

### Orbitals + Hybridization

S orbital	Sphere, low energy, one orbital, holds up to 2e
P orbital	Dumbell, high energy, 3 orbitals, can hold up to 6e
Hybridization	The hybridization is sp( # different e- fields -1)

### Lewis structure + Formal charge

1. Count ve- keep in mind ions add for negative subtract for positive

2. placement H are terminal, C usually in center of atoms

3. Form bonds and create structure

Aknowledge resonance structures

Formal charge an atom is negative if it has an additional electron and positive if it is missing electrons

Nucleophilic center negative

Electrophilic center positive

### Conjugate acid-> base pairs

Stronger acid	weaker conjugate base
Weaker acid	stronger conjugate base

### Comparing Acidities

1. Resonance If the conjugate base is more stabilized the acid is more acidic

Which proton is more acidic The one with a conjugate base with resonance

2. Inductive effects More electronegative atoms= more acidic

3. Hybridization CHsp is more acidic than CH sp3

4. Charge Positively charged acids are more acidic.

### SN1 reaction

Weak nucleophile and weak base	SN1, E1
	H2O, ROH
Strong base, bad nucleophile	E2
	t-But, LDA, DBN, DBU
Strong nucleophile, weak base	SN2
	I-, Cl-, Br-, N3, CN-, HS-, RS-
Strong nucleophile, strong base	SN2, E2
	HO-, RO-, -NH2, -OR

### Hydrocarbons + Halides

Alkane	C-C
Alkene	C=C
Alkyne	C≡C
Halide	R-X (X=Cl, Br, I, F)
-Primary halide	C attached to H is attached to 1 other C
-Secondary halide	C attached to H is attached to 2 other carbons
-Tertiary halide	C attached to H is attached to 3 other carbons

### Constitutional Isomers

Same molecular formula	Different Connectivity
Constitutional isomers often have	-Always have same formula
-different branching	-Different C skeleton
-Functional group in different location	-Different C chain length
Ex	CH3-O-CH3 vs CH3-CH2-OH

### Molecular geometry

Sigma bonds	all single bonds, stronger, usually allows rotation, axial overlap
Pi bonds	double and triple bonds, slightly longer, restricted rotation creating cis and trans



By NoelleEvelyn

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Resonance stability	
More bonds	More stable
Negative charges on	more electronegative atoms is more stable
Positive charges	on less electronegative atoms is more stable
Less formal charges	More stable
Avoid	like charges next to each other

Acidity trends	
1. (most acidic)	Strong acids
2.	Carboxylic acid
3.	Phenol
4.	Alcohol
5.	Water
6.	Amines
7.	Alkanes/Alkenes/Alkynes
Pka as acidity decreases	increases
Pka vs acidity	inverse relationship

Nucleophile vs Base	
Nucleophile	Donates a pair of electrons Attacks electrophile Causes substitution reactions
Nucleophilicity	kinetic (how fast it attacks C)
Base	Removes a proton Causes Elimination reactions
Basicity	thermodynamics, how badly it wants a proton
-	
Negative charge	Strong nucleophile, stronger base
Less electronegative	Better nucleophile
Larger	Better nucleophile
Smaller	Stronger Base
Steric hinderance for nucleophiles	bulky bases are bad nucleophiles
Has resonance	weaker nucleophile

Oxygen, Nitrogen and other functional groups	
Alcohol	R-OH
Phenol	OH on aromatic ring
Esther	R-O-R
Carbonyl-containing groups	O=C-R, R
Aldehyde	O=C-H, -R
Ketone	O=C-R -R
Carboxylic acid	O=C-R, -OH
Esther	
Amide	C-



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