

element has atomic # = # protons
neutral: # ~~p~~ protons = # e's
Isotopes: varying # of neutrons

1924 de Broglie expressed the e's as
wave functions - ψ

ψ^2 = probability of finding an e' at
a particular place

Regions of space w/ high probability of e'
density are atomic orbitals.

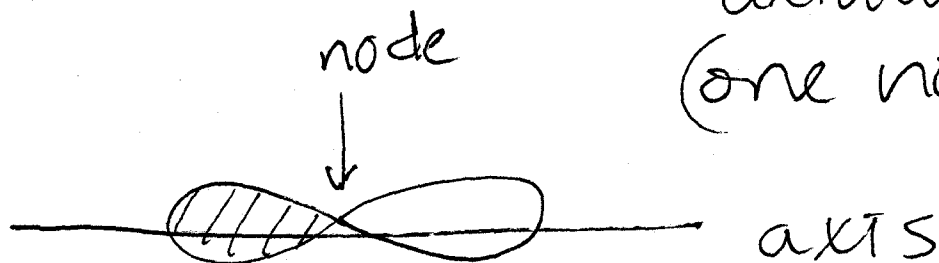
Types of orbitals: s, p, d, f , etc.

we care about:

* s orbitals - spherically symmetrical
(no nodes)

basically a sphere centered on the nucleus.

* p orbitals - dumbbell-shaped
axially symmetrical
(one node)



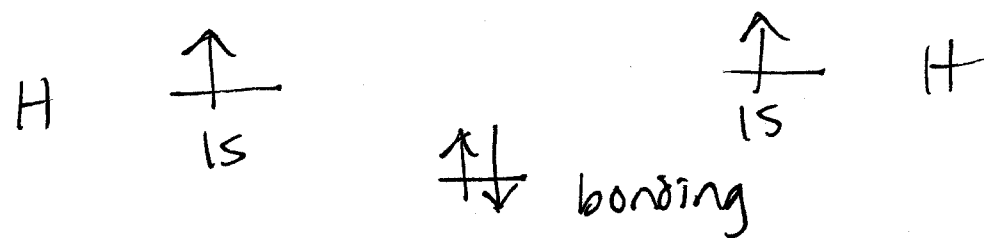
orbitals come in a series of energy levels - use " n " (principal quantum #) to describe the energy level - $n = 1, 2, 3$, etc.

Ca: $1s^2 2s^2 2p^6 3s^2 3p^6 (4s^2)$ valence $20 e^-$ 20 protons

Be able to write out e^- config. up to Ca.

* outermost shell is where the valence e^- s are.

Drawing orbitals.



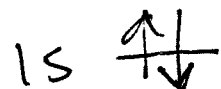
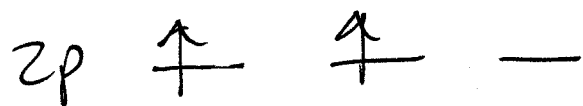
H 1s'

— antibonding

molecular orbitals
are linear
combinations
of A.O.'s

$\psi_1 + \psi_2$ or $\psi_1 - \psi_2$

Carbon: $1s^2 2s^2 2p^2$

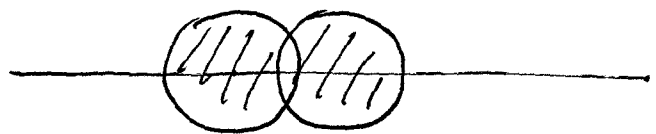


3 degenerate orbitals
(same energy level)

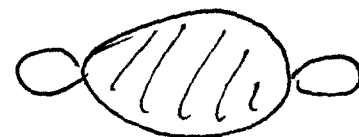
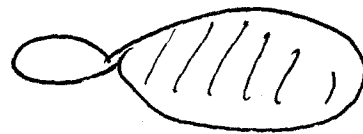
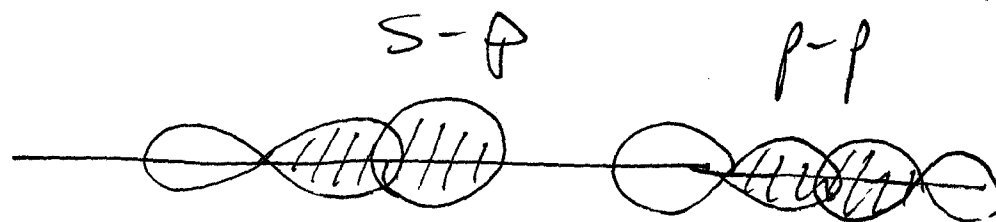
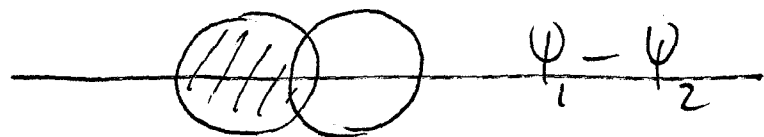
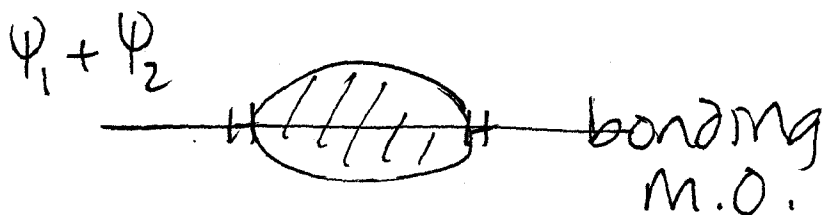
What is a bond?

single bonds - σ bonds - cylindrically symmetrical

use Principle of Maximum Overlap - strongest bonds are formed from the greatest amount of orbital overlap.

