PART-I (SHORT QUESTIONS)

Q.2 Write short answers to any SIX (6) questions

(i) What is duplet rule?

Ans. Duplet Rule: *"Attaining 2 electrons in th valence shell is called duplet rule."*

Example: Helium (He) has two electrons in its valenc shell. Its electronic configuration is $1s^2$. Thus, i obeys duplet rule.

(ii) Define and explain Octet rule.

Ans. Octet Rule: *"Attaining 8 electrons in the valenc shall is called an octet rule."*

(OR)

"Attaining of 8 electron configuration in outer mos shell (valence shell) either by sharing, by losing o by gaining electrons, is called octet rule."

Examples: "Neon (Ne) and argon (Ar) has 8 electrons in their valence shell. Thus, they obey octet rule.

(iii) What is meant by a chemical force /chemical bond? Give its types.

Ans. Chemical Forces/Chemical Bond: *"The forces responsible for binding the atoms together in a molecule are called chemical forces or chemical bonds."*

Types of Chemical Bonds: There are four main types of chemical bonds. These are as following:

(1) Ionic Bond (2) Covalent Bond
(3) Coordinate/Dative Covalent Bond
(4) Metallic Bond

(iv) When does a chemical bond is formed between two atoms and when it does not?

Ans. When two approaching atoms come closer, the attractive as well as repulsive forces become operative. The formation of chemical bond is a result of net attractive forces which dominate. The energy of that system is lowered and molecule is formed. Otherwise if repulsive forces become dominate no chemical bond will be formed. In that case there will be increase in the energy of the system due to creation of repulsive forces.

(v) What is an ionic bond? Give two examples of ionic compounds.

Ans. Ionic Bond: *"The type of chemical bond, which is formed due to complete transfer of electron(s) from one atom to another atom, is called an ionic bond".*

Examples:

Sodium chloride (NaCl) and Magnesium oxide (MgO) are two examples of ionic compounds.

(vi) Give two/four properties of ionic compounds.

Ans. Properties of Ionic Compounds:

(1) Ionic compounds are mostly crystalline solids.

(2) Ionic compounds in solid state have negligible electrical conductance but they are good conductors in solution and in the molten form. It is due to presence of free ions in them.

(3) Ionic compounds have high melting and boiling points. For example, sodium chloride has melting point 800 °C and a boiling point 1413 °C. 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.

(4) They dissolve easily in polar solvents like water. Water has high dielectric constant that weakens the attraction between two bonded ions.

Examples:

NaCl, KCl, NaI, etc.

(vii) Define covalent bond. What are its types? Give one example of each type.

Ans. Covalent Bond:

"The bond which is formed due to mutual sharing of electrons between two atom, is called a covalent bond."

Types of Covalent Bonds:

There are three types of covalent bonds. These are:

(1) Single Covalent Bond — e.g. H – H or H_2

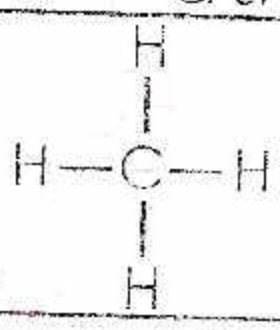
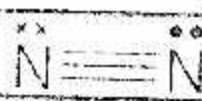
(2) Double Covalent Bond — e.g. O = O or O_2

(3) Triple Covalent Bond — e.g. N ≡ N or N_2

(viii) Point out the nature of chemical bond in the following molecules:

Cl_2, CH_4, O_2, N_2.

