

*Book Name: Selina Concise*

**INTEXT - QUESTION- 1**

**Question 1:**

How do atoms attain noble gas configuration?

**Solution 1:**

Atoms lose, gain or share electrons to attain noble gas configuration

**Question 2:**

Define:

- (a) a chemical bond
- (b) an electrovalent bond
- (c) a covalent bond

**Solution 2:**

- (a) A chemical bond may be defined as the force of attraction between any two atoms, in a molecule, to maintain stability.
- (b) The chemical bond formed between two atoms by transfer of one or more electrons from the atom of a metallic electropositive element to an atom of a non-metallic electronegative element.
- (c) The chemical bond formed due to mutual sharing of electrons between the given pairs of atoms of non-metallic elements.

**Question 3:**

What are the conditions for the formation of an electrovalent bond?

**Solution 3:**

Conditions for formation of Ionic bond are:

- (i) The atom which changes into cation should possess 1, 2 or 3 valency electrons. The other atom which changes into anion should possess 5, 6 or 7 electrons in the valence shell.
- (ii) A high difference of electronegativity of the two atoms is necessary for the formation of an Ionic bond.
- (iii) There must be an overall decrease in energy i.e., energy must be released.  
For this an atom should have low value of Ionisation potential and the other atom should have high value of electron affinity.
- (iv) Higher the lattice energy, greater will be the case of forming an ionic compound.

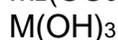
**Question 4:**

An atom X has three electrons more than the noble gas configuration. What type of ion will it form? Write the formula of its

- (i) sulphate
- (ii) nitrate
- (iii) phosphate
- (iv) carbonate
- (v) hydroxide

**Solution 4:**

It will form a cation :  $M^{3+}$

**Question 5:**

Mention the basic tendency of an atom which makes it to combine with other atoms.

**Solution 5:**

Atoms combine with other atoms to attain stable octet or noble gas configuration.

**Question 6:**

What type of compounds are usually formed between metals and non-metals and why?

**Solution 6:**

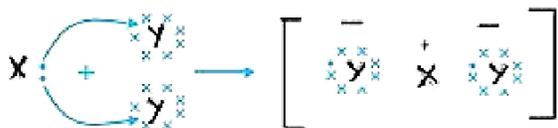
Ionic compounds are generally formed between metals and non-metals as metals always lose electrons to form cations while non-metals gain electrons forming anions to complete their octet. These oppositely charged ions are held together by electrostatic force of attraction and hence results in an ionic compound.

**Question 7:**

In the formation of the compound  $XY_2$ , an atom X gives one electron to each Y atom. What is the nature of bond in  $XY_2$ ? Draw the electron dot structure of this compound.

**Solution 7:**

X and Y form an ionic bond in  $XY_2$ .



**Question 8:**

An atom X has 2, 8, 7 electrons in its shell. It combines with Y having 1 electron in its outermost shell.

- (a) What type of bond will be formed between X and Y?  
 (b) Write the formula of the compound formed.

**Solution 8:**

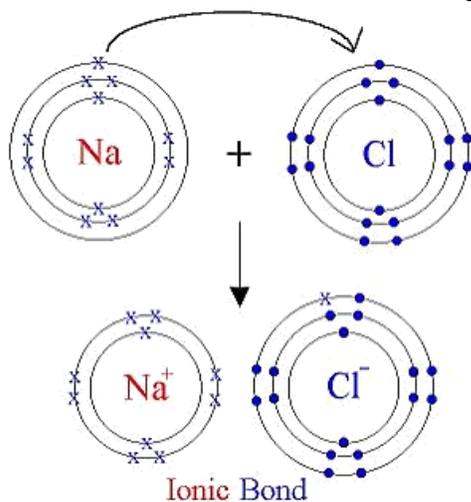
- (a) X has 7 electrons in its outermost shell and Y has only one electron in its outermost shell so Y loses its one electron and X gains that electron to form an ionic bond.  
 (b) The formula of the compound would be XY.

**Question 9:**

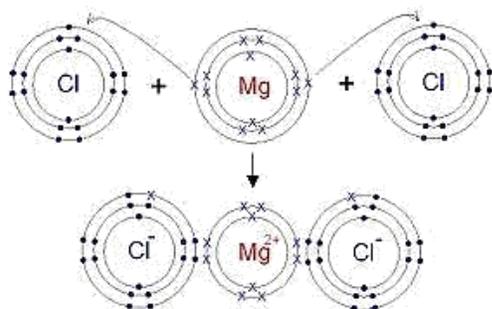
Draw orbit structure and electron dot diagram of NaCl, MgCl<sub>2</sub> and CaO.

