MANAS STUDIES

For Academic and Competitive Excellence

Most Expected Questions

For Class – XII

CHEMISTRY

Board Examination 2023-24

With Best Wishes

1. How does change in temperature changes the molarity and molality values?
2. What is the effect of pressure on solubility of a gas?
3. State Henry's Law and Significance of its constant and its Application.
4. What are the factors on which vapour pressure depends?
5. The vapour pressure of solvent gets lowered, when a non- volatile solute is added to it. Why?
6. Name two ways by which vapour pressure of a liquid can be lowered.
7. What are the possible deviations from ideal behaviours? Give one example of each deviation?
8. What is SHE? What is its electrode potential?
9. A cell is represented by notation – Cu (s) /Cu^{2+} (aq) //Ag^{+} (aq) / Ag (s)

   Calculate e.m.f of the cell if $E^0_{Cu^{2+}/Cu}$ = + 0.34V and $E^0_{Ag^{+}/Ag}$ = 0.08V?
10. What would happen if Nickel spatula is used to stir a solution of $CuSO_4$?

    $E^0_{Cu^{2+}/Cu}$ = 0.34 V, $E^0_{Ni^{2+}/Ni}$ = -0.25V?
11. State the factors that affect the value of electrode potential?
12. State kohlrausch's Law?
13. How many faradays are needed to reduce 1 mole of Cu^{2+} to Cu metal?
14. Identify the reaction order for each of the following from rate constant value–

    (a) $k = 2.3 \times 10^{-5}$ L mol^{-1} s^{-1}

    (b) $k = 3.1 \times 10^{-4}$ s^{-1}
15. Consider the equation $2NO(g) + 2H_2(g) \longrightarrow N_2(g) + 2H_2O(g)$

    The rate law for this equation is first order with respect to H_2 and second order with respect to NO. Write the rate law for this reaction.
16. Give reasons-
    (i) Transition metals have high melting points.
    (ii) Second and third transition series have similar radii.
    (iii) Second ionization is difficult from Cu and Cr whereas it is easy for Zn.
    (iv) Most of the transition elements are paramagnetic.
    (v) Transition elements form alloys.

17. What is the ore of $K_2Cr_2O_7$ and $KMnO_4$?
18. What is the effect of adding a base to potassium dichromate?
19. What is the most common oxidation state of lanthanoids and actionoids?
20. Actionoid contraction is more than lanthanoid contraction. Give reason.
21. Actionoids show larger number of oxidation states than lanthanoids. Why?
22. What were the two valences given by Werner for coordination compounds?
23. Distinguish between homoleptic and hetroleptic ligands.
24. What IUPAC names of following complex

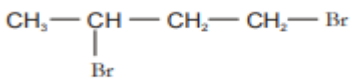
(i) $[Co\ (NH_3)_6]^{3+}$ (ii) $[Fe\ (C_2O_4)_3]^{3-}$ (iii) $[Ni\ (CN)_4]^{2-}$ (iv) $[Pt(NH_3)_4\ Cl_2]^{2+}$

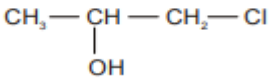
(v)$[NiCl_4]^{2-}$ (vi) $[Co(NH_3)_5\ ONO]^{2+}$ (vii) $[Co\ (NH_3)_5Cl]Cl_2$

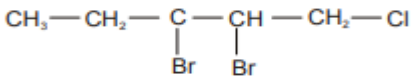
(viii) $[Cr\ (CN)\ (H_2O)_5]^{2+}$ (ix) $[Co\ (NO_2)_6]^{3-}$ (x)$[Co\ (en)_3]Cl_3$

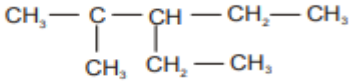
25. Write formula for the following compounds.
    (i) Hexammineplatinum (VI) Chloride
    (ii) Potassium hexacyanoferrate (III) ion
    (iii) diamminedichloridoplatinum (III) ion
    (iv) Tetramminedichloridocobalt (III) ion
    (v) Annine chlorobis (elhylenediamine) cobalt (III) ion .
    (vi) Hexaamminechromium (III) hexacyanocobaltate (III)
    (vii) Pentramminenitro –N- Cobalt (III) Chloride.
    (viii) Pentramminebromidoocobalt (III) sulphate
    (ix) triamminediaquachlorocobalt (III) Chloride
    (x) Tetramminedichloridooplatinum (IV) Bromide
26. Draw the geometrical isomers of $[Cr\ (NH_3\ )_2\ (CN)_4)]^-$?
27. Indicate the types of isomerism shown by the complex – K [$Fe\ (H_2O)_2\ (en)_2\ Cl_2$] ?

28. Give IUPAC names of following compounds

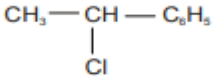
(i) 

(ii) 

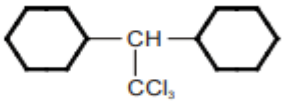
(iii) 

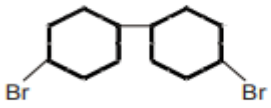
(iv) 

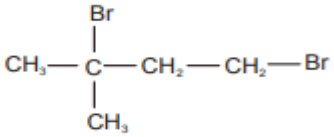
(v) $C_6H_5CH_2CH_2Cl$

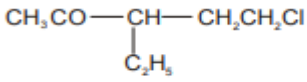
(vi) 

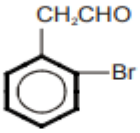
(vii) $C_6H_6Cl_6$

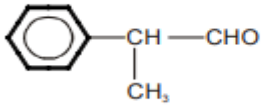
(viii) 

