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CBSE – XIIth

Chemistry

Central Board of Secondary Education (CBSE)

Most Probable Questions Topic Wise

SIERRA INNOVATIONS

INDEX

Self Evaluation

Case Based Questions

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

The properties of the solutions which depend only on the number of solute particles but not on the nature of the solute are called colligative properties. Relative lowering in vapour pressure is also an example of colligative properties.

For an experiment, sugar solution is prepared for which lowering in vapour pressure was found to be 0.061 mm of Hg. (Vapour pressure of water at 20°C is 17.5 mm of Hg.)

(i) Relative lowering of vapour pressure for the given solution is

(a) 0.00348 (b) 0.061
(c) 0.122 (d) 1.75

(ii) The vapour pressure (mm of Hg) of solution will be

(a) 17.5 (b) 0.61
(c) 17.439 (d) 0.00348

(iii) Mole fraction of sugar in the solution is

(a) 0.00348 (b) 0.9965
(c) 0.061 (d) 1.75

(iv) If weight of sugar taken is 5 g in 108 g of water then molar mass of sugar will be

(a) 358 (b) 120 (c) 240 (d) 400

(v) The vapour pressure (mm of Hg) of water at 293 K when 25 g of glucose is dissolved in 450 g of water is

(a) 17.2 (b) 17.4 (c) 17.120 (d) 17.02

A & R Questions

In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following.

(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

(c) Assertion is correct statement but reason is wrong statement.

(d) Assertion is wrong statement but reason is correct statement.

2. **Assertion :** The vapour pressure of 0.1 M sugar solution is less than 0.1 M $MgCl_2$ solution.

Reason : Lowering of vapour pressure is directly proportional to the number of species present in the solution.

3. **Assertion :** The relative lowering of vapour pressure for the $CH_3COOH - H_2O$ solution is more in comparison to $CH_3COOH - C_6H_6$.

Reason : Water is less volatile than benzene.

Multiple Choice Questions

4. 0.001 molal solution of $Pt(NH_3)_4Cl_4$ in water had a freezing point depression of 0.0054 °C. If K_f for water is 1.80, the correct formula of the compound is

(a) $[Pt(NH_3)_4Cl_3]Cl$ (b) $[Pt(NH_3)_4Cl_4]$
(c) $[Pt(NH_3)_4Cl_2]Cl_2$ (d) $[Pt(NH_3)_4Cl]Cl_3$

5. At high altitudes, the boiling point of water lowers because

(a) atmospheric pressure is low
(b) temperature is low
(c) atmospheric pressure is high
(d) none of these.

6. The correct order of increasing boiling point is

(a) 0.01 m $NaNO_3$ < 0.01 m $La(NO_3)_3$ < 0.01 m $MgBr_2$
(b) 0.01 m $NaNO_3$ < 0.01 m $MgBr_2$ < 0.01 m $La(NO_3)_3$
(c) 0.01 m $MgBr_2$ < 0.01 m $La(NO_3)_3$ < 0.01 m $NaNO_3$
(d) 0.01 m $La(NO_3)_3$ < 0.01 m $MgBr_2$ < 0.01 m $NaNO_3$.

OR

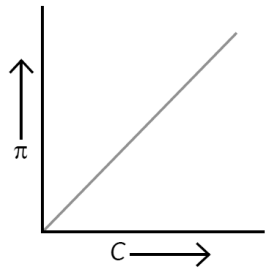
In comparison to a 0.01 M solution of glucose, the depression in freezing point of a 0.01 M $MgCl_2$ solution is _____.

(a) the same (b) about twice
(c) about three times (d) about six times

VSA Type Questions

7. Why are soda water and soft drink bottles sealed under pressure?

8. A graph showing variation of osmotic pressure (p) versus molar concentration 'C' of an aqueous solution at temperature T is given below



What does the slope of the line represents?

9. What are isotonic solutions?

10. Why does the freezing point of a solution decreases on adding non-volatile solute?

11. On what factor does the elevation in boiling point depend?

SA I Type Questions

12. Find the molality of a solution containing a nonvolatile solute if the vapour pressure is 2% lower than the vapour pressure of pure water.

13. What will be the degree of dissociation of 0.1 M $Mg(NO_3)_2$ solution if van't Hoff factor is 2.74?

14. Define vapour pressure. What happens to the vapour pressure when (i) volatile solute dissolves in the liquid, (ii) non-volatile solute dissolves in the liquid?

15. Explain why on addition of 1 mol of NaCl to 1 litre of water, the boiling point of water increases, while addition of 1 mol of methyl alcohol to one litre of water decreases its boiling point.

16. How does sprinkling of salt help in clearing the snow covered roads in hilly areas? Explain the phenomenon involved in the process.

OR

Why is the vapour pressure of an aqueous solution of glucose lower than that of water?

SA II Type Questions

17. Why is it not possible to obtain pure ethanol by fractional distillation? What general name is given to binary mixtures which show deviation from Raoult's law and whose components cannot be separated by fractional distillation. How many types of such mixtures are there?

18. Calculate molarity and molality of a 13% solution (by weight) of sulphuric acid. Its density is 1.020 g cm^{-3}. (Atomic mass of H = 1, O = 16, S = 32 amu)

19. A 5% solution (w/W) of cane sugar (molar mass = 342 g mol^{-1}) has freezing point 271 K. What will be the freezing point of 5% glucose (molar mass = 180 g mol^{-1}) in water if freezing point of pure water is 273.15 K?

20. Arrange the depression in freezing point of water observed for the same amount of acetic acid, trichloroacetic acid and trifluoroacetic acid in increasing order. Explain briefly.

OR

Explain the terms ideal and non-ideal solutions in the light of forces of interactions operating between molecules in liquid solutions.

Case Based Questions

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

An ideal solution may be defined as the solution which obeys Raoult's law exactly over the entire range of concentration. The solutions for which vapour pressure is either higher or lower than that predicted by Raoult's law are called non-ideal solutions. Non-ideal solutions can show either positive or negative deviations from Raoult's law depending on whether the A–B interactions in solution are stronger or weaker than A – A and B – B interactions.

(i) What type of solution is formed when chloroform is mixed with acetone?

(ii) What are the signs of ΔH and ΔV for a solution with positive deviation from ideal behaviour?

(iii) Name two factors on which the vapour pressure of a liquid depends.

OR

With suitable diagram and appropriate examples explain a non-ideal solution with negative deviation.

LA Type Questions

22. (i) When is the value of van't Hoff factor more than one?

(ii) An aqueous solution of glucose is made by dissolving 10 g of glucose (C6H12O6) in 90 g of water at 303 K. If the vapour pressure of pure water at 303 K be 32.8 mm of Hg, what would be the vapour pressure of the solution?

(iii) With the help of a suitable diagram show that the lower vapour pressure of a solution than the pure solvent causes a lowering of freezing point for the solution compared to that of the pure solvent.

23. Calculate the osmotic pressure and the vapour pressure of 0.6% aqueous solution of non-volatile, non-electrolyte urea at 25 °C. The vapour pressure of pure water at 25°C is 24 mm of Hg. Take density to be 1 g mL^{-1} and assume ideal solution behaviour.

24. A solution of glucose in water is labelled as 20% (w/W). The density of the solution is 1.20 g mL–1. Calculate

(i) molality (ii) molarity and

(iii) mole fraction of each component in solution.

25. (i) H_2S is a toxic gas used in qualitative analysis. If solubility of H_2S in water at NTP is 0.195 m, what is the value of KH?

(ii) Define negative deviation from Raoult's law. Give an example of solution showing negative deviation from ideal behaviour.

(iii) What are minimum boiling azeotropes? Give an example.

