ISC Class 12 Exam 2024

Chemistry

Reasoning Based Questions

1. When and why is molality preferred over molarity in handling solution in chemistry?

Ans. Molality is preferred in studies that involve change in temperature as in some of the colligative properties of solutions. This is because molality depends on mass of solvent which do not change the temperature.

2. The dissolution of ammonium chloride in water is an endothermic process but still it dissolves in water readily. Why ?

Ans. This is because the entropy changes. In this case, DS = positive NH4Cl (aq) NH4+ + Cl– The ion that were held together in crystalline solid are free and moves in all positive directions. Its entropy increases and this makes TDS > DH i.e., DG = negative.

3. Why does a solution of ethanol and cyclohexane cyclohexane shows positive deviation from Raoult's law ?

Ans. On adding cyclohexane to ethanol, its molecule get in between the molecule of ethanol thus breaking the hydrogen bond and reducing interaction between ethanol molecules. This will increase the vapour pressure of the solution and results in positive deviation from Raoult's law.

4. Why vapour pressure of solution of glucose in water is lower than that of water ?

Ans. This is due to decrease in the escaping tendency of the water molecules from the surface of the solution as of the surface area is occupied by non-volatile solute, i.e., glucose particles.

5. Why does pressure cooker reduces cooking time ?

Ans. As steam inside the cooker build up the pressure hence develops heat faster and maintain temperature. The increased pressure inside cooker increases the boiling point and food is cook before the boiling point of water is attained.

6. Cutting onion taken from the fridge is more comfortable than cutting onion lying at room temperature. Explain why.

Ans. At lower temperature, the vapour pressure is low. Also the vapours of the tear producing chemical are less. Hence it is more comfortable to cut onions taken out from the fridge.

7. Why is liquid ammonia bottle first cooled in ice before opening it ?

Ans. At room temperature, the vapour pressure of ammonia is very high, on cooling, the vapour pressure decreases and hence liquid ammonia will not splash out.

8. Addition of one liquid to other causes decrease decrease in its vapour pressure. Explain, why ?

Ans. Addition of liquid decreases surface area of previous liquid which decreases number of molecules of vapour as well as vapour pressure of liquid.

9. Why are aquatic species more comfortable in cold water in comparison to warm water ?

Ans. At a given pressure the solubility of oxygen in water increases with decrease in temperature. Presence of more oxygen at lower temperature makes the aquatic species more comfortable in cold water.

10. Why is osmotic pressure of 1 M KCl higher than 1 M urea solution ?

Ans. This is because KCl dissociates to give K+and Cl– ion while urea being a molecular solid does not dissociates into ions in the solution.

11. Solution A is prepared by dissolving 2 mole of glucose in 1 litre of water and solution B is prepared by dissolving 1 mole of sodium chloride in 1 litre of water. will the osmotic pressure of solution A be higher, lower or equal to that of B ? Give reasons for your answer.

Ans. The osmotic pressure of the two solutions A and B will be equal. Osmotic pressure is a colligative property, hence it depends upon the number of particles of solute in solution and not upon the nature of the particles. Glucose is a non electrolyte solute therefore, on dissolving two mole of glucose in one litre of water it will not dissociate. However, sodium chloride will dissociate into sodium ions and chloride ions because it is a strong electrolyte. NaCl Na+ + Cl– (1 mole) (1 mole) (1 mole) Due to dissociation one mole of NaCl will form two mole of particles (one mole Na+ and one mole Cl–). In glucose, there are 2 moles of glucose in 1 litre in NaCl, due to dissociation there will be 2 moles in 1 litre. Therefore, the osmotic pressure will be same.

12. 0·1 M urea solution shows less depression in freezing point than 0·1 M $MgC1_2$ solution. Explain.

Ans. Depression in freezing point is a colligative property which depends upon the number of particles present in the solution. $MgCl_2$ when dissolved in water gives three particles per molecule

$MgC1_2$ Mg^{2+} + $2C1^-$ (3 particles on dissociation)

0.1 M urea solution shows less depression in freezing point than 0.1 M $MgC1_2$ solution because $MgC1_2$ is electrolyte that dissociate to give 3 ions.

13. Why does sodium chloride solution freezes at a lower temperature than water ?

Ans. On the other hand, urea remains undissociated. Hence, $MgC1_2$ has depression in freezing point than urea.

