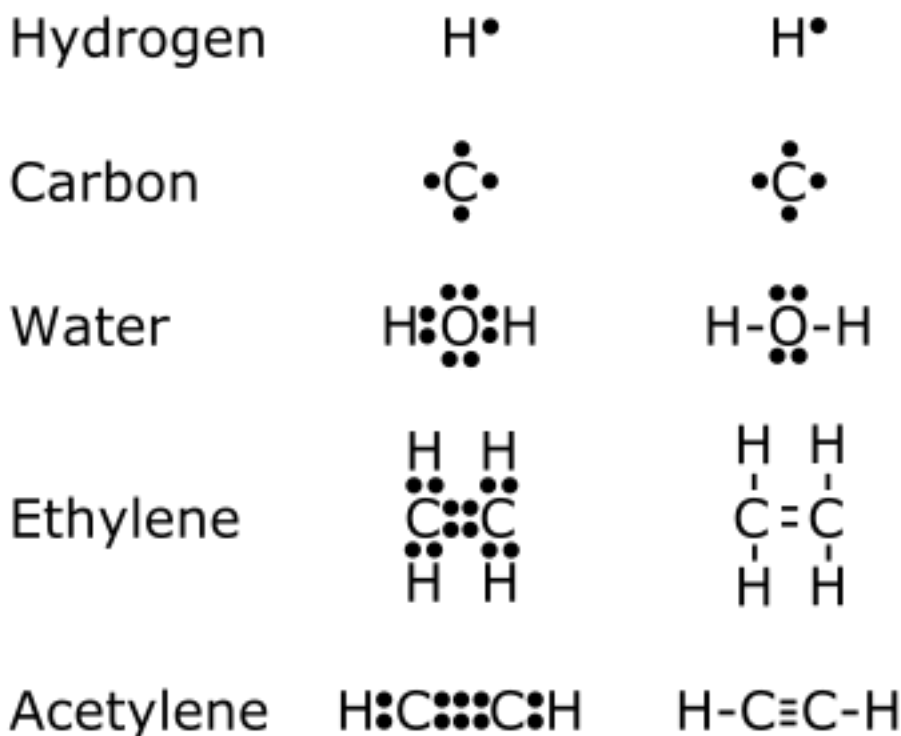


## Lewis Dot Structures

Dot Structures are diagrams that contain symbols of elements as well as dots. The symbols represent atoms in molecules and the dots represent valence electrons. These diagrams are used as a way to keep track of electrons so that it is possible to predict the number bonds between atoms in molecules, and the number electrons that are not part of these bonds. The diagrams show bonding electrons between the element symbols and nonbonding electrons as dots that are located on the sides of the symbol. Often bonding electrons are replaced with lines. If there is 1 covalent bond between atoms and single line is shown, a double bond is 2 lines, and triple bond is 3 lines. This can be seen below.



We will be using Lewis Dot Structures as a tool to learn about the geometry and electron distributions in organic molecules (Molecules that are predominantly made from Carbon, Oxygen, Nitrogen and Hydrogen.) Understanding these diagrams is also important because it clarifies many diagrams used in biochemistry.

We will be drawing diagrams of simpler molecules containing only carbon, nitrogen, oxygen, halogens, and sulfur. Things you need to remember in

order to successfully draw the diagrams are

- Only the valence electrons appear in a Lewis structure.
- Bonds are made in order to fill the outer shell of the element.
- Bonds are indicated by electron pairs shown between the element symbols.
- There may be as many as three bonds between a pair of atoms.
- Stable molecules will only have paired electrons.

There are many sets of rules for drawing dot structures. Since we are working with relatively simple molecules the following steps will work.

1. Arrange the element symbols around the central atom. (This will be indicated with a star or it will be obvious.)
2. All of the atoms will be joined by at least a single bond. To show this place one electron dot from each atom between each bonded pair. (This represents a single bond between the elements.)
3. Now place any remaining valence electrons around their element symbol. Draw the electrons in is pairs. This will make it very clear if one of the elements does not have a complete octet. If all of the electrons are paired go onto step 4. If some are unpaired use one of the steps below to pair them.
  - 3a) If there is one unpaired electron on adjacent elements move the unpaired dot on each symbol to indicate an additional bond between these elements.
  - 3b) If there is an unpaired electron on each of the atoms near the central atom, split one of the pairs on the central atom to form a new bond to each these atoms.
4. Check to see if there are 8 electrons around each of the symbols, if not shift a pair from the symbol with most electrons between the two atoms. \*

Once you have practiced drawing the structures you will probably find that you don't need these rules. door, late Tuesday afternoon.

\* Remember that a shared electron belongs equally to both. If there are 6 electrons between 2 atomic symbols then each has 6 electrons from this bond.

Below are some chances for practice. Try following the rules. Hints are given to help you find your way through the rules. I will place copies of answers in an enveloped taped to my office.

Draw a dot structures for:

$N_2$  (Hint: Once you have completed steps 1 and 2, skip straight to 4, because there are no unpaired electrons.

$CO$ . (Hints: Once you have completed step 2 you should have 1 unpaired dot on each atom. Use step 3a, to get rid of unpaired dots, then go onto step 4.)

$CO_2$ . (Hints: Carbon is the central atom. After step 2 you should have one unpaired dot on both oxygen atoms and no unpaired dots on carbon. Use step 3b to get rid of the unpaired atoms.)