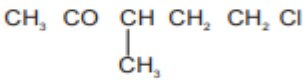
(ix) 

(x) 

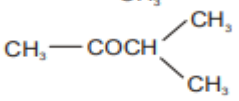
(xi) 

(xii) 

(xiii) 

(xiv) 

(xv) $CH_3CH(OH)CH_2COCH_3$

(xvi) 

29. Give the structures of following:

(i) 1,3-Dichloro -2-(bromomethyl) propane (ii) Isobutylchloride

(iii) Ortho bromotoluene (iv) 1 – Bromo – 4 – chlorobutane

(v) 3 – Bromo – 5 – chloro – 3,5 – dimethyloctane (vi) 2,3 – Dibromo – 1 – chloro -3-methylpentane

(vii) 2 – Chloro – 3 – ethyl -1, 4- pentadieme (viii) 2,3 – Dibromo – 1 – chloro -3-methylpentane

(ix) 2 – Chloro – 1 – phemylpropane (x) Tert – butylchloride

30. Convert the following

1. 1 - Butene to 1 — chlorobutane.
2. Ethene to ethanol.
3. Chlorobenzene to phenol.
4. Methyl bromide to acetic acid.
5. 2- chlorobutane to sec- butyl ethyl ether.
6. Chlorobenzene to benzyl chloride.

7. Chlorobenzene to Benzene.
8. Methane to Ethane.
9. Benzene to o- chlorotoluene.
10. 1- chloropropane to 2- iodopropane.
11. Ethene to 1,2 -ethanediol
12. Phenol to Salicyldehyde
13. Butanol to Butanoic acid
14. Ethanol to propanone
15. Phenol to salicylic acid
16. Methanol to Ethanol
17. Ethanol to propanol
18. Phenol to Benzyl Alcohol
19. Ethanal to propan -2- ol
20. l – propanol to 2 – bromo propane
21. Toluene to benzaldehyde
22. Acetaldehyde to Acetamide
23. Methanol to acetic acid
24. Methanol to Ethanol
25. Acetic acid to Propionic acid
26. Aniline to benzoic acid
27. Aniline to p- nitro aniline
28. Methylamine to ethylamine
29. Benzoquinone fromphenol
30. 2-Methylpropan-2-ol frommethylmagnesiumbromide

31. Which disaccharides are non – reducing sugars?

32. Classify the following as monosaccharides, disaccharides and polysaccharides- Glucose, Sucrose, maltose, ribose, glycogen, lactose, fructose.

33. What is the meaning of statement- Glucose is an aldohexose.

34. Why are polysaccharides considered as non- sugars?

35. Give two examples of reducing sugars

36. Which sugar is present in milk?

37. Name the reagents used to check the reducing nature of carbohydrates.

38. Rearrange the following in an increasing order of their basic strengths:
$C_6H_5NH_2$, $C_6H_5N(CH_3)_2$, $(C_6H_5)_2NH$ and CH_3NH_2

39. The thermal decomposition of HCO_2H is a first order reaction with a rate constant of $2.4 \times 10^{-3}\ s^{-1}$ at a certain temperature. Calculate how long will it take for three fourths of initial quantity of HCO_2H to decompose. (log 0.25 = – 0.6021)

40. How would you account for the following:

a. Cr^{2+} is reducing in nature while with the same d-orbital configuration (d^4) Mn^{3+} is an oxidising agent.

b. In a transition series of metals, the metal which exhibits the greatest number of oxidation states occurs in the middle of the series.

41. Complete the following chemical equations:

    a. $MnO_4^- - (aq)\ SO_3^{2-}(aq)\ \ H_2O(l) \longrightarrow$

    b. $Cr_2O_7^{2-}(aq)\ Fe^{2+}\ (aq)\ \ H^+(aq) \longrightarrow$

42. State reasons for the following:

    (i)Cu (I) ion is not stable in an aqueous solution.

    (ii)Unlike Cr^{3+}, Mn^{3+}, Fe^{3+} and the subsequent other M^{3+} ions of the 3d series of elements, the 4d and the 5d series metals generally do not form stable cationic species.

43. Explain what is meant by the following:

    (i) Peptide linkage (ii) Pyranose structure of glucose

44. Write the main structural difference between DNA and RNA. Of the four bases, name those which are common to both DNA and RNA.

45. A solution is prepared by dissolving 11g glucose in 200 cm^3 water at 30°C. What is the mass percentage of glucose in solution? The density of water at 30°C is 0.996 g/cm^3?

46. Find the molality and molarity of a 15% solution of H SO when its density is 1.10 g/cm^3 & molar mass = 98 amu.

47. Calculate the mole fraction of ethanol and water in a sample of rectified spirit which contains 46% ethanol by mass?

48. Calculate the % composition in terms of mass of a solution obtained by mixing 300g of a 25% & 400 g of a 40% solution by mass?

49. Why do mountaineers carry oxygen cylinder while climbing mountains?

50. Plot a graph between vapour pressure and mole fraction of a solution obeying Raoult's Law at constant temperature?

51. Name different colligative properties?

52. A mixture of chlorobenzene and bromobenzene is a nearly an ideal solution but a mixture of chloroform and acetone is not Explain?

53. Define the term azeotrope?

54. Draw the graphs of both deviations from ideal behaviours?

55. 0.90g of a non – electrolyte was dissolved in 87.90g of benzene. This raised the boiling point of benzene by 0.25°C. If the molecular mass of non – electrolyte is 103.0 g/mol, calculate the molal elevation constant for benzene?

