IIT-JAM

CONDUCTANCE

Single Answer Type

1. The unit of molar conductivity is

(a) Ω^{-1} (b) $\Omega^{-1}cm^{-1}$ (c) $\Omega^{-1}cm^{-1}mol^{-1}$ (d) $\Omega^{-1}cm^{2}mol^{-1}$

2. The cell constant of a conductivity cell is defined as

(a) $K = \frac{l}{A}$ (b) $K = lA$ (c) $K = \frac{A}{l}$ (d) $K = \frac{1}{lA}$

Where l = distance between electrodes and A = area of cross-section of each of the electrodes

3. Molar conductivity is defined as

(a) $\frac{K}{V_m}$ (b) KV_m (c) Gl (d) Kl^2

Where k = conductivity, G = conductance, l = distance between two electrodes and V_m = volume of solution containing 1 mol of electrolyte

4. For a dilute solution of a strong electrolyte, the variation of molar conductivity with concentration is given by

(a) $\Lambda_M = \Lambda_M^{\infty} + bc$ (b) $\Lambda_M = \Lambda_M^{\infty} - bc$ (c) $\Lambda_M^{\infty} = \Lambda_M - b\sqrt{c}$ (d) $\Lambda_M = \Lambda_M^{\infty} - b\sqrt{c}$

5. Which of the following ion is expected to have least value of molar conductivity at infinite dilution in an aqueous solution?

(a) Na^+ (b) K^+ (c) Rb^+ (d) Cs^+

6. Which of the following ion is expected to have highest value of molar conductivity at infinite dilution in an aqueous solution?

(a) Na^+ (b) K^+ (c) H^+ (d) $\frac{1}{2}Ca^{2+}$

7. The degree of dissociation of a weak electrolyte is given by

(a) $\alpha = \frac{\Lambda_C}{\Lambda^{\infty}}$ (b) $\alpha = \frac{\Lambda^{\infty}}{\Lambda_C}$ (c) $\alpha = \frac{\Lambda_C^2}{\Lambda^{\infty}}$ (d) $\alpha = \Lambda_C \Lambda^{\infty}$

8. Which of the following ion has highest molar conductivity at infinite dilution in an aqueous solution?

(a) F^- (b) Cl^- (c) Br^- (d) HCO^-

9. The equilibrium constant of acetic acid in an aqueous solution of concentration C is given by

(a) $K = \frac{C\Lambda_C^2}{\Lambda^{\infty} - \Lambda_C}$ (b) $K = \frac{C\Lambda_C^2}{\Lambda^{\infty}(\Lambda^{\infty} - \Lambda_C)}$ (c) $K = \frac{C\Lambda_C^2}{\Lambda^{\infty} + \Lambda_C}$ (d) $K = \frac{C\Lambda_C^2}{\Lambda^{\infty}(\Lambda^{\infty} - \Lambda_C)}$

10. Molar conductivity of $Fe_2(SO_4)_3$ is given by

(a) $\Lambda_M^{\infty} = \Lambda_{eq}^{\infty}(Fe^{3+}) + \Lambda_{eq}^{\infty}(SO_4^{2-})$ (b) $\Lambda_M^{\infty} = \Lambda_M^{\infty}(Fe^{3+}) + \Lambda_{eq}^{\infty}(SO_4^{2-})$

(c) $\Lambda_M^{\infty} = \Lambda_{eq}^{\infty}(Fe^{3+}) + 3\Lambda_{eq}^{\infty}(SO_4^{2-})$ (d) $\Lambda_M^{\infty} = 2\Lambda_M^{\infty}(Fe^{3+}) + 3\Lambda_M^{\infty}(SO_4^{2-})$

11. Equivalent conductivity of $Fe_2(SO_4)_3$ is related to molar conductivity by the expression

(a) $\Lambda_{eq} = \Lambda_M$ (b) $\Lambda_{eq} = \Lambda_{M/3}$ (c) $\Lambda_{eq} = 3\Lambda_M$ (d) $\Lambda_{eq} = \Lambda_{M/6}$

