

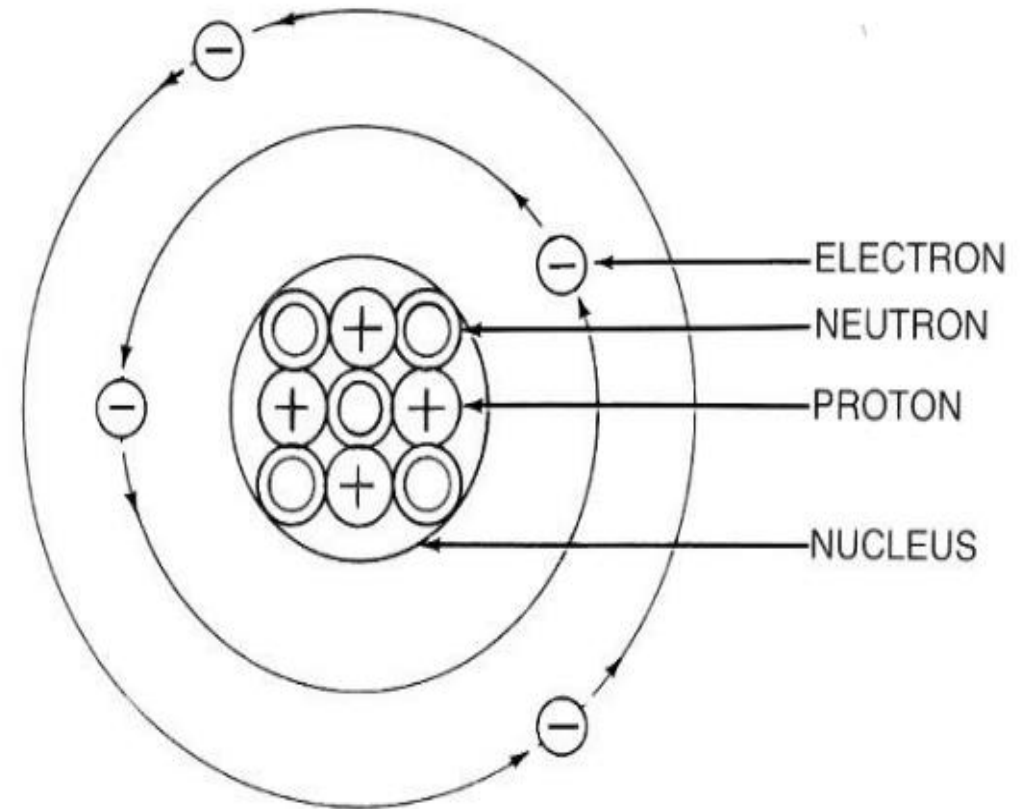
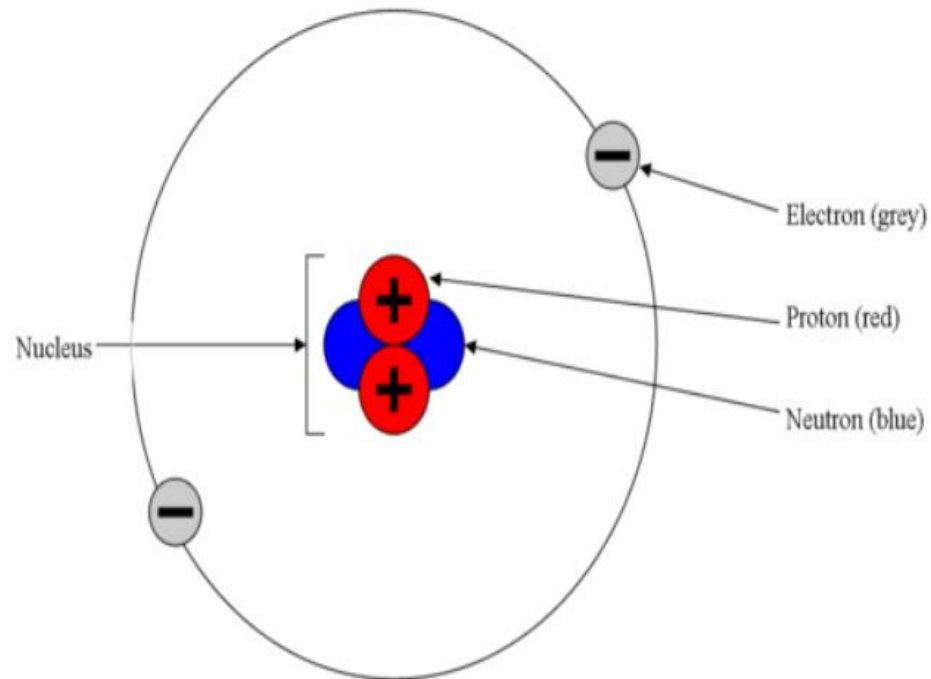


# *Electronics Devices (19EC31)*

*Dr. Shilpa K.C*  
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*Communication*  
*Engineering*  
*Dr. AIT*

