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 of atoms	H are terminal, C usually in center
3. Form bonds and create strcutre	
Aknowledge resonance structures	
Formal charge	an atom is negative if it has an additonal 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 attatched to H is attatched to 1 other C
-Secondary halide	C attatched to H is attatched to 2 other carbons
-Tertiary halide	C attatched to H is attatched 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

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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.	Carboxyllic 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
Carboxyllic acid	O=C-R, -OH
Esther	
Amide	C-

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