14. The molecular weights of sodium chloride and glucose are determined by the depression of freezing point method. Compared to their theoretical molecular weights, what will be their observed molecular weights when determined by the above method ? Justify your answer.

Ans. Sodium chloride is a strong electrolyte therefore dissociates in solution to give twice the actual number of particles, therefore, the molecular weight determined by colligative property will be half of the actual weight. The molecular weight of the non-electrolyte glucose will be same as the theoretical molecular weight.

15. Water boils above 100°C by the addition of NaCl. Why ?

Ans. Water boils above 100°C by the addition of NaCl because because salt is a non-volatile solute and addition of salt increases the boiling point of water which is responsible for boiling point elevation.

16 The elevation in boiling point produced by dilute equimolal solutions of three substances are in the order A > glucose > B. Suggest a reason for this observation.

Ans. This observation suggests that The substance A undergoes dissociation and substance B undergoes association while glucose is a non-electrolyte and neither undergoes association nor dissociation.

17. The molecular weights of potassium chloride and glucose are determined by the depression in freezing point method. As compared to their theoretical molecular weights, what do you expect about their molecular weights determined by this experiment ? Why ?

Ans. When potassium chloride is dissolved in water it is dissociated into K+ and Cl –. Thus, the number of particles becomes double (because one KCl molecule forms two ions). The depression in freezing point (ΔTf) is a colligative property which depends upon the number of solute particles and not upon their nature. Thus, ΔTf becomes double due to the dissociation of KCl. The molecular weight of solute is inversely proportional to the colligative property. Thus, due to double the value of colligative property (ΔTf) the observed molar mass of KCl will be half of its actual value.

On the other hand, glucose molecules will not undergo any association or dissociation, therefore, the number of particles will remain same. Thus, there will be no change in colligative properties and molar mass and the actual value and observed value with the help of ΔTf , will be same in case of glucose.

18. What care is generally taken, during intravenous injection and why ?

Ans. During intravenous injection, the concentration of the solution should be approximately same as that of blood plasma so that they are isotonic if the solution to be injected is hypertonic, it will cause blood cells to shrink and, if the solution to be injected is hypotonic, it will cause blood cells to burst.

19. Why is alternating current used for measuring resistance of an electrolytic solution ?

Ans. Alternating current is used in electrolysis so that concentration of ions in the solution remains constant and exact value of resistance is measured.

20. Why does a dry cell becomes dead after a long time even if it has not been used ?

Ans. Dry cell become dead after long time, even if it has not been used because dry cell contains an acidic salt NH4Cl which corrodes the zinc container. Thus, the cell becomes dead after a long time even when it is not in use.

21. Why does a galvanic cell becomes dead after some time ?

Ans. Galvanic cell becomes dead after some time due to various reasons. One reason may be that the electrode which is the anode (being oxidised) may simply be used up, i.e., there are no more atoms to remove electrons from which means there are no more electrons moving. Another reason can be that the substance in the salt bridge or electrolyte may have a level too low to allow for movement of ions or the waste products may accumulate to such a degree that charges can no longer move.

22. Why does the conductivity of a solution decreases with dilution ?

Ans. Conductivity of a solution is the conductance of ions present in a unit volume of the solution. On dilution, the number of ions per unit volume decreases. So, the conductivity also decreases.

23. Why on dilution the lm of CH3COOH increases drastically while that of CH3COONa increases gradually ?

Ans. In the case of CH^3COOH which is a weak electrolyte the number of ions increases on dilution due to increase in degree of dissociation.

$CH^3COOH + H^2O \; CH^3COO^- + H^3O^+$

In the case of strong electrolyte such as CH_3COONa, the number of ions remains the same but the interionic attraction decreases due to which lm of CH_3COONa increases gradually.

24. Specific conductance decreases with dilution whereas equivalent conductance increases with dilution. Explain.

Ans. Specific conductance decreases with dilution as the number of current carrying particles, i.e., ions present per cm3 of solution becomes less and less. Equivalent conductance increases with dilution because the degree of dissociation of an electrolyte increases on dilution.

