FUNDAMENTALS OF CHEMISTRY

# Chemical bonding

* **Chemical bond :** The force of attraction between two atoms in a molecule is called chemical bond.
* **Significance:**

1. Atoms combine to form molecules to get stability.
2. Atoms have high energy and less stable
3. Molecules have less energy and more Stable.
4. “The Stability of atoms due to the presence of eight electrons in the valency Shell is called octet rule”.
5. Nobel gas elements are stable due to ns2 np6 configuration.

**Electronic theory of valency:-**

* **Postulates:-**

1. It was proposed by Lewis and kossel in 1916.
2. A Chemical bond is formed In between the atoms with the help of valency electrons.
3. A Chemical bond is formed in between the atoms by transfer (or) Sharing of electrons takes place.
4. “The Stability of atoms due to the presence of eight electrons in the valency Shell is called octet rule”.
5. Nobel gas elements are stable due to ns2 np6 configuration.

* **Ionic bond (or) electrovalent bond:-** **It was proposed by kossel.**
* **Def: The electrostatic force of attraction between two oppositively charged ions by the transfer of electron is called ionic Bond.**

**Ex:- NaCl , MgO , etc…**

**Formation of ionic bond in Nacl(sodium chloride):-**

1. **The “Na” atom lose “1” electron to get stability and form “Na+” ion.**

**Na --------------🡪 Na+ + e-**

1. **The “Cl” atom gain “1” electron to get stability and form “Cl-” ion.**

**Cl + e- -----------🡪 Cl-**

1. **The Na+ and Cl- combine to form NaCl.**

**Na+ + Cl- ---------🡪 NaCl**

**Formation of ionic bond in MgO (Magnesium Oxide):-**

1. **The “Mg” atom lose “2” electron to get stability and form “Mg2+” ion.**

**Mg -----------🡪 Mg2+ + 2e-**

1. **The “O” atom gain “2” electron to get stability and form “O2-” ion.**

**O + 2e- --------🡪 O2-**

1. **The Mg2+ and O2- combine to form MgO.  
   Mg2+ +O2- ---------🡪 MgO**

**PROPERTIES OF IONIC COMPOUNDS:**

1. **They are crystalline solids.**
2. **They are soluble in polar solvents like H20**
3. **They are formed by transfer of electrons**
4. **They are good conductors of heat and electricity.**
5. **These reactions are fast.**
6. **They have high M.P & B.P**

**They don’t exhibit Isomerism**

**Covalent bond:-**

1. **It was proposed by lewis**
2. **Def : A chemical , bond formed by mutual Sharing of electrons between two atoms is called Covalent bond.**
3. **Ex :- H2 , O2 , N2 , HCl , HF ,etc…..**
4. **A Covalent bond formed between two similar atoms is called non-polar Covalent bond.**

**Ex:- H2 , O2 , N2 , etc..**

1. **A Covalent bond formed between two different atoms is called polar Covalent bond.**

**Ex:- HCl , HF ,etc…..**

1. **It is denoted by “-”.**

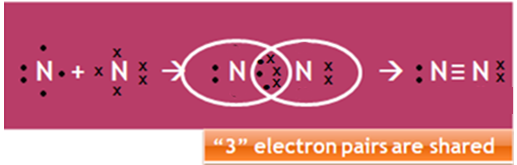
**Lewis dot method (or) electron (e-) dot method:-**