**Solution 9:**

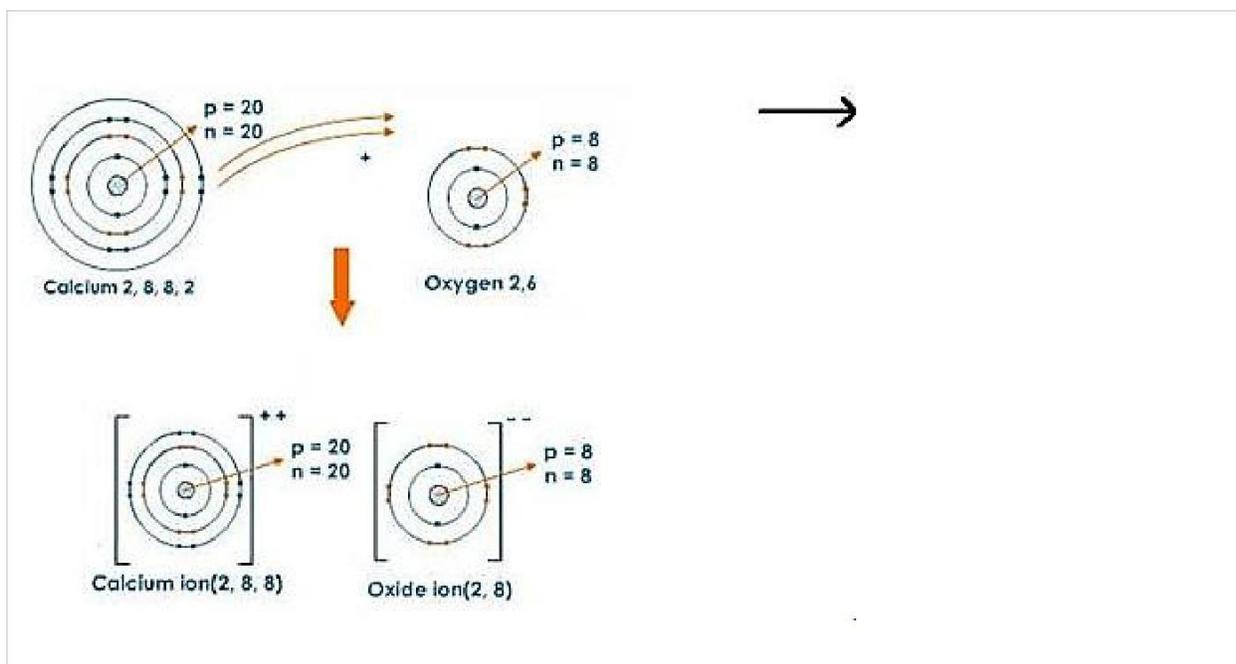
Orbit structure and electron dot diagram of NaCl:



Orbit structure and electron dot diagram of MgCl<sub>2</sub>:



Orbit structure and electron dot diagram of CaO:

**Question 10:**

Compare:

- (a) sodium atom and sodium ion
- (b) chlorine atom and chloride ion, with respect to
  - (i) atomic structure
  - (ii) electrical state
  - (iii) chemical action
  - (iv) toxicity

**Solution 10:**

- (a) Sodium atom and sodium ion
  - (i) Sodium atom has one electron in M shell while sodium ion has 8 electrons in L shell.
  - (ii) Sodium atom is neutral while sodium ion is positively charged.
  - (iii) Sodium atom is highly reactive while its ion is inert.
  - (iv) Sodium atom is poisonous while sodium ion is non-poisonous.
- (b) Chlorine atom and chlorine ion
  - (i) Chlorine atom has 7 electrons in its M shell while Chloride ion has 8 electrons in the same shell.
  - (ii) Chlorine atom is neutral while chloride ion is negatively charged.
  - (iii) Chlorine atom is highly reactive while its ion is inert.
  - iv) Chlorine gas is poisonous while chloride ion is non-poisonous.

