Course Chem 343 Lecturer Prof. Gellman

Day ~~9/2/15~~ Wed. Date 9/2/15

Notes Taken By Kirandeep Deol Total # of Pages 3

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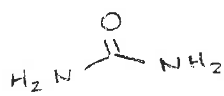
website ⇒ https://www.chem.edu/chem343-gellman/index

introduction : what is organic chemistry?

- study of molecules that contain carbon
- many drugs & biologically revelant molecules are comprised with carbon

ie. AgNCO + NH_4Cl ⟶



inorganic molecules; urea (organic molecule)

1828 : Wöhler
- proved the vital theory was incorrect

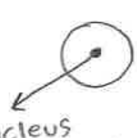
- carbon valence = 4 ie. carbon prefers to form 4 bonds
- for carbon, in its electronic ground state (ie e⁻ in lowest energy orbital) ⇒ 2e⁻ in 1s orbital
  2e⁻ in 2s/2p orbitals

- valence shell orbitals of a given atom interact with valence shell orbitals of other atoms to form bonds

ie AO "atomic orbital" —combine to form→ MO's (molecular orbitals)

- molecular orbitals are shared by the atoms

ie. 4AO's in 2^{nd} shell : 2s, 2px, 2py, 2pz



"s orbital"
= spherically symmetric

p orbital
= directional
= higher energy than s
↳ contains a node at the nucleus (area of no e⁻ density), which makes it higher in energy than s

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- prototypical organic molecules (CH_4)
  - ⇒ carbon forms 4 equivalent bonds to H atoms
    - ∴ carbon valence AO's must be hybridized (combined) to form 4 equivalent AO's

E↑ 2p: 1 1 _ ; 2s: 1L ⟶ 1 1 1 1 sp^3

combine 1 × s & 3 × p to get 4 sp^3 (25% s, 75% p)

1 = e^-, "spin state"

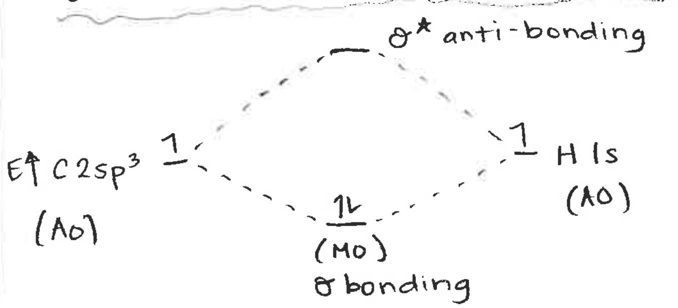
- Form CH_4 from sp^3 hybridized C + 4 H atoms

(4 × H·) + ·C̈· ⟶ H–C(H)(H)–H

Note · = e^-
⇒ line between 2 atoms is a pair of e^-'s shared between them (ie bond)

- Each C-H bond can be thought of as arising from combination of a 1s orbital on (H) and a 2sp^3 orbital on carbon
  (AO's → MO's) process depicted via 2 different drawings

C-H bond orbital energy diagram



1. Roman letters for AO's, greek for MO's
2. * conservation of orbital # (2 AO's ⟶ 2 MO's)
3. * one MO higher in energy than AO
4. Place e^- in most stable arrangement (ground state)

- "one MO is lower in energy than either AO"
  ⇒ binding (putting e's here, leads to stability) } note for *(2)
- antibonding (e's at higher energy than in isolated atoms)
  - population of σ* weakens overall bonding } note for *(3)

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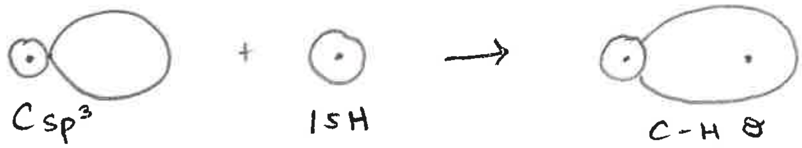
- "spatial characteristics of C-H bond"
  - regions of space in when e⁻'s likely to be found



[e⁻ density between nucleus]

e⁻ density has node between nuclei

∴ antibonding