

Chemical bonds



Chemical bonds are the connections between atoms in a molecule.

Chemical bonds are the forces of attraction that tie atoms together.

Bonds are formed when valence electrons, the electrons in the outermost electronic “shell” of an atom, interact.



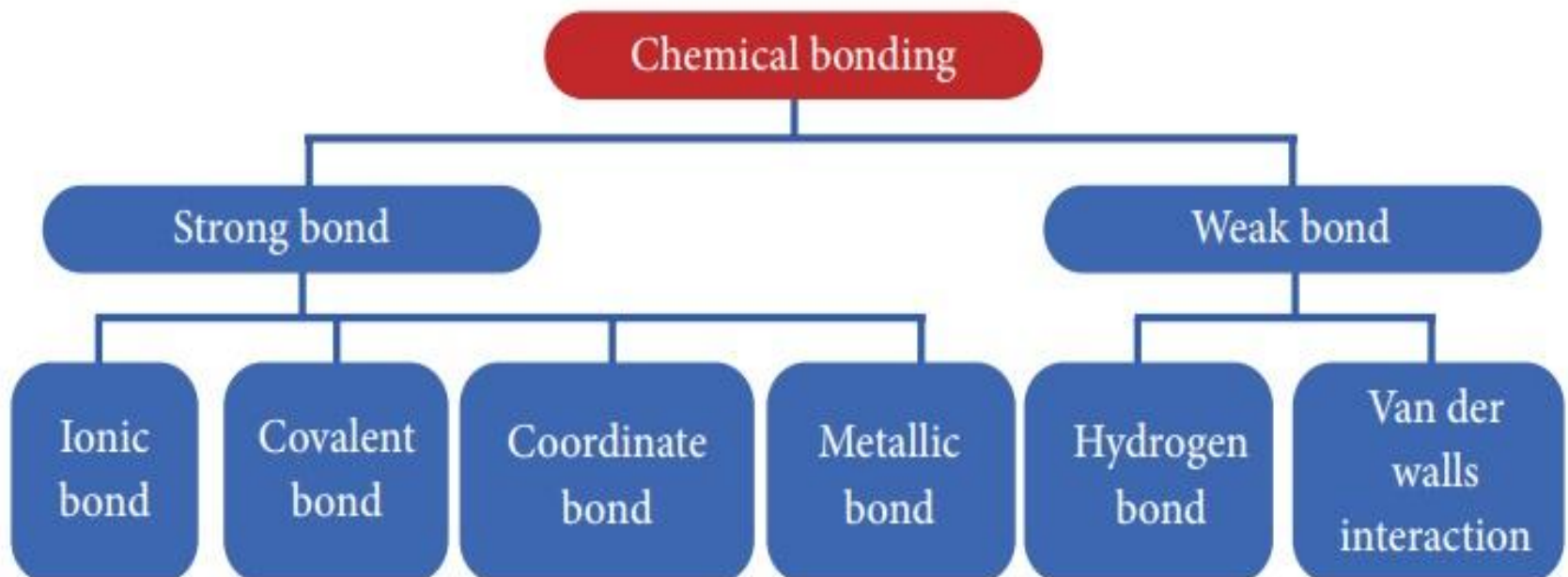
These bonds include both

a) strong *intramolecular* interactions, such as covalent, ionic and metallic bonds.

and

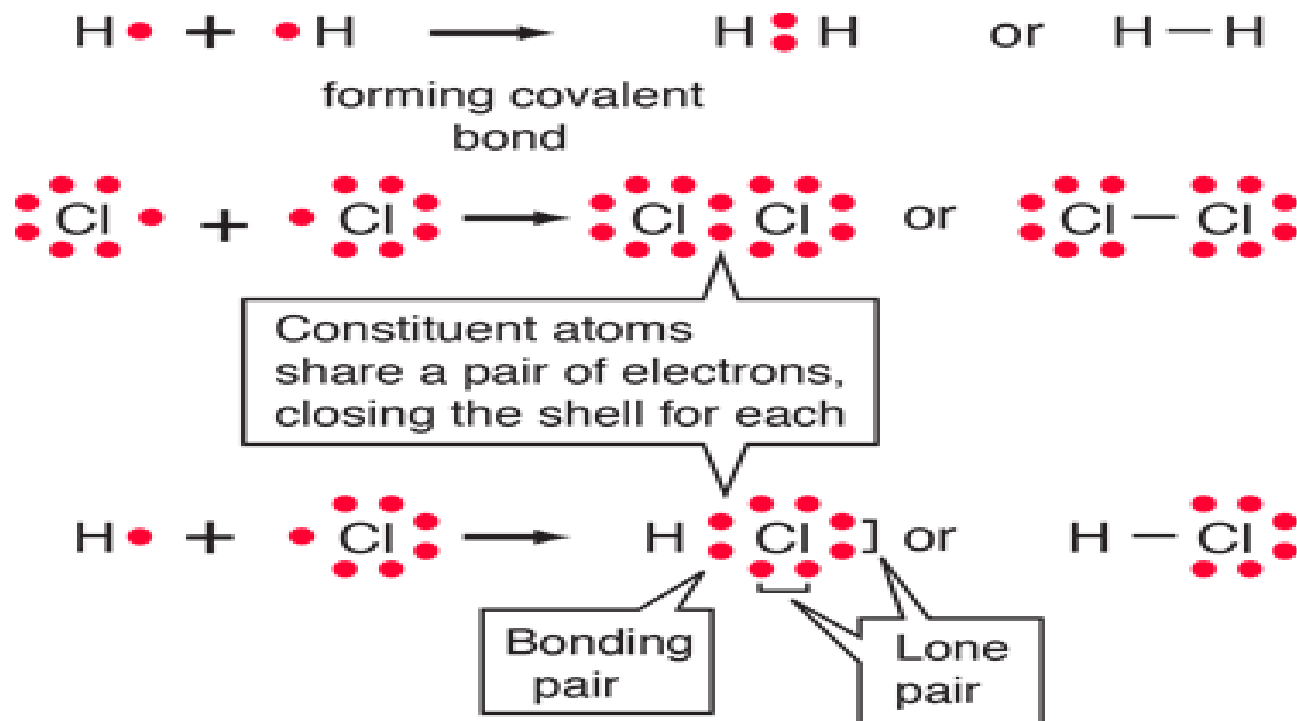
b) weaker *intermolecular* forces, such as dipole-dipole interactions, and hydrogen bonding.





