# ISC Class 12 Exam 2024

# Chemistry

# Multiple Choice Questions

**Multiple Choice Questions**

**1. Sprinkling of salt helps in clearing the snow covered roads in hills. The phenomenon involved in the process is :**

(a) Lowering in vapour pressure of snow
(b) Depression in freezing point of snow
(c) Melting of ice due to increase in temperature by putting salt
(d) Increase in freezing point of snow

**Ans. (b) Depression in freezing point of snow**

**Explanation :** The phenomena of depression in freezing point of water helps in clearing the snow covered roads in hilly areas. When salt is sprinkled over snow covered roads, snow melts from the surface because depression of freezing point of water takes place due to addition of salt.

**2. Which of the following condition is not satisfied by an ideal solution ?**

(a) $AH_{mixing} = O$
(b) $AV_{mixing} = O$
(c) Raoult's Law is obeyed
(d) Formation of an azeotropic mixture

**Ans. (d) Formation of an azeotropic mixture**

**Explanation :** An ideal solution satisfies the following conditions :

AHmixing = O

AVmixing = O

It obeys Raoult's Law Whereas, azeotrophic mixtures are formed only in case of non-ideal solutions

**3. The osmotic pressure of equimolar solution of NaCl, BaCl2 and glucose will be in the order of :**

(a) NaCl > BaCl2 > Glucose
(b) BaCl2 > NaCl > Glucose
(c) Glucose > NaCl > BaCl2
(d) NaCl > Glucose > BaCl2

**Ans. (b) BaCl2 > NaCl > Glucose**

**Explanation :** Osmotic pressure is a colligative property, and more the number of particles more the osmotic pressure. $\pi V = nRT$

Where, $\pi$ = Osmotic pressure

V = Volume
R = Gas Constant
T = Temperature

Hence, the order is BaCl2 > NaCl > Glucose since the concentration is same and i for BaCl2 is 3, NaCl is 2 and glucose is 1

**4. Colligative properties depend on :**

(a) The nature of solute particles in solution
(b) The number of solute particles in solution
(c) The nature of solute and solvent particles
(d) The physical properties of solute particles in solution

**Ans. (b) The number of solute particles in solution**

**Explanation :** A colligative property is a property of a solution that is dependent on the ratio between the total number of solute particles to the total number of solvent particles in a solution. It does not depend on the nature or identity of solute particles. The four colligative properties that can be exhibited by a solution are :

(i) Boiling point elevation
(ii) Freezing point depression
(iii) Relative lowering of vapour pressure
(iv) Osmotic pressure

**5. Relative lowering of vapour pressure, osmotic pressure of a solution and elevation in boiling points are _____ properties. Osmosis is the passage of _____ through a semipermeable membrane from a solution of _____ towards a solution of _____ Osmotic pressure is equivalent to mechanical pressure which must be applied on _____ to prevent osmosis.**

(a) Colligative, solvent, lower concentration, higher concentration, solution.
(b) Colligative, solution, lower concentration, higher concentration, solvent.
(c) Colligative, solvent, higher concentration, lower concentration, solution.
(d) Colligative, solution, higher concentration, lower concentration, solution.

**Ans. (a) Colligative, solvent, lower concentration, higher concentration, solution.**

**Explanation :** Relative lowering of vapour pressure, osmotic pressure of a solution and elevation in boiling points are colligative properties. Osmosis is the passage of, solvent through a semipermeable membrane from a solution of lower concentration towards a solution of higher concentration. Osmotic pressure is equivalent to mechanical pressure which must be applied on solution to prevent osmosis.

**6. Solutions which strictly obey _____ law are called _____ solutions. If the vapour pressure of non-ideal solution is _____ than predicted by Raoult's law then it shows positive deviation and if it is _____ than predicted by Raoult's law then it shows negative deviation**

(a) Ideal, Raoult's, lower, higher
(b) Higher, Raoult's, ideal, lower
(c) Raoult's, ideal, higher, lower
(d) Raoult's, lower, higher, ideal

**Ans. (c) Raoult's, ideal, higher, lower**

**Explanation :** Solutions which strictly obey Raoult's law are called ideal solutions. If the vapour pressure of non-ideal solution is higher than predicted by Raoult's law then it shows positive deviation and if it is lower than predicted by Raoult's law then it shows negative deviation

**7. A solution which does not obey Raoult's law at all range of concentration is called _____ . A solution which distills without change in composition is called _____ Ideal solutions obey _____ law and they _____ form azeotropic mixtures.**

(a) Non-Ideal, Azeotrope, Raoult's, do not
(b) Azeotrope, Raoult's, Non-Ideal, do not
(c) Raoult's, Non-Ideal, do not, Azeotrope
(d) Non-Ideal, Raoult's, Azeotrope, do not

**Ans. (a) Non-Ideal, Azeotrope, Raoult's, do not**

**Explanation :** A solution which does not obey Raoult's law at all range of concentration is called non-ideal. A solution which distills without change in composition is called azeotrope. Ideal solutions obey Raoult's law and they do not form azeotropic mixtures.

