Chapter 4

Chemical Bonding and Molecular Structure

CHEMICAL BOND

Introduction

(a) With the exception of inert gases, it is widely recognized that no element exists as independent atoms under ordinary conditions.

(b) The majority of elements exist as clusters of atoms known as molecules. This chapter will address questions about how atoms combine to create molecules and explore the reasons behind the formation of bonds.

(c) Molecules form only when they are more stable and possess lower energy compared to individual atoms.

Why Chemical Bond Formation Take Place?

In the realm of natural phenomena, stability holds a special place, and the establishment of chemical bonds is intricately linked to achieving a state of stability. Elements inherently incline towards adopting inert electronic configurations, specifically characterized by the occupation of either ns np or ns^2 orbitals, as these configurations are deemed highly stable.

The attainment of a noble gas electronic configuration, renowned for its stability, can be realized through various mechanisms:

(i) Electron transference involves the movement of electrons from one element to another.

(ii) Mutual sharing of electrons, where two elements collaborate to share electrons, promoting a balanced and stable state.

(iii) The donation of a lone pair of electrons, a process wherein an element contributes its unshared electron pair to another, fostering the attainment of a noble gas-like stability.

Types of Bonds

1. lonic bond or electrovalent bond
2. Covalent bond
3. Co-ordinate bond
4. Metallic bond
5. Hydrogen bond
6. van der Waals bond

Several endeavors have been undertaken to elucidate the electron-related aspects of chemical bond formation. One notable proposition in this regard was put forth by Lewis, who theorized that atoms attain a stable octet configuration when connected by a

chemical bond. According to Lewis's postulation, the linkage of atoms in a chemical bond facilitates the achievement of a stable electron arrangement resembling an octet, thereby contributing to the overall stability of the bonded system.