25. Why is it not possible to measure the single electrode potential ?

Ans. Oxidation or reduction cannot takes place alone. Therefore, it is not possible to measure single electrode potential because the half cell containing single electrode cannot exist independently, as charge cannot flow on its own in a single electrode. Moreover, electrode potential is a relative tendency and can be measured with respect to a reference electrode only.

26. The value of standard electrode potential for oxidation of Cl– ions is more positive than that of water, even then in the electrolysis of aqueous sodium chloride. Why is Cl– oxidised at anode instead of water ?

Ans. In the electrolysis of aqueous sodium chloride solution, Cl– is oxidised at anode because at anode, the reaction with lower value of E° is preferred for oxidation. Thus, at anode $O_2(g)$ must have been produced instead of $C1_2(g)$ but the formation of O_2 at anode is kinetically so slow and needs some overvoltage to be additionally provided.

Thus, At anode, oxidation reaction takes place and ions get oxidized. At cathode, reduction reaction takes place and ions get reduced. Thus, reaction at anode will be:

$C1^- \rightarrow C1_2 + e^-$ $E° = 1.36V$

$2H_2O \rightarrow O_2 + 4H^- + 4e^-$ $E° = 1.23V$

27. Why does an aqueous solution of NaC1 on electrolysis gives H2 gas at the cathode and not sodium metal ?

Ans. Sodium chloride and water ionize as follows:

$NaC1(aq) \rightarrow Na^+(aq) + C1^-(aq)$

$H_2O(l)$ □ $H^+(aq) + OH^-(aq)$

At cathode: Both Na^+ and H^+ ions are present near the cathode. But the discharge potential of H+ is lower than that of Na+ ion. So H+ ions are discharged in preference to Na+ ions.

$H^+ + e^- \rightarrow H$

$H + H \rightarrow H_2(g)$

Thus H_2 gas is liberated at the cathode and Na^+ ions remain in the solution.

28. Why electrolysis of NaBr and NaI gives Br2 and I2 respectively while that of NaF gives O2 instead of F2 ?

Ans. Br– and I – ion have higher oxidation potentials than water. Hence, they are more easily oxidised. But F– ions have lower oxidation potential than H2O. So, H2O is easily oxidised to give O2 gas.

29. How will the pH of brine (aq. NaCl solution) be affected when it is electrolysed ?

Ans. The pH of the solution will increase as NaOH is formed in electrolytic cell.

30. Can you store copper sulphate solution in a zinc pot ?

Ans. For this we have to check whether the following reaction will take place or not.

$Zn(s) + CuSO^4 (aq)\ ZnSO^4 (aq) + Cu(s)$

$_E°cell = {}_E°Cu2+/Cu - {}_E°Zn2+/Zn = 0·34 - 0·76 = 1·10$ V

E°cell is positive, the reaction will take place there. Therefore, we cannot store copper sulphate in zinc pot.

31. Explain precipitation of silver when copper rod is dipped in silver nitrate solution.

Ans. When copper rod is dipped in silver nitrate solution, silver is precipitated because copper metal lies above in the electrochemical series. That is why it replaces silver from silver nitrate solution or the reduction potential of silver is +0·80V while that of Cu is + 0·34V and a metal with lower reduction potential displaces the metal with higher reduction potential.

32. When a zinc piece is added to CuSO4 solution, copper gets precipitated, why ?

Ans. Standard electrode potential of zinc is lesser than that of copper hence, zinc metal gets oxidised to Zn2+ ions and Cu2+ ions gets reduced to copper metal.

33. Blocks of magnesium are often strapped to the steel hulls of ocean going ships. Why ?

Ans. Magnesium prevents the oxidation of steel by transferring the excess of electrons to the steel. Thus, rusting of steel is protected and it is called cathodic protection. Thus, blocks of magnesium provide cathodic properties and protect steel from oxidation.

34. Why a salt bridge or a porous plate is not needed in a lead storage battery ?

Ans. The half cells in a cell must be separated only if the oxidising and reducing agents can migrate to the other half cell. In lead storage cell the oxidising agent PbO2 and the reducing agent Pb as well as their oxidation and reduction product PbSO4 are solids. Therefore, there is no need to separate half cells.

35. Why an aqueous solution of NaCl on electrolysis gives H_2 gas at cathode and not the Na metal ?

Ans. Because the standard electrode potential of hydrogen is higher than that of Na, therefore, water gets reduced and gives H2 gas at cathode.