## Introduction

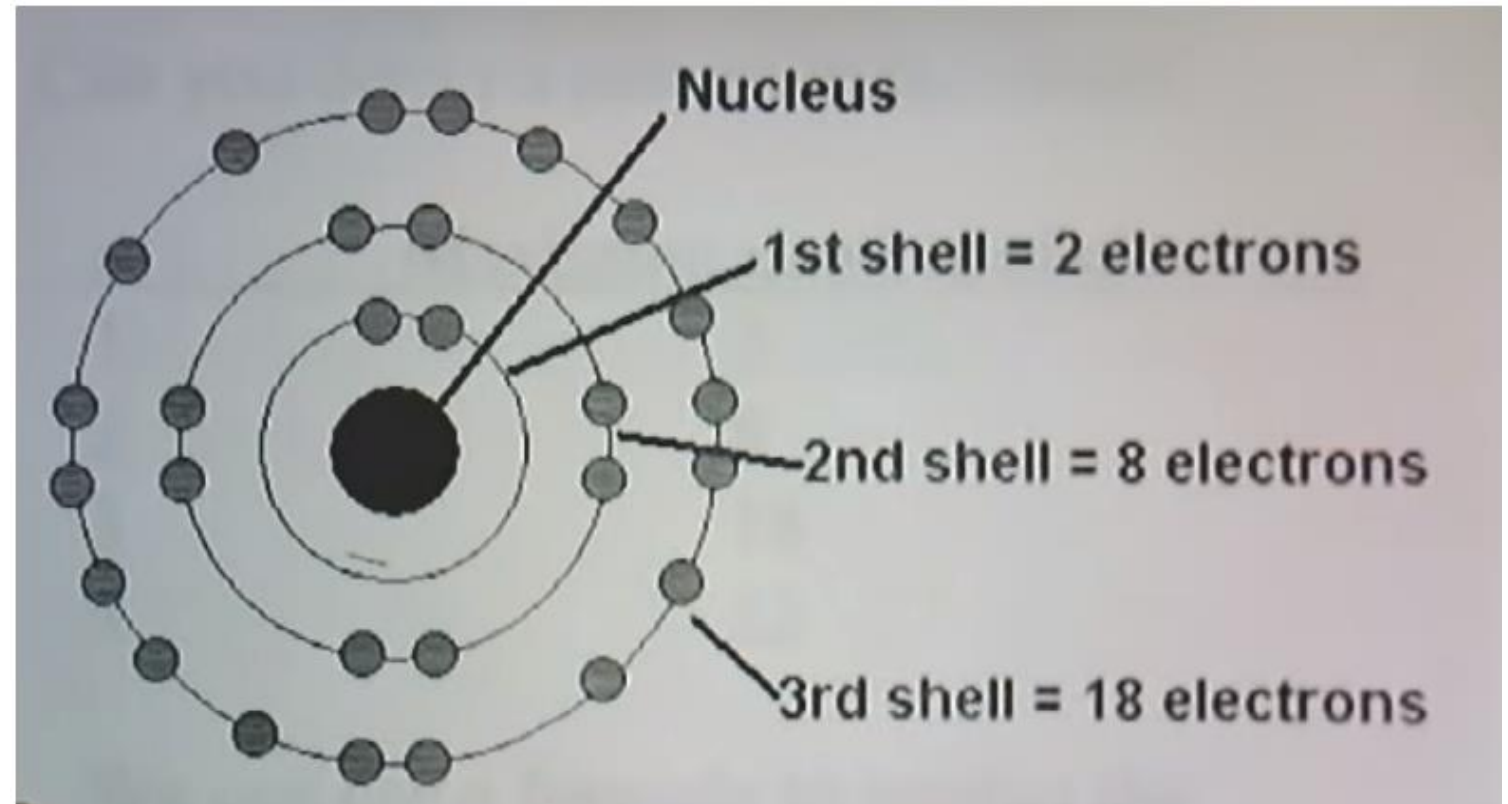
### An Atom



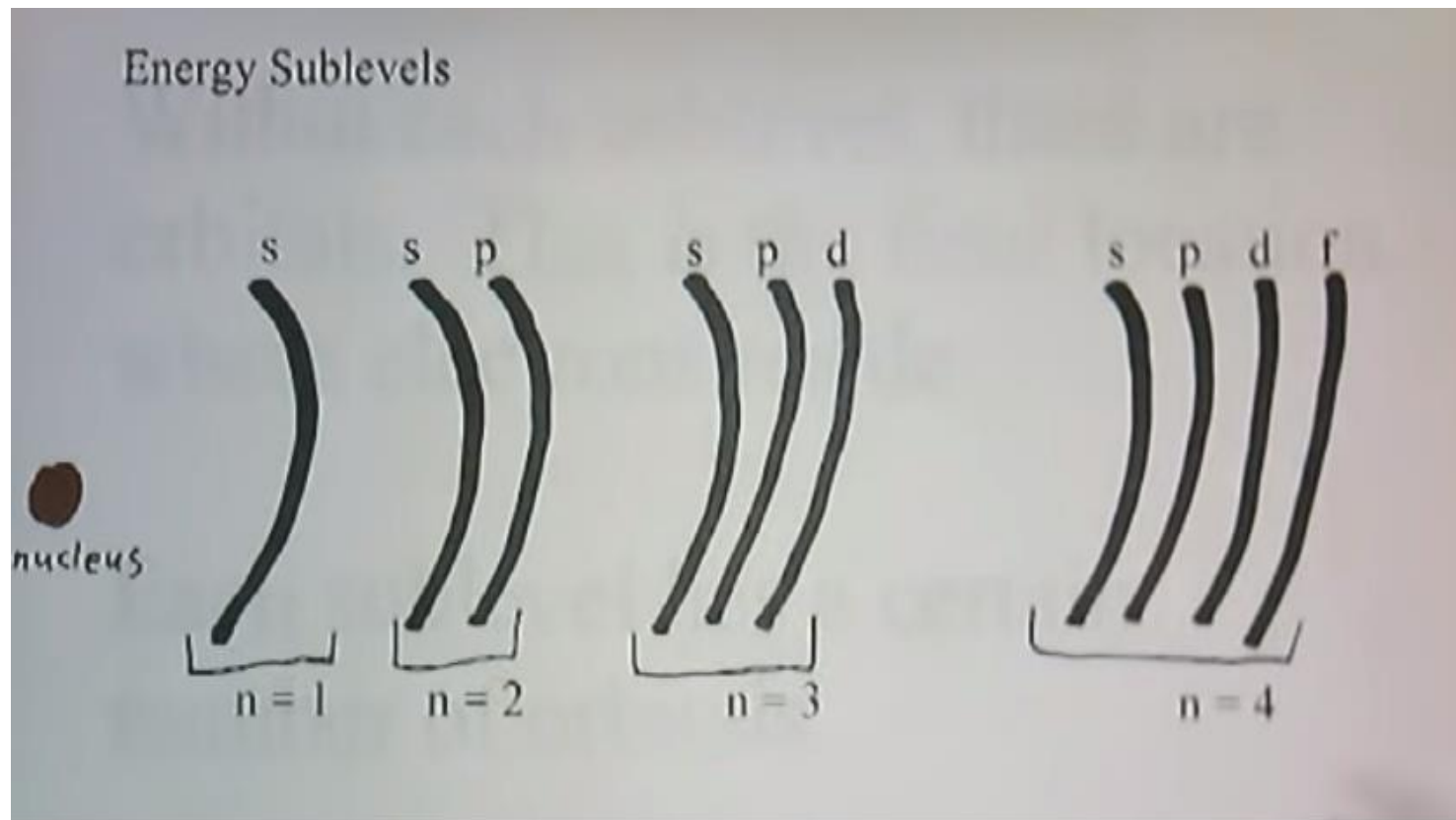
## Introduction

### Energy Level Diagram in an Atom

- Electron capacity =  $2(n^2)$
- $n$  = energy level



## Energy Sublevel Diagram



$n$  = energy level

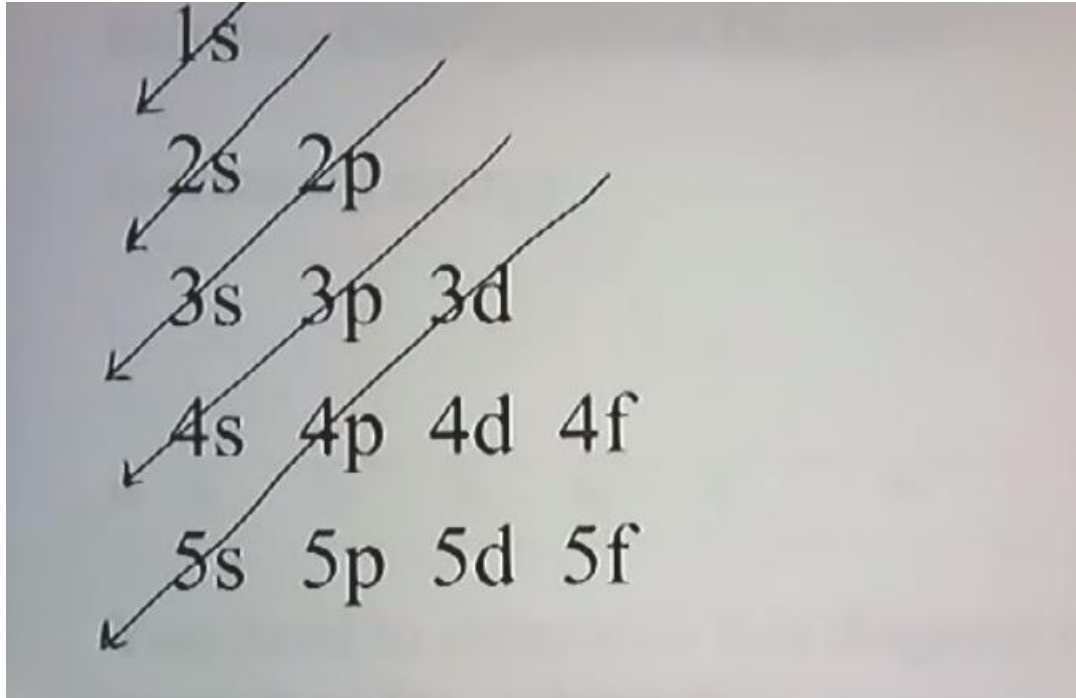
s,p,d,f = subshells

## *Sublevels and electrons in the subshell*

| n | sublevels inside the energy level |
|---|-----------------------------------|
| 1 | s                                 |
| 2 | s, p                              |
| 3 | s, p, d                           |
| 4 | s, p, d, f                        |
| 5 | s, p, d, f                        |

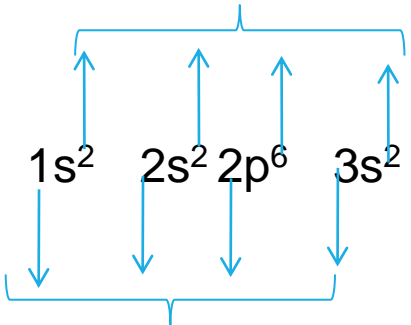
| Sublevels | Electrons capacity |
|-----------|--------------------|
| s         | 2 electrons        |
| p         | 6 electrons        |
| d         | 10 electrons       |
| f         | 14 electrons       |

## *Atomic Data Representation*



1s 2s 2p 3s 3p 4s 3d 4p 5s

## Examples of Atomic Data Representation

| SL.NO | Compound    | Atomic Weight | Data Representation  |
|-------|-------------|---------------|--|
| 1     | Sodium (Na) | 11            | $1s^2 2s^2 2p^6 3s^2$<br>Electrons capacity<br><br>Energy levels |



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## *Examples of Atomic Data Representation*

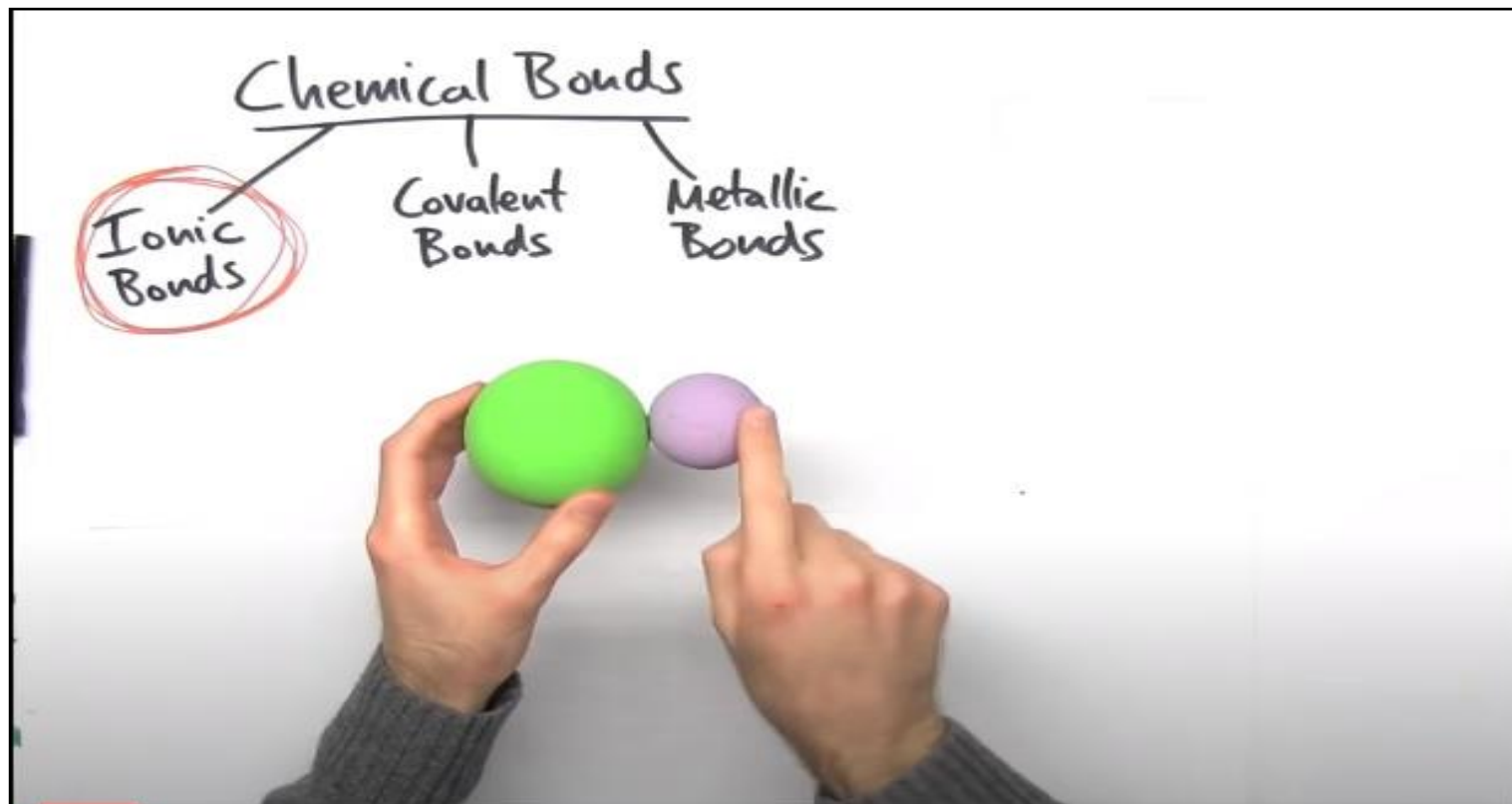
| <i>SL.NO</i> | <i>Compound</i> | <i>Atomic Weight</i> | <i>Data Representation</i> |
|--------------|-----------------|----------------------|----------------------------|
| 1            | Sodium (Na)     | 11                   |                            |
| 2            | Chlorine (Cl)   | 17                   |                            |
| 3.           | Oxygen( $O_2$ ) | 08                   |                            |
| 4.           | Nitrogen        | 07                   |                            |
| 5            | Zinc            | 30                   |                            |
| 6.           | Iron            | 26                   |                            |



## *Examples of Atomic Data Representation*

| <i>SL.NO</i> | <i>Compound</i> | <i>Atomic Weight</i> | <i>Data Representation</i>              |
|--------------|-----------------|----------------------|---|
| 1.           | Sodium (Na)     | 11                   | $1s^2 2s^2 2p^6 3s^2$                   |
| 2.           | Chlorine (Cl)   | 17                   | $1s^2 2s^2 2p^6 3s^2 3p^5$              |
| 3.           | Oxygen( $O_2$ ) | 08                   | $1s^2 2s^2 2p^4$                        |
| 4.           | Nitrogen        | 07                   | $1s^2 2s^2 2p^3$                        |
| 5.           | Zinc            | 30                   | $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$ |
| 6.           | Iron            | 26                   | $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$    |

