

## TEST YOUR SELF

### TEST YOURSELF 4.1 (TYPES OF CHEMICAL BONDS)

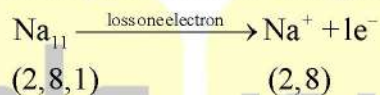
i. **Why does sodium form a chemical bond with chlorine?**

**Ans:** Sodium forms chemical bond with chlorine because:

- Sodium has only one electron in its valence and has tendency to lose one electron shell while, chlorine has seven electron in its valence and has tendency to gain one electron this favours the transfer of electron from sodium to chlorine and forms chemical bonds.
- Sodium is electropositive in nature, and is at high energy state while chlorine is electronegative and is at low energy state. This energy difference favors the formation of chemical bond between them

ii. **Why does sodium lose an electron and attains +1 charge?**

**Ans.** Sodium is electropositive in nature, it easily loss its valence electron and valence shell to attain its stability and noble gas electronic configuration like helium.



iii. **How do atoms follow octet rule?**

**Ans.** Atoms follow octet rule to achieve stability by attaining noble gases electronic configuration. Atoms follow octet rule in three ways.

- By giving valence electrons (If less than 4) to other atoms.
- By gaining electrons (If more than 4) from other atoms.
- By sharing electron with other atoms.

iv. **Which electrons are involved in chemical bonding?**

**Ans.** Only valence shell electrons are involved in chemical bonding which are called bonding electrons. The inner shell electrons do not take part in chemical bonding.

v. **Why does group 1 elements prefer to combine with group 17 elements?**

**Ans.** Group I elements are highly electropositive with low ionization energies. Thus they have tendency to lose electrons easily and become positive ions. On the other hand group 17 elements are highly electronegative with high ionization energies. Thus they have tendency to gain electron easily and become negative ion. Therefore group I elements prefer to combine with group 17 elements to form ions and develop ionic bond due to electrostatic force of attraction.

vi. **Why chlorine can accept only 1 electron?**

**Ans:** Chlorine have seven electrons in its outermost shell:

It requires only one electron to complete its valence shell to gain electronic configuration of noble gas (Argon ( $_{18}\text{Ar}$ )). That's why it accepts only one electron.

### TEST YOURSELF 4.2 (COVALENT BOND)

i. **Give the electronic configuration of carbon atom.**

**Ans:** The electronic configuration of carbon is:  ${}_6\text{C}=1s^2, 2s^2, 2p^2$

ii. **What type of elements have tendency of sharing of electrons?**

**Ans:** The non metallic elements with comparable values of electro negativity have tendency of sharing electrons.

**Example:**

The elements of group 13 to group 17 usually form bonds by sharing of electrons.

**iii. If repulsive forces dominate, attractive forces will a covalent bond be formed?**

**Ans:** If repulsive forces dominate to the attractive forces covalent bond will not be formed. This is due to increase in energy. The bond formation takes place when the attractive forces dominate rather than repulsive forces.

**iv. Considering the electronic configuration of nitrogen atom, how many electrons are involved in bond formation and what type of covalent bond is formed.**

**Ans.** Electrons configuration of  ${}_7N = 1s^2, 2s^2, 2p^3$

There are 3 unpaired electrons in a nitrogen atom which are involved in bond formation.

Nitrogen atoms will form three covalent bonds with other nitrogen atom:



**v. Point out the type of covalent bonds in the following molecules  
CH<sub>4</sub>, C<sub>2</sub>H<sub>4</sub>, H<sub>2</sub>, N<sub>2</sub>, and O<sub>2</sub>**

**Ans.**

i. CH<sub>4</sub> : Single covalent bond.

ii. C<sub>2</sub>H<sub>4</sub> : Double covalent bond.

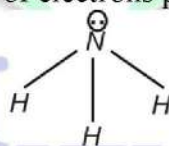
iii. H<sub>2</sub> : Single covalent bond.

iv. N<sub>2</sub>: Triple covalent bond.

v. O<sub>2</sub> : Double covalent bond.

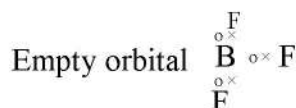
**vi. What is a lone pair? How many lone pairs of electrons are present on nitrogen in ammonia?**

**Ans:** The non-bonded electron pair available on an atom in a molecule is called lone pair of electrons. There is one lone pair of electrons present on nitrogen in ammonia.



