Lewis Structures

Drawing Lewis Structures

① Determine valence electron # in molecule

- # of valence e^- for each atom (main group elements the # of valence e^- is equal to its group # (row #))
- if structure is negative add $1e^-$ for each negative charge

PCl_3O (5, 7, 6)

$5 + 3(7) + 6 = 32$

② • choose central atom (pick least electronegative atom)

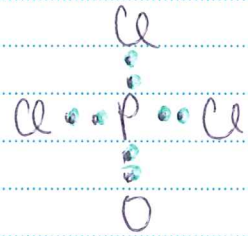
$P < O < Cl$

$B < C < N < O < F$

(least → most)

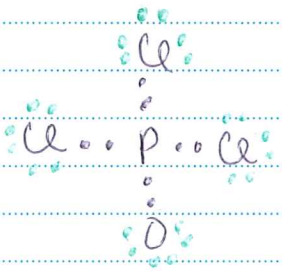
• draw structure to give each atom the electron structure of a noble gas (start adding e^- to most electronegative 1st)

③ Insert electron pairs between the atoms to be bonded

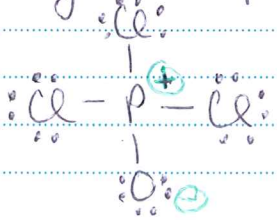


$32 - 8 = 24$

④ Distribute the remaining electrons (starting with the most electronegative first) to fulfill octet rules



⑤ Calculate formal charges of each atom & check that they add up to overall molecule charge



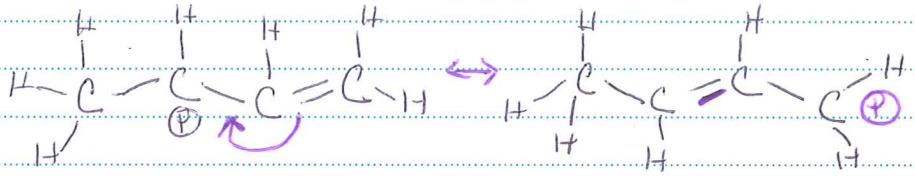
← Charges (formal charges equal neutral however we may be able to connect this to make a more stable noncharged structure)

Resonance

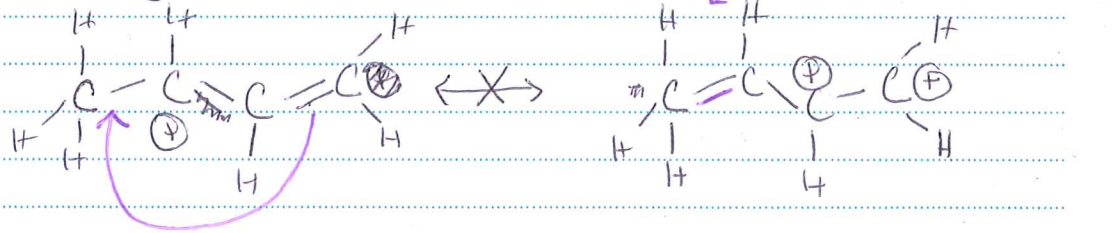
Resonance theory - whenever a molecule or ion can be represented by two or more lewis structures that differ only in the positions of electrons then the actual structure will be a weighted hybrid of these structures

