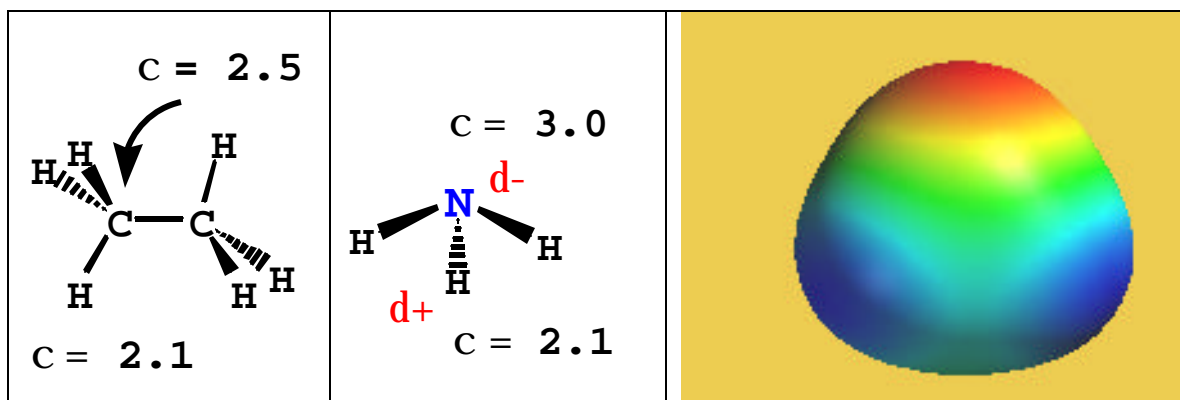


Chapter 2 - Bonding and Molecular Properties*

Electronegativity (χ) and polar covalent bonds...

Polar covalent bonds arise when bonded atoms have different χ 's.

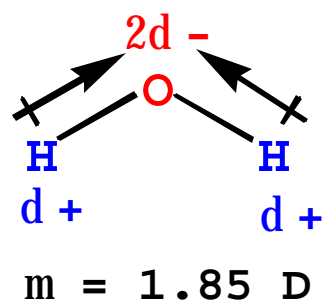


Bond polarity -> **dipole moment (m)** = product of partial charges * separation distance

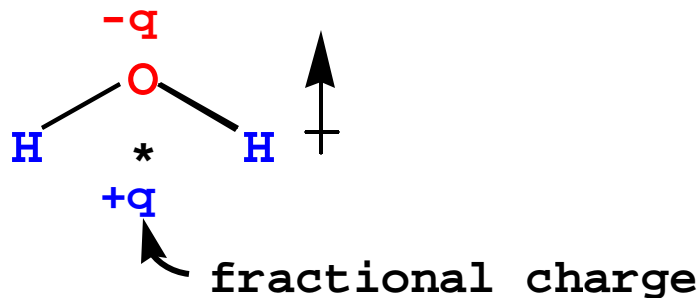
$$m = Q * d \quad \leftarrow m's \text{ can be measured experimentally}$$

Helpful link:

http://www.chem.umd.edu/courses/chem233/Handouts&Topics/dipole_moments/dp_main.htm



what are examples
of molecules with
 $m = 0$ D?

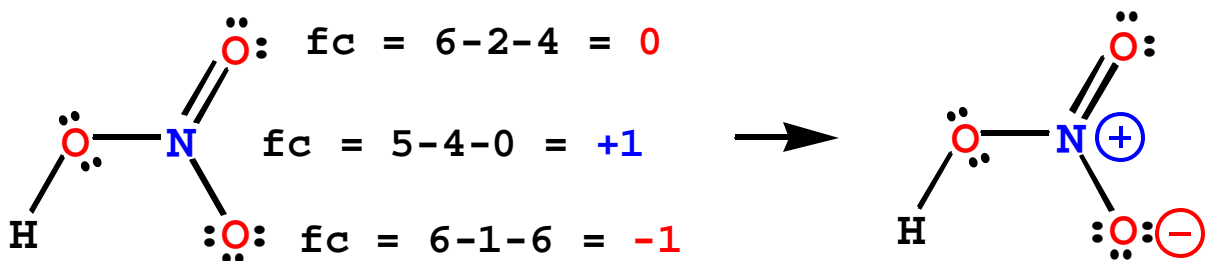


Formal charges (electron bookkeeping)...

