

1. Ionic Compounds - Forming Ions

Be able to combine atoms from groups with difference valence to make a salt in which donation and accepting of electrons yields octet

Group I + VII NaCl
Group I + VI Na₂O
etc.

Hint: Be able to draw Lewis structures

Example



2. Nomenclature - Ionic and Covalent

This is a pretty broad topic. How about we narrow it.

Be able to correctly name covalent compounds in the main group.

Example: Given N_2O_5 , name it.

N_2O_5
dinitrogen pentoxide
prefix and element prefix and ide suffix

HINT

3. Ionic Compounds - Rank Lattice Energy

Lattice energy scales with charge density. So rank charge density and you have ranked lattice energy.

Example Rank CaO MgO and KCl

first step, assign charge $\overset{+2}{\text{Ca}}\overset{-2}{\text{O}}$ $\overset{+2}{\text{Mg}}\overset{-2}{\text{O}}$ $\overset{+1}{\text{K}}\overset{-1}{\text{Cl}}$

second step, sort by amount of charge $\text{KCl} < \text{CaO}, \text{MgO}$

third step, sort by size. Mg is smaller so $\text{KCl} < \text{CaO} < \text{MgO}$
MgO charge density is larger

4. Ions - Charge density

This is one of the steps for question 3. It is really easy.

Step 1, - sort by charge

Step 2, - sort by size

If you can do 3, you have done 4.

5. Covalent Bonding - energy diagram

Be able to understand the famous potential energy plot for bond distance

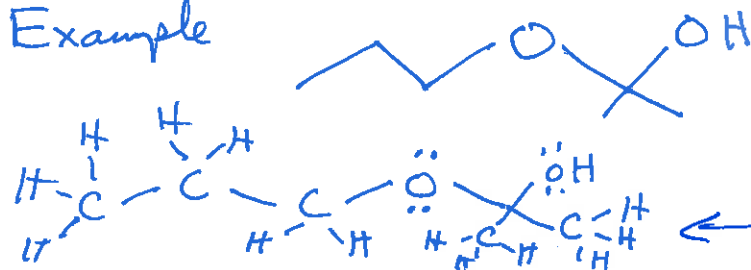


Hint. Compare attractive and repulsive contributions on plot

6. Line Drawings - Determine the Formula

You need to be able to interpret an organic molecule drawing and assign molecular formula. Hint: you assign C and H

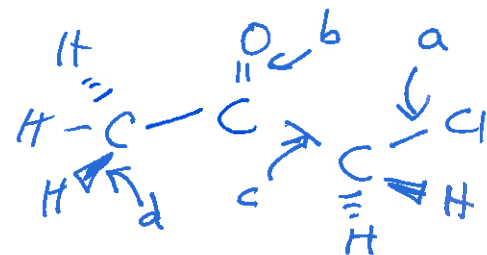
Example



- each vertex is a C so there are six carbons
 - each C must have 4 bonds so there are 14 H
- $C_6H_{14}O_2$ is answer

7. Bonding - Rank Polarity based on ΔEN

- Remember
- $L: \overset{1.0}{\rightarrow} \overset{4.0}{F}$ by 0.5 units
 - $H \equiv 2.1$
 - EN decreases going down table.



d C-H	$2.5 - 2.1 = 0.4$
b O=C	$3.5 - 2.5 = 1.0$
c C-C	$2.5 - 2.5 = 0$
a C-Cl	something $< 4 - 2.5 = < 1.5$

You will be given an organic molecule and need to rank polarity of different bonds based on ΔEN values

8. Lewis Structures - Multiple Bonds

Look at a bunch of molecules. Draw them. Which has multiple bonds.

Hint: In the 5 step process, "is everyone happy" is answered for multiple bonds by showing to make = or \equiv bonds

Hint: Know the famous multiple bonds so you don't have to draw them

= bonds: O_2 , C_2H_4 , CO_2 \equiv N_2 , C_2H_2

9. Lewis Structures - Multiple Central Atoms

Be able to draw a structure with more than one central atom. The key is to spread out atoms with perimeter atoms on outside (always H, usually halogen, often oxygen = O). Then assign 2 or 8 to perimeter, make bonds with rest and fill in extra e⁻s on central atoms. Then make sure octet is satisfied by showing.