Ans. Nature of Chemical Bond in Different Molecules:

Molecule	Formula	Nature of Bond
Cl_2	Cl – Cl or Cl_2	Single covalent bond.
CH_4		Single covalent bond.
O_2	 or O_2	Double covalent bond.
N_2		Triple covalent bond.
C_2H_2		

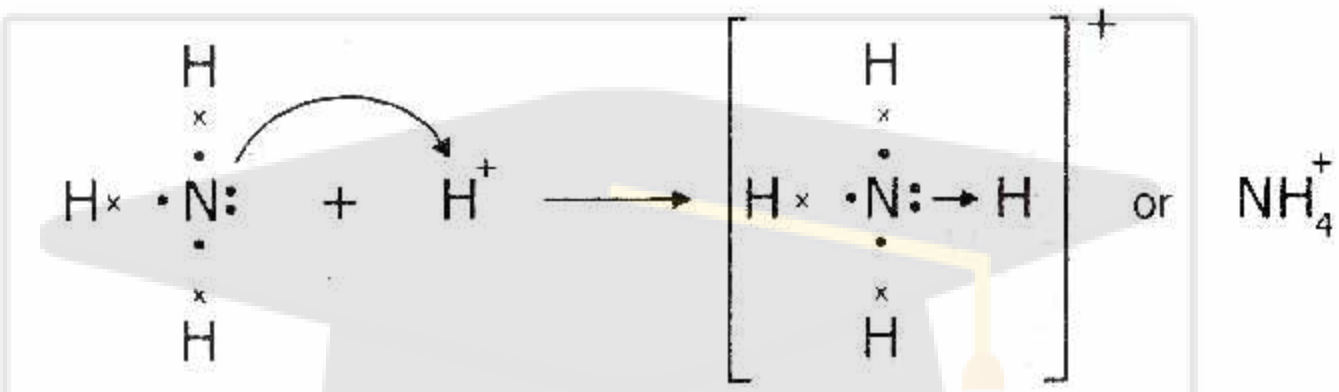
(ix) Define coordinative covalent bond. Explain with one example.

Ans. Coordinate Covalent Bond or Dative Covalent Bond:

"Coordinate covalent or dative covalent bonding is a type of covalent bonding in which the bond pair of electrons is donated by one bonded atom only."

Formation of Ammonium Ion (NH_4^+):

In ammonia molecule ($\ddot{N}H_3$), nitrogen atom has one lone pair of electrons. The proton (H^+) has two electrons short to complete its duplet. Thus, when ammonia ($\ddot{N}H_3$) and a proton (H^+) are allowed to react, nitrogen atom donates a pair of electron (N is a donor atom) and proton (H^+ is an acceptor atom) accepts a pair of electrons. Thus, a coordinate covalent bond is formed between nitrogen atom of ammonia and a proton. It is represented as following:



Ammonia + Proton ⟶ Ammonium ion

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Q.3 Write short answers to any FIVE (5) questions.

(i) Differentiate b/w donor and acceptor atoms with the help of bond formation.

Ans. Donor atom:

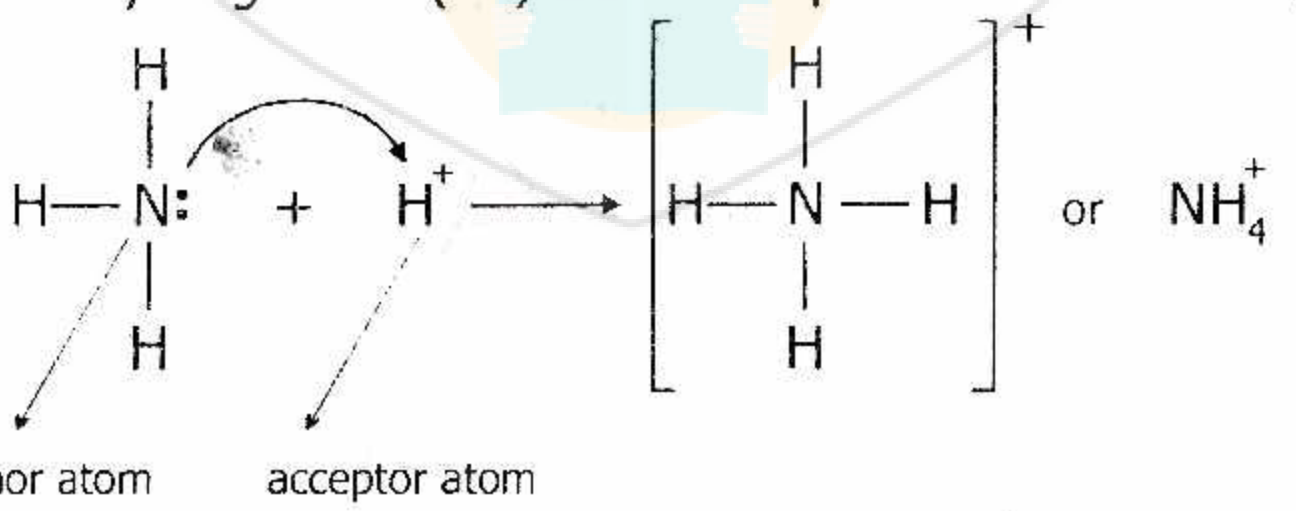
"The atom which donates the electron pair is called a donor atom."

