Element has atomic # = # protons

Neutral: # ~~prons~~ 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 <u>atomic orbitals</u>.

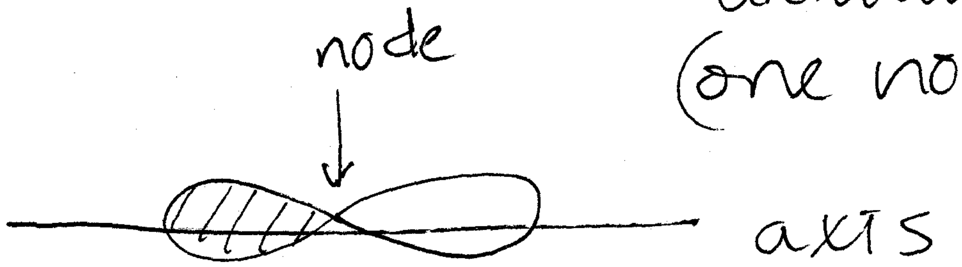
Types of orbitals: s, p, d, f, etc.

we care about:

- * s orbitals - spherically symmetrical (no nodes)

  basically a sphere centered on the nucleus.

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



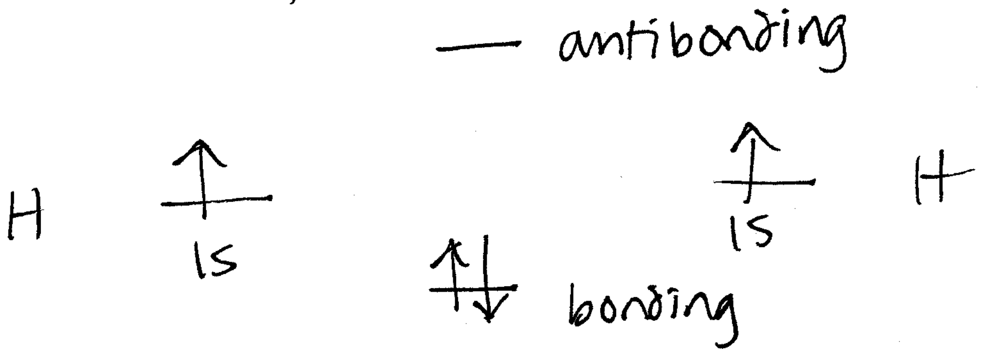
orbitals come in a series of energy levels - use "n" (principal quantum #) to describe the energy level - $n = 1, 2, 3,$ etc.

Ca: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$ valence e' 20 e' 20 protons

Be able to write out e' config. up to Ca.

* outermost shell is where the valence e's are.

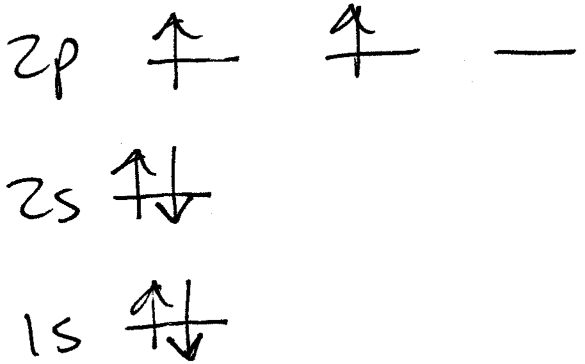
Drawing orbitals. H $1s^1$



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

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

carbon: $1s^2 2s^2 2p^2$

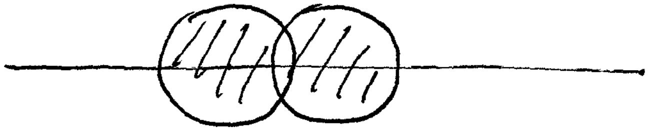


3 degenerate orbitals (same energy level)

What is a bond?

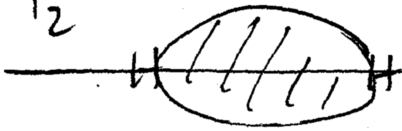
single bonds - σ bonds - cylindrically symmetrical

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

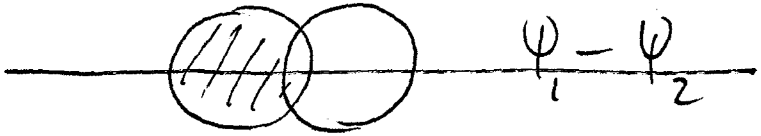


s-s σ bond

$\Psi_1 + \Psi_2$



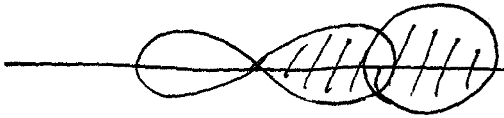
bonding M.O.



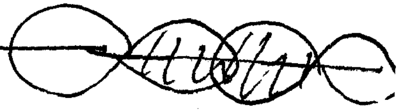
$\Psi_1 - \Psi_2$

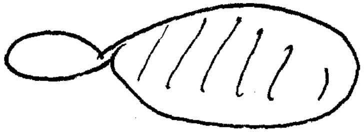
antibonding M.O.

