

QUESTION BANK

PAPER: CC-1 (Inorganic Chemistry)

(SEM -1)

1. Write MO configurations of O_2 and N_2^+ . Calculate the bond order of those species. [3]
2. Write the MO configuration of CO molecule and explain its donating property as a base. [3]
3. Calculate formal charges on each atom of SO_4^{2-} . [2]
4. Write the half-reactions for the oxidation of Fe(II) by potassium permanganate in acid medium and calculate the standard potential for the whole reaction. [3]
[Given: $E^0 (MnO_4^-/Mn^{2+}) = 1.51V$ and $E^0 (Fe^{3+}/Fe^{2+}) = 0.77V$]
5. Calculate the limiting radius ratio for tetrahedral coordination. [3]
6. Explain the structure of ClF_3 molecule on the basis of VSEPR THEORY. [2]
7. In PCl_5 , axial and equatorial P–Cl bond lengths are not same but in PF_5 molecule all P–F bond are equal-explain. [3]
8. Calculate formal charges on each atom of $S_2O_3^{2-}$. [3]
9. In CH_2Cl_2 molecules H-C-H angle is differ from Cl-C-Cl, explain this with suitable rule. [3]
10. The percent P-character (% P) of central atom in H_2S (bond angle is 92°) will be
i) 96.6% ii) 95.6% iii) 85% iv) 90% [1]
11. The bond order of N_2^- is: (use MOT); [1]
i) 3 ii) 2.5 iii) 2 iv) 1.5
12. He_2 does not exist. Which is/are not true for He_2 of the followings: [1]
i) bond order zero
ii) no. of stabilized electrons = no. of destabilized electrons (MO configuration)
iii) no. of bonding electrons = no. of antibonding electrons
iv) all of the above are incorrect
13. Which of followings is not correct? [1]
i) B_2 is paramagnetic ii) B_2 is diamagnetic iii) O_2^+ is paramagnetic iv) O_2^- is paraiamagnetic
14. Polarity of HF molecule is higher than H_2O , but later has higher boiling point than former-explain. [3]
15. Calculate formal charges on each atom of ClO_4^- . [2]
16. Explain the most probable structure of ClF_4^- using VSEPR theory. [3]

17. The percent s-character (% s) of central atom in NF_3 (bond angle is 102°) will be [1]

- i) 17% ii) 17.4% iii) 18% iv) 18.4%

18. The bond order of O_2^+ is: (use MOT); [1]

- i) 3 ii) 2 iii) 2.5 iv) 1.5

19. H_2^+ may exist, due to (b.o. = bond order) [1]

- i) b.o. = 0 ii) b.o. = +ve iii) b.o. = -ve iv) none of the above

20. CO molecule may act as electron donor due to [1]

i) stabilized lone-pair at carbon site ii) less stable lone-pair at carbon site

iii) stabilized lone-pair at oxygen site ii) destabilized lone pair at oxygen site

21. Explain with example the mono-atomic nature of zero group elements by MOT. [2]

22. All P – F bonds in PF_5 molecule are equal – explain. [2]

23. Explain the stable structure of BrF_3 molecule on the basis of VSEPR theory. [3]

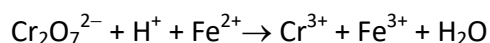
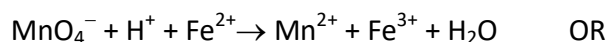
24. The H–C–H and H–C–Cl bond angles in CHCl_3 are different – explain. [2]

25. Find the bond order and explain the relative stabilities of the following species: [2×2]



26. Explain the magnetic properties of B_2 and C_2 molecular system by MOT. [3]

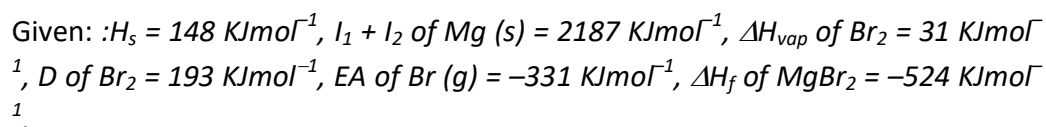
27. Balance the reaction by ion-electron method: (any one) [2]



28. Differentiate between *primary standard* and *secondary standard* solution. [2]

29. Calculate the limiting radius ratio for tetrahedral coordination system of ionic crystal. [3]

30. Calculate the lattice energy (using B–H cycle) MgBr_2 . [3]



31. Draw the MO diagram of CO molecule. Explain its coordinating behaviour as Lewis base. [2×2]

32. Draw the radial probability distribution curves for 2s and 3s orbitals. [2]

33. Draw the radial probability distribution curves for 3s and 3p orbitals.

34. What are the significance of ψ ? [1]

35. What are the significance of ψ^2 ? [1]

36. Define Pauli's exclusion principle and Hund's rule in connection to electron filling in an atom. [1+1]

37. Write the electronic configurations of the following species atomic number in parentheses: [1 each]

i) Hg^+ (80), ii) Tl (81), iii) Sm (62), iv) Th (90), v) Ru^{3+} (44), vi) Eu (63)

38. Define and explain uncertainty principle. [2]

39. Ionic radius is always lower than atomic radius-explain. [2]

40. What is screening effect? Explain with example. [1+1]

41. Define electronegativity. Explain the periodic trend of electronegativity. [1+1]

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SEM-1
PAPER: CHEM CC2 (PHYSICAL CHEMISTRY)

Each question carries 1 mark

1. Write down the SI unit of surface tension.
2. How do the viscosities of gaseous and liquids vary upon change in temperature?
3. What are most probable velocity and mean free path of gaseous molecules?
4. Generally pH scale is kept from 0 to 14. Explain why?
5. What is the unit cell of a crystal?
6. Define Bragg's law.
7. Give an example of natural buffer system.
8. Write down Henderson equation.
9. What is the dimension of viscosity co-efficient?
10. What is collision diameter?
11. How does the mean free path of a gas molecule vary with pressure?
12. What are Miller indices?
13. What is Boyle temperature?
14. Ideal gas cannot be liquefied – explain.
15. Under what conditions real gases behave ideally?

Each question carries 5 marks

1. Derive explicitly the following from Maxwell's distribution formula in 2-dimension and 3-dimension – Average speed, RMS speed, Variance and SD of speed, Most probable speed and Average kinetic energy.
2. Explain the buffer action of (a) ammonium acetate and (b) a mixture of acetic acid and sodium acetate. Why a mixture of $NaCl$ and $NaOH$ does not act as a buffer?
3. Define work of adhesion between two immiscible liquids and work of cohesion of a liquid. Establish the condition of spontaneous spreading of one liquid over another immiscible liquid.
4. What is contact angle? Define wetting and non-wetting surfaces based on contact angle. Describe the factors that affect the contact angle.
Prove that the deflected X-rays in Bragg's diffraction is deviated by 2θ where θ is glancing angle.
5. Describe the working principle of surfactants. Give examples of cationic and anionic surfactants.
Calculate the pH of $10^{-8}M HCl$.
6. What is packing efficiency? Calculate the packing efficiency of a face-centred cubic system.
 KCl has a face-centred cubic lattice. ρ of KCl is 2 g/cc at a certain temperature

- and edge length is 6.28 \AA . Find the number of K^+ and Cl^- ions per gram.
7. Why it is difficult to blow a balloon initially, but becomes easier afterwards? (consider the balloon as bubble). State and explain the principle of continuity of states.