Accepter atom:

"The atom or ion which accepts electron pair is called an acceptor atom."

Examples:

In the formation of ammonium ion, the nitrogen atom of $\ddot{N}H_3$ molecule is the donor atom while hydrogen ion (H^+) is the acceptor atom.



(ii) Describe the formation of coordinatve covalent bond in ammonia-boron trifluoride aduct.

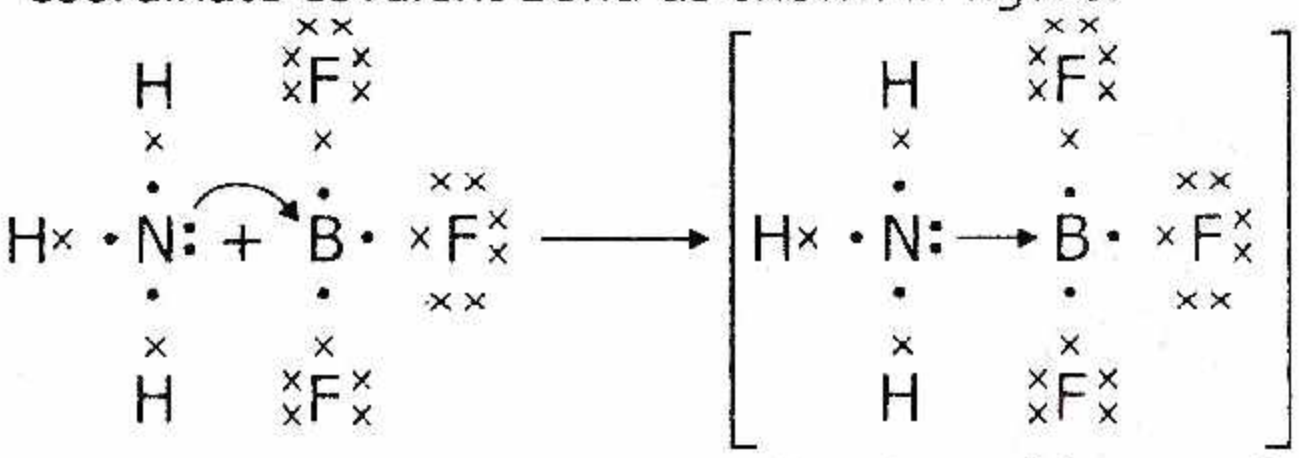
Ans. **Formation of Ammonia-Boron Trifluoride Aduct:**

In the formation of BF_3 (bornon trifluoride) molecule, three valence electrons of boron atom (Z = 5) pair up with three electrons, one from each three fluorine atoms. The boron atom even after this sharing of electrons (covalent bond formation),

remains short or deficit of two electrons in its outermost shell.

Now, if a molecule with a lone pair approaches this molecule, it accepts lone pair from that donor and forms a coordinate covalent bond.

The lone pair on nitrogen of ammonia molecule ($\ddot{N}H_3$) makes it a good donor molecule to form a coordinate covalent bond as shown in figure.