**vii. Why is the BF<sub>3</sub> electron deficient?**

**Ans.** Boron atom has total 5 electrons out of which 3 electrons are present in valence shell. These electrons share with three atoms of fluorine to form BF<sub>3</sub>



Now boron has 6 electrons in valence shell in BF<sub>3</sub>. It still needs two electrons to complete its octet. That is why it is called electron deficient molecule.

**viii. What types of electron pairs make a molecule good donor?**

**Ans:** Lone pairs of electrons present on atoms in a molecule make a molecule good donor. These electrons are not involved in bonding so they can be used to form further bonds.

**Example:**

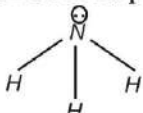
In ammonia, there is one lone pair of electrons on nitrogen atom which can form a



coordinate covalent bond with  $H^+$  to form  $NH_4^+$ ;

- ix. **What is difference between bonded and lone pair of electron 'and how many bonded pair of electrons is present in  $NH_3$  molecule?**

Ans.

Bonded pair	Lone pair
i. Bond pair of electrons is involved in bond formation	i. Lone pair of electron is not involved in bond formation.
ii. Electrons of bond pair are contributed by two atoms.	ii. Electrons of lone pair are contributed by one atom only.
iii. It is under the influence of two nuclei (atoms)	iii. It is under the influence of only one nucleus.
In an ammonia molecule there are three bond pairs and one lone pair of electrons	
	

- x. **What do you mean by delta sign and why it develops?**

Ans: The delta(s) sign indicates partial positive or partial negative charge that is developed due to unequal sharing of shared pair or bonded pair of electrons.

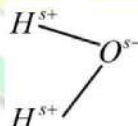
- xi. **Why does oxygen molecule not form a polar covalent bond?**

Ans: Oxygen molecule does not form a polar covalent bond because it consists of two similar oxygen atoms (homoatomic). There is no difference of electronegativity and shared pair of electrons is attracted by both the atoms equally.

$$0 = 0$$

- xii. **Why has water polar covalent bonds?**

Ans. Water has polar covalent bond because there is difference of electronegativity (1.3) between H and O atoms. The shared pairs of electrons are unequally attracted by both the bonded atoms. Hence poles will be developed and molecule will become polar.



### TEST YOURSELF 4.3 (HYDROGEN BONDING)

- (i) **What type of elements form metallic bonds?**

Ans. Metals form metallic bond because they have low ionization energies and high shielding effect. Due to these properties metal atoms lose electrons easily and form a sea of mobile electrons with positive ions.

Examples: Sodium, Calcium etc.

- (ii) **Why is the hold of nucleus over the outermost electrons in metals weak?**

Ans. The hold of nucleus over the outermost electrons is weak because of large sized atoms and greater number of shells in between nucleus and valence electrons which results in increased shielding effect. The large size and increased shielding effect decreases the force of attraction between the nucleus of atom and valence electrons in metals.

- (iii) **Why the electrons move freely in metals?**

Ans. Electrons move freely in metals because of large sized atoms, increased shielding effect and low ionization energy. Due to these properties the metals have the tendency to lose their outer electrons easily. Resultantly, these lose or free electrons of all metal atoms move freely in the spaces between atoms of a metal. None of these electrons is attached to any particular atoms. Nuclei of metal

- (iv) **Which types of electrons are responsible for holding the atoms together in metals?**



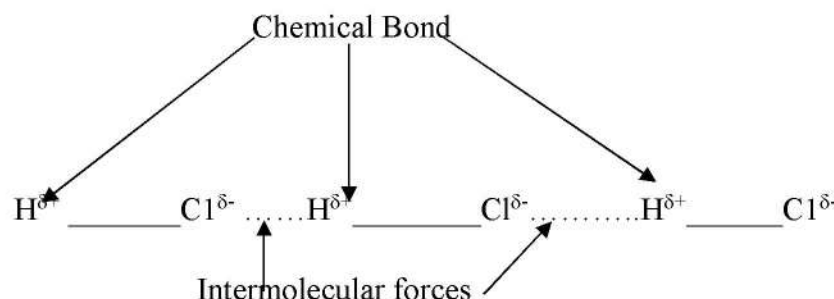
**Ans.** Mobile electrons present within the metals are responsible for holding the atoms of metals together forming a metallic bond.

