

Rayat Shikshan Sanstha's
Yashwantrao Chavan Institute of Science, Satara (Autonomous)

Question Bank

B. Sc. II, Sem IV

BCT 401: Physical Chemistry

One Line Questions/Beats

(1 Mark)

- 1) What is transport number? Transport number of Ag^+ ion in AgNO_3 is 0.47, calculate the transport number of NO_3^- ion.
- 2) State and explain Raoult's law.
- 3) What are additive and constitutive properties?
- 4) Define emf of cell. Give Nernst equation for emf of cell.
- 5) What are the number of components in the following equilibrium system?
$$\text{CaCO}_3(\text{s}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$$
- 6) State mathematical equation for Gibb's phase rule and explain meaning of the terms involved in it.
- 7) Define the terms Normality and mole Fraction.
- 8) Define Transport number of an ion and state its relation with speed of ion.
- 9) State and explain Raoult's Law.
- 10) What is electrochemical or Galvanic cell? Give one example.
- 11) Define the terms – a) Component b) Degrees of freedom.
- 12) Define molality and molarity.
- 13) What do you mean by Amalgam electrode?
- 14) State the Faraday's first law of electrolysis and write its mathematical equation.
- 15) Define viscosity. Give equation for coefficient of viscosity.
- 16) Define the binary solutions and give one example.
- 17) Define electrochemical series.
- 18) Name the electrode universally accepted as reference electrode with standard potential of zero volt.
- 19) Give the statement of Hittorf's rule.
- 20) Define equivalence conductance and write its unit.

- 21) Give the relationship between specific conductance and equivalent conductance.
- 22) Write the equation of reduced or condensed phase rule.
- 23) What is salt bridge. Write its function.
- 24) Which of the following aqueous solution of NaCl has highest specific conductivity. Why?
- a. 0.1 M b. 0.001 M c. 0.0001 d. 1M
- 25) Transport number of Cl^- ion in dilute solution of LiCl is 0.67 while Transport number of Cl^- ion in dilute solution of HCl is 0.18 only. Give reason.

Long Answer Questions:

(10 Marks)

- Describe moving boundary method for the determination of transport number. Moving boundary experiment is done to determine the transport number of Li^+ ion in 0.01 mol/lit of LiCl. In a tube having cross sectional area 0.125 cm^2 , boundary moves 7.3 cm in 1490 seconds using a current of 0.0018A. Calculate transport number of Li^+ and Cl^- ion.
- Derive the Nernst equation for emf measurement and single electrode potential.
- What is true and metastable equilibrium? Draw phase diagram of water system. Discuss the importance of triple point, curves and areas at equilibrium.
- Derive Clausius Clapeyron's equation. Water boils at 100°C at a pressure of 1 atm. Calculate the vapor pressure of water at 90°C . The heat of vaporization of water is $9.80 \text{ Kcal.mol}^{-1}$ ($R = 2 \text{ cal.mol}^{-1}$).
- Explain the applications of phase rule to Sulphur system.
- What is pH? Describe how pH of solution can be determined using quinhydrone electrode Find the pH of the solution placed in quinhydrone half cell which was coupled with standard calomel electrode. The emf of the combined cell was determined to be 0.123 V at 25°C . ($E_{\text{calomel}} = 0.2415 \text{ V}$ $E^0_{\text{Q}} = 0.6996 \text{ V}$)
- What is transport number? Explain the factors affecting transport number. Absolute velocities of NH_4^+ and NO_3^- ions at 298 K are 0.00076 and 0.0007 m s^{-1} . Calculate transport number of ions.
- Explain how emf measurements may be employed to determine thermodynamic parameters ΔG , ΔH and ΔS .
- Explain the various types of electrodes along with their electrode potential equations.

10. State Gibbs phase rule. Explain the terms involved in it.
11. What are ideal solutions? State Raoult's law. Explain with the help of diagram the vapour pressure of ideal solutions.
12. What are the real or non-ideal solutions. Explain in detail the three types of non-ideal solutions.
13. What is viscosity? Explain how to determine relative viscosity of given liquid using Ostwald's viscometer.
14. Explain the method of determination of molar and specific refractivities using Abbe's refractometer.
15. State and explain Kohlraush law. How it may be applied to determine solubility and solubility product of a sparingly soluble salt.