Covalent bonds

The two bonded atoms are shared their electrons equally



The nature of the interaction between the atoms depends on their relative electronegativity.

For atoms with equal electronegativity, the bond between them will be a **non-polar covalent** interaction.

In non-polar covalent bonds, the electrons are equally shared between the two atoms.



For atoms with differing electronegativity, the bond will be a **polar covalent** interaction, where the electrons will not be shared equally.



electronegativity: The tendency of an atom or molecule to attract electrons and thus form bonds

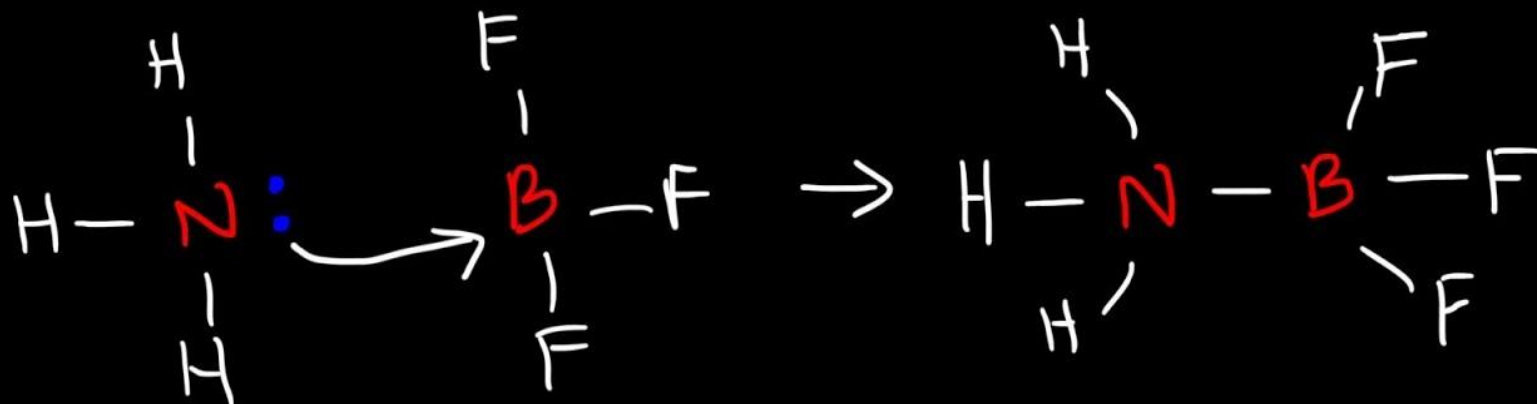


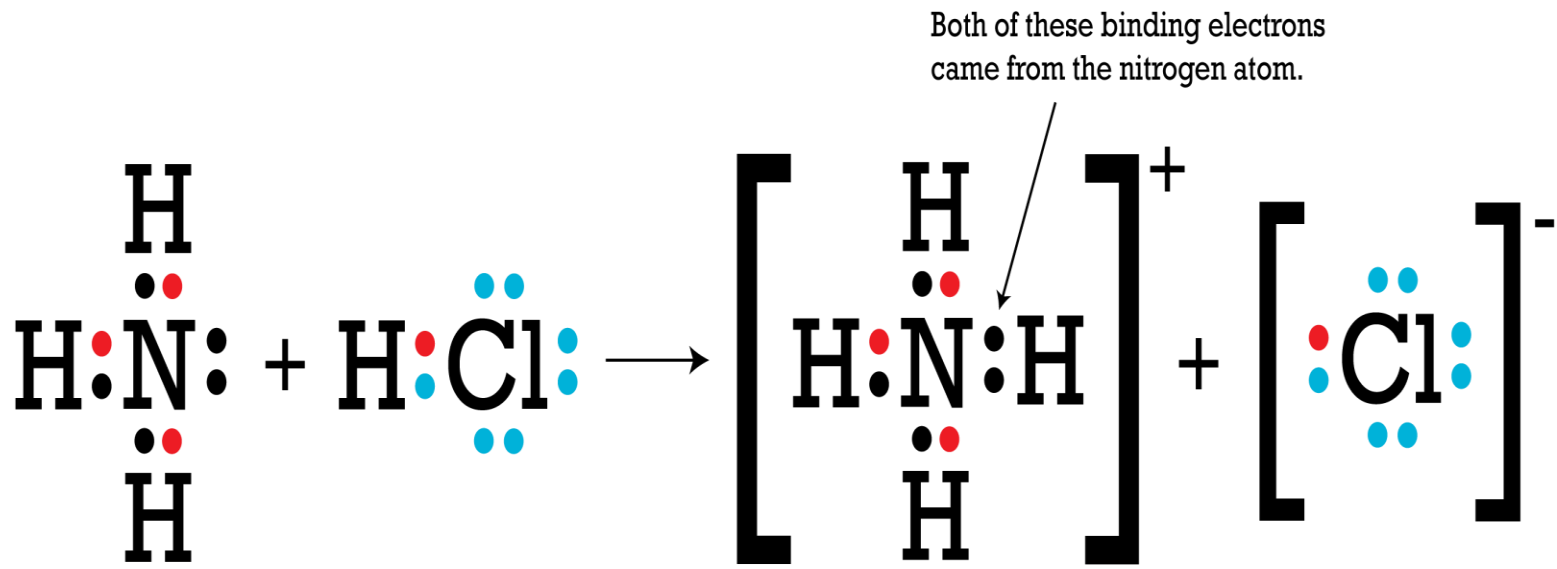
coordinate bond

A **coordinate bond** is a covalent **bond** (a shared pair of electrons) in which both electrons come from the same atom. The atoms are held together because the electron pair is attracted by both of the nuclei.



Coordinate Covalent Bonds







Types of covalent bonds

- ▶ **Polar covalent bonds** – occurs between atoms with small difference in electronegativity
- ▶ **Nonpolar covalent bond** occurs between atoms that have the same electronegativites