**8. For sodium chloride solution, Van't Hoff factor is _____ When solvent starts flowing from _____ into _____ through semi-permeable membrane, the phenomenon is termed as reverse osmosis. Relative lowering of vapour pressure is equal to the mole fraction of the _____ .**

(a) solvent, solution, Greater than 1, Solute
(b) Solute, solution, solvent, Greater than 1
(c) Greater than 1, solute, solvent, solution
(d) Greater than 1, solution, solvent, Solute

**Ans. (d) Greater than 1, solution, solvent, Solute**

**Explanation :** For sodium chloride solution, Van't Hoff factor is greater than 1. When solvent starts flowing from solution into solvent through semi- permeable membrane, the phenomenon is termed as reverse osmosis. Relative lowering of vapour pressure is equal to the mole fraction of the solute.

**9. The minimum excess pressure that has to be applied on the solution to prevent the entry of the solvent into the solution through semi- permeable membrane is called as _____ The unit of molal depression constant is _____ . The relative lowering in vapour pressure is proportional to the ratio of number of _____ Solutions having same osmotic pressure are called as _____ .**

(a) Atmospheric pressure, ppm, hypertonic solutiom, Solute molecules to the total number of solvent
(b) Atmospheric pressure, K kg mol-1, Solute molecules to the total number of molecules in solution, hypertonic solution
(c) Osmotic Pressure, K kg mol-1, Solute molecules to the total number of molecules in solution, isotonic solution
(d) Osmotic Pressure, ppm, Solute molecules to the total number of solvent, hypertonic solution

**Ans. (c) Osmotic Pressure, K kg mol−1, Solute molecules to the total number of molecules in solution, isotonic solution**

**Explanation :** The minimum excess pressure that has to be applied on the solution to prevent the entry of the solvent into the solution through semi- permeable membrane is called as osmotic pressure. The unit of molal depression constant is K kg mol-1. The relative lowering in vapour pressure is proportional to the ratio of number of Solute molecules to the total number of molecules in solution. Solutions having same osmotic pressure are called as isotonic solutions.

**10. Which one of the following statements is TRUE for the Galvanic cell ?**

(a) Electrons flow from copper electrode to zinc electrode
(b) Current flows from zinc electrode to copper electrode
(c) Cations move towards copper electrode
(d) Cations move towards zinc electrode

**Ans. (c) Cations move towards copper electrode**

**Explanation :** In Galvanic cell electrons flow from zinc electrode to copper electrode. So, current flows from copper electrode to zinc electrode. Hence, Cations move towards copper electrode

**11. The number of Faradays required to reduce one mol of $Cu^{2}+$ to metallic copper is :**

(a) One
(b) Two
(c) Three
(d) Four

**Ans. (b) Two**

**Explanation :** Faraday's First Law of Electrolysis states that the chemical deposition due to the flow of current through an electrolyte is directly proportional to the quantity of electricity (coulombs) passed through it.

The reduction of one mole of $Cu^{2}+$ to Cu can be represented as : $Cu^{2+} + 2e- \rightarrow Cu$

Since in the reduction of one mole of $Cu^{2+}$, two moles of electrons are required thus the amount of charge required is 2F.

**12. On dilution, the specific conductance of a solution :**

(a) Remains unchanged
(b) Increases
(c) Decreases
(d) First increases then decreases

**Ans. (c) Decreases**

**Explanation :** On dilution, the specific conductance of a solution decreases. Conductivity changes with the concentration of the electrolyte. On dilution as volume of solution increases. Thus, the number of ions per ml decreases and hence conductivity decreases. Thus, the specific conductivity decreases on dilution.

**13. The standard reduction potential values of three metallic cations X, Y and Z are 0.52 V,-3.03 V and -1.18 V respectively. The order of reducing power of**

**the corresponding metals is :**

(a) Y > Z > X
(b) x > Y > Z
(c) Z > Y > X
(d) Z > X > Y

**Ans. (a) Y > Z>X**

**Explanation :** As the reduction potential drops, the reducing power of the electrode increases Y (-3.03 V) > Z (-1.18 V) > X (0.52 V)

**14. When zinc granule is dipped into copper sulphate solution, copper is precipitated because :**

(a) Both copper and zinc have a positive reduction potential.
(b) Both copper and zinc have a negative reduction potential.
(c) Reduction potential of zinc is higher than that of copper.
(d) Reduction potential of copper is higher than that of zinc.

**Ans. (d) Reduction potential of copper is higher than that of zinc.**

**Explanation :** When zinc granule is dipped into copper sulphate solution, copper is precipitated because reduction potential of copper is higher than that of zinc. Therefore, copper get reduced more easily as compared to zinc.

**15. The molar conductance of a solution _____ with dilution, while its specific conductance _____ with dilution. The electrode at which there is acceptance of electrons is called _____ .**

(a) Decreases, increases, anode
(b) Remains same, decreases, Pt electrode
(c) Increases, decreases, cathode
(d) Decreases, remains same, anode

**Ans. (c) Increases, decreases, cathode**

**Explanation :** The molar conductance of a solution increases with dilution, while its specific conductance decreases with dilution. The electrode at which there is acceptance of electrons is called cathode.