Each question carries 10 marks

1. Derive the Maxwell's momentum distribution formula from Maxwell's speed distribution formula in one dimension. State the principle of equipartition of energy. What do you mean by collision number and collision frequency?
2. Describe the effect of addition of small amount of solute on surface tension. How does the viscosity of a liquid change with temperature? The ST of a liquid decreases as the temperature is raised. Explain this phenomenon qualitatively. What is half-neutralisation point? How do you explain the difference in PV isotherms of H_2 and NH_3 gases?
3. Why NaCl and KCl have remarkably different X-ray powder diffraction pattern? Write down the drawbacks of Bragg's law. Five-fold symmetry of a solid is possible. Justify or criticize. Discuss graphically the effect of temperature and mass on the Maxwell distribution of speed.
4. Derive the expression for the hydrolysis constant, degree of hydrolysis, and pH of solution of a salt of the weak acid and weak base. What is meant by surface energy? Why is the drop of a liquid spherical? Deduce an expression for the total number of collisions in unit volume and unit time among the molecules of gas. (The gas is made up of like molecules).
5. Derive kinetic gas equation $pV = \frac{1}{3}mnc^2$ and from this deduce Boyle's law, Charles's law, Avogadro's law, and Dalton's law of partial pressure. Draw the pV vs P isotherm of a real gas (a) below the T_c (b) at a temperature between its critical and Boyle temperature (T_B). (c) at T_B (d) why is He gas very difficult to liquefy (b.p of He is $4.2K$)? Why does a liquid rise in a capillary tube? Describe the capillary rise method for determining the surface tension of a liquid.
6. Draw schematically a set of experimental $P - V$ isotherms based on Andrews' experiment for real gas. The exponential term in the Maxwell's distribution law of molecular speed has a negative sign. Do positive sign in it make any sense? Explain your argument clearly. The molecules of a gas are confined to move in a plane. Derive the expression for r.m.s. speed and most probable speed.

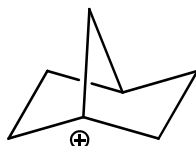
SEM-II

CC3

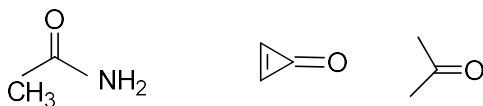
(ORGANIC CHEMISTRY)

1. Answer following questions (Each question carries 1 mark)

- Draw most stable conformational isomer of n-butane in Newmann projection.
- Mention one drawback of Fischer projection formula.
- Name one acidic compound which has no carboxylic acid group.
- Give example of one compound having plane of symmetry.
- Why makes allene optically active?
- Give example of a compound having Rotation-reflection axis of symmetry.



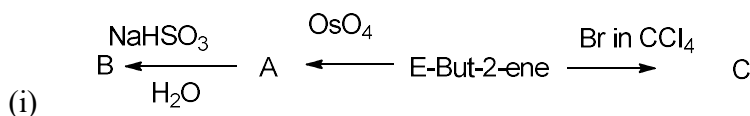
- The above carbocation has a transient existence.
2. Answer following questions. (Each question carries 2 marks)
- Salicylic acid is a stronger acid than 4-Hydroxy benzoic acid. Explain.
 - 2,4,6-Trinitro-N,N-dimethyl aniline is 40,000 times stronger base than 4-Hydroxy benzoic acid. Explain.
 - Pyridine has a dipole moment 2.3 D, explain.
 - Describe role of anhydrous aluminium chloride in Friedel-Crafts reaction.
 - Singlet carbenes prefer concerted ring formation reaction when reacted with an active alkene, comment.
 - Which of the following compounds has longest C=O bond?

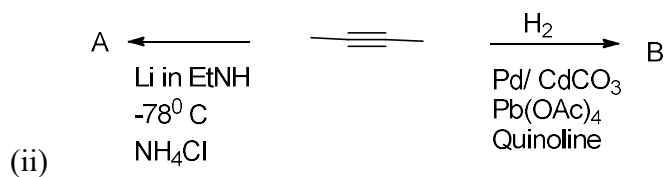


- Cyclopentadiene reacts with alkali. Why does this happens?

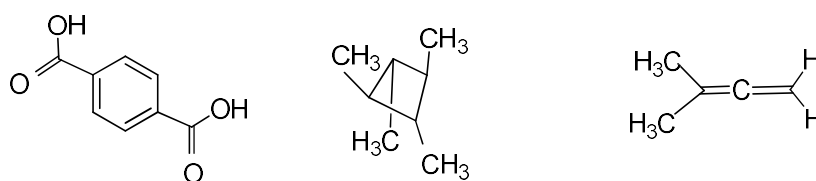
3. Answer following questions. (Each question carries 5 marks)

- Predict products for the following reactions and justify stereochemistry of the products.

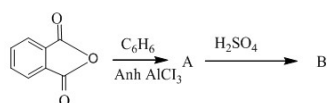




- (b) Describe the potential energy curve of n-Butane as a function of torsional angle. Why do Allyl halides more reactive than vinyl halides
- (c) Identify symmetry elements in the following compounds. How do those symmetry elements help in judging symmetry of any compound?



- (d) Why do aromatic nucleophilic substitutions are less common than aromatic electrophilic substitution?
- (e) Identify A and B for the following reaction. Give mechanism of the conversions.



APCRGC SEM – 2

PAPER: CHEM CC4

Each question carries 5 marks

1. Justify or Criticize: “Osmosis is an entropy effect”.
2. Write down the statement of Hess’s law. What is its importance?
3. Write down the statement of Zeroth law of thermodynamic.
4. What do you mean Van’t Hoff factor (i)?
5. Explain $\left[\frac{\partial(\frac{G}{T})}{\partial(\frac{1}{T})} \right]_P$ is a state function.
6. For which of the following systems the energy is conserved in every process? (i) a closed system (ii) an open system (iii) an isolated system (iv) a system enclosed in adiabatic walls.
7. What is the dimension of enthalpy?
8. Which of the following parameter(s) are state function(s): q, H, U and w . The terms have their usual meaning.
9. Classify each of the following properties as extensive or intensive.
Specific heat, Enthalpy, Chemical potential, Pressure
10. What is meant by ideal solution?

Each question carries 5 marks.

1.
$$C_p - C_v = \frac{\alpha^m VT}{\beta^n}$$
Using dimensional analysis find the value of m and n .
Compare adiabatic cooling and Joule-Thomson cooling. [5]
2. An ideal gas is carried through a Carnot Cycle. Draw the H vs. T diagram of the cycle and explain it. [5]
3. Test the cyclic rule for the gas obeying $P(V - b) = RT$ equation. How the enthalpy function can be derived from the mathematical form of the first law of thermodynamics? [5]
4. Derive the Gibbs-Duhem equation involving chemical potential. What is the physical significance of this equation? [5]
5. “An adiabatic transformation is always an isoentropic.” Criticize the statement. Derive an expression of μ_{JT} for a gas obeying the equation $P(V - b) = RT$ and comment on its inversion temperature. [5]
6. Derive the Kirchhoff’s equation with the help of First Law of Thermodynamics. [5]
7. Justify or criticize: A system must be isolated if neither heat nor matter can enter or leave the system. Work done may be a state function. Justify or [5]

criticize. Calculate α and β for an ideal gas.

8. Show that during isothermal expansion $|w_{rev}| > |w_{irr}|$. The value of equilibrium constant of a reaction is dependent on the stoichiometric equation by which it is expressed — Justify or criticize. [5]
9. Starting from the same initial state if final volume be the same then show that for ideal gas final pressure in the isothermal reversible expansion is greater than adiabatic reversible expansion. $\left(\frac{\partial H}{\partial P}\right)_T = 0$ is a better criterion for ideality of a gas – justify. [5]

Each question carries 10 marks.