Short Answer Questions

(5 Marks)

- 1) Distinguish between electronic and electrolytic conductors.
- 2) State mathematical equation of Gibb's phase rule. Explain the terms involved in it.
- 3) Explain the terms upper and lower CST. Discuss Nicotine-Water system.
- 4) What is the relation between specific conductance, equivalent conductance and molar conductance? Specific conductance of 0.12 M solution of an electrolyte is 0.024 Scm^{-1} . Calculate its molar conductance.
- 5) Define viscosity. Describe a method of determination of coefficient of viscosity by Ostwald viscometer method.
- 6) Explain the following with suitable example i) Metal-metal ion electrode ii) Metal insoluble salt electrode.
- 7) Define critical solution temperature. Explain the system with upper CST
- 8) What are ideal and non-ideal solutions? Draw vapour pressure composition curves for non-ideal solutions.
- 9) Derive Nernst equation for emf of metal-metal ion electrode.
- 10) State Snell's law. Explain the terms specific refraction and molecular refraction. How are they related?
- 11) Write a note on moving boundary method for determination of transport number

- 12) Define Specific conductance, equivalent conductance and molar conductance. What is the effect of dilution on them?
- 13) Write a precise note on Pattinson's process of desilverisation of lead.
- 14) What is critical solution temperature? Discuss phenol-Water system.
- 15) Explain the following with suitable example
 - i) Metal-insoluble salt electrode
 - ii) Oxidation-reduction electrode.
- 16) What is refractive index? How is it measured with Abbe's refractometer?
- 17) State Kohlrausch's law. How is it used to determine equivalent conductance of weak electrolyte at infinite dilution?
- 18) How will you determine pH of solution from emf measurement?
- 19) Write a note on reversible and irreversible cell.
- 20) Write a note on determination of equilibrium constant for cell.
- 21) What is gas electrode? Give the cell emf equation for gas electrode.
- 22) Give the expression for electrode potential for Amalgam electrode.
- 23) What are homogenous and heterogenous systems? Give examples.
- 24) Explain in brief true and metastable equilibria.
- 25) Explain the triple point with suitable example.
- 26) Give the general idea about condensed system along with reduced phase rule equation.
- 27) Give the brief classification of physical properties of liquids.
- 28) Write a note on colligative properties of liquids.
- 29) Define transport number of an ion and deduce its relation with speeds of ions.
- 30) Explain the term equivalent conductance at infinite dilution. How will you obtain its value for strong electrolyte.

Rayat Shikshan Santha's
Yashavantrao Chavan Institute of Science, Satara (Autonomous)
Department of Chemistry
B. Sc. II (Sem IV)
Question Bank
Inorganic Chemistry (BCT-402)

Q. 1 Answer in one sentence

]

- 1) Define coordination number.
- 2) Why transition metal ions shows different colours?
- 3) Explain the term primary valency.
- 4) Why Ce^{+3} is paramagnetic in nature?
- 5) What is the electronic configuration of actinium?
- 6) What are high spin complexes?
- 7) Why Lu^{+3} is diamagnetic in nature?
- 8) Explain the term secondary valency.
- 9) Why Co^{3+} ion shows pink colour?
- 10) What is the electronic configuration of plutonium?
- 11) What are low spin complexes?
- 12) Explain the term auxiliary valency.
- 13) What is coordinate bond?
- 14) What is the magnetic moment of Sc^{3+} ion?
- 15) What is the electronic configuration of Lawrencium?
- 16) What are lanthanides?
- 17) What are f block elements?
- 18) What is Chelating agent?
- 19) What is metal chelate?
- 20) What are metalloporphyrins?
- 21) What is cooperativity effect?
- 22) Define Coordinate covalent bond.
- 23) What is ligand?
- 24) What is complex salt?
- 25) Define the term double salt.

Q. 2 Attempt the following question

- 1) Explain Werner's theory with a suitable example.
- 2) What is lanthanide contraction? Explain the cause and consequences of lanthanide contraction.
- 3) Explain the term ligand and the various types of ligands with examples.