**16. The solution of sugar in water is _____ conductor of electricity. In a galvanised iron, the iron is coated with a layer of _____ metal.**

(a) Bad, zinc
(b) Good, copper

(c) Bad, less, chromium
(d) Good, Silver

**Ans. (a) Bad, zinc**

**Explanation :** The solution of sugar in water is bad conductor of electricity. In a galvanised iron, the iron is coated with a layer of zinc metal.

**17. The rate of a chemical reaction is double for every 10°C rise in temperature because of :**

(a) increase in the activation energy.
(b) decrease in the activation energy.
(c) increase in the number of molecular collisions.
(d) increase in the number of activated molecules.

**Ans. (d) increase in the number of activated molecules.**

**Explanation :** The rate of a chemical reaction is double for every 10°C rise in temperature because of increase in the number of activated molecules (i.e., the number of particles that have the minimum energy required). As the number of activated molecules is increased therefore, the rate of chemical reaction gets double.

**18. In the reaction $2A + B \rightarrow A_2B$, if the concentration of A is doubled and that of B is halved, then the rate of the reaction will :**

(a) increase 2 times
(b) increase 4 times
(c) decrease 2 times
(d) remain the same

**Ans. (a) increase 2 times**

**Explanation :**

Reaction : $2A + B \rightarrow A_2B$

Rate = $k[A]^2 [B]$; $k \rightarrow$ rate constant

According to question, concentration of A is doubled and B is halved.

$\rightarrow$ Rate = $k[2A]^2[B/2]$

$= k \times 2[A]^2 [B]$

Thus, the rate of reaction increases 2 times when the concentration of A is doubled and that of B is halved.

**19. A catalyst is a substance which :**

(a) Changes the equilibrium constant of the reaction.
(b) Increases the equilibrium constant of the reaction.
(c) Supplies energy to the reaction.
(d) Shortens the time to reach equilibrium.

**Ans. (d) Shortens the time to reach equilibrium.**

**Explanation :** A catalyst is a substance which increases the rate of the reaction without itself being consumed during the course of the reaction. They shortens the time to reach equilibrium for a chemical reaction as they decreases the activation energy of the reactants.

**20. Which transition metal has the highest density ?**

(a) Os
(b) Zn
(c) Sc
(d) La

**Ans. (a) Os**

**Explanation :** The decrease in the metallic radius coupled with increase in atomic mass results in a general increase in the density of the elements. Thus, Osmium is the transition element which has the highest density of 22.

**21. Which transition metal shows highest oxidation state ?**

(a) Sc
(b) Ti
(c) Os
(d) Zn

**Ans. (c) Os**

**Explanation :** Osmium is the 5d series transition element that shows the highest oxidation state. The electronic configuration of Osmium is Os(76) = [Xe] $4f^{14}$ $5d^6$ $6s^2$

(i) Osmium has the highest oxidation state because the number of unpaired electrons in the outermost shell is more, i.e., $5d^5$ $6s^2$.

(ii) If we consider all the transition metals the highest oxidation state is eight and the element which shows +8 oxidation state are Ruthenium (Ru) and Os (Osmium).

**22. Which ion gives coloured solution ?**

(a) $Cu^{+}$
(b) $Zn^{2+}$
(c) $Ag^{+}$
(d) $Fe^{2+}$

**Ans. (d) $Fe^{2+}$**

**Explanation :** $Fe^{2+}$ ions give coloured solution due to the presence of 4 unpaired electrons. Only the ions that have electrons in orbital and in which d-d transition is possible will be coloured. The ions in which d-orbitals are empty or completely filled will be colourless as no d-d transition is possible in those configurations.

**23. Which of the following oxides of chromium is amphoteric in nature ?**

(a) CrO
(b) $Cr_2O_3$
(c) $CrO_3$
(d) $CrO_5$

**Ans. (b) $Cr_2O_3$**

**Explanation :** Chromic oxide (or chromium (III) oxide) is an amphoteric compound. It has the ability to dissolve in acids, liberating hydrated chromiumions in the process. These hydrated Cr ions can react with bases to form complex salts.

**24. Number of moles of $K_2Cr_2O_7$ reduced by one mole of $Sn^{2+}$ ions is :**

(a) 1/3
(b) 3
(c) 1/6
(d) 6

**Ans. (a) 1/3**

**Explanation :** The balanced chemical reactions (ionic reactions) for reduction of K2Cr2O7 by $Sn^{2+}$ are : $Cr2O72+ 14H++ 6e^{-} \rightarrow 2Cr3+ + 7H2O$

$( Sn2+ \rightarrow Sn4+ + 2e- ) \times 3$

Balanced Net reaction : $3Sn2+ + Cr2O72 + 14H+ \rightarrow 3Sn4+ + 2Cr3+ + 7H2O$

Thus, according to the balanced reaction : 1 mole of $Cr_2O7^{2-}$ will be reduced by 3 moles of $Sn^{2+}$.

Thus, 1 mole of $Sn^{2+}$ will reduce = 1/3 moles of $Cr_2 07^{2-}$ .

