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GENERAL CHEMISTRY

Department :- Radiology Techniques

Class:1st year

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The atom and molecular structure. Electronically distribution

Atom – the smallest unit of matter "indivisible"

- The atom consists of a nucleus Centre contain positively charged particles called protons (P+) and particles neutrons (n0) are called neutrons, and they turn around the nucleus negatively charged particles called electrons (e-).

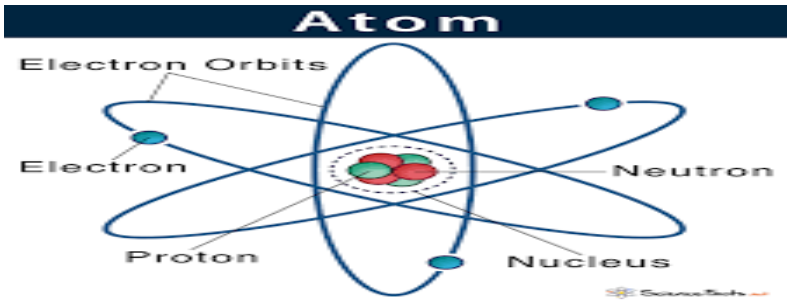
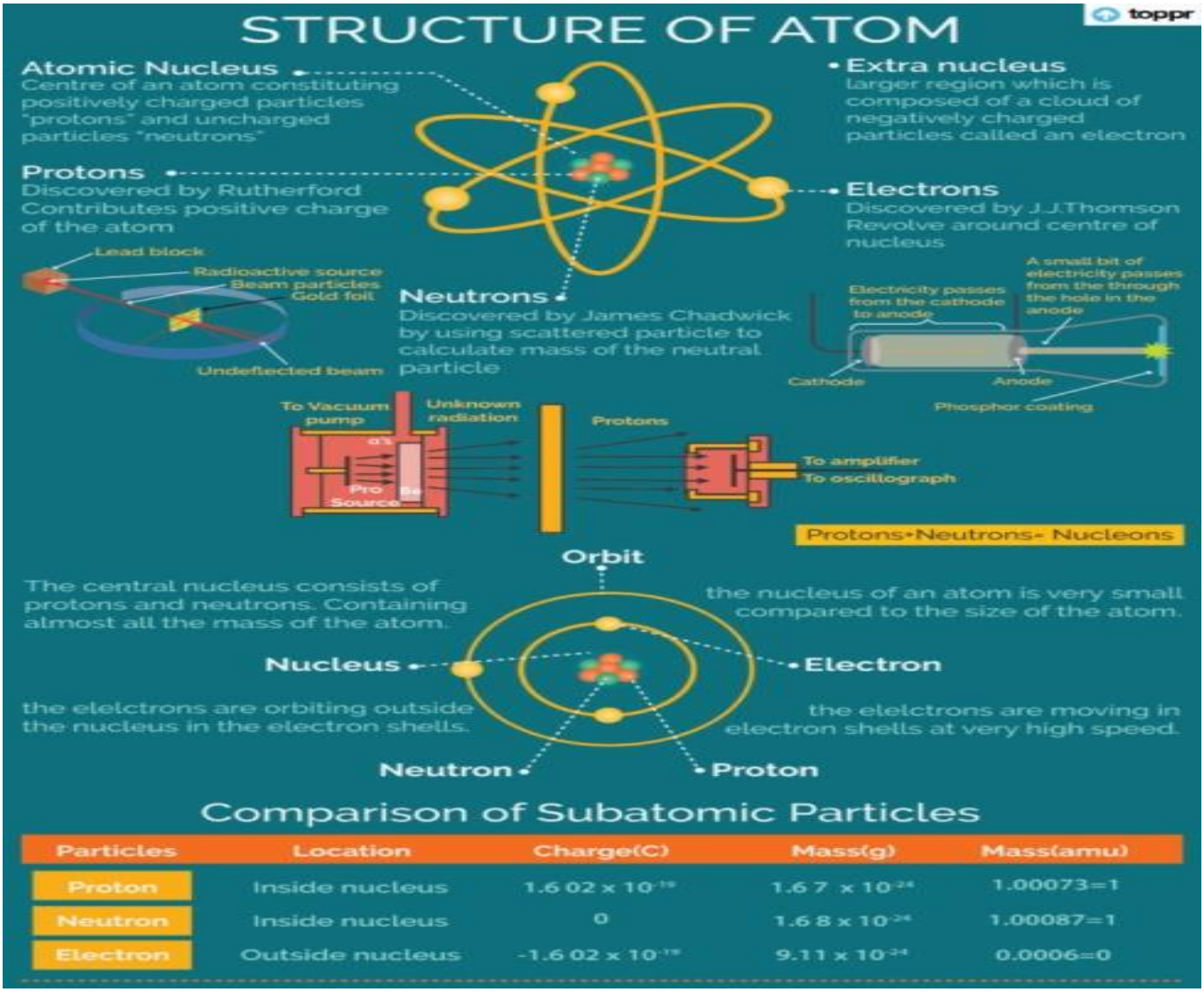
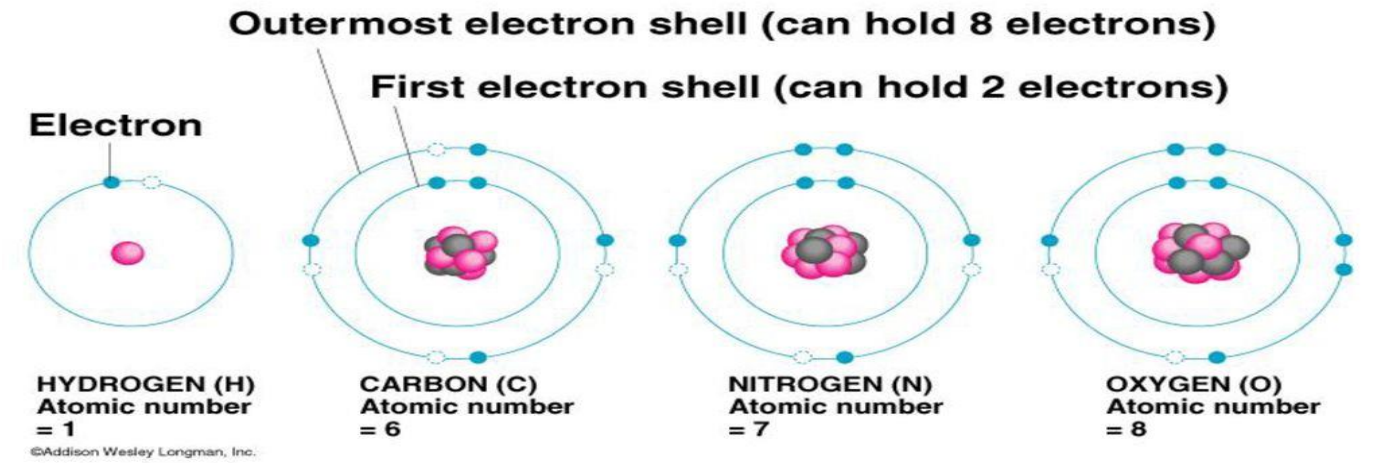