56. Show graphically the depression in freezing point on adding a nonvolatile solute?

57. When 20g of a non – volatile solid is added to 250 ml of water, the freezing point of water becomes –0.9°C. Calculate molecular mass of the solid if K_f of water is 1.86°C kg/mol.
58. Calculate the osmotic pressure of 0.25 M solution of urea at 37°C. R = 0.083 L bar/mol/K.
59. An aqueous solution of glucose, $C_6H_{12}O_6$ has osmotic pressure of 2.72 atm at 298 K. How many moles of glucose were dissolved per litre of solution?
60. The boiling point elevation of 0.6 g acetic acid in 100g benzene is 0.1265K. What conclusion can you draw about the state of solute in solution? Molar elevation constant for benzene is 2.53 degree per molar?
61. A weak electrolyte AB is 5% dissociated in aqueous solution. What is the freezing point of a 0.10 molar aqueous solution of AB? K_f = 1.86 deg/molal.
62. The osmotic pressure of a 0.0103 molar solution of an electrolyte is found to be 0.70 atm at 273°C. Calculate van't Hoff factor. R = 0.082 L atm/1 mol/K?
63. Calculate pH of following half cell . Pt , H_2 / H_2SO_4 , if its electrode potential is 0.03V.
64. What are the factors on which conductivity of an electrolyte depend?
65. The conductivity of an aqueous solution of NaCl in a cell is 92 Ω^{-1} cm^{-1} the resistance offered by this cell is 247.8 Ω. Calculate the cell constant?
66. The molar conductivity of 0.1M CH_3COOH solution is 4.6 Ω^{-1} cm^2 mol^{-1}. What is the conductivity and resistivity of the solution?
67. The conductivity of metals decreases while that of electrolytes increases with increases in temperature. Why?
68. The measured resistance of a cell containing 7.5 x10^{-3} M solution of KCl at 25° C was 1005 Ω calculate
    (i)Specific conductance and
    (ii)Molar conductance of the solution. Cell Constant = 1.25 cm^{-1}
69. How is Limiting molar conductivity related to
    (i) degree of ionization and (ii)dissociation constant
70. At 298 K , the molar conductivities at infinite dilution of NH_4Cl , NaOH and NaCl are 129.8 , 217.4 and 108.9 scm^2 mol^{-1} respectively.

    If molar conductivity of 0.01M NH_4 OH solution is 9.33 S cm^2 mol^{-1}, calculate the degree of dissociation of NH_4OH at this dilution?
71. State Faraday's Laws of electrolysis?

72. How many gms of chlorine can be produced by the electrolysis of molten NaCl with a current of 1 ampere for 15 min?
73. How many electrons flow when a current of 5 amps is passed through a solution for 193 sec. Given F = 96500 C.

    $N_A = 6.02 \times 10^{23}$ mol^{-1}1?
74. There are two possible reactions for cathode in the electrolysis of aqueous $ZnCl_2$:

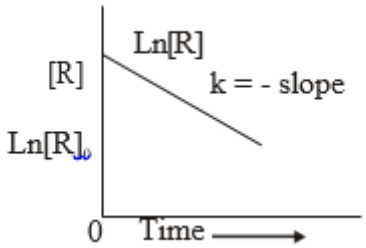
    $Zn^{2+}(aq) + 2e^- \longrightarrow Zn(s)$ E = -0.76 V

    $2H_2O(l) + 2e^- \longrightarrow H(g) + 2OH^-(aq)$ E = –0.83V

    Which one will take place ?
75. Silver is deposited on a metallic vessel by passing a current of 0.2 amps. for 3 hrs. Calculate the weight of silver deposited. (Atomic mass of silver = 108 amu, F = 96500 C) ?
76. For the chemical decomposition of SO_2 Cl_2, its initial concentration is 0.8420 mol/L and final concentration is 0.215 mol/L in 2 hours. What is the average rate of this reaction?
77. In the expression of rate of reaction in terms of reactants, what is the significance of negative sign?
78. For the reaction $2O_3 \leftrightharpoons 3O_2\ (g)$ $\frac{\Delta[O_3]}{\Delta t}$ was found to be 5.0×10^{-4}atm/s. Determine the value of $\frac{\Delta[O_2]}{\Delta t}$ in atm /s during this period of time?
79. A chemical reaction $2A \longrightarrow 4B + C$ in gas phase occurs in a closed vessel. The concentration of B is found to be increased by 5×10^{-3} mole L^{-1} in 10 second.
    Calculate (i) the rate of appearance of B (ii) the rate of disappearance of A?
80. Define the terms – (i) Order of a reaction (ii) Molecularity of a reaction.
81. Differentiate between order and molecularity of a reaction?
82. Determine the overall order of a reaction which has the rate law
    $R = K[A]^{5/2}[B]^{3/2}$
83. For the reaction A+B ⟶ C + D, the rate of reaction doubles when the concentration of A doubles, provided the concentration of B is constant. To what order does A enter into the rate expression?
84. The rate Law for the reaction A + B ⟶ C is rate = $K[A]^2[B]$. What would the reaction rate be when concentration of both A and B are doubled?
85. Write the integrated rate equation for –
    (i) zero order reaction.
    (ii) first order reaction.

86. From the graph below

(i) Identify the order of reaction.(ii)What will be the unit of rate constant?



87. Draw a graph for

a. Concentration of reactant against time for a zero order reaction.

b. Log [Ro]/ [R] against time for a first order reaction.

88. For first order reaction A ⟶ B Write (1) Differential rate law. (2) Integrated rate law.

89. The time required to decompose SO_2Cl_2 to half of its initial amount is 60 min. If the decomposition is a first order reaction, calculate the rate constant of the reaction?