**FORMATION OF COVALENT BOND IN H2:**

****

**Thus , each hydrogen atom share ‘1’ electron and form single bond between two hydrogen atoms**

**Formation of covalent bond in O2:-**

****

**Thus , each oxygen atom shared “2” electrons and form double bond between two oxygen atoms.**

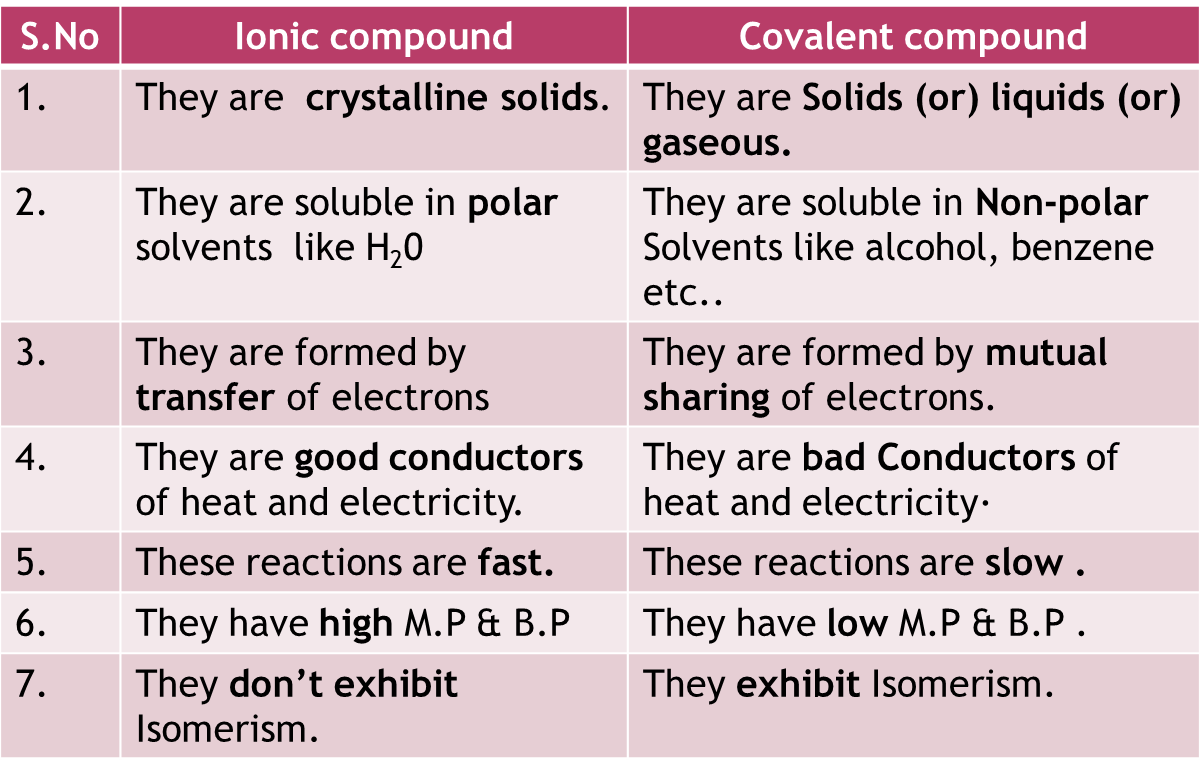
**Formation of covalent bond in N2:-**

**Thus , each nitrogen atom share “3” electrons and forms “triple bond” between two nitrogen atoms.**

**Properties of covalent bond:-**

1. **They are Solids (or) liquids (or) gaseous.**
2. **They are soluble in Non-polar Solvents like alcohol, benzene etc..**
3. **They are formed by mutual sharing of electrons.**
4. **They are bad Conductors of heat and electricity·**
5. **These reactions are slow .**
6. **They have low M.P & B.P .**
7. **They exhibit Isomerism.**

**Distinguish between ionic compounds & covalent compounds:-**

****

**Structure of ionic solid:-**

**Unit cell:- The smallest part of crystalline solid which represents the structure of crystal is called unit cell.**

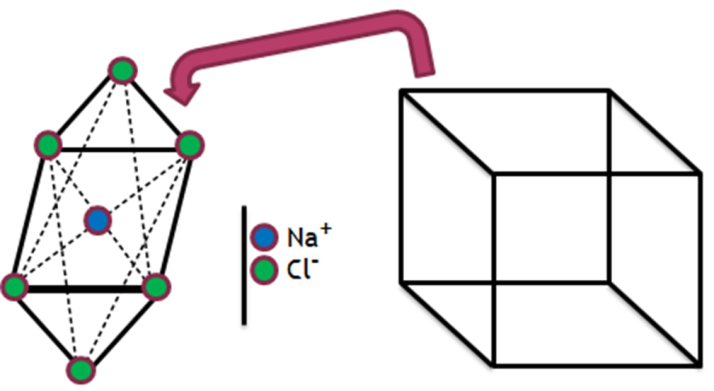
**Co-ordination number:- the number of oppositively charged ions present around an ion is called co-ordination number.**

**Ex-1:- The co-ordination number in NaCl is “6”**

**Ex-2:- The co-ordination number in MgO is “8”**

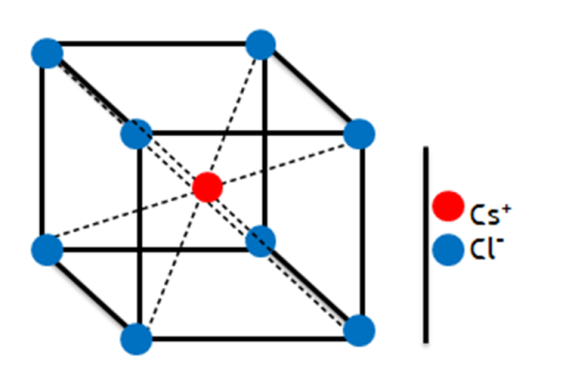
**Structure of unit cell of NaCl:-**

1. **The co-ordination number in NaCl is “6”**
2. **Each Na+ ion is surrounded by “6” Cl- ions and each Cl- ion is surrounded by “6” Na+ ions.**
3. **The structure of unit cell of NaCl is FCC(Face Centered Cubic).**

