(1) Count valence electrons

(2) Pick central atom and draw skeletal structure

- central atom is usually the one that needs to gain the most electrons!
- skeletal structure has all atoms connected to center with single bonds

(3) Distribute remaining valence electrons around structure, outer atoms first. Follow octet rule until you run out of electrons.

(4) Check octet rule - each atom should have a share in 8 electrons (H gets 2). if not, make double or triple bonds.

NOCl

N : 1 x 5
O : 1 x 6
Cl : 1 x 7

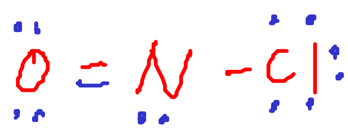
18 e^-

O - N - Cl

We'll pick NITROGEN as the central atom since it needs more valence electrons than O or Cl

We ran out of space on the outer atoms, so we put the last pair of electrons on NITROGEN

... even so, the central nitrogen atom only has a share in six valence electrons! So we'll need a double bond.



As before, we choose oxygen for the double bond (same reason as last example ... oxygen needed to gain two electrons so it is more likely to share two electrons of its own!)

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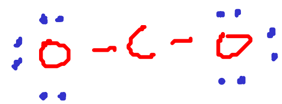
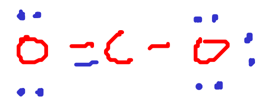
CO_2

C: 1 x 4
O: 2 x 6
16 e^-

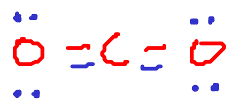
Choose CARBON as central atom.



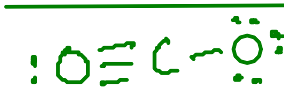
... but carbon has a share in only FOUR valence electrons!



... now SIX



Adding a second double bond gives carbon a share in EIGHT valence electrons!



Why not this structure? The two oxygen atoms are in the same environment and should bond the same way!

This structure is experimentally testable. It has two different bond lengths (bond distances) for carbon-oxygen bonds. Via x-ray diffraction, we can measure bond distances in the carbon dioxide molecule, and we find that there is only ONE bond distance in carbon dioxide. So the bonds are identical, and the triple bond/single bond structure is NOT correct!

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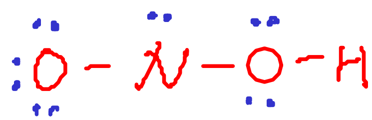
HNO_2 "nitrous acid"

In oxyacids, the acidic hydrogen atoms are attached to OXYGEN atoms in the structure!

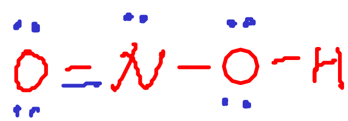
H: 1 x 1
N: 1 x 5
O: 2 x 6

18 e^-

Since this is an OXYACID, we must have at least one H attached to an O...



We run out of elecrrons after putting a pair onto nitrogen. But nitrogen still has a share in only six valence electrons.



Unlike the last structure where the two oxygen atoms were in the same environment, these two oxygens are in different environments (the left O only bonds with N, the right O bonds with both N and H)

A DOT STRUCTURE FOR A LARGER MOLECULE

(1) Count valence electrons

(2) Pick central atom and draw skeletal structure

- central atom is usually the one that needs to gain the most electrons!
- skeletal structure has all atoms connected to center with single bonds

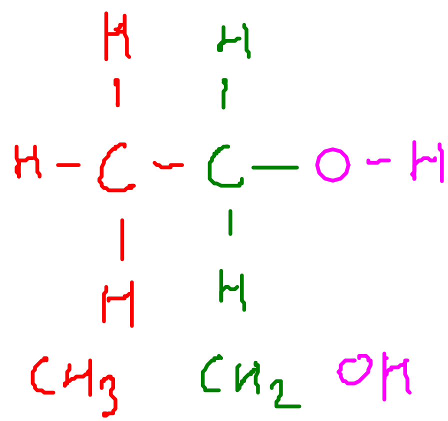
(3) Distribute remaining valence electrons around structure, outer atoms first. Follow octet rule until you run out of electrons.

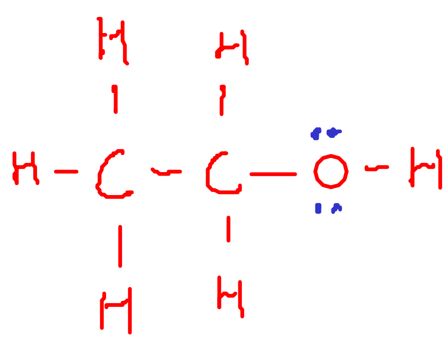
(4) Check octet rule - each atom should have a share in 8 electrons (H gets 2). if not, make double or triple bonds.

CH_3CH_2OH ETHANOL!

C : 4 x 2 = 8
H : 1 x 6 = 6
O : 6 x 1 = 6
| 20

This formula gives us a hint to the structure of ethanol. Ethanol has THREE central atoms chained together.





Putting the last two pairs of electrons on the oxygen completes this structure!

A DOT STRUCTURE FOR A POLYATOMIC ION

1. Count valence electrons

2. Pick central atom and draw skeletal structure
   - central atom is usually the one that needs to gain the most electrons!
   - skeletal structure has all atoms connected to center with single bonds

3. Distribute remaining valence electrons around structure, outer atoms first. Follow octet rule until you run out of electrons.

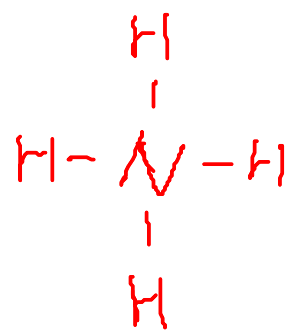
4. Check octet rule - each atom should have a share in 8 electrons (H gets 2). if not, make double or triple bonds.

NH_4^+

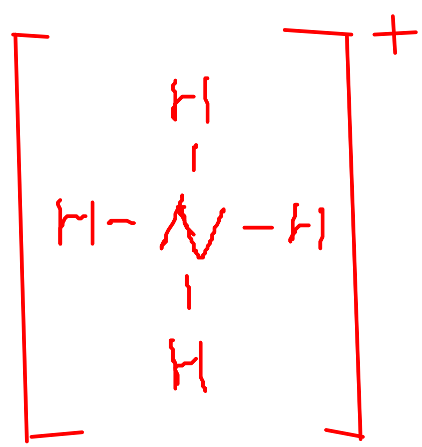
N: 1 x 5 = 5
H: 4 x 1 = 4

$9e^-$
$-1e^-$ (+1 charge)

$8e^-$



After adjusting the electron count for the +1 charge (subtract one electron), we choose NITROGEN as the central atom.



For polyatomic ions. put the entire structure in brackets and indicate the charge in the upper-right corner ... same position as the charge for other ions.