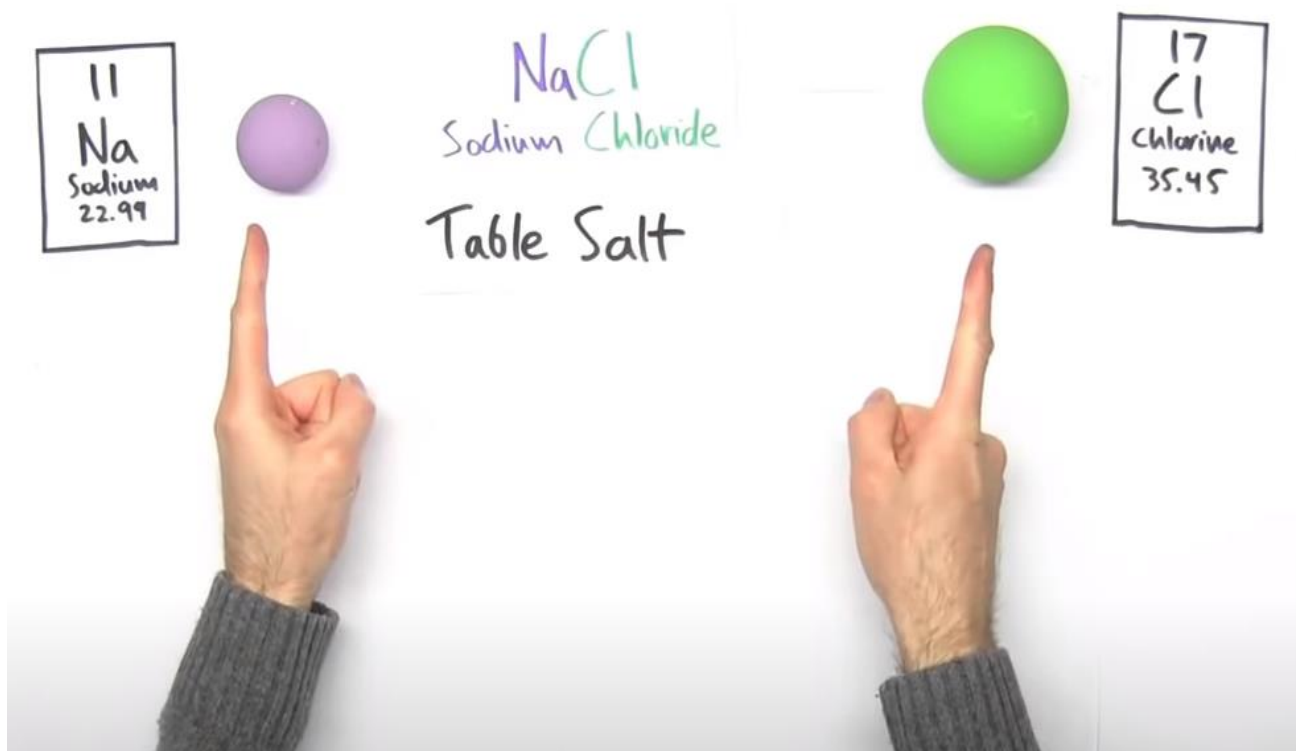
## Chemical Bonding



### Chemical Bonds-

Are the forces that holds atoms together to make a molecule or compound.

## *Ionic Bonding*

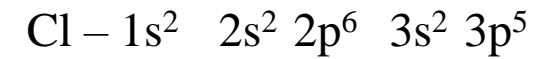
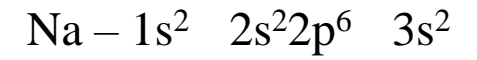
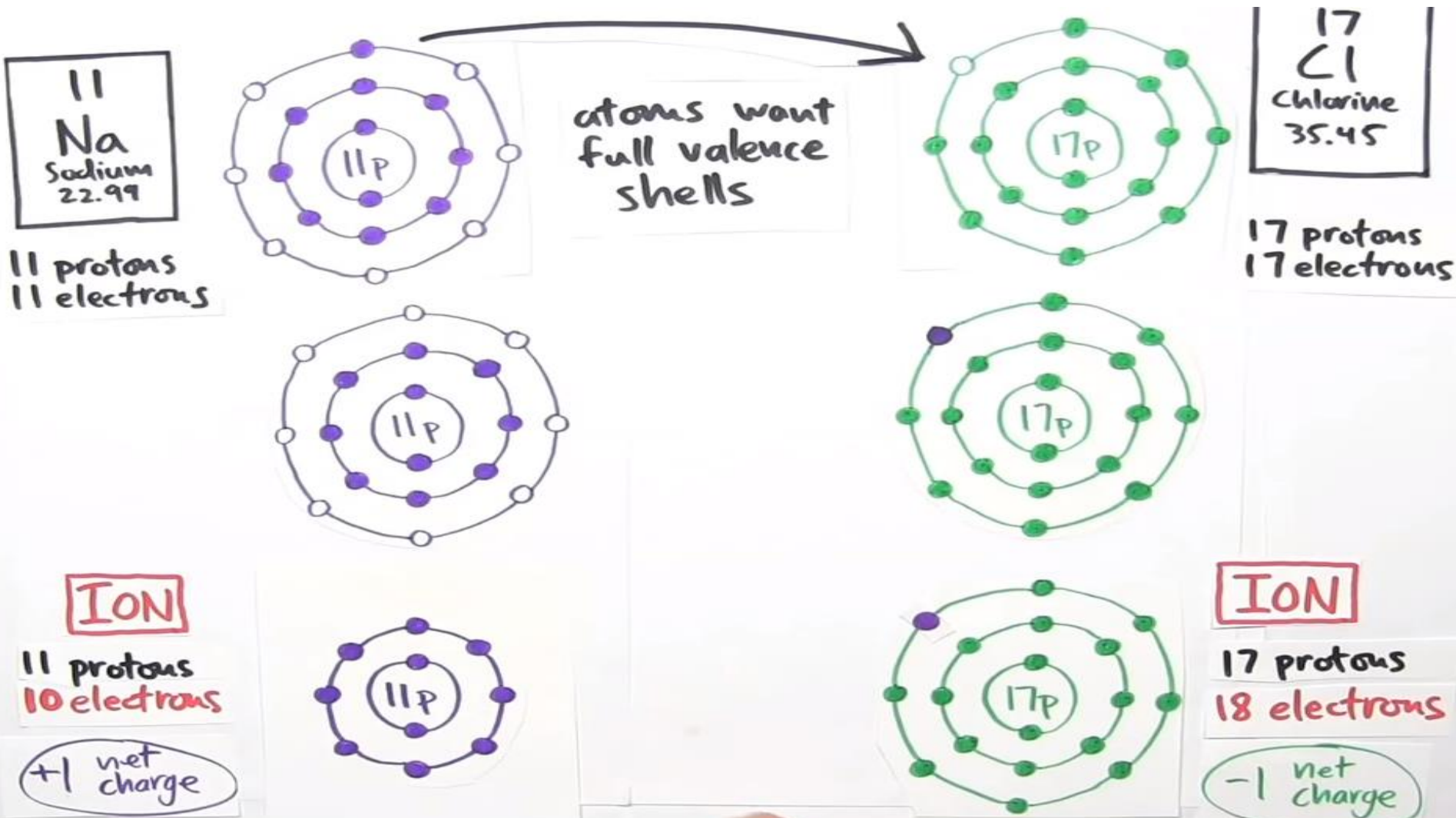


*Ionic Bonding* –  
*Connects between*  
*Metal & Non-Metal*

Sodium(Na) is a Metal

Chlorine (Cl) is a Non-Metal

# Ionic Bonding



## Octet Rule

The Octet rule refers to the tendency of atoms to prefer to have eight electrons in the valence shell.