Fig 1: Structure of atom and its continent



- Octet Rule = atoms tend to gain, lose or share electrons so as to have 8 electrons



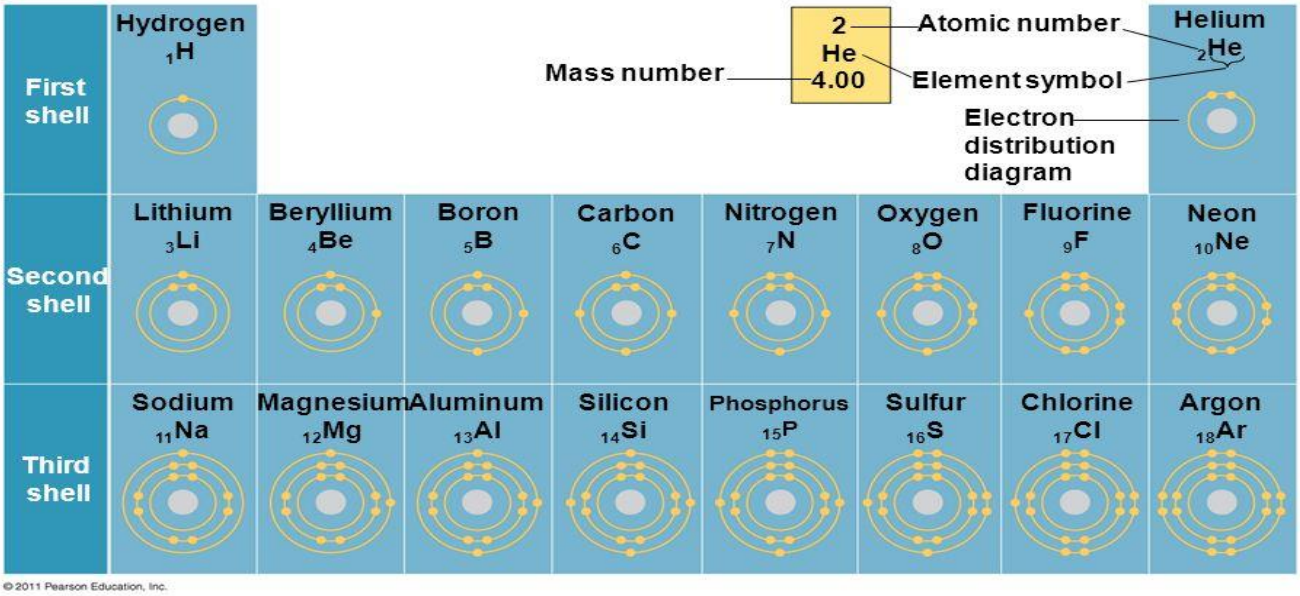
Octet Rule = atoms tend to gain, lose or share electrons so as to have 8 electrons