12. Which of the following expressions is correct?

(a) $\Lambda_M^{\infty}(NH_4OH) = \Lambda_M^{\infty}(NH_4Cl) + \Lambda_M^{\infty}(NaOH) - \Lambda_M^{\infty}(NaCl)$

(b) $\Lambda_M^\infty(NH_4OH) = \Lambda_M^\infty(NH_4Cl) - \Lambda_M^\infty(NaOH) + \Lambda_M^\infty(NaCl)$
(c) $\Lambda_M^\infty(NH_4OH) = \Lambda_M^\infty(NH_4Cl) - \Lambda_M^\infty(NaOH) - \Lambda_M^\infty(NaCl)$
(d) $\Lambda_M^\infty(NH_4OH) = \Lambda_M^\infty(NH_4Cl) + \Lambda_M^\infty(NaOH) + \Lambda_M^\infty(NaCl)$

13. If x is the specific resistance of the electrolyte solution and y is he molarity of the solution, then Λ_M is given by
(a) $\frac{1000x}{y}$ (b) $\frac{1000y}{x}$ (c) $\frac{1000}{xy}$ (d) $\frac{xy}{1000}$

14. When a conductance cell was filled with a 0.0025 M solution of K_2SO_4, its resistance was 326 Ω. If cell constant is 0.2281 cm^{-1}, the specific conductance ($\Omega^{-1}cm^{-1}$) of K_2SO_4 solution is
(a) 4.997×10^{-4} (b) 5.997×10^{-4} (c) 6.997×10^{-4} (d) 7.997×10^{-4}

15. Equivalent conductance of 0.1 M HA (weak acid) solution is 105 cm^2 equivalent^{-1}. The pH of HA solution is
(a) 1.3 (b) 1.7 (c) 2.3 (d) 3.7

16. For HCl solution at 25°C, the equivalent conductivity at infinite dilution is 425 Ω^{-1} cm^2 eq^{-1}. The specific conductance of a solution of HCl is 3.825 Ω^{-1} cm^{-1}. If the apparent degree of dissociation is 90%, the normality of solution is
(a) 0.9 (b) 10.00 (c) 1.1 (d) 1.2

17. The conductance at infinite dilution follow the order
(a) $Li^+ > Na^+ > K^+$ (b) $Na^+ > Li^+ > K^+$ (c) $K^+ > Li^+ > Na^+$ (d) $K^+ > Na^+ > Li^+$

18. The correct relation which depicts the Debye-Huckel Onsager Theory for strong electrolytes is
(a) $\Lambda_M = \Lambda_M^\infty - (A\Lambda_M^\infty - B)\sqrt{C}$
(b) $\Lambda_M = \Lambda_M^\infty - A\Lambda_M^\infty\sqrt{C} - B\sqrt{C}$
(c) $\Lambda_M^\infty = \Lambda_M - (A\Lambda_M^\infty + B)\sqrt{C}$
(d) $\Lambda_M^\infty = \Lambda_M - A$ [illegible] $\sqrt{C} + B\sqrt{C}$

19. The unit of A in Debye-Huckel-Onsager equation for strong electrolytes is
(a) $\Omega^{-1}cm^2M^{-1/2}$ (b) $\Omega^{-1}cm^{-2}M^{1/2}$ (c) $\Omega^{-1}m^2M^{-1}$ (d) M [illegible]

20. Which of the following solutions will show the minimum value of transference number of [illegible] ions?
(a) 0.1 M NaCl solution
(b) 0.1 M KCl solution
(c) 0.1 M HCl solution
(d) 0.1 M Mg[illegible] solution

Multiple Answer Type

21. Which of the following options are correct?
(a) The metallic conduction is due to the movement of electrons in [illegible]
(b) The electrolytic conduction is due to the movement of ions in the [illegible]
(c) The metallic conduction increases with increase in temperature
(d) The electrolytic conduction decreases with increase in temperature

22. The correct expressions between conc. mobility and molar conductivity are
(a) $\Lambda_M = \frac{Fu}{Z_+}$ (b) $\Lambda_M = FuZ_+$ (c) $u = \frac{\Lambda_M Z_+}{F}$ (d) $u = \frac{\Lambda_M}{F Z_+}$