OR

(i) What is the use of reverse osmosis?

(ii) 4% NaOH solution (mass/volume) and 6% urea solution (mass/volume) are equimolar but not isotonic. Why?

(iii) Name the colligative property mostly used for the determination of molecular mass of macromolecules.

(iv) What happens when RBCs are placed in

(a) 1% NaCl solution (b) pure water?

1 Topic Wise Questions

Types of Solutions

1. Which of the following is an example of a solid solution containing a gas as solute ?
(A) H_2 in water
(B) O_2 in water
(C) Camphor in nitrogen gas
(D) H_2 in platinum

2. Number of phases present in a true solution is
(A) 1
(B) 2
(C) Depends on number of solutes
(D) Innumerable

Methods Of Expression Of Concentration

3. How much the amount of benzoic acid (C_6H_5COOH) required for preparing 250 ml of 0.15 M solution in methanol ?
(A) 45.75 g (B) 4.575 g (C) 0.2 M (D) 9.15 g

4. How much water is needed to dilute 10 ml of 10N hydrochloric acid to make it exactly decinormal (0.1 N)?
(A) 990 ml (B) 1000 ml (C) 1010 ml (D) 100 ml

5. What will be the mass percentage of aspirin ($C_9H_8O_4$) in acetonitrile (CH_3CN) when 6.5g of $C_9H_8O_4$ is dissolved in 450 g of CH_3CN?
(A) 2.848% (B) 1.424% (C) 14.24% (D) 28.48%

6. If 9.55 g of CuS are dissolved in 500 ml H_2O. What will be the molarity of CuS in aqueous solution ? [Molar mass of CuS is 95.5 g]
(A) 0.02 M (B) 2M (C) 0.2 M (D) 20 M

7. A solution of known concentration is known as
(A) Molar Solution (B) Normal Solution
(C) Mole Solution (D) Standard Solution

8. Which of the following methods of expressing concentration is independent of temperature?
(A) Molarity (B) Molality
(C) Formality (D) Normality

9. When the volume of the solution is doubled, the following becomes exactly half
(A) Molality (B) Mole-fraction
(C) Molarity (D) Weight percent

10. Find the volume of 0.1M potassium dichromate solution required to oxidise 20ml of 0.6M ferrous sulphate solution in acid medium
(A) 10ml (B) 20ml
(C) 40ml (D) 60ml

11. If 50ml of 0.1M NaCl and 50ml of 0.1 M $BaCl_2$ are mixed, molarity of chloride ion in the resulting solution will be
(A) 0.2 M (B) 0.3M
(C) 0.15M (D) 0.1M

12. A solution of $CaCl_2$ is 0.5 mol / litre, then the moles of chloride ion in 500 ml. will be
(A) 0.25 (B) 0.50 (C) 0.75 (D) 1.00

13. A solution is obtained by mixing 300 g of 25% solution and 400 g of 40% solution by mass. What will be the mass percentage of the solute of resulting solution ?
(A) 23% (B) 12.5% (C) 33.6% (D) 50%

14. 1 kg of NaOH is added to 10 ml of 0.1N HCl, the resulting solution will
(A) turn blue litmus red
(B) turn phenolphthalein solution pink
(C) turn methyl orange red
(D) will have no effect on red or blue litmus paper

15. The solution having lowest molar concentration is
(A) 1.0N HCl (B) 0.4N H_2SO_4
(C) 0.1N Na_2CO_3 (D) 1*N NaOH*

16. In a normal solution of $BaCl_2$, normalities of Ba^{+2} and Cl^- are in the ratio
(A) 2:1 (B)1:2 (C) 1:1 (D) 2:3

17. Number of moles of solute dissolved in 1000g. of the solvent is called
(A) Molarity (B) Molality
(C) Formality (D) Normality

18. The density of 2 M solution of acetic acid (Mol. wt. 60) is 1.02 g ml^{-1}. The molality of the solution 'X' is
(A) 1.0 (B) 2.0 (C) 2.22 (D) 2.25

19. Which of the following is correct?
(A) For a binary solution sum of the mole fractions of all components is equal to one
(B) $\frac{\text{Mole fraction of I}}{\text{Mole fraction of II}} = \frac{\text{moles of I}}{\text{moles of II}}$ (for binary solution)
(C) Mole fraction of solute $= \frac{\text{moles of solute}}{\text{moles of solute + moles of solvent}}$
(D) All

20. Which of the following has no units?
(A) Molarity (B) Normality
(C) Molality (D) Mole fraction

21. Maltose is converted to 'A' by Maltase. The mole fraction of 'A' in 10% (w/w) aq. solution is approximately:
(A) 0.18 (B) 0.012 (C) 0.1 (D) 0.017

22. Molarity of 4% (w/v) solution of NaOH is
(A) 0.1 (B) 0.5 (C) 0.001 (D) 1.0

23. The number of moles of solute present in 2.0 lits of 0.5M NaOH solution is
(A) 2 (B) 1 (C) 4 (D) 0.1

24. 100 ml 0.2M NaOH is exactly neutralised by a mixture of which of the following?
(A) 100 ml of 0.1M HCl + 100 ml of 0.1M H_2SO_4
(B) 100 ml of 0.1M HCl + 50 ml of 0.1M H_2SO_4
(C) 50 ml of 0.1M HCl + 50 ml of 0.1M H_2SO_4
(D) 50 ml of 0.1M HCl + 100 ml of 0.1M H_2SO_4

25. 250 ml of a sodium carbonate solution contains 2.65 grams of Na_2CO_3. 10 ml of this solution is added to x ml of water to obtain 0.001 M Na_2CO_3 solution. What is the value of x in ml? (Molecular weight of Na_2CO_3=106)
(A) 1000 (B) 990 (C) 9990 (D) 90

26. The molarity of pure water is
(A) 18 M (B) 55.55 M
(C) 10 M (D) 5.55 M

27. If 250ml of 0.25M NaCl solution is diluted with water to a volume of 500ml, the new concentration of solution is
(A) 0.167M (B) 0.0167M
(C) 0.125M (D) 0.0833M

28. What volume of 0.8M solution contains 0.1 mole of the solute?
(A) 100ml (B) 125 ml (C) 500 ml (D) 62.5 ml

29. 250 ml of a calcium carbonate solution contains 2.5 grams of $CaCO_3$. If 10 ml of this solution is diluted to one litre, what is the concentration of the resultant solution?
(A) 0.1 M (B) 0.001 M
(C) 0.01 M (D) 10^{-4} M

30. 3.65 grams of HCl is dissolved in 16.2 grams of water. The mole fraction of HCl in the resulting solution is
(A) 0.4 (B) 0.3 (C) 0.2 (D) 0.1

31. 5.85g NaCl is dissolved in 500ml of water. The molarity is
(A) 0.1 (B) 0.2 (C) 0.3 (D) 0.4

32. Number of milli equivalents of solute in 0.5 litres of 0.2N solution is
(A)10 (B) 1 (C)100 (D)1000

33. Weight of solute present in 500 ml 0.2 N-H_2SO_4 solution is
(A) 14.2 g (B) 4.9 g
(C) 3.55 g (D) 1.42 g

34. Number of milli equivalents of solute present in 250 ml of 0.1M oxalic acid solution are
(A) 25 (B) 50 (C) 250 (D) 125

35. The weight of $H_2C_2O_4\,2H_20$ required to prepare 500ml of 0.2N solution is
(A) 1.26g (B) 6.3g
(C) 1.575g (D) 3.15g

36. What is the volume (in litres) of 0.1M H_2SO_4 required to completely neutralize 1 litre of 0.5M NaOH?
(A) 5 (B) 2.5 (C) 0.5 (D) 10