Hint: Often we find out if you drew structure correctly by asking the number of bonding e⁻s, unpaired e⁻s, bonds, unpaired pairs

10. Octet Exceptions - Incomplete Octet

Since salts formed from ionic compounds donate to satisfy octet, there are really very few atoms left that are hypervalent.



11. Octet Exceptions - Expanded Valence

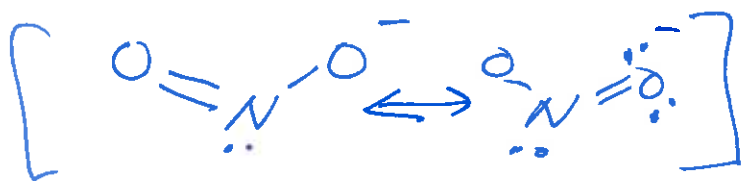
Compounds with 5 or 6 e⁻ rich regions, like ^{third row and fourth row} main group elements: P, S, Cl, Br etc can form electronic geometries that are hypervalent



Hint: Second row can't be hypervalent
Third row often is hypervalent
but draw to be sure

12. Lewis Structures - Resonance

When you draw the structure of a compound, if there are multiple bonds that are equivalent and can share a bond, you have resonance.



Hint. Here are the famous resonance structures



Why not memorize them?

13. Lewis Structures - Predicting Correct Structure from Formal Charge

You will be given 2 structures to compare and asked which has the best structure based on formal charge.

You will need to draw the molecules, assign F.C., and whichever has the smallest values on atoms is best.

Example $\underbrace{0, 0, 0, 0}_{\text{FC values}}$ is better than $\underbrace{0, 0, -1, +1}_{\text{FC values}}$

14. VSEPR - Bond Angles - Pure and Distorted

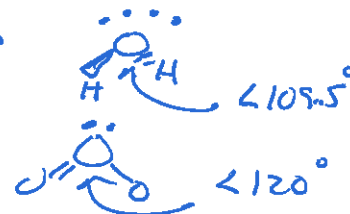
The pure bond angles based on electron rich regions are

- 2 180
- 3 120
- 4 109.5
- 5 180, 90, 120
- 6 180, 90

However distortion occurs when asymmetry (polarity) occurs.

So $\text{H}_2\text{O} \equiv$ angle slightly less than 109.5°

$\text{O}_3 \equiv$ angle slightly less than 120°



15. VSEPR - Electronic Geometries

Draw a structure. Count e⁻ rich regions. Assign electronic geometry

- 2 linear
- 3 trigonal planar
- 4 tetrahedral
- 5 trigonal bipyramidal
- 6 octahedral

16. VSEPR Molecular Geometries

Draw a structure. Count e^- rich regions. Divide into $\Sigma B + \Sigma U$

Apply

AB_2	linear	5 RHED	{	AB_5	trig bipy	6 RHED	{	AB_6	octahedral
AB_3	trig. plana			AB_4U	see saw			AB_5U	square pyramidal
AB_2U	bent			AB_3U_2	T-shap			AB_4U_2	square plana
AB_4	tetrahedral			AB_2U_3	linear				
AB_3U	trig pyramidal								

4
RHED AB_2U_2 bent

17. VSEPR - Molecular Polarity

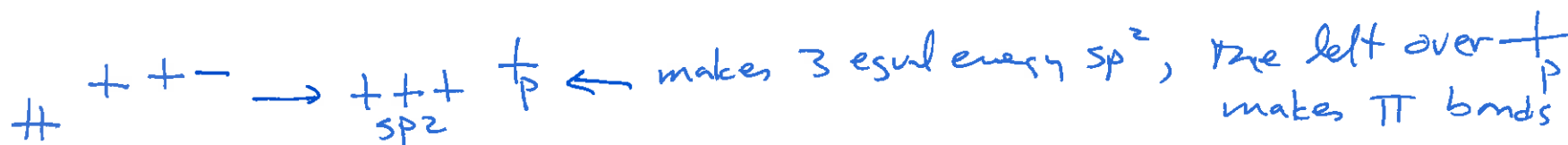
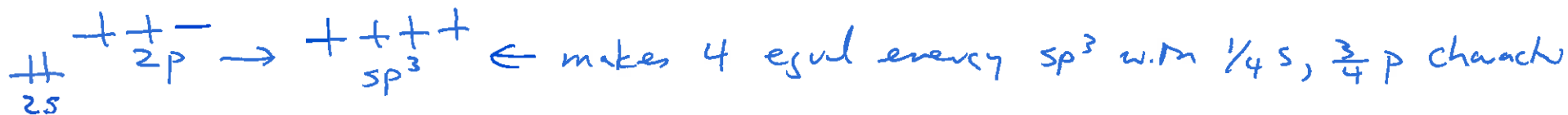
Draw molecules. Look for 3 planes of symmetry.