23. Which of the following are correct?
(a) Conductivity of a solution increases with dilution
(b) Molar conductivity of a solution increases with dilution
(c) Conductivity of a solution decreases with dilution

(d) Molar conductivity of a solution decreases with dilution

24. Which of the following expressions are correct?

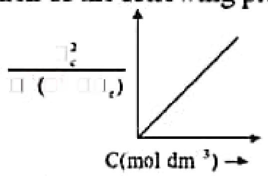
(a) $\Lambda^{\infty}_{eq}[Al_2(SO_4)_3] = 6\{\Lambda^{\infty}_{eq}(Al^{3+}) + \Lambda^{\infty}_{eq}(SO_4^{2-})\}$

(b) $\Lambda^{\infty}_{eq}[Al_2(SO_4)_3] = 2\Lambda^{\infty}_{eq}(Al^{3+}) + 3\Lambda^{\infty}_{eq}(SO_4^{2-})$

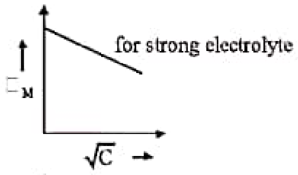
(c) $\Lambda^{\infty}_{M}(O_xH_2) = \Lambda^{\infty}_{M}(Na_2O_x) + \Lambda^{\infty}_{M}(H_2SO_4) - \Lambda^{\infty}_{M}(Na_2SO_4)$

(d) $\Lambda^{\infty}_{M}(FeSO_4) = \Lambda^{\infty}_{M}(Fe^{2+}) + \Lambda^{\infty}_{M}(SO_4^{2-})$

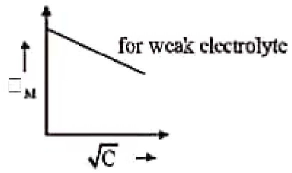
25. Which of the following plots are correct



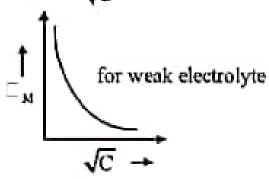
(a)



(b)



(c)



(d)

26. The correct expressions of molar conductivity are

(a) $\Lambda_M = \frac{K}{C}$ (b) $\Lambda_M = \frac{K}{V_m}$ (c) $\Lambda_M = KV_m$ (d) $\Lambda_M = KC$

27. The correct expressions for dissociation constant of weak acid are

(a) $K = \frac{C\alpha^2}{(1-\alpha)}$ (b) $K = \frac{C\Lambda_c^2}{(\Lambda^{\infty})^2(\Lambda^{\infty} - \Lambda_c)}$

(c) $K = \frac{C\Lambda_c}{\Lambda^{\infty}(\Lambda^{\infty} - \Lambda_c)}$ (d) $K = \frac{C\Lambda_c^2}{\Lambda^{\infty}(\Lambda^{\infty} - \Lambda_c)}$

28. The correct expressions which explain the Debye-Huckel-Onsager Theory for strong electrolytes are

(a) $\Lambda_M = \Lambda^{\infty}_M - (A\Lambda^{\infty}_M + B)C$ (b) $\Lambda_M = \Lambda^{\infty}_M - A\Lambda^{\infty}_M\sqrt{c} - B\sqrt{C}$

(c) $\Lambda^{\infty}_M = \Lambda^{\infty}_M - (A\Lambda^{\infty}_M + B)\sqrt{C}$ (d) $\Lambda_M = \Lambda^{\infty}_M - (A\Lambda^{\infty}_M + B)\sqrt{C}$

29. The correct order of molar conductivities at infinite dilution are

(a) $Li^+ < Na^+ < K^+$ (b) $K^+ < Na^+ < Li^+$ (c) $H^+ < Li^+ < Na^+ < K^+$ (d) $Li^+ < Na^+ < K^+ < H^+$

30. The correct expressions for equivalent conductance are

(a) $\Lambda_{eq} = Gl^2/eq$ (b) $\Lambda_{eq} = KV_{eq}$ (c) $\Lambda_{eq} = \frac{K}{V_{eq}}$ (d) $\Lambda_{eq} = \frac{Gl^2}{V_{eq}}$

31. Choose the correct statements

(a) In comparison to other cations, H^+ has highest value of molar conductivity in aqueous solution

(b) Among anions NH_2^- has highest value of molar conductivity in liquor ammonia

(c) Among cations, H^+ has highest value of molar conductivity in all solutions

(d) Among anions, HO^- has highest value of molar conductivity in all solutions.