F. C. = charge on an atom assuming equal sharing of bonding e's

$$\text{F. C.} = \# \text{ valence e's} - \frac{1}{2} \text{ bonding e's} - \text{nonbonding e's}$$

Nitric acid Lewis e-dot and fc example...

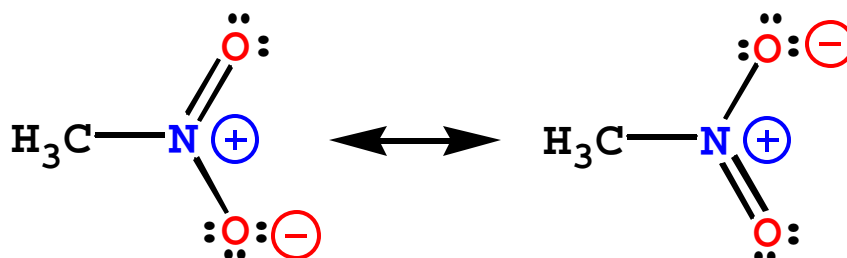


Resonance structures...

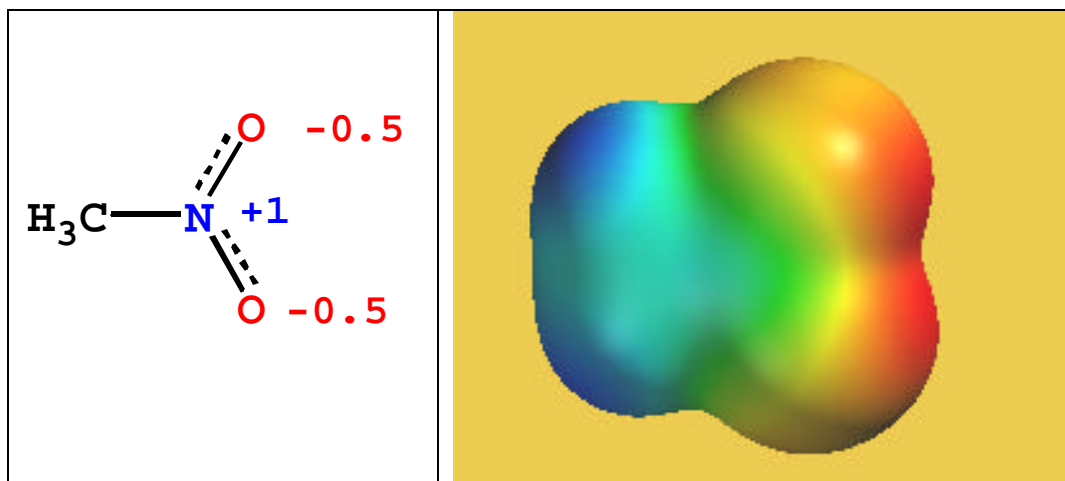
Possible structures for a molecule for which 2 or more e-dot structures can be written.