36. Electrolysis of KBr (aq.) gives Br_2 at anode but KF (aq.) does not give F_2 at anode. Why ?

Ans. Br – ions have higher oxidation electrode potential than water, hence KBr gets oxidized to give Br_2 while the oxidation electrode potential of F – ions is lower than water hence KF would not oxidize in comparison of water.

37. Why does the rate of a reaction increase with rise in temperature ?

Ans. At higher temperature larger fraction of colloiding particles can cross the energy barrier (i.e., activation energy) which leads to faster rate.

38. Why the probability of reaction with molecularity higher than three is very rare ?

Ans. The probability of more than three molecules colliding simultaneously is very small. Hence possibility of molecularity being there is very rare.

39. Why does the rate of any reaction generally decreases during the course of the reaction ?

Ans. The rate of reaction depends upon the concentration of reactants. As the reaction proceeds the concentration of reactant decreases hence rate of chemical reaction decreases.

40. Why is it that instantaneous rate of reaction does not changes when a part of the reacting solution is taken out ?

Ans. Instantaneous rate is measured over a very small interval of time. Hence, it does not changes when a part of solution is taken out.

41. Can a reaction have zero activation energy ?

Ans. If Ea = 0, then according to Arrhenius equation $K = Ae^{-Ea/RT} = Ae^{\circ} = A$. This implies that every collision results into a chemical reaction which cannot be true. Hence, a reaction cannot have zero activation energy.

42. Why is molecularity applicable only for elementary reaction and order is applicable for elementary as well as complex reaction ?

Ans. A complex reaction proceeds through several elementary reactions. Number of molecules involved in each elementary reaction may be different i.e., the molecularity of each step may be different. Therefore, discussion of molecularity of overall complex reaction is meaningless. On the other hand order of a complex reaction is determined by the slowest step in its mechanism and is not meaningless even in the case of complex reaction.

43. For a zero order reaction will the molecularity be equal to zero ? Explain.

Ans. No, the molecularity can never be equal to zero or a fractional number. Molecularity is the number of molecules involve in each elementary reaction which may be different i.e., the molecularity of each step may be different.

44. For a reaction A + B Product the rate law is Rate = k [A] [B]3/2. Can the reaction be an elementary reaction ? Explain.

Ans. During an elementary reaction, the number of atoms or ions colliding to react is referred to as molecularity. If the given reaction is an elementary reaction the order of reaction with respect to B would be 1. But in the give rate law it is 3/2. This indicates that the reaction is not an elementary reaction.

45. In some cases, it is found that a large number of colloiding molecules have energy more than threshold value, yet the reaction is slow why ?

Ans. The main reason behind the reaction to be slow even after a large number of colliding molecules have energy more than threshold energy for a reaction, is because of the improper alignment of the molecules which are colliding.

46. How do temperature and presence of a catalyst brings about an increase in the rate of a reaction ?

Ans. Increase in temperature increases the kinetic energy of the molecules thus a larger fraction of molecules have energy equal to or more than the threshold energy. Hence, the rate of reaction increases. Presence of a catalyst provides an alternate path for the reaction to proceed which has lower energy barrier therefore, more reacting molecules have sufficient energy to cross it.

47. Why do transition metal ions possess a great tendency to form complexes ?

Ans. The transition metal ions possess a great tendency to form complexes because of their small size, high ionic charge and availability of partially filled d-orbitals for bond formation. These partially filled d-orbitals can easily accommodate ligands, electrons and consequently transition metal ions form complexes. Examples $[Fe(CN6)]^{3-}$, $Ni(CO)_4$ etc.

48. The paramagnetic character in 3d-transition series elements increases upto Mn and then decreases. Why ?

Ans. In the 3d-transition series as we move from Sc(21) to Mn(25), the number of unpaired electrons increases and hence paramagnetic character increases. After Mn, the pairing of electrons in the d-orbital starts and the number of unpaired electrons decreases and hence, the absorption of visible light. Since, the energy involved in d-d transition is quantised, only a definite wavelength gets absorbed, remaining wavelengths present in the visible region gets transmitted. Therefore, transmitted light shows some colour complementary to the absorbed colour.

49. In a given transition series, there is no significant change in the atomic radii of elements with increase in atomic number. Explain why ?