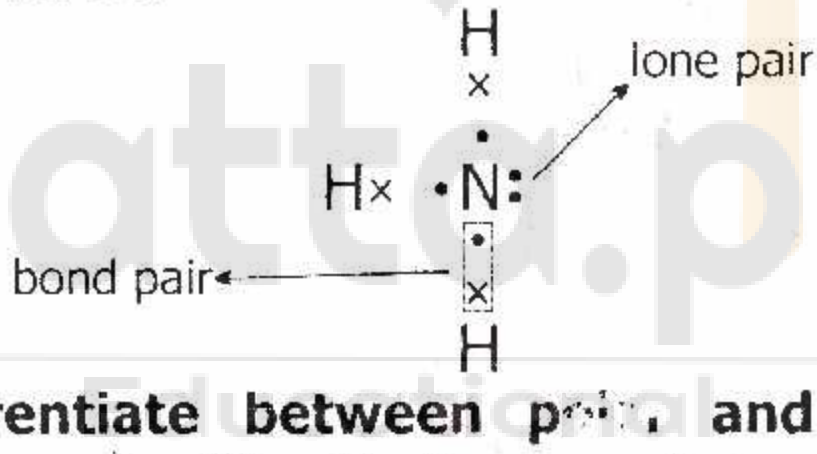
(iii) Differentiate between bond pair and lone pair of electrons.

Ans. Bond Pair: *'The electrons that pair up to form a chemical bond are called bond pair electrons."*

Lone Pair: *"The non-bonded electron pair available on an atom, is called a lone pair."*

Example:

In ammonia molecule, three bond pairs and one lone pair is present as indicated in the formula given below:



(iv) Differentiate between polar and non-polar compounds. Give their examples.

Ans. Polar Compounds:

"The compounds which are made up of polar molecules are called polar compounds".

Examples:

HCl, H_2O, HF, etc.

Non-polar Compounds: *"The compounds which are made up of non-polar molecules are called non-polar compounds".*

Examples:

H_2, Cl_2, O_2, N_2, etc.

(v) How we can predict whether a chemical bond will be ionic or covalent in nature?

Ans. (1) If the difference of electro-negativities between two bonded atoms of different elements is more than 1.7, then the bond b/w the bonded atoms will be predominantly ionic bond.

(2) If the difference of electronegativities between two atoms of different elements is less than 1.7, then the bond between two bonded atoms will be predominantly covalent.

(vi) Explain the difference between intermolecular forces and chemical bonding.

Ans. Intermolecular Forces:

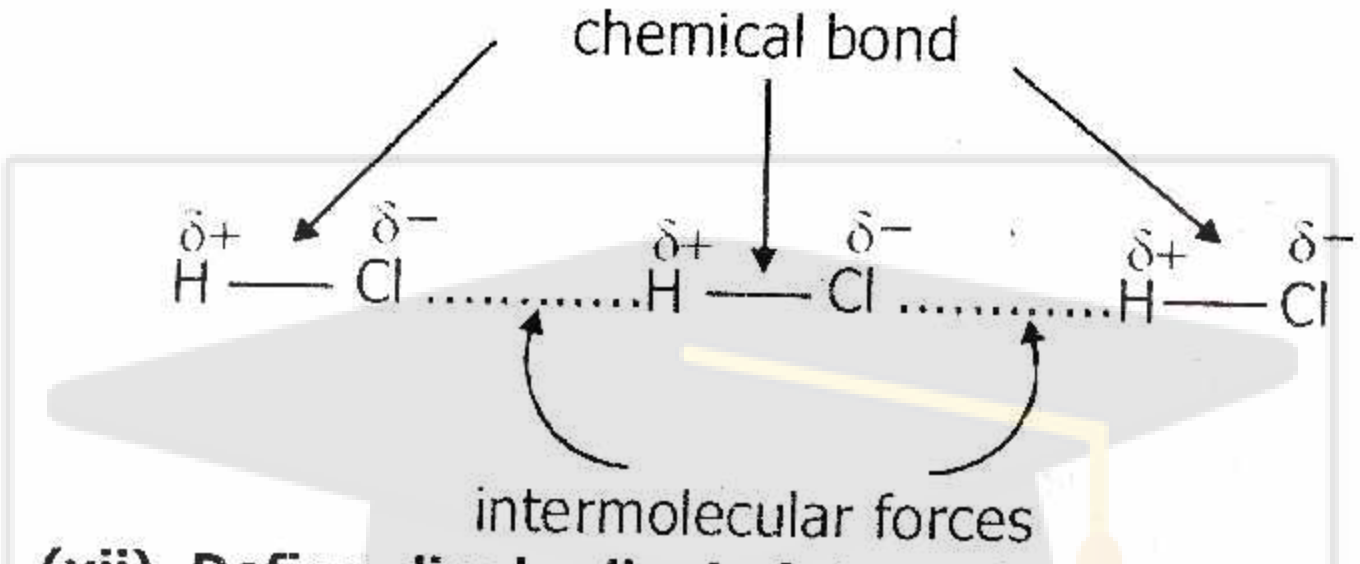
"The relatively weak forces which holds the molecules in an element or a compound are called intermolecular forces."