37. 3.42 g of a substance of molecular weight 342 is present in 250g of water. Molality of this solution is
(A) 0.4m (B) 0.04 m (C) 0.8 m (D) 4m

38. 3g of a salt [mol.wt. 30] is dissolved in 250g of water the molality of the solution is
(A) 0.4 (B) 0.2 (C) 0.6 (D) 0.8

39. The mole fraction of NaCl in a solution containing 1 mole of NaCl in 1000g of water is
(A) 0.0177 (B) 0.001 (C) 0.5 (D) 0.244

40. The mole fraction of water in 20% of aqueous hydrogen peroxide solution is
(A) 0.2 (B) 0.8 (C) 0.883 (D) 0.117

41. An aqueous solution of Methyl alcohol contains 48g of alcohol. The mole fraction of alcohol is 0.6. The weight of water in it is
(A) 27g (B) 2.7g (C) 18g (D) 1.8g

42. A gaseous mixture contains 4.0g of H_2 and 56.0g of N_2. The mole fraction of H_2 in the mixture is
(A) 0.1 (B) 0.2 (C) 0.5 (D) 0.8

43. Three statements are given about mole fraction
(i) Mole fraction of a solute + mole fraction of solvent = 1
(ii) Equal weights of Helium and methane are present in a gaseous mixture. The mole fraction of He is 4/5
(iii) The mole fraction of water in the aqueous solution of NaOH is 0.8. The molality of the solution is nearly 14 moles kg^{-1}
(A) i and ii are correct (B) ii and iii are correct
(C) i and iii are correct (D) all are correct

Solubility - Henry's Law

44. The partial pressure of the gas in vapour phase is proportional to the mole fraction of the gas in the solution is given by
(A) Raoult's law (B) Ostwald's law
(C) Distribution law (D) Henry's law

45. Four gases like H_2, He, CH_4 and CO_2 have Henry's constant values (K_H) are 69.16, 144.97, 0.413 and 1.67. The gas which is more soluble in liquid is
(A) He (B) CH_4 (C) H_2 (D) CO_2

46. The solubility of gas in a liquid increases with
(A) Increase of temperature
(B) Amount of liquid taken
(C) Decrease in temperature
(D) Reduction of gas pressure

47. How many grams of CO_2 gas is dissolved in a 1 lt bottle of carbonated water if the manufacturer uses a pressure of 2.4 atmosphere in the bottling process at 25^0C Given K_H of CO_2 water = $29.76 atm/mole/l$ at 25^0C
(A) 3.52 (B) 4.2 (C) 3.1 (D) 2.5

48. Henry's law constant for the solubility of N_2 gas in water at 298K is $1.0\times10^5 atm$. The mole fraction of N_2 in air is 0.6. The no.of moles of N_2 from air dissolved in 10 moles of water at 298K and 5atm pressure is
(A) 3.0×10^{-4} (B) 4.0×10^{-5}
(C) 5.0×10^{-4} (D) 6.0×10^{-6}

49. H_2S ,a toxic gas with rotten egg like smell, is used for the qualitative analysis.If the solubility of H_2S in water at STP is 0.195M,then Henry's law constant is
(A) 28.94 (B) 282
(C) 145.2 (D) 2890.4

50. Henry's law constant for CO_2 in water is 1.67×10^8 pa at 298 K the quantity of CO_2 in 500ml of soda water when packed under 2.5 atm pressure is
(A) 0.0084gms (B) 0.00084gms
(C)1.848gms (D) 8.4gms

Vapour Pressure - Raoult's Law Ideal And Non-Ideal Solutions

51. Which of the following conditions is not satisfied by an ideal solution ?
(A) $\Delta H_{mix} = 0$ (B) $\Delta S_{mix} = 0$
(C) $\Delta V_{mix} = 0$ (D)Raoult's law is obeyed

52. Which of the following liquid pairs will exhibit a positive deviation from Raoult's law ?
(A) Water – Hydrochloric acid
(B) Cyclohexane – Ethanol
(C) Acetone – Chloroform
(D) Water – Nitric acid

53. The azeotropic mixture of water and HCl boils at 108.5°C . When this mixture is distilled, it is possible to obtain
(A) Pure HCl
(B) Pure water
(C) Neither pure HCl nor pure water
(D) Both pure HCl and pure water

54. A solution is non-ideal when
(A) $(\Delta P)_{sol.} \neq 0$ (B) $(\Delta H)_{sol.} = 0$
(C) $(\Delta G)_{sol.} < 0$ (D) $(\Delta V)_{sol.} = 0$

55. Vapour pressure is the pressure exerted by vapours
(A) In equilibrium with liquid
(B) In any condition
(C) In an open system
(D) In atmospheric conditions

56. The pair of solutions which shows positive deviation in non ideal solution
(A) $CCl_4 + C_6H_6$ (B) $CHCl_3 + C_6H_6$
(C) $CCl_4 + CHCl_3$ (D) Both 1 and 3

57. The pair of solutions which shows negative deviation in non-ideal solution

(A) $CHCl_3 + CH_3COCH_3$

(B) $CH_3COCH_3 + C_6H_5NH_2$

(C) $CHCl_3 + C_6H_6$

(D) All the above

58. Azeotropy is the property of

(A) all the solutions (B) Non-ideal solution

(C) gas in liquid solution (D) ideal solution

59. Pure water boils at 373K and pure nitric acid boils at 359K. The azeotropic mixture of water and nitric acid boils at T K.

(A) T < 359 K (B) T > 359 K

(C) T < 373 K but > 359 K (D) Unpredictable

60. Which of the following statements is correct, if the intermolecular force in liquids A, B and C are in the order A < B < C?

(A) B evaporates more readily than A

(B) B evaporates less readily than C

(C) A and B evaporate at the same rate

(D) A evaporates more readily than C

61. An aqueous solution of methanol in water has vapour pressure

(A) Equal to that of water

(B) Equal to that of methanol

(C) More than that of water

(D) Less than that of water

62. The boiling point of $C_6H_6, CH_3OH, C_6H_5NH_2$ and $C_6H_5NO_2$ are 80°C, 65°C, 184°C and 212°C respectively. Which will show highest vapour pressure at room temperature?

(A) C_6H_6 (B) CH_3OH

(C) $C_6H_5NH_2$ (D) $C_6H_5NO_2$

63. If an ideal solution is made by mixing 2 moles of benzene (p^0 = 266 mm) and 3 moles of another liquid (p^0 = 236 mm). The total vapour pressure of the solution at the same temperature would be

(A) 502 mm (B) 248 mm

(C) 600 mm (D) 250.6 mm

Colligative Properties Relative Lowering Of Vapour Pressure

64. An aqueous solution of 2% non-volatile solute exerts a pressure of 1.004 bar at the normal boiling point of the solvent. What is the molar mass of the solute ?

$[P^0_{H_2O} = 1.013 bar]$

(A) 41.35 g mol^{-1} (B) 82.70 g mol^{-1}

(C) 20.67 g mol^{-1} (D) 60 g mol^{-1}

65. Which of the following is a colligative property?

(A) Boiling point (B) Osmotic pressure

(C) Vapour pressure (D) Freezing point

66. 12g of urea is present in 1litre of solution and 68.4 g of sucrose is separately dissolved in 1litre of another sample of solution. The lowering of vapour pressure of first solution is

(A) Equal to second (B) Greater than second

(C) Less than second (D) Double that of second

67. A solution is obtained by dissolving 0.2 moles of urea in a litre water. Another solution is obtained by dissolving 0.4 moles of cane-sugar in a litre of water at the same temperature. The lowering of vapour pressure to the first solution is.