90. The rate constant for the first order decomposition of N_2O_5 at 25°C is 3×10^{-2} min^{-1}. It the initial concentration of N_2O_5 is 2×10^{-3} mol/L, How long will it take to drop the concentration to 5×10^{-4} mol/L?

91. The activation energy of reaction is 75.2 KJ/mol in the absence of a catalyst and 50.14 KJ/Mol in the presence of a catalyst. How many times will the reaction grow in the presence of a catalyst, if the reaction proceeds at 25°C

92. The rate of a particular reaction quadruples when the temperature changes from 293 K to 313 K. Calculate activation energy for such a reaction.

93. Transition metals generally form coloured ions. Why?

94. Which of the following will be colored?

Sc^{3+}, V^{2+}, Mn^{2+}, Cu^{+}, Ni^{2+}.

95. Give an explanation for the catalytic properties shown by transition metals.

96. Write some characteristics of interstitial compounds.

97. Draw the structure of chromate and dichromate ions?

98. Describe the steps of preparation of $KMnO_4$?

99. What is the composition of mischmetall? Give its one use.

100. Make the cis and trans forms of the complex$[Cr\ Cl_2\ (en)_2]^+$.

Which one of these will be optically active?

101. Which isomerism is shown by a compound having ambidentate ligand? Give example.

102. What is geometric isomerism? When can a compound show.
(i) Cis – Trans isomerism
(ii)Fac and Mer isomerism.

103. State the postulates of valence bond theory.

104. Explain that the complex $[Co(NH_3)_6]^{3+}$ is diamagnetic on the basis of valence bond theory.

105. $[Ni(CO)_4]^{2+}$ is square planar whereas $[NiBr_4]^{2-}$ is tetrahedral. Explain.

106. State crystal field theory.

107. Show with diagram, the crystal field splitting of d - orbital in an octahedral field.

108. Explain the synergic bonding in metal carbonyls.

109. Phenol cannot be converted to chlorobenzene by reacting with HCl. Why

110. HNO_3 is added during iodination of benzene.Why

111. p- dichlorobenzene has higher melting point than meta – dichlorobenzene.Why

112. The boiling points of isomeric haloalkenes decrease with increase in branching.

113. Hydrolysis of optically active 2- bromobutane forms optically inactive butan - 2 - ol.

114. Chlorobenzene is less reactive towards nucleophilic substitution reaction.

115. Chloroform is stored in dark coloured bottles.

116. The order of boiling points is RCl < RBr < RI.Explain

117. Vinyl chloride is less reactive than allyl chloride, explain.

118. Give Reasons :-
a. Carboxylic acid is stronger acid than phenol.
b. Ethanol is more soluble in water than ethyl chloride
c. Aldehydes are more reactive than Ketones towards nucleophilic additions.
d. Carboxylic acids has higher boiling points than alcohols of same no. of carbon atoms.
e. Carboxylic acids do not give characteristic reactions of carbonyl group.
f. formaldehyde does not undergo aldol condensation.
g. Floro acetic acid is a stronger acid than acetic acid.

119. Give the reason for the following
(a)It is difficult to prepare pure amines by ammonolysis of alkylhalides.
(b)Amines have higher boiling points than hydrocarbons of similar molecular mass.
(c)Aniline is weaker base than cyclohexylamine.
(d)Methylamine is a stronger base than aniline.

(e) Before nitration, aniline is converted to acetanilide.

(f) It is easier to brominate aniline as compared to benzene.

(g) Reduction of nitro compound to aniline using iron scrap and HCl is preferred.

(h) Aromatic amines cannot be prepared by Gabriel Phthalimide synthesis.

(i) During acylation of amines, pyridine is added.

(j) Aniline does not undergo Friedel – Craft's reaction.

120. Give a reaction to prove that –

(a) Glucose has carbonyl group

(b) The six carbons in glucose are arranged in a straight chain

121. What is the significance of 'D' and '+' before the name of glucose in D (+) – glucose?

122. Which reaction of glucose cannot be explained by its cyclic structure?

123. What are anomers? Name the two anomers of glucose.

124. Give the structures of α and β forms of glucose.

125. What are the expected products of hydrolysis of

(a) Sucrose (b) Galactose

126. What is animal starch ? Where is it found?

127. Differentiate between α - helical and β - pleated sheet structure.

128. What do you understand by secondary structure of proteins?

129. Write functional differences between RNA & DNA

130. Obtain a relationship between relative lowering of vapour pressure and mole fraction of solute?

131. The vapour pressure of CS_2 at 500°C is 854 mm Hg . A solution of 2.0 g sulphur in 100g of CS_2 has a vapour pressure of 848.9 mm Hg .Calculate the formula of sulphur molecule.

132. At 400°C, the vapour pressure of water is 55.3 mm Hg .Calculate the vapour pressure at the same temperature over 10% aqueous solution of urea $[CO(NH_2)_2]$?

133. How much urea (molar mass 60 g/mol) should be dissolved in 50g of water so that its vapour pressure at room temperature is is reduced by 25%?