**(v) Define intermolecular forces; show these forces among HCl molecule.**

**Ans. Intermolecular forces:**

The attractive forces that exist between molecules of a substance are called intermolecular forces.

**Example:**



**(vi) Why a dipole develops in a molecule?**

**Ans:** A dipole develops in a molecule due to electro negativity difference between the two bonded atoms. The unequal sharing of electrons between two different types of atoms make one end of the molecule slightly positive and other end slightly negatively charged. Hence a dipole develops in a molecule.

**For example:**



**(vii) What do you mean by induced dipole?**

**Ans:** A temporary dipole which is produced in a non polar molecule due to the influence of a polar molecule is called an induced dipole.

The positive end of polar molecule attracts the mobile electrons of the nearby non polar molecule and induce the polarity in non polar molecule.

**(viii) Why are dipole forces of attraction not found in halogen molecules?**

**Ans.** Dipole forces of attraction are not found in halogen molecules because halogens are homo atomic molecules. Due to no difference of electronegativity between atoms halogen molecules have no dipoles and thus are non polar.

**Example:**  $\text{Cl}_2$ ,  $\text{I}_2$ ,  $\text{Br}_2$  and  $\text{F}_2$

**(ix) What types of attractive forces exist between HCl molecules?**

**Ans.** HCl forms a polar covalent bond atoms due to difference of electro negativity between bonded atoms. There exists a dipole in the molecule. The positive end of one molecule attracts the negative end of there molecule. Hence dipole force. (Intermolecular forces) exist between HCl molecules.

**Example:**  $\text{H}^{\delta+} - \text{Cl}^{\delta-} \cdots \text{H}^{\delta+} - \text{Cl}^{\delta-}$

#### TEST YOURSELF: 4.4 (NATURE OF BONDING AND PROPERTIES)

**(i) Why the ionic compounds have high melting and boiling points?**

**Ans.** As ionic compounds are made up of positive and negative ions, there exist strong electrostatic forces of attraction between oppositely charged ions. So, a great amount of energy is required to break these forces, therefore ionic compounds have high melting and boiling points.

**(ii) What do you mean by malleability?**

**Ans.** Malleability is a special property of metal, by virtue of metal can be drawn into sheets

**Example:** Metals such as gold, silver, copper, are malleable.

**(iii) Why are ionic compounds easily soluble in water?**

**Ans.** Ionic compounds are easily soluble in water, because water is a polar solvent and has high dielectric constant that weakens the attraction between ions of ionic compounds.

We also know that like dissolved like similar solvents dissolve similar solutes. Ionic compounds are polar. They are soluble in polar solvent like water.

**Example:** Sodium chloride can easily soluble in water.

**Dielectric Constant:**

The extent to which the force of attraction between two oppositely charged ions is decreased due to a solvent is called dielectric constant.

**(iv) What type of bond exists in sodium chloride?**

**Ans:** Sodium chloride is an ionic compound therefore ionic bond is present in sodium chloride.

**(v) Why the covalent compounds of bigger size molecules have high melting points?**

**Ans.** The covalent compounds of bigger size molecules have three dimensional bonding in them, which form covalent crystals which are very stable and hard. So, they have high melting and boiling points.

**Example:**  $\text{SiO}_2$ ,  $\text{SiC}_4$ ,  $(\text{AlN})_n$  etc.

**(vi) How much there is electronegativity difference between the following pair or elements (atoms). Predict the nature of the bond between them?**

**(a) H and Cl**      **(b) H and Na**      **(c) Na and I**      **(d) K and Cl**

**b. Comparing the electronegativity differences, arrange these compounds in increasing ionic strength.**

**Ans.**

Pair of Elements	Electronegativity differences	Nature of bond
(a) H and Cl (H=2.2, Cl=3.2)	1.0	Polar covalent bond
(b) H and Na (H=2.2, Na=0.9)	1.3	Ionic bond
(c) Na and I (Na=0.9, I=2.5)	1.6	Ionic bond
(d) K and Cl (K=0.8, Cl=3.2)	2.4	Ionic bond

**b.  $0.9 < 1.2 < 1.6 < 2.2$**

Comparing the electro negativity differences, arrange these compounds in increasing ionic strength.

The order of increasing ionic strength of compounds is:

