Chapter 8 : Electrochemistry

Sl. No.	Question	Obj/ Spec./ Diff. Level
1.	Give reason : HCO_3^- is amphoteric.	U Interpret Average
	Acts as both acid and base	
2.	Give reason : CaO is not a base according to Bronsted-Lowry concept.	U Interpret Average
	Does not accept H^+ (proton)	
3.	Write the formula of conjugate base of HSO_4^-.	A Generalize Average
	SO_4^{2-}	
4.	What is a hydronium ion?	K Recall Average
	Protonated water H_3O^+ or Hydrated H^+	
5.	What is an amphoteric substance?	K Recall Easy
	Substance which behaves both as acid and base.	
6.	Write the formula of hydrated hydrogen ion.	K Recall Easy
	H_3O^+	
7.	Which among the following species is a Lewis acid? a) NH_3 b) BF_3 c) PH_3 d) CaO	U Identify Average
	BF_3	

8. Define the term 'Ionic product of water'.

K
Recall
Average

The product of molar hydrogen ion concentration and molar hydroxide ion concentration in water or in any other aqueous solution at a given temperature.

9. K_b values of A, B, C and D are 5.6×10^{-4}, 4.38×10^{-4}, 1.8×10^{-5} and 3.8×10^{-10} respectively. Arrange them in the decreasing order basic strength.

U
Interpret
Average

A > B > C > D

10. What happens to the ionic product of water when temperature is increased?

A
Interpret
Average

Ionic product of water increases

11. Which among the following species is a Lewis base?
BF_3, $AlCl_3$, $FeCl_3$, MgO

U
Identify
Average

MgO

12. Why is BF_3 a Lewis acid?

A
Reason
Average

It accepts lone pair of electrons.

13. What is the value of ionic product of water at 298 K ?

K
Recall
Easy

10^{-14}

14. What is $[H^+]$ in the 0.02 M H_2SO_4 solution?

A
Predict
Average

$2 \times 0.02 = 0.04$
or
4×10^{-2} M

15. What is $[OH]^-$ in 0.1 M HCl solution? — A, Analyse, Average

10^{-13} M

16. Define the term pH. — K, Recall, Easy

Negative log of molar concentration of hydrogen ion

17. What is the pH of a neutral solution at 298 K ? — K, Recognize, Average

7

18. What happens to the pH of a neutral solution when small amount of a strong acid is added? — A, Interpret, Average

pH decreases

19. What is $[H^+]$ in the 1M KOH solution at 298 K? — A, Predict, Average

10^{-14} M

20. What is $[OH^-]$ in 0.1 M Ca $(OH)_2$ solution assuming complete ionization? — A, Problem, Average

0.2 M or 2×10^{-1} M

21. The pK_b values of CH_3NH_2, $(CH_3)NH$, $(CH_3)_3N$ and $C_6H_5NH_2$ are 3.35, 3.22, 4.22 and 9.37 respectively. Arrange them in decreasing order of basic strength. — U, Compare, Average

$(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N > C_6H_5NH_2$

22. Give an example for neutral buffer. — K, Recall, Easy

$CH_3 - 100NH_4$

23. What is buffer capacity? — K, Recall, Easy

The ability due to reserve alkalinity or acidity

24. When will be the buffer capacity of a basic buffer maximum ? — U, Generalize, Average

[Salt] = [Base]

25. The pKa values of C_6H_5OH, CH_3COOH, HCOOH and H_2CO_3 are 9.96, 4.74, 3.75 and 6.37 respectively. Arrange them in the decreasing order of acidic strength. — U, Compare, Average

$HCOOH > CH_3COOH > H_2CO_3 > C_6H_5OH$

26. Give an example for basic buffer. — K, Recall, Easy

$NH_4OH + NH_4Cl$

27. What happens to the pH of the acetate buffer when further amount of sodium acetate is added ? — A, Predict, Difficult

pH increases.

28. When will be the buffer capacity of the acidic buffer maximum? — U, Generalize, Average

[salt] = [acid]

29. Write the Henderson equation for basic buffer. — K, Recall, Easy

$$P^{OH} = pKb + \log \frac{[salt]}{[base]}$$

30. What will be the p^{OH} of basic buffer if [salt] = [base] ? — A, Recall, Easy

$P^{OH} = P^{Kb}$

31. What is basic buffer?

K
Recall
Easy

A mixture of weak base and its salt with a strong acid.