**Question 11:**

The electronic configuration of fluoride ion is the same as that of a neon atom. What is the difference between the two?

**Solution 11:**

Fluoride ion is negatively charged while neon atom is neutral.

**INTEXT - QUESTION- 2****Question 1:**

What are the conditions necessary for the formation of covalent molecules?

**Solution 1:**

- (i) Both atoms should have four or more electrons in their outermost shells, i.e., non-metals.
- (ii) Both the atoms should have high electronegativity.
- (iii) Both the atoms should have high electron affinity and high ionisation potential.
- (iv) Electronegativity difference between the two atoms should be zero or negligible.
- (v) The approach of the atoms towards one another should be accompanied by decrease of energy.

**Question 2:**

Elements A, B and C have atomic number 17, 19 and 10 respectively.

- (a) State which one is: (i) a non-metal (ii) a metal, (iii) chemically inert?
- (b) write down the formula of the compound formed by two of the above elements.

**Solution 2:**

- (a) A is a non-metal; B is a metal while C is a chemically inert element.
- (b) BA

**Question 3:**

Five atoms are labelled from A to E.

Atoms	Mass No.	Atomic No.
A	40	20
B	19	9
C	7	3
D	16	8
E	14	7

- (a) Which one of these atoms:
  - (i) contains 7 protons,
  - (ii) has an electronic configuration 2, 7?
- (b) Write down the formula of the compound formed between C and D.
- (c) predict which are: (i) metals, (ii) non-metals?

**Solution 3:**

- (a)  
    (i) E  
    (ii) B  
(b) C<sub>2</sub>D  
(c) A and C are metals while B, D and E are non -metals.

**Question 4:**

What is the difference between:

- (a) ionic compounds and polar covalent compounds,  
(b) ionic compounds and covalent compounds,  
(c) a polar covalent compound and a non-polar covalent compound?

**Solution 4:**

- (a) Ionic compounds are formed as a result of transfer of one or more electrons from the atom of a metallic electropositive element to an atom of a non-metallic electronegative element. A polar covalent compound is the one in which there is an unequal distribution of electrons between the two atoms.
- (b) Ionic compounds, made up of ions, are generally crystalline solids with high melting and boiling points.  
They are soluble in water and good conductors of electricity in aqueous solution and molten state.  
Covalent compounds, made up of molecules, can exist as soft solids or liquids or gases with low melting and boiling points. They are generally insoluble in water and poor conductors of electricity.
- (c) Polar covalent compounds are formed between 2 non-metal atoms that have different electro negativities and therefore have unequal sharing of the bonded electron pair. Non-polar compounds are formed when two identical non-metals equally share electrons between them.

**Question 5:**

The element X has the electronic configuration 2, 8, 18, 8, 1. Without identifying x,

- (a) predict the sign and charge on a simple ion of X.  
(B) write if X be an oxidizing agent or reducing agent and why.

**Solution 5:**

- (a) X<sup>+</sup>  
(b) X will be a strong reducing agent as it will have the tendency to donate its valence electron.

**Question 6:**

What do you understand by polar covalent compounds? Explain it by taking hydrogen chloride as an example.

**Solution 6:**

Covalent compounds are said to be polar when shared pair of electrons are unequally distributed between the two atoms. For example in HCl, the high electronegativity of the chlorine atom attracts the shared electron pair towards itself. As a result, it develops a slight negative charge and hydrogen atom develops a slight positive charge. Hence, a polar covalent bond is formed.

**Question 7:**

Methane molecule is non-polar molecule. Explain.

**Solution 7:**

During the formation of a non-polar covalent bond between two similar atoms or dissimilar atoms, the atoms involved in sharing share the electrons equally. The molecule of methane has four carbon-hydrogen single covalent bonds. It is a non-polar covalent compound as the electrons are shared by the carbon and hydrogen atoms equally and hence the shared pair lies between the atoms at an equal distance from both carbon and hydrogen atom.

**Question 8:**

Give the characteristic properties of:

- (a) electrovalent compounds,
- (b) covalent compounds.

**Solution 8:**

(a) Properties of Ionic Compounds:

1. Ionic compounds usually exist in the form of crystalline solids.
2. Ionic compounds have high melting and boiling points.
3. Ionic compounds are generally soluble in water but insoluble in organic solvents.
4. They are good conductors of electricity in the fused or in aqueous solution state.