Carbon has 4 valence electrons — Needs 4 electrons

Nitrogen has 5 valence electrons — Needs 3 electrons

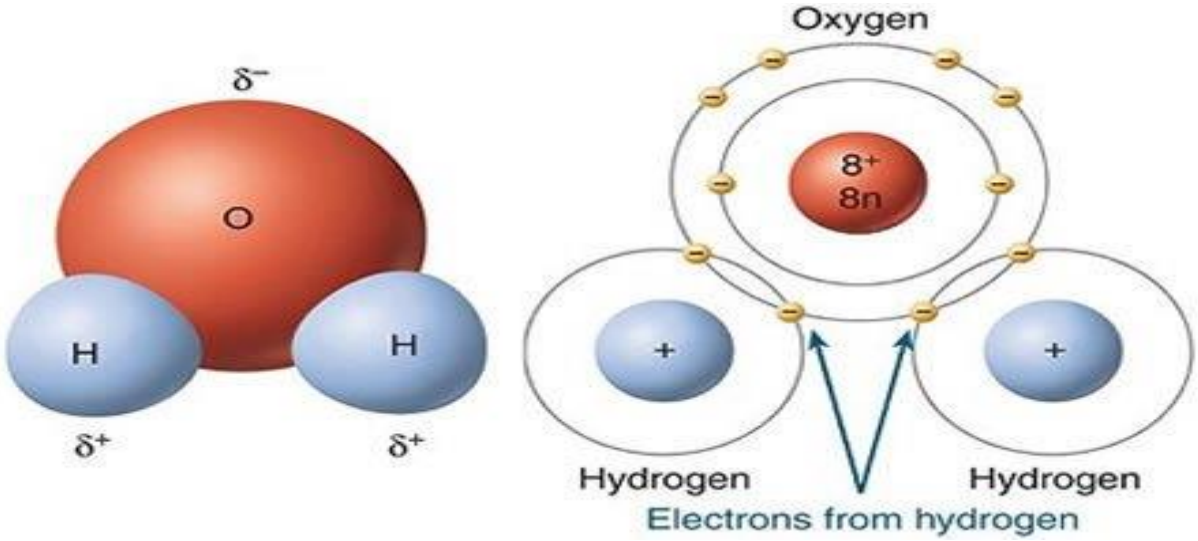
Oxygen has 6 valence electrons — Needs 2 electrons

Chapter 2
The Chemical Context of Life

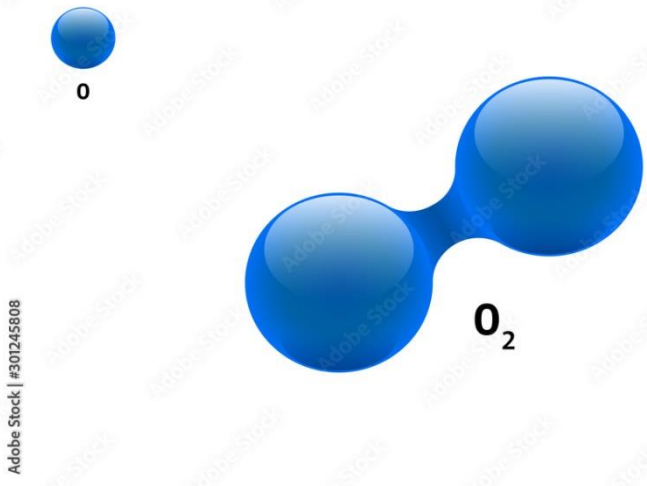


- Element Molecule: An element molecule is a mixture of two or more atoms of the same type.

- Compound molecule: It is a mixture of two or more atoms of different types.



Compound molecule H2O



Element Molecule O2

Elements, Atoms, Molecules & Compounds

• Elements → Substances that can't be broken down any further.

