Guru Nanak Dev Engineering College , Ludhiana
APPLIED SCIENCES DEPARTMENT

Subject Code:-BSC-105 **Subject Name:- Chemistry**
Section:-All Branches **Session:- 2018 Batch onwards**
(CS, IT, EE, EC, ME, PE, CE)

Note:- This is Question Bank for preparation of students in context of Final Exam. Try to give crystal clarified answer with proper conclusion. Underlined words are keywords for extracting appropriate answer. "OR" means question can be of different form but you have to write same answer for relevant questions. Positively you all will be benefited by these questions and give your best in exams.

Question Bank for UV Spectroscopy

Q.1 Define Chromophore and Auxochrome with suitable examples?

Q.2 Explain different types of Electronic transition with representation?

Q.3 Draw labelled diagram of Double Beam UV-Visible Spectrophotometer?

Q.4 Describe different factors affecting width and intensity of spectral lines?
OR
Why UV Spectra is broad in nature instead of sharp peak?

Q.5 Define Bathochromic, Hypsochromic, Hyperchromic and Hypochromic shift and Isobestic point with examples?
OR
Explain different factors affecting λ_{max} of spectral lines?

Q.6 Discuss the influence of increase in polarity of solvent on $\pi - \pi^{\#}$ and n-$\pi^{\#}$ transition?

Q.7 Give a statement of Frank-Condon principle with Potential energy level diagram?

Q.8 How UV Spectroscopy helps in identification of Geometrical Isomers and different carbonyl containing functional group?

Q.9 Explain Principle and Selection Rules of UV Spectroscopy?

Q.10. "1,3-butadiene absorb at high wavelength as compared to ethene'. Justify your answer with relevant reasons?

Q.11. Why β-carotene an orange pigment in carrots absorb at 452 and 478 nm?

Q.12. Derive Beer-Lambert Law and what are its application and limitations?

Q.13. A substance when dissolved in water at 10^{-3} M concentration absorbs 15% of incident radiation in a path of 1 cm length. What should be concentration of solution in order to absorb 75% of same radiation?

Q.14. Calculate λ_{max} value of following compounds using Woodward-Fieser Rule

- **1,4-diethylcyclohexa-1,3-diene**
- **3,4-dimethylpent-3-ene-2-one**
- **Ethyl vinyl ketone**
- **2,3-dimethyl-1,3-butadiene**

Q.15. An organic compound of molecular mass 455 has an absorption band at λ_{max} value of 645 nm and molar absorption coefficient value of 7600. A solution of this organic compound shows absorption at 7.0 with 0.1 m cell. Calculate the concentration in grams per litre?

Question Bank for I.R.Spectroscopy

Q.1 Explain different types of stretching and bending fundamental vibrations?

Q.2 If the force constant of CO molecule is 1560 Nm^{-1}.Calculate the fundamental frequency of vibration in cm^{-1}?

(HINT:- Hooke's Law formula)

Q.3 Define Finger-print and Functional group region and mention their range?

Q.4 How alkane, alkene and alkyne can be distinguished with the help of I.R. Spectroscopy?

Q.5 What are the main factors which affect the Vibrational frequency?

Q.6 Discuss the Principle and Selection rule of I.R. Spectroscopy?

Q.7 Calculate the number of modes of vibration in CO_2, SO_2, methane, benzene Molecule and Nitro group?

Q.8 How different types of H-bonding can be distinguished with the help of I.R. Spectroscopy?

Q.9 Distinguish following pairs using IR Spectra

(a) Ethyl alcohol and Dimethyl ether

(b) Propane and propanol

(c) Acetone and Acetaldehyde

(HINT:- Use of concept of Inductive effect, Resonance and Hooke's Law)

Q.10 HCl is IR active but H_2 and Cl_2 is IR inactive.Explain?

Q.11 How can carbonyl group be differentiated in Formaldehyde, Acetaldehyde and Acetone with the help of IR Spectroscopy?

Q.12 Mention the range of Infrared radiation in terms of Kcal/mole?

Q.13. Explain the significance of Finger-print and Functional group region?

Question bank for N.M.R. Spectroscopy

Q.1 What do you mean by shielding and deshielding of protons in N.M.R. Spectroscopy?

OR

What is meant by term Chemical Shift?

Q.2. Why TMS is used as standard reference compound/Super compound in NMR Spectroscopy?

