Older Bonding Concepts (CB III)

- VSEPR
- Lewis Diagrams
- Formal Charge

Ref 1: 4 - 7, 16

Prob 8^{th} Ed 1: 3, 28 -30
9^{th} Ed 1: 3, 27 -29
HMWK #4

Adv Rdg 2 : 3, 4

VSEPR Theory

(Valence Shell Electron Pair Repulsion)

- predicts: 3D shape of molecules
- principle: e^- clouds will spread as far apart as possible

e^- cloud (= "effective pair") can be

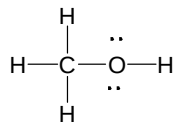
- bonding assembly (single, double, triple bond)
- lone pair (non-bonding)
- single e^- (± ?)

VSEPR

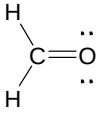
Expected Geometries	
# of e^- clouds	cloud arrangement
4	
3	
2	

Practice: e^- clouds, geometry, hybridization

1)



2)



3) H—C≡C—H

Octet Rule

"molecule is stable

if each atom is surrounded by 8 valence e⁻'s",

esp. valid for C, N, O

Ex. CO_2

Modifications

"element"	stable with
H	
group 2 (Be, Mg)	
group 13 (B, Al)	
row 3 + (P, S, …)	

N.B.: 1.)

2.)

Lewis Structures

(*e⁻ dot diagrams*)

general derivation:

- account for all valence e⁻'s,
- adher to "octet rule"

(in CHEM 101 get elaborate rules;
a simpler approach is sufficient in Organic:
trial & error;will become intuitive)

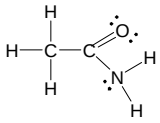
Lewis structure shows

- all valence e⁻'s
- bonding e⁻'s as dashes
- non-bonding e⁻'s as dots (*often omitted !!*)
- place + and – charges

Required Skills:

1. Is proposed Lewis structure valid?
2. Given atom connection, place e⁻'s.

Practice

Is  valid for CH_3CONH_2; C_2H_5NO ?

Formal Charge (F.C.)

shows charge on *individual* atom(s)

is due to difference in charge between

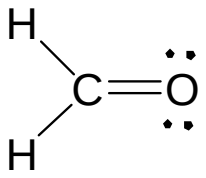
- # of e⁻'s associated w/ atom in cmpd &
- # of e⁻'s in neutral atom

" associated e⁻'s ":

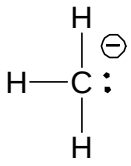
all non-bonding e⁻'s + ½ of bonding e⁻'s

F. C. Practice

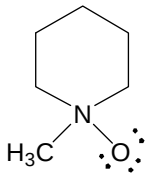
1.)



2.)



F.C. Practice



CB III Summary

Definition of e^- cloud

Derivation of Hybridization/Geometry

- 4 clouds, tetrahedral, sp^3
- 3 clouds, trig. planar, sp^2
- 2 clouds, linear, sp

Octet Rule, incl. modifications

Lewis structures:

- dashes, lone pairs, F.C.'s

Determine F.C.'s