Rules on pages 46 and 47:

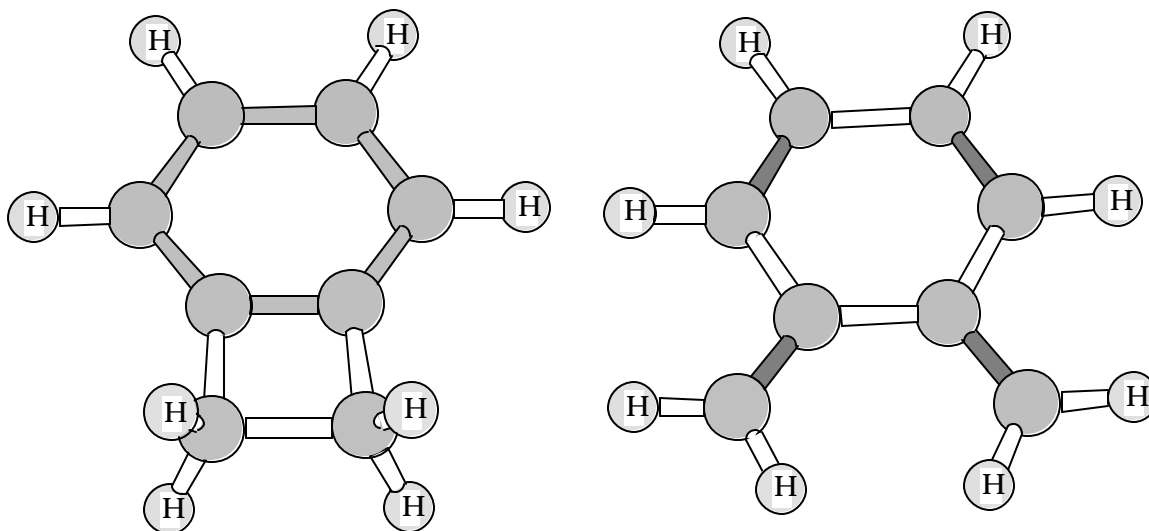
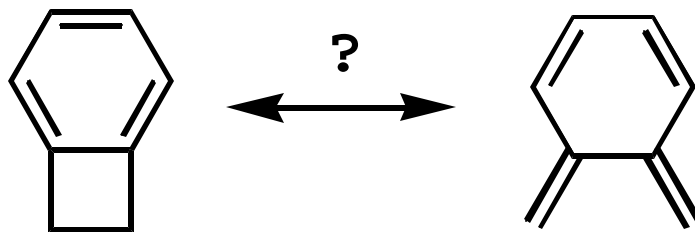
- (1) atoms never move -> hybridization does not change
- (2) just move p e's



What does nitromethane really look like? -> an average (resonance hybrid) of the above two structures.

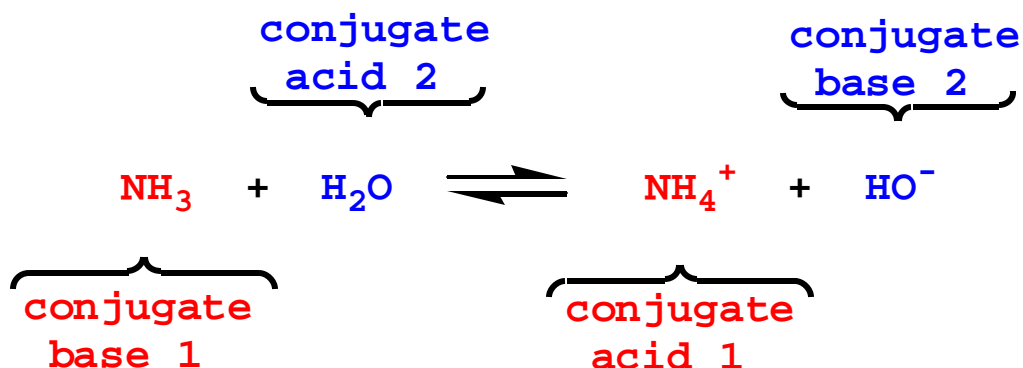


Question: Are the following two structures resonance forms of one another?



Acids and bases: Bronsted-Lowry and other definitions...