Chemical Bonding:

"The forces that hold atoms in a compound are chemical bonds."

Comparison of Intermolecular Forces and Chemical Bond Force:

In the figure given below solid lines show chemical bonding between hydrogen and chlorine atoms in HCl. While dotted lines show intermolecular forces between two HCl molecules.



(vii) Define dipole-dipole interaction. Explain with example of HCl.

Ans. Dipole-Dipole Interaction:

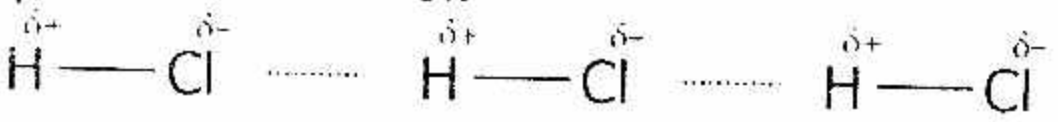
"The attractive forces between oppositely charged ends of polar molecules are called dipole-dipole interactions (forces)."

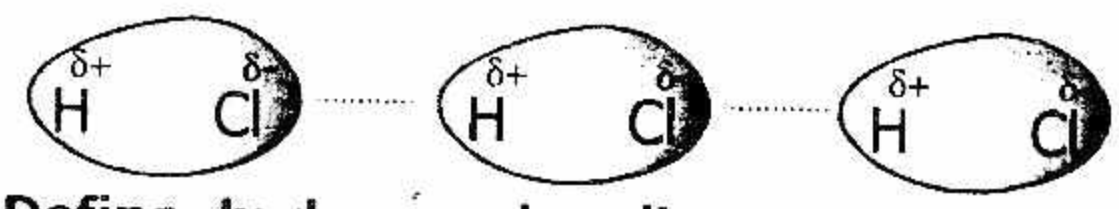
Explanation:

When two atoms of different electronegativity values are boned in a molecule, the shared pair of electron is displaced/drawn/shifted towards more electronegative atom. It becomes partially negatively charged indicated by delta negative sign i.e. $\delta-$. In turn, the other end automatically becomes partially positively charged indicated by delta positive sign i.e.$\delta+$. In this way, two poles are created in a molecule and the molecule is said to be polar. It is shown in HCl molecule.

$$H^{\delta+} — Cl^{\delta-}$$

Thus, when partial positive and partial negative charges exist at different position in a molecule, the adjacent molecules will arrange themselves in such a way that negative portion of that molecule come near to positive portion of other molecule. It results in the net forces of attraction between oppositely charged portions of two adjacent molecules. These attractive forces are called dipole-dipole interactions as represented in HCl.