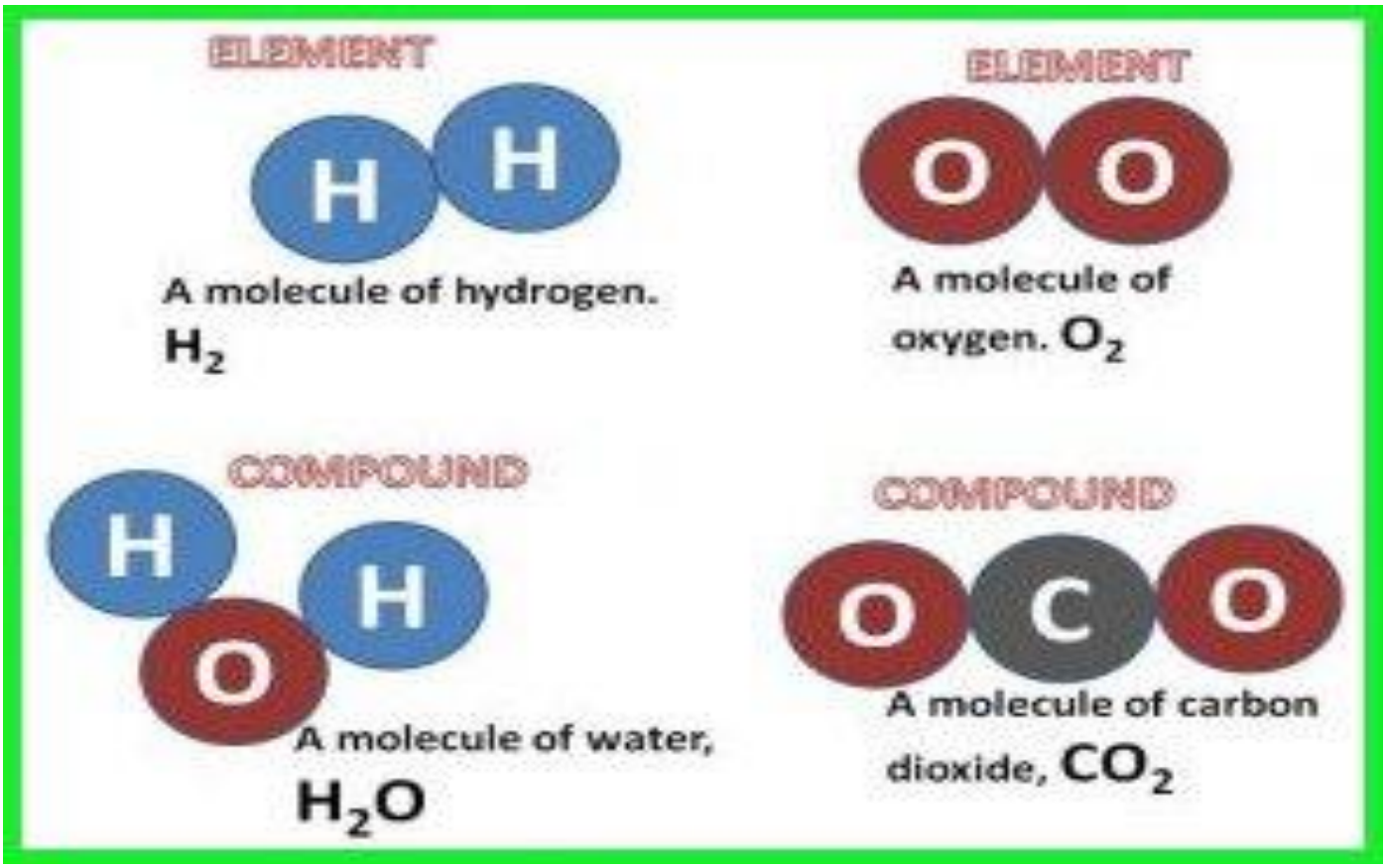
• Molecule: Two or more atoms joined together chemically:

• Compound : Molecule containing at least two different Elements.

Examples of molecules: Carbon dioxide (CO2) and methane (CH4) , molecular hydrogen (H2), molecular oxygen (O2) and molecular nitrogen (N2).

• Examples of compounds: Only molecules containing two or more elements, such as carbon dioxide (CO2) and methane (CH4).

• Q: Explain why all compounds are molecules but not all molecules are compounds.



Chemical Bonding

• Bonding is the force of attraction that holds atoms together in an element (N_2) or compound (CO_2 or NaCl).

• The distances between bonded atoms are less than those between non-bonded atoms.

• The forces between bonded atoms are greater than those between non-bonded atoms.

– All atoms are trying to achieve a stable octet

• Types of chemical bonds:

1- Ionic bond

2- Covalent bond

3- van der Waals forces

4- Hydrogen bond

Types of Chemical Bonds

1- Ionic Bonds

Ionic substances are formed when an atom that loses electrons easily reacts with an atom that gains electrons easily.

– forms ionic compounds

– transfer of valence e^-

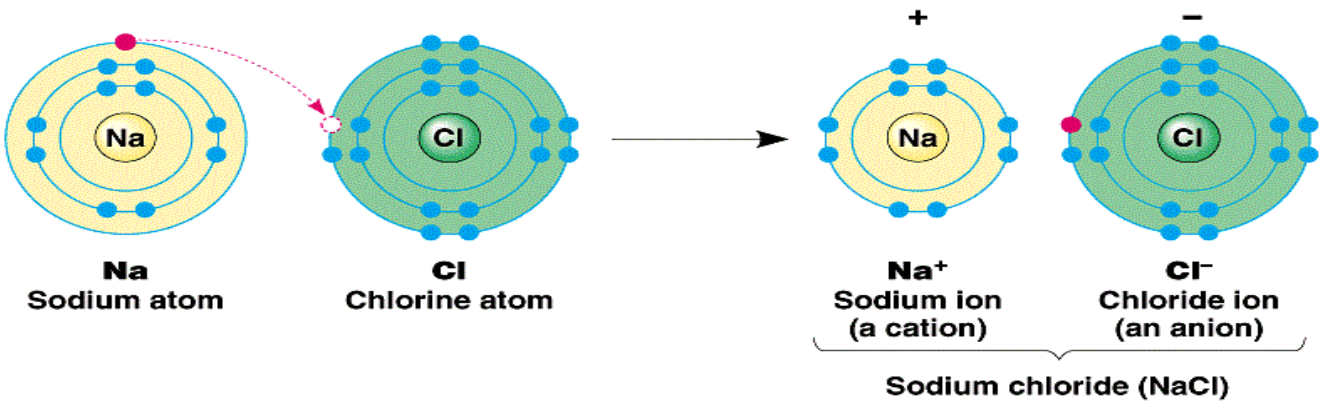
• Always formed between two ions by the transfer of electrons (metal cations and non-metals anions)

$Na \cdot \rightarrow Na^+ + e$		Loss of an electron
$e + Cl \rightarrow :\ddot{Cl}:^-$		Gain of an electron
$Na^+ + :\ddot{Cl}:^- \rightarrow$	NaCl	Combination to form the compound NaCl

• The oppositely charged ions stick like magnets [METALS]+ Gained e^- [NON-METALS]- Lost e^-

for example the sodium atom needs one ion of chloride because the last orbit needs one electron to reach a stable state

$$Na + Cl \rightarrow Na+ + Cl- \rightarrow NaCl\ (s)$$



Ion = an atom or group of atoms which have lost or gained one or more electrons, making them negatively or positively charged.