B-L acid = proton donor; base = proton acceptor



Conj acid - H^+ \rightarrow conj base

Conj base + H^+ \rightarrow conj acid

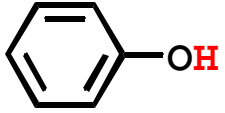
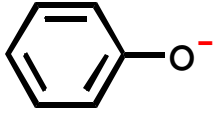
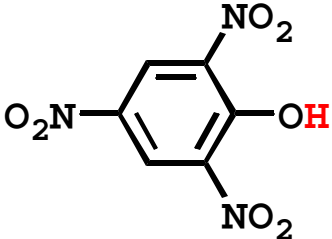
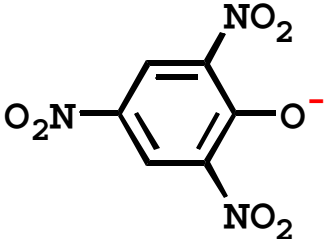
Acid strength is expressed by K_{eq} or K_{a} or $\text{p}K_{\text{a}}$ for dissociation in water...

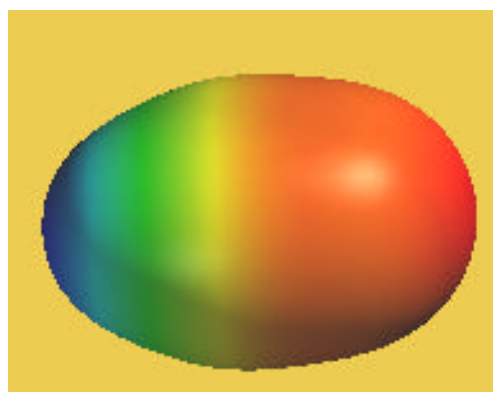
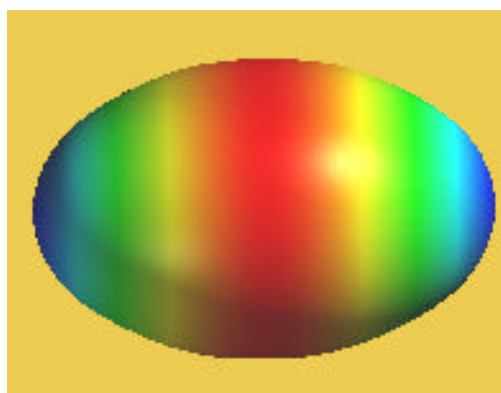


$$K_{\text{eq}} = \frac{[\text{H}_3\text{O}^+][\text{A}^-]}{[\text{H}_2\text{O}][\text{HA}]}$$

$$K_{\text{a}} = K_{\text{eq}}[\text{H}_2\text{O}] = \frac{[\text{H}_3\text{O}^+][\text{A}^-]}{[\text{HA}]}$$

$$\text{p}K_{\text{a}} = -\log(K_{\text{a}})$$

acid	pK _a	conj. base
HI	-10	I ⁻
H ₂ SO ₄	-4.8	HSO ₄ ⁻
CH ₃ CO ₂ H	4.76	CH ₃ CO ₂ ⁻
H ₂ O	15.7	OH ⁻
CH ₃ CH ₂ OH	16	CH ₃ CH ₂ O ⁻
H—C≡C—H	25	H—C≡C ⁻
NH ₃	35	NH ₂ ⁻
H ₂ C=CH ₂	44	H ₂ C=CH ⁻
CH ₃ CH ₃	~60	CH ₃ CH ₂ ⁻
	9.9	
	0.6	



Lewis acid/base definitions...

