Lewis Structures – part I

Chem Worksheet 9-4

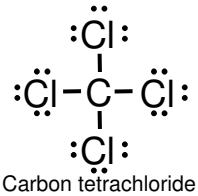
Name _____

A Lewis structure is a way to represent the **valence electrons** of an atom using dots. These valence electrons are important because they are involved in bonding. The Lewis structure for an atom is formed by writing the element symbol and placing one dot next to the symbol for each valence electron. For example, the Lewis structure for carbon would have four dots surrounding it, while the Lewis structure of chlorine would have seven.


Carbon


Chlorine

In a molecule atoms are held together with **covalent bonds**. These bonds are formed when pairs of electrons are shared. For example, carbon will bond with four chlorine atoms to form the molecule carbon tetrachloride, CCl_4. Each bond in the molecule represents a pair of shared electrons and is represented as a dash. The guiding principle behind bonding in atoms is the **octet rule** which states that each element is trying to get a full set of valence electrons. When carbon shares electron pairs with four chlorine atoms it has an octet. Each chlorine atom has three nonbonding pairs of electrons and one bonding pair. This arrangement is favorable because both carbon and the chlorine atoms have an octet of electrons.


Carbon tetrachloride

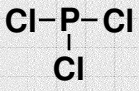
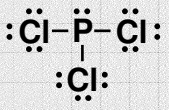
Rules for Drawing Lewis Structures

1. Determine the total number of valence electrons.
2. Join all elements with bonds.
3. Arrange remaining electrons to follow octet rule. Use multiple bonds if necessary.

Symbol	Name	Electrons
—	single bond	2
=	double bond	4
≡	triple bond	6

example

Draw the Lewis structure for phosphorus trichloride, PCl_3.

- determine total number of valence electrons: $5 + 3(7) = 26$ *the group number indicates the number of valence electrons*
- join all elements with single bonds:  *the first element listed in the formula usually goes in the middle*
- add remaining electrons following the octet rule:  *the 20 remaining valence electrons are placed around atoms to give each an octet*

Draw Lewis structures for each of the following.

1. nitrogen trifluoride, NF_3
2. hydrogen sulfide, H_2S
3. fluorine, F_2
4. carbon monoxide, CO
5. sulfur dioxide, SO_2
6. oxygen, O_2
7. sulfur difluoride, SF_2
8. boron trihydride, BH_3
9. chloroform, $CHCl_3$
10. carbon disulfide, CS_2
11. beryllium chloride, $BeCl_2$
12. hydrogen cyanide, HCN
13. acetylene, C_2H_2
14. silicon dioxide, SiO_2
15. hydrogen peroxide, H_2O_2
16. sulfate, SO_4^{2-}
17. methanol, CH_3OH
18. nitrate, NO_3^-
19. chlorite, ClO_2^-
20. formic acid, CH_2O