Writing resonance structures

1. Only move e^- of multiple bonds & non bonding pairs (atom positions cannot change)

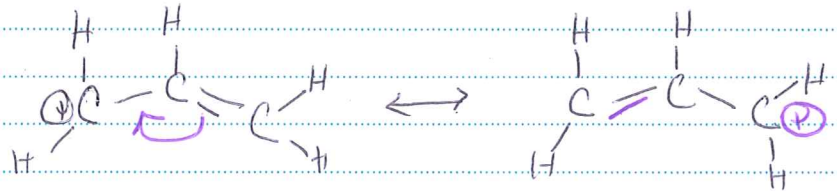


2. Atoms accepting electrons must be adjacent to the atoms donating electrons



3. All structures must be proper lewis structures (1st row atoms can only have a max of 8 e^-)

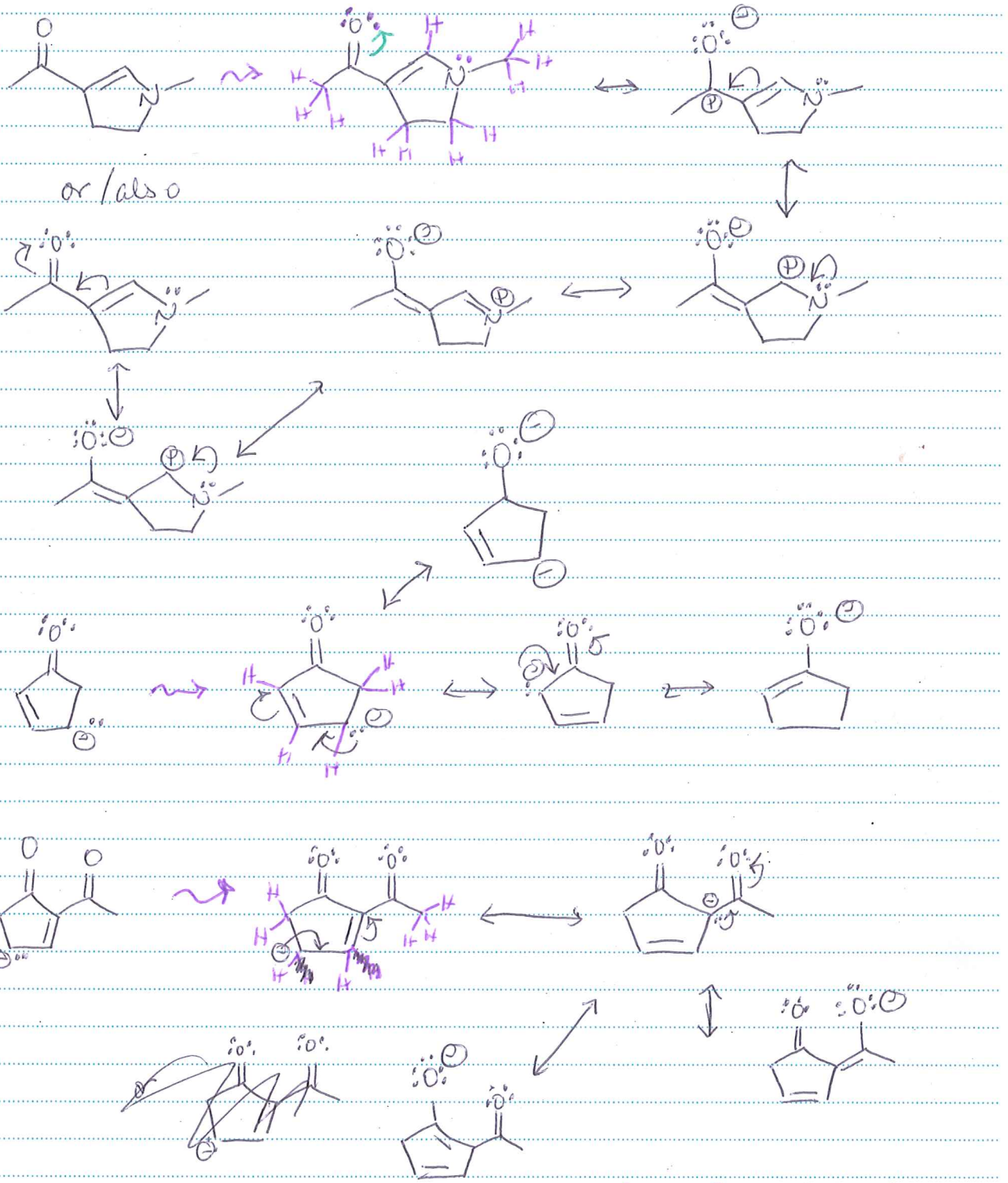
4. Accepting atoms must have an open octet (room to accomodate more electrons), able to expand it's octet (Cl, Br, S, P) or have another e^- pair that can be displaced
   * formal + charges can accept electrons!