**25. Which of the following element belongs to actinoid series ?**

(a) La
(b) Gd
(c) Lu
(d) Th

**Ans. (d) Th**

**Explanation :** Lu, Gd and La belongs to lanthanide series and Th belongs to actinide series.

**26. Lanthanide contraction is caused due to:**

(a) The same effective nuclear charge from Ce to Lu.
(b) The imperfect shielding on outer electrons by 4f electrons from the nuclear charge.
(c) The appreciable shielding on outer electrons by 4f electrons from the nuclear charge.
(d) the appreciable shielding on outer electrons by 5d electrons from the nuclear charge.

**Ans. (b) The imperfect shielding on outer electrons by 4f electrons from the nuclear charge.**

**Explanation :** The cause of the lanthanoid contraction is the poor shielding effect of 4f orbital due to which the electrons of s-orbitals attract more towards the nucleus due to which the size of the atoms decreases resulting in a smaller atomic radius.

**27. In the complexes $[Fe(CN)6]^{3-}$ and $[Pt\ (en\ (H_2O)_2(NO_2)\ (Cl)]^{2+}$ the respective oxidation numbers of central metal atoms are :**

(a) + 3 and + 4
(b) + 6 and + 4
(c) + 6 and + 3
(d) + 3 and + 3

**Ans. (a) + 3 and + 4**

**Explanation :** In the complexes $[Fe(CN)_6]^{3-}$ and $[Pt(en)(H_2O)_2(NO_2)(Cl)]^{2+}$, the respective oxidation numbers of central metal atoms are + 3 and + 4.

In the complex $[Fe(CN)_6]^{3-}$, the cyano ligand has - 1 oxidation number. Six cyano

ligands contribute - 6 to the oxidation number. The complex ion has a net charge of - 3. Hence, the oxidation number of Fe is + 3.

In the complex $[Pt(en)(H_2O)_2(NO_2)(Cl)]^{2+}$, en and water ligands have o-oxidation number and C1 ligand has −1 oxidation number and $NO_2$ ligand has -1 oxidation number. The net charge of the complex ion is + 2. Hence, the oxidation number of Pt is + 4.

**28. What is the oxidation number of central atom in Na $[Hg(CN)_2]$ ?**

(a) +4
(b) +2
(c) 0
(d) +1

**Ans. (d) +1**

**Explanation :** The oxidation number of central atom is $Na[Hg(CN)_2]$ is + 1. The oxidation state of Na is + 1 and of CN is - 1, so by calculating oxidation state of Hg is

x - 2 = -1

x = -1 + 2

x = + 1

Hence, the oxidation number of central metal Hg is +1.

**29. What is the coordination number of central metal atom in $[Pt(NH_3)_2C1_2]C1$ ?**

(a) 6
(b) 4
(c) 3
(d) 7

**Ans. (b) 4**

**Explanation :** $NH_3$ is neutral while Cr has - 1 charge. Hence cation part of complex has + 2 net charge on it. So, Pt has + 4 oxidation state.

**30. The IUPAC name for the complex $[Co(NO_2)(NH_3)_5]C1_2$ is :**

(a) Nitrito-N-pentaammine cobalt(III) chloride
(b) Nitrito-N-pentaammine cobalt(II) chloride
(c) Pentaammine nitrito-N-cobalt(II) chloride

(d) Pentaammine nitrito-N-cobalt(III) chloride

**Ans. (d) Pentaammine nitrito-N-cobalt(III) chloride**

**Explanation :** Oxidation number of Co is x - 1 = 2 → x = 3. Nitrogen is donating its lone pairs in the given compound. The IUPAC name is pentaammine nitrito-N-cobalt(III) chloride.

**31. The coordination number of 'Co' in the complex $[Co(en)_3]^{3+}$ is :**

(a) 3
(b) 6
(c) 4
(d) 5

**Ans. (b) 6**

**Explanation :** Ethylenediamine is a bidentate chelating ligand for coordination compounds, with the two nitrogen atoms donating their lone pairs of electrons. In the complex $[Co(en)_3]^{3+}$, there are three bidentate en ligands, and the coordination number of the cobalt(III) ion is six because 3 en ligands are present.

**32. Which is not true about the coordination compound $[Co(en)_2C1_2]C1$ ?**

(a) Exhibits geometrical isomerism
(b) Exhibits optical isomerism
(c) Exhibits ionisation isomerism
(d) Is an octahedral complex

**Ans. (c) Exhibits ionisation isomerism**

**Explanation:** The complex $[Co(en)_2C1_2]Cl$ will possess two geometrical isomer (cis and trans) and its cis isomer is optically active that's why the total number of isomer is three. Also, the number of ligands attached are 6 therefore it is a octahedral complex. But it cannot show ionisation isomer because compounds which gives different ions in solution although they have same composition are called ionisation isomerism.

