

L E C T U R E N O T E S

LECTURE 21 Covalent Bonds (Supplement)

GENERAL CHEMISTRY

Fall 2009

The Nature of Covalent Bonding

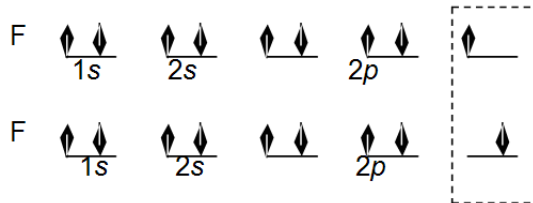
The Octet Rule in Covalent Bonding

A. Covalent compounds tend to form so that each atom, by sharing electrons, has an octet of electrons in its highest occupied energy level

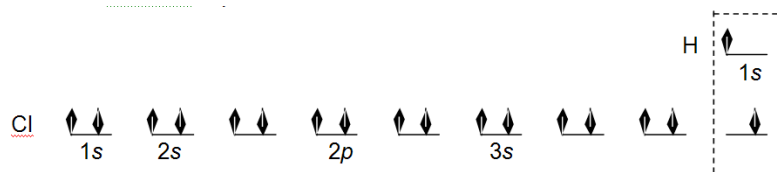
B. Single Covalent Bonds

1. One shared pair of electrons between two atoms

a. Example – Diatomic fluorine



b. Example - Hydrogen Chloride



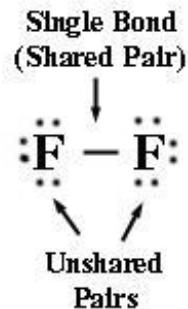
Lewis Structures

A. Unshared Pairs (Lone Pairs)

1. A pair of electrons that is not involved in bonding and that belongs exclusively to one atom

B. Lewis Structures

1. Formulas in which atomic symbols represent nuclei and inner-shell electrons, dot pairs or dashes between two atomic symbols represent electron pairs in covalent bonds, and dots adjacent to only one atomic symbol represent unshared electrons



C. Structural Formula

1. Formulas indicating the kind, number, arrangement, and bonds but not unshared pairs of the atoms in a molecule



D. Drawing Lewis Structures (trichloromethane, CHCl₃ as an example)

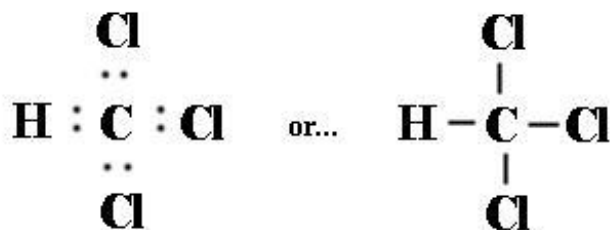
- Determine the type and number of atoms in the molecule
1 x C, 1 x H, 3 x Cl
- Write the electron dot notation for each type of atom in the molecule



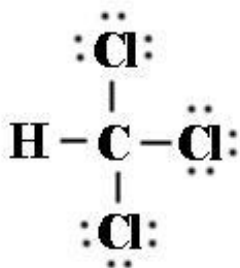
- Determine the total number of valence electrons to be combined

Element	Number of Atoms	Number of e-	Total
H	1	1	1
Cl	3	7	21
C	1	4	4
Total			26 e-

- Arrange the atoms to form a skeleton structure for the molecule. If carbon is present, it is the central atom. Otherwise, the least electronegative element atom is central (except for hydrogen, which is never central). Then connect the atoms by electron-pair bonds
- Add unshared pairs of electrons so that each hydrogen atom shares a pair of electrons and each other nonmetal is surrounded by eight electrons



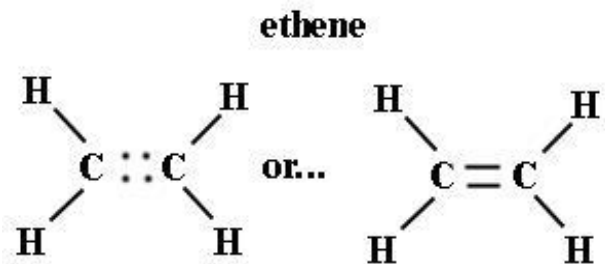
- Count the electrons in the structure to be sure that the number of valence electrons used equals the number available



Multiple Covalent Bonds

A. Double Bonds

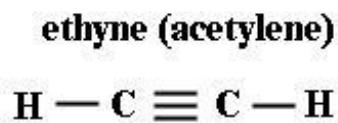
1. A covalent bond produced by the sharing of two pairs of electrons between two atoms



2. Higher bond energy and shorter bond length than single bonds

B. Triple Bonds

1. A covalent bond produced by the sharing of three pairs of electrons between two atoms



2. Higher bond energy and shorter bond length than single or double bonds