(A) Same as that of the second solution

(B) Half to that of the second solution

(C) Double to that of the second solution

(D) None

68. 3 gms of urea is added to 36 gms of boiling water. How much lowering in its vapour pressure is noticed

(A) 19 mm (B) 38 mm

(C) 760 mm (D) 76 mm

69. Which of the following solutions have more lowering in vapour pressure at a certain temperature?

(A) 90 grams of glucose in 900 grams of H_2O

(B) 34.2 grams of sucrose in 450 grams of H_2O

(C) 20 grams of urea in 900 grams of H_2O

(D) 45 grams of glucose in 900 grams of H_2O

70. The vapour pressure of methanol at certain temperature is 1 atm. by adding a small amount of ethyl acetate the vapour pressure of the solution is found to be 684 mm. The relative lowering of vapour pressure is

(A) 0.1 (B) 0.9 (C) 76 (D) 0.694

71. The vapour pressure of water at 23^0C is 19.8 mm. 0.1 mole of glucose is dissolved in 178.2 g of water. What is the vapour pressure (in mm) of the resultant solution at same temperature
(A) 19.0 (B) 19.602 (C) 19.402 (D) 19.202

72. The magnitude of colligative properties in colloidal dispersions is .... than solution
(A) Lower (B) Higher (C) Both (D) None

Elevation In Boiling Point

73. When 10g of a non-volatile solute is dissolved in 100g of benzene, it raises boiling by 1^oC then molecular mass of the solute is (K_b for benzene =2.53 K-m^{-1})
(A) 223 g (B) 233 g (C) 243 g (D) 253 g

74. The molal elevation constant is the ratio of the elevation is B.P. to s
(A) molarity (B) molality
(C) mole fraction of solute (D) mole fraction of solvent

75. The value of ebullioscopic constant depend upon
(A) $\Delta H_{Solution}$
(B) Nature of solvent
(C) Nature of solute
(D) Freezing point of solution

76. An aqueous solution of 2% non volatile solute exerts a pressure of 1.004bar at the normal boiling point of the solvent.What is the molecular mass of the solute?
(A) $4.135 g / mol$ (B) $22.1 g / mol$
(C) $90.1 g / mol$ (D) $41.35 g / mol$

77. Pure water boils at 99.725^0C in Shimla. If K_b for water is 0.51 K mol^{-1} kg, the boiling point of 0.69 molal urea solution will be
(A) 100.35 (B) 100.08
(C) 99.37 (D) none of these

78. The rise in the boiling point of a solution containing 1.8g of glucose in 100g of solvent is 0.1^0C. The molal elevation constant of the liquid is
(A) 0.01 K/m (B) 0.1 K/m
(C) 1K/m (D) 10 K/m

79. The boiling point of benzene is 353.23 K.When 1.80g of a non-volatile solute was dissolved in 90g of benzene,the boiling point is raised to 354.11 K. The molar mass of the solute is.(K_b for benzene is $2.53 K\ kg\ mol^{-1}$)
(A) 58 $g\ mol^{-1}$ (B) 106 $g\ mol^{-1}$
(C) 174 $g\ mol^{-1}$ (D) 232 $g\ mol^{-1}$

Depression In Freezing Point

80. The molal freezing point constant for water is 1.86 K. molality^{-1}. If 34.2 g of cane sugar ($C_{12}H_{22}O_{1(}A$) are dissolved in 1000g of water, the solution will freeze at
(A) -0.186^{o}C (B) 1.86^{o}C
(C) -3.92^{O}C (D) 2.42^{O}C

81. The use of common salts, e.g., $NaCl$ or $CaCl_2$ anhydrous, is made to clear snow on the roads. This causes:
(A) A lowering in the freezing point of water.
(B) A lowering in the melting point of ice.
(C) Ice melts at the temperature of atmosphere present at that time.
(D) All the above

82. The freezing point of 1% aqueous solution of calcium nitrate will be
(A) $0\ ^0C$ (B) Above $0\ ^0C$
(C) $1\ ^0C$ (D) Below $0\ ^0C$

83. Antifreeze are the substances which
(A) Stop freezing
(B) Decreases freezing point
(C) Increases freezing point
(D) Melt the ice

84. Two elements A and B form compounds of formula AB_2 and AB_4. When dissolved in 20.0 g of benzene 1.0 g of AB_2 lowers F.pt. by 2.3^0C whereas 1.0g of AB_4 lowers F.pt. by 1.3^0C. The K_f for benzene is 5.4. The atomic masses of A and B are respectively
(A) 27, 45 (B) 42, 25 (C) 52, 48 (D) 48, 52

85. The amount of ice that will separate on cooling a solution containing 50g of ethylene glycol in 200g water to -9.3^0C is: [K_f= 1.86 K molality$^-$1]
(A) 38.71 g (B) 38.71 mg
(C) 42 g (D) 42 mg

86. Molal elevation constant and molal depression constant of water respectively (in Km^{-1}) are
(A) 0.52, 1.86 (B) 1.86, 0.52
(C) 1.52, 0.86 (D) 0.86, 1.52

87. What is the normal b.p of an aqueous solution whose freezing point is $-2.48^0 C$?
$\left(K_f = 1.86^0 C.kg / mol, K_b = 0.512^0 C.kg / mol\right)$
(A) $100.7^0 C$ (B) $102.5^0 C$
(C) $109.0^0 C$ (D) $99.3^0 C$

88. Calculate the molal depression constant of a solvent which has freezing point 16.6^0 and latent heat of fusion $180.75 Jg^{-1}$
(A) 3.3 (B) 3.86 (C) 2.9 (D) 38.6

89. Calculate the mass of ascorbic acid($C_6H_8O_6$)to be dissolved in 75g of acetic acid to lower its melting point by 1.5^0 $C.K_f = 3.9 K\ kg\ mol^{-1}$
(A) 5.08g (B) 5.06 (C) 5.04 (D) 5.02

90. 1.00g of a non-electrolyte solute dissolved in 50g of benzene, lowered the freezing point of benzene by 0.40 K. The freezing point depression constant of benzene is 5.12 K. $kg\ mol^{-1}$. Find the molar mass of the solute.
(A) 236 gm / mole (B) 256 gm / mole
(C) 266 gm / mole (D) 274 gm / mole

Osmotic Pressure

91. Osmotic pressure is measured by
(A) Ostwald's method
(B) Berkeley and Hartley method
(C) Preffer's method
(D) Beckmann's method

92. Blood cells retain their normal shape in solution which are
(A) isotonic to blood (B) hypotonic to blood
(C) hypertonic to blood (D) equinormal to blood

93. The osmotic pressure of a dilute solution is directly proportional to the
(A) Diffusion rate of the solute
(B) Ionic concentration
(C) Boiling point
(D) Flow of solvent from a concentrated solution

94. A perfectly semi-permeable membrane when used to separate a solution from its solvent permits through it the passage of
(A) Solute only (B) Solvent only
(C) Both (a) and (b) (D) None

95. Which statement is incorrect about osmotic pressure (π), volume(V) & temperature(T)?
(A) $\pi \alpha \frac{1}{V}$, if T is constant
(B) $\pi \alpha$ T, if V is constant
(C) $\pi \alpha$ V, if T is constant
(D) π V is constant, if T is constant

96. The Osmotic pressure of a dilute solution is given by
(A) $P_0 = P_0 \times N_1$ (B) $\pi V = nRT$
(C) $\frac{\Delta P}{P^0} = \frac{P^0 - P_S}{P^0}$ (D) $\Delta P = P_0 N_2$

97. Which of the following chemical entities can act as semipermeable membrane?
(A) $Cu_2[Fe(CN)_6]$ (B) $Cu(SCN)_2$
(C) BaC_2O_4 (D) $BaSO_4$