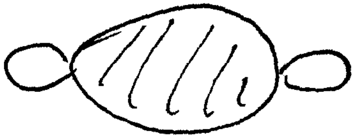
s-p

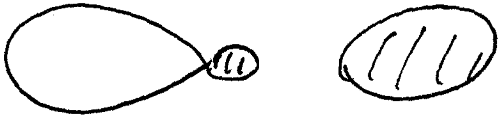


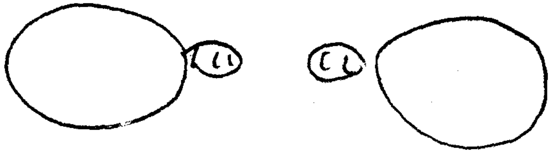
p-p







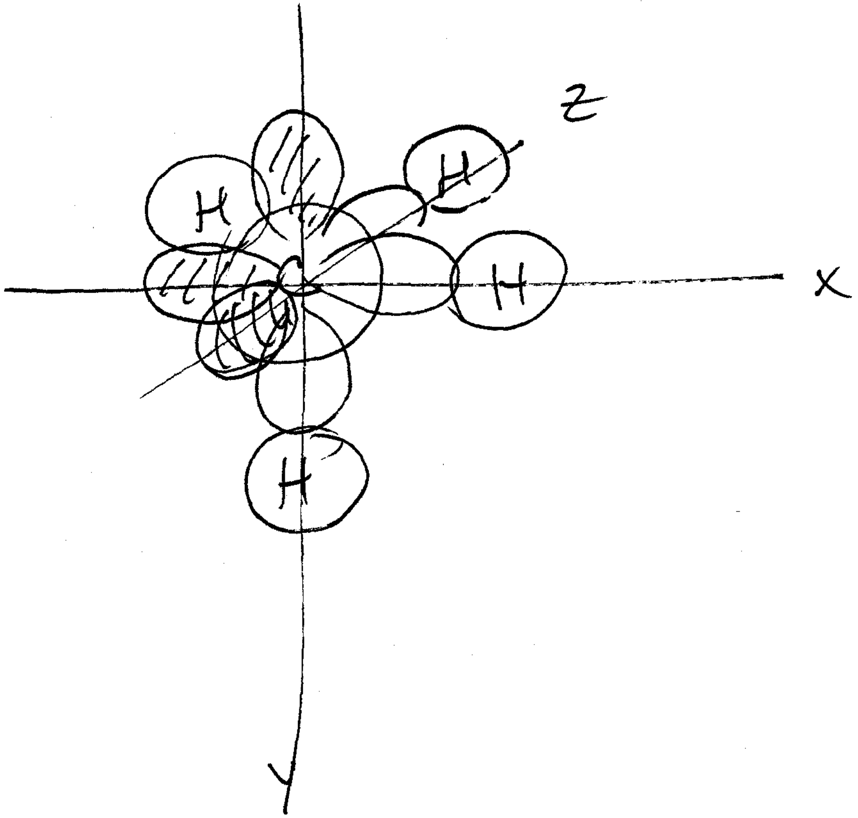




consider methane. CH_4 we know that it is tetrahedral.

109.5°

carbon: 4 v.e. ($2s^2 2p^2$)



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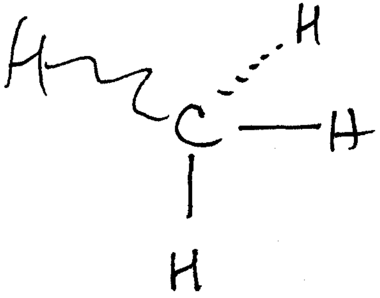


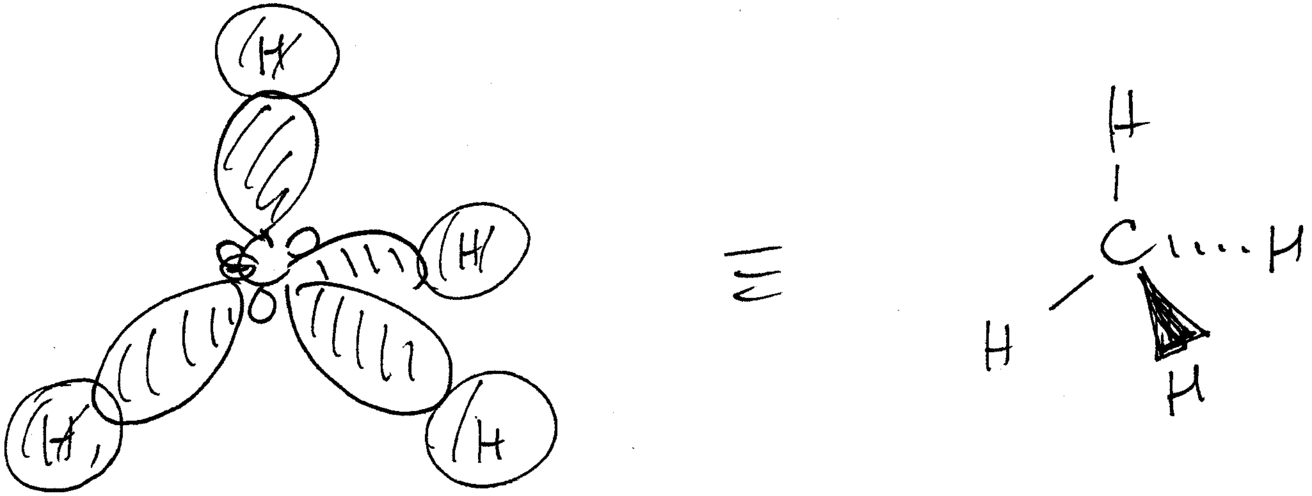
3 90° bond angles

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.

$s + p_x + p_y + p_z = 4\ sp^3$



when drawing 3D molecules

straight —— implies in the plane

wedge  - coming out of the plane towards you

hatch ıllı.. - coming out of the plane away from you