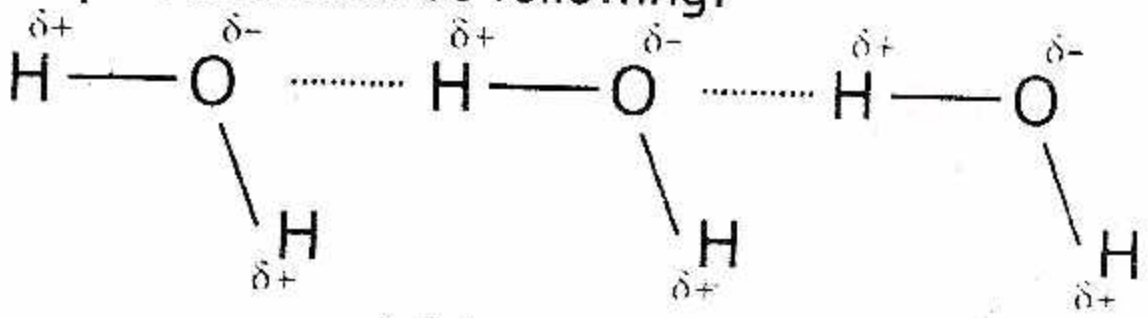
(viii) Define hydrogen bonding. Explain with the example of water molecule.

Ans. Hydrogen Bonding

"The attractive force which binds hydrogen atom of one molecule with electronegative atom of another molecule in a compound is called a hydrogen bonding."

Example of Water Molecule:

In water, there exist a hydrogen bonding between oxygen atom of one water molecule and the hydrogen atom of another water molecule. It is shown by dotted lines as following:



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Q.4 Write short answers to any FIVE (5) questions.

(i) What are covalent compounds? Describe their two/four properties.

Ans. Covalent Compounds: *"The compounds which are made up of covalent molecules are called covalent compounds".*

Examples:

H_2, CH_4, H_2SO_4 and $C_6H_{12}O_6$, etc. are examples of covalent compounds.

Properties of Covalent Compounds:

(1) They have usually low melting and boiling points.

(2) They are usually bad conductors of electricity. However, the compounds having polar character in their bonding are conductor of electricity when they are dissolved in polar solvents.

(3) They are usually insoluble in water but are soluble in non-aqueous solvents like benzene, ether, alcohol and acetone.

(4) Bigger molecules with three dimensional bonding form covalent crystals which are very stable and hard. They have high melting and boiling points.

(ii) Give two/four properties of metals.

Ans. Metals:

Properties of Metals:

Metals have common property of conducting heat and electricity. It gives them prime role in many technologies. Major properties shown by the metals are as following:

(1) They show metallic luster.

(2) They are usually malleable. *Malleability is the property by virtue of which a metal can be drawn into sheets.*

(3) Metals are ductile. *Ductility is the property by virtue of which a metal can be drawn into wires.*

(4) They have usually high melting and boiling points.

(5) Being greater in size, they have low ionization energies and form cations (M^+) very easily.

$$M \longrightarrow M^+ + e^-$$

(6) They are good conductors of heat and electricity in sold and liquid states due to mobile electrons.

(iii) Differentiate between malleability and ductility of metals?

Ans. Malleability: *"Malleability is the properties by virtue of which a metal can be drawn into sheets."*

Ductility: *"Ductility is the property by virtue of which a metal can be drawn into wires."*

(iv) Compare the properties of non-polar and polar compounds.

Ans.

Non-polar Compounds	Polar Compounds
(i) Non-polar covalent compounds usually do not dissolve in water.	**(i)** Polar covalent compounds usually dissolve in water.
(ii) Non-polar compounds do not conduct electricity.	**(ii)** Aqueous solutions of polar compounds conduct electricity.

(v) Why does ice float on water?

Ans. The important phenomenon of floating of ice over water is because of hydrogen bonding. The density of ice at 0°C (0.917g cm^{-3}) is less than that of liquid water at 0°C (1.00g cm^{-3}). In the liquid state, water molecules move randomly. However, when water freezes, the molecules arrange themselves in an ordered form, that gives them open structure. This process expands the molecules, that result in ice being less dense as compared to water. That is why ice float on water.

(vi) What do you mean by induced dipole?

Ans. Induced Dipole: *A dipole which is produced artificially due to electrons distortion in a molecule by the other nearby dipole is called an induced dipole.*

(OR)

"A molecule in which polarity is created due to other polar molecule is called induced dipole."

Explanation: The positive end of the polar molecule attracts the mobile electron of the nearby non-polar molecule, and both molecules become dipoles. These forces are called dipole induced dipole forces.

