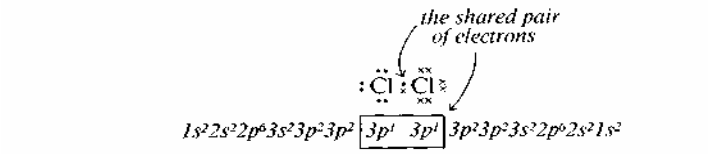
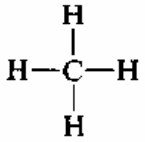
Covalent Bonds

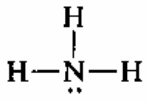
- Atoms that are held together as result of sharing of the valence electron are bonded by covalent bonds.
- Example Cl_2

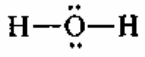


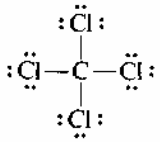
- Single covalent bond is a bond where the atoms are held together by sharing two electorns.
- Covalent bonds form between two atoms when ionic or metallic is unlikely because of the loss of or gain of electrons requires large amount of energy.
- The number of valence electron and the octet rule govern the formation of most covalent bonds.

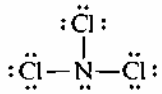
C (Group IV)	N (Group V)	O (Group VI)
4 valence electrons	5 valence electrons	6 valence electrons
4 shared pairs	3 shared pairs	2 shared pairs

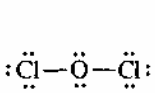








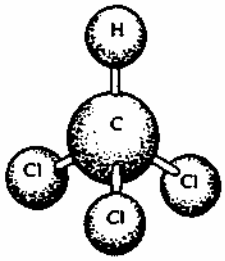




Understanding the Three-Dimentional Models

- Molecules will arrange themselves to the most stable structure.
- Structures are often characterized by their bond length and bond angles.
  Bond length (A) is the distance between nuclei of two bonded atoms.
  Bond angle is the angle of the arc between any two bonds that are joined to the same atom.
- The three-dimensional models are represented on as shown:

chloroform, $CHCl_3$

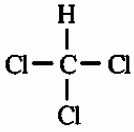


- How are three dimensional structures demonstrated?

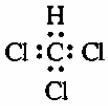
a. ball and stick models
b. space filling models

- Write the structural formula and electron dot formula for molecules after building a model.
  (a) Draw the structural formula
  (b) Draw the electron dot formula corresponding to the model
  (c) verify the electron dot formula by checking the total number of electron dots against the sum of all valence electrons.

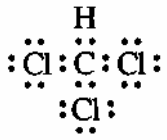
Solution: (a) Each stick represents a single bond so the structural formula is



(b) Each dash in the structural formula indicates an electron pair; therefore,



Hydrogen shares two electrons and is complete. Carbon shares a total of eight electrons and satisfies the octet rule. However, each chlorine also requires an octet, which we will complete as follows:



(c) To verify the above electron dot formula we will find the sum of all valence electrons.

1H (1 x 1 e^-) = 1 e^-
1C (1 x 4 e^-) = 4 e^-
3Cl (3 x 7e^-) = 21 e^-
sum of valence electrons = 26 e^-