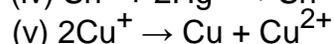
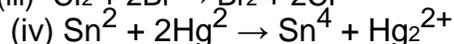
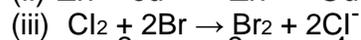
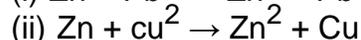
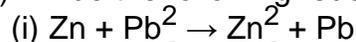
(b) Properties of Covalent Compounds:

1. The covalent compounds exist as gases or liquids or soft solids.
2. The melting and boiling points of covalent compounds are generally low.
3. Covalent compounds are insoluble in water but dissolve in organic solvents.
4. They are non-conductors of electricity in solid, molten or aqueous state.

**Question 9:**

(a) What do you understand redox reactions? Explain oxidation and reduction in terms of loss or gain of electrons.

(b) Divide the following redox reactions into oxidation and reduction half reactions.



(c) Potassium (at No. 19) and chlorine (at No. 17) react to form a compound. Explain on the basis of electronic concept.

(i) oxidation

(ii) reduction

(iii) oxidizing agent

(iv) reducing agent

**Solution 9:**

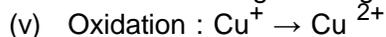
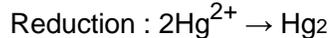
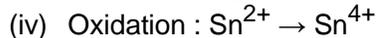
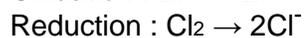
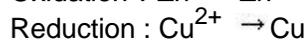
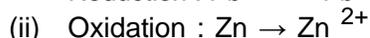
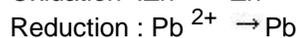
**(a)** A reaction in which oxidation and reduction occur simultaneously is called an oxidation-reduction, or simply, a redox reaction.

Redox reactions involve the transfer of electrons between two chemical species.

The reaction in which electron is gained is called a reduction reaction and the reaction in which electron is lost is called oxidation reaction.

The compound that loses an electron is said to be oxidized, the one that gains an electron is said to be reduced.

**(b)**



**(c)**

(i) Potassium undergoes oxidation as it loses an electron and forms a cation.

(ii) Chlorine undergoes reduction as it gains an electron and forms chloride anion.

(iii) Potassium acts a reducing agent and gets oxidised.

(iv) Chlorine acts an oxidizing agent and gets reduced.

**Question 10:**

What do you understand by a dipole molecule? Give one example.

**Solution 10:**

Dipole molecule is a molecule that has both, slight positive and slight negative charge. For example, in HCl hydrogen has a slight positive charge and chlorine has a slight negative charge. The dipole moment of HCl molecule is 1.03 D and may be represented as:

**INTEXT - QUESTION- 3****Question 1:**

Explain the following:

- Electrovalent compounds conduct electricity.
- Electrovalent compounds have a high melting point and boiling point while covalent compounds have low melting and boiling points.
- Electrovalent compounds dissolve in water whereas covalent compounds do not.
- Electrovalent compounds are usually hard crystals yet brittle.
- polar covalent compounds electricity.

**Solution 1:**

- Electrovalent compounds in the solid state do not conduct electricity because movement of ions in the solid state is not possible due to their rigid structure. But these compounds conduct electricity in the molten state. This is possible in the molten state since the electrostatic forces of attraction between the oppositely charged ions become weak. Thus, the ions move freely and conduct electricity.
- The atoms of covalent compounds are bound tightly to each other in stable molecules, but the molecules are generally not very strongly attracted to other molecules in the compound. On the other hand, the atoms (ions) in electrovalent compounds show strong attractions to other ions in their vicinity. This generally leads to low melting points for covalent solids, and high melting points for electrovalent solids.
- Electrovalent compounds dissolve in polar solvents like water because the forces of attraction between positive and negative charges become weak in water. But since covalent compound are made up of molecules, they do not ionize in water and hence do not dissolve in water.
- Since it takes a lot of energy to break the positive and negative charges apart from each other, the ionic compounds are so hard. But on applying stress, ions of the same charge are brought side-by-side and so the opposite ions repel each other and crystal breaks into pieces.
- Since polar covalent compounds are made up of charged particles, they conduct electricity in aqueous solution.

**Question 2:**

A solid is crystalline, has a high melting point and is water soluble. Describe the nature of the solid.