Q: What are positively charged ions (+) called?

Q: What are negatively charged ions (-) called?

• The properties of ionic bonds:

1- Medium hard.

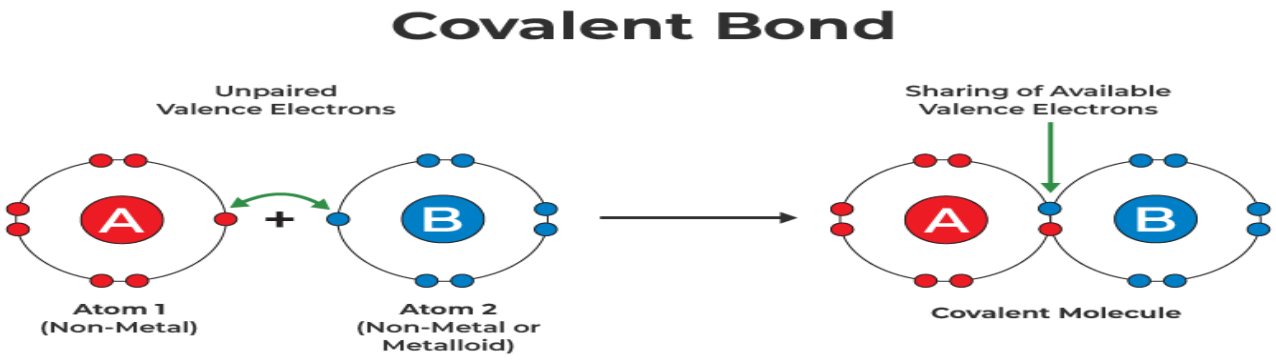
2 - High melting point due to the strong electrostatic attraction between the positive and negative ions.

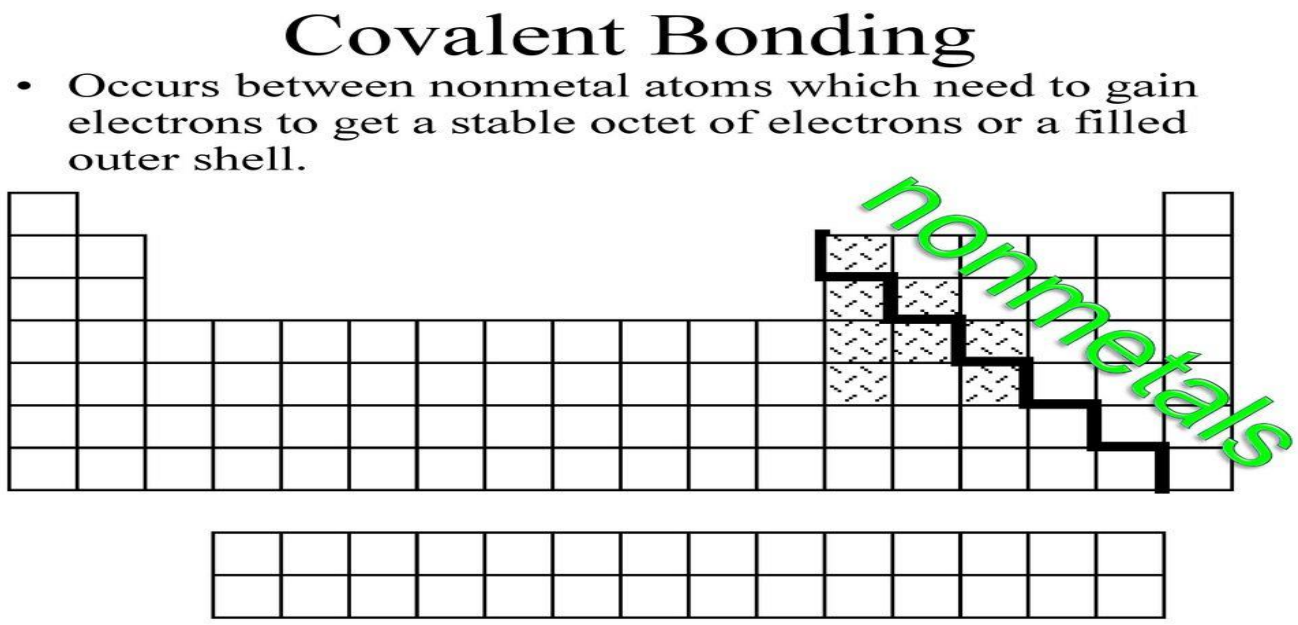
3 - Low electrical conduction and thermal conductivity.