1. Derive thermodynamically a relation between the depression of freezing point and molality of a solute in a dilute solution mentioning the assumptions involved. Why the concentration is expressed here in molality and not in molarity? State and explain Le-Chatelier's principle. State the effect of pressure and temperature in the equilibrium condition of the system from the thermodynamic point of view. [10]
2. Derive thermodynamically van't Hoff reaction isotherm. From van't Hoff reaction isotherm how will you derive van't Hoff equation at constant pressure? For a closed system, show that

$$C_p = C_v + p \left(\frac{\partial V}{\partial T}\right)_p + \left(\frac{\partial U}{\partial V}\right)_T \left(\frac{\partial V}{\partial T}\right)_p$$

Where the terms have their usual meaning. Explain the physical significance of the two terms on RHS, especially in the case of a gaseous system. [10]

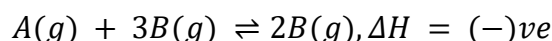
3. If P, V and T of 1 mole of a gas are related as $\left(P + \frac{a}{V^2}\right)V = RT$ show that (i) P is a state function (ii) dP is an exact differential and (iii) $\left(\frac{\partial P}{\partial T}\right)_V \left(\frac{\partial T}{\partial V}\right)_P \left(\frac{\partial V}{\partial P}\right)_T + 1 = 0$

Prove that, $\left(\frac{\partial \alpha}{\partial P}\right)_T + \left(\frac{\partial \beta}{\partial T}\right)_P = 0$, where α and β are the coefficient of thermal expansion and compressibility factor respectively.

1 mol of an ideal gas is expanded isothermally from $P_1 V_1$ to $P_2 V_2$ in two stages. First stage uses constant opposing pressure P' and second stage uses constant opposing pressure P_2 . Show that maximum value of the work produced is given by

$$2RT \left\{ 1 - \left(\frac{P_2}{P_1}\right)^{\frac{1}{2}} \right\} \text{ and } P' = \sqrt{P_1 P_2}$$
 [10]

4. Arrive at the concept of Clausius inequality from an irreversible Carnot Cycle. What is the Kelvin Scale of temperature? How Kelvin introduces this scale? An ideal gas is expanded under the condition $PV^\gamma = \text{constant}$. Will the entropy of the system increase, decrease or remain same? Justify your answer. Amongst the quantities Q_{rev} , W , $Q_{rev}T$, which one is state function? [10]
5. Derive thermodynamically the relation $\Delta T_b = K_b m$. Explain the meaning of the term K_b . What is the unit of K_b ? Explain how relative lowering of vapour pressure is used for the determination of molar mass of a Solute. Consider the following equilibrium



Discuss the effect of pressure and the addition of an inert gas at constant pressure on this equilibrium. [10]

6. Why $P - V$ curves of adiabatic process is more steep than that of the isothermal process? Derive the equation for the work of reversible isothermal expansion of a van der Waals gas from V_1 to V_2 . A gas obeys the equation of state $\left(P + \frac{a}{V^2}\right)V = RT$. Derive the cyclic rule.

[10]

QUESTION BANK

PAPER: CC-5 (Inorganic Chemistry)

(SEM – 3)

1. Explain differentiating solvent with example. [2]
2. Explain the reducing property of metal using Ellingham diagram. [3]
3. Describe the method of purification of metal through 'zone refining'. [3]
4. State the Bronsted-Lowry acid - base theory with example. [2]
5. State the SHAB principle of Lewis acids and bases. [2]
6. Complete the reaction: $\text{Na}^+ + \text{Cs}^+ + \text{I}^- + \text{F}^- \rightarrow$ [1]
7. Explain leveling solvent with example. [2]
8. Differentiate chemically benzene with inorganic benzene. [2]
9. Explain the reducing property of metal using Ellingham diagram. [3]
10. What are silicones? Trialkyl substituted silanol gives only one type of product upon polymerization-explain. [3]
11. What happens when XeO_3 is treated with NaOH solution? Draw the structure of the ion generated finally. [3]
12. What happens when XeO_3 is treated with NaOH solution? Draw the structure of the ion generated finally. [3]
13. Explain the reducing property of metal using Ellingham diagram. [3]
14. Describe the structure and bonding in diborane. [3]
15. Explain the reaction either proceeds towards right or left: [2]
$$\text{AlH}_3\text{F}^- + \text{AlF}_3\text{H} \rightleftharpoons \text{AlH}_4^- + \text{AlF}_4^-$$
16. Draw the structures of the following species, indicating hybridization of central atom(s): [3]
 - i) XeO_3F_2
 - ii) $\text{S}_2\text{O}_8^{2-}$
17. Describe the structure and bonding in borazine. [3]
18. CH_3Hg^+ is a typical soft acid – explain. [1]
19. What is pseudohalogen? Give the examples of two pseudohalogen. [1+1]

20. Write name or formula of one peroxo acid of sulphur. Draw the structure of it. [1+1]

21. Write the formulae of two poly-halide ions. [1]

22. Complete the reaction: $B_2H_6 + CO \rightarrow$ [1]

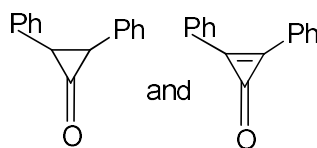
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**CC6- CHEMISTRY
ORGANIC CHEMISTRY**

All symbols are of usual significance.

1. Answer following questions $2\frac{1}{2} \times 4 = 10$

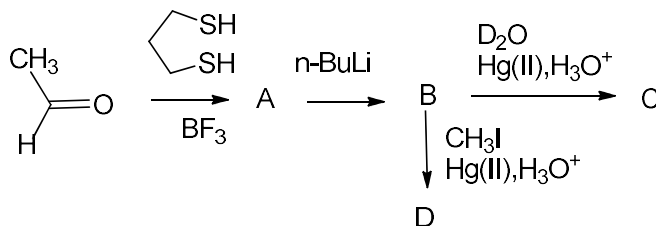
(a) Between two carbonyl compounds which one has higher dipole moment and why?



(b) Anhydride used in Perkin reaction must have two α -hydrogens. Justify the statement

(c) Between maleic and fumaric acid which acid lactonizes readily and why?

(d) Identify A,B,C,D



2. Answer following questions $2\frac{1}{2} \times 4 = 10$

(a) Mention starting materials for preparing Coumarin following Perkin reaction. Give chemical equations describing the process.

(b) Complete the sentence and explain the fact.

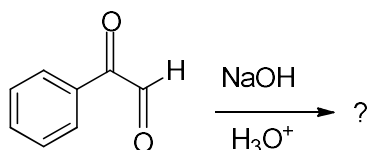
Ethanol has pKa _____ and ethanethiol has pKa _____ (10.5, 15.9).

(c) Commercial grade ether is adulterated with small amount of hydroquinone. Why?

(d) Knoevenagel reaction is normally carried out with piperidine. What would happen if piperidine is replaced by a strong base.

3. Answer following questions $2\frac{1}{2} \times 4 = 10$

(a) Predict major product and show mechanism

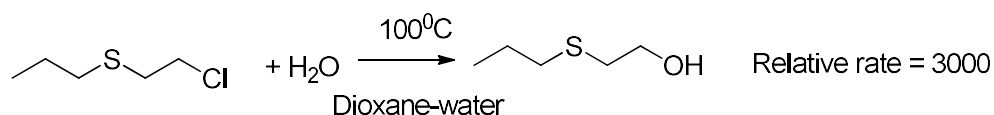
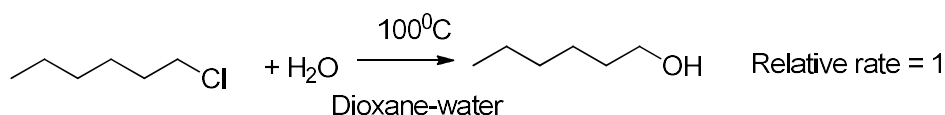


- (b) Between cis tertiary butyl cyclohexanol and trans tertiary butyl cyclohexanol which one reacts faster with Jones's reagent and why?
- (c) 4-Dimethyl amino benzaldehyde fails to undergo Benzoin condensation but when mixed with benzaldehyde, condensation becomes possible. Why? Write mechanism for mixed condensation.
- (d) During synthesis of benzillic acid, one has taken furil by mistake. Does the reaction proceed to forward direction? If so, what product do you expect? Write reaction.