32. Choose the correct options

(a) $\Lambda_{eq} = 2\Lambda_M$ for $FeSO_4$ solution (b) $\Lambda_{eq} = 6\Lambda_M$ for $FeSO_4$ solution
(c) $\Lambda_M = 6\Lambda_{eq}$ for $Al_2(SO_4)_3$ solution (d) $\Lambda_{eq} = 6\Lambda_M$ for $Al_2(SO_4)_3$ solution

33. Which of the following will have same value of molar conductivity and equivalent conductivity
(a) 0.1 M NaCl solution (b) 0.1 M Na_2SO_4 solution
(c) 0.1 M KCl solution (d) 0.1 M $MgCl_2$ solution

34. If $\Lambda_M^\infty(K^+) = 73.5\Omega^{-1}cm^2mol^{-1}$, $\Lambda_M^\infty(Al^{3+}) = 189\Omega^{-1}cm^2mol^{-1}$ and $\Lambda_M^\infty(SO_4^{2-}) = 160\Omega^{-1}cm^2mol^{-1}$, then
(a) $\Lambda_M^\infty(K_2SO_4) = 307\Omega^{-1}cm^2mol^{-1}$ (b) $\Lambda_M^\infty(K_2SO_4) = 393.5\Omega^{-1}cm^2mol^{-1}$
(c) $\Lambda_M^\infty(Al_2(SO_4)_3) = 858\Omega^{-1}cm^2mol^{-1}$ (d) $\Lambda_M^\infty(\text{Potash Alum}) = 165\ S\ cm^2mol^{-1}$

35. The unit of conductance is (are)
(a) Ω (b) Ω^{-1} (c) $\Omega^{-1}cm^{-1}$ (d) S

36. The unit of conductivity is(are)
(a) $\Omega^{-1}cm^{-1}$ (b) $\Omega^{-1}cm^2mol^{-1}$ (c) $S\ cm^{-1}$ (d) $S\ cm^2eq^{-1}$

37. If $\Lambda_M^\infty(K^+) = 73.5\Omega^{-1}cm^2mol^{-1}$, $\Lambda_M^\infty(Al^{3+}) = 189\ \Omega^{-1}cm^2mol^{-1}$ and $\Lambda_M^\infty(SO_4^{2-}) = 160\ \Omega^{-1}cm^2mol^{-1}$, then
(a) $\Lambda_{eq}^\infty(K_2SO_4) = 153.5\ \Omega^{-1}cm^2mol^{-1}$ (b) $\Lambda_{eq}^\infty(Al_2(SO_4)_3) = 143\ \Omega^{-1}cm^2eq^{-1}$
(c) $\Lambda_{eq}^\infty(\text{Potash Alum}) = 519.5\ \Omega^{-1}cm^2eq^{-1}$ (d) $\Lambda_{eq}^\infty(\text{Potash Alum}) = 145.6\ \Omega^{-1}cm^2eq^{-1}$

38. For which of the following $\Lambda_M = 6\Lambda_{eq}$ relation is correct?
(a) Potash Alum (b) $Al_2(SO_4)_3$ (c) $K_4[Fe(CN)_6]$ (d) $FeSO_4$

39. Choose the correct statements
(a) Conductance is an extensive property
(b) Specific conductance is an extensive property
(c) Molar conductivity is an extensive property
(d) Equivalent conductivity is an intensive property

40. On dilution, the
(a) Specific conductance decreases
(b) Specific conductance increase
(c) Molar conductivity of both weak electrolyte & strong electrolyte increases
(d) Molar conductivity of weak electrolyte becomes more than that of strong electrolyte

Numerical Answer Type

41. The equivalent and molar conductance of 0.01 M solution of K_2SO_4 whose specific conductance is $1.26 \times 10^{-3}\ \Omega^{-1}\ cm^{-1}$ are ________ $\Omega^{-1}cm^2\ eq^{-1}$ and ________ $\Omega^{-1}\ cm^2\ mol^{-1}$ respectively.