- 4) What is CFSE? Explain factors affecting the crystal field splitting.
- 5) List the old and modern methods of separation of lanthanides. Explain the ion exchange method with labeled diagram.
- 6) Explain the various types of ligands with examples.
- 7) Explain in detail colour and spectra of lanthanide elements.
- 8) What is CFSE? Explain Crystal field splitting of 'd' orbital in octahedral.
- 9) What is structural isomerism? Explain its types with suitable examples.
- 10) Discuss the electronic configuration of elements of the first transition series. Why do Cr and Cu show anomalous configuration?
- 11) Discuss the magnetic behavior of '3d' block elements. Why do 3d block elements give coloured ions?
- 12) Explain the Electronic structure of first transition series elements (3d block elements) and explain why 3d block elements give coloured ions?
- 13) Explain oxidation states of 3d block elements and correlate its complex formation ability.
- 14) What are f block elements? Give symbols, names and atomic numbers of lanthanides.
- 15) What are structural requirements for chelate formation?

Q. 3 Attempt the following question

- 1) What are transition elements? Discuss various oxidation states of elements of first transition series.
- 2) Explain Separation of lanthanides by ion exchange method.
- 3) Differentiate between metal chelate and metal complex.
- 4) Discuss the biological role of alkali and alkaline earth metal ions.
- 5) Match the following

a. $[\text{FeF}_6]^{3-}$	1. Triamine trichloro cobalt (III)
b. $\text{K}_4[\text{Ni}(\text{CN})_4]$	2. Potassium tetracyano nickelate (0)
c. $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$	3. Tetraaquo dichloro chromium (III) nitrate
d. $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2] \text{NO}_3$	4. Hexafluoro ferrate (III)
e. $[\text{Co}(\text{NH}_3)_6][\text{CoCl}_6]$	5. Hexaamine cobalt (III) hexachlorobaltate
- 6) Write a note on methods of prevention of corrosion of metal.
- 7) What is lanthanide contraction? Explain its effects on properties of lanthanides.
- 8) What is chelation? Discuss the use of EDTA as a chelating agent.
- 9) Discuss the function of haemoglobin and myoglobin in biological system.

10) Match the following

- | | |
|---|--|
| a. $[\text{FeF}_6]^{3-}$ | 1. Hexaamine cobalt (III) hexachloro cobaltate |
| b. $\text{K}_4[\text{Ni}(\text{CN})_4]$ | 2. Triamine trichloro cobalt (III) |
| c. $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$ | 3. Potassium tetracyano nickelate (0) |
| d. $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2] \text{NO}_3$ | 4. Tetraaquo dichloro chromium (III) nitrate |
| e. $[\text{Co}(\text{NH}_3)_6][\text{CoCl}_6]$ | 5. Hexafluoro ferrate (III) |

11) Why 3d elements are called transition elements? Discuss the electronic configuration of elements of first transition series.

12) Explain Separation of lanthanides by ion exchange method.

13) Differentiate between metal chelate and metal complex.

14) Explain in brief deoxy-haemoglobin and oxy-haemoglobin.

15) How corrosion of metals can be prevented?

16) What are 3d block elements? Discuss in detail why 3d block elements give coloured ions.

17) Match the following

- | | |
|---|---|
| a. $\text{K}_3[\text{Al}(\text{C}_2\text{O}_4)]^{3-}$ | 1. Potassium tetracyano nickelate (0) |
| b. $\text{K}_4[\text{Ni}(\text{CN})_4]$ | 2. Potassium tris(oxalate) aluminate (III) |
| c. $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$ | 3. Triamine trichloro cobalt (III) |
| d. $[\text{Cr}(\text{en})_3]\text{Cl}_3$ | 4. Pentaamine chloro cobalt (III) chloride |
| e. $[\text{Co Cl}(\text{NH}_3)_5]\text{Cl}_2$ | 5. Tris(ethylene diamine) chromium (III) chloride |

18) "3d block elements form large number of complexes". Justify the statement with brief explanation.

19) Discuss the electronic configuration of elements of the first transition series.

20) Why do Cr and Cu show anomalous configuration?

21) Discuss the magnetic behavior of '3d' block elements.

22) Why do 3d block elements give coloured ions?

23) Explain paramagnetic character of 3d block elements.

24) Cobalt salts are coloured where as zinc salts are colourless. Why?

25) What are causes of colouration in transition metal compounds?

26) What are f block elements? Give symbols, names and atomic numbers of lanthanides.

27) Give important oxidation states of lanthanides. How do you account for the stability of different oxidation states?

28) Mention various applications of EDTA as a chelating agent and discuss any one of them in detail.

29) Mention various applications of DMG as a chelating agent and discuss any one of them in detail.

30) Discuss the role of Ca^{++} w.r.t. sources and functions.