4. Answer following questions

$$2\frac{1}{2} \times 4 = 10$$

- (a) Relative rate of hydrolysis for two chlorides are assigned along with chemical reactions. Justify findings.



- (b) What happens when a mixture of Phenol, chloroform and sodium hydroxide is refluxed at 70°C ? Write the reaction and justify the findings.
- (c) Prove that chlorobenzene when reacted with sodamide in liquid ammonia produces a normal substituted product and an unexpected product.
- (d) Distinguish substitution and elimination on the basis of structural features of substrates and bases.

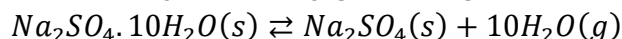
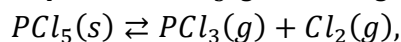
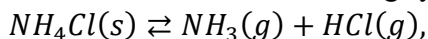
APCRGC SEM – 3
PAPER – CHEM CC7 (PHYSICAL CHEMISTRY)

Each question carries 1 mark

1. Write down the S.I. unit of reaction rate.
2. Adsorption is entropically not favourable. However, often adsorption is found to occur spontaneously. — Explain.
3. Define phase rule. Write down the number of components in PCl_5 decomposition.
4. Photochemical reaction between H_2 and Cl_2 to produce HCl is a zero order reaction. Explain why?
5. What is activation energy? Concentration of activated complex remains same during the course of a chemical reaction. — Explain.
6. What does mean by the term ‘sorption’?
7. Write down the unit of Michaelis-Menten’s constant, K_m in S.I. unit.
8. What are the maximum number of phases that can co-exist for a two-component system?
9. For a reaction of the type $A + B \rightarrow$ Products, the unit of the rate constant is $mol L^{-1}s^{-1}$. What will be the overall order of the reaction?
10. For a zero-order reaction, write down the unit of the rate constant.

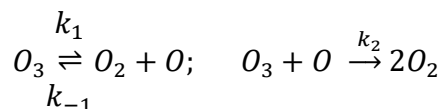
Each question carries 5 marks

1. Deduce the Langmuir adsorption isotherm involving the fraction of surface covered at θ at pressure P . Show that for $\theta \ll 1$, it can be converted into Freundlich’s adsorption isotherm. Adsorption is of thermodynamic necessity. — Explain.
2. In a solid phase reaction, $X + Y \rightarrow Z$ where X, Y and Z are solids. How many phases are present in this system? What are the conditions under which the formula $P + F = C + 2$ is valid? What is the significance of triple point?
3. Derive Michaelis-Menten equation for an enzymatic reaction $E + S \rightleftharpoons ES \rightarrow E + P$. Write down the significance of ‘A’, pre-exponential factor in Arrhenius equation.
4. Using the Gibbs phase rule, show that for a pure substance more than three phases cannot be in equilibrium. Two metals which are completely soluble in the liquid state but show no solid-solid solubility, form an eutectic. Apply phase rule to find whether the eutectic point is invariable or not. How can it be verified that the eutectic mixture is not a compound?
5. Calculate the number of degrees of freedom in the following systems



$KCl - NaCl - H_2O$ is a three-component system while $NaBr - KCl - H_2O$ is a four-component system – explain.

6. The decomposition mechanism of ozone is



If $k_{-1}[O_2] \ll k_2[O_3]$, then determine the order of the reaction with respect to ozone.

“A mixture of ice and salt acts as a freezing mixture” – explain.

7. What is LEVER RULE? Why is it so called? Derive this rule with the help of vapour pressure versus composition diagram. “A mixture of Na_2CO_3 & K_2CO_3 is used as fusion mixture” – explain.

Each question carries 10 marks

1. Deduce Clausius-Clapeyron equation for the liquid-vapour system. What are azeotropes? Can they be regarded as true chemical compounds? — Justify. A eutectic has a definite composition and a sharp melting point yet it is not a compound. — Explain. All the four phases of Sulphur can't co-exist in equilibrium. Why?
2. Write down the postulates of Lindemann's Time-Lag theory. Define the terms molecularity and order of reaction. Molecularity in an elementary slowest step is the order of a chemical reaction. – Explain. Write down the differences between physical and chemical adsorptions. Give examples from each.
3. What is chain reaction? Give examples of chain reaction. What is the driving force for a reaction to be the chain reaction? Why are higher order reactions rare? Write down the limitations of collision theory. A high positive value of ΔS^\ddagger means a high energy of activation – justify or criticize.
4. Mention the basic assumptions and limitations of Langmuir adsorption isotherm. Show that Freundlich's adsorption isotherm is a special case of Langmuir adsorption isotherm. Draw the labelled phase diagram of CO_2 or H_2O system and explain the importance of various points, lines and curves.
5. Explain why slope of the fusion curve is positive in case of CO_2 but negative in case of H_2O . Derive Duhem-Margule's equation for a binary solution of A and B. “It is not possible to obtain pure ethanol by distilling a mixture of ethanol and water” – justify or criticize this statement.

6. Elementary steps of a reaction are as follows $A + B \xrightleftharpoons[k_{-1}]{k_1} 2C$, $2C \xrightarrow{k_2} D$. If steady state

approximation is applicable to C, then determine the rate of product formation.

Starting from Clapeyron equation, deduce the Clausius- Clapeyron equation, mentioning the necessary assumptions. In a single graph, draw the $\mu - T$ plot for solid and liquid phases of (i) pure solvent (ii) solvent in solution. Mention the thermodynamic basis for the depression of freezing point. What is an azeotrope?

SEM-III

SEC 1 P 1

(PHARMACEUTICAL CHEMISTRY)

1. Answer following questions (Each question carries 1 mark)
 - (a) Name a ligand present in Vitamin B₁₂.
 - (b) What are ADMET and NSAID?
 - (c) What does Barbiturate mean?
 - (d) Name the amino acid which is associated with AGC codon?
 - (e) How do you express Stop codon?
 - (f) Give examples of two antibiotics.

2. Answer following questions (Each question carries 2marks)
 - (a) State basic difference between Pharmacokinetics and Pharmacodynamics.
 - (b) What is antifungal agent? Name a natural antifungal agent.
 - (c) What are antiseptic and antipyretic?
 - (d) Mention therapeutic uses of glycerol nitrite.
 - (e) Write chemical name of Vitamin B₂. What happens in case of its deficiency?
 - (f) Mention use of citric acid.
 - (g) What are broad spectrum and narrow spectrum antibiotics?
 - (h) What are synthetic and semi synthetic antibiotics?
 - (i) Write two differences between aerobic and anaerobic fermentation.
 - (j) Write scientific name of Vitamin C and mention its importance.
 - (k) Draw structure of Penicillin G and any one Sulpha drug.

3. Answer following questions (Each question carries 5 marks)
 - (a) Define drug. How drugs are classified? Mention characteristics of each category with suitable examples.
 - (b) Name and explain three design tools which computational techniques provide to assist a chemist to synthesize a drug molecule.
 - (c) Define antibiotic. How does Penicillin check bacterial attack on host?
 - (d) What is Sulpha drug? Mention two routes for preparation of Sulpha drug. Mention use of aspirin and Paracetamol.