Q.3 Explain the NMR spectra of the following compounds using spin-spin coupling concept and do mention the intensity of splitted signals?

(A) 2-Chloropropane

(B) Ethyl amine

(C) Ethanol

(D) 1,1,2-trichloro propane

Q.4 Which type of nuclei show NMR spectra?

Q.5 Describe the components of NMR Spectrophotometer along with block diagram?

Q.6 What do you mean by relaxation process and coupling constant in NMR Spectroscopy?

Q.7 A compound with molecular formula C_3H_6O and $C_2H_4Br_2$ show one signal in NMR. Predict its structure?

Q.8 How NMR Spectroscopy can distinguish cis and trans isomers of molecule?

Q.9 Explain different factors influencing Chemical shift?

Q.10 What type of solvents are used in NMR Spectroscopy?

Q.11 How proton exchange processes can be studied with the help of NMR Spectroscopy?

Q.12. Draw PMR spectra of the following compounds using spin-spin coupling/splitting and do mention intensity of signals.

Ethyl alcohol (ultrapure), Ethyl acetate, 2-chloropropane, 2,2-dichlorobutane

Question Bank for Water and its Treatment(Water Chemistry)

Q.1 Explain Lime soda process and Zeolite method for softening of hard water?

Q.2 Define the following terms:-

(a) Electrodialysis and Reverse osmosis
(b) Temporary and Permanent Hardness
(c) Priming and Foaming
(d) Sludge and Scale formation
(e) Break-point Chlorination

Q.3 Calculate the amount of lime(91%) and soda(97.2%) required for softening of one million litres of water containing calcium bicarbonate (30.5 ppm), magnesium bicarbonate (35.5 ppm), magnesium sulphate (20.0 ppm), calcium sulphate(24.0 ppm), calcium chloride (25.0 ppm) and sodium chloride (10.0 ppm).

Q.4 Discuss the principle of EDTA titration and Soap method for estimation of Hardness of water?

Q.5 Which factors are responsible for Boiler Corrosion/Caustic Embrittlement?

Q.6 Explain ion-exchange process for softening of hard water?

Q.7 Explain the function of following in treatment of water:-

(a) Colloidal, Carbonate and Calgon
(b) Sodium phosphate, Hydrazine and Alum

Q.8 Define the term Sterlization/Disinfection and mention different methods used for purification of water?

Q.9 What are parameters determined in analysis of water to ascertain quality and utility of water?

Q.10 A water sample contains 19 mg of $MgCl_2$ per litre of water. Calculate the hardness of water in ppm in terms of $CaCO_3$ equivalent?

Q.11 How demineralised water is different from soft water?

Q.12 Explain how chlorination of water leads to killing of micro-organisms?

Q.13. Calculate the amount of lime (91%) and soda (97.2%) required for treatment of one million of water containing Mg^{2+} = 42 ppm , Ca^{2+} = 90 ppm , H^{+} = 1.5 ppm , HCO_3^{-} = 396.5 ppm, $FeSO_4.7H_2O$ = 14 ppm.

Question Bank for Phase Equilibria

Q.1. Define the following terms by taking suitable examples:-

(a) Phase (b) Component (c) Degree of freedom/Variance

Q.2. Construct and explain phase diagram of KI-H_2O system. Apply phase rule to the diagram and describe the formation of eutectic mixture by the components. Discuss the formation of freezing mixtures by addition of suitable salts to ice?

Q.3. Differentiate between Gibb's Phase Rule and Reduced/Condensed Phase Rule?

Q.4. Draw and explain phase diagram of H_2O system and discuss the effect of temperature at constant pressure?

Q.5. Explain the following terms

(a) Critical temperature (b) Triple point of H_2O (c) Cryohydrate point

(d) Pattinson's process (e) Metastable equilibrium (f) Solubility curve

Q.6. How Eutectic system, Eutectic point, Eutectic mixture, Eutectic temperature and Eutectic composition are related to each other?

Q.7. Draw well labelled phase diagram of lead-silver system and explain application of this diagram in extraction of silver from an ore of lead (Desilverization)?

Q.8. Discuss how Freeze Drying, Flash Evaporation and Refreezing/Regelation can be explained with the help of application of phase diagram of water?

Q.9. What are advantages and limitations of Gibb's Phase Rule?