32. Write the relationship between solubility product and solubility of AB_2 type of salts.

U
Relationship
Average

$K_{sp} = 4S^3$

33. What is an acidic buffer?

K
Recall
Easy

A mixture of a weak acid and its salt with a strong base.

34. Write the relationship between solubility product and solubility of AB type salt.

U
Establish relationship
Easy

$K_{sp} = S^2$

35. Write Henderson's equation for acidic buffer.

K
Recall
Easy

$$pH = pKa + \log \frac{[salt]}{[acid]}$$

36. What will be the pH of an acidic buffer if [salt] = [acid] ?

K
Recall
Average

$pH = pKa$

37. Write an example for AB type sparingly soluble salt.

U
Cite examples
Average

AgCl or any suitable example

38. Write an example for A_2B type of sparingly soluble salt.

U
Cite examples
Average

Ag_2CrO_4 or any suitable example

39. Write any example for AB_2 type sparingly soluble salt.

U
Cite example
Average

PbI_2, $PbCl_2$, CaF_2 or any other suitable example

40. Among AgCl and $PbCl_2$ which has the higher solubility ?
Given K_{sp} of AgCl = 1.7×10^{-10} and K_{sp} of $PbCl_2 = 2.4 \times 10^{-4}$.

U
Identify
Difficult

$PbCl_2$

41. Give reason : NH_4Cl is added before adding NH_4OH in the precipitation of III group basic radicals.

A
Reason out
Average

To decrease the $[OH^-]$

42. Define the term : common ion effect.

K
Recall
Easy

Suppression in the degree of dissociation of a weak electrolyte by adding a strong electrolyte containing common ion.

43. Give reason : Dilute HCl is added before adding H_2S in precipitation of II group basic radical.

A
Reason out
Average

To suppress the dissociation of H_2S

44. The degree of derivation of NH_4OH is suppressed by the addition of NaOH. Why ?

A
Reason out
Average

Due to common ion effect

45. Give reason : Zn displaces ion from ferrous sulphate solution.

A
Reason out
Average

Zinc lies above iron or in electrochemical series.
$E_oZn < E_oFe$

46. Give an example for corrosion. — Easy

Rusting of iron or any other example or tarnishing of sodium.

47. Write the relationship between standard free energy change and EMF of a cell. — K Recall Average

$\Delta G^o = - nFE^o$

48. Give reason : Mg displaces H_2 gas from dil. H_2SO_4. — A Assign reason Difficult

$E^o_{Mg} < E^o_{H_2}$

49. Define standard electrode potential. — K Recall Easy

It is the potential developed when a metal is in equilibrium with the 1M solution of its own ions at 298 K.

50. What is an electrochemical series? — K Recall Easy

It is the list of standard electrodes in the increasing order of standard reduction electrode potential.

51. What is the effect of temperature or the solubility product of a sparingly soluble salt in its saturated solution ? — U Interpret Average

Increases

52. Define single electrode potential. — K Recall Easy

It is the potential developed when a metal is in equilibrium with solution, its own ions.

53. What happens to the following chemical equilibrium when NH_4Cl is added ?
$NH_4OH \quad NH_4^+ + OH^-$

A
Interpret
Average

The equilibrium is shifted towards left direction.

54. Define the term solubility product.

K
Recall
Easy

Product of molar concentrations of constituent ions in 1 mole of an electrolyte in its saturated solution at constant temperature.

55. What is a base according to Arrhenius concept?

K
Recall
Average

Substance dissociated to give Hydroxide ion in water.

56. What is an acid according to Brownsted-Lowry concept ?

K
Recall
Easy

Proton donor

57. Define the term 'specific conductance'.

K
Recall
Average

Conductivity of 1 m^3 solution of an electrolyte.

58. Write the relationship between specific conductance and molar conductance.

U
Relationship
Easy

$\mu = K_s \cdot V_m$

59. State Faraday's first law of electrolytes.

K
Recall
Easy

Mass of the substance discharged is directly proportional to quantity of electricity passed.

60. Define the term "electrochemical equivalent". K Recall Average

Amount of substance liberated per one coulomb of current.

61. An electrolyte conducts electricity either in molten state or in aqueous solution. Give reason. A Assign reasons Average

An electrolyte dissociates into ions.