42. The conductivity of 0.1 M NaOH solution is 0.0221 $\Omega^{-1}\ cm^{-1}$. When an equal volume of 0.1 M HCl is added, the conductivity decreases to 0.0056 $\Omega^{-1}\ cm^{-1}$. A further addition HCl solution, the volume of which of which is equal to that of the first portion added, the conductivity increases to 0.017 $\Omega^{-1}\ cm^{-1}$. The $\Lambda_M(NaOH)$, $\Lambda_M(NaCl)$ and $\Lambda_M(HCl)$ are ________, _____ and _______ $\Omega^{-1}\ cm^{-1}$ respectively.

43. For the strong electrolytes NaOH, NaCl and $BaCl_2$, the molar ionic conductances at infinite dilution are 248×10^{-4}, 126.5×10^{-4} and $280 \times 10^{-4}\ Sm^2\ mol^{-1}$. The value of x is ________.

44. The specific conductance of a saturated solution of AgCl at 25°C after subtracting the specific conductance of water is 2.28×10^{-4} Sm^{-1}. The molar ionic conductance of Ag^{+} and Cl^{-} ions are 73.3×10^{-4} and 65×10^{-4} $Sm^2 mol^{-1}$. The solubility of AgCl at 25°C is _______ g/dm^3.

45. The ionic conductivities at infinite dilution of O_x^{2-}, K^{-} and Na^{+} are 148.2, 50.1 and 73.5 $\Omega^{-1} cm^2 mol^{-1}$ respectively. The molar and equivalent conductivities at infinite dilution of the salt KOOC. COONa are _______ $\Omega^{-1} cm^2 mol^{-1}$ and $\Omega^{-1} cm^2 eq^{-1}$ respectively.

46. The molar conductivity of NH_4Cl at infinite dilution is 149.7 Ω^{-1} cm^2 mol^{-1} and the ionic conductivities of OH^- and Cl^- ions are 198 and 76.3 Ω^{-1} cm^2 mol^{-1} respectively. The molar conductivity of NH_4OH at the dilution is _______ $\Omega^{-1} cm^2 mol^{-1}$.

47. A conductivity cell whose cell constant is 2cm^{-1} is filled with 0.1 M acetic acid solution. Its resistance is found to be 3765 Ω. The degree of dissociation and equilibrium constant of acetic acid are _______ and _______ respectively. Given that $\Lambda_M^{\infty}(H^+) = 349.8\Omega^{-1}cm^2mol^{-1}$ and $\Lambda_M^{\infty}(Ac^+) = 40.9\Omega^{-1}cm^2mol^{-1}$.

48. The conductivity of a saturated solution of silver okalate is 4.5×10^{-5} Ω^{-1} cm^{-1}. If its $K_{sp} = 1.35 \times 10^{-11}$ M^3, the molar conductivity of the saturated solution would be _______ $\Omega^{-1} cm^2 mol^{-1}$.

49. The molar conductivity of 0.05 M of solution of an electrolyte is 200 Ω^{-1} cm^2 mol^{-1}. The resistance offered by a conductivity cell with cell constant (1/3 cm^{-1}) would be _______Ω.

50. A conductivity cell whose cell constant is 3 cm^{-1} is filled with 0.1 M solution of weak acids. Its resistance is found to be 3000 Ω. If $\Lambda_M^{\infty} = 400\Omega^{-1}cm^2mol^{-1}$, the degree of dissociation of weak acid is _______.

