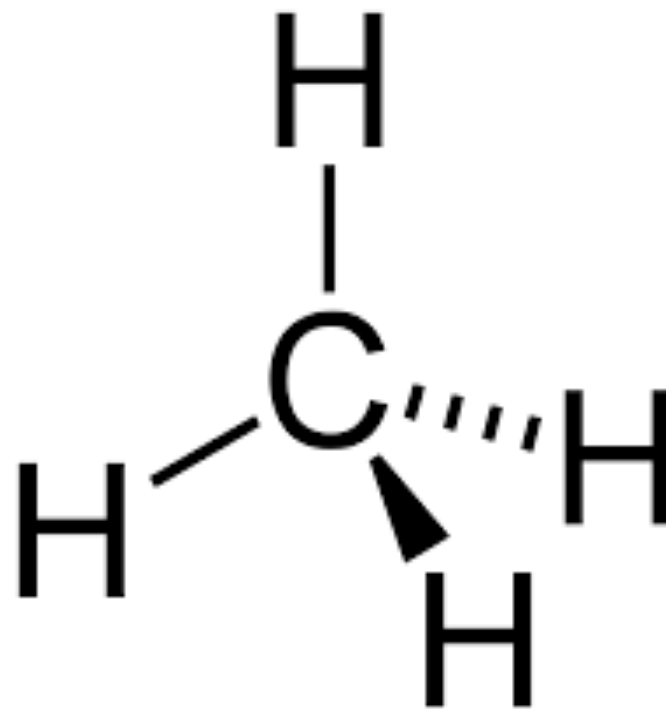
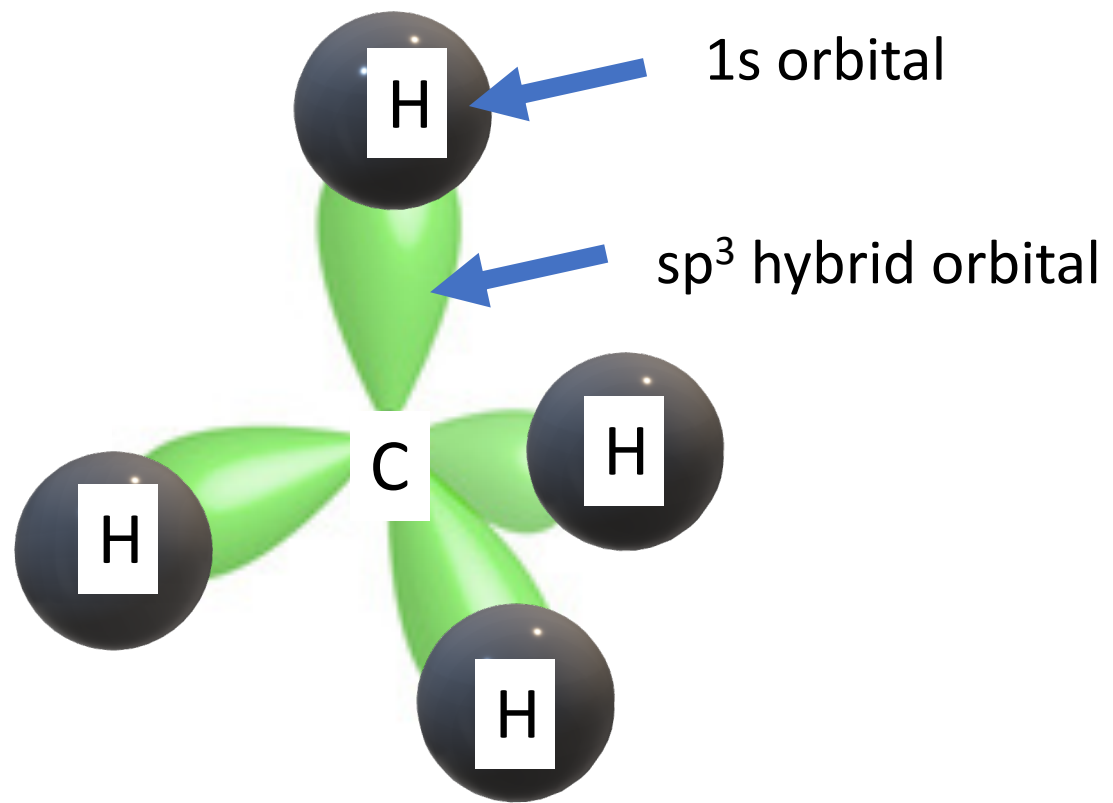