**Solution 2:**

The solid is ionic in nature as the oppositely charged ions are being held tightly by strong intermolecular force of attraction and that's the reason for its high melting point and solubility in water.

**Question 3:**

.Match the atomic number 4, 8, 14, 15 and 19 with each of the following:

- (a) A solid non-metal of valency 3.
- (b) A gas of valency 2.
- (c) A metal of valency 1.
- (d) A non-metal of valency 4

**Solution 3:**

- (a) Atomic number 15
- (b) Atomic number 8
- (c) Atomic number 19
- (d) Atomic number 14

**Question 4:**

.Elements X, Y, and Z have atomic numbers 6, 9 and 12 respectively. Which one:

- (a) forms an anion,
- (b) forms a cation,
- (c) State type of bond between Y and Z and give its molecular formula.

**Solution 4:**

- (a) Y
- (b) Z
- (c) X

**Question 5:**

Taking  $\text{MgCl}_2$  as an electrovalent compound,  $\text{CCl}_4$  as a covalent compound, give four differences between electrovalent and covalent compounds.

**Solution 5:**

Electrovalent Compounds	Covalent compounds
They are made up of ions; $\text{Mg}^{2+}$ and $\text{Cl}^-$	They are made up of molecules; 1 carbon and 4 chlorine atoms form a molecule of $\text{CCl}_4$ .
They are made up of ions; $\text{Mg}^{2+}$ and $\text{Cl}^-$	They are generally gases or liquids under ordinary conditions; $\text{CCl}_4$ is a liquid.
They have high m.p. and b.p.	Their m.p. and b.p. are low.

They are easily soluble in water but insoluble in organic solvents, such as benzene, chloroform, etc.

They are insoluble in water but are usually soluble in organic solvents, such as benzene, chloroform, etc.

**Question 6:**

Potassium chloride is an electrovalent compound, while hydrogen chloride is a covalent compound. But, both conducts electricity in their aqueous solutions. Explain.

**Solution 6:**

Potassium chloride conducts electricity in water because the forces of attraction between positive and negative charged ions become weak in water and hence the ions become mobile.

On the other hand, the HCl bond is a polar covalent compound, which means that there is a partial positive charge on H and a partial negative charge on Cl.. Hence it also ionizes in water and forms ions and conducts electricity.

**Question 7:**

- (a) Name two compounds that are covalent when taken pure but produce ions when dissolved in water.  
(b) For each compound mentioned above give the formulae of ions formed in aqueous solution.

**Solution 7:**

- (a) HCl and H<sub>2</sub>O  
(b) H<sup>+</sup> and Cl<sup>-</sup> ions  
And  
H<sup>+</sup> and O<sup>2-</sup> ions

**Question 8:**

.An element M burns in oxygen to form an ionic bond MO. Write the formula of the compounds formed if this element is made to combine with chlorine and sulphur separately.

**Solution 8:**

Since M combines with oxygen to form MO which means that M has a valency of +2. Hence, the formula of the compounds with chlorine and sulphur are: MCl<sub>2</sub> and MS.

**Question 9:**

**Give electron dot diagram of the following:**

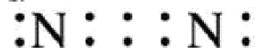
- (a) Magnesium chloride  
(b) nitrogen  
(c) methane

**Solution 9:**

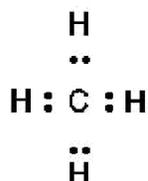
a.



b.



c.

**Question 10:**

State the type of bonding in the following molecules.

- Water
- Calcium oxide
- hydroxyl ion,
- methane,
- ammonium ion
- ammonium chloride

**Solution 10:**

- Water - Covalent bond
- Calcium oxide - Ionic bond
- Hydroxyl ion - Polar covalent bond
- Methane - Covalent bond
- Ammonium ion - Co-ordinate covalent bond
- Ammonium chloride - Covalent, coordinate and ionic bonds

**Question 11:**

Define a coordinate bond and give the conditions for its formation. Explain with an example.

**Solution 11:**

The bond formed between two atoms by sharing a pair of electrons, provided entirely by one of the combining atoms but shared by both is called a coordinate bond. It is represented by an arrow starting from the donor atoms and ending in the acceptor atom.

Conditions:

- One of the two atoms must have at least one lone pair of electrons.
- Another atom should be short of at least a lone pair of electrons.

