Lewis Structures

2 peripheral Lewis' bonded to a central Lewis

Skeletal structures

- Because there are exceptions to the octet rule, we need a set of rules to determine how many electrons surround atoms
- The first step is to determine how the atoms are bonded in a molecule
- Generally, if there is only one of one element and multiple copies of another element, the unique element is central
- Commonly, H is peripheral, bonded to O
- Read 7.6 (pg. 236) up to PE5. Do PE5.

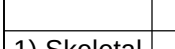
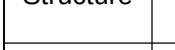
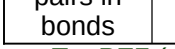
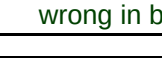
Counting total electrons

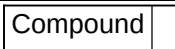
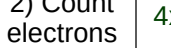
- Once we have determined the basic structure of the molecule we can start placing electrons around atoms
- The first step is to determine the total number of electrons that are available
- We use the group number of an element to indicate the number of valence electrons that it contributes to the molecule.
- E.g. O in group VIA (6A), contributes 6 e^-s
- Read 7.6 (pg. 237) up to PE6 (including example). Do PE6.

Lewis Structures

- Once we have determined the number of total valence electrons we can start distributing them throughout the molecule
- The rules for this are outlined in fig. 7.4 (pg. 241). These also appear on study notes (with additional details added)
- When we represent electrons they will be in pairs (since an orbital holds 2 electrons)
- Electron pairs can be represented with 2 dots or a solid line …

Placing electrons around atoms

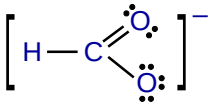
Compound	ClO_2^-	4) Octet for peripheral atoms	 16 - 12 = 4
1) Skeletal Structure	O Cl O	5) Remaining e^-s on center atom	 4 - 4 = 0
2) Count electrons	7x1 + 6x2 +1 = 20	6) Create multiple bonds?	No need
3) Electron pairs in bonds	 20 - 4 = 16	Final structure	or 

Compound	CO	4) Octet for peripheral atoms	 8 - 6 = 2
1) Skeletal Structure	C O	5) Remaining e^-s on center atom	2 - 2 = 0
2) Count electrons	4x1 + 6x1 = 10	6) Create multiple bonds?	
3) Electron pairs in bonds	C O 10 - 2 = 8	Final structure	or

- Try PE7 (pg. 241) (answer for $HClO_4$ is wrong in book - missing an O)

Resonance structures

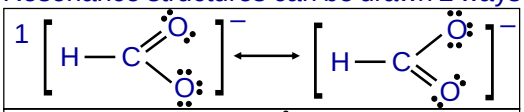
- Lewis structures for certain atoms do not match experimental observations
- For example, the bond lengths of CHO_2^- predicted by the Lewis structure are incorrect

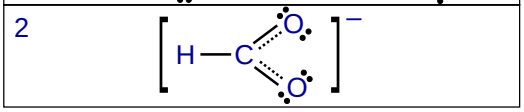


- The double CO bond should be shorter, and possess a greater bond energy (due to the higher concentration of e^-s in a double bond)
- Yet, experimentally, both bonds are the same
- The reason is due to "resonance"

Resonance structures

- A resonance structure can be drawn for any molecule in which a double bond can be formed from two or more identical choices
- Resonance structures can be drawn 2 ways…

1 

2 

- Resonance implies that the bond flips back and forth. Really, it lies between extremes
- Read 7.7 (pg. 242). Do PE 8.