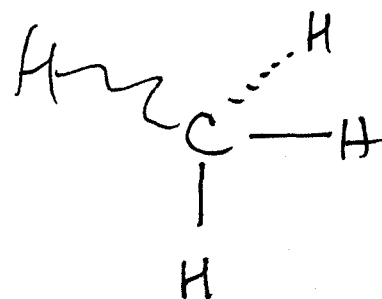
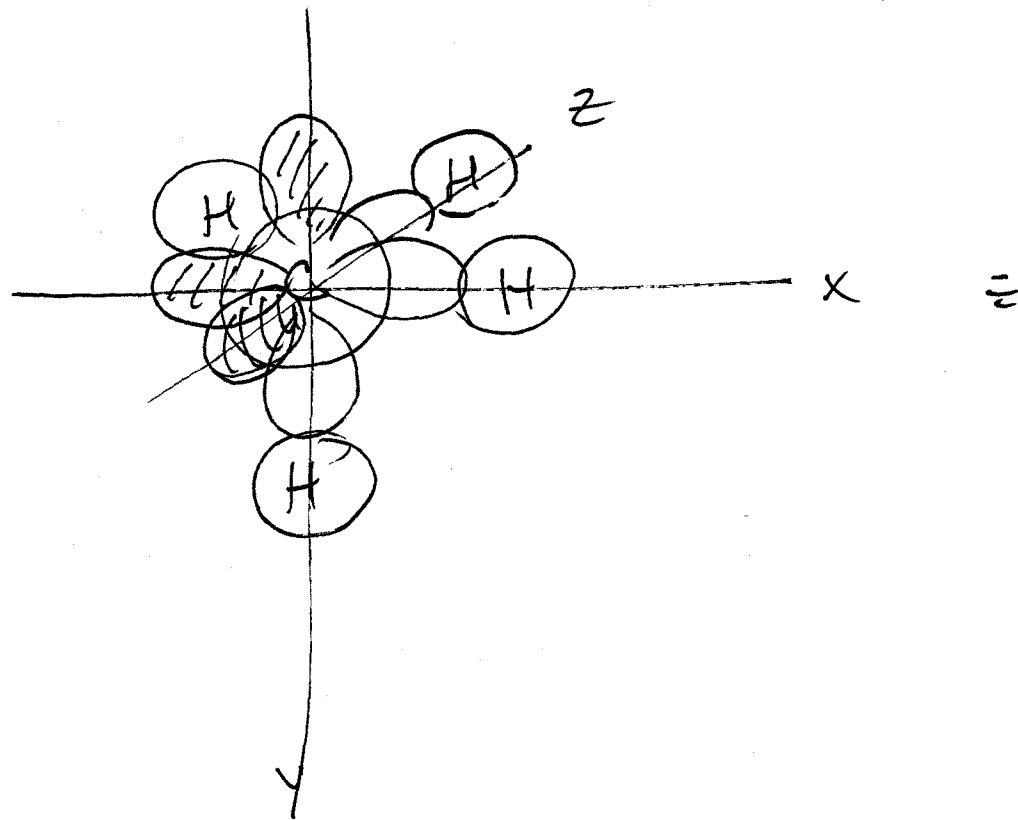


s-s σ bond



consider methane. CH_4
carbon, 4 v.e. ($2s^2 2p^2$)

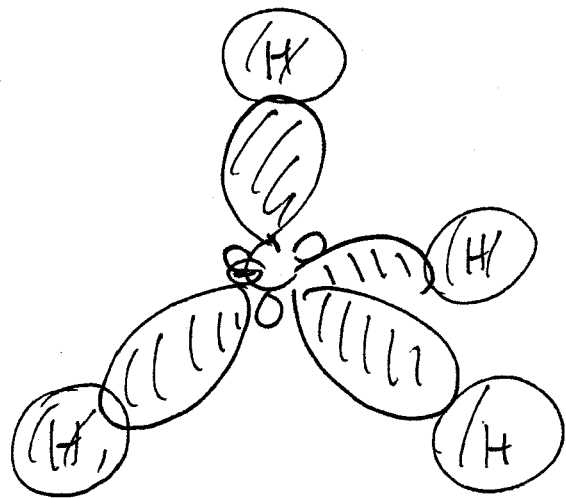
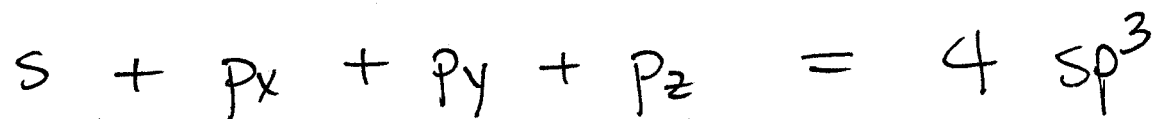
we know that it
is tetrahedral.
 109.5°



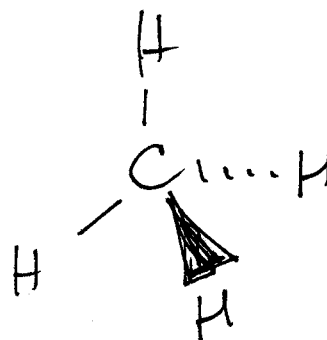
3 90° bond angles
1 ? bond angle

This doesn't work. So, use orbital
hybridization, mathematical combinations
of atomic orbitals on the same atom.

methane has 4 identical bonds, so use all 4 A.O.s.



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when drawing 3D molecules

straight



implies in the plane

wedge



- coming out of the plane towards you

hatch



- coming out of the plane away from you