Answer Key & Solution

1.	D	2.	A
3.	B		

$$\Lambda_M = \frac{K}{C}$$

Where C = concentration of electrolyte

$$C = \frac{n}{V}$$

When n = 1, $C = \frac{1}{V_m}$

$$\therefore \Lambda_M = \frac{k}{(1/V_m)} = kV_m$$

4.	D	5.	A	6.	C	7.	A	8.	D
9.	B	10.	D	11.	D	12.	A	13.	C
14.	C								
15.	C								

$$\alpha = \frac{\Lambda_{eq}}{\Lambda_{eq}^{\infty}} = \frac{10}{200} = 0.05$$

$$HA \rightleftharpoons H^+ + A^-$$

$$\begin{array}{lll} C & - & - \\ C - C\alpha & C\alpha & C\alpha \end{array}$$

$$[H^+] = C\alpha = 0.1 \times 0.05 = 5 \times 10^{-3}$$

$$pH = -\log[H^+] = 2.3$$

16. B

$$\alpha = \frac{\Lambda_{eq}}{\Lambda_{eq}^{\infty}} \Rightarrow 0.9 = \frac{\Lambda_{eq}}{425} \Rightarrow \Lambda_{eq} = 425 \times 0.9\,\Omega^{-1}cm^2eq^{-1}$$

$$\Lambda_{eq} = \frac{1000 \times k}{N}$$

$$\Rightarrow (425 \times 0.9\,\Omega^{-1}cm^2eq^{-1}) = \frac{1000 \times (3.825\,\Omega^{-1}cm^{-1})}{N}$$

N = 10

17. D **18.** B **19.** D

20. C

Because t_{H^+} has maximum value of transference no. as compared to other cations. Hence t_{Cl^-} will be minimum in 0.1 M HCl solution

21. A,B **22.** B,D **23.** B,C **24.** B,C,D **25.** A,B,D

26. A,C **27.** A,D **28.** B,D **29.** A,D **30.** A,B

31. A,B **32.** B,C **33.** A,C

34. A,C,D

Potash alum is $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$

On dilutions ions will be $2K^+$, $2Al^{3+}$ and $4SO_4^{2-}$

35. B,D

36. A,C **37.** B,D **38.** B,D **39.** A,C **40.** [illegible],C

41. 63 and 1.26×10^{-3}

$$\Lambda_M = \frac{1000 \times 1.26 \times 10^{-3}}{0.01} = 126\,\Omega^{-1}cm^2mol^{-1}$$

$$\Lambda_{eq} = \frac{\Lambda_M}{2}\frac{126}{2} = 63\,\Omega^{-1}cm^2eq^{-1}$$

42. 221, 112 and 398

$$\Lambda_M(NaOH) = \frac{1000 \times k}{M} = \frac{1000 \times 0.0221}{0.1} = 221\,\Omega^{-1}cm^2mol^{-1}$$

$$NaOH + HCl \rightarrow NaCl$$

$$\begin{array}{ll} 0.1\,M & 0.1\,M \\ V & V \end{array}$$

0.1 V 0.1 V

– –

0.1 V

$$\frac{0.1V}{2V} = 0.05$$

$$\therefore \Lambda_M(\text{NaCl}) = \frac{1000\times 0.0056}{0.05} = 112\Omega^{-1}\text{cm}^2\text{mol}^{-1}$$

$$K_{HCl} + K_{NaCl} = 0.017$$

$$\Rightarrow \frac{\Lambda_M \times M_{HCl}}{1000} + \frac{\Lambda_M \times M_{NaCl}}{1000} = 0.017$$

$$\Rightarrow \frac{\Lambda_M(\text{HCl})\times\left(\frac{0.1}{3}\right)}{1000} + \frac{102\times\left(\frac{0.1}{3}\right)}{1000} = 0.017$$

$$\Rightarrow \Lambda_M(\text{HCl}) = 398\Omega^{-1}\text{cm}^2\text{mol}^{-1}$$

43. 5.23

$$\Lambda_M^\infty(\text{Ba(OH)}_2) = \Lambda_M^\infty(\text{BaCl}_2) + 2\Lambda_M^\infty(\text{NaOH}) - 2\Lambda_M^\infty(\text{NaCl}) = [(280\times10^{-4}) + 2(126.5\times10^{-4})]$$

