DRAWING DOT STRUCTURES FOR SIMPLE MOLECULES

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.

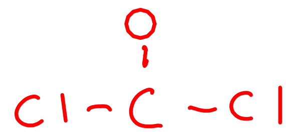
4. Check octet rule - each atom should have a share in 8 electrons (H gets 2). if not, make double or triple bonds.

$COCl_2$

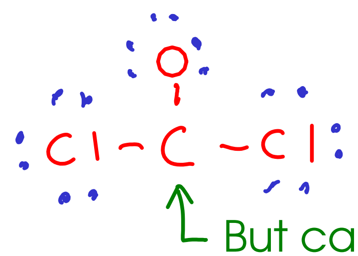
C: 1x4
O: 1x6
Cl: 2x7 = 14

24 valence electrons

Pick CARBON as the central atom, since it needs to gain more electrons than either O or Cl (and therefore should form more bonds!)

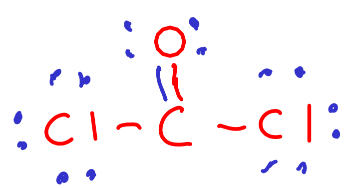


Skeletal structure. Now distribute the rest of the electrons!



Stop distributing when you run out of valence electrons (here, that's 24 total!)

But carbon has a share in only six valence electrons! How to fix? Take a lone pair from one of the outer atoms and use it to make a second bond to carbon! Pick oxygen, since it needed two more electrons anyway (and so it's likely to form two bonds!)



Adding a double bond "fixes" this structure so that all atoms have a share in eight valence electrons!

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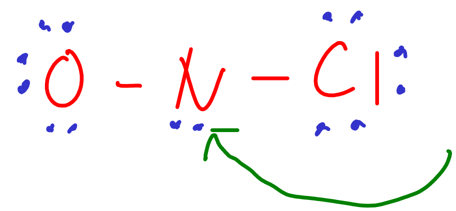
NOCl

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

18 e^-

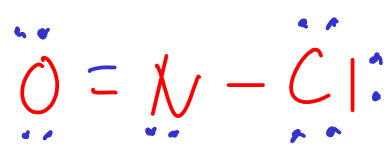
Pick NITROGEN as central atom, since it needs more electrons than either O or Cl.

Skeletal structure. Now distribute!



The outer atoms are "full" when we reach 16 electrons, so the last pair goes on the central N.

... but N still has only six valence electrons! Make a double bond using some of the electrons from O (same reason as last example!



Adding the double bond "fixes" this structure!

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(2) Pick central atom and draw skeletal structure

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- 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.

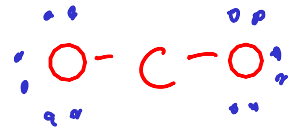
CO_2

C: 1 x 4
O: 2 x 6

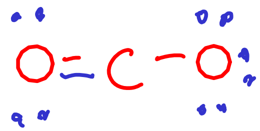
$16e^-$

Choose CARBON as central atom!

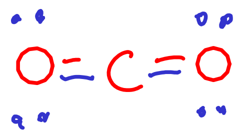
Skeletal structure



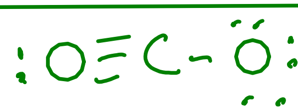
Distribute. But C has a share in only four!



Now, six!



Making a second double bond "fixes" this structure!



why not this one?

Any atom of oxygen put into the same chemical environment should behave the same way. In the triple bond structure, we have the atoms on the left and right bonding differently, when there's no reason for them to! The O=C=O structure doesn't have that problem!

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

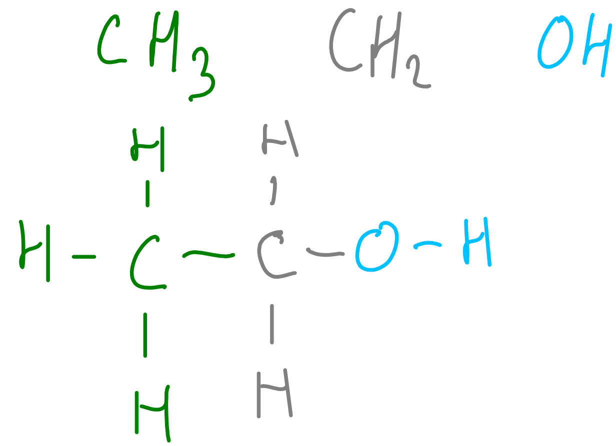
(3) Distribute remaining valence electrons around structure, outer atoms first. Follow octet rule until you run out of electrons.

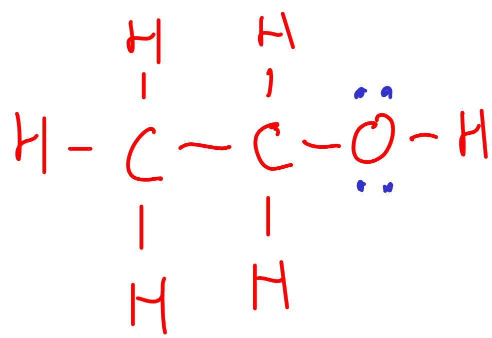
(4) Check octet rule - each atom should have a share in 8 electrons (H gets 2). if not, make double or triple bonds.

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.





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.

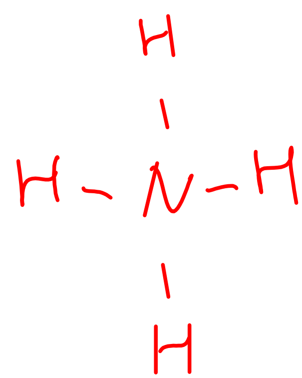
NH_4^+

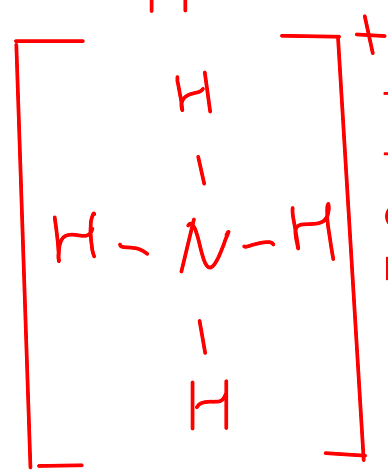
$N: 1 \times 5$
$H: 4 \times 1$

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

$8e^-$

For an ion, adjust the number of valence electrons to account for the ion's charge.
For '+', subtract electrons, and for '-', add them.





To indicate charge, you can put the dot structure in brackets and add the charge in the upper right corner.