62. Which is the product formed at cathode during the electrolysis of aqueous NaCl ? A Analyse Average

H_2 gas

63. Write the formula of conjugate acid of HCO_3^-. A Generalize Average

H_2CO_3

64. Write the formula of conjugate acid of HS^-. A Generalize Average

H_2S

65. Write the formula of conjugate base of HCO_3^-. K Recall Average

CO_3^{--}

66. Give an example for amphoteric substance. K Recall Average

H_2O or any suitable example

67. The Ka values of A, B, C and D acids are 1.77×10^{-4}, 1.75×10^{-5}, 1×10^{-10} and 1×10^{-8} respectively. Arrange them in the increasing order of acidic strength. U Compare Average

$1 \times 10^{-10} < 1 \times 10^{-8} < 1.75 \times 10^{-5} < 1.77 \times 10^{-4}$

68. What is the $[H^+]$ in the 0.1 M HCl solution? — U, Predict, Average

$[H^+] = 10^{-1}$ M

69. Give reason : SO_2 is not an acid according to Bronsted and Lowry concept. — U, Interpret, Average

It is not a proton donor.

70. Give reason : NH_3 is a Lewis base. — U, Interpret

Electron pair donor.

71. Give an example for acidic buffer. — U, Cite example, Average

$CH_3COOH + CH_3COONa$

72. What is a Buffer solution ? — K, Define, Average

A solution which maintains pH value constant on adding small amount of strong acid or strong base.

73. Define p^{OH}. — K, Define

Negative logarithm of $[OH^-]$ to the base 10.

74. What happens to the p^{OH} of a basic solution when small amount of strong base is added ? — A, Analyse, Average

P^{OH} decreases

75. Give an example for an electrolyte. — K, Recall, Easy

NaCl, H_2SO_4 or any suitable example.

76. What happens to the conductivity of an electrolyte when temperature is increased? — A Interpret

Conductivity of an electrolyte increases

77. What is an electrolyte ? — K Recall Easy

A substance which conducts electricity either in molten state or in aqueous solution.

78. Which among the following is an electrolyte ?
a) NH_4Cl b) urea c) Ethanol d) Benzene — U Identify Easy

NH_4Cl

79. What is a strong electrolyte ? — K Recall Easy

A substance which dissociates completely in aqueous solution.

80. What is a weak electrolyte ? — K Recall Easy

A substance which dissociates partially in aqueous solution.

81. What is an non-electrolyte ? — K Recall Easy

A substance which does not conduct electricity either in molten state or in aqueous solution.

82. Give reason : Ethanol is a non-electrolyte. — A Assign reasons Easy

1. Ethanol is a covalent compound
Or
2. It does not ionize in solution.

83. Give reason : Sodium chloride is a strong electrolyte.

A
Assign reasons
Easy

It undergoes complete ionization in solution.

84. Give reason : 1 M HCl and 1 M CH_3COOH do not contain the same number of H^+ ions.

A
Analyse

HCl – strong electrolyte
CH_3COOH – weak electrolyte

85. What is ionization ?

K
Recall
Easy

Dissociation of electrolytes into constituent ions in aqueous solution.

86. Which is the product formed at the cathode during the electrolysis of molten sodium chloride ?

A
Analyse
Average

Sodium metal

87. Which is the product formed at the cathode during the electrolysis of molten $MgCl_2$?

A
Analyse
Average

Magnesium metal

88. Define the term degree of dissociation.

K
Recall
Easy

The fraction of the electrolytes that dissociates at equilibrium.

89. Give reason : HCl is a non-electrolyte in a non-aqueous solution.

A
Analyse
Difficult

∴ HCl is a covalent compound.

90. Define the term electrolysis. K Recall Easy

The process of decomposition of an electrolyte into elements by passing direct current through it.

91. Define the term molar conductance. K Recall Easy

It is the conductivity due to all the ions produced by the dissociation of 1 mole of an electrolyte.

92. Write the SI unit of molar conductance. K Recognize Average

∴ Sm^2mol^{-1}

93. Write the mathematical form of Faraday's I Law of Electrolysis. K Recognize

$W = ZIt$

94. Define the term Faraday. K Recall Average

It is the charge on 1 mole of electrons.
OR
Quantity of electricity required to liberate 1g equivalent mass of a substance.

95. State Faraday's II law of electrolysis. K Recall Average

∴ The mass of the substance liberated at an electrode is directly proportional to their equivalent mass when same amount of electricity is passed through different electrolyte solution.