Ans. In a transition series the electrons are filled in inner d-orbitals so there is no increase in the number of shells but there is an increase in the nuclear charge and also an increase in the repulsion between inner orbital electrons. The two opposite forces i.e., increased attraction by the nucleus and increased repulsion between electrons counter balance each other, as a result there is no significant change in atomic radii of transition elements.

50. Why Cd salts are white ?

Ans. Cd salts are white because they have fully filled d-orbitals, hence d-d transitions is not possible.

51. Why tungsten is used as a filament ?

Ans. Due to high melting point and high resistance, tungsten is used as a filament.

52. Why K2Cr2O7 is generally preferred to Na2Cr2O7 in volumetric analysis although both are oxidising agents ?

Ans. Potassium dichromate is preferred over sodium dichromate in volumetric analysis because the latter is hygroscopic in nature and, therefore, accurate weighing is not possible in normal atmospheric conditions.

53. Why chromium is used for electroplating iron ?

Ans. Chromium is shiny in nature and it makes the object attractive after electroplating. Also it is corrosion and scratch resistant. This is the reason that chromium is used for electroplating iron.

54. Why Ti4+ complexes are diamagnetic ?

Ans. Ti^{4+} complex are diamagnetic because it has no unpaired electrons

$Ti_{4+}(\rightarrow)1s_2$, 2 s_2, 2 p_6, 3 s_2, 3 p_6.

55. Why transition elements have high melting and boiling points ?

Ans. The melting and boiling points of transition elements are generally high. this is due to strong metallic bonds and the presence of half filled d-orbitals in them. Due to these half filled orbitals some covalent bonds exist between atoms of transition elements, because of strong inter atomic bonding, they have high melting and boiling points.

56. Why transition metals and their compounds are widely used as catalysts ?

Ans. Transition metals and their compounds are extensively used as catalysts due to following reasons :

(i) Their partially empty d-orbitals provides surface area for the reactant molecules.

(ii) They combines with reactant molecules to form transition state and lowers the activation energy.

(iii) They show multiple oxidation states and by giving electrons to reactants they form complexes and lowers their energies.

57. Silver ores have to be leached with cyanides. Give a reason for this.

Ans. Silver forms water soluble complexes with alkali metal cyanides (NaCN, KCN) from which pure metal can be precipitated by the addition of more electropositive metal like zinc. Therefore, silver metal is extracted by leaching with metal cyanides.

58. Explain why, melting point of transition metals first increases to maximum and then decreases regularly towards the end of the period.

Ans. The strength of inter atomic bonds in transition elements is roughly related to the number of half filled d-orbitals. In the beginning the number of half filled d-orbitals increases till the middle of the period causing increase in strength of interparticle bonds. But thereafter, the pairing of electrons in d-orbitals occurs and the number of half-filled orbitals decreases which also causes decrease in the melting point.

59. Why are transition elements named so ?

Ans. Transition elements are named so because their properties are in between those of s and p-block elements.

60. In what way is the electronic configuration of transition elements different from that of the non-transition elements ?

Ans. Transition elements contain incompletely filled d-subshell i.e., their electronic configuration is (n–1) d1–10 ns1–2 whereas non-transition elements have no d-subshell or their subshell is completely filled and have ns1–2 or ns2 np1–6 electrons in their outermost shell.

61. Why does a transition series contain 10 elements ?

Ans. There are five d-orbitals in an energy level and each orbital can contain two electrons. As we more from one element to the next, an electron is added. For complete filling of the five d-orbitals 10 electrons are required.

62. Why are transition elements known as d-block elements ?

Ans. Transition elements are known as d-block elements because. The last electron enters (n–1) d-orbital i.e., d-orbital of the penultimate shell.

63. Why do transition elements shows similarities along the horizontal period ?

Ans. All transition elements contain incompletely filled d-subshell whereas outershell electronic configuration remains the same.

64. Reactivity of transition element decreases almost regularly from Sc to Cu. Explain.

Ans. It is due to regular increase in ionisation enthalpy.

65. Why copper does not replace hydrogen from acids ?

Ans. Since Cu has positive value of E° thus it does not replaces H2 from acids.

66. Which of the 3d series of the transition metal exhibits the largest number of oxidation state and why ?

Ans. Manganese (Z = 25), as its atom has the maximum number of unpaired electron. Thus it shows oxidation states from + 2 to + 7 (+ 2, + 3, + 4, + 5, + 6 and + 7) which is the maximum number.