sp^3 hybrid orbitals
tetrahedral

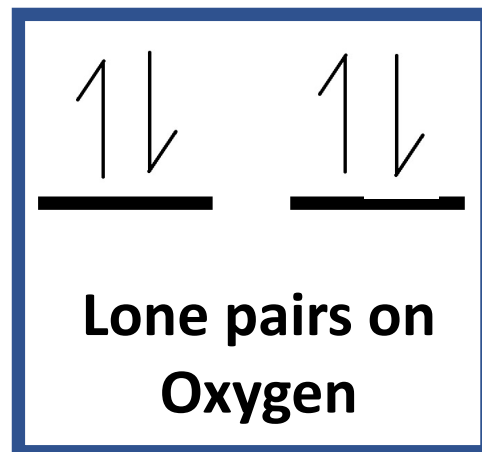
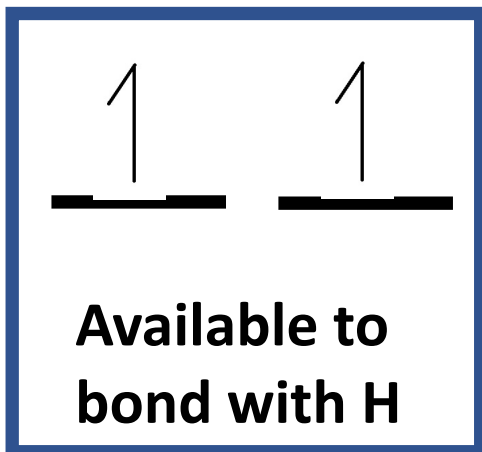




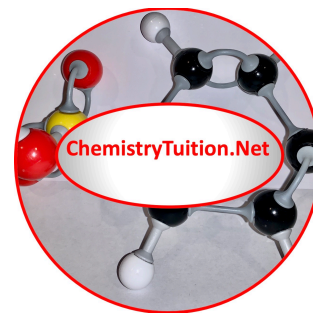
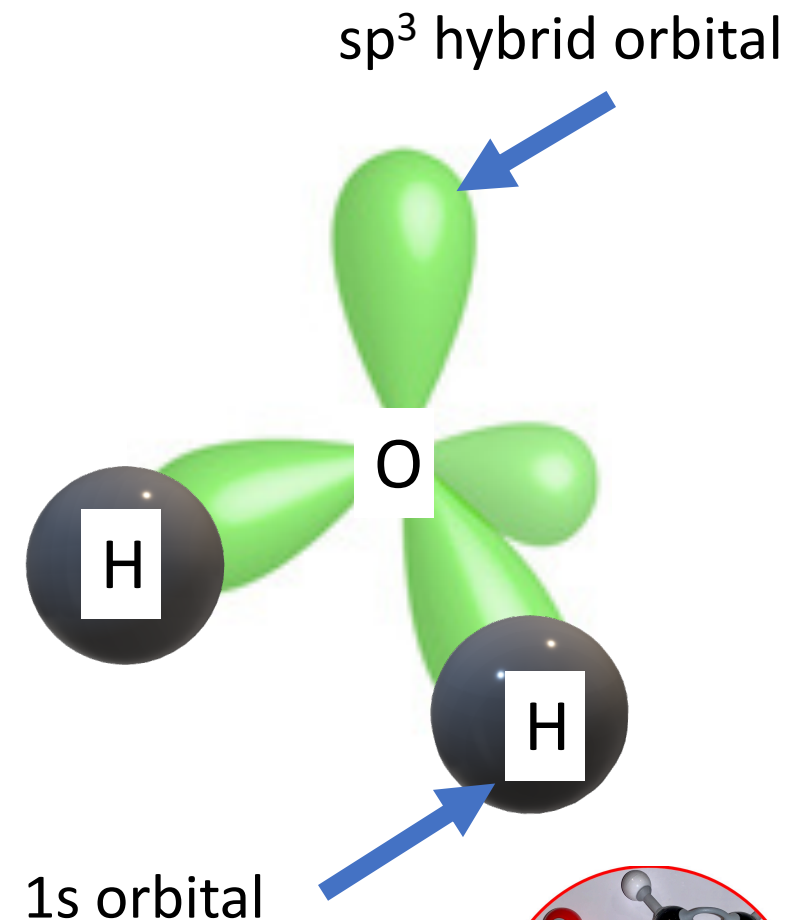
sp^3 hybrid orbitals are formed by nitrogen and oxygen when their geometry is based upon a tetrahedron.

Four sp^3 hybrid orbitals

In H_2O :