96. What is the value of 1 Faraday in Coulomb? K

Recall
Easy

1 F = 96500 C

97. Mention the S.I. unit of specific conductance.

K
Recall
Easy

Sm^{-1}

98. How does molar conductance vary with dilution?

U
Identify
Average

Increases

99. What is a conjugate acid-base pair?

K
Recall
Average

A pair of an acid and a base which differ by a proton.

100. Write the formula of conjugate acid of NH_2^-.

A
Generalize
Average

NH_3

101. What is an acid according to Arrhenius concept?

K
Recall
Easy

Produces proton when dissolved in water.

102. Arrhenius concept of acids and bases does not consider BF_3 as an acid. Give reason.

A
Interpret
Average

It does not produce H^+ ion in water.

103. Arrhenius concept of acids and bases does not consider SO_2 as an acid. Give reason.

A
Interpret
Average

It does not produce H^+ ion in water.

104. What is a base according to Bronsted-Lowry concept? — K, Recall, Easy

Proton acceptor

105. Write the formula of conjugate acid of OH^-. — A, Generalize, Average

H_2O

106. Write the formula of conjugate base of H_2CO_3. — A, Generalize, Average

HCO_3^-

107. Define term corrosion. — K, Recall, Easy

The chemical attack on the metal by the constituents of the environment.

108. The standard reduction potential values of the electrodes A, B and C are +0.8 V, -3.05 V and –0.44 V respectively. Arrange the electrodes in the order of increasing reducing power. — U, Compare

A < C < B

109. What is a Galvanic cell? — K, Recall, Easy

A device in which electricity is produced using a spontaneous reaction involving oxidation and reduction.

110. Give an example for a galvanic cell. — U, Cite examples, Average

Daniel Cell or any one suitable example.

111. Calculate the standard free energy change in a Daniel cell.
Given $E^\circ_{Zn} = -0.76V$
And $E^\circ_{Cu} = +0.34$ V — A, Problems – Analyse, Average

Formula – ½ mark
Substitution – ½ mark
Answer with unit – 1 mark

112. Mention any two limitations of SHE. K Recall Average

Two limitations (2 × 1 = 2 marks)

113. Daniel cell is represented by Zn / Zn^{2+} || Cu^{2+} | Cu, write the electrode reactions taking place in the oxidation half-cell and the reduction half cell. A Analyse Difficult

1. Oxidation half cell reaction – 1 mark
2. Reduction half cell reaction - 1 mark

114. Mention any two methods of prevent corrosion. K Recall Easy

Any two suitable methods (2 × 1 = 2 marks)

115. Calculate the electrode potential of zinc electrode dipped in 0.001M $ZnSO_4$ solution at 298 K. Given E°_{Zn} = -0.76 V. A Problems Average

Formula – ½ mark
Substitution – ½ mark
Answer with unit – 1 mark

116. Calculate the electrode potential of copper electrode dipped in 0.01M $CuSO_4$ solution at 298 K. Given E°_{Cu} = + 0.34 V. A Problems Average

Formula – ½ mark
Substitution – ½ mark
Answer with unit – 1 mark

117. Write the diagram of Daniel cell and also label the parts. K Labeling Average

Diagram with labeling – 2 marks

118. Calculate EMF of a Daniel cell. Given, E°_{Cu} = +0.34V and E°_{Zn} = - 0.76 V.

Formula – ½ mark
Substitution – ½ mark
Answer with unit – 1 mark

119. Give reason : When NH_4OH and NH_4Cl are added to a solution containing Al^{3+} and Zn^{2+} ions, $Al(CH_3)$ precipitates but $Zn(OH)_2$ does not.

U
Compare
Difficult

1. $[OH^-]$ is very low. (½ mark)
2. $I_c > K_{sp}$ does not exceed ionic product (½ mark)
3. $Zn(OH)_2$ has high K_{sp} value (½ mark)
4. Ionic product of $Zn(OH)_2$ does not exceed K_{sp} value (½ mark)

120. Give reason: When H_2S is passed into acidic solution containing Zn^{2+} and Cu^{2+} ions, CuS precipitates but ZnS does not.

