2021

Full Marks - 60

Time - 3 hours

The figures in the right-hand margin indicate marks

Answer *all* questions

Part-I

1. Fill in the blanks : 1 × 8

   a) The formula of hexacyanoferrate (II) ion is ___ .

   b) The word 'trans' is used to designate ___ positions.

   c) Ti^{3+} ions are ___ in colour.

   d) Electronic configuaration of Ruthenium is ___ .

   e) Important oxidation states of Vanadium are ___ .

   f) Pure lanthanide metals are ___ colour.

   g) The important ore of Mercury is ___ .

   h) Haemoglobin is ___ protein of blood.

Part-II

2. Answer any *eight* of the following : 1½ × 8

   a) Why square planar complexes do not show optical isomerism ?

   b) What is Chelate and Chelation ?

   c) Why transition elements have paramagnetic and diamagnetic behaviour ?

   d) Why $CuSO_4$ (anhydrous) is colourless but $CuSO_4 . 5H_2O$ (hydrated) is blue in colour.

   e) Which transition element has maximum oxidation state ? Give one example.

   f) Give oxidation state of Ti (III).

   g) What is Lanthanide contraction ?

   h) Why blood is red in colour ?

   i) What do you mean by trace element ?

   j) Dimethyl mercury is very dangerous. Explain.

Part-III

3. Answer any *eight* of the following : 2×8

   a) Define confirmation isomerism. Give one example.

   b) Why tetrahedral complexes are generally high speen complexes ?

   c) What od you mean by crystal field splitting.

   d) Distinguish between Ferromagnetism and anti-ferromagnetism.

   e) What is the unique feature of Vanadium chemistry ?

   f) Distinguish Co(II) tetraedral and octahedral complexes from their colour.

   g) The magnetic behaviour of transition elements differs from that of lanthanides. Explain why ?

   h) Why Md^{2+} ion is more stable than Eu^{2+} ion ?

   i) Write short note on heme.

   j) Why Arsenic is toxic in nature ?

Part-IV

4. a) Give the postulates of Werner's co-ordination theory. What are its draw backs ?   6

   OR

   b) What are Labile and inert complexes ? Explain them with a suitable example.

5. a) What is Latimer diagrams ? Give its applications.   6

   OR

   b) Describe the magnetic properties of elements of second and third transition series.

6. a) Discuss the chemistry of Iron in its various oxidation states.   6

   OR

   b) What are Lanthanides ? Give the cause and effects of Lanthanide contraction.

7. a) Describe carbonic anhydrase and carboxypeptidase.   6

   OR

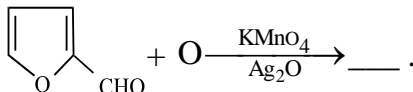   b) Discuss the function of haemoglobin / myoglobin in transport of oxygen.

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Part-I

1. Fill in the blanks : 1×8

   a) Hydrolysis of benzonitrile gives ___ .

   b) Nitrobenzene is converted to aniline in ___ medium.

   c) The general formula of diazonium salt is ___.

   d) Anthracene undergoes electrophilic substitution reaction at ___ position.

   e) Pyrrole is a flat molecule due to ___ hybridisation.

   f) $+ O \xrightarrow[\text{Ag}_2\text{O}]{\text{KMnO}_4}$ ___ .

   g) Alkaloids are ___ in nature.

   h) The oxygenated derivatives of Terpenes are called ___.

Part-II

2. Answer any *eight* of the following within two to three sentences each : 1½×8

   a) Nitrobenzene does not undergo Friedel Craft alkylation. Give reasons.

   b) Which is more basic : Ethylamine or Acetamide ? Give reasons.

   c) What happens when Napthalene is reduced with sodium and alcohol ?

   d) Why Napthalene is less aromatic than benzene ?

   e) What is Sandmeyer's reaction ?

   f) Give one example with structure of five membered heterocylic compound.

   g) Pyridine is more basic than Pyrrole. Give reason.

   h) Thiophene undergoes Huckel's rule. Explain.

   i) Furan is less reactive than Pyrrole. Why ?

   j) Give the comparision of basic strength of primary, secondary and tertiary amines.