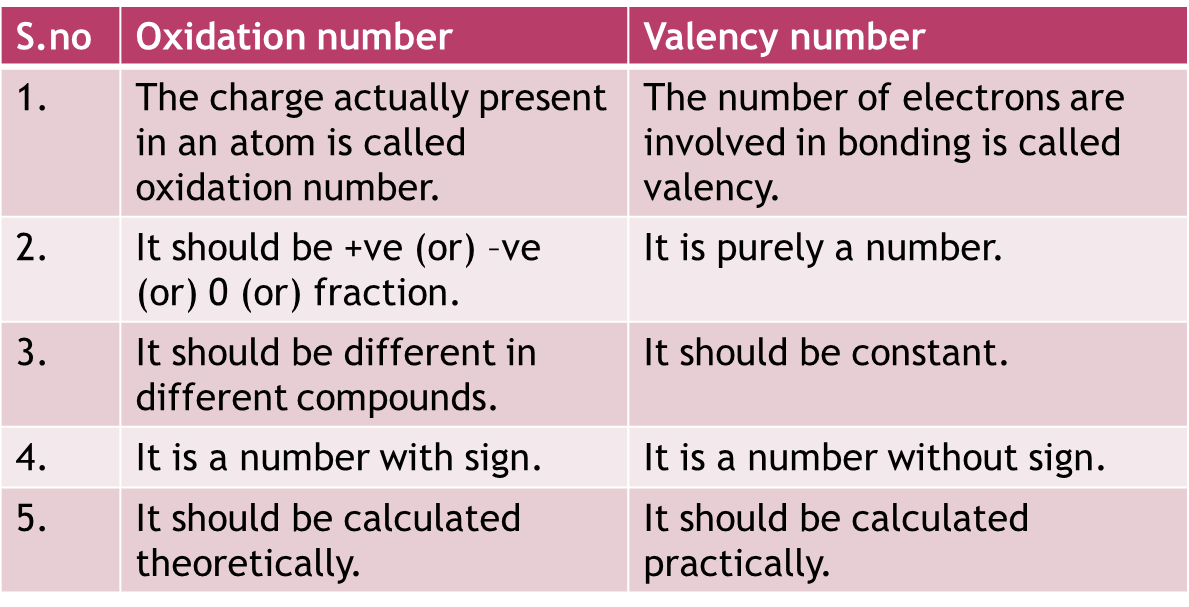
****

**Structure of unit cell of CsCl:**

1. **The co-ordination number in CsCl is “8”**
2. **Each Cs+ ion is surrounded by “8” Cl- ions and each Cl- ion is surrounded by “8” Cs+ ions.**
3. **The structure of unit cell of CsCl is BCC(Body Centered Cubic).**

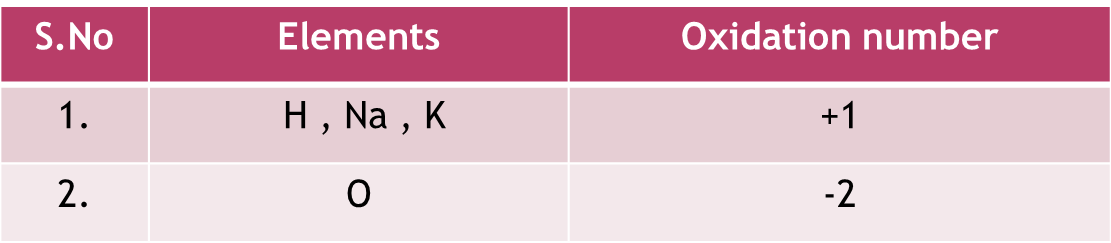
****

* **Oxidation:-The process of removal of electrons from an atom is called oxidation.**
* **Ex:- Na----🡪 Na+ +e-**
* **Reduction:- The process of addition of electrons to an atom is called reduction.**
* **Ex:- Cl + e- ---🡪 Cl-**
* **Oxidation number (or) oxidation state :- The charge actually present in an atom is called oxidation number.**
* **Ex-1:- Na+ 🡪 oxidation number = +1**
* **Ex-2:- Cl- 🡪 oxidation number = -1**
* **Valency (or) valency number :- The number of electrons are involved in bonding is called valency.**
* **Ex-1:- The valency of “O” is 2.**
* **Ex-2:- The valency of “N” is 3.**
* **Difference between oxidation number and valency :**

****

**Calculation of oxidation number:-**

**Note :**

****

**Rules:-**

1. **The sum of oxidation number of all atoms in a neutral molecule is equal to “0”.**
2. **The sum of oxidation numbers of all atom in a charged ion is equal to it’s charge.**

