UNIT 5

Chemical bonding

TEXT BOOK EXERCISES

I. Choose the correct answer:

1. Number of valence electrons in carbon is

   a) 2 b) 4 c) 3 d) 5

   Ans: b) 4

2. Sodium having atomic number 11, ready to _____ electron/ electrons to attain the nearest Noble gas electronic configuration.

   a) gain one b) gain two
   c) lose one d) lose two

   Ans: c) lose one

3. Atoms having 1,2 or 3 electrons in its valence shell will readily form _____

   a) Cation b) anion

   Ans: a) Cation

4. The element that would form anion by gaining electrons in a chemical reaction is _____

   a) Potassium b) Calcium
   c) Fluorine d) Iron

   Ans: c))Fluorine

5. Bond formed between a metal and non metal atom is usually _____

   a) ionic bond b) covalent bond
   c) Coordinate bond

   Ans: a) ionic bond

6. _____ compounds have high melting and boiling points.

   a) Covalent b) Coordinate c) Ionic

   Ans: c) Ionic

7. Covalent bond is formed by _____

   a) transfer of electrons
   b) sharing of electrons
   c) sharing a pair of electrons

   Ans: b) sharing of electrons

8. Oxidising agents are also called as _____ because they remove electrons form other substances.

   a) electron donors b) electron acceptors

   Ans: b) electron acceptors

9. Elements with stable electronic configurations have eight electrons in their valence shell. They are ___

   a) Halogens b) Metals
   c) Noble gases d) non metals

   Ans: c) Noble gases

II. Answer in brief

1. How do atoms attain Noble gas electronic configuration.

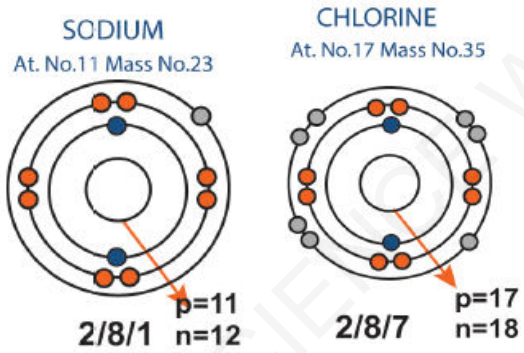
Atoms can combine either by transfer of valence electrons from one atom to another or by sharing of valence electrons in order to achieve the stable outer shell of eight electrons.

2. CCl_4 is insoluble in water but NaCl is soluble in water. Give reason.

* CCl_4 is a Covalent compound but NaCl is a Ionic Compound.
* Water is a polar solvent so NaCl is soluble in water.
* CCl_4 is soluble in non polar solvent.

3. Explain Octet rule with an example.

The octet rule is a chemical rule of thumb that reflects observation that atom of main-group elements tend to combine in such a way that each atom has eight electrons in its valance shell, giving it the same electron configuration as a noble gas.



4. Write a note on different types on bonds?

* Ionic bonds
* Covalent bonds
* Co-Ordinate Covalent bond.

5. Find the odd one out.

a. H_2, Cl_2, NaCl, O_2, N_2

b. H_2O_2, MnO_4^-, $LiAlH_4$, $Cr_2O_7^{2-}$

Ans: a) NaCl , b) $LiAlH_4$

6. Correct the wrong statements.

a. Ionic compounds dissolve in non polar solvents

b. Covalent compounds conduct electricity in molten or solution state.

Ans:

a. Ionic compounds dissolve in **polar** solvents

b. Covalent compounds **do not conduct** electricity in molten or solution state.

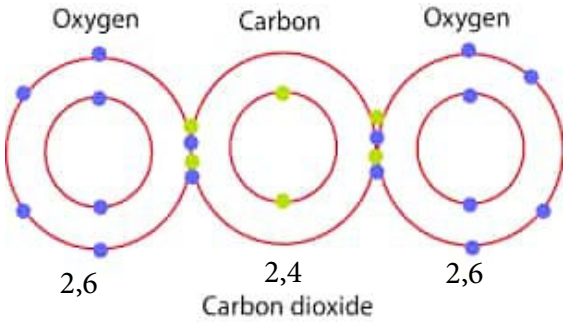
7. Complete the table give below.

Element	Atomic number	Electron distribution	Valence electrons	Lewis dot structure
Lithium	3			
Boron	5			
Oxygen	8			

Ans:

Element	Atomic number	Electron distribution	Valence electrons	Lewis dot structure
Lithium	3	**2,1**	**1**	$\cdot Li$
Boron	5	**2,3**	**3**	$\cdot\dot{B}\cdot$
Oxygen	8	**2,6**	**6**	$:\ddot{O}:$

8. Draw the electron distribution diagram for the formation of Carbon di oxide (CO_2) molecule.



O=C=O

9. Fill in the following table according to the type of bonds formed in the given molecule.

$CaCl_2$, H_2O, CaO, CO, KBr, HCl, CCl_4, HF, CO_2, Al_2Cl_6

Ans:

Ionic bond	Covalent bond	Coordinate covalent bond
$CaCl_2$	H_2O, CCl_4	CO
CaO, KBr	HF, CO_2	.....
HCl	Al_2Cl_6	.....