* most stable resonance structure is the greatest contributor to the hybrid *

Resonance practice

- draw out electron pairs
- draw out hydrogens

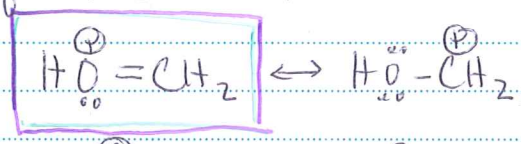


- ~~don't forget to try to make more than one resonance structure~~
- don't forget to try to make more than one resonance structure from each resonance structure

Most Stable / Greatest Resonance Contributor

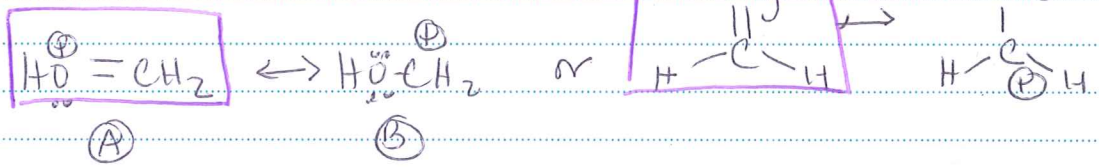
In order of importance

1. Max # of atoms with full octets

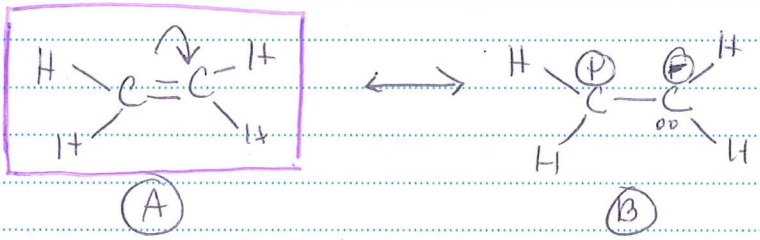


(A) In molecule A ~~both~~ all atoms have a full octet even though oxygen has (+) charge

2. Max # of covalent bonds

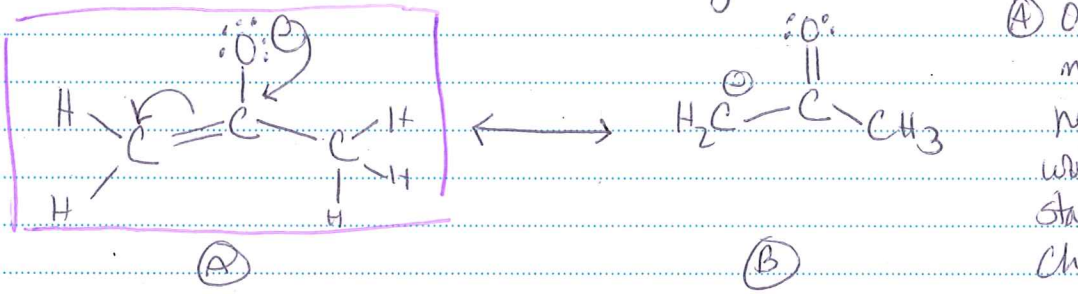


3. Have the least # of formal charges & no charge seperation



(A) Has no charges and no charge seperation

4. Charges reside on appropriate atoms
   (-) on electronegative
   (+) on less electronegative



(A) Oxygen is more electronegative ∴ would be more stable w/ (-) charge

★ write out your hydrogens in the beginning to make sure you aren't forming 5-bond carbons, it also helps you keep track of charges