98. The osmotic pressure of solution at 0^0C is 4 atm what will be its osmotic pressure at 546 K. Under similar conditions
(A) 4 atm (B) 2 atm (C) 1 atm (D) 8 atm

99. The molar mass of solute X in $g\ mol^{-1}$, if its 1% solution is osmotic with a 5% solution of cane sugar (molar mass =34 $g\ mol^{-1}$ (B) is
(A) 68.4 (B) 34.2 (C) 136.2 (D) 171.2

100. 200 c.c of an aqueous solution contains 1.26 gms of a polymer. The osmotic pressure of such solution at 300 K is found to be 2.57×10^{-3} bar. Calculate the molar mass of the polymer
(A) 61038 g/mole (B) 122076 g/mole
(C) 610.38 g/mole (D) 122.076 g/mole

101. The osmotic pressure of a solution of an organic substance containing 18 gm in 1 lit of solution at 293 K is $2.414 \times 10^5\ Nm^{-2}$. Find the molecular mass of the substance.
(If S= 8.3 J K^{-1} $mole^{-1}$(A)
(A) 181.33 (B) 362.66 (C) 36.2 (D) 18.1

102. What is the volume of solution containing 1 gm mole of sugar that will give rise to an osmotic pressure of 1 atm at 0^0C
(A) 11.2 lit (B) 112 lit (C) 224 lit (D) 22.4 lit

103. Find the osmotic pressure of M/20 solution of Urea at 27 ^{0}C
(A) 12.315 atm (B) 1.2315 atm
(C) 0.12315 atm (D) 0.0123 atm

104. The osmotic pressure of a decimolar solution of urea at 27 ^{0}C is
(A) 2.49 bar (B) 5 bar
(C) 3.4 bar (D) 1.25 bar

105. What is the volume of a solution containing 2g mole of sugar that will give rise to an osmotic pressure 1 atm. at STP
(A) 4.48 lit (B) 0.448 lit
(C) 44.8 lit (D) 448 lit

Abnormal Colligative Properties - Van't Hoff Factor

106. The molecular mass of sodium chloride obtained by using a colligative property is
(A) 58.5 g/mol (B) 29.25 g/mol
(C) 117 g/mol (D) 85 g/mol

107. The ratio of value of colligative property for equimolar Hg_2Cl_2 solution to that for sugar solution is nearly
(A) 4 (B) 1 (C) 8 (D) 3

108. A 0.01 m aqueous solution of $K_3[Fe(CN)_6]$ freezes at –0.062°C. What is the apparent percentage of dissociation ? (K_f of water = 1.86)
(A) 22% (B) 78 % (C) 75 % (D) 50 %

109. In a solvent 50% of benzoic acid dimerises while rest ionises, determine molar mass of acid which is observed and also its van't Hoff factor.
(A) 1.5 (B) 1.25 (C) 1 (D) 2

110. The values of observed and calculated molecular weights of silver nitrate are 92.64 and 170 respectively. The degrees of dissociation of silver nitrate is
(A) 60% (B) 83.5%
(C) 46.7% (D) 60.23%

111. Which solution will have the highest boiling point?
(A) 1m $C_6H_{12}O_6$ solution (B) 1m NaCl solution
(C) 1m $BaCl_2$ solution (D) 1m urea solution

Self Evaluation

CBSE Based Questions

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

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 500 mL of this solution is electrolysed.

This leads to the evolution of chlorine gas at one of the electrode. The amount of products formed can becalculated by using mole concept.

(i) The total number of moles of chlorine gas evolved is
(a) 0.5 (b) 1.0 (c) 1.5 (d) 1.9

(ii) If cathode is a Hg (Atomic mass = 200.59 g/mol) electrode, then the maximum weight of amalgam formed from this solution is
(a) 300 g (b) 446 g (c) 396 g (d) 296 g

(iii) The total charge (coulomb) required for complete electrolysis is
(a) 186000 (b) 24125
(c) 48296 (d) 193000

(iv) In the electrolysis of aqueous NaCl, the number of moles of electrons involved are
(a) 2 (b) 1 (c) 3 (d) 4

(v) In electrolysis of aqueous NaCl solution when Pt electrode is taken, then which gas is liberated at cathode?
(a) H_2 gas (b) Cl_2 gas
(c) O_2 gas (d) None of these

A & R Questions

In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following.

(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(c) Assertion is correct statement but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement.

2. Assertion : Λ_m for weak electrolytes shows a sharp increase when the electrolytic solution is diluted.
Reason : For weak electrolytes degree of dissociation increases with dilution of solution.

3. Assertion : Electrolysis of NaCl solution gives chlorine at anode instead of O_2.
Reason : Formation of oxygen at anode requires overvoltage.

Multiple Choice Questions

4. Among the following, which will be the best conductor of electricity?
(a) 1 M Acetic acid (b) 1 M Sulphuric acid
(c) 1 M Boric acid (d) None of these

5. The molar conductance of 0.001 M acetic acid is 50 $ohm^{-1}\ cm^2\ mol^{-1}$. The maximum value of molar conductance is 250 $ohm^{-1}\ cm^2\ mol^{-1}$. What is its degree of ionization?
(a) 0.5% (b) 2%
(c) 20% (d) 22%

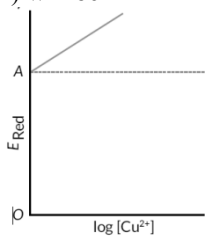
6. The electrode reactions for charging of a lead battery are

$PbSO_4 + 2e^- \rightarrow SO_4^{2-} + Pb$

$PbSO_4 + 2H_2O \rightarrow PbO_2 + SO_4^{2-} + 4H^+ + 2e^-$

The electrolyte in the battery is an aqueous solution of sulphuric acid after the battery has been charged
(a) the sulphuric acid will be more concentrated
(b) the sulphuric acid will be less concentrated
(c) the concentration of sulphuric acid will be unchanged
(d) sulphuric acid will have been completely decomposed.

7. $Cu^{2+} + 2e^- \rightarrow Cu$; log $[Cu^{2+}]$ vs ERed graph is of the type as shown in figure where OA = 0.34 V.
Then electrode potential of the half cell of
Cu | Cu^{2+}(0.1 M) will be



(a) $-0.34 + \frac{0.0591}{2}$ (b) $0.34 + \frac{0.0531}{2}$ V
(c) 0.34 V (d) None of these

8. Standard reduction potentials of the half reactions are given below :

$F_{2(g)} + 2e^- \rightarrow 2F^-_{(aq)}$; E° = + 2.85 V

$Cl_{2(g)} + 2e^- \rightarrow 2Cl^-_{(aq)}$; E° = + 1.36 V

$Br_{2(l)} + 2e^- \rightarrow 2Br^-_{(aq)}$; E° = + 1.06 V

$I_{2(s)} + 2e^- \rightarrow 2I^-_{(aq)}$; E° = + 0.53 V

The strongest oxidising and reducing agents respectively are

(a) F_2 and I^- (b) Br_2 and Cl^-

(c) Cl_2 and Br^- (d) Cl_2 and I_2

VSA Type Questions

9. Arrange the following metals in the order in which they displace each other from the solution of their salts.

Al, Cu, Fe, Mg and Zn.

10. What is the necessity to use a salt bridge in a Galvanic cell?

11. Under what condition $E_{cell} = 0$ or $\Delta_r G = 0$?

OR

Express the relation among the conductivity of solution in the cell, the cell constant and the resistance of solution in the cell.

SA I Type Questions

12. Value of standard electrode potential for the 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?

13. How many moles of mercury will be produced by electrolysing 1.0 M $Hg(NO_3)_2$ solution with a current of 2.00 A for 3 hours?

