DRAWING DOT STRUCTURES FOR SIMPLE MOLECULES

$COCl_2$

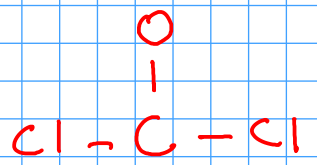
C : 4
O : 6
Cl : 2x7 = 14
24 electrons

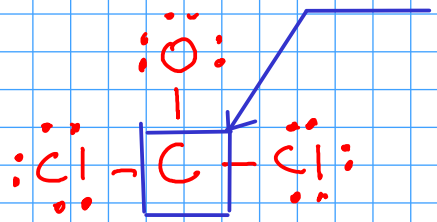
1. Count valence electrons

2. Pick central atom and draw skeletal structure

   - central atom is usually the one that needs to gain the ost electrons!

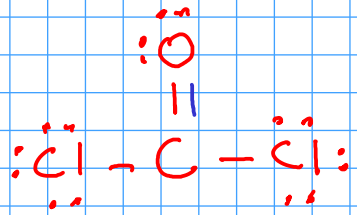
   - skeletal structure has all atoms connected to center with single bonds





This carbon atom has only six valence electrons!

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



Where to put double bond? Oxygen needed two more electrons, so it's more likely than chlorine to share two pairs.

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

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NH_3

N: 5

H: $3 \times 1 = 3$

8

Remeining electrons have to go on the nitrogen atom because the outer shell of hydrogen is completely full with TWO electrons!

A DOT STRUCTURE FOR A LARGER MOLECULE

CH_3CH_2OH

This molecule has THREE centers!

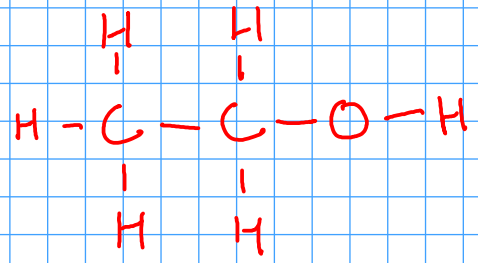
C 2 x 4 = 8
H 6 x 1 = 6
O 6 = 6
20 electrons

1. Count valence electrons

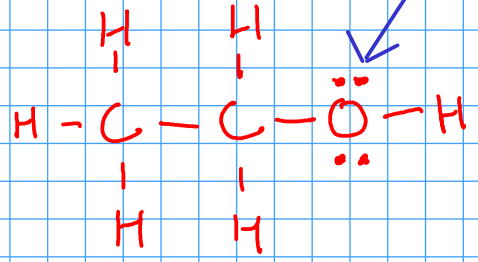
2. Pick central atom and draw skeletal structure

   - central atom is usually the one that needs to gain the ost electrons!

   - skeletal structure has all atoms connected to center with single bonds



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



It appears that the remaining four electrons must go onto the oxygen atom.

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

A DOT STRUCTURE FOR A MOLECULE WITH DELOCALIZED BONDS

O: 3 x 6 = 18

O_3

1. Count valence electrons

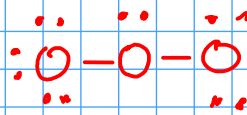
2. Pick central atom and draw skeletal structure

   - central atom is usually the one that needs to gain the ost electrons!

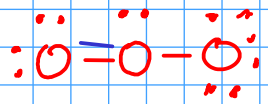
   - skeletal structure has all atoms connected to center with single bonds

3. Distribure remainig 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.



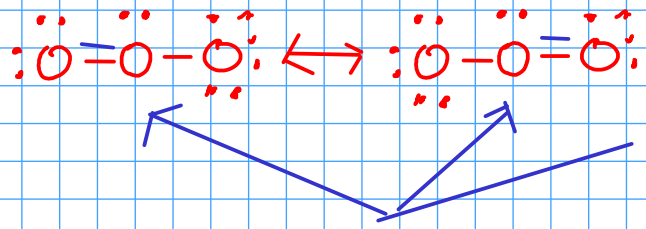
Central oxygen doesn't have enough electrons - make double bond?



This structure satisfies the octet rule, BUT ...

This structure predicts that one oxygen atom will be closer to the center than the other. Experimentally, both oxygen atoms are exactly the same distance from the central oxygen atom!

A simple dot structure doesn't adequately explain the bonding in ozone. Ozone shares some of its bonding electrons with ALLTHREE oxygen atoms in the molecule. We call this at DELOCALIZED BOND.



RESONANCE structures. The "average" of these two structures better represents the real molecule than just one of them.

A DOT STRUCTURE FOR A POLYATOMIC ION

NH_4^+

1. Count valence electrons

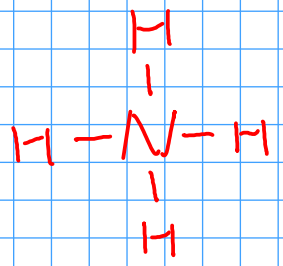
N : 5
H : 4 x 1
9
−1
8 electrons

To get a +1 charge, the ammonium ion must have lost one of its valence electrons. So we subtract one from the total.

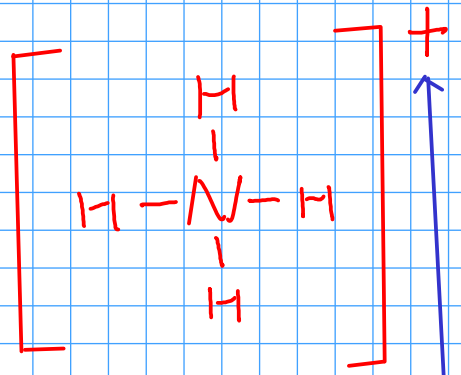
2. Pick central atom and draw skeletal structure

   - central atom is usually the one that needs to gain the ost electrons!

   - skeletal structure has all atoms connected to center with single bonds



3. Distribure remainig 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.

We draw brackets around this structure and indicate the CHARGE since it's an ion!