QUESTION BANK

PAPER: CC-8 (Inorganic Chemistry)

(SEM-4)

1. Draw the possible isomeric structures of $[\text{PdClBr}(\text{H}_2\text{O})(\text{NH}_3)]$ [2]
2. Write the IUPAC names of the following complexes: [1×2]
i) $[\text{Fe}(\text{cp})_2]$ ii) $[\text{Pt}(\text{NH}_3)_2\text{Cl}_4]^{2-}$
3. Draw the crystal field splitting diagrams and calculate the CFSE for the complexes: [2+2]
i) $[\text{Fe}(\text{CN})_6]^{3-}$ ii) $[\text{CoCl}_4]^{2-}$
4. Write the possible optical isomers of the complex $[\text{Cr}(\text{acac})_3]$. [2]
5. Draw the splitting diagram in octahedral crystal field describing the terms involved. [2]
6. Calculate CESE and magnetic moments (spin only) for the complexes: [2+2]
i) $[\text{Fe}(\text{CN})_6]^{3-}$ and ii) $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$.
7. What are the difference between hemoglobin and myoglobin in mammalian system? [2]
8. What is 'lanthanide contraction'? Give reason. [2]
9. Write the IUPAC name for the following: i) $[\text{Co}(\text{C}_5\text{H}_5)_2]$ & ii) $\text{Na}_3[\text{Fe}(\text{ox})_3]$ [2]
10. Draw the splitting diagram in tetrahedral crystal field describing the terms involved. [2]
11. Calculate CESE for the complexes: i) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ and ii) $[\text{Co}(\text{CN})_6]^{3-}$. [1×2]
12. What are the functions of hemoglobin and myoglobin in mammalian system? [2]
13. Calculate the magnetic moment of Sm^{3+} ion and determine the ground state term for this ion. [2]
14. Write the isomeric structures of $[\text{Co}(\text{NH}_3)_3(\text{H}_2\text{O})_3]^{3+}$ and indicate their optical nature. [2]
15. Write the IUPAC names for the following: [1×2]
i) $\text{K}[\text{PtCl}_3(\text{C}_2\text{H}_4)]$ & ii) $[(\text{NH}_3)_4\text{Cr}(\text{O}_2)(\text{NH})\text{Cr}(\text{NH}_3)_4]^{3+}$.
16. What is 'lanthanide contraction'? Give reason. What is the consequence of lanthanide contraction? [1+2+1]
17. Calculate the μ_{eff} for Pr^{3+} ion. Write down the ground state term for this ion. [3]
18. Explain why third transition energy (I_3) of Eu is greater than that of Gd metal. [3]
19. Explain the separation of lanthanide ions through chromatographic separation technique. [3]

20. The experimental values of magnetic moment of Sm and Eu are different from the calculated values – explain. [3]

21 Electronic spectra of Ln^{III} – ions give rise to sharp peak – explain. [3]

22. Write the IUPAC names for the compounds: [1×2]

i) $\text{Cr}(\text{C}_6\text{H}_6)_2$ ii) $[(\text{phen})_2\text{Co}(\text{O}_2)(\text{NH}_2)\text{Co}(\text{phen})_2]^{3+}$

23. Write the beneficiary roles of Na and K in biology. [2]

24. Define Jahn-Teller distortion for coordination complex. Write the d-orbital energy sequence for the tetragonal elongated structure. [1+1]

25. Calculate the CFSE for the following complexes: [1+1]

i) $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ ii) $[\text{Mn}(\text{CN})_6]^{3-}$

.....●.....

SEM-IV

CC9

(ORGANIC CHEMISTRY)

1. Answer following questions (Each question carries 1 mark)

- (a) State one application of Carbylamine reaction.
- (b) Write formula of Hinsberg's reagent.
- (c) Name basic unit of terpene.
- (d) Mention structure of Hygrine and Quinine.
- (e) Which reagent is used in Hoffmann's exhaustive methylation?
- (f) Naphthalene has lesser delocalisation energy than benzene. Why?

2. Answer following questions. (Each question carries 2 marks)

- (a) State and explain isoprene rule.
- (b) Synthesise thiophene 2-carboxylic acid from thiophene.
- (c) How do you introduce carbonyl group at ortho position of furan?
- (d) Pyridine is a 3⁰ amine. Justify.
- (e) Between 3-Amino pyridine and 4-Amino pyridine which one is more basic?

3. Answer following questions. (Each question carries 5 marks)

- (a) Establish structure of Nicotine and outline its synthesis.
- (b) Describe the scheme of preparing Terpenylic acid from acetoacetic acid.
- (c) What happens when Furan is heated with maleic anhydride? Which product is major and why?
- (d) Write short note on Fischer-Indole synthesis.

APCRGC SEM 4
PAPER: CHEM CC10 (PHYSICAL CHEMISTRY)

Each question carries 1 mark

1. Is the transport number constant for an ion?
2. Explain why KCl is used as electrolytes in salt bridge.
3. Write down the CGS and SI unit of dipole moment
4. "In the measurement of conductance of an electrolytic solution in a conductivity cell alternating current has to be used" – explain.
5. What is meant by transport number of an ion?
6. Show that the sum of transport numbers of cation and anion is unity.
7. What are the advantages of conductometric titration.
8. What do you understand by molar polarization?
9. Why electrodes of a conductivity cell are platinised?
10. Distinguish between formal potential and standard potential.

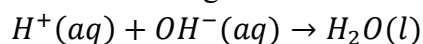
Each question carries 5 marks

1. Discuss the limitations of Arrhenius theory. Describe the measurement of electrolytic conductance.
2. What is Ostwald dilution law? How will you test the validity of Ostwald dilution law? Discuss Faraday's laws of electrolysis.
3. What is meant by cell constant? How is it determined? Discuss the variation of molar conductance with concentration of strong electrolytes.
4. State and explain Kohlrausch Law. Discuss the application of Kohlrausch Law.
5. Draw the equivalent conductance versus concentration plot for a weak electrolyte. Explain qualitatively the nature of variation of equivalent conductance with dilution. Is it possible to determine the equivalent conductance of weak electrolyte at infinite dilution from the plot? Explain the significance of conductance ratio $\left(\frac{\Lambda}{\Lambda^0}\right)$ for a weak electrolyte.
6. What are the differences between electrochemical cell and electrolytic cell. How will you determine the solubility of a sparingly soluble salt by conductance measurement?
7. Consider the cell :
$$Pt(L)|Cl_2(P_L)|HCl(aq)|Cl_2(P_R)|Pt(R)$$
and give (i) The half-cell reaction and the overall cell reaction, (ii) E^0 and E of the cell.
8. Describe Hittrof's method for the determination of transport number.
9. Describe the moving boundary method for the determination of transport number.

Each question carries 10 marks

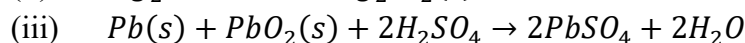
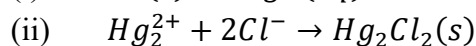
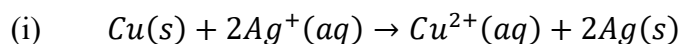
1. Discuss the curve obtained in conductometric titration of a
 - (i) strong acid with a strong base
 - (ii) weak acid with a strong base
 - (iii) strong acid with a weak base
 - (iv) weak acid with a weak base
2. Prove that $\Lambda_m = (pq)\Lambda_e$ where p and q are the stoichiometric number of cation and anion respectively. Derive a relationship between the ionic conductance and transport number. Discuss the shape of the curve in the conductometric titration of silver nitrate against KCl (precipitation reaction).
3. Define transport number of an ion and show that solution of single electrolyte, $t_+ = \frac{u_+}{u_+ + u_-}$ and $t_- = \frac{u_-}{u_+ + u_-}$, where u_+ and u_- are the ionic mobilities of the cation and anion respectively.

Write down the cell where the following chemical reaction takes place:

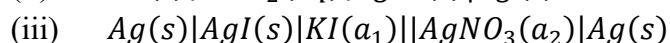
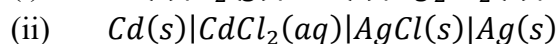
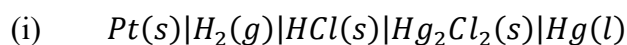


Discuss Debye-Huckel's theory of strong electrolyte.

4. What do you mean by reversible and irreversible cell? Give examples. Construct cell from the following cell reaction.



5. Write down the cell reactions from the following cells.



Explain the asymmetric effect and electrophoretic effect found in strong electrolytes.

6. What is meant by equivalent conductance and molar conductance? What is the effect of dilution on specific conductance and equivalent conductance? What are the factors that influence transport number of ions?