# Ionic Bonding

11  
Na  
Sodium  
22.99

NaCl  
Sodium Chloride

17  
Cl  
Chlorine  
35.45

---

start with separate atoms

sodium gives an electron to chlorine

atoms get a charge and become ions

ions have opposite charges, so they stick together

metal atom      nonmetal atom

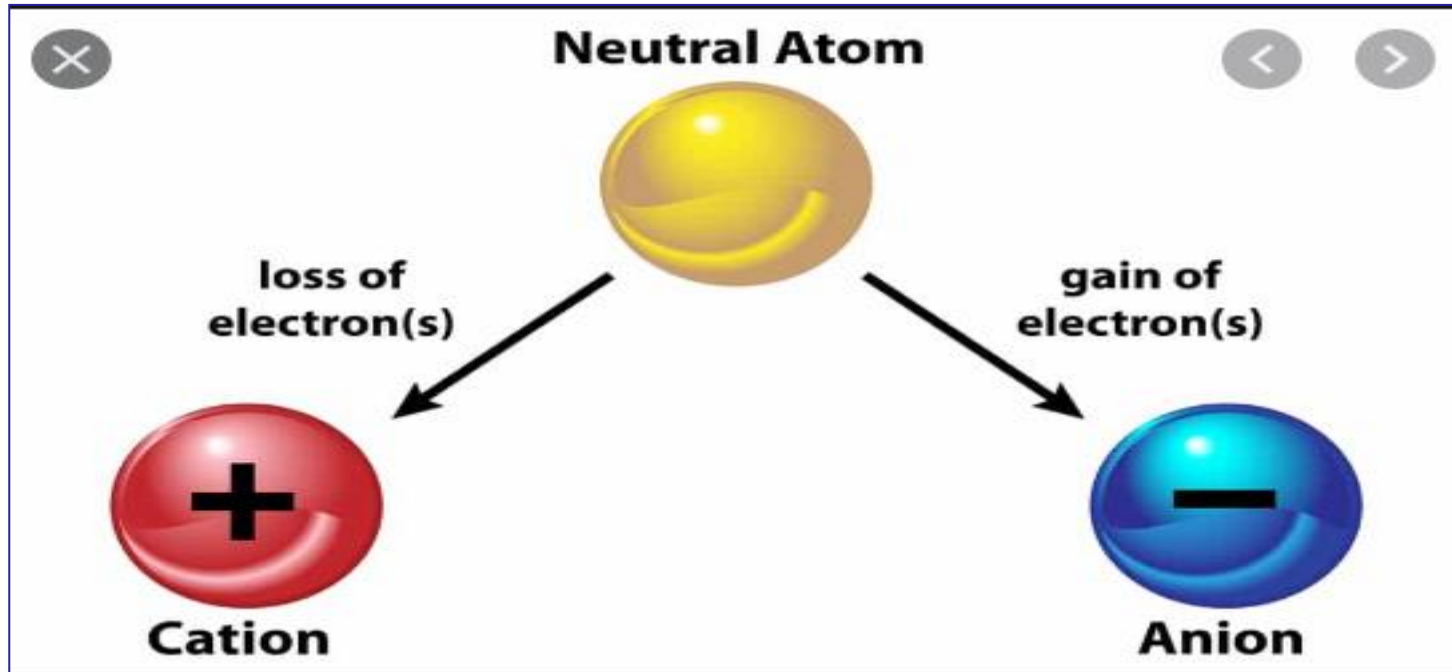
← chlorine (0 charge)

**IONS**

lost 1 electron      gained 1 electron

← chloride (-1 charge)

## *Ionic Bonding*



$\text{Na}^+ \longrightarrow$  Cation

$\text{Cl}^- \longrightarrow$  Anion

The atoms that have charges are called

***Ions***

The Ions have opposite charges , hence

*Electrostatic attractive forces bonds* the atoms together



# *Electronics Devices (19EC31)*

## *Class 2*

*Dr. Shilpa K.C*  
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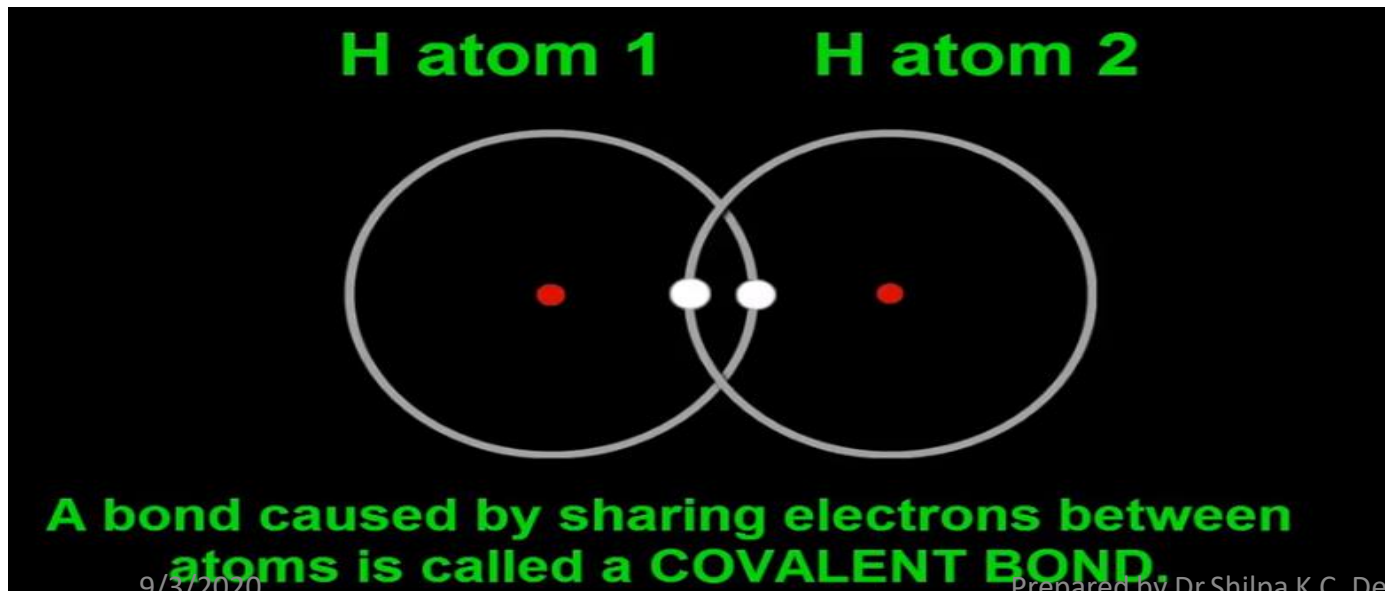
## Covalent Bonding

Sharing of electrons between atoms of the same kind  
E.g. Formation of  $H_2$ ,  $Cl_2$ ,  $O_2$ , etc.

