Course Chem 343 Lecturer Gellman

Day Friday Date 9-2-2011

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Molecular Model Kits for sale in lobby outside class.

Answers to all textbook questions available on course Website

Organic Chemistry → chemistry of carbon

Why carbon? all life is carbon based - carbon tends to form strong bonds with other carbon atoms

Chapter 1 - Bonding in carbon-rich molecules

Rec. Problems - 1, 3-10, 12-15, 18-22, 24-29, 31, 33, 34, 41, 42, 45

Carbon Valence = 4 (prefers to form 4 bonds)

Electronic ground state (electrons in lowest energy state)

2 electrons (e's) in 1S - core electrons ← unimportant for bonding

4 e's in 2S/2P - valence electrons ← important for bonding

"Valence shell"

Bonding ~ sharing electrons between atoms

Atomic orbitals (AOs) combine to form Molecular orbitals (MOs)

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AOs in carbon's valence shell:

2s, 2Px, 2Py, 2Pz

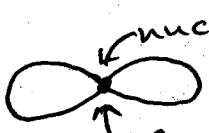
Spatial characteristics:

2s orbital

orbital spherically symmetric

electron density evenly distributed

2P orbital

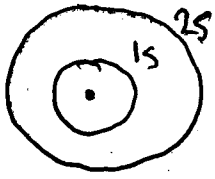


no electron density at nucleus (node)

P-orbitals:

- Directional
- Node at nucleus (no electron population)

- 1s orbital more stable than 2s b/c 1s lies more tightly around the nucleus.



- electron is negative. nucleus is positive. electron most wants to be at nucleus. S orbital is the only orbital that allows the electrons to be at the nucleus.
  - this makes S orbitals more stable than P orbitals.

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Prototypical organic molecules - illustrate bonding patterns

#1 Methane (CH_4)

C forms 4 equivalent bonds to each of 4 H's

Requires hybridization of carbon valence AOs

[Note convention] 1 = 1 electron

direction of arrow (↑ or ↓) refers to spin

higher energy

E↑ (Energy)

lower energy

$\frac{\uparrow\downarrow}{2s}$ $\frac{\uparrow}{2p_x}$ $\frac{\uparrow}{2p_y}$ $\frac{}{2p_z}$ —hybridize→ ↑ ↑ ↑ ↑

carbon ground state.

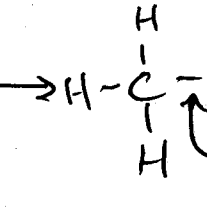
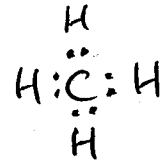
Not equivalent energy!

2s lower energy than 2p

4 "sp^3" orbitals ($2sp^3$)

1 part S (25%) 3 part P (75%)

Bonding in CH_4

$4 \times H\cdot + 1 \cdot\dot{C}\cdot \longrightarrow$  or 

↑ electrons →

Each C-H bond arises from combination of 1S AO from H + $2sp^3$ AO from C