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Organic Chemistry I, CHM 3140, Dr. Laurie S. Starkey

Ch. 1 Summary (Klein 4th edition) Chemistry Review & Intro to Organic Molecules

I. Review of General Chemistry concepts (1.1 – 1.8)
- A) atomic structure; energy of atomic orbitals (*s, p*)
- B) electronegativity - ability of an atom to attract electron density
  - i) fluorine is most electronegative element (oxygen is second-most!), periodic trends
  - ii) C ≈ H electronegativity, N = Cl electronegativity
- C) a filled valence shell (full octet) imparts stability
- D) covalent vs. ionic bonds
- E) bond polarity (δ+ and δ–) ***SkillBuilder 1.4***

II. Reading Line Drawings (1.6) ***SkillBuilder 1.5***

III. Lewis Structures (1.3, 1.4) ***SkillBuilder 1.2***
- A) structures show σ, π and nonbonded electrons
- B) formal charges (1.4) ***SkillBuilder 1.3***
- C) recognize "typical" configurations for common atoms (H, C, N, O, X)

IV. Atomic Orbitals (AO's) combine to give Molecular Orbitals (MO's) (1.7 – 1.9)
- A) Bonding MO's (σ, π) contain electrons in covalent bonds
- B) Antibonding MO's (σ*, π*) are usually empty, can contain excited electrons
- C) Relative energies, stabilities of MO's

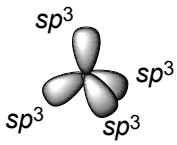
V. Hybrid Orbitals (1.10) and Shape/Geometry (1.11) ***SkillBuilders 1.7, 1.8***
- A) sp^3 hybridization: 4 regions of electron density, tetrahedral geometry
- B) sp^2 hybridization: 3 regions of electron density, trigonal planar geometry, contains an unhybridized *p* orbital
- C) *sp* hybridization: 2 regions of electron density, linear geometry, contains two unhybridized *p* orbitals

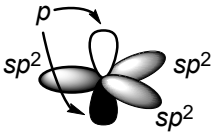
VI. 3-D sketches (2.6)
- A) determine hybridization to learn geometry about each atom
- B) draw aligned p orbitals to show π bonds

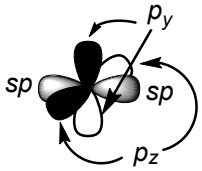
VII. Molecular Polarity (1.12) & Physical Properties (1.13, 1.14) ***SkillBuilders 1.9, 1.10***
- A) Nonbonding (intermolecular) Interactions affect bp, mp
  - i) dipole-dipole for polar molecules (δ+, δ-)
  - ii) hydrogen bonding for molecules containing NH, OH or HF (STRONG dipole)
  - iii) van der Waals (London dispersion) temporary dipole moments
    - a) explains why bp varies by MW (higher MW, higher bp)
    - b) straight vs. branched molecules (greater surface area, higher bp)
- B) mp increases for molecules that can pack tighter (more spherical, higher mp)
- C) water solubility increases with polarity, hydrogen-bonding ability

VIII. Isomerism (1.2) ***SkillBuilder 1.1***
- A) structural (constitutional): same molecular formula, different connectivity
- B) cis-trans (stereoisomers): structures vary only by orientation in space

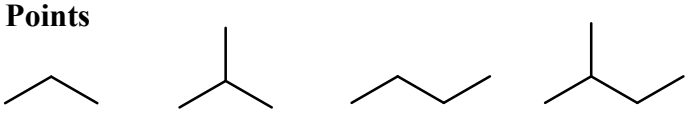
Hybridization







Predicting Boiling Points



Formula	C_3H_8	C_4H_{10}	C_4H_{10}	C_5H_{12}
BP (ºC)	- 42.1	- 11.7	- 0.6	27.9

↑ Molecular Weight, ↑ BP. *If MW is the same,* THEN ↑ branching, ↓ BP