LEWIS STRUCTURES AND MULTIPLE BONDING

The Basics

Let's go over some of the main things you need to consider if you want to draw Lewis structures. Lewis structures will be the principal way you communicate ideas about molecules in this course, so it is best to get some practice with them as soon as possible.

Here's what you need to do:

a) count up the valence electrons in the atoms that will be bonded together.

b) place the atoms beside each other on paper.

c) arrange the given electrons around the atoms so that each atom has an octet.

d) these electrons can be shared between the atoms (these are called bonding pairs) or held by one atom or the other (these are called nonbonding pairs or "lone pairs")

Occasionally, you will need to share more than one pair of electrons between two atoms so that all atoms can obtain an octet. That's what happens in the structure of carbon monoxide, CO.

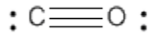

Figure IM3.1. Carbon monoxide: both atoms have octets.

Carbon has 4 valence electrons and oxygen has 6, for a total of 10 electrons. That's 5 pairs. If carbon and oxygen share a pair of electrons, there will be four pairs left. You could put three pairs on the oxygen and one pair on the carbon. The oxygen has four pairs, including the lone pair and the shared pairs. Carbon only has two pairs. That isn't an octet, and if possible the molecule will avoid that situation.

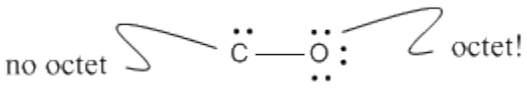

Figure IM3.2. Carbon monoxide: not all the atoms have octets.

There could be one bond, and two lone pairs on each atom. That isn't much better. Now neither atom has an octet.

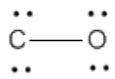

Figure IM3.3. Carbon monoxide: neither atoms have octets.

Multiple bonds can help. Suppose carbon forms four bonds with oxygen. Both atoms will have an octet, but that will only use eight of the ten electrons. Second row atoms never have more than eight electrons; there's no room for more. There will be one pair with nowhere to go.

Figure IM3.4. Carbon monoxide: neither atoms have octets.

That means we can only have three bonds between the carbon and oxygen -- a total of six electrons. The other four electrons could become lone pairs -- one on carbon and one on oxygen. Now both atoms have an octet.

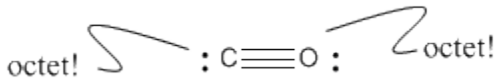

Figure IM3.5. Carbon monoxide: both atoms have octets.

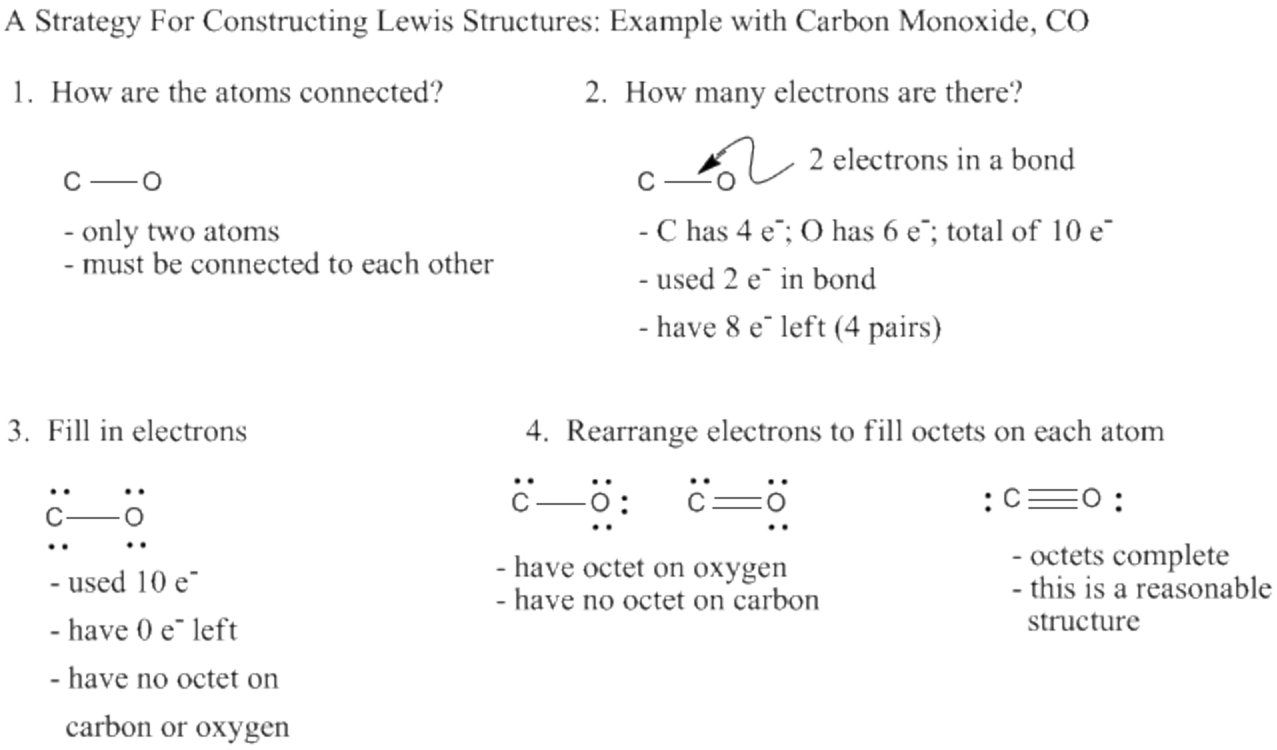

Figure IM3.6. A *beginning* set of instructions for completing a Lewis structure.

Source : http://employees.csbsju.edu/cschaller/Principles%20Chem/molecules/1_3_multiple_bonds.htm