U
Compare
Difficult

1. $[S^{2-}]$ is very low. (½ mark)
2. Ionic product of CuS exceeds K_{sp} value. (½ mark)
3. K_{sp} value of ZnS is high. (½ mark)
4. Ionic product of ZnS cannot exceed K_{sp} value. (½ mark)

121. Mention any two factors which affect single electrode potential.

K
Mention
Easy

1. Nature of the metal. (1 mark)
2. Temperature OR any two suitable factors (1 mark)

122. Write Nernst equation for electrode potential and expand the terms involved in it.

K
Equation – recall
Easy

Equation (1 mark)
Expanding the terms (1 mark)

123. The solubility product of a sparingly soluble salt of type AB is 3.9×10^{-10} K. Calculate its solubility in mol/dm^3.

A
Problems
Average

1. $S = \sqrt{K_{sp}}$ (½ mark)
2. Substitution (½ mark)
3. result (1 mark)

124. The solubility product of CaF_2 in water at a given temperature is 3.4×10^{-11}. Calculate its solubility in g/dm^3.

A
Problems
Average

1. $S = \sqrt[3]{\frac{K_{sp}}{4}}$ (½ mark)
2. Substitution (½ mark)
3. Result (1 mark)

125. Mention any two applications of common ion effect.

K
Mention
Average

1. III gp analysis of basic radicals (1 mark)
2. II gp analysis of basic radicals or any two applications (1 mark)

126. Predict whether AgCl will be precipitated or not if $[Ag^+] = 1.8 \times 10^{-8}$ M and $[Cl^-] = 1.8 \times 10^{-8}$ M. Given K_{sp} of AgCl = 1.08×10^{-10}.

A
Predict
Average

Ionic product (1 mark)
AgCl precipitated (1 mark)

127. 4g of NaOH is dissolved in 10 dm^3 of the solution. Calculate the pH of the solution?

A
Problems
Average

$[OH^-]$ = ---------- (1 mark)
pH = ---------- (1 mark)

128. Mention any two uses of buffer.

K
Mention
Average

Two uses of buffer (1 mark for each)

129. Explain common ion effect with an example.

U
Explain
Easy

Example (1 mark)
Explanation (1 mark)

130. Calculate $[OH^-]$ of the solution whose pOH value is 6.7.

A
Problems
Average

$pOH = - \log [OH^-]$ (½ mark)
$[OH^-]$ calculation (1 mark)
Result with unit (½ mark)

131. Calculate the pH value of the resulting solution when equal volumes of two solutions of pH = 3 and pH = 5 are mixed.

S
Problems solving
Difficult

When pH = 3, $[H^+] = 10^{-3}$ M (½ mark)
When pH = 5, $[H^+] = 10^{-5}$ M (½ mark)
In the mix, $[H^+] = \frac{10^{-3} + 10^{-5}}{2} = 5.05 \times 10^{-4}$ M (½ mark)
$pH = - \log [H^+] = - \log (5.50 \times 10^{-4}) = 3.2967$ (½ mark)

132. Calculate $[H^+]$ and $[OH^-]$ concentration of a solution whose pH is 4.2. [Given $K_w = 10^{-14}$]

A
Problems
Average

Formula (½ mark)
$[H^+]$ (1 mark)
$[OH^-]$ (½ mark)

133. Calculate the pH of $10^{-3.8}$ M sodium hydroxide solution.

A
Problems
Average

$[OH^-]$ (½ mark)
$[H^+]$ (½ mark)
pH formula (½ mark)
Result (½ mark)

134. Calculate the pH of $\frac{N}{100}$ H_2SO_4 assuming complete dissociation.

A
Problem
Average

$[H^+]$ (½ mark)
pH – formula (½ mark)
Substitution (½ mark)
Result (½ mark)

135. The pH of a solution is 3.4. Calculate the $[H^+]$ ion concentration.

A
Problem
Average

Formula (½ mark)
Calculation (½ mark)
Result with unit (1 mark)

136. What is the pH of 0.1 M $Ca(OH)_2$?

A
Problem – analyse
Average

$[OH^-]$ (½ mark)
$[H^+]$ (½ mark)
pH (formula) (½ mark)
Substitution and Result (½ mark)

137. Calculate the pH of $\frac{N}{50}$ HCl assuming complete dissociation.

A
Problem
Average

$[H^+]$ (½ mark)
pH formula (½ mark)
Substitution (½ mark)
Result (½ mark)

138. 0.01 M solution of formic acid is 4% ionized. Calculate $[H^+]$.

A
Problem
Average

Formula (½ mark)
Substitution (½ mark)
Result with unit (1 mark)

139. 0.05 M solution of NH_4OH is 2% dissociated. Calculate K_p.