Part-III

3. Answer any *eight* of the following within 75 words each : 2 × 8

   a) Explain the inertness of Nitrobenzene.

   b) What is Gabriel phthalimide synthesis ?

   c) How would you explain that aliphatic amines are more basic than Ammonia ?

   d) What do you mean by Diazotisation ?

   e) Explain the resonating structures of Napthalene.

   f) Give the orbital structure of Anthracene.

   g) Pyrrole is amphoteric in character. Explain with example.

   h) Write notes on Madelung synthesis.

   i) What is Hoffmann's exhaustive methylation method ?

   j) What is isoprene rule ?

Part-IV

4. Answer following within 500 words :

   a) How cyanides are prepared from amides and Grignard reagent ? Give the reactions of cyanides in (i) Hydrolysis, (ii) Reduction. 6

   OR

   b) Discuss Carbylamine reaction and Mannich reaction with mechanism.

5. a) Discuss with mechanisms : 6

   i) Reduction of Diazonium chloride with $SnCl_2 | HCl$

   ii) Coupling reaction with Phenol.

   OR

   b) i) Give synthesis of Anthracene using Friedel Craft reaction

   ii) What happens when Antheracene undergoes halogenation and oxidation.

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6. a) Discuss the electrophilic substitution reaction of Furan (resonating structures) Give its reactions ____ sulphonation, Gattermann reaction and coupling reaction.   6

OR

b) Elusicate the orbital structure of pyridine and confirm it by Hantzsch synthesis.

7. a) Elucidate the structure of Nicotine and describe its synthesis.   6

OR

b) Describe the structure elucidation of α-Terpineol and confirm its structure by synthesis.

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Answer *all* questions

Part-I

1. Fill in the blanks :   8

   a) $(NH_4) CO_3$ is a ____ electrolyte.

   b)   Conductance is the reciprocal of ____ .

   c)   The conductance of a unit cube of a solution of an electrolyte is called ____ conductance.

   d)   The unit of ionic mobility in C.G.S. system is __.

   e)   One mole of Aluminium will be deposited by __ of charge of electricity.

   f)   A chemical cell converts chemical energy into ____ .

   g)   For pure solids and liquids, the Nernst equation can be written as E = ____.

Part-II

2. Answer any *eight* of the following :   1½×8

   a)   Define degree of ionisation.

   b)   State Ohm's law.

   c)   Which of the two is a better conductor and why ?

   i)   A storng electrolyte and ii) a metal.

   d)   Define molar conductance.

   e)   What is transport Number ?

   f)   Electroplating is applicable to which purposes ?

   g)   Write the advantages of conductometric titrations.

   h)   A molar solution of ethanoic acid conducts elecricity but not so easily as that of HCl acid. Explain.

   i)   What do you mean by activity and activity coefficient ?

   j)   Define Electronic and Atomic polarisation.

Part-III

3. Answer any *eight* of the following :   2 × 8

   a)   Define equivalent conductance.

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b) The specific conductance of 0.02N KCl at 25°C using conductivity water is 0.002765 Ohm^{-1}cm^{-1}. If the resistance of the solution is 400 Ohm, calculate the cell constant.

c) Write Walden Rules.

d) State Wien effect.

e) Calculate the solubility of a Sparingly soluble salt by conductance measurement.

f) Derive the relationship between ionic mobility and transport number.

g) Write briefly reversible and irreversible cell.

h) What do you know about electrode potential ?

i) What is dipolemoment ?

j) Why dipolemoment of CO_2 and H_2O differs ?

Part-IV

4. a) What is Kohlrausch law ? How is the equivalent conductance at infinite dilution for weak electrolyte is determined by the application of this law ?   6

OR

b) Discuss Relaxation and Elecrophoretic effect.

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5. a) Determine the transport number of H$^+$ ion by moving boundary method.   6

OR

b) What are conductometric titrations ? Explain conductometric acid-base titration curves of strong acid-strong base and weak acid-strong base.