$$= 523\times10^{-4}\ \text{S m}^2\text{mol}^{-1}$$

$$= (523\times10^{-4}\times10^4)\text{S cm}^2\text{mol}^{-1}$$

$$= 5235\text{cm}^2\text{mol}^{-1} = 5.23\times10^2\text{Scm}^2\text{mol}^{-1}$$

44. 2.36×10^{-3}

$$\Lambda_M(\text{AgCl}) = (73.3+65)\times10^{-4}\text{S m}^2\text{mol}^{-1} = 0.01383\ \text{S m}^2\text{mol}^{-1} = 0.01383\times10^4\ \text{S cm}^2\text{mol}^{-1}$$

$$K = 2.28\times10^{-4}\text{S m}^{-1} = 2.28\times10^{-6}\ \text{S cm}^{-1}$$

$$\Lambda_M = \frac{1000\times K}{M} \Rightarrow M = \frac{1000\times K}{\Lambda_M} = \frac{1000\times 2.28\times10^{-6}}{0.01383\times10^4} = 1.648\times10^{-5}\text{mol L}^{-1}$$

1mol of $\text{AgCl} = 108 + 35.5 = 143.5\text{g}$

$$B = 1.648\times10^{-5}\times143.5\text{g/L or g/dm}^3$$

$$= 2.36\times10^{-3}\text{g dm}^{-3}$$

45. 271.8 and 135.9

$$\Lambda_M^\infty(\text{KOOC·COONa}) = \Lambda_M^\infty(\text{K}^+) + \Lambda_M^\infty(\text{C}_2\text{O}_4^{2-}) + \Lambda_M^\infty(\text{Na}^+)$$

$$= 50.1 + 148.2 + 73.5 = 271.8\Omega^{-1}\text{cm}^2\text{mol}^{-1}$$

$$\Lambda_{eq}^\infty = \frac{\Lambda_M^\infty}{2} = 135.9\Omega^{-1}\text{cm}^2\text{eq}^{-1}$$

46. 271.4

$$\Lambda_M^\infty(\text{NH}_4\text{OH}) = \Lambda_M^\infty(\text{NH}_4\text{Cl}) - \Lambda_M^\infty(\text{Cl}^-) + \Lambda_M^\infty(\text{HO}^-)$$

$$= (149.7 - 76.3 + 198)\Omega^{-1}\text{cm}^2\text{mol}^{-1}$$

$$= 271.4\Omega^{-1}\text{cm}^2\text{mol}^{-1}$$

47. 0.0136 and 1.84×10^{-5}

$$\Lambda_M = \frac{1000\times 2}{3675\times 0.1} = 5.442\Omega^{-1}cm^2mol^{-1}$$

$$\alpha = \frac{\Lambda_M}{\Lambda_M^{\infty}} = \frac{5.442}{(349.8+40.9)} = 0.013$$

$$K = \frac{C\alpha^2}{(1-\alpha)} = \frac{0.1(0.013)^2}{(1-0.013)} = 1.84\times 10^{-5}$$

48. 300

$$\underset{}{Ag_2C_2O_4} \rightleftharpoons \underset{2s}{2Ag^+} + \underset{s}{C_2O_4^{2-}} \qquad K_{sp} = 4s^3$$

$$\Rightarrow s = \left(\frac{1.35\times 10^{-11}}{4}\right)^{1/3} = 1.5\times 10^{-4}M$$

$$\Lambda_M = \frac{1000\times 1s}{M} = \frac{1000\times 4.5\times 10^{-5}}{1.5\times 10^{-4}} = 300\Omega^{-1}cm^2mol^{-1}$$

49. 33.33

$$\Lambda_M = \frac{1000\times x}{R\times M}$$

$$\Rightarrow 200 = \frac{1000\times(1/3)}{R\times 0.05} \;\Rightarrow R = \frac{1000\times(1/3)}{0.05\times 200} = 33.33\Omega$$

50. 0.025

$$\Lambda_M = \frac{1000\times k}{M} = \frac{1000\times x}{R\times M}$$

Where x = cell constant

$$\Lambda_M = \frac{1000\times 3}{3000\times 0.1} = 10\Omega^{-1}cm^2mol^{-1}$$

$$\alpha = \frac{\Lambda_M}{\Lambda_M^{\infty}} = \frac{10}{400} = 0.025$$