A
Problem
Average

Formula (½ mark)
Substitution (½ mark)
Result with unit (1 mark)

140. Calculate $[H^+]$ and $[OH^-]$ of 0.01 M $Ba(OH)_2$ assuming complete dissociation.

A
Analyse
Average

$[OH^-] = 2 \times 10^{-2}$ M (½ mark)

$[H^+] = \frac{10^{-14}}{(OH^-)}$ Substitution with formula (1 mark)

Result with unit (½ mark)

141. What is the pH of 1M HCl assuming complete dissociation?

A
Analyse
Average

Formula of pH (½ mark)
Substitution (½ mark)
Result (1 mark)

142. Calculate (OH^-) of 0.02 M NH_4OH, given K_b of $NH_4OH = 1.75 \times 10^{-5}$.

A
Problem
Average

Formula (½ mark)
Substitution (½ mark)
Result with unit (1 mark)

143. Calculate the $[H^+]$ of 0.1 M HCOOH. Given $K_a = 1.77 \times 10^{-4}$.

A
Problem
Average

Formula (½ mark)
Substitution (½ mark)
Result with unit (1 mark)

144. The dissociation constant of CH_3COOH is 1.8×10^{-5} at 298 K. Calculate the degree of dissociation in 0.02M solution.

A
Interpret
Difficult

Formula (½ mark)
Substitution (½ mark)
Result (1 mark)

145. The degree of dissociation of a weak acid is 0.02 in 0.01 M solution. Calculate the dissociation constant of the weak acid.

A
Interpret
Average

Formula (½ mark)
Substitution (½ mark)
Result (1 mark)

146. Explain Lewis acid and base with an example.

U
Cite example and identify
Average

$BF_3 + :NH_3 \longrightarrow BF_3 \longleftarrow :NH_3$
Lewis Acid — Lewis base
Example (1 mark)
Identification of the species (1 mark)

147. Water is a Bronsted acid but not Lewis acid. Give reason.

A
Reason out
Average

1. Donates H^+ ion (1 mark)
2. does not accept lone pair of electrons (1 mark)

148. What is a Lewis acid? Give an example.

U
Recall
Easy

A substance which accepts a pair of electrons (2 mark)
BF_3, $AlCl_3$ or any one suitable example (1 mark)

149. What is a Lewis Base ? Give an example.

K
Recall
Easy

A substance that donates pair of electrons (1 mark)
NH_3, H_2O, MgO or any one suitable example (1 mark)

150. A current of 0.01 amp was passed through copper and silver electrolytic cells connected in the series for 30 minutes. Calculate the ratio of masses of Cu and Ag deposited.
Formula – 1 mark
Correct answer – 1 mark

151. Mention any two evidences for Arrhenius Theory of electrolytic dissociation.

K
Recall
Average

One mark each for correct evidence.

152. Mention any two demerits of Arrhenius Theory of electrolytic dissociation.

K
Recall
Average

One mark each for correct demerit.

153. Mention any two factors affecting conductance of an electrolytic solution.

One mark each for correct factors.

154. Calculate the ionic product of water at 310 K.
Given $[H^+] = 1 \times 10^{-6}$ M.

A
Solve
Average

i) $K_w = [H^+]\ [OH^-]$ and substitution.
ii) Answer and unit

155. The ionic product of water at 323 K is 10^{-12}. Calculate $[H^+]$ $[OH^-]$.

A

i) Equation with substitution
ii) Answer and unit

156. NH_3 acts as both Bronsted base and Lewis base. Give reason.

U
Identify
Average

i) Proton acceptor
ii) Electron pair donor

157. Write any two demerits of Bronsted and Lowry concept of acids and bases.

A
Generalize
Average

i) Failed to classify basic oxides like CaO, MgO, etc. as Bases.
ii) Failed to classify SO_2, CO_2, etc. as acids.