14. Mention the reactions occurring at (i) anode, (ii) cathode, during working of a mercury cell. Why does the voltage of a mercury cell remain constant during its operation?

OR

Give reasons for the following :

(i) Rusting of iron is quicker in saline water than in ordinary water.

(ii) Aluminium metal cannot be produced by the electrolysis of aqueous solution of aluminium salt.

15. Zinc can reduce hydrogen ion but copper cannot. Why?

16. Mention few applications of electrochemical series.

SA II Type Questions

17. Depict the galvanic cell in which the reaction $Zn_{(s)} + 2Ag^+_{(aq)} \rightarrow Zn^{2+}_{(aq)} + 2Ag_{(s)}$ takes place.

Further show:

(i) Which of the electrode is negatively charged?

(ii) The carriers of the current in the cell.

(iii) Individual reaction at each electrode.

18. (a) What is corrosion? Explain the electrochemical theory of rusting of iron and write the reactions involved in the rusting of iron.

(b) Which reference electrode is used to measure the electrode potential of other electrodes?

19. The conductivity of 0.001 M acetic acid is 4×10^{-5} S/cm. Calculate the dissociation constant of acetic acid, if molar conductivity at infinite dilution for acetic acid is 390 S cm^2/mol.

20. How does the molar conductance increase on diluting the solution of a weak electrolyte? Electrolytic conductivity of 0.30 M solution of KCl at 295 K is 3.72×10^{-2} S cm^{-1}. Calculate the molar conductivity.

OR

Account for the following :

(i) Alkaline medium inhibits the rusting of iron.

(ii) Iron does not rust even if the zinc coating is broken in a galvanized iron pipe.

Cased Based Questions

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

The electrochemical cell shown below is concentration cell.

$M \mid M^{2+}$ (saturated solution of a sparingly soluble salt, MX_2) $\| M^{2+}$ (0.001 mol dm^{-3}) $\mid M$

The emf of the cell depends on the difference in concentrations of M^{2+} ions at the two electrodes. The emf of the cell at 298 K is 0.059 V.

(i) Calculate the solubility product (K_{sp} in mol^3 dm^{-9}) of MX_2 at 298 K based on the information available for the given concentration cell.

(Take $2.303 \times R \times 298/F = 0.059$) (1 Mark)

(ii) Calculate the value of ΔG (in kJ mol^{-1}) for the given cell. (Take 1 F = 96500 C mol^{-1}) (1 Mark)

(iii) The standard electrode potential (E°) for OCl^-/Cl^- and $Cl^-/\frac{1}{2}Cl_2$ respectively are 0.94 V and – 1.36 V.

What will be the E° value for $OCl-/\frac{1}{2}Cl_2$?

OR

Calculate the solubility product of a saturated solution of Ag_2CrO_4 in water at 298 K if the emf of the cell $Ag|Ag^+$ (satd. Ag_2CrO_4 soln) || $Ag^+(0.1\ M)$ | Ag is 0.164 V at 298 K.

LA Type Questions

22. Answer the following :

(a) Suggest a way to determine Λ°_m value of water.

(b) The molar conductivity of 0.025 mol L^{-1} methanoic acid is 46.1 S cm^2 mol^{-1}. Calculate its degree of dissociation and dissociation constant.

Given : $\Lambda^\circ_{(H^+)} = 349.6\,S\,cm^2\,mol^{-1}$ and

$\Lambda^\circ_{(HCCO^-)} = 54.6\,S\,cm^2\,mol^{-1}$

23. (i) Why electrolysis of $NaBr_{(aq)}$ and $NaI_{(aq)}$ gives Br_2 and I_2 respectively while that of $NaF_{(aq)}$ gives O_2 instead of F_2?

(ii) (a) Why Λ°_m for acetic acid cannot be determined experimentally?

(b) State Kohlrausch's law for electrical conductance of an electrolyte at infinite dilution.

24. 19 g of molten $SnCl_2$ is electrolysed for some time using inert electrodes. 0.119 g of Sn is deposited at the cathode. No substance is lost during the electrolysis. Find the ratio of the weights of $SnCl_2$: $SnCl_4$ after electrolysis. (At. wt. of Sn = 119)

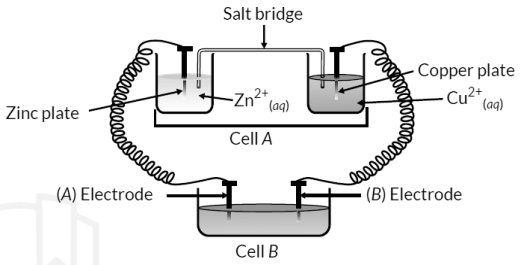
(b) A direct current deposits 19.58 g of potassium in one minute. How many grams of aluminium will be deposited by the same current in the same time? (At. wt. of K = 39, Al = 27)

25. (i) On passing equal amount of charge, 11.2 L of Cl_2 was liberated at STP from NaCl solution whereas 9.88 g of metal was deposited from a nitrate solution of this metal. If the specific heat of metal is 0.216 cal/g, what is the formula of metal nitrate?

(ii) A steady current was passed for 5 hours through two cells connected in series. First cell contains a solution of $AuCl_3$ and second contains $CuSO_4$ solution. 9.85 g of gold was deposited in the first cell. Find the amount of Cu deposited in the second cell. Also calculate the magnitude of current in ampere.

OR

Consider the figure and answer the following questions.



(i) Cell 'A' has E_{cell} = 2 V and cell 'B' has E_{cell} = 1.1 V which of the two cells 'A' or 'B' will act as an electrolytic cell? Which electrode reactions will occur in this cell?

(ii) If cell 'A' has E_{cell} = 0.5 V and cell 'B' has E_{cell} = 1.1 V then what will be the reactions at anode and cathode?

(iii) Calculate the potential for half-cell containing 0.10 M $K_2Cr_2O_{7(aq)}$, $0.20\,M\,Cr^{3+}_{(aq)}$ and 1.0×10^{-4} M $H^+_{(aq)}$. The half cell reaction is:

$Cr2O^{2-}_{7(aq)} + 14H^+_{(aq)} + 6e^- \rightarrow 2Cr^{3+}_{(aq)} + 7H_2O_{(l)}$ and the standard electrode potential is given as E° = 1.33 V.

1 Topic Wise Questions

LEVEL – 1

Electrolytic Conductance

1. The best conductor of electricity is a 1M solution of
(A) Boric acid (B) Acetic acid
(C) H_2SO_4 (D) Phosphoric acid

2. Pure water does not conduct electricity because it is
(A) Neutral (B) Readily decomposed
(C) Almost unionised (D) Completely ionised

3. Which of the following is a poor conductor of electricity
(A) CH_3COONa (B) C_2H_5OH
(C) NaCl (D) KOH

4. Which of the following does not conduct current in aqueous solution
(A) KNO_3 (B) CH_3COOH
(C) CH_3OH (D) NaOH

5. The units of conductivity of solution are
(A) ohm^{-1} (B) ohm
(C) $ohm^{-1}cm^{-1}$ (D) $ohm^{-1}eq^{-1}$

6. The cell constant is the product of resistance and
(A) conductance (B) molar conductance
(C) specific conductance (D) specific resistance

7. A solution of concentration 'C' g equiv/litre has a specific resistance R. The equivalent conductance of the solution is
(A) $\frac{1000}{RC}$ (B) $\frac{C}{R}$ (C) $\frac{R}{C}$ (D) $\frac{1000R}{C}$