Sharing of electrons between atoms of different kind .  
E.g. Formation of  $CH_4$ ,  $H_2O$  etc.

*Covalent Bonding –  
Connects between  
Non-Metal & Non-Metal*

H – atomic number 1 –  $1s^1$



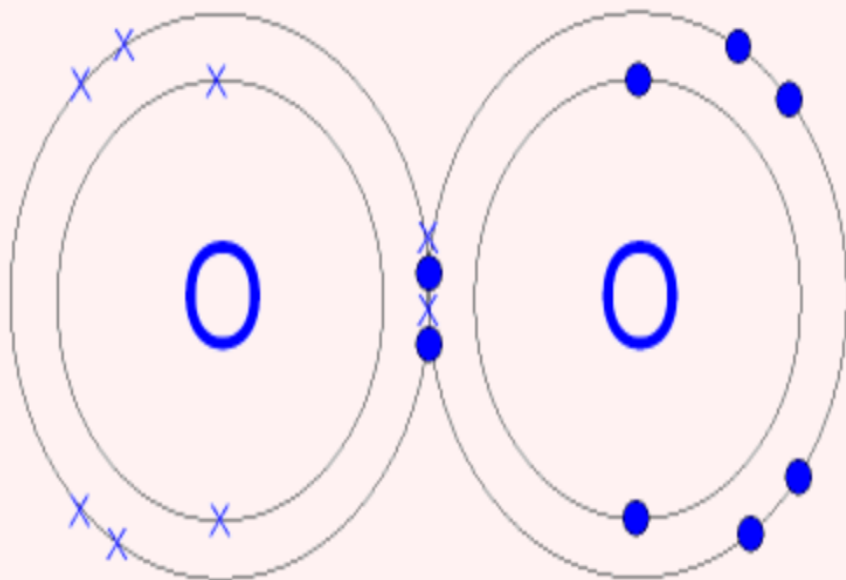


## Covalent Bonding

Two oxygen atoms will each share two electrons to form two covalent bonds and make an oxygen molecule ( $O_2$ ).

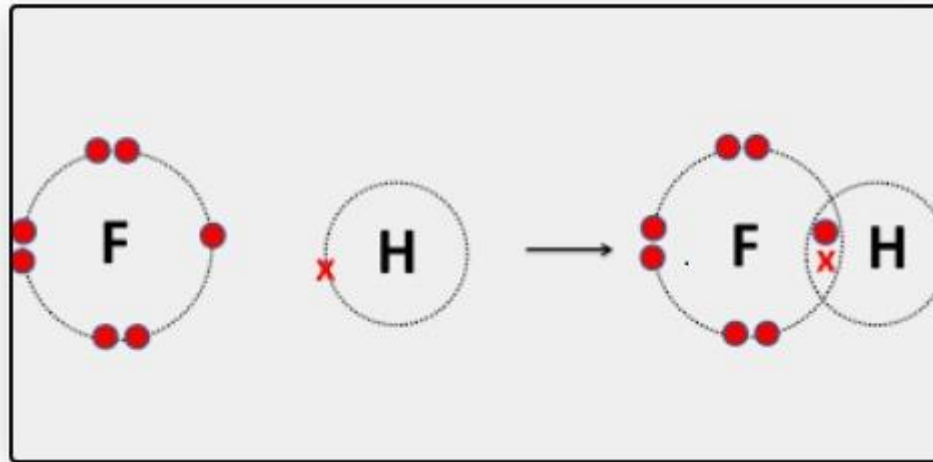
O – atomic number 8 –  $1s^2 2s^2 2p^4$

This is a picture of an oxygen molecule.



## Covalent Bonding

Sharing of electrons between atoms of different kind .  
E.g. Formation of  $\text{CH}_4$ ,  $\text{H}_2\text{O}$ ,  $\text{HF}$  ,  $\text{HCl}$  etc.

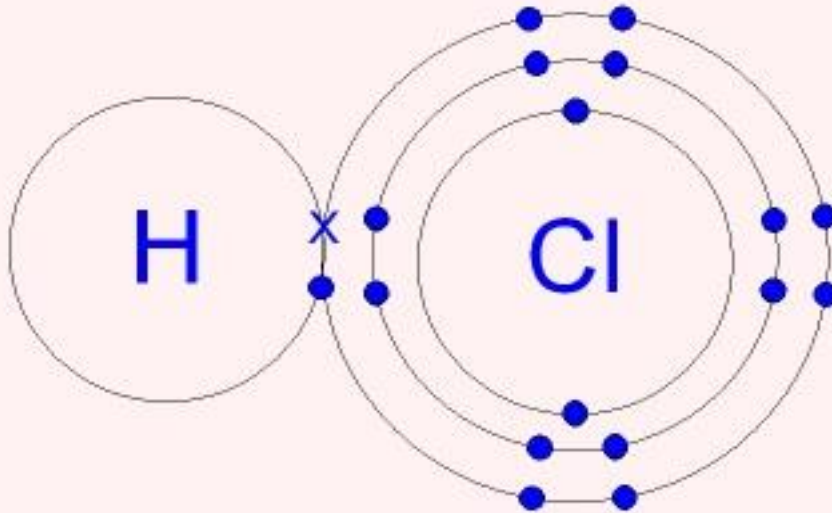


H – atomic number 1 –  $1s^1$

F – atomic number 9 –  $1s^2 2s^2 2p^5$

## Covalent Bonding

This is a picture of a hydrogen chloride molecule.