67. Why do Zr and Hf exhibit almost similar properties ?

Ans. Zr and Hf have similar ionic size, due to which they exhibit almost similar properties.

68. Which divalent metal ion has maximum paramagnetic character among the first transition series ? Why ?

Ans. Mn2+ has the maximum paramagnetic character because of the maximum number of unpaired electrons i.e., 5.

69. Why are lanthanoids called f-block elements.

Ans. Lanthanoids are called f-block elements because the last electron in them enters into f-orbital.

70. On what basis can you say that scandium (Z = 21) is a transition element but zinc (Z = 30) is not ?

Ans. On the basis of incompletely filled 3d-orbitals in case of scandium atom in its ground state (3d1), it is regarded as a transition element on the other hand, zinc atom has completely filled d-orbitals (3d10) in its ground state as well as in its oxidised state. Hence, it is not regarded as transition element.

71. The E° (M2+/M) value for copper is positive (+ 0·34V). What is possibly the reason for this ?

Ans. E° (M2+/M) for any metal is related to the sum of the enthalpy changes taking place in the following steps :

M(s) + ΔaH M(g)

M(g) + ΔiH M_2+(g)

M_2+(g) + aq M_2+(aq) + Δhyd ^{H}

Copper has high enthalpy of ionisation and relatively low enthalpy of hydration. So E° (Cu2+/Cu) is positive. The high energy to transform Cu(s) to Cu2+(aq) is not balanced by its hydration enthalpy.

72. Explain, why an aqueous solution of potassium hexacyanoferrate(II) does not give the test for ferrous ion ?

Ans. Potassium hexacyanoferrate(II) does not gives ferrous ion test, because it is a coordination compound and coordination compounds do not ionise in aqueous solution, thus does not give ferrous ion test.

73. Why is CO a stronger ligand than Cl– ?

Ans. CO is a stronger ligand than Cl– because it can form 'sigma' (sigma) as well as 'pi'-bond, therefore it is stronger ligand than Cl–.

74. Why are low spin tetrahedral complexes not found ?

Ans. Low spin tetrahedral complexes are not found, because for tetrahedral complexes, the crystal field stabilisation energy is lower than paring energy.

75. Tetrahedral complexes do not show geometrical isomerism. Why ?

Ans. Tetrahedral complexes do not show geometrical isomerism because the relative position of the ligands attached to the central metal atom are the same with respect to each other.

76. The trans isomer of complex CoCl2 (en)2 is optically inactive. Why ?

Ans. It is because the trans isomer has a plane of symmetry and can be divided into two equal halves.

77. Why chelate complexes are more stable than unchelated complexes ?

Ans. When a chelating ligand attaches to the central metal atom the process is accompanied by the increase in entropy resulting in the formation of a stable complex.

78. Why $[Co(NH_3)_6]^{3+}$ is an inner orbital complex whereas $[Ni(NH_3)_6]^{2+}$ is an outer orbital complex?

Ans. In $[Co(NH_3)_6]^{3+}$ inner d-orbitals are used in hybridisation whereas in $[Ni(NH_3)_6]^{2+}$ outer d-orbitals of valence shell are used in hybridisation.

79. Explain why K_3 $[Fe(CN)_6]$ is more stable than $K_4[Fe(CN)_6]$?

Ans. In $K_4[Fe(CN)_6Fe$ is present as Fe^{2+}

In $K_3[Fe(CN)_6]$, Fe is present Fe^{3+}

Due to the increase in charge, there is a decrease in the size of the atom and stability increases.

Hence, $K_3[Fe(CN)_6]$ is more stable.

80. Why inner orbital octahedral complexes are called low spin complexes ?

Ans. Inner orbital octahedral complexes are also called low spin complexes because of the pairing of electrons in them they can have either zero or maximum of one unpaired electrons and hence their magnetic moment can't exceed 173 B.M.

81. Why outer orbital octahedral complexes are called high spin complexes ?

Ans. Outer octahedral complexes are also called high spin complexes because as no pairing occurs in these complexes, they cannot have many unpaired electrons (from 1 to 5) and hence, high large value of magnetic moment.