8. If x is the specific resistance of the solution and N is the normality of the solution. Then equivalent conductivity of the solution is given by
(A) $\frac{1000x}{N}$ (B) $\frac{1000}{Nx}$
(C) $\frac{1000N}{x}$ (D) $\frac{Nx}{1000}$

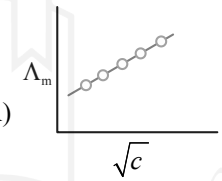
9. The relationship $\lambda_m = \lambda^0{}_m - B\sqrt{C}$ will not hold good for the electrolyte?
(A) HCl (B) KCl (C) $BaCl_2$ (D) HCN

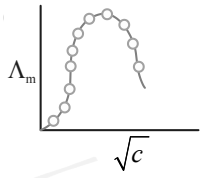
10. During electric conduction, the composition of which of the following is changed ?
(A) Graphite (B) Zinc wire
(C) Copper wire (D) H_2SO_4

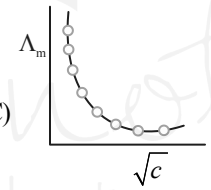
11. The degree of dissociation of an electrolyte does not depend on
(A) Nature of electrolyte (B) Catalytic action
(C) Dilution (D) Temperature

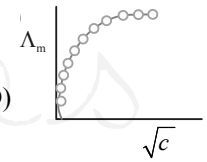
12. The correct order of equivalent conductance at infinite dilution of *LiCl, NaCl* and *KCl* is
(A) *LiCl>NaCl>KCl* (B) *KCl>NaCl>LiCl*
(C) *NaCl>KCl>LiCl* (D) *LiCl>KCl>NaCl*

13. The variation of $\wedge_m$ of acetic acid with concentration is correctly represented by

(A) 

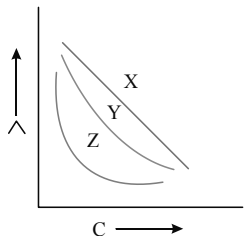
(B) 

(C) 

(D) 

14. A conductivity cell was filled with a 0.02*M KCl* solution which has a specific conductance of $2.768\times10^{-3}\ ohm^{-1}cm^{-1}$. If its resistance is 82.4 ohm at 25^0C, the cell constant is
(A) 0.2182 cm^{-1} (B) 0.2281 cm^{-1}
(C) 0.2821 cm^{-1} (D) 0.2381 cm^{-1}

15. Equivalent conductance ($\wedge$) vs concentration graphs are given for some electrolytes X, Y and Z. Here X, Y and Z are



(A) $NiSO_4, KCl, CH_3COOH$
(B) $KCl, NiSO_4, CH_3COOH$
(C) $KCl, CH_3COOH, NiSO_4$
(D) $CH_3COOH, NiSO_4, KCl$

Kohlrausch's Law & Applications

16. Equivalent conductance of 1 M CH_3COOH is 10 Ω^{-1} cm^2 $equiv^{-1}$ and that at infinite dilution is 200 Ω^{-1} cm^2 $equiv^{-1}$. Hence the % ionisation of CH_3COOH is
(A) 5% (B) 2% (C) 4% (D) 1%

17. The equivalent conductance of NaCl, HCl and C_2H_5COONa at infinite dilution are 126.45, 426.6 and 91 ohm^{-1} cm^{-2}. The equivalent conductance of C_2H_5COOH is
(A) 201.28 ohm^{-1} cm^{-2} (B) 390.71 ohm cm^{-2}
(C) 698.25 ohm cm^{-2} (D) 570.71 ohm cm^{-2}

18. A conductance cell when filled with 0.5M KCl solution (specific conductivity = 6.67×10^{-3} Ω^{-1} cm^{-}(A) registers a resistance of 243 Ω. Its cell constant is
(A) 1.62 cm (B) 1.62 cm^{-1}
(C) 1.62 m (D) 1.62 m^{-1}

19. The expression showing the relationship between equivalent conductance and molar conductance is (z = Total positive (or) negative charge per formula unit of electrolyte)
(A) $\lambda_m = Z \times \lambda_{eq}$ (B) $\lambda_{eq} = Z \times \lambda_m$
(C) $\lambda_m = \frac{\lambda_{eq}}{Z}$ (D) $\lambda_m = \lambda_{eq}^2$

20. In the plot of Λ and $\sqrt{C}$, the slope is
(A) Λ^o (B) -b (C) $\frac{-2.303}{R}$ (D) ∞

21. Equivalent conductance at infinite dilution of $BaCl_2, H_2SO_4$ *and* HCl aqueous solutions are x_1, x_2 *and* x_3 respectively. Equivalent conductance of $BaSO_4$ solution is
(A) $x_1 + x_2 - x_3$ (B) $x_1 - x_2 - x_3$
(C) $x_1 + x_2 - 2x_3$ (D) $x_1 - 2x_2 - x_3$

22 The specific conductance of saturated solution of silver chloride is $k\left(ohm^{-1}cm^{-1}\right)$. The limiting ionic conductance of Ag^+ and Cl^- ions are x and y respectively. The solubility of $AgCl$ in $gram.litre^{-1}$ is : (Molar mass of $AgCl = 143.5g\ mol^{-1}$)
(A) $k \times \frac{1000}{x-y}$ (B) $\frac{k}{x+y} \times 143.5$
(C) $\frac{k \times 1000 \times 143.5}{x+y}$ (D) $\frac{x+y}{k} \times \frac{1000}{143.5}$

Phenomenon Of Electrolysis

23. In electrolysis of dil. H_2SO_4 using platinum electrodes
(A) H_2 is evolved at cathod
(B) SO_2 is produced at anode
(C) O_2 is obtained at cathode
(D) SO_2 is produced at cathode

24. When Na_2SO_4(aq) is electrolysed between Pt electrodes, the reaction that occurs at cathode is
(A) $Na^+ + e^- \rightarrow Na$
(B) $H^+ + e^- \rightarrow \frac{1}{2}H_2$
(C) $2OH^- \rightarrow \frac{1}{2}O_2 + H_2O + 2e^-$
(D) $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$

25. Electrolysis of salt solution is due to the formation of
(A) Electron (B) Ions
(C) Oxides (D) Acids

26. Electrode at which electrons flow into the electrolyte is
(A) Anode
(B) Cathode
(C) Both anode & cathode
(D) +ve electrode

27. During electrolysis electrons flow from
(A) cations to cathode (B) anode to anions
(C) cathode to anode (D) anions to anode

28. The cathode reaction in electrolysis of dilute sulphuric acid with Platinum electrode is
(A) Oxidation
(B) Reduction
(C) Both oxidation and reduction
(D) Neutralization

29. The following are some statements about electrolytic cell
(A) In this, chemical energy converted into electrical energy
(B) In this cell, electrons flow from cathode to anode through external circuit
(C) In this cell reduction takes place at cathode
(D) In this, cathode is a +ve electrode
The correct combination is
(A) only B (B) only C
(C) only C,D (D) only B,C

30. In electrolysis of NaCl when Pt electrode is taken then H_2 is liberated at cathode while with Hg cathode, it forms sodium amalgam. This is because
(A) Hg is more inert than Pt
(B) More voltage is required to reduce H^+ at Hg than at Pt
(C) Na is dissolved in Hg while it does not dissolve in Pt
(D) Conc. of H^+ ions is larger when Pt electrode is taken

31. If mercury is used as cathode in the electrolysis of NaCl solution, the ions discharged at cathode are
(A) H^+ (B) Na^+ (C) OH^- (D) Cl^-

32. Which of the following occurs at cathode
(A) $2OH^- \rightarrow H_2O + \frac{1}{2}O_2 + 2e^-$
(B) $Ag \rightarrow Ag^+ + e^-$
(C) $Fe^{+2} \rightarrow Fe^{+3} + e^-$
(D) $Cu^{+2} + 2e^- \rightarrow Cu$