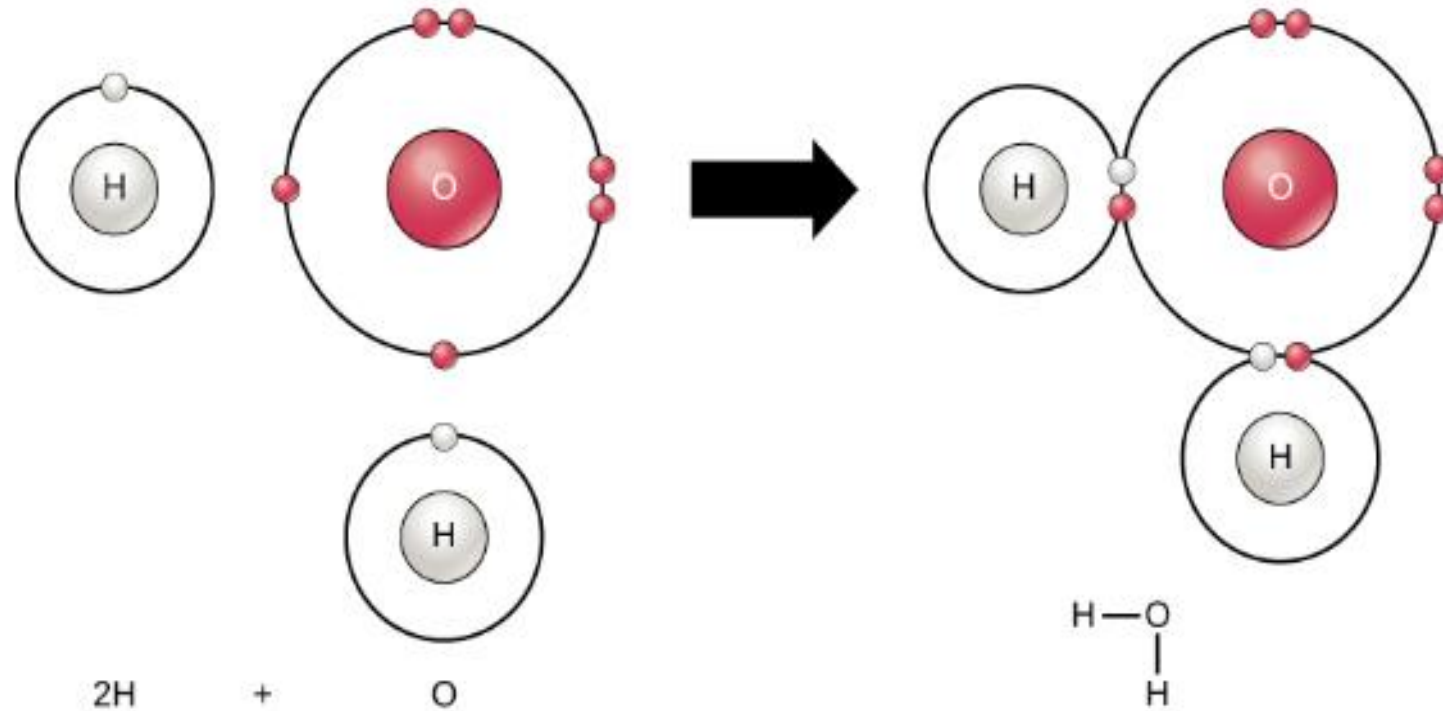


H – atomic number 1 –  $1s^1$

Cl – atomic number 17 –  
 $1s^2 2s^2 2p^6 3s^2 3p^5$

# Covalent Bonding

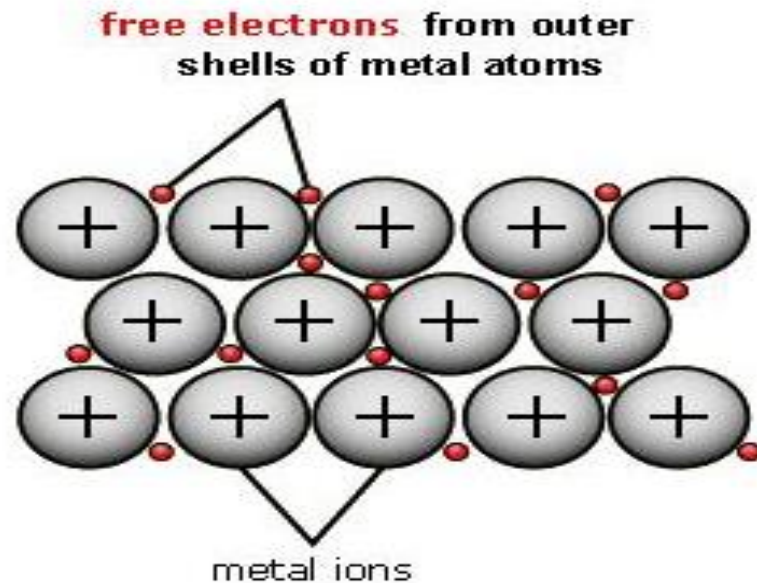
Bonds between hydrogen and oxygen atoms in *a water molecule*



Sharing of  
Electrons  
bonds the  
atoms  
together  
In Covalent  
Bonding

## *Metallic Bonding*

Metallic Bonding - The bond produced due to the combination of electrostatic force of attraction between the electrons and the positive nuclei of metal atoms