AB_2	AB_6	} all are nonpolar & symmetrical if B is same atom
AB_3	AB_4U_2	
AB_4		
AB_5		
AB_2U_3		

AB_2U	} all are polar + asymmetrical
AB_3U	
AB_2U_2	
AB_4U	
AB_3U_2	
AB_5U	

18. VB - Hybrid Orbit Theory

Understand how

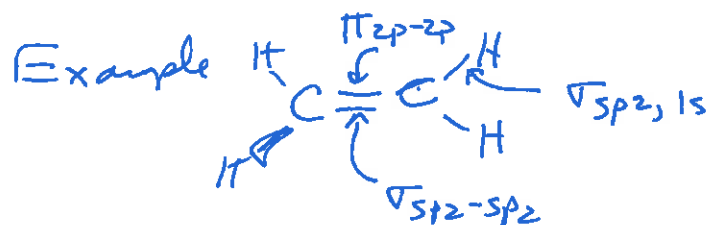


19. VB - AOs that Comprise MOs

Draw a structure. Pick a bond. If it is first (single) then it is σ . The second and third are π .

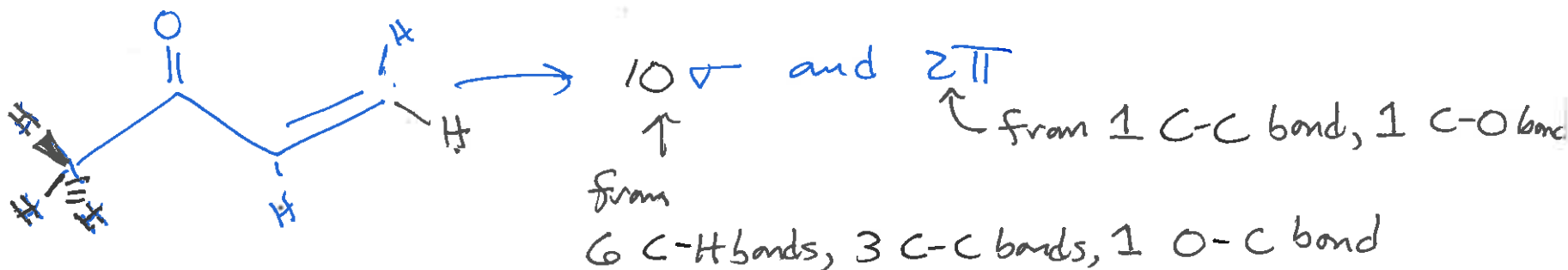
Then assign A.O.s.

- the central σ are hybridized A.O.s
- the perimeter are $H \equiv 1s$ $O \equiv$ hybridized
- The π bonds are always p-p A.O.



20. VB - Identifying sigma and pi bonds

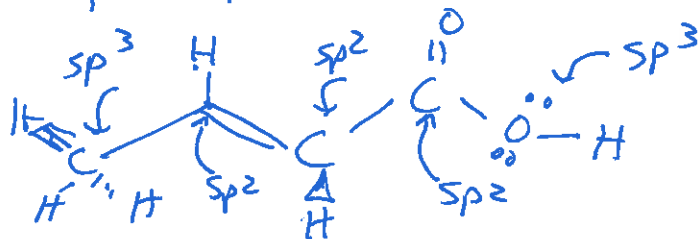
Draw a structure. Count all the first bonds. These are σ bonds. The rest are $=$ or \equiv and are π bonds



