Atomic Bonding

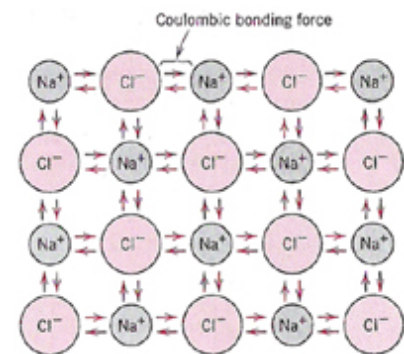There are three primary types of bonding: ionic, covalent, and metallic.

Ionic bonding

Definition: An ionic bond is formed when valence electrons are transferred from one atom to the other to complete the outer electron shell.
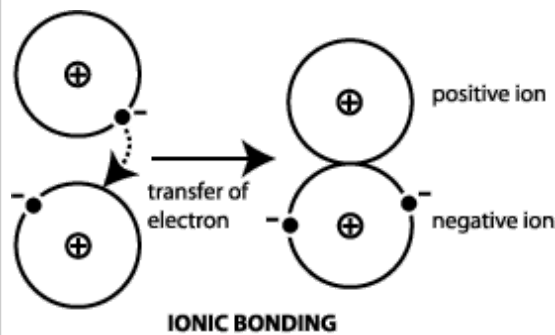

Example: A typical ionically bonded material is NaCl (Salt):

The sodium (Na) atom gives up its valence electron to complete the outer shell of the chlorine (Cl) atom. Ionic materials are generally very brittle, and strong forces exist between the two ions.

Covalent bonding

Definition: A covalent bond is formed when the valence electrons from one atom are shared between two or more particular atoms.
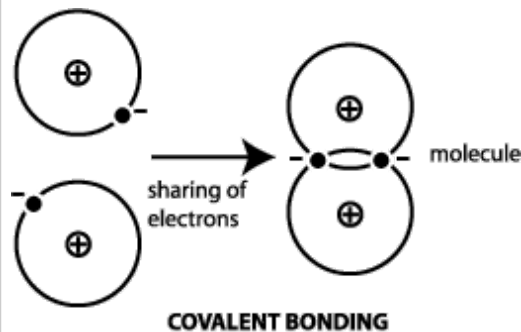

Example: Many compounds have covalent bonding, such as polymers. Nylon rope is an example of a material that is made up of polymers. Polymer structures typically are long chains of covalently bonded carbon and hydrogen atoms in various arrangements.
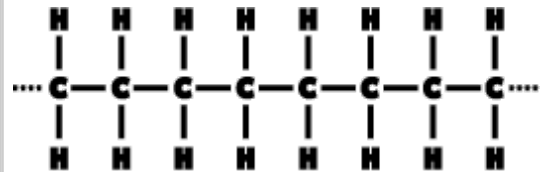
Metallic bonding

Definition: A metallic bond is formed when the valence electrons are not associated with a particular atom or ion, but exist as a "cloud" of electrons around the ion centers.

Example: In the real and imperfect world, most materials do not have pure metallic, pure covalent, or pure ionic bonding; they may have other types of bonding as well. For example, iron has predominantly metallic bonding, but some covalent bonding also occurs.
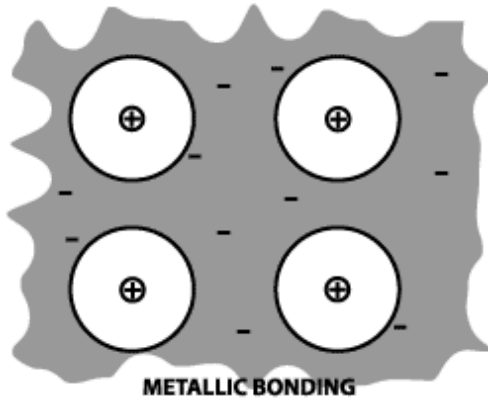
METALLIC BONDING

Metallic materials have good electrical and thermal conductivity when compared to materials with covalent or ionic bonding. A metal such as iron has metallic bonding.

This wrench, found in a car shop in Malaysia, has been subjected to much abuse and is clearly showing signs of age. In its current condition, signs of rust shows that, at a molecular level, its metallic bonding is not perfect and the bending indicates that the original crystalline structure is altered.