**33. In $Fe(CO)_5$, the Fe-C bond possesses :**

(a) π-character only
(b) Both s and Π- characters
(c) Ionic character
(d) s-character only

**Ans. (b) Both s and π - characters**

**Explanation :** It's called "synergic bonding". The ligand (CO) donates it's lone pair of electrons to the vacant orbitals of the iron atom and forms the sigma- bond. Since the iron atom also possesses some electrons in it's d-orbitals, it back donates those electrons to the molecular orbitals of the ligand forming a p-bond. In this way, the metal-carbon bond length is reduced and the complex donates it's electron pairs to the antibonding molecular orbital of CO, so the C-O bonds is weakened by this synergic bonding, leading to a larger C-O bond length in the complex (as opposed to a free CO molecule).

Metal-C bond length reduces, C-O bond length increases, complex gets stability.

It is important to note that the metal atom gets more stability.

**34. Carbylamine test involves heating a mixture of :**

(a) Alcoholic KOH, methyl iodide, and sodium metal
(b) Alcoholic KOH, methyl iodide, and primary amine
(c) Alcoholic KOH, chloroform, and primary amine
(d) Alcoholic KOH, methyl alcohol, and primary amine

**Ans. (c) Alcoholic KOH, chloroform, and primary amine**

**Explanation :** Aliphatic and aromatic primary amines on heating with CCl4 and alcoholic potassium hydroxide (alc. KOH) gives foul smelling alkyl isocyanides or carbylamines. So, Carbylamine test is performed in alcoholic KOH by heating a mixture of chloroform, and primary amine.

**35. A primary alkyl halide would prefer to undergo :**

(a) $S_N^1$ reaction
(b) $S_N^2$ reaction
(c) a-Elimination
(d) Racemisation

**Ans. (b) $S_N^2$ reaction**

**Explanation :** As primary alkyl halide is least sterically hindered among primary, secondary and tertiary alkyl halides, therefore primary alkyl halides undergo $S_N^2$ reaction.

**36. During the course of $S_N^1$ reaction, the intermediate species formed is :**

(a) A free radical
(b) A carbanion

(c) A carbocation
(d) An intermediate complex

**Ans. (c) A carbocation**

**Explanation :** $S_N1$ reactions are unimolecular and the rate of such reactions depends only on the concentration of one reactant. $S_N1$ reactions happen in two steps :

(i) The leaving group leaves, and the substrate forms a carbocation which is an intermediate.

(ii) The nucleophile attacks the carbocation, forming the product.

**37. The reaction : $CH_3Br + OH- \rightarrow CH_3OH + Br+$**

**(i) The expected mechanism of the above reaction is :**

(a) $S_N1$ mechanism
(b) $S_N2$ mechanism
(c) $S_E1$ mechanism
(d) $S_E2$ mechanism

**Ans. (b) $S_N2$ mechanism**

**Explanation :** Usually, primary alkyl halides and methyl halides undergo substitution by $S_N2$ mechanism. During the by $S_N2$ mechanism, bond breaking and bond formation takes place.

**(ii) The above reaction is :**

(a) Elimination reaction
(b) Nucleophilic addition reaction
(c) Nucleophilic substitution reaction
(d) Electrophilic substitution reaction

**Ans. (c) Nucleophilic substitution reaction**

**Explanation :** $CH_3Br + OH- \rightarrow CH_3OH + Br-$

In this reaction, nucleophile Br- is replaced by another nucleophile OH-. So, this is a nucleophilic substitution reaction.

**38. In alkyl halides, due to greater polarity as well as higher molecular mass,**

**as compared to the parent hydrocarbon, the intermolecular _____ and _____ of attraction are stronger in the halogen derivatives.**

(a) Dipole-dipole and Van der Waal's forces.
(b) Hydrogen bond and dipole-dipole forces.
(c) Van der Waal's and hydrogen bond forces.
(d) Dipole-dipole and London forces.

**Ans. (a) Dipole-dipole and Van der Waal's forces.**

**Explanation :** In alkyl halides, due to greater polarity as well as higher molecular mass, as compared to the parent hydrocarbon, the intermolecular dipole-dipole and Van der Waal's forces of attraction are stronger in the halogen derivatives.

**39. Which of the following alcohol is least soluble in water ?**

(a) N-Butyl alcohol
(b) Iso-Butyl alcohol
(c) Tert-Butyl alcohol
(d) Sec-Butyl alcohol

**Ans. (a) N-Butyl alcohol**

**Explanation :** Amongst isomeric alcohols, as branching increases, the surface area of the non-polar hydrocarbon increases, consequently the solubility increases.

**40. The ionisation constant of phenol is higher than that of ethanol because :**

(a) Phenoxide ion is a stronger base than ethoxide ion
(b) Phenoxide ion is stabilised through delocalization
(c) Phenoxide ion is less stable than ethoxide ion
(d) Phenoxide ion is bulkier than ethoxide ion

**Ans. (b) Phenoxide ion is stabilised through delocalisation**

**Explanation :** As phenoxide ion is stabilized through delocalisation, thus the ionisation constant of phenol is higher than that of ethanol.