(vii) Comparing the electronegativity differences, arrange these compound in increasing ionic strength.

Ans. Arrangement of above compounds in the increasing ionic strength is as following:

KCl > NaI > NaH > HCl.

(viii) What is epoxy adhesive? Give its uses.

Ans. Epoxy: Epoxy is a polymer that is formed from two different chemicals. These are referred as resin and the hardener. Epoxy adhesives are called structural adhesives.

Uses of Epoxy Adhesive: Epoxy are high performance adhesives. They are used in the construction of aircraft, automobiles, bicycles, boats, golf clubs, where high strength bonds are required.

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PART-II (LONG/DESCRIPTIVE QUESTIONS)

Q.5 **(a)** What is an ionic bond? Discuss the formation of ionic bond between sodium and chlorine atoms. **(4)**

(b) Define covalent bond. Describe its different types with atleast two examples of each type. **(3)**

Ans. **(a)** **See Chapter 4 Q.No.22**

(b) **See Chapter 4 Q.No.30**

Q.6 **(a)** Define coordinate covalent or dative covalent bond? Explain with two examples. **(4)**

(b) What is meant by polar and non-polar covalent bonds? Explain with examples. **(3)**

Ans. **(a)** **See Chapter 4 Q.No.35**

(b) **See Chapter 4 Q.No.40**

Q.7 **(a)** What is a metallic bond? Explain the metallic bonding in metals with the help of a diagram. **(4)**

(b) Define hydrogen bonding. What conditions are necessary for the formation of hydrogen bond. Explain the formation of hydrogen bonding with examples. **(3)**

Ans. **(a)** **See Chapter 4 Q.No.46**

(b) **See Chapter 4 Q.No.52**

Q.8 **(a)** Define intermolecular forces. Pointout these forces in HCl. **(4)**

(b) What is meant by Dipole Dipole forces? Define the formation of Dipole Dipole forces. **(3)**

Ans. **(a)** **See Chapter 4 Q.No.8**

(b) **See Chapter 4 Q.No.9**

Q.9 **(a)** What are Ionic Compounds? Also explain their properties. **(4)**

(b) What are covalent compounds? Explain their properties. **(3)**

Ans. **(a)** **See Chapter 4 Q.No.12**

(b) **See Chapter 4 Q.No.13**

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PART-III (PRACTICAL QUESTIONS)

10. (i) What do you conclude from your observations about the nature and purity of the given compound? (2)

(ii) Can you name some other mineral acids? (3)

Ans. (i) Nature of a Substance:

If a compound has low melting point such as naphthalene, then it will be an organic compound.

Pure of a Substance:

If the melting point of the given compound is less than its standard melting point, then it will be an impure substance.

(ii) (a) Hydrochloric acid (HCl)
(b) Sulphuric acid (H_2SO_4)
(c) Nitric acid (HNO_3)

11. (i) Which one of the following acids is not used as part of our food? (2)

(a) Tartaric acid (b) Citric acid
(c) Lactic acid (d) Benzoic acid

(ii) How oxalic acid is used to remove rust spot from the cotton clothes? (3)

Ans. (i) (d) Benzoic acid

(ii) Oxalic acid is used to remove rust spots from the cotton clothes. For this purpose we rub some crystals of oxalic acid on the spot and then after some time, the spots on the clothes are washed with water.

12. (i) To save human life, saline glucose is injected. Do you think its concentration is important? (2

(ii) What is the difference between miscible and immiscible liquids? (3)

Ans. (i) The proper concentration of saline glucose is required for human life. Saline glucose maintains the activities of brain and keeps the human body energetic.

(ii) Miscible Liquids:

Miscible liquids are those which can mix in all proportions and make a single phase of a homogeneous mixture.

Examples:

(a) Ethanol and water
(b) Mustard oil and olive oil

Immiscible Liquids:

Immiscible liquids are those which on mixing form two layers and there exists a boundary between the two liquids.

Examples:

(a) Water and olive oil are immiscible to each other.

(b) Water and chloroform are immiscible to each other.