4- Soluble in water.

2- Covalent Bonding

Pairs of e- are shared between 2 nonmetal atoms to acquire the electron configuration of a noble gas.





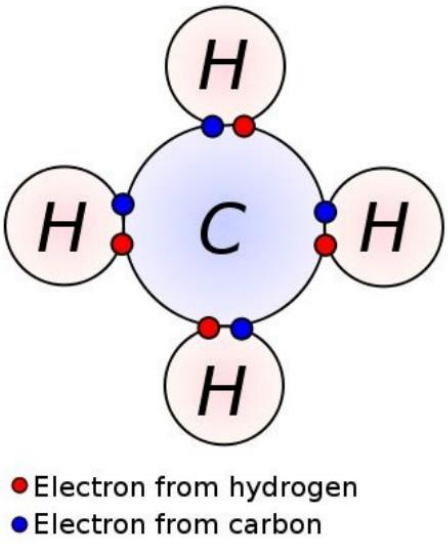
Covalent Bonds

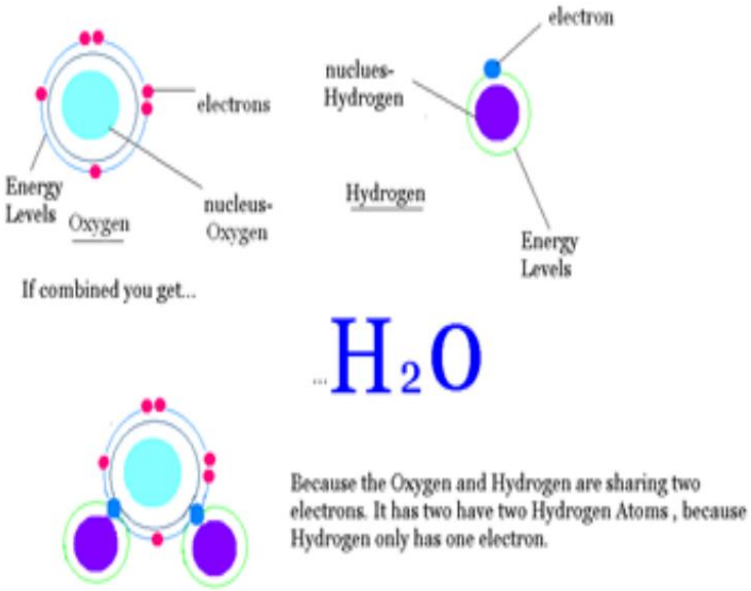
Involves the sharing of a pair of electrons between atoms. One covalent bond = 1 pair of shared electrons Covalent Compounds can make single (2 electrons), double (4 electrons) or even triple bonds

• (6 electrons) depending on the number of electrons they share.