134. What is the cell potential for the cell at 25°C

Cr/Cr^{3+} (10.1 m)//Fe^{2+} (0.01 m) /Fe

$$E^0_{Cr^+/Cr} = -0.74V; E^0_{Fe^{2+}/Fe} = -0.44V$$

135. Calculate ΔG^0 for the reaction at 25^0C

$Zn(s)|Zn^{2+}$ [0.0004m] $||Cd^{2+}$ (0.2m) Cd (s);

$E^0_{Zn^{2+}/Zn} = 0.763, E^0_{Cd^{2+}/Cd} = -0.403v, F = 96500\,C\,Mol^{-1}, R = 8.314\,J/K$

136. Calculate Equilibrium constant K for the reaction at 298K

$Zn(s) + Cu^{2+}(aq) \rightleftharpoons Zn^{2+}/(aq) + Cu$

$E^0_{Zn^{2+}/Zn} = +0.76V; E^0_{Cu^{2+}/Cu} = +0.34V$

137. For what concentration of Ag^+ (aq) will the emf of the given cell be zero at 25^0C if the concentration of Cu^{2+} (aq) is 0.1 M ?

$Cu(s)/Cu^{2+}(0.1M)//Ag^+(aq)/Ag(s)$; $E^0 Ag^+/Ag = +0.80\,V; E^0_{Cu^{2+}/Cu} = 0.34\,V$

138. Calculate the standard free energy change for the cell- reaction.

$Fe^{2+}(aq) + Ag^+(s) \longrightarrow Fe^{2+}(aq) + Ag(s)$

How is it related to the equilibrium constant of the reaction?

$E^0_{Fe^{3+}}/Fe^{2+} = 0.77V, E^0_{Ag^{+1}/Ag} = 0.08V\ F = 96500\,C/mol.$

139. The reaction $2N_2O_5$ (g) $\rightarrow$ $2NO_2$ (g) $+O_2$ (g) was studied and the following data were collected :

S.No. (mol/L/min)	$[N_2O_5]$ mol L^{-1}	Rate of disappearance of $[N_2O_5]$
1.	1.13×10^{-1}	34×10^{-5}
2.	0.84×10^{-2}	25×10^{-5}
3.	0.62×10^{-2}	18×10^{-5}

Determine i) The order ii) The rate law. iii) Rate constant for the reaction.

140. In general it is observed that the rate of a chemical reaction doubles with every 10^o rise in temperature. If this generalization holds for a reaction in the temperature range295K to 305K, what would be the activation energy for this reaction? (R = 8.314Jk^{-1} mol^{-1})

141. The rate constant for a reaction is 1.5 x 10^7 s^{-1} at 50°C and 4.5 × 10^7 s^{-1}at 100°C. Calculate the value of activation energy for the reaction R = 8.314 JK^{-1} mol^{-1}?

142. Explain the steps of preparation of potassium dichromate?

143. What is the lanthanide contraction? What are its causes and consequences?

144. An organic compound ' A ' having molecular formula C_3H_6 on treatment with aq. H_2SO_4 give 'B' which on treatment with Lucas reagent gives 'C'. The compound 'C' on treatment with ethanolic KOH gives back ' A' .Identify A, B , C.

145. An organic compound A (C_6H_6O) gives a characteristic colour with aq. $FeCl_3$ solution. (A) On reacting with CO_2 and NaOH at 400k under pressure gives (B) which on acidification gives a compound (C) .The compound (C) reacts with acetyl chloride to give (D) which is a popular pain killer. Deduce the structure of A,B,C & D.

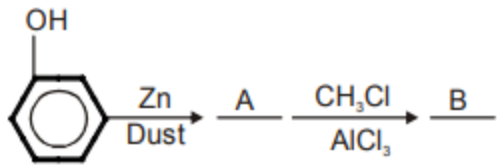
146. An organic compound (X) when dissolved in ether and treated with magnesium metal forms a compound Y. The compound, Y, on treatment with acetaldehyde and the product on acid hydrolysis gives isopropyl alcohol. Identify the compound X. What is the general name of the compounds of the type Y.

147. A compound 'A' with molecular formula $C_4H_{10}O$ on oxidation forms compound 'B' gives positive iodoform test and on reaction with CH_3MgBr followed by hydrolysis gives (c). Identify A, B & C.

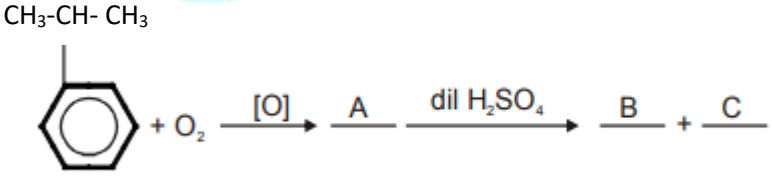
148. An aromatic compound (A) having molecular formula C_6H_6O on treatment with $CHCl_3$ and KOH gives a mixture two isomers 'B' and 'C' both of 'B' & 'C' give same product 'D' when distilled with Zn dust. Oxidation of 'D' gives 'E' of formula $C_7H_6O_2$. The sodium salt of 'E' on heating with soda lime gives 'F' which may also be obtained by distilling 'A' with zinc dust. Identify compounds 'A' to 'F' giving sequence of reactions.

149. Compound 'A' of molecular formula $C_5H_{11}Br$ gives a compound 'B' of molecular formula $C_5H_{12}O$ when treated with aq. NaOH. On oxidation the compound yields a mixture of acetic acid & propionic acid. Deduce the structure of A, B & C.

150.



151.



152. A compound 'A' with formula $C_5H_{10}O$ gives a positive 2, 4 –DNP test but a negative Tollen's test It can be oxidizing to carboxylic acid 'B' of molecular formula $C_3H_6O_2$, when treated with alkaline $KMnO_4$ under vigorous conditions. The salt of 'B' gives a hydrocarbon 'C' on Kolbes' electrolytic decarboxylation. Identify A,B.C & write chemical equations.