The lone pair of electrons in the oxygen atom of water is used to form coordinate bond with the hydrogen ion which is short of an electron resulting in the formation of the hydronium ion.

$\text{H}_2\text{O} + \text{H}^+ \rightarrow \text{H}_3\text{O}^+$  Over here the hydrogen ion accepts one lone pair of electrons of the oxygen atom of water molecule leading to the formation of a coordinate covalent bond.

**Question 12:**

- (a) What do you understand by lone pair and shared pair?  
(b) (i) How many atoms of each kind are present in the following molecules: calcium oxide, chlorine, water, carbon tetrachloride?  
(ii) How many electrons are required for their octet structure?

**Solution 12:**

- (a) A pair of electrons which is not shared by any other atom is called lone pair of electrons. The electrons of valence shell shared by two atoms to form a covalent bond are called shared pair of electrons.  
(b)  
(i) Calcium and oxygen make up Calcium oxide. Calcium needs to lose 2 electrons while oxygen needs to gain 2 electrons to complete octet structure.  
ii) Two atoms of hydrogen and an atom of oxygen make up water molecule. Hydrogen atoms need to gain one electron to complete its duplet while oxygen needs to gain 2 electrons to complete octet structure.  
(ii) In carbon tetrachloride, there is one carbon and 4 chlorine atoms. Each of the four chlorine atoms needs to gain one electron to complete its octet while carbon needs to gain 4 electrons to complete octet state.

**Question 13:**

Complete the following:

- (a) When the nuclei of two different reacting atoms are of ..... mass, then a bond so formed is called ..... covalent band (Equal, unequal, polar, non-polar).  
(b) In case of non-polar covalent bond, the covalent bond is formed in the ..... Of atoms and shared electrons are ..... Distributed (corner, middle, equally, unequally).  
(c) The ions in ..... compounds are held very strongly due strong ..... Forces (electrovalent, covalent, electromagnetic, electrostatic).

**Solution 13:**

- (a) Unequal, polar  
(b) Middle, equally  
(c) Electrovalent, electrostatic

**Question 14:**

- (a) Draw an electron dot diagram to show the structure of each of the following:

- (i) Hydronium ion,
- (ii) Ammonium ion,
- (iii) Hydroxyl ion.

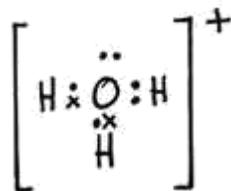
State the type of bonding present in them.

- (b) Give two example in each case:
  - (i) Co-ordinate bonds compounds,
  - (ii) solid covalent compounds,
  - (iii) Gaseous polar compounds,
  - (iv) Gaseous non polar compounds,
  - (v) Liquid non polar compounds.

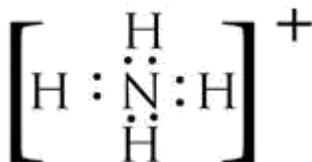
**Solution 14:**

(a)

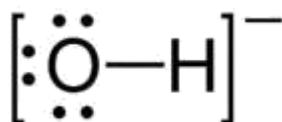
(i)



(ii)



(iii)



(b)

- (i) Ammoniumion and hydronium ion
- (ii) Phosphoruspentachloride and diamond
- (iii) Hydrogen chloride and water vapour
- (iv) Oxygen gas and nitrogen gas
- (v) Toluene and Gasoline

**Question 15:**

Element M forms a chloride with the formula  $\text{MCl}_2$  which is a solid with high melting point. M would most likely be in the group in which ..... is placed.

[ (a) Na (b) Mg (c) Al (d) Si ]

**Solution 15:**

Mg

**Question 16:**

Complete the following:

	Sodium	Phosphorus	Carbon
Formula of chloride			
Nature of bonding			
Physical state of chloride			

**Solution 16:**

	Sodium	Phosphorus	Carbon
Formula of chloride	NaCl	PCl <sub>5</sub>	CCl <sub>4</sub>
Nature of bonding	Ionic	Covalent	Covalent
Physical state of chloride	Solid	Solid	Liquid

**Question (2004):**

- (a) Element X is a metal with a valency 2. Element Y is a non-metal with a valency 3.
- Write equations to show how X and Y form ions.
  - If Y is a diatomic gas, write the equation for the direct combination of X and Y to form a compound.
  - If the compound formed between X and Y is melted and an electric current is passed through the molten compound, the element X will be obtained at the ..... and Y at the ..... of the electrolytic cell.