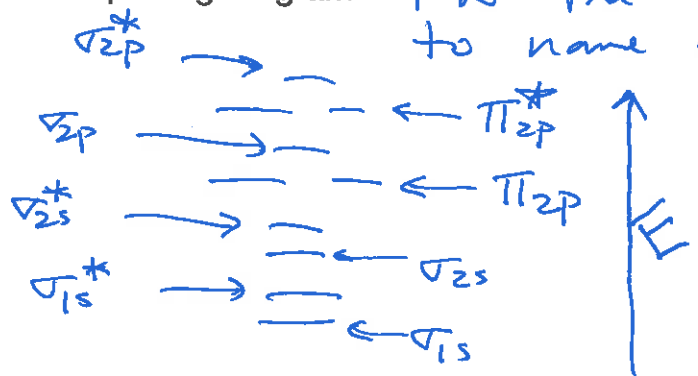
21. VB - Identifying Hybrid Orbitals

Draw a structure. Count electron rich regions. Use table to assign hybridization

Table	
2	sp
3	sp^2
4	sp^3
5	dsp^3
6	d^2sp^3

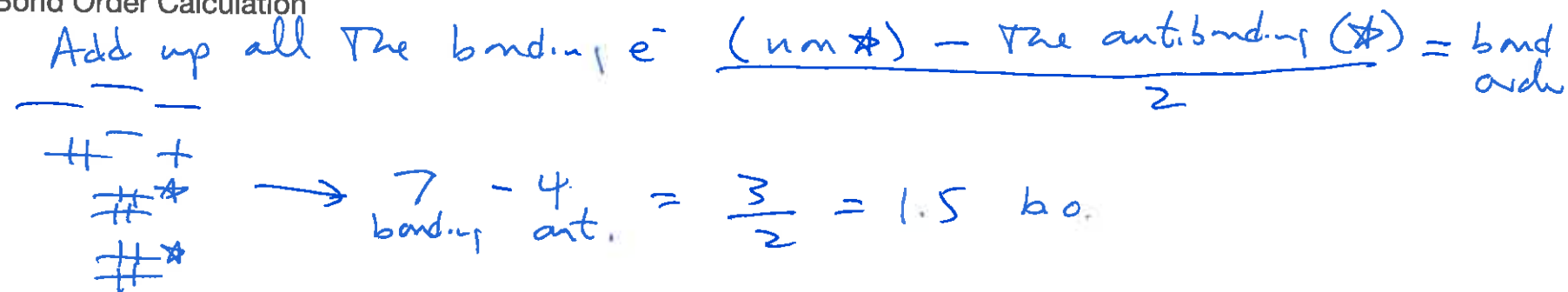


22. MO - Interpreting Diagram For the MO energy levels of diatoms, be able to name orbitals



Hint Don't do valence e⁻ you have to count all e⁻s for MO theory questions

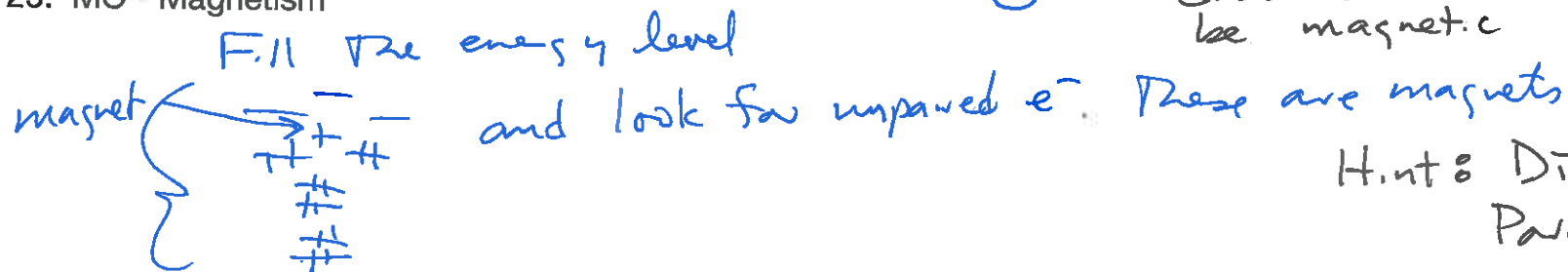
23. MO - Bond Order Calculation



24. MO - Orbital Types

Be able to distinguish and define
 bonding orbitals
 anti-bonding orbitals
 non bonding orbitals

25. MO - Magnetism



Hint: O₂ has odd # of e⁻, so don't draw the orbitals. It must be magnetic

Hint: Diamagnetic → No magnet
 Paramagnetic → magnet