6. a) State and explain Faraday's First law and Second law of electrolysis.   6

OR

b) What is E.M.F. of a cell and its measurement ? Discuss its application in determining Equilibrium constant of a cell reaction.   6

7. a) Derive an expression for the EMF of a concentration cell with transference.   6

OR

b) What are potentiometric titrations ? Give the applications of EMF measurements as regard to

i) Acid-Base titrations and

ii) Redox titrations.

CHEMISTRY CC-X

PART I (1 mark)

1. Define conductivity.

2. Define equivalent conductivity.

3. Define molar conductivity.

4. State Walden's rule.

5. Define ionic mobility.

6. Define transport number of an ion?

7. What is liquid junction potential?

8. What is dipole moment?

9. Write the unit of molar conductivity.

10. Define solubility product.

11. What is conductometric titration?

12. What is a concentration cell?

13. What is potentiometric titration?

14. Define dipole moment.

15. Define molecular polarizability.

16. What is electrostatics?

17. Define cell EMF?

PART II (1.5 marks)

18. Explain Debye-Falkenhagen effect.

19. Write Debye-Huckel-Onsager equation.

20. How transport number of a cation is related to transport number of anion?

21. Explain the applications of electrolysis in metallurgy.

22. What are the advantages of conductometric titration?

23. Describe the factors which affect the transport number of ions?

24. What is indicator electrolyte? Explain with an example.

25. What is standard electrode potential?

26. Write the applications of Nernst equation.

27. Write Lorenz-Lorentz equation.

28. Write Clausius Mosotti equation.

29. What is quinhydrone electrode?

30. Can we use a copper vessel to store 1M $AgNO_3$ solution? State the reason.

31. What is the effect of temperature on molar conductivity?

32. How does molar conductivity of a weak electrolyte vary with concentration?

PART III (2 marks)

33. Explain Wien effect.

34. State and explain Kohlraush's law of independent migration of ions.

35. Explain how equivalent conductance of electrolytes vary with dilution?

36. What is the function of a salt bridge?

37. Define oxidation potential and reduction potential. Write their units.

38. Distinguish between single electrode potential and standard electrode potential.

39. What is relaxation effect?

40. Explain ionic velocity and ionic mobility. Write their unit.

41. Explain how solubility of a sparingly soluble salt is determined by using conductance data?

42. Describe conductometric titration of a strong acid against a strong base?

43. Describe conductometric titration of a strong acid against a weak base?

44. Discuss reversible and irreversible cells with examples.

45. The equivalent conductance of a decinormal solution of a weak acid is 8 ohm-1cm2eq-1.If the equivalent conductance of the acid at infinite dilution is 400 ohm-1cm2eq-1, calculate the dissociation constant of the acid?

46. What are the advantages of a glass electode in the determination of pH of a solution?

47. What are the limitations of Hydrogen electrode?

PART IV (6 mark)

48. Explain Arrhenius theory of electrolytic dissociation. Write its limitations.

49. State and explain Kohlrausch's law with an example. Write its applications. Discuss the variation of molar conductance with concentration of strong and weak electrolytes.

50. Explain the determination of ionic product of water by conductance measurement.

51. Derive an expression for EMF of a concentration cell with transference.

52. Derive an expression for EMF of a concentration cell without transference.

53. What are redox titrations? Explain with an example how these titrations are carried out potentiometrically?

54. Explain potentiometric acid-base titration?

55. Explain Hittorf method to find the transport numbers of silver and nitrate ions in a solution of silver nitrate using silver electrodes?

56. Describe the moving boundary method for the determination of transport number of H+?

57. Explain the term "electrode potential"? Derive Nernst equation for measuring EMF of a cell?

58. How free energy, enthalpy and entropy of a cell reaction can be determined from EMF measurements?

59. Discuss how the pH of a solution is determined by using glass electrode.

60. Discuss how the pH of a solution is determined by using Hydrogen electrode.

61. Discuss how the pH of a solution is determined by using Quinhydrone electrode.

62. Discuss Clausius Mosotti equation and its significance.

63. Discuss Lorenz-Lorentz equation and its significance.

64. Write short notes on conductometric titration and its advantages.

65. Explain the construction and working of quinhydrone electrode. Discuss its merits and demerits.