82. Ethyl iodide undergoes S_N^2 reaction faster than ethyl bromide. Why ?

Ans. Since I_- ion is a better leaving group than Br_- ion, hence CH_3I reacts faster than CH_3Br in S_N^2 reaction with OH– ion.

83. (±) 2-Butanol is optically inactive. Why ?

Ans. (±) 2-Butanol is a racemic mixture i.e., there are two enantiomers in equal proportion. The rotation by one enantiomer will be cancelled by the rotation due to the other isomer, making the mixture optically inactive. Thus, 2-butanol is optically inactive.

84. C—X bond length in halobenzene is smaller than C—X bond length in CH_3—X. Why ?

Ans. In CH_3—X the carbon atom is sp_2 hybridised while in halobenzene the carbon atom is sp_3 hybridised. The sp_2 hybridised carbon is more electronegative due to greater s-character and hold the electron pair of C—X bond tightly than sp_3 hybridised carbon with less s-character. Thus, C—X bond length in C—X is larger than C—X in halobenzene.

85. Explain why dipole moment of chlorobenzene is lower than that of cyclo-hexyl-chloride ?

Ans. Because of the greater s-character, sp^3-hybrid carbon is more electronegative than sp2-hybrid carbon. Thus, the sp^2-hybrid carbon of C—C1 bond in chloro benzene has less tendency to release electron to Cl than sp^3-hybrid carbon of cyclo-hexyl-chloride.

86. Alkyl halide, though polar, are immiscible with water. Why ?

Ans. Alkyl halides though polar, are immiscible in water because they are unable to form hydrogen bonds with water molecules.

87. Grignard reagent should be prepared under anhydrous conditions. Why ?

Ans. Grignard's reagent are very reactive. They react with moisture present in the apparatus or the starting material to give hydrocarbons.

$R — Mg — X + H — OH \rightarrow R — H + Mg (OH) X$

Grignard reagent

Hence, Grignard reagent must be prepared under anhydrous conditions.

88. Chloroethane is insoluble in water. Why.

Ans. Chloroethane is unable to form hydrogen bond with water. Hence, it is insoluble in water.

89. Why is thionyl chloride considered as the best reagent to convert alcohol into alkyl chlorides ?

Ans. Thionyl chloride is considered the best reagent because both the byproducts (SO_2 and HC1) are gaseous which escape from the reaction mixture. This makes the purification of the chloro compounds easy.

90. Why can benzene not be iodinated with I2 directly ?

Ans. The electronegativity and electrophilicity decreases from F to I in a group. Flourine is most electrophilic and reactive whereas iodine is unreactive.

91. A small amount of ethanol is added to chloroform bottles. Why ?

Ans. A small amount of ethanol is added to convert poisonous COCl2 into a non-poisonous diethyl carbonate

$COC1_2 + 2C_2H_5OH$

$(C_2H_5)_2CO_3 + 2HC1$

diethyl carbonate

92. Iodoform is obtained by the reaction of acetone with hypoiodite ion but not iodite ion. Why.

Ans. Hypoiodite ion acts as an oxidising agent but iodite ion does not.

93. Chloroform is a chlorine compound but it does not give white precipitate with silver nitrate solution. Why ?

Ans. Chloroform ($CHC1_3$) ionises to give H^+ and $CC1_3-$ and not $C1^-$. Therefore, no precipitate with $AgNO_3$ solution is obtained.

94. Alcohols are comparatively more soluble in water than the hydrocarbons of comparable molecular masses. Why?

Ans. Because of the presence of O—H group in them, alcohols are capable of forming H-bonds with water molecules whereas hydrocarbons cannot form H-bonds with water. As a result, alcohols are more soluble in water than the hydrocarbons of comparable molecular masses.

95. Lower alcohols are soluble in water, higher alcohols are not.

Ans. Lower alcohols can form H-bond with water whereas higher alcohols cannot due to larger hydrocarbon part.

96. Ketones are less reactive than aldehydes. Why ?

Ans. Due to the steric hinderance to the attacking groups, ketones are less reactive than aldehydes.

97. Dipole moments of aldehydes is ketones are different from those of alcohols, though both have polar C—O bonds, why ?

Ans. The dipole moment of aldehydes and ketones is greater than that of alcohols. Due to the presence of p bond between carbon and oxygen atom of carbonyl compounds (>C = O) the loosely held p electron can be readily shifted to oxygen atom. Consequently, the magnitude of +ve and –ve charge developed in > C = O bond is higher than C—O bond of alcohols.