158. Identify the conjugate bases in the following reaction :
$HCl + H_2O \quad Cl^- + H_3O^+$

U
Identify

i) Cl^-
ii) H_2O

159. Identify the conjugate acids in the reaction :
$NH_3 + CH_3COOH \quad NH_4^+ + CH_3COO^-$

i) NH_4^+
ii) CH_3COOH

160. Derive an expression for Ostwald's dilution law. U Explain Average

	BA	$B^+ + A^-$
	C	O O
Initial Conc		
Conc. At equation	$(1 - \alpha)c$	αc αc

Apply the law of mass action:

$$K = \frac{[B^+]\,[A^-]}{[BA]} = \frac{\alpha c \times \alpha c}{(1-\alpha)c} = \frac{\alpha^2 c}{1-\alpha}$$

161. Calculate $[H^+]$ of 0.01 M CH_3COOH. Given K_a of CH_3COOH = 1.8×10^{-5}. U

Equation, substitution, answer, units.

162. Explain with an example of Brownsted-Lowry concept of base. U Average

A substance which can accept proton. Ex. NH_3

163. What is a conjugate and base pair? Give an example. A Generalize

Differ by a proton.
Ex: H_3O^+ and H_2O
HCO_3^- and CO_3^{2-} or any suitable example.

164. When the same amount of electricity is passed through solutions of $CuSO_4$ and $AgNO_3$, 3.2 g of copper is deposited on the cathode in the first case. Calculate the mass of Ag deposited. A Analyse Average

Formula (½ mark)
Substitution (½ mark)
Result with unit (½ + ½ = 1 mark)

165. Calculate the quantity of electricity required to deposit 6g of Mg (Eq. Mass = 12). A Generalize Average

Calculation (1 mark)
Result with unit (1 mark)

166. Mention any two limitations of Arrhenius concept of acids. U Interpret Average

1. Amphoteric nature of NH_3
2. BF_3, $AlCl_3$, etc. do not have proton to donate.

167. Explain with an example if Bronsted-Lowry concept of acid. U Average

A substance which can donate proton. Ex: HCl

168. Group the following into strong electrolytes and weak electrolytes. U Classify Average
i) NH_4OH ii) H_2S iii) CH_3COONa iv) H_2SO_4

Strong electrolytes : CH_3cOONa and H_2SO_4
Weak electrolytes : NH_4OH and H_2S

169. Calculate the mass of silver deposited from $AgNO_3$ solution by passing a current of 2 amperes for 30 minutes. A Interpret Difficult

$Q = I \times t$
$Q = 2 \times 30 \times 60 = 3600\ C$ } (1 mark)

$Z = \frac{E}{96,500} = \frac{108}{96,500}$

$\therefore\ W = Zit = \frac{108}{96,500} \times 3600 = 4.02\ g$ } (1 mark)

170. Explain with an example Arrhenius – concept of an acid. A Average

A compound that dissociates and releases hydrogen ion when dissolved in water.
Ex : $HCl_{aq} \xrightarrow{H_2O} H^+ + Cl^-$

171. Explain with an example Arrhenius concept of a base. A Average

The compound undergoes dissociation and releases hydroxide ion when dissolved in water.
$NaOH \longrightarrow Na^+ + OH^-$

172. Mention any two factors affecting ionisation.

K
Recall
Easy

Temperature, dilution or any suitable factors.

173. What happens to the degree of dissociation of aqueous solution on weak electrolytes?
   a) An infinite dilution
   b) An adding a strong electrolyte conducts a common ion.

A
Analyse
Average

   a) 1
   b) decreases

174. Mention any two differences between strong electrolyte and weak electrolyte.

U
Distinguish
Average

Strong electrolyte : 1. Undergoes complete ionisation, 2. Degree of dissociation is high.
Weak Electrolyte : 1. Partial ionisation, 2. Low

175. On passing 1F of electricity, 108 g of silver is deposited at cathode. Calculate the mass of silver on passing 965 C of electricity.

A
Interpret
Difficult

Calculation (1 mark)
Result with unit (1 mark)

176. Mention the factors affecting the conductance of an electrolytic solution.

K
Mention
Average

One mark for each factor

177. Explain the application of common ion effect and principles of solubility product on the precipitation of III group basic-radicals.

U
Explain/
interpret
Difficult

1. Common ion effect (1 mark)
2. Low $[OH^-]$, K_{sp} of III gp low (1 mark)
3. Ionic product exceeds K_{sp} (1 mark)

178. Explain the construction and working of a Daniel cell and also write the cell reaction.

U
Explain
Average

1. Construction (1 mark)
2. Working (1 mark)
3. Cell reaction (1 mark)

179. Explain the use of SHE in the determination of standard electrode potential of copper electrode.

S
Construct and measure
Difficult

1. Cell representation (1 mark)
2. Explanation (1 mark)
3. EMF calculation (1 mark)

180. The pOH of a basic buffer is 5. Calculate the mole proportion of NH_4OH and NH_4Cl. Given $K_b = 1.8 \times 10^{-5}$.