33. The passage of current through a solution of certain electrolyte results in the formation of hydrogen at anode the solution is
(A) Aqueous *HCl*
(B) Fused CaH_2
(C) sulphuric acid in water
(D) $K_2SO_4(Aq)$

34. Which of the following statements are correct?
(a) The electrolysis of aqueous *NaCl* produces hydrogen gas at cathode and chlorine gas at anode,
(b) The electrolysis of a $CuSO_4$ solution using Pt electrodes causes the liberation of O_2 at the anode and the deposition of copper at the cathode.
(c) Oxygen and hydrogen are produced at the anode and cathode during the electrolysis of dilute aqueous solution of H_2SO_4 (d) All electrolytic reactions are redox reactions
(A) Only a is correct (B) a,b are correct
(C) a,d are correct (D) a,b,c and d are correct

Faraday's Laws & Applications

35. The unit of electrochemical equivalent is
(A) Gram (B) Gram / Ampere
(C) Gram / Coulomb (D) Coulomb / Gram

36. On electrolysis 1 mole Al atoms will be deposited by
(A) 1 mole of electrons (B) 2 moles of electrons
(C) 3 moles of electrons (D) 6 moles of electrons

37. The electric charge for electrode deposition of 1gram equivalent of a substance is
(A) 96,500 coulombs
(B) One ampere per sec
(C) One ampere for one hour
(D) Charge in faradays

38. 6.24×10^{19} electrons are equal approximately to
(A) 10 coulombs (B) 96500 coulombs
(C) one electron volt (D) 0.1F

39. Number of electrons required to deposit one mole of Mg^{2+} ions is
(A) 6.023×10^{23} (B) 12.046×10^{23}
(C) 18.069×10^{23} (D) 3.012×10^{23}

40. The number of electrons needed to reduce 3gm of Mg^{2+} to Mg are
(A) N (B) $\frac{N}{2}$ (C) $\frac{N}{4}$ (D) $\frac{N}{8}$

41. During the electrolysis of cryolite, aluminium and fluorine are formed in ..... molar ratio
(A) 1: 2 (B) 2 : 3 (C) 1 : 1 (D) 1 : 3

42. The electro chemical equivalent of an element is 0.0006735 g/C. Its equivalent weight is
(A) 65 (B) 67.35 (C) 130 (D) 32.5

43. One coulomb of electricity produces m kg of a substance 'X'. The electrochemical equivalent of 'X' in grams is
(A) m (B) $m \times 10^3$
(C) $m \times 10^{-3}$ (D) 0.1 m

44. The charge required to reduce 1mole $Cr_2O_7^{-2}$ to Cr^{+3} ions is
(A) 3F (B) 3 coulomb
(C) 6F (D) $2x6.023x10^{23}e^-$

45. In a hydrogen - oxygen fuel cell, 67.2 litre of H_2 at S.T.P is used in 5 min. What is the average current produced?
(A) 549.4 amp (B) 643.33 amp
(C) 965 amp (D) 1930 amp

46. A quantity of electrcity required to reduce 12.3 g of nitrobenzene to aniline arising 50% current efficiency is
(A) 115800C (B) 579000C
(C) 231600C (D) 289500C

47. The electrochemical equivalent of two substances are E_1 and E_2. The current that flows to deposit their equal amount at the cathodes in the same time must be in the ratio of
(A) $E_1 : E_2$ (B) $E_2 : E_1$
(C) $E_1 : E_2 - E_1$ (D) $E_1 X E_2 : E_1 + E_2$

48. One faraday of electricity is passed separately through one litre of one molar aqueous solution of I) $AgNO_3$, ii) $SnCl_4$ and iii) $CuSO_4$. The number of moles of Ag, Sn and Cu deposited at cathode are respectively
(A) 1.0, 0.25, 0.5 (B) 1.0, 0.5, 0.25
(C) 0.5, 1.0, 0.25 (D) 0.25, 0.5, 1.0

49. Which one of the following could not be liberated from a suitable electrolyte by the passage of 0.25 faraday of electricity through that electrolyte
(A) 0.25 mole of Ag (B) 16gm of Cu
(C) 2gm of O_2 (g) (D) 2.8ltrs of H_2 at STP

50. The charge required for the oxidation of one mole of Mn_3O_4 *to* MnO_4^{2-} in alkaliine medium is (assume 100% current efficiency):
(A) 10/3F (B) 6F (C) 10F (D) 4F

51. The same quantity of electricity is passed through 0.1 M H_2SO_4 and 0.1 M HCl. The amounts of H_2 obtained at the cathodes are in the ratio
(A) 1 : 1 (B) 2 : 1 (C) 1 : 2 (D) 3 : 1

Electrochemical Cells

52. The half cell reduction potential of a hydrogen electrode at pH = 10 will be
(A) –0.50 V (B) –0.59 V
(C) 0.059 V (D) –0.059 V

53. The half reactions for a cell are
$Zn \longrightarrow Zn^{2+} + 2e^-$ $E° = 0.76$ V
$Fe \longrightarrow Fe^{2+} + 2e^-$ $E° = 0.41$ V
The $\Delta G°$ (in kJ) for the overall reaction
$Fe^{2+} + Zn \longrightarrow Zn^{2+} + Fe$ is
(A) 67.6 kJ (B) –67.6 kJ
(C) 33.78 kJ (D) –33.78 kJ

54. In a galvanic cell electron flow will be from
(A) Negative electrode to positive electrode
(B) Positive electrode to negative electrode
(C) There will be no flow of electrons
(D) Cathode to anode in the external circuit

55. Which of the following is not true for a galvanic cell represented in IUPAC system
(A) Right hand electrode is a +ve terminal
(B) Right hand electrode acts as cathode
(C) Electrons are given out in the external circuit from the anode
(D) Electrons are given out in the external circuit from the cathode.

56. A half cell reaction is one that
(A) Involves only half a mole of electrolyte
(B) Goes only half way to completion
(C) Takes place at one electrode
(D) Consumes half a unit of electricity

57. Agar–Agar is used in salt bridge since it is
(A) Electrolyte (B) Non–electrolyte
(C) Inert electrolyte (D) A solid

58. The thermodynamic efficiency of cell is given by
(A) $\Delta H / \Delta G$ (B) $-nFE / \Delta G$
(C) $-nFE / \Delta H$ (D) $-nFE$

Electrochemical Series & Emf

59. For which of the following SOP and SRP are equal
(A) SHE (B) Mg electrode
(C) Ni electrode (D) Copper electrode

60. The potential across the metal and the aqueous solution of its ions of unit activity at 298K is known as
(A) Electrode potential
(B) Standard electrode potential
(C) Formal electrode potential
(D) Oxidation potential

61. Arrange the following in the order of their decreasing electrode potentials: Mg, K, Ba,Ca
(A) K,Ba,Ca,Mg (B) Ba,Ca,K,Mg
(C) Ca,Mg,K,Ba (D) Mg,Ca,Ba,K

62. The EMF of a galvanic cell is determined by using a
(A) Voltmeter (B) Spectrometer
(C) Coulometer (D) Ammeter

63. Which of the following is most powerful oxidizing agent?
(A) $Cl_2 + 2e^- \rightarrow 2Cl^-$; E^0=1.36V
(B) $Na^+ + e^- \rightarrow Na$; E^0=–2.71V
(C) $MnO_4^- + 2H_2O + 2e^- \rightarrow MnO_2 + 4OH^-$, E^0=0.6v
(D) $H_2O_2 + 2H^+ + 2e^- \rightarrow 2H_2O$; E^0=1.78V