**41. The correct order of boiling points for primary (1°), secondary (2°) and tertiary alcohol (3°) is :**

(a) 1° > 2° >3°
(b) 3° > 2° > 1°
(c) 2° > 1° >3°
(d) 2° >3° > 1°

**Ans. (a) 1° 2° >3°**

**Explanation :** For alcohols boiling points depends upon 3 factors, viz. molecular weight, number of available H-bonds and the surface area of the molecule. If the molecular weight of all the alcohols are more or less same, then the boiling point will also be nearly same. Now, both the number of available H-bonds and the surface area of the molecule are least In 3° alcohols and maximum in 1° alcohols. Hence, 3° alcohols have a least boiling point while 1° alcohols have a maximum boiling point. Hence the correct sequence will be, 1° > 2° > 3°.

**42. Lucas test is used for distinction of :**

(a) Alcohols
(b) Phenols
(c) Alkyl halides
(d) Aldehydes

**Ans. (a) Alcohols**

**Explanation :** Lucas test in alcohols is conducted to distinguish between primary, secondary, and tertiary alcohols. It is based on the difference in reactivity of the three classes of alcohols with hydrogen halides through a substitution reaction :

$ROH + HC1 \rightarrow RC1 + H_2O$

**43. The boiling point of methanol is greater than that of methyl thiol because :**

(a) There is intermolecular hydrogen bonding in methanol and no hydrogen bonding in methyl thiol.
(b) There is intramolecular hydrogen bonding in methanol and no hydrogen bonding in methyl thiol.
(c) There is intramolecular hydrogen bonding in methanol and intermolecular hydrogen bonding in methyl thiol.
(d) There is no hydrogen bonding in methanol and intermolecular hydrogen bonding in methyl thiol

**Ans. (a) There is intermolecular hydrogen bonding in methanol and no hydrogen bonding in methyl thiol.**

**Explanation :** Methanol has high boiling point than methyl thiol because there is intermolecular hydrogen bonding in methanol and no hydrogen bonding in methyl thiol.

**44. Alcohols can be obtained from all methods except :**

(a) Hydroboration-oxidation
(b) Oxymercuration-demercuration
(c) Reduction of aldehyde/ketones with Zn-Hg/HCl
(d) By fermentation of starch

**Ans. (c) Reduction of aldehyde/ketones with Zn-Hg/HCl**

**Explanation :** As per the Clemmensen reduction, reduction of aldehydes and ketones with Zn(Hg)/HCl yields alkanes.

**45. When phenol is treated with excess of bromine water, it gives :**

(a) m-bromophenol
(b) o-and p-bromophenol
(c) 2,4-dibromophenol
(d) 2, 4, 6-tribromophenol

**Ans. (d) 2, 4, 6-tribromophenol**

**Explanation :** When phenol is treated with excess bromine water, it gives 2, 4, 6-tribromophenol

**46. _____ is an example of trihydric alcohol and _____ is an example of dihydric alcohol. Ethyl bromide on reaction with moist silver oxide gives _____ as the main product.**

(a) iso-propanol, methanol, ethanol
(b) Glycol, ethanol, methanol
(c) Ethanol, glycol, propanol
(d) Glycerol, glycol, ethanol

**Ans. (d) Glycerol, glycol, ethanol**

**Explanation :** Glycerol is an example of trihydric alcohol and glycol is an example of dihydric alcohol. Ethyl bromide on reaction with moist silver oxide gives ethanol. as the main product.

**47. Alcohols act as _____ due to the presence of unshared electron pairs on oxygen atom. Ethers are _____ in nature.**

(a) Bronsted bases, basic
(b) Bronsted acids, acidic
(c) Bronsted acid, neutral
(d) Bronsted bases, amphoteric

**Ans. (a) Bronsted bases, basic**

**Explanation :** Alcohols act as bronsted bases due to the presence of unshared electron pairs on oxygen atom. Ethers are basic in nature.

**48. The addition of HCN to carbonyl compounds is an example of :**

(a) Nucleophilic addition
(b) Electrophilic addition
(c) Free radical addition
(d) Electromeric addition

**Ans. (a) Nucleophilic addition**

**Explanation :** The reaction of HCN with carbonyl compounds is an example of the nucleophilic addition reaction. The base is used as a catalyst and it deprotonates the HCN molecule to produce a stronger nucleophile i.e., cyanide ion. The cyanide ion thus formed acts as a nucleophile which attacks at the double bond of carbon and oxygen and forms an addition product.

**49. Which of the following compounds will undergo Cannizzaro reaction ?**

(a) $CH_3CHO$
(b) $CH_3COCH_3$
(c) $C_6H_5CHO$
(d) $C_6H_5CH_2CHO$

**Ans. (c) $C_6H_5CHO$**

**Explanation :** Self-oxidation and reduction of aldehydes which do not possess an alpha hydrogen atom in the presence of concentrated alkali (aqueousor alcoholic) is known as Cannizzaro reaction. The reaction products are alcohol and salt of carboxylic acid.

**50. Which of the following does not answer iodoform test ?**

(a) n-Butyl alcohol
(b) Ethylmethyl ketone
(c) Acetophenone
(d) Acetaldehyde

**Ans. (a) n-Butyl alcohol**

**Explanation :** Iodoform test is given by the compounds containing $CH_3CO$-group or $CH_3CHO$-group. From the given options, acetophenone, acetaldehyde and ethylmethyl ketone, all will give positive iodoform test because all are having $CH_3CO$ present. But the n-butyl alcohol will not give positive iodoform test as it does not have $(CH_3)RCH$-OH group that can be oxidized to $CH_3CO$.