A
Problem
Difficult

Handerson equation (1 mark)
Substitution of values and simplification (1 mark)
Mole proportion calculation and answer (2 marks)

181. Calculate the pH of a buffer solution prepared by mixing 0.2 M of sodium acetate and 0.15 M of acetic acid. Given $K_a = 1.8 \times 10^{-5}$.

A
Problems
Difficult

Handerson formula (1 mark)
Substitution and simplification (2 marks)
Answer and units (1 mark)

182. Calculate the pH of a buffer mixture of 0.04 M NH_4Cl and 0.1M NH_4OH at 298 K. Given K_b of $NH_4OH = 1.8 \times 10^{-5}$.

A
Problem
Difficult

Handerson formula (1 mark)
Substitution and simplification (2 marks)
Calculation and answer (1 mark)

183. Explain the mechanism of acetic acid and sodium acetate buffer.

U
Explain
Average

Ionization equation

$NH_4OH \quad NH_4^+ + OH^-$

$NH_4Cl \quad NH_4^+ + Cl$ } (1 mark)

Introduction (1 mark)
Action of acid (1 mark)
Action of base (1 mark)

184. The pH of acetic acid and sodium acetate buffer is 6. Calculate the mole proportion of sodium acetate and acetic acid. Ka of acetic acid = 1.8×10^{-5}. — A, Problems, Average

Henderson's equation (1 mark)
PKa calculation (1 mark)
Mole proportion calculation and answer (1 + 1 = 2 marks)

185. Explain the principles involved in the preparation of an acidic buffer solution of desired pH. — K, Recall

1. A suitable weak acid for which Ka is known is selected. (1 mark)
2. Mixing a weak acid and its salt with a strong base (1 mark)
3. Adjusting the ratio $\frac{[salt]}{[acid]}$ (1 mark)
4. Determining the pH using Henderson's equation (1 mark)

186. Mention any four postulates of Arrhenius Theory of electrolytic dissociation. — K, Recall, Average

One mark each for one postulate.

187. Derive an expression for Henderson's equation for pH of a buffer solution. — U, Derivation – interpret, Average

1. Equation (1 mark)
2. Ka (1 mark)
3. $[H^+]$ (1 mark)
4. pH (1 mark)

188. Mention any two merits and two demerits of electrolyte dissociation of Arrhenius theory. — K, Mention, Average

One mark for each merit (2 marks)
One mark for each demerit (2 marks)

189. Explain the construction and workign of SHE.

S
Construction and drawing

1. Neat labelled diagram of SHE (1 mark)
2. Construction of SHE (1 mark)
3. Workign of SHE (1 mark)
4. Cell representation and cell reaction (1 mark)

190. Explain the principles involved in the preparation of a basic buffer solution of desired pH.

1. Selecting a suitable weak base for which Kb is known. (1 mark)
2. Mixing the weak base and its salt with a strong acid (1 mark)
3. Adjusting the ratio $\frac{[Salt]}{[Base]}$ (1 mark)
4. Determining the pOH using Henderson's equation and pH by 14-pOH (1 mark)

191. Calculate the pH of a solution prepared by mixing 40 cm^3 of 10^{-2}M NaOH solution and 10 cm^3 of 10^{-3} M HCl.

S
Solve
Difficult

Calculation of amount of NaOH (1 mark)
Calculation of amount of HCl (1 mark)
Calculation of $[H^+]$ (1 mark)
Calculation of pH (1 mark)

192. Explain the mechanism of buffer action of NH_4OH and NH_4Cl buffer solution.

U
Explain
Average

1. Equations (1 mark)
2. Explanation (Introduction) (1 mark)
3. Action of acid (1 mark)
4. Action of base (1 mark)

193. Elaborate the statement "Corrosion is an Electrochemical phenomenon". Taking rusting of Fe as example.

U
Explain
Difficult

1. Oxidation of Fe → Fe^{2+} (1 mark)
2. Reduction of H_2O - OH^- (1 mark)
3. Formation of $Fe(OH)_2$ and $Fe(OH)_3$ (1 mark)
4. Decomposition of $Fe(OH)_3$ → Fe_2O_3 xH_2O (1 mark)