• This bond is always stronger than the

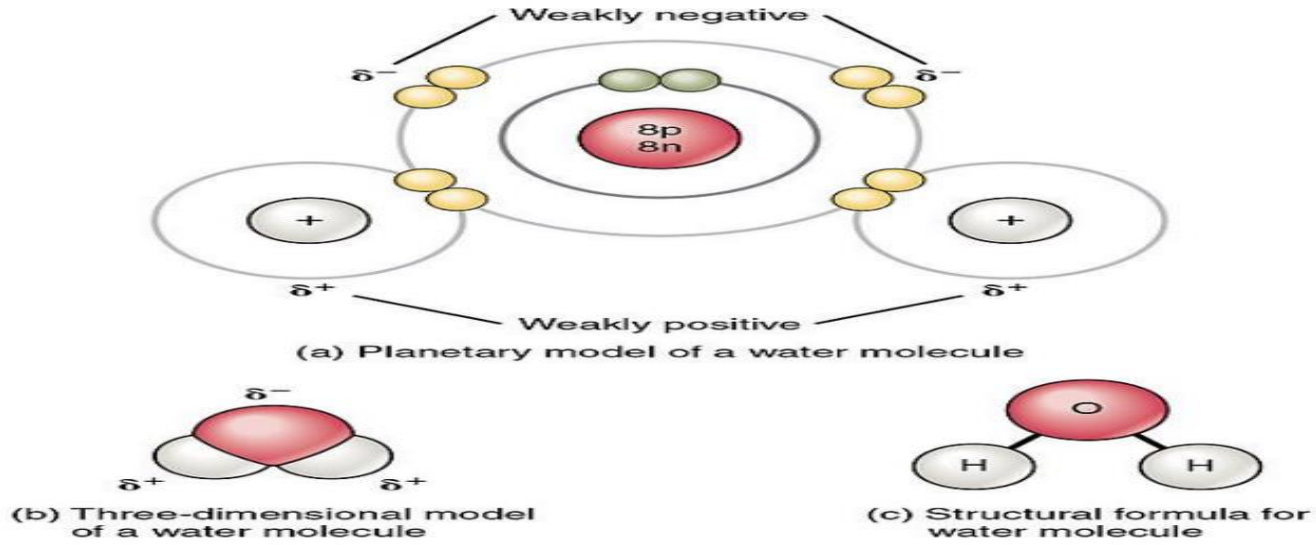
• hydrogen bond



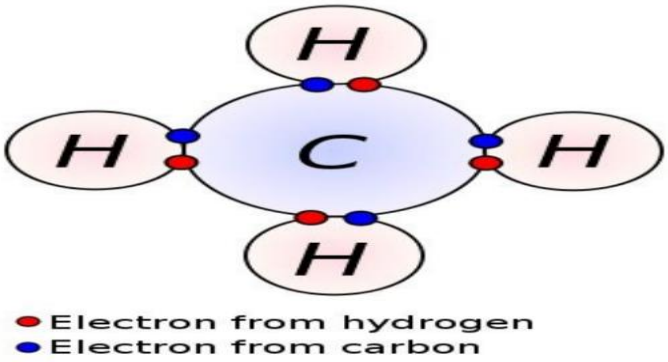


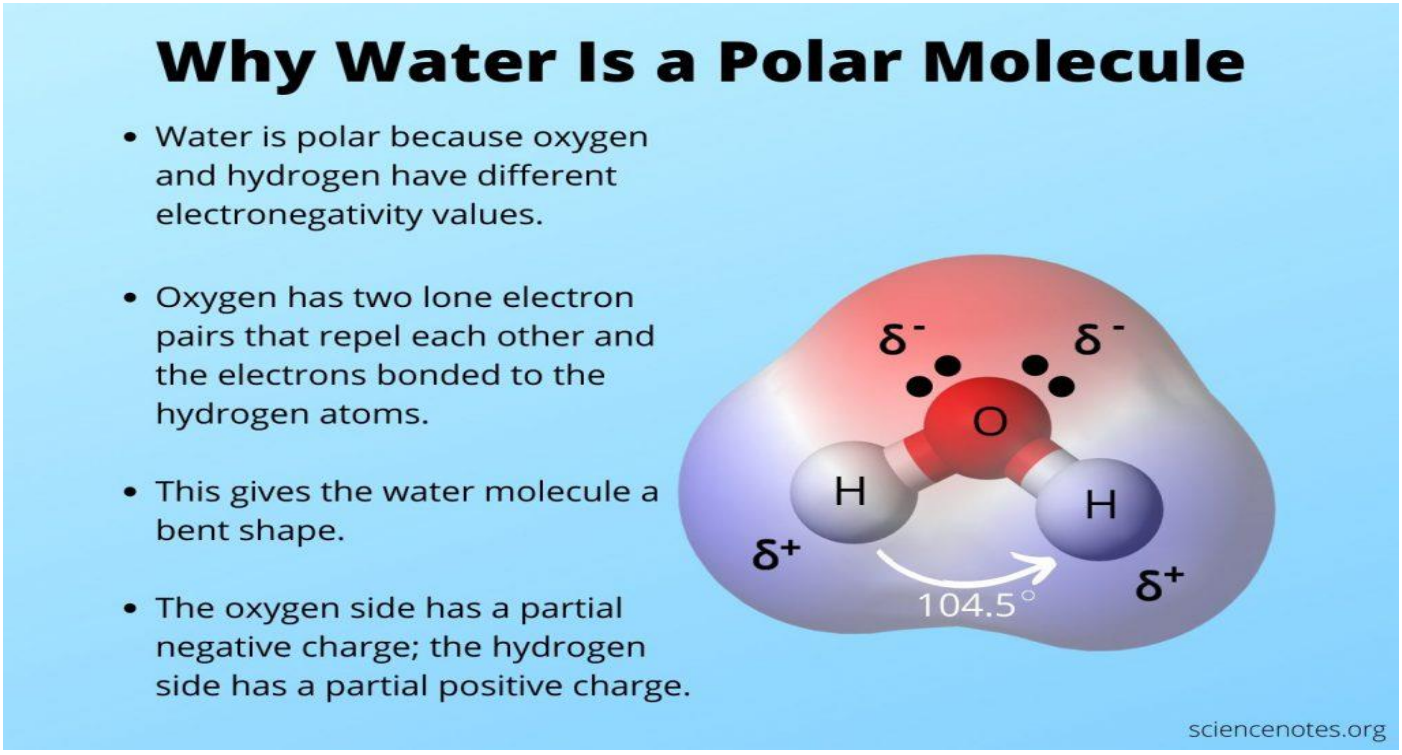
Polar vs. Non-Polar Covalent Bonds

- Polar molecules unequally share electrons between atoms, so have a slight positive charge at one end and a slight negative charge at the other. H2O



Non-polar molecules have electrons equally shared between their atoms. H2 or Cl2





Properties of covalent bonds:

1- Insoluble in general.

2- Chemically Stable.

3- Very high melting and boiling point.