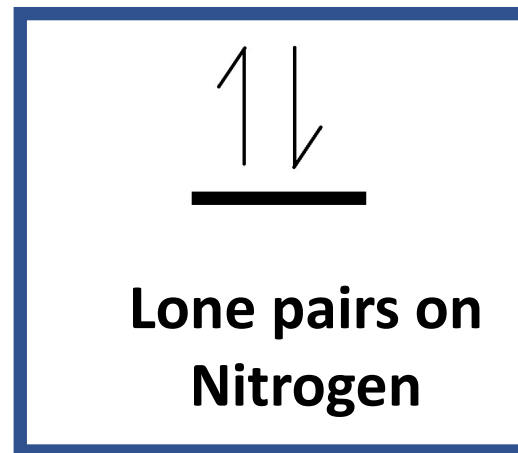
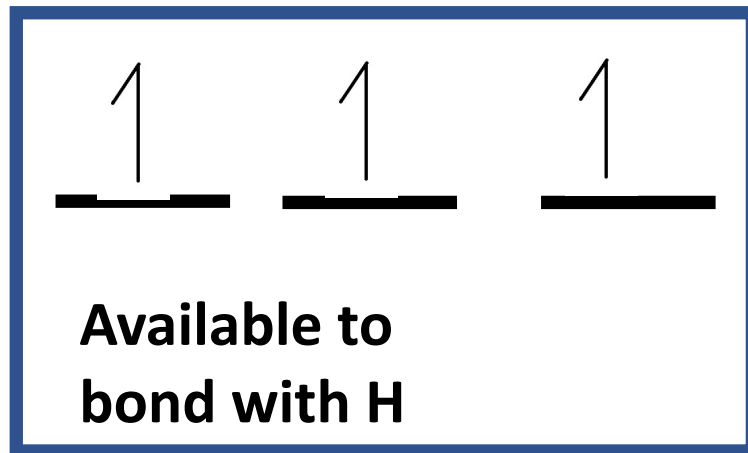


Non-linear shape

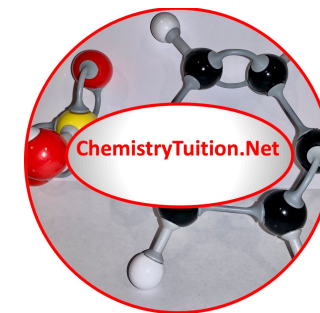
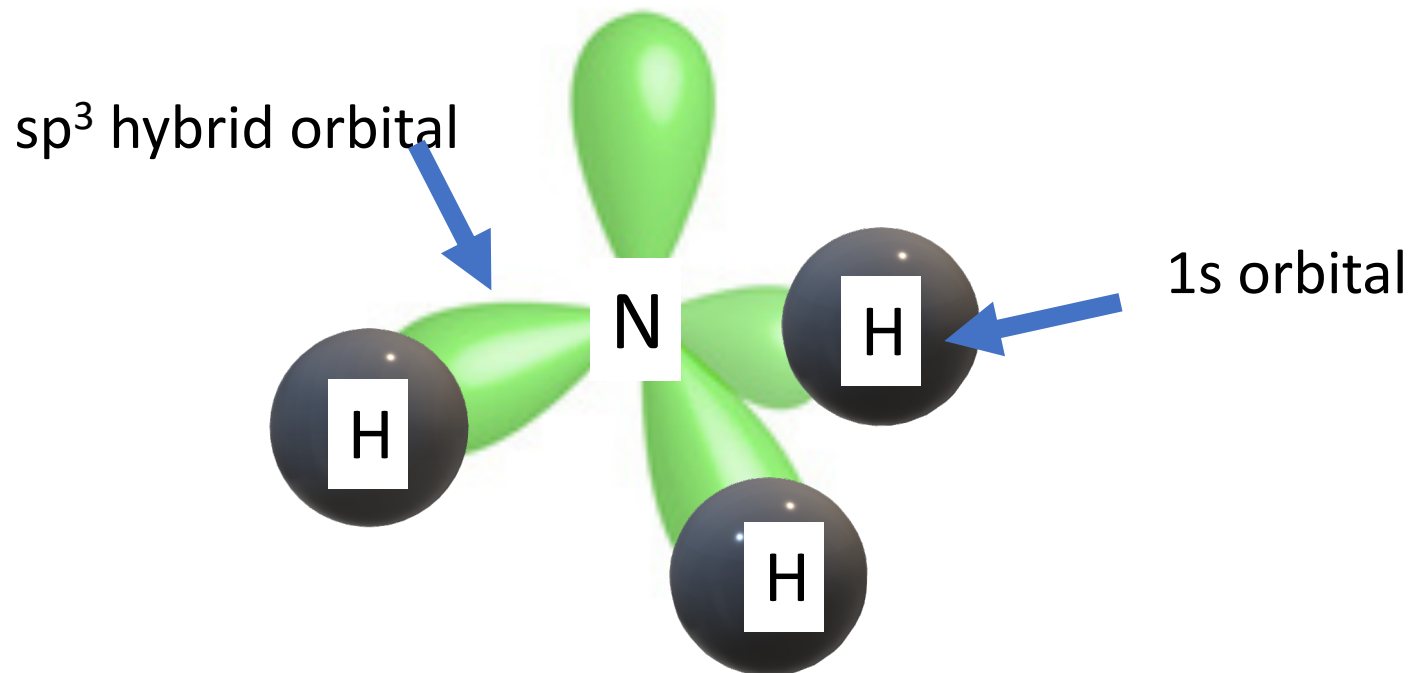


Four sp^3 hybrid orbitals

In NH_3 :



Pyramidal





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