**Model-1:**

**Find the oxidation number of “S” in H2SO4.**

**Ans: Let , the oxidation number of “S”= x**

**Since , H2SO4**

**🡪 2(H) + S + 4(O) = 0**

**🡪 2(1) + x + 4(-2) = 0**

**🡪 2 + x – 8 = 0**

**🡪 x – 6 = 0**

**🡪 x= +6**

**Model-2:**

**Find the oxidation number of “Cl” in ClO4.**

**Ans: Let , the oxidation number of “Cl” = x**

**since , ClO4**

**🡪 Cl + 4(O) = -1**

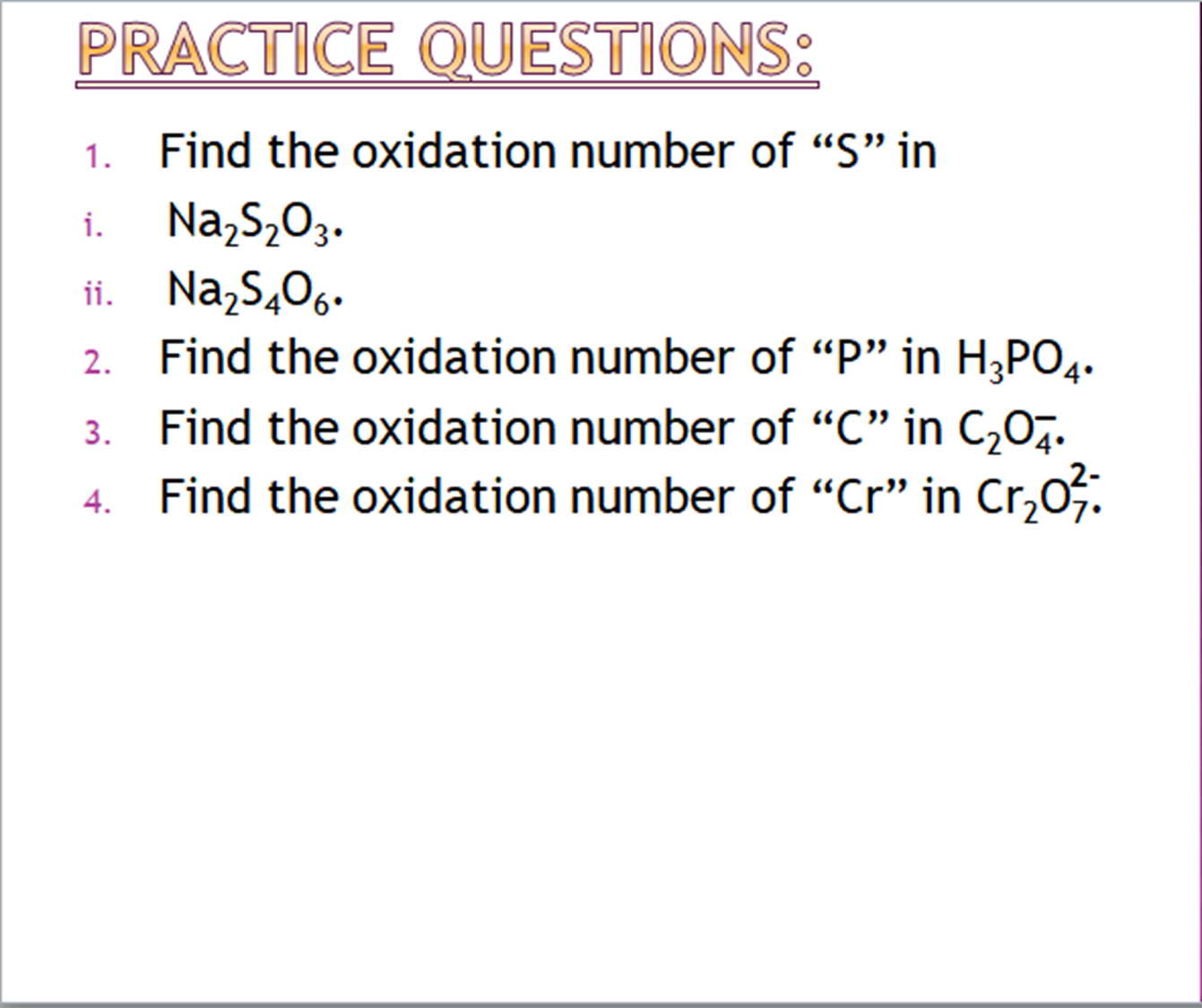
**🡪 x + 4(-2) = -1**

**🡪 x – 8 = -1**

**🡪 x = -1 + 8**

**🡪 x = +7.**

**Practice problems:**

****