153. A compound A with molecular formula $C_5H_{12}O$ on oxidation forms compound B with molecular formula $C_5H_{10}O$. The compound B gives iodoform test but does not reduce ammonical silver nitrate. The compound B on reduction with Zn – Hg/ HCl gives compound C with molecular formula C_5H_{12}. Identify A,B,C & give the chemical reactions involved.

154. An organic compound A, which has a characteristic odour, on treatment with NaOH forms two compound B and C. Compound B has molecular formula C_7H_8O which on oxidation gives back A. Compound C is the sodium salt of an acid. C, when heated with soda lime yields an aromatic hydrocarbon D. deduce the structures of A to D.

155. $CH_3COOH \xrightarrow{Cl_2/red\,P} (A) \xrightarrow{Alc.NH_3} (B)$

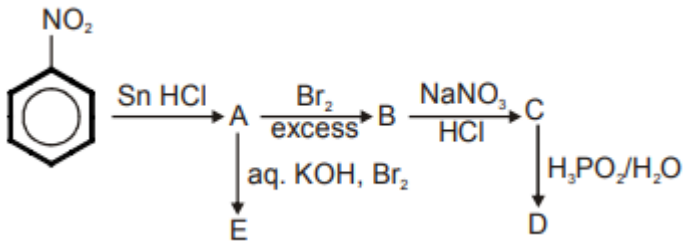
156. $C_6H_5CONH_2 \xrightarrow{Br_2/KOH} (A) \xrightarrow{NaNO_2/HCl} (B) \xrightarrow{K_2Cr_2O_7/H_2SO_4} (C)$

157. $CH_3Cl \xrightarrow{KCN} (A) \xrightarrow[\text{Dry distillation}]{H_2O/H^+} (B) \xrightarrow{PCl_5} (C)$

158. $CH_3COOH \xrightarrow{Ca(OH)_2} (A) \xrightarrow{\text{dry distribution}} (B) \xrightarrow{I_2/NaOH} (C)$

159. Two moles of compound (A) on treatment with a strong base gives two compounds (B) and (C). The compound (B) on dehydrogenation with Cu gives (A) while acidification of (C) gives carboxylic acid (D) having molecular formula CH_2O_2. Identify (A) to (D).

160.



161. A compound (X) having formula C_3H_7NO reacts with Br_2 in the presence of NaOH to give another compound (Y). Compound (Y) reacts with HNO_2 to form ethanol and N_2 gas . Identify (X) and (Y) . Write the reaction involved.

162. An organic compound A (C_3H_5N) on boiling with alkali gives NH_3 and sodium salt of an acid B ($C_3H_6O_2$). The compound A on reduction gives C (C_3H_9N) which on treatment with nitrous acid gives an alcohol D (C_3H_8O). Identify A to D

163. Rearrange the compounds of each of the following sets in order of reactivity towards SN_2 displacement:

(i) 2-Bromo-2-methylbutane, 1-Bromopentane, 2-Bromopentane

(ii) 1-Bromo-3-methylbutane, 2-Bromo-2-methylbutane, 3-Bromo-2-methylbutane

(iii) 1-Bromobutane, 1-Bromo-2, 2-dimethylpropane, 1-Bromo-2-methylbutane

164. The time required for 10% completion of a first order reaction at 298K is equal to that required for its 25% completion at 308K. If the pre-exponential factor for the reaction is $3.56 \times 10^9\ s^{-1}$ calculate its rate constant at 318K and also the energy of activation.

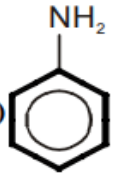
165. Write the disease caused by deficiency of vitamins A, B_2 , B_6 , B_{12}, C, D E and K.

166. What type of a battery is lead storage battery? Write the anode and cathode reactions and the overall cell reaction occurring in the operation of a lead storage battery.

167. Complete the following reaction

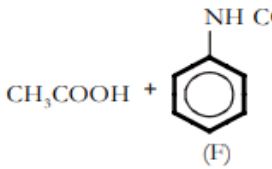
(a) $C_6H_5CONH_2 \xrightarrow[SOCl_2]{P_2O_5 \text{ or}} (A) \xrightarrow{\text{catalytic reduction}} (B) \xrightarrow[NaNO_2/HCl]{HONO \text{ or}} (C)$

(b) $(A) \xrightarrow{Br_2/KOH} (B) \xrightarrow[HNO_2]{NaNO_2/HCl} (C) \xrightarrow[Br_2]{Red\ P/} CH_3Br$

(c)  $\xrightarrow{aq.Br_2} (A) \xrightarrow[HNO_2]{NaNO_2/HCl} (B) \xrightarrow[\Delta]{H_3PO_2} (C)$

(d) $C_6H_5NH_2 \xrightarrow{CH_3CO\ Cl} (A) \xrightarrow[H_2SO_4]{HNO_3/} (B) \xrightarrow{HO_2/H^+} (C)$

(e) $(A) \xrightarrow[Conc.]{HNO_3/H_2SO_4} (B) \xrightarrow{Sn./HCl} (C) \xrightarrow{CHCl_3/KOH} (D) \xrightarrow{H_2/Pt} (E)$



(F)

168. Calculate the potential for half-cell containing

$$0.10\ M\ K_2\ CrO_7^{2-}\ (aq), 0.20\ M\ Cr^{3+}\ (aq)\ and\ 1.0\ x\ 10^{-4}\ M\ H^+\ (aq)$$