4- The electrical conduction department

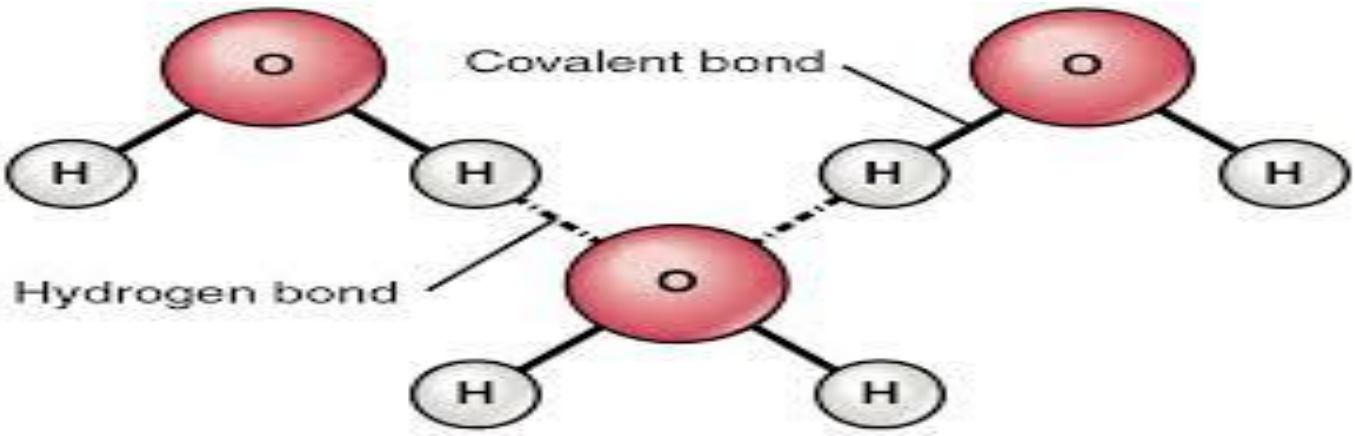
3-Hydrogen Bonds

Hydrogen Bonds:

When an atom of hydrogen is attracted to another electronegative atom in addition to the one it is covalently bonded to. In some covalent bonds electrons are shared unequally by the hydrogen and the atom that the hydrogen is bound to. When the electrons in a covalent bond are not equally shared, the molecule is polar.

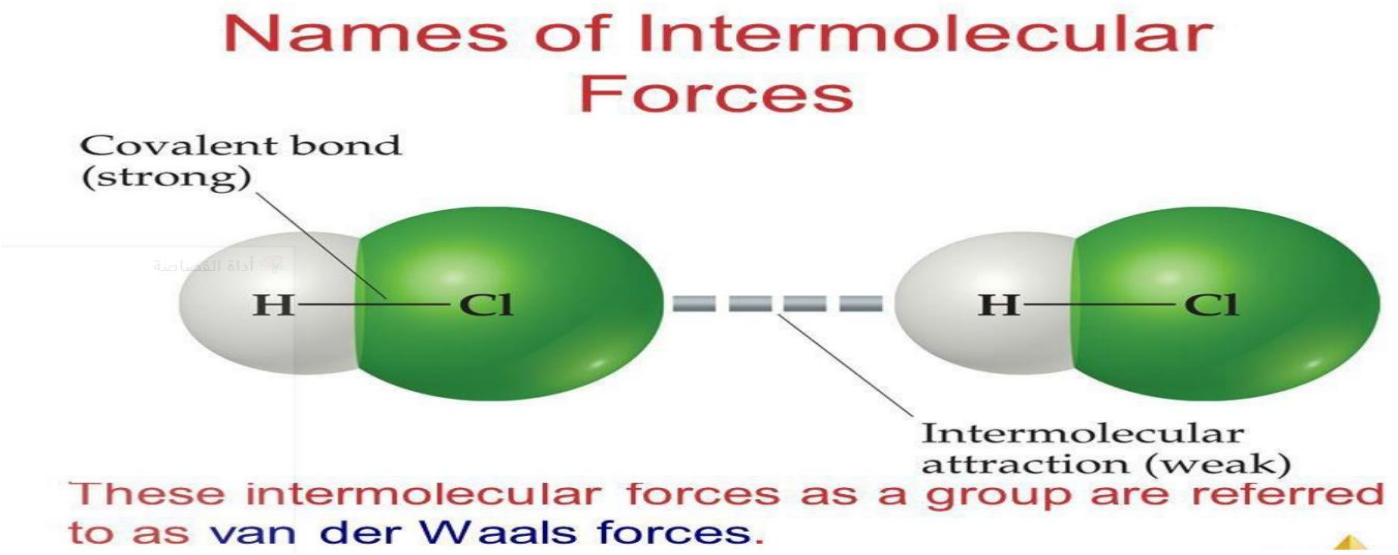
See the polar, covalent bonds of each individual water molecule below.

See the hydrogen bond attractions between the hydrogen's and the oxygen's of nearby, but separate water molecule below



4-Van der Waals forces:

are the forces of mutual effects between the molecules of a single substance that are electrically neutral with each other, and result from the attraction of the nuclei of atoms in a particular molecule with the valence electrons in a neighboring molecule .



No.	Vocabulary	Meaning
1	General Chemistry	الكيمياء العامة
2	Atom	الذرة
3	Structure	التركيب
4	Chemical bond	الاصرة الكيميائية
5	Electrons	الكترونات
6	Proton	بروتونات
7	Neutron	نيترونات
8	Nucleus	النواة
9	elements	عناصر
10	compound	مركب
11	ionic	ايونية
12	covalent	تساهمية
13	Van der Waals forces	قوى فندرفالز