Q.10. Determine the number of phases, components and degree of freedom for the following system:-

(a) NH_4Cl (s) → NH_3 (g) + HCl (g)

(b) Solution of acetic acid in water

Q.11. Draw phase diagram of Water system at high pressure?

Q.12. What is the effect of pressure on melting curve of ice? Calculate the value of degree of freedom.

Q.13. Draw and explain well labelled Phase diagram of two component system (KI-H_2O) by applying Reduced/Condensed phase rule. Do mention Solubility curve of KI along with different points and areas in phase diagram with reference to number of phases, components and degree of freedom?

Question Bank for Atomic and Molecular Structure

Q.1. List any two reasons for less crystal field splitting in tetrahedral complexes than in octahedral complexes?

Q.2. Discuss and draw Crystal field energy level diagram for d^6 weak field, octahedral complex?

Q.3. On basis of band structure of solids, differentiate between conductors, semiconductors and insulators?

Q.4. With the help of suitable diagram, explain splitting of d-orbitals, when transition metal ion is placed in octahedral field of strong and weak field ligands?

Q.5. All tetrahedral complexes are high spin complexes. Why?

Q.6. Does temperature influence the conductivity of N-type semiconductor? Discuss

Q.7. Calculate CFSE of d^5 system both weak and strong field ligand, octahedral complex?

Q.8. How the nature of ligands influence the crystal field splitting?

Q.9. Describe the role of doping in case of semiconductors w.r.t. electrical conductivity?

Q.10. Discuss the bonding in $[CoF_6]^{3-}$ and $[Co(NH_3)_6]^{3-}$ complexes in terms of crystal field theory?

Q.11. What do you mean by Spectrochemical Series?

Q.12. Discuss the bonding in $[Fe(H_2O)_6]^{3+}$ and $[Fe(CN)_6]^{3-}$ complexes in terms of crystal field theory? Also calculate CFSE for d_7 and d_{10} system in tetrahedral complex?

Q.13. Differentiate between N-type and P-type Semiconductors?

Q.14. Explain Hybridisation and Magnetic character in $Ni(CO)_4$ and $[Ni(CN)_4]^{2-}$

Q.15. Draw Crystal field Energy level diagram of octahedral complex $[Fe(CN)_6]^{4-}$. Also calculate CFSE in d^3 and d^7 system of tetrahedral complex?

Q.16. Define extrinsic and intrinsic semiconduction?

Question Bank of Electrochemistry and Thermodynamics

Q.1. Define an Electrochemical cell. Taking Zn-Cu electrochemical, explain its working along with chemical reactions, draw its diagram and give its representation? Mention functions of salt bridge?

Q.2. Explain the term electrode potential and standard electrode potential. Derive Nernst equation for describing effect of concentration of electrolyte on electrode potential. Also calculate electrode potential of zinc electrode placed in 0.01 M solution of $ZnSO_4$ at 25^0C. Provided $E^0_{(Zn^{2+}, Zn)} = -0.76$ V

Q.3. What do you mean by Electrochemical Series and explain its applications?

Q.4. For the following cell reaction

$$Zn(s) + 2AgCl(s) \rightarrow ZnCl_2(0.555\ M) + 2Ag(s)$$

EMF at 0^0C is 1.015 V while Temp. coefficient of EMF is -4.02×10^{-4} volt per degree. Find Enthalpy change, Entropy change and Gibbs free energy change?

Q.5. Calculate the equilibrium constant for the following reaction

$$Zn + Cd^{2+} \rightarrow Zn^{2+} + Cd \quad (E^\circ_{cell} = 0.36\ V)$$

Q.6. Can a solution of 1 M $CuSO_4$ be stored in a vessel made of nikel metal? Given that $E^0_{(Ni, Ni^{2+})} = +0.25$ V , $E^0_{(Cu, Cu^{2+})} = -0.34$ V

Q.7. Differentiate between EMF and Potential Difference?

Q.8. Calculate the half cell potential of an electrode of an iron rod dipped in a 91% dissociated solution of 0.2 M $FeSO_4$. Given that $E^0_{Fe/Fe2+} = 0.44$ V.

Q.9. What is the difference between open, closed and isolated system?

Q.10. How would you determine thermodynamic functions ΔG, ΔH and ΔS with e.m.f data?

Q.11. Calculate the standard electrode potential of Cu^{2+}/Cu electrode, if the electrode potential at 298 K is 0.296 V when $[Cu^{2+}] = 0.015$ M.