The half-cell reaction is

$$CCrO_7^{2-}(aq) + 14H^+(aq) + 6e^- \longrightarrow 2Cr^{3+}(aq) + 7H_2O(l)\,,$$

and the standard electrode potential is given as E^o = 1.33 V. 5

169. How many moles of mercury will be produced by electrolysing 1.0 M $Hg(NO_3)_2$ solutionwith a current of 2.00A for 3 hours ? [$Hg(NO_3)$ = 200.6 $gmol^{-1}$]

170. Avoltaic cell is set up at 25°C with the following half-cells Al^{3+}(0.001 M) and Ni^{2+}(0.50M). Write an equation for the reaction that occurs when the cell generates an electric current and determine the cell potential. (Given:

$$E^o_{Ni^{2+}/Ni} = 0.25\ V, E^o_{Al^{2+}/Al} = 1.66\ V\ )[]$$

171. (a) Illustrate the following name reactions:

(i) Cannizzaro's reaction

(ii) Clemensen reduction

(iii) Aldol condensation

(iv) Crossed Aldol condensation

(v) Decarboxylation

(b) Write the mechanism of acid dehydration of ethanol to yield ethane.

(c) An organic compound with molecular formula $C_9H_{10}O$ forms 2, 4-DNP derivative reduces Tollen reagent and undergoes Cannizzaro reaction. On vigorous oxidation, it gives 1.2-benzendicarboxylic acid. Identify the compound.

172. Arrange the following compounds in increasing order of their property as indicated:

(i) Acetaldehyde, Acetone, Di-tert-butyl ketone, Methyl tert-butyl ketone (reactivity towards HCN)

(ii) $CH_3CH_2CH\,Br\,COOH$. $CH_3CH\,Br\,CH_2COOH$, $CH_3\,CHFCOOH$, CH_3CH_2COOH (acid strength)

(iii) Benzoic acid, 4-Nitrobenzoic acid, 3,4-Dinitrobenzoic acid, 4-Methoxybenzoic acid (acid strength)

173. Give possible explanation for each of the following:

(i) Cyclohexanone forms cyanohydrin in good yield but 2,2,6-trimethylcyclohexanonev does not.

(ii) There are two $-NH_2$ groups in semicarbazide. However, only one is involved in the formation of semicarbazones.

(iii) During the preparation of esters from a carboxylic acid and an alcohol in the presence of an acid catalyst, the water or the ester should be removed as soon as it is formed.

(a) An organic compound contains 69.77% carbon, 11.63% hydrogen and rest oxygen.The molecular mass of the compound is 86. It does not reduce Tollens' reagent but forms an addition compound with sodium hydrogensulphite and give positive iodoform test. On vigorous oxidation it gives ethanoic and propanoic acid. Write the possible structure of the compound.

174. Account for the following:

(i) p*Kb* of aniline is more than that of methylamine.

(ii) Ethylamine is soluble in water whereas aniline is not.

(iii) Methylamine in water reacts with ferric chloride to precipitate hydrated ferric oxide.

(iv) Although amino group is *o*– and *p*– directing in aromatic electrophilic substitution reactions, aniline on nitration gives a substantial amount of *m*-nitroaniline.

(v) Aniline does not undergo Friedel-Crafts reaction.

(vi) Diazonium salts of aromatic amines are more stable than those of aliphatic amines.

(vii) Gabriel phthalimide synthesis is preferred for synthesising primary amines.

175. Arrange the following:

(i) In decreasing order of the p*Kb* values:
$C_2H_5NH_2$, $C_6H_5NHCH_3$, $(C_2H_5)_2NH$ and $C_6H_5NH_2$

(ii) In increasing order of basic strength:
$C_6H_5NH_2$, $C_6H_5N(CH_3)_2$, $(C_2H_5)_2NH$ and CH_3NH_2

(iii) In increasing order of basic strength:

(a) Aniline, *p*-nitroaniline and *p*-toluidine

(b) $C_6H_5NH_2$, $C_6H_5NHCH_3$, $C_6H_5CH_2NH_2$.

(iv) In decreasing order of basic strength in gas phase:
$C_2H_5NH_2, (C_2H_5)_2NH, (C_2H_5)_3N$ and NH_3

(v) In increasing order of boiling point:
$C_2H_5OH, (CH_3)_2NH, C_2H_5NH_2$

(vi) In increasing order of solubility in water:
$C_6H_5NH_2, (C_2H_5)_2NH, C_2H_5NH_2$

176. An aromatic compound 'A' on treatment with aqueous ammonia and heating forms compound 'B' which on heating with Br_2 and KOH forms a compound 'C' of molecular formula C_6H_7N. Write the structures and IUPAC name s of compounds A, B and C.

177. Compound 'A' with molecular formula C_4H_9Br is treated with aq. KOH solution . The rate of this reaction depends upon the concentration of the compound 'A' only . When another optically active isomer 'B' of this compound was treated with aq. KOH solution , the rate of reaction was found to be dependent on concentration of compound and KOH both.

a) Write down the structural formula of both compounds 'A' and 'B'.

b) Out of these two compounds , which one will be converted to the product with inverted configuration .

178. Write the structures and names of the compounds formed when compound 'A' with molecular formula , C_7H_8 is treated with Cl_2 in the presence of $FeCl_3$.

179. An alkyl halide, of formula $C_6H_{13}Cl$ on treatment with potassium tertiary butoxide gives the isomeric alkenes Y and Z (C_6H_{12}). Both alkenes on hydrogenation give 2, 3-dimethylbutane. Predict the structures of X, Y and Z.