98. Why do amines behave as nucleophiles ?

Ans. Due to presence of a lone pair of electron on nitrogen atom, amines behaves as nucleophiles.

99. Why are amines less acidic than alcohols of comparable molecular masses ?

Ans. Loss of a proton from an amine gives amide ion while loss of a proton from alcohol gives an alkoxide ion as shown below :

$R — NH_2$ $R — NH- + H+$

Amine Amide ion

R — O — H R — O– + H+

Alcohol Alkoxide ion

As O is more electronegative than N, RO– can accommodate the negative charge more easily than the RNH– ion. Thus, RO– is more stable than RNH–. Therefore, amines are less acidic than alcohols.

100. Why do primary amines have higher boiling point than tertiary amines ?

Ans. In primary amines, two hydrogen atoms of N are present and they undergo extensive intermolecular hydrogen bonding which results in association of molecules while in tertiary amines, no hydrogen atom of N is present. Hence, there is no H—bonding in tertiary amines. As a result primary amines have higher boiling point than tertiary amines

101. Why are aliphatic amines stronger bases than aromatic amines ?

Ans. Aliphatic amines are stronger bases than aromatic amines because :

(i) Due to resonance in aromatic amines, the lone pair of electron on the nitrogen atom gets delocalised over the benzene ring and this is less easily available for protonation.

(ii) The aryl, amine ions have lower stability than the corresponding alkyl amine i.e., protonation of aromatic amines is not favoured.

102. Direct nitration of aniline is not possible. Why ?

Ans. Nitration: Direct nitration of aniline yields tarry oxidatioon products in addition to the nitro derivatives. Moreover, in the strongly acidic medium, aniline is protonated to form the anilinium ion which is meta directing. That is why besides the ortho and para derivatives, significant amount of meta derivative is also formed.

103. Why the boiling points of alkyl nitrites are lower than the corresponding nitroalkanes ?

Ans. Boiling points of alkyl nitrites are lower then the corresponding nitroalkanes because the alkyl nitrites are less polar than that of corresponding nitroalkanes, hence the intermolecular forces are comparatively weak.

104. Arylamines are weaker bases than alkyl amines why?

Ans. Arylamines are weaker bases than alkyl amines because the lone pair of electrons on nitrogen is withdrawn away from it and partially shared with benzene ring. Therefore, in aniline electron donating capacity of nitrogen for protonation decreases considerably.

105. Why cyanides are fairly soluble in organic solvents ?

Ans. Cyanides are fairly soluble in organic solvents because with the increase in molecular mass, the bulk of the non-polar portion increases and hence solubility in water decreases.

106. Why the boiling points of alkyl isocyanides are lower than that of corresponding alkyl cyanides ?

Ans. Isocyanides are less polar than the cyanides. Due to this reason the intermolecular forces in isocyanides are weaker than cyanides, thus the boiling points of isocyanides are lower than corresponding cyanides undergo.

107. Why isocyanide does not undergo hydrolysis in alkaline medium ?

Ans. Isocyanide does not undergo hydrolysis in alkaline medium because the basic hydrolysis is initiated by the attack of OH– ion on the substrate molecule. but in alkyl isocyanide, the carbon atom of isocyanide group being negatively charged resists the attack of OH– ions. Hence, it readily undergoes the attack of H+ ion in acidic medium.

108. Alkyl isocyanides do not undergo basic hydrolysis. Why ?

Ans. The carbon atom of isocyanide (N C) group in isocyanides bears a negative charge and repels OH– (from alkalies) which is a nucleophile. But they undergo hydrolysis only in acidic medium.

109. Why is cellulose not digested in human body ?

Ans. Cellulose is not digested in human body because human beings do not have enzyme to digest cellulose.

110. Why are carbohydrates generally optically active ?

Ans. Carbohydrates have chiral or asymmetric carbon atom.

111. Fructose cannot be oxidised by the action of Br2 water. Why ?

Ans. Fructose cannot be oxidised by mild oxidising agent like bromine (Br2) water because it contains ketonic group. Therefore, fructose has no action with bromine water.