Lewis acid = e-pair acceptor

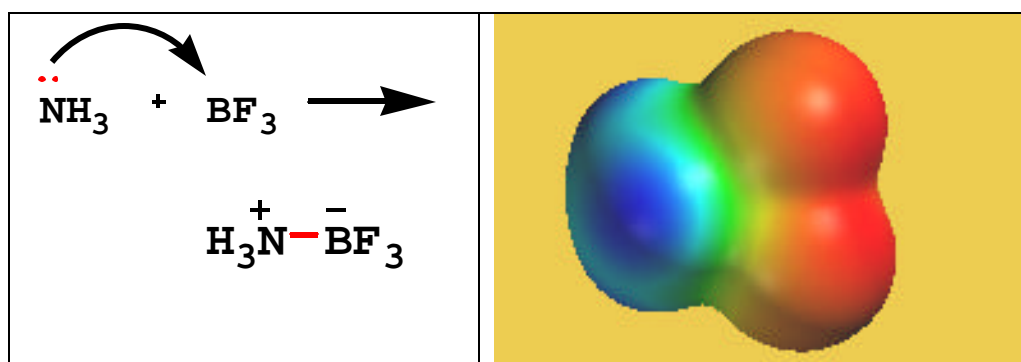
Lewis base = e-pair donor

Lewis acid examples...

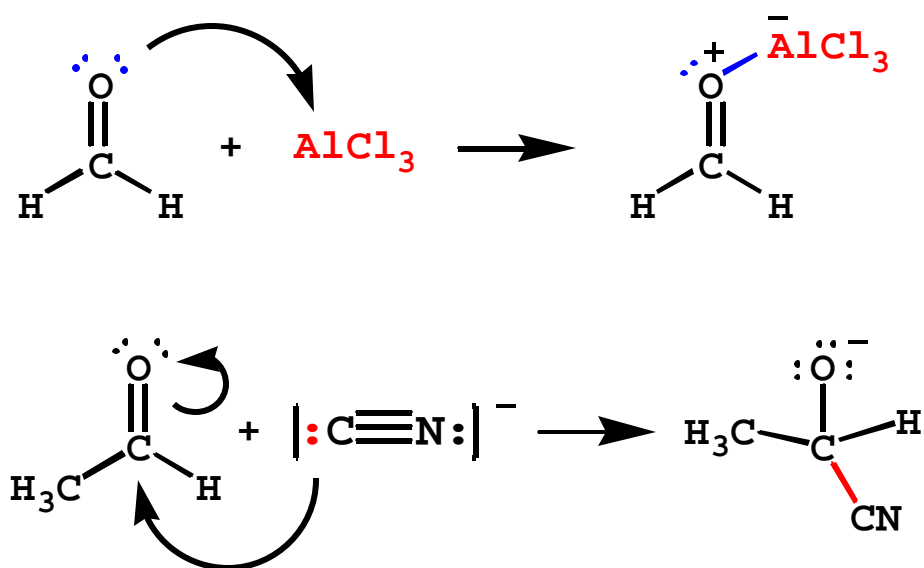
H-Cl, CH₃CO₂H, CH₃OH, Mg⁺⁺, AlCl₃, BF₃, ZnCl₂

Lewis base = anything with an unshared e-pair...

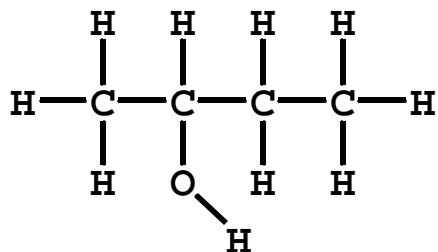
Usually O, S, N, P



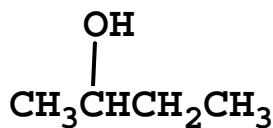
Question: identify the Lewis acids and bases...



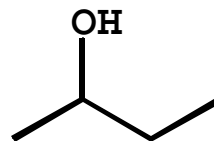
Drawing chemical structures...



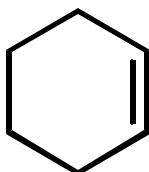
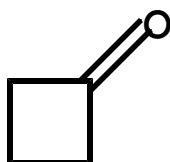
Kekulé or
line bond



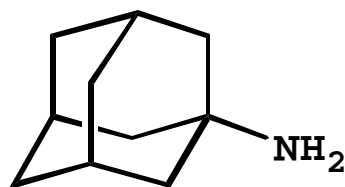
condensed



skeletal



Question: What is the molecular formula for amantadine?



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