180. Which of the following compounds will be formed when methoxy benzene is reacted with HBr?

a) Phenol and bromomethane
b) Methanol and bromobenzene
c) Phenol and methanol
d) Bromobenzene and bromomethane

181. Read the passage given below and answer the following questions:

The order of reactivity towards S_N1 reaction depends upon the stability of carbocation in the first step. Greater the stability of the carbocation, greater will be its ease of formation from alkyl halide and hence faster will be the rate of the reaction. As we know, 3º carbocation is most stable, therefore, the tert-alkyl that halides will undergo S_N1 reaction very fast. For example, it has been observed that the reaction $(CH_3)_3CBr$ with OH ion to give 2-methyl-2-propanol is about I million times as fast as the corresponding reaction of the methyl bromide to give methanol. The primary alkyl halides always react predominantly by S_N2 mechanism. On the other hand, the tertiary alkyl halides react predominantly by S_N1 mechanism. Secondary alkyl halides may react by either mechanism or by both the mechanisms without much preference depending upon the nature of the nucleophile and solvent.

In these questions (Q. No. I to iv), a statement of assertion followed by a statement of reason is given. Choose tile correct answer out of tile following choices.

1. Assertion and reason both are correct statements and reason is correct explanation for assertion.
2. Assertion and reason both are correct statements but reason is not correct explanation for assertion.
3. Assertion is correct statement but reason is wrong statement.
4. Assertion is wrong statement but reason is correct statement.

1. **Assertion:** Low concentration of nudeophile favours S_N1 mechanism.
   Reason: 2º alkyl halides are less reactive than 1º towards S_N1 reactions.
2. **Assertion:** Polar solvent slows down S_N2 reactions.
   Reason: CH_3-Br is less reactive than CH_3Cl.
3. **Assertion:** Benzyl bromide when kept in acetone- water it produces benzyl alcohol.
   Reason: The reaction follows S_N2 mechanism.

4. **Assertion**: Rate of hydrolysis of methyl chloride to methanol is higher in DMF than in water.
   Reason: Hydrolysis of methyl chloride follows second order kinetics.
5. **Assertion**: S_N1 reaction is carried out in the presence of a polar protic solvent.
   Reason: A polar protic solvent increases the stability of carbocation due to solvation.

182. Read the passage given below and answer the following questions: Werner, a Swiss chemist in 1892 prepared and characterised a large number of coordination compounds and studied their physical and chemical behaviour. He proposed that, in coordination compounds, metals possess two types of valencies, viz. primary valencies, which are normally ionisable and secondary valencies which are non-ionisable. In a series of compounds of cobalt (III) chloride with ammonia, it was found that some of the chloride ions could be precipitated as AgCl on adding excess of $AgNO_3$ solution in cold, but some remained in solution. The number of ions furnished by a complex in a solution can be determined by precipitation reactions. The measurement of molar conductance of solutions of coordination compounds helps to estimate the number of ions furnished by the compound in solution.
In these questions (Q. No. i-iv), a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.
1. Assertion and reason both are correct statements and reason is correct explanation for assertion.
2. Assertion and reason both are correct statements but reason is not correct explanation for assertion.
3. Assertion is correct statement but reason is wrong statement.
4. Assertion is wrong statement but reason is correct statement.

The following questions are multiple choice questions. Choose the most appropriate answer
1. **Assertion:** The complex $[Co(NH_3)_3C_3]$ does not give precipitate with silver nitrate solution.
Reason: The given complex is non-ionisable.
2. **Assertion:** The complex $[Co(NH_3)_4Cl_2]Cl$ gives precipitate corresponding to 2 mol of AgCl with $AgNO_3$ solution.
Reason: It ionises as $[Co(NH_3)_4Cl_2]^+ + Cl^-$.
3. **Assertion:** $CoCl_3.4NH_3$ gives 1 mol of AgCl on reacting with $AgNO_3$, its secondary valency is 6.
Reason: Secondary valency corresponds to coordination number.

4. **Assertion:** 1 mol of $[CrCl_2(H_2O)_4]Cl \cdot 2H_2O$ will give 1 mol of AgCl on treating with $AgNO_3$.
Reason: Cl^- ions satisfying secondary valanceis will not be precipitated.
5. **Assertion:** $CoCl_3 . 3NH_3$ is not conducting while $CoCl_3 . 5NH_3$ is conducting.
Reason: The complex of $CoCl_3 . 3NH$ is $[CoCl_3(NH_3)_3]$ while that of $CoCl_3 \cdot 5NH_3$ is $[CoCl(NH_3)_5]Cl_3$.

183. All chemical reactions involve interaction of atoms and molecules. A large number of atoms/molecules are present in a few gram of any chemical compound varying with their atomic/ molecular masses. To handle such large number conveniently, the mole concept was introduced. All electrochemical cell reactions are also based on mole concept. For example, a 4.0 molar aqueous solution of NaCl is prepared and 500mL of this solution is electrolysed. This leads to the evolution of chlorine gas at one of the electrode. The amount of products formed can be calculated by using mole concept
The following questions are multiple choice questions. Choose the most appropriate answer
1. The total number of moles of chlorine gas evolved is:
1. 0.5 2. 1.0 3. 1.5 4. 1.9
2. If cathode is a Hg electrode, then the maximum weight of amalgam formed from this solution is:
1. 300g 2. 446g 3. 396g 4. 296g
3. The total charge (coulomb) required for complete electrolysis is:
1. 186000 2. 24125 3. 48296 4. 193000
4. In the electrolysis, the number of moles of electrons involved are:
1. 2 2. 1 3. 3 4. 4
5. In electrolysis of aqueous NaCl solution when Pt electrode is taken, then which gas is liberated at cathode?
1. H_2 gas 2. Cl_2 gas 3. O_2 gas 4. None of these.