10. Choose the correct answer form the choices given below.

The property which is characteristics of an Ionic compound is that

a. it often exists as gas at room temperature

b. it is hard and brittle

c. it undergoes molecular reactions

d. it has low melting point

Ans: b. it is hard and brittle

11. Identify the following reactions as oxidation or reduction

a. $Na \rightarrow Na^+ + e^-$

b. $Fe^{3+} + 2e^- \rightarrow Fe^+$

Ans: a) Oxidation reactions
b) Reduction reactions

12. Identify the compounds as Ionic/ Covalent/Coordinate based on the given characteristics.

a. Soluble in non polar solvents -

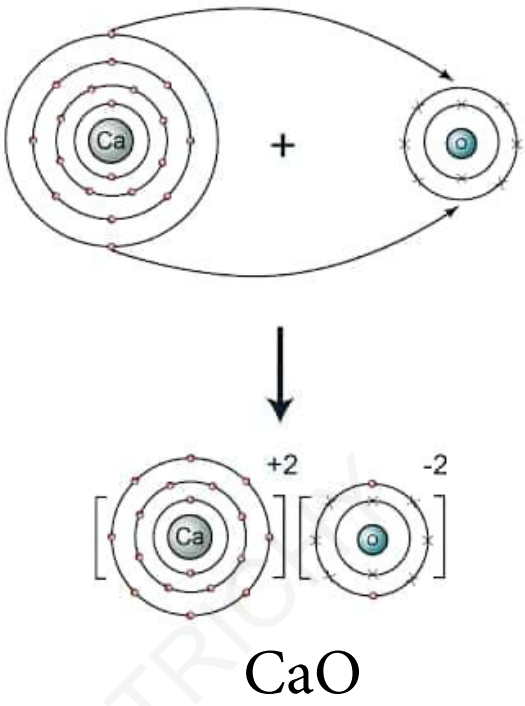
b. undergoes faster/instantaneous reactions -

c. Non conductors of electricity -

d. Solids at room temperature -

Ans: a) Covalent bond
b) Ionic bond
c) Covalent bond
d) Co-ordinate Covalent bond

13. An atom X with atomic number 20 combines with atom Y with atomic number 8. Draw the dot structure for the formation of the molecule XY.



CaO

14. Considering $MgCl_2$ as ionic compound and CH_4 as covalent compound give any two differences between these two compounds.

Ionic bond	Covalent bond
1. Transfer of electron	1. Sharing of electron
2. It is solid at room Temperature	2. It is gas,liqiud and softness at room Temperature

15. Why are Noble gases inert in nature?

All noble gases have incomplete valance shell, and tends to stable electronic configuration. so Noble gas inert in nature.

III. Answer in detail

1. List down the differences between Ionic and Covalent compounds.

Ionic Compounds	Covalent Compounds
Formed by the transfer of electrons from a metal to a non-metal atom	Formed by sharing of electrons between non-metal atoms
Strong electrostatic force of attraction between cations and anions	Mutual sharing of electrons and so weak force of attraction between atoms
Solids at room temperature	Gases, liquids and soft solids
Conducts electricity in molten state or in solutions	Non-conductors of electricity
Have high melting and boiling points	Have low melting and boiling points
Soluble in polar solvents	Soluble in non-polar solvents
Hard and brittle	Soft and waxy
Undergo ionic reaction which are fast and instantaneous	Undergo molecular reactions which are slow

2. Give an example for each of the following statements.

a. a compound in which two Covalent bonds are formed

b. a compound in which one ionic bond is formed

c. a compound in which two Covalent and one Coordinate bonds are formed

d. a compound in which three covalent bonds are formed

e. a compound in which Coordinate bond is formed

a) O_2 $O=O$
b) HCl
c) CO
d) $N \equiv N$
e) NH_4^+

3. Identify the incorrect statement and correct them.

a. Like covalent compounds, Coordinate compounds also contain charged particles (ions), so they are good conductors of electricity.

b. Ionic bond is a weak bond when compared to Hydrogen bond.

c. Ionic or electrovalent bonds are formed by mutual sharing of electrons between atoms.

d. Loss of electrons is called Oxidation and Gain of electron is called Reduction.

e. The electrons which are not involved in bonding are called valence electrons.

Ans:

a. Like covalent compounds, Coordinate compounds also contain charged particles (ions), so they are **bad** conductors of electricity.

b. Ionic bond is a **strong** bond when compared to Hydrogen bond.

c. Ionic or electrovalent bonds are formed by mutual **transfer** of electrons between atoms.

d. Loss of electrons is called Oxidation and Gain of electron is called Reduction. **(statement Correct)**

e. The electrons which are not involved in bonding are called **lone pair** electrons.

4. Discuss in brief about the properties of Coordinate covalent compounds.

Characteristics of coordinate covalent compounds

The compounds containing coordinate covalent bonds are called coordinate compounds.

a. Physical state – These compounds exist as gases, liquids or solids.

b. Electrical conductivity – Like covalent compounds, coordinate compounds also do not contain charged particles (ions), so they are bad conductors of electricity.

c. Melting point – These compounds have melting and boiling points higher than those of purely covalent compounds but lower than those of purely Ionic compounds.

d. Solubility – Insoluble in polar solvents like water but are soluble in non-polar solvents like benzene, CCl_4, and toluene.

e. Reactions – Coordinate covalent compounds undergo molecular reactions which are slow.

5. Find the oxidation number of the elements in the following compounds.

a. C in CO2

b. Mn in MnSO4

c. N in HNO3

a. C in CO2

$$x + 2(-2) = 0$$
$$x - 4 = 0$$
$$x = 4$$

C=+4

b. Mn in MnSO4

$$x + 1(6) + 4(-2) = 0$$
$$x + 6 - 8 = 0$$
$$x - 2 = 0$$
$$x = 2$$

Mn=+2

c. N in HNO3

$$1(1) + x + 3(-2) = 0$$
$$1 + x - 6 = 0$$
$$x - 5 = 0$$
$$x = 5$$

N=+5

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