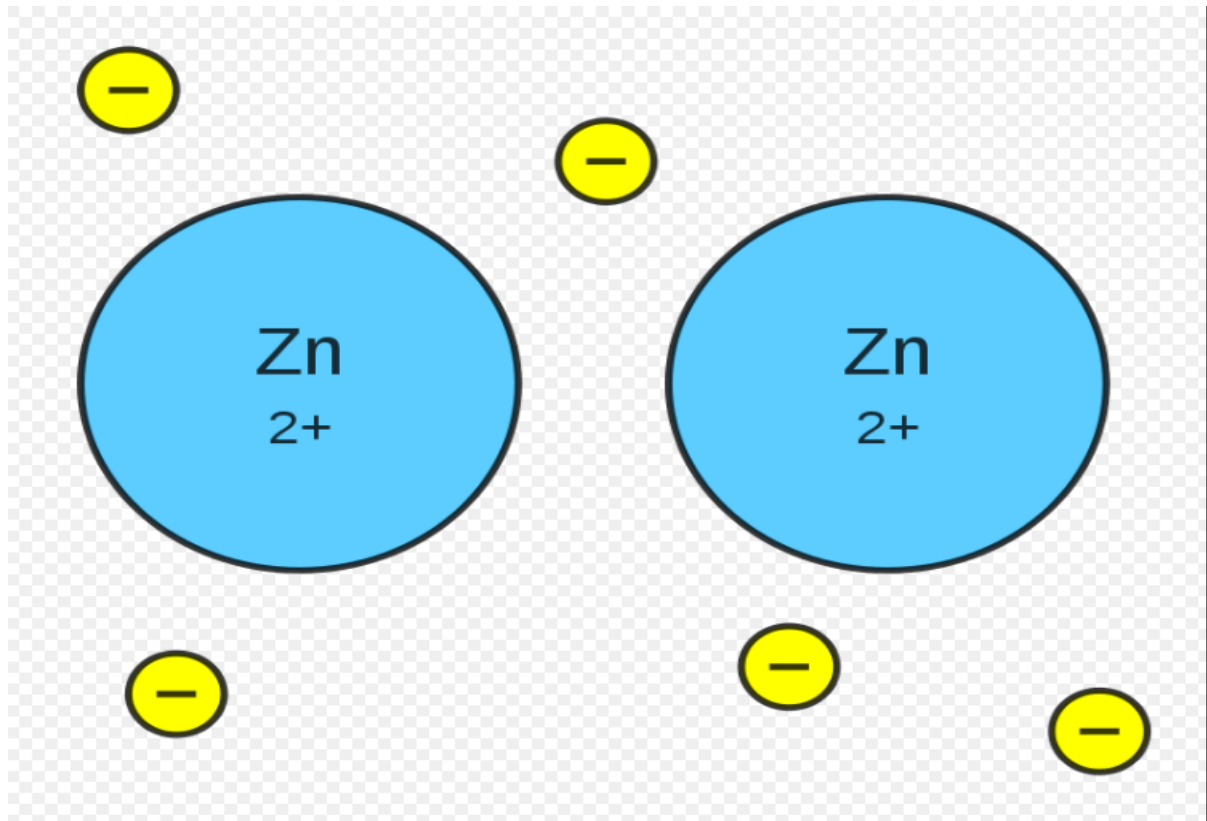


*Metallic Bonding* –  
*Connects between*  
*Metal & Metal*

Sodium(Na) is a Metal

Valence electrons are 1 in outer most orbit

## *Metallic Bonding*



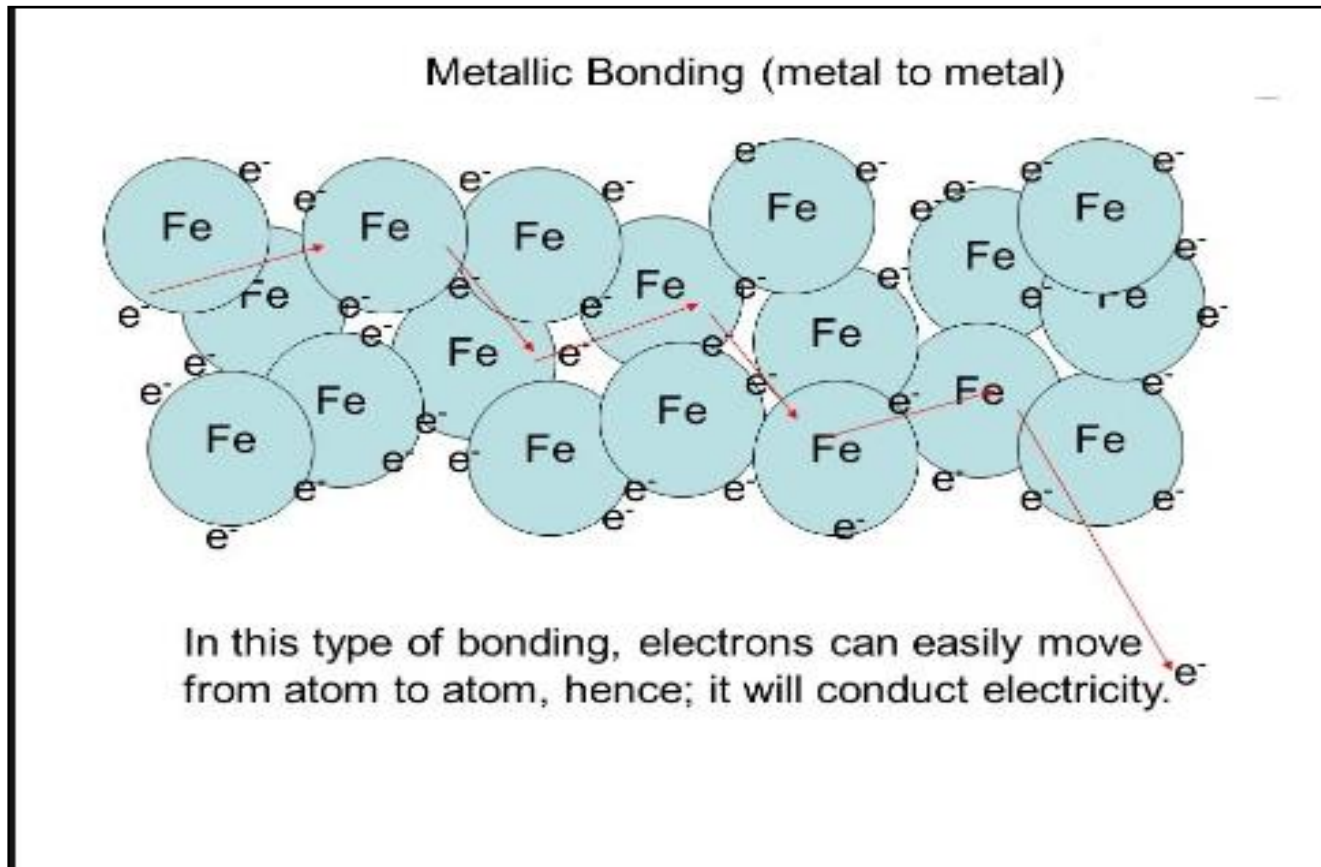
Zinc is a Metal

Atomic number of Zinc is **30**

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$

Valence electrons are 2 in outer most orbit

## *Metallic Bonding*



Iron is a Metal

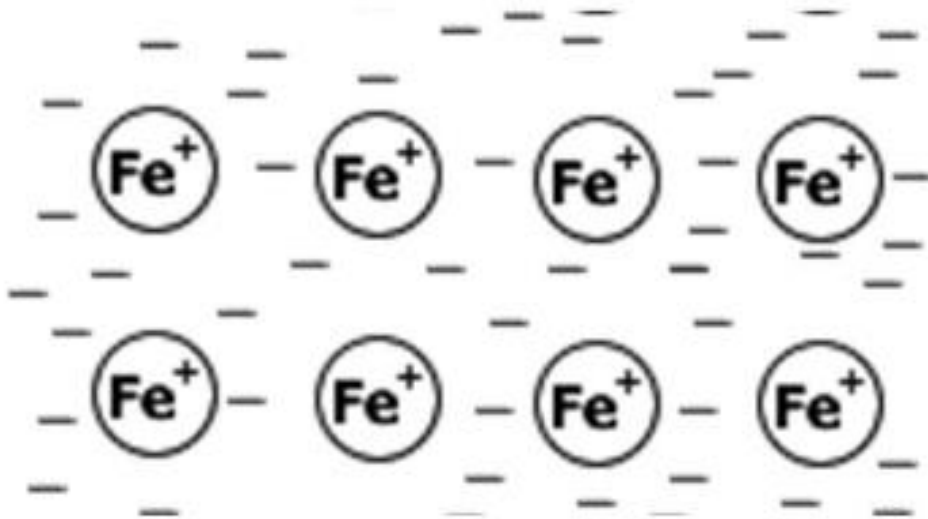
Atomic number of Iron (Fe) is  
**26**

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$

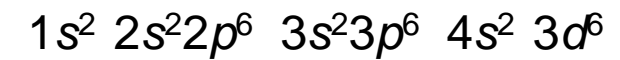
Valence electrons are 2 in outer  
most orbit

## *Metallic Bonding*

The Metallic Bond in Iron, and the  
"Sea of Electrons"



Atomic number of Iron (Fe) is  
**26**



Valence electrons are 2 in outer  
most orbit





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## *Metallic Bonding*

- Properties of Metals

1. They are also called as Sea of Electrons

2. High Conductivity

3. High Ductility -- Can be drawn into fine wires

4. High Malleability --- Can be bend any shapes



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## *Comparsion of the 3 Chemical Bonding*

| <b>Ionic Bonding</b>   | <b>Covalent Bonding</b>   | <b>Metallic Bonding</b>   |
|--|---|---|
| Bonding between Metal and Non Metal                                | Bonding between Non Metal and Non Metal                                       | Bonding between Metal and Metal   |
| <u>Electrostatic attraction</u> between positive and negative ions | <u>Sharing of electrons</u> between atoms of the same kind or different kinds | <u>Electrostatic force of attraction</u> between the electrons and the positive nuclei of metal atoms |



*Thank You*

*HAVE A NICE DAY*