**Solution (2004):**

- $X \rightarrow X^{2+} + 2e^{-}$   
 $+ 3e^{-} \rightarrow Y^{3-}$
- $6X + 2Y_2 \rightarrow 2X_3Y_2$
- cathode , anode

**Question (2005):**

- (a) Compound X consists of molecules.
- Choose the letter corresponding to the correct answer from the options A,B,C and D given below:
- The type of bonding in X will be:

- A. ionic
- B. electrovalent
- C. covalent
- D. molecular

(ii) X is likely to have a:

- A. low melting point and high boiling point,
- B. high melting point and low boiling point
- C. Low melting point and low boiling point,
- D. high melting point and high boiling point.

(iii) In the liquid state, X

- will:
- A. become ionic
  - B. be an electrolyte
  - C. conduct electricity
  - D. not conduct electricity

(b) Electrons are getting added to an element Y:

- (i) is Y getting oxidized or reduced?
- (ii) what charge will Y migrate to during the process of electrolysis?

(c)

- (i) Acids dissolve in water and produce positively charged ions. Draw the structure of these positive ions.
- (ii) Explain why carbon tetrachloride does not dissolve in water.
- (iii) Elements Q and S react together to form an ionic compound. Under normal conditions, which physical state will the compound QS exist in?
- (iv) Can Q and S, both be metals? Justify your answer.

**Solution (2005):**

**(a)**

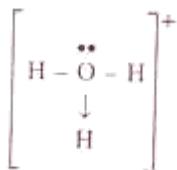
- (i) C
- (ii) C
- (iii) D

**(b)**

- (i) reduced
- (ii) negative

**(c)**

- (i)  $\text{H}_3\text{O}^+$  ions



Structure of hydronium ion

- (ii) Like dissolves like. Since carbon tetrachloride is non-polar and water is polar compound, carbon tetrachloride does not dissolve in water.
- (iii) Solid
- (iv) No as ionic bonds can only be made by transfer of electrons from a metal to non-metal.

**Question (2006):**

(a) Choose the correct answer from the choices A,B,C and D:

- (i) The property which is characteristic of an electrovalent compound is that:
  - A. it is easily vaporized
  - B. it has a high melting point
  - C. it is a weak electrolyte,
  - D. it often exists as a liquid.
- (ii) When a metal atom becomes an ion:
  - A. It loses electrons and is Oxidized
  - B. It gains electrons and is reduced,
  - C. It gains electrons and is oxidized,
  - D. it loses electrons and is reduced.

(b) Identify the following reactions as either oxidation or reduction:

- (i)  $O + 2e^- \rightarrow O^{2-}$
- (ii)  $K - e^- \rightarrow K^+$
- (iii)  $Fe^{3+} + e^- \rightarrow Fe^{2+}$

**Solution (2006):**

(a)

- (i) B
- (ii) A

(b) (i) Reduction

- (ii) Oxidation
- (iii) Reduction

**Question (2007):**

(a)

- (i) Name the charged particles which attract one another to form electrovalent compounds.
- (ii) In the formation of electrovalent compounds, electrons are transferred from one element to another. How are electrons involved in the formation of a covalent compound?
- (iii) The electronic configuration of nitrogen is (2, 5). How many electrons in the outer shell of a nitrogen atom are not involved in the formation of a nitrogen molecule?
- (iv) In the formation of magnesium chloride (by direct combination between magnesium and chlorine), name the substance that is oxidized and the substance that is reduced.

**Solution (2007):**

- (i) Ions
- (ii) Electrons are shared between the atoms of two or more elements
- (iii) Two
- (iv) Magnesium is oxidized and chlorine is reduced

**Question (2008):**

- (a) Which of the following is not a common characteristic of an electrovalent compound?
- A. High melting point
  - B. Conducts of electricity when molten.
  - C. Consists of oppositely charged ions
  - D. Ionizes when dissolved in water.
- (b) What are the terms defined below?
- (i) A bond formed by a shared pair of electrons, each bonding atom contributing one electrons to the pair.
  - (ii) A bond formed by a shared pair of electrons with both electrons coming from the same atom.

**Solution 2008:**

- (a)
- (i) D
- (b)
- (i) Covalent bond
  - (ii) Coordinate bond.