SEM IV
SEC1P2

1. Answer the following reaction (one mark each)
 - a) Give an example of green chemical reaction
 - b) What is Supercritical CO₂
 - c) Write down the structure of one "Rightfit pigment".
 - d) Explain why energy obtained from fossil fuel is not green energy.
 - e) Give example of two Ionic liquids
 - f) Give example of two common solvents used in dry cleaning.
 - g) Name a parameter to measure greenness of a reaction.
 - h) Give one example of non-renewable resources.
 - i) Why ionic liquid is considered as a green solvent?
 - j) How is it possible for a reaction to have 100% atom economy?
2. Answer the following reaction (five marks each)
 - a) What is "atom economy" of a reaction? What are basic characteristics of reactions that have high "atom economy"?
 - b) What is pigment? Write down the green contents of Rightfit pigments over common organic and inorganic pigments.
 - c) Discuss the objectives of green chemistry.
 - d) Why the term "dry" is used in dry cleaning process? Discuss benefits and limitations of dry cleaning.
3. Answer the following reaction (ten marks each)
 - a) What is green energy? Discuss different types of green energy. What are benefits of green energy? Discuss two limitations of green energy.
 - b) Discuss the green synthesis of Benzilic acid. Explain why conventional procedure for the synthesis of benzilic acid is less atom efficient than the green approach.
 - c) Write down the principles of green chemistry
 - d) Synthesis of ibuprofen and paracetamol by green route
4. Write short notes on: (five marks each)
 - a) Microwave assisted synthesis
 - b) Green synthesis using Ionic Liquid as a solvent
 - c) Industrial application of Green Chemistry
 - d) Green chemistry in sustainable development
 - e) Ultrasound assisted green reactions
 - f) Combinatorial Green Chemistry
 - g) solvent-free reaction

CC11- CHEMISTRY

ORGANIC CHEMISTRY

All symbols are of usual significance.

1. Answer following questions (2 + 2 + 2) + (2 + 2) = 10

(a) Electrocyclic reaction of 2E,4E-Hexa-2,4-diene under thermal and photochemical excitation produces a set of stereospecific products. Comment on this statement mentioning their valence orbitals, directional character of termini orbitals, and orientation of substituents in the products.

(b) Complete the following sentence.

Cycloaddition of 2E,4E-Hexa-2,4-diene and acraldehyde involves HOMO of _____ and LUMO of _____.

What difference occurs if you consider reverse set of FMOs?

2. Answer following questions

2 + 2 + 2 + 2 + 2 = 10

(a) Proton and ^{13}C are NMR active. Why?

(b) Carrot is a bright coloured vegetable. What makes it coloured?

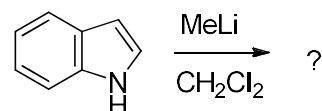
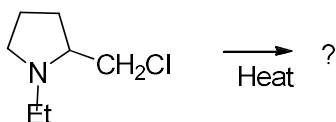
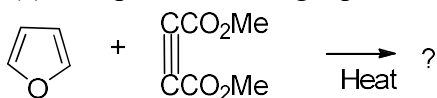
(c) What difference is noticed for signals of aromatic protons in 4-Nitro toluene and 1,4-Dinitro benzene?

(d) How do you distinguish 2-Nitro phenol and 4-Nitro phenol by IR spectroscopy?

(e) Draw a rough sketch of ^1H -NMR spectrum of ethanol.

3. (a) Complete following equations

(2 + 2 + 2) + (2 + 2) = 10



(c) Perform following conversions

(i) 8-Hydroxy quinoline from 2-Aminophenol

(ii) 3-Amino pyridine from β -Picoline

4. Answer following questions.

(2 + 2) + (2 + 2 + 2) = 10

(a) Define Saponification value and Iodine value of fat. Suggest their working formula.

(b) Describe principle of determination of iodine value.

(c) Mention reagent used for determining iodine index and write chemical reaction.

(d) Oils are liquid while Ghee is solid. What structural feature is responsible for their difference in appearance?

APCRGC SEM-V
PAPER: CHEM CC12 (PHYSICAL CHEMISTRY)

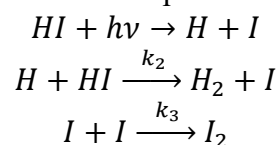
Each question carry 1 mark

1. What is Schrödinger time independent wave equation?
2. What do you mean by eigen function and eigenvalues of an operator?
3. Write operators associated with energy and momentum.
4. State Heisenberg's uncertainty principle.
5. What is a commutator?
6. Write down the unit of molar extinction coefficient
7. What are the main chemicals used in chemical actinometer?
8. What do you mean by intersystem crossing?
9. What will be the number of fundamental vibrational lines in O_2 ?
10. A sample is excited with 1064 nm light which is coming from $Nd - YAG$ laser. What will be position of the Rayleigh scattered light in cm^{-1} ?
11. Write down the selection rule for pure rotational Raman scattering.

Each question carry 5 marks

1. Calculate the difference in the zero point energy of H-H and H-D by assuming that the force constants are same.

The photochemical decomposition of HI proceeds by the following mechanism



Derive the expression for $-\frac{d[HI]}{dt}$ and hence calculate the quantum yield (Φ).

2. Express mathematically the potential energy of Morse oscillator and state the significance of the terms. Sketch the potential energy curve of a real diatomic molecule and indicate the spectroscopic dissociation energy of the molecule in the diagram.

State and explain Franck-Condon principle.

3. Calculate $[x, P_x^2]$, $[x, P_x^3]$
4. The vibrational energy levels of F_2 molecule is given by the expression

$$E_v(cm^{-1}) = 215 \left(v + \frac{1}{2} \right) \left\{ 1 - 0.003 \left(v + \frac{1}{2} \right) \right\}$$

Find (i) the anharmonicity constant (ii) equilibrium oscillation frequency and (iii) zero-point energy of the molecule.

A linear molecule AB_2 has either ' ABB' ' or ' BAB' ' structure. Using its IR and Raman spectra together how would you ascertain the actual structure of the molecule?

- Derive the expression for rotational quantum number of the level having the maximum population (J_{max}).
- Give examples of three model systems where the energy gap between successive levels (i) remains the same (ii) decreases (iii) increases
If α , β and γ are three operators then show that $[\alpha + \beta, \gamma] = [\alpha, \gamma] + [\beta, \gamma]$
- The zero point energy of a harmonic oscillator cannot be zero. Explain.
Explain why the IR frequency of $C = C$ vibration is lower than that of $C \equiv C$ vibration.
- Define perfect blackbody. Write the characteristic features of intensity distribution of radiation emitted by a blackbody. Show that the rotational spectral lines of a rigid diatomic molecule are equispaced.

Each question carry 10 marks

- Determine whether each of the following functions are acceptable or not as state function over the indicated interval.

$$(i) e^{-x}[-\infty, \infty] (ii) e^{-|x|}[-\infty, \infty] (iii) x e^{-x}[0, \infty] (iv) \sin^{-1} x [-1, 1]$$

Define a Hermitian operator. Confirm that the operator $\frac{\hbar}{i} \frac{d}{dx}$ is Hermitian.

How does the intensity of fluorescence vary with pressure and temperature?

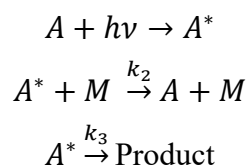
- Consider a particle constrained to move in a two dimensional box. Determine $[x, p_y]$ and interpret the result.

The normalized wave function of a particle in 1D box is given by

$$\psi_n = \sqrt{\frac{2}{L}} \sin \frac{n\pi x}{L}, \quad 0 \leq x \leq L$$

- Find the expression for E
 - Why $n = 0$ is not permitted?
 - Find the value of Δp_x where $(\Delta p_x)^2 = \langle p_x^2 \rangle - \langle p_x \rangle^2$
- What is photoelectric effect? Explain it by using quantum theory of light. A photon has an energy of 1 eV. Estimate its momentum. Prove that Hermitian operators have real eigenvalues. What is the difference between overtones and hot bands in the IR spectra.
 - What do you understand by 'photo-stationary state'? State with reason whether it is a steady state or an equilibrium state.

