Molecular Covalent Compounds

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Text Book Reference: 5.11, Pages 201 – 204

Elements are held together by forces which are called **bonds**. Some bonds are strong and require much energy to break them, while others are relatively weak.

The most stable electronic configuration of all is the 'noble-gas' structure with its outer shell of eight electrons. There are essentially two ways in which other elements can achieve this stable structure: (i) by electron transfer, i.e. ionic bonding,
(ii) by electron sharing, i.e. covalent bonding.

In the last few sections, we studied a model of how a metal atom and a non-metal atom might be held together by an ionic bond.
In an ionic model, the metal atom transfers its valence electrons to the non-metal atom, and both atoms become ions that resemble a noble gas in electronic configuration, (i.e. they become isoelectronic to the noble gas structure).

Now, we will consider a binary compound of two non-metals: The Covalent Bond
The two non-metals achieve the noble gas electronic configuration by **sharing** their valence electrons.

This sharing of electrons is called a **covalent bond**.

Covalently bonded groups of atoms are called **molecules**.

To conveniently show this sharing of electrons, chemists draw structures of covalent molecules using **Lewis electron-dot structures**.

When two electrons are shared between two atoms, one atom donates one electron and the other atom donates the second electron.

The shared pair of electrons represents a **covalent bond.**

The sharing of electrons follows the same basic principle that applies to the formation of ions.

The atoms are trying to attain a **noble-gas configuration**, an **octet**, (except hydrogen, it has two valence electrons, similar to the noble gas, helium).

Each atom in the covalent bond regards the shared pair of electron as its own.

Example:

1. H + H ⟶

2. Cl + Cl ⟶

3. H* + .Cl: ⟶ H*. Cl:
   hydrogen chloride molecule (**single covalent bond**)

4. H + O ⟶

In order to achieve a stable octet of electrons, atoms sometimes share more than one pair of electrons to form a bond.

5. If two pairs of electrons are shared between two atoms, a **double covalent bond** exists:

O + O ⟶

6. When three pairs of electrons are shared, there is a **triple covalent bond**:

N + N ⟶

7. C + O ⟶

8. Show the sharing between:

(a) C + H

(b) C + S

(c) S + O

(d) C + Cl

(e) N + H

(f) P + F

(g) O + F

(h) Si + Cl

(i) H + S