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

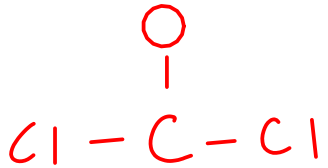
3. Distribute remaining valence electrons around structure, outer atoms first. Follow octet rule until you run out of electrons.

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

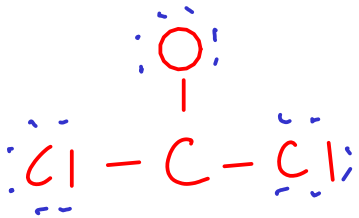
$COCl_2$

C : 1 x 4
O : 1 x 6
Cl : 2 x 7 = 14
24 valence e⁻

Pick CARBON as the central atom, since it need to gain more electrons than any of the other atoms.

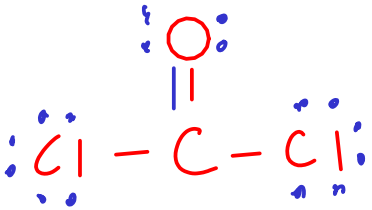


Skeletal structure. Now we need to distribute remaining electrons.



Stop when I reach the total number of valence electrons (24 here)

Problem! C atom has a share in only SIX valence electrons. How to fix? Make a double bond - but to which atom? Choose O since it needed to gain two electrons (and thus is likely to form two bonds) instead of only one like Cl.



Making a double bond "fixes" the structure so that each atom has a share in eight valence electrons (octet rule)

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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
16 e⁻

Pick N as central atom, since it needs to gain more electrons than the other two.

O - N - Cl

Distribute remaining electrons ...

The last two electrons go on the central N ...

... but N still doesn't have enough electrons (needs 2 more). Make a double bond using electrons from the O atom. (Same reasons as previous example!)

The double bond with O fixes this 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.

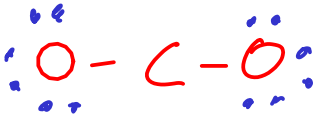
4. Check octet rule - each atom should have a share in 8 electrons (H gets 2). if not, make double or triple bonds.

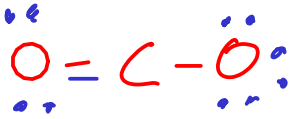
CO_2

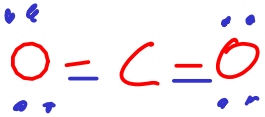
C: 1 x 4
O: 2 x 6
16 e⁻

Choose C as the central atom!

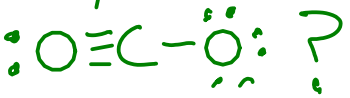

Skeletal structure.


Distribute remaining electrons, stop at the total (16). C has only 4 valence electrons. Fix with double bond!


Now C has six ... Make another double bond.


Fixed!

Why not


?

These oxygen atoms are in the SAME chemical environment (bonded to a single carbon atom and to nothing else) So, they should bond the same way. That agrees more with the C=O=C structure than the one with single and triple bonds!

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

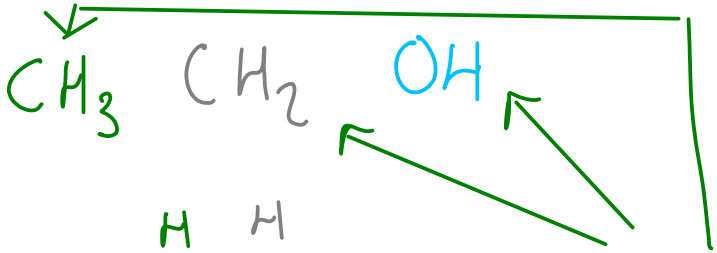
3. Distribute remaining valence electrons around structure, outer atoms first. Follow octet rule until you run out of electrons.

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

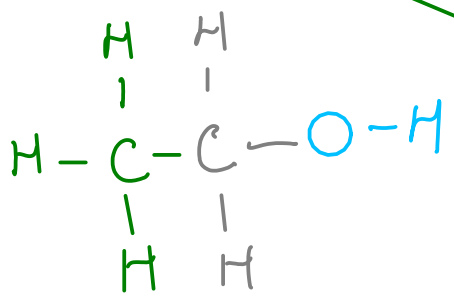
CH_3CH_2OH ETHANOL!

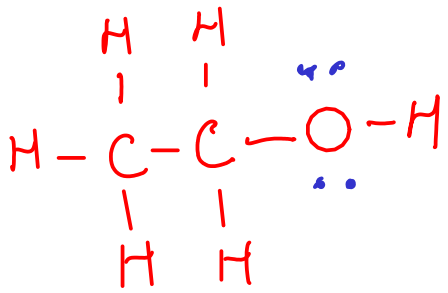
C : 4 x 2 = 8
H : 1 x 6 = 6
O : 6 x 1 = 6
| 20

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



Skeletal structure links each of our "mini molecules" 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

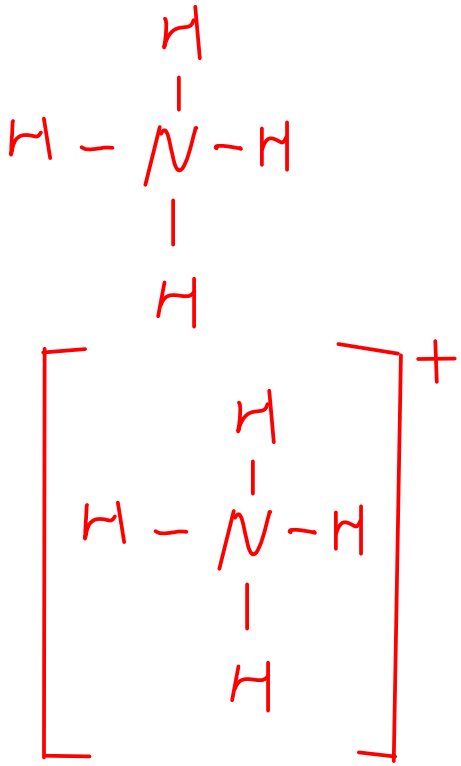
3. Distribute remaining valence electrons around structure, outer atoms first. Follow octet rule until you run out of electrons.

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: 1x5
H: 4x1
9 valence e⁻
−1 e⁻ (+1 charge)
8 e⁻

With polyatomic ions (or any molecule with a charge), we need to adjust the electron count for the charge of the ion. Positive charges mean take away electrons, and negative charges mean to add them!



We need to indicate that this is an ion. Easiest way to do that is to put the whole structure in brackets and put the charge at the upper right.