A photochemical reaction takes place according to the following mechanism:



Derive the expression for the quantum yield of the reaction.

The quantum yield for the photochemical formation of HBr from hydrogen and bromine gases is very low. Explain.

State law of photochemical equivalence.

5. Explain what you understand by Compton effect. Determine the scattering angle for which the shift in wavelength would be maximum.

State and explain Lambert-Beer law. Discuss the deviation of this law from its ideal behavior.

Express mathematically the Planck's distribution law for blackbody radiation and show that, under particular condition, it reduces to the Rayleigh-Jeans law.

6. Setup the Hamiltonian operator for a harmonic oscillator. Write down the time independent SE of a 1D harmonic oscillator. What are the characteristic features of linear harmonic oscillator obeying quantum mechanical laws.

Find the number of normal modes of vibration of CO_2 and H_2O . State and explain which of these vibrations are IR and Raman active.

QUESTION BANK

PAPER: DSE1 (Inorganic Chemistry)

SUB: ANALYTICAL METHODS in CHEMISTRY

(SEM-5)

1. How the systematic error can be minimized? [2]
2. Define absolute error and relative error with examples. [2]
3. Explain why the distribution ratio is better in considering solute distribution in comparison to distribution constant. [2]
4. For analysis of a nickel sample, the percent of nickel are obtained as:
10.19, 10.21, 10.24, 10.18, 10.17

Calculate

- i) standard deviation
 - ii) coefficient of variation
 - iii) standard deviation of mean for the values. [1×3]
5. For analysis of a cobalt sample, the percent of cobalt are obtained as:
4.19, 4.21, 4.22, 4.18, 4.17, 4.24.

Calculate

- i) standard deviation
- ii) coefficient of variation
- iii) standard deviation of mean for the values. [1×3]

6. A solute is extracted from aqueous solvent to organic layer. Distribution ratio, $D = 20$. Calculate percent efficiency of extraction when i) $V_{aq}/V_o = 1$ and ii) $V_{aq}/V_o = 0.50$. [3]

7. A solute is extracted from aqueous solvent to organic layer. Distribution ratio, $D = 10$. Calculate percent efficiency of extraction when i) $V_{aq}/V_o = 1$ and ii) $V_{aq}/V_o = 1.5$. [3]

8. For analysis of an iron sample, the percent of iron are obtained as:
4.16, 4.20, 4.22, 4.18, 4.17, 4.25.

Calculate

- i) standard deviation
- ii) coefficient of variation
- iii) standard deviation of mean for the values. [1×3]

9. A solute is extracted from aqueous solvent to organic layer. Distribution ratio, $D = 10$. Calculate percent efficiency of extraction when i) $V_{aq}/V_o = 1$ and ii) $V_{aq}/V_o = 0.50$. [3]

10. In an experiment the following results (in mg/L) are obtained:
103, 102, 101, 106 and 120

Is the value 120 mg/L correct at the 95% confidence level? [Given: tabulated Q_{95} – value for five observations is 0.71]. [2]

11. A solute is extracted from aqueous solvent to organic layer. Distribution ratio, $D = 12$. Calculate percent efficiency of extraction when i) $V_{aq}/V_o = 1$ and ii) $V_{aq}/V_o = 0.25$. [2]
12. In an experiment, the actual amount provided to you is 18.5 g. The measured value is 18.29g. Calculate the relative error for the experiment in i) percent and ii) ppt. [3]
13. For analysis of a cobalt sample, the following values of percent cobalt are obtained:

3.15, 3.21, 3.24, 3.18, 3.19, 3.26.

Calculate

- i) standard deviation
ii) coefficient of variation and
iii) standard deviation of mean for the values. [1×3]
14. What is the basic principle of Job's method in determining the composition of a complex? [2]
15. The true value for an analysis of a component is 20.15. The two analysts A and B get the following results:

Analyst A: 20.12, 20.16., 20.17, 20.21

Analyst B: 20.48, 20.52, 20.49, 20.47

- i) Whose result is correct?
ii) Whose experiment is more précised?
iii) The error occurred in analyst A is error.
iv) The error occurred in analyst B is error. [2]
16. In an experiment the following results (in mg/L) are obtained:

104, 102, 105, 106 and 125

Is the value 125 mg/L correct at the 95% confidence level? Given: tabulated Q_{95} – value for five observations is 0.71. [3]

.....●.....

QUESTION BANK

DSE-P2- CHEMISTRY

1. Answer the following questions: (1 Mark for each question)

- a. Define Portland cement with example.
- b. What do you mean by annealing of glass?
- c. What do you mean by binders? Give example.
- d. Give an example of high technology ceramics.
- e. Mention one disadvantage of ceramic.
- f. What do you mean by safety glass.
- g. Write down one application of fluorosilicate glass.
- h. Give one example of Sodalime glass.
- i. What do you mean by white cement?
- j. Give one application of waterproof cement.

2. Answer the following questions: (5 Marks for each question)

- a.i. What is paint? What do you mean by weather quoting?1+2
ii. Mention the harsh effect of lead and cadmium in the preparation of paint.2
- bi. What is emulsifying agent? Give one example.2+1
ii. Give examples of filler and binder.2
- c. i. Describe the manufacturing process of urea.4
ii. Give one example of bio fertilizer.1
- d.i. Write down the redox reactions occurring in galvanic cell.3
ii. what is solar cell?2
- e.i. What is mineral fertilizer? How does it work?1+2
ii. What is epoxy polymer? Give one example.2
- f. i. What do you mean by catalyst poison? Give one example.2+1
ii. What is autocatalysis? Give one example.
- g. i. Write down the working principle of a rechargeable battery.3
ii. Write down the beneficial roles of agricultural waste on soil.2

3. Answer the following questions: (10 Mark for each question)

a. Write short note on the followings 2.5×4

Feldspar, Ceramics, Armoured glass, Weather proof paint.

b. i. What do you mean by Phase Transfer catalyst? Give its mechanism. 1+3

ii. Describe the method of decarbonization of steel. 3

iii. Discuss briefly about fire retardant and heat retardant cement. 3

c. i. "Alloys are more suitable than pure metals" justify the statement. 3

ii. What are the objectives of coatings of surface? Show the chemical reactions during setting of cement. 2+3

d. i. Discuss about the manufacturing process of glass? What is annealing of glass? 3+2

ii. What do you mean by superconducting and semiconducting oxides? Give example. 2+1

iii. Write down the applications of borosilicate and fluorosilicate glass. 2

e. What are the characteristics of a good quality fertilizer? Mention about the benefits of using bio-fertilizer over chemical fertilizer? 2+2

ii. Write a short note on heterogeneous catalyst. 3

iii. Define electroless metallic coatings with example. 3

QUESTION BANK

PAPER: CC-13 (Inorganic Chemistry)

(SEM – 6)

1. Explain the synergism for bonding involved in metal carbonyl complex. [2]
2. Identify the ions from their mixture: NO_3^- & NO_2^- . [2]
3. Explain the structure and bonding of Zeise's salt. [3]
4. Explain the variation of stretching frequency (cm^{-1}) for the complexes: [3]

Compound	$\nu_{\text{CO}} / \text{cm}^{-1}$
$\text{V}(\text{CO})_6^-$	1859
$\text{Cr}(\text{CO})_6$	2000
$\text{Mn}(\text{CO})_6^+$	2100