**51. Which of the following compound will undergo self-aldol condensation in the presence of cold dilute alkali ?**

(a) CH = C-CHO
(b) $CH_2$ = CHCHO
(c) $C_6H_5CHO$
(d) $CH_3CH_2CHO$

**Ans. (d) $CH_3CH_2CHO$**

**Explanation :** Since CH3CH2CHO has a-hydrogen atom, therefore it will undergo self-aldol condensation in the presence of cold dilute alkali.

**52. Trimer of acetaldehyde is named as _____ .**

(a) Paraldehyde
(b) Formaldehyde
(c) Metaldehyde
(d) Pentaldehyde

**Ans. (a) Paraldehyde**

**Explanation :** Trimer of acetaldehyde is named as Paraldehyde which is the cyclic trimer of acetaldehyde molecules. Formally, it is a derivative of 1,3,5- trioxane, with a methyl group substituted for a hydrogen atom at each carbon.

**53. A _____ precipitate is obtained on adding iodine and sodium hydroxide to _____ .**

(a) Red, acetic acid
(b) Yellow, ketone
(c) Orange, propanol
(d) Blue, acetaldehyde

**Ans. (b) Yellow, ketone**

**Explanation :** When acetone reacts with iodine in the presence of alkali, iodoform is formed which is a light yellow color precipitate and the reaction is known as iodoform reaction. The reaction is as follows :

$C_6H_5COCH_3 + NaOH + I_2 \rightarrow C_6H_5Ca_2Na + CHI_3$

**54. Benzaldehyde undergoes _____ reaction on treatment with concentrated sodium hydroxide because it has _____ atom.**

(a) Cannizzaro, no alpha-hydrogen
(b) Aldol condensation, alpha hydrogen
(c) Wurtz, no alpha-hydrogen

(d) HVZ reaction, alpha hydrogen

**Ans. (a) Cannizzaro, no alpha-hydrogen**

**Explanation :** Benzaldehyde undergoes cannizzaro reaction on treatment with concentrated sodium hydroxide because it has no alpha-hydrogen atom. One molecule of benzoic acid is oxidised to benzoate ion and other molecule is reduced to benzyl alcohol.

**55. The reaction of a primary amine with chloroform and ethanolic KOH is called :**

(a) Carbylamine reaction
(b) Kolbe's reaction
(c) Reimer-Tiemann reaction
(d) Wurtz-Fitting reaction

**Ans. (a) Carbylamine reaction**

**Explanation :** The reaction of a primary amine with chloroform and ethanolic KOH is called as carbylamine reaction, which is given as :

$RNH_2 + CHC1_3 + 3KOH \rightarrow RN^+ = C^- + 3KC1 + 3H_2O$

**56. Which of the following does not react with Hinsberg reagent ?**

(a) Ethyl amine
(b) $(CH_3)_2NH$
(c) $(CH_3CH_2)_3N$
(d) Propane-2-amine

**Ans. (c) $(CH_3CH_2)_3N$**

**Explanation :** N,N-Diethylethanamine $(CH_3CH_2)_3N$ is a Tertiary amine. Tertiary amines ($R_3N$) does not react with Hinsberg reagent ($C_6H_5SO_2C1$) as there are no freely available hydrogen on the amine group which can donate electrons to the sulphur of the Hinsberg reagent.

**57. The linkage that holds monosaccharide units together in a polysaccharide is called :**

(a) Peptide linkage
(b) Glycoside linkage
(c) Ester linkage
(d) Ionic linkage

**Ans. (b) Glycoside linkage**

**Explanation :** In polysaccharides, the linkage connecting monosaccharide is called a glycosidic linkage. Glycosidic linkage is the covalent bond between two or more monosaccharides to form a polysaccharide. It is formed between the hemiacetal or hemiketal group of a saccharide (or a molecule derived from a saccharide) and the hydroxyl group of some compound such as alcohol.

**58. _____ is a monosaccharide which is sweeter than sucrose.**

(a) Fructose
(b) Glucose
(c) Galactose
(d) Maltose

**Ans. (a) Fructose**

**Explanation :** Fructose is a naturally occurring monosaccharide which is sweeter than sucrose. It is 1.2-1.8 times sweeter than sucrose. Fructose metabolism does not require insulin and has a low impact on blood glucose levels.

**59. a-helix refers to :**

(a) Primary structure of proteins
(b) Secondary structure of proteins
(c) Tertiary structure of proteins
(d) Quaternary structure of proteins

**Ans. (b) Secondary structure of proteins**

**Explanation :** Proteins are the polypeptides of amino acid and they have different structure which is because of a different arrangement of amino acid. a-helix refers to secondary structure of proteins. In other words, the folding of the linear polypeptide chain into a specific structure that has the alpha helix is called the secondary structure.