- ▶ **Coordinate Covalent Bond** – the shared electron pair comes from the lone pair of one of the atoms in the molecules



Covalent bonds can be single, double, and triple bonds.

Single bonds occur when two electrons are shared and are composed of one sigma bond between the two atoms.

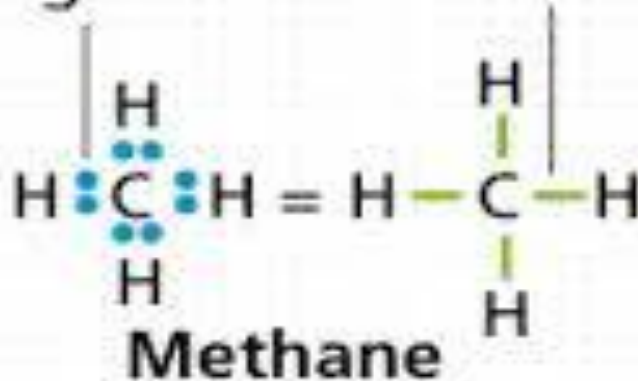
Double bonds occur when four electrons are shared between the two atoms and consist of one sigma bond and one pi bond.



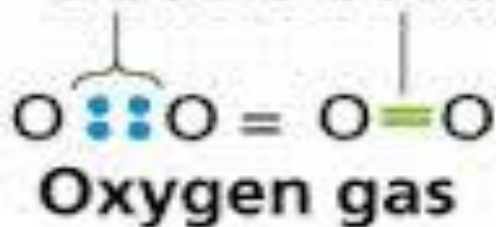
Triple bonds occur when six electrons are shared between the two atoms and consist of one sigma bond and two pi bonds



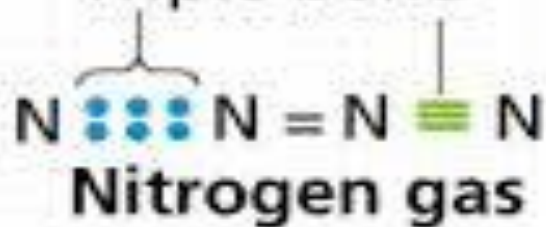
Single covalent bond



Double bond



Triple bond



Ionic Bonds

Atoms with the largest electronegativity differences (such as metals bonding with nonmetals), the bonding interaction is called ionic, and the valence electrons are typically represented as being transferred from the metal atom to the nonmetal.



Once the electrons have been transferred to the non-metal, both the metal and the non-metal are considered to be ions. The two oppositely charged ions attract each other to form an ionic compound.