5. Explain the synergism for bonding involved in metal carbonyl complex. [2]
6. Acylation reaction of ferrocene with acetic anhydride and anhydrous AlCl_3 gives di-acetyl derivative – explain which product is major (with reaction sequence). [2]
7. Explain the mechanistic steps involved in the hydrogenation of alkene. [3]
8. Identify the ions from their mixture: Br^- & I^- . [2]
9. For separation of metal ions in different groups, H_2S may be used as precipitating reagent. Explain the reason, mentioning the groups and the chemical environment used for metal separation. [3]
10. Draw the energy profiles for uncatalyzed and catalyzed reactions. Mention the terms involved. [2]
11. Establish the relation between stepwise and overall stability constants. [3]
12. Explain the mechanistic steps involved for polymerization of olefin. [3]
13. Explain the mechanistic steps involved for the catalytic hydroformylation reaction. [3]
14. Name two important catalyst used for the [1×4]
 - i) hydrogenation of olefin
 - ii) oxidation of olefin through Wacker process
 - iii) hydroformylation reaction

iv) polymerisation of alkene

15. What are the different mechanistic processes involved for substitution reactions in inorganic complexes? [2]

16. Discuss the structure of $\text{Co}_2(\text{CO})_8$ [2]

17. Discuss the structure of $\text{Mn}_2(\text{CO})_{10}$ [2]

18. Discuss the bonding in metal carbonyl complex mentioning the orbital diagram. [3]

19. Explain with orbital picture the synergic bonding nature in metal carbonyl complexes.

20. Find the value of x and y following 18-electron rules for the complexes:

i) $\text{Fe}(\eta^5\text{-Cp})(\text{CO})_x(\text{NO})_y$ ii) $\text{Mn}(\text{CO})_x(\text{NO})_y$

21. Explain the steps of catalytic cycle for hydroformylation of an olefin. [3]

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SEM-VI

CC14

(ORGANIC CHEMISTRY)

1. Answer following questions (Each question carries 1 mark)

- What do you mean by the term Spectroscopy
- Give one example with structure of reducing sugar
- Give one example with structure of vat dye
- Calculate the no of non-equivalent proton of p-anisidine.
- Define coupling constant in NMR spectroscopy.

2. Answer following questions (Each question carries 3 mark)

- UV-Vis spectroscopy shows a broad hump rather than sharp peak. Explain the facts.
- meso*.Butan-2,3-diol and active butan-2,3-diol can be distinguished spectroscopically. Explain the fact.
- How would you explain the unfield shift of acetylinic proton with respect to ethylenic proton though sp hybridised carbon has greater electronegativity?
- What is meant by coupling constant in NMR spectroscopy? How do these coupling constant values help to interpret NMR spectrum having non-equivalent hydrogen atoms?
- Explain why sucrose does not undergo mutarotation but maltose does.
- Sucrose cannot reduce Tollen's Reagent but maltose can. Justify.
- What are the products formed if you carry out two consecutive Killiani-Fischer syntheses on D-glyceraldehyde?

3. Answer following questions (Each question carries 5 mark)

- Predict the compounds with the following NMR data:
 - Molecular formula C_8H_8O : δ (in ppm): 7.28 (m, 5H) ; 2.8 (d, 2H) ; 9.78 (t, 1H)
 - Molecular formula $C_4H_8O_2$: δ (in ppm): 4.0 (q, 2H) ; 1.97 (s, 1H) ; 1.23 (t, 3H)
- Outline the synthesis of the following dyes:
 - Methyl orange
 - Malachite green
- How would you distinguish following pair of compounds spectroscopically?
 - Trans*-stilbene and *cis*-stilbene by UV-Vis
 - 1,3-Butanedione and 1,4-Butanedione by IR spectroscopy.
- Draw the structure a Phenolphthalein. Why does it produce a deep red colour when dissolved in alkali?
- How many types of protons are found in the following molecules by 1H -NMR spectra?
 - Acetone
 - Acetophenone.
 - Ethyl acetoacetate.
 - toluene
 - Benzene

QUESTION BANK

DSE3- CHEMISTRY

1. Answer the following questions: (1 Mark for each question)

- a. What do you mean by polymer. Give example.
- b. Write down the structure of repeating unit of PVC.
- c. What is Ziegler-Natta catalyst.
- d. Give examples of thermoplastic and thermosetting polymer.
- e. What are the raw materials for Bakelite.
- f. Write the mathematical expression of number average molecular weight of polymer.
- g. Give examples of addition and condensation polymer.
- h. What do you mean by vulcanization of rubber.
- i. What do you mean by amphiphilic polymer?
- j. Give examples of two vulcanizing agents.

2. Answer the following questions: (5 Marks for each question)

- a. Write down the monomer of PAN. How are the polymers classified? 1+4
- b. Write down the comparison between thermoplastic and thermosetting polymer. Write one application of PTFE.
- c. Define polymerization. Differentiate between addition and condensation polymerization. 2+3
- d. Explain the mechanism of cationic polymerization taking isobutylene as an example. Distinguish between inhibitors and retarders during radical polymerization. 3+2
- e. Explain the kinetics of free radical chain growth polymerization and derive the rate equation of polymerization. 5
- f. Explain gelation and gel point in condensation polymerization. What is ring opening polymerization? 3+2
- g. Give the structure of PMMA. Discuss its properties and applications. 1+2+2

3. Answer the following questions: (10 Marks for each question)

- a. i. Distinguish between the two types of phenol-formaldehyde resin. Write down the major applications of poly vinyl acetate. 3+2
- ii. Discuss the mechanism of coordination polymerization of alkenes by Ziegler Natta catalysts. 5
- b. i. How silicons are prepared? Discuss it's properties and applications. 2+2+2
- ii. What are polyurethanes? How Nylon 6,10 is prepared. 2+2
- c. i. Discuss the properties and applications of Buna-S rubber. 2+2+2
- ii. Discuss the process of vulcanization of rubber. 4
- d. i. Define bio-degradable and non bio-degradable polymers with example, make a comparison between them. 2+3
- ii. Write a short note about molecular weight distribution. Give it's significance. 3+2
- e. i. Write down the preparation, structure and application of following polymers: 5×2
- PVC, PVA, PTFE, PAN, PS

QUESTION BANK

DSE 4- CHEMISTRY

1. Answer the following questions: (1 Mark for each question)

- a. Which enzyme is mainly used in industry?
- b. What is the composition of reformat gas?
- c. What is BOD?
- d. What is COD?
- e. Name some particulate in Air Pollutants?
- f. What is Photo chemical smog?
- g. What is green power?
- h. What is meant by smelting?
- i. What is green-house effect?
- j. Give two examples of non-conventional energy source.

2. Answer the following questions: (5 Marks for each question)

- a. Discuss about carbon cycle. What is the basic ozone photochemistry? 3+2
- b. Write a short note about photochemical smog. What are phytoplanktons? 3+2
- c. What are the different forms of cast iron? Write down the alloys of copper. 3+2
- d. How BOD is measured? How water is disinfected? 3+2
- e. What is Kroll process? How can you distinguish between mineral and ore? 3+2
- f. What are the different ways of exploiting ocean as blue energy source? What are the different types of coal? 3+2
- g. Discuss the physical and health hazards of following industrial gases
He, SO₂, CO₂, NO₂, H₂S

3. Answer the following questions: (10 Marks for each question)

a.i. Write a short note on reverse osmosis method for water treatment.3

ii. What are the different water quality parameters?3

iii. Briefly describe the industrial waste management?4

b.i. What do you mean by conventional and non conventional sources of energy? Give examples.3

ii. What are the advantages and disadvantages of solar energy?4

iii. Write a short note on hydrogen as source of energy?3

c.i. What are the effects of nuclear pollution? How this can be prevented?2+3

ii. Discuss about the nuclear disposal management.5

d.i. Discuss the bio-desulphurisation of coal.4

ii. Discuss briefly the sources and nature of water pollutants.4

iii. What is COD?2

e. i. Discuss the remedial measures for photochemical smog. 3

ii. Discuss about the ozone depletion of CFC.4

iii. Discuss about the hazards of using sulphuric acid.3