**60. The non-proteinous substances which certain enzymes require for their activity are called :**

(a) Catalysts
(b) Inhibitors
(c) Co-enzymes
(d) Epimers

**Ans. (c) Co-enzymes**

**Explanation :** The non-proteinous substances which certain enzymes require for their activity are called co-enzymes that are organic molecules required by certain enzymes to carry out catalysis. Co-enzymes function as an intermediate carriers of electrons, specific atoms or functional groups that are transferred in the overall reaction. They bond to the active site of the enzyme and participate in catalysis but are considered substrates of the reaction.

**61. Amino acids are least soluble in water :**

(a) At pH = 7
(b) At pH > 7
(c) At pH < 7
(d) At isoelectric point

**Ans. (d) At isoelectric point**

**Explanation :** Amino acids are least soluble in water when the pH of the solution is the same as the isoelectric point for the amino acid.

**62. Which of the following amino acid is not optically active ?**

(a) Alanine
(b) Glycine
(c) Phenylanine
(d) All are optically active

**Ans. (b) Glycine**

**Explanation :** All amino acids have an amine and a carboxyl group. They also have a functional group which is unique to each of them. Depending on the polarity of the functional group the amino acid can be rendered optically inactive or active. The simplest of all amino acids, Glycine which has H as a functional group lacks optical acitivity, as the saturated alpha carbon is unsubstituted. Others among the 20 amino acids have D or L stereoisomers.

**63. At isoelectric point the amino acids have _____ solubility in water.**

(a) Maximum
(b) Zero
(c) Least
(d) None of these

**Ans. (c) Least**

**Explanation :** At isoelectric point the amino acids have least solubility in water. The solubility of amino acids depend on the pH of the solution. The intermediate pH at

which a protein molecule has a net charge of zero is called the isoelectric point of that protein. In general, the net charge on the protein, either positive or negative, can interact with water molecules, meaning that it is more likely water soluble. As a result, amino acid is the least soluble when the pH of the solution is at its isoelectric point.

**64. Neutral amino acids have _____ in the pH range of 5.6 - 6.3.**

(a) Iso-electric point
(b) Electric point
(c) Piezoelectric point
(d) None of the above

**Ans. (a) Iso-electric point**

**Explanation :** The isoelectric point (IP) is the pH at which the amino acid has an overall zero charge. The isoelectric point (IP) of neutral amino acids range from 5.6 - 6.3.

**65. A nucleoside is made up of :**

(a) A base and sugar
(b) A base and phosphoric acid
(c) A sugar and phosphoric acid
(d) A sugar, a base and phosphoric acid

**Ans. (a) A base and sugar**

**Explanation :** Nucleoside is sugar + base. Nucleosides are glycosylamines that can be thought of as nucleotides without a phosphate group. A nucleoside consists simply of a nucleobase (also termed as nitrogeneous base) and a 5-carbon sugar (either ribose or deoxyribose).

**66. The sequence of bases on m-RNA molecule, synthesised on the GCATA strand of DNA is :**

(a) CGUAU
(b) CGTAT
(c) TACGC
(d) ATCGC

**Ans. (a) CGUAU**

**Explanation :** The sequence of bases on m-RNA molecule synthesised on the GCATA strand of DNA is CGUAU. Within the RNA double helix, A forms two hydrogen bonds with U on the opposite strand, and G forms three hydrogen bonds with C on the opposite strand.

**67. Which of the following is correct about H-bonding in nucleotide ?**

(a) A-T, G-C
(b) A-G, T-C,
(c) G-T, A-C
(d) A-A, T-T

**Ans. (a) A-T, G-C**

**Explanation :** The double helix structure of DNA molecule is made up of polynucleotide chains which are held together by H-bonds. In these helixes, the adenine (A) base is linked with thymine (T) by two H-bonds and guanine (G) is linked with cytosine (C) by three H-bonds as A = T and G = C.

**68. The chemical changes in DNA molecule that could lead to synthesis of proteins with an altered amino acid sequence is called _____ .**

(a) Transcription
(b) Translation
(c) Mutation
(d) Replication

**Ans. (c) Mutation**

**Explanation :** The chemical changes in DNA molecule that could lead to synthesis of proteins with an altered amino acid sequence is called mutation.

**69. The sugar in RNA is _____ .**

(a) D-ribose
(b) L-ribose
(c) Deoxyribose
(d) D-ribonucleic

**Ans. (a) D-ribose**

**Explanation :** Ribose, also called D-ribose is a five-carbon sugar found in RNA, where it alternates with phosphate groups to form the "backbone" of the RNA polymer and binds to nitrogenous bases. Thus, the sugar in RNA is D-ribose.

**70. The helical structure of protein is stabilised by :**

(a) Hydrogen bonds
(b) Ether bonds
(c) Peptide bonds
(d) Dipeptide bonds

**Ans. (a) Hydrogen bonds**

**Explanation :** The helical structure of protein is stabilised by hydrogen bonds between amide group of the same peptide chain. These bonds are formed by -NH- group of one unit and oxygen of carbonyl group of the third unit. This H-bonding is responsible for holding helix in a position.