

1
[This question paper contains 4 printed pages]

Your Roll No. :

Sl. No. of Q. Paper : **1784**

Unique Paper Code : **2172011201**

Name of the Course : **B.Sc.(H) Chemistry**

Name of the Paper : **DSC : Chemistry of s- and p-Block Elements**

Semester : **II (UGCF-NEP)**

Time : 3 Hours **Maximum Marks : 90**

Instructions for Candidates :

- (a) Write your Roll No. on the top immediately on receipt of this question paper.
 - (b) Attempt any **six** questions out of eight questions. All questions carry equal marks.
1. (a) Give reasons for any **five** of the following.

5×2

- (i) Why Fluorine is extremely reactive molecule amongst halogens.
- (ii) Out of SO_2 and TeO_2 which one is acting as a reducing agent ?
- (iii) MgSO_4 is soluble in water but BaSO is insoluble.
- (iv) Why Alkali metals are softer than Alkaline earth metals.
- (v) Despite ring strain in P_4 molecule. White phosphorus is stable relative to P_2 .

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- (vi) Why Carbon show a much greater tendency for catenation in comparison to silicon and nitrogen.
- (b) The sigma bonding in the linear molecule XeF_2 , may be described as 3 Centre, 4 electron bond. If the Z axis is assigned as the inter nuclear axis, use the P orbitals on each of the atom, to prepare a molecular orbital description of the sigma bonding in XeF_2 . 5
2. (a) Considering the electrolytic refining of CuSO_4 , which consists of Fe, Zn, Ag Pt, Au as impurities. Explain which of the metals will be oxidized and dissolve in solution and which will simply form sludge that accumulate at the bottom of the cell. 5
- (b) Draw the structure of oxoacids of chlorine determining the oxidation state of chlorine in each and arrange them in the increasing order of their acidic strength . 5
- (c) The first ionization energies does not decrease smoothly down the Gp13. 5
- (i) Identify the anomaly in the trend
- (ii) Explain the reasons.
3. (a) Explain the trend in thermal stability and relate to its solubility for Gp2 carbonates.
- (b) Explain the diagonal relationship between B and Si based on the polarizing power. List three example showing similarities in their chemical properties.
- (c) (i) Explain the shape and hybridization of IF_5 and ClF_3 .
- (ii) Why Interhalogen compounds are more reactive than parent halogens. $3 \times 5 = 15$

4. (a) (i) Discuss the role of Lattice energy and Hydration energy in determining the solubility of LiF and CsF.
- (ii) Why LiCO_3 decomposes easily.
- (b) Draw the structure of Basic Beryllium acetate and 2, 2, 2 Cryptand
- (c) Explain why the solution of alkali metals in liquid ammonia acts as a good reducing agent.
 $3 \times 5 = 15$
5. (a) Arrange the following hydrides in decreasing order of their basicity : NH_3 , PH_3 , AsH_3 , SbH_3 . Explain the trend based on atomic size, hybridization and lone pair availability on central atom.
- (b) Write down the autoionisation of BrF_3 and identify the species acting as acids and bases according to the solvent system concept.
- (c) (i) Despite having lower ionization energy, why is Potassium not a stronger reducing agent than lithium in aqueous medium ?
- (ii) Write down the hydrolysis product of peroxydisulphuric acid ($\text{H}_2\text{S}_2\text{O}_8$) $3 \times 5 = 15$
6. (a) Explain based on the Ellingham Diagram out of C and CO who acts as a better reducing agent in low temperature range and in high temperature range.
- (b) (i) Arrange the following elements in order of increasing electron affinity and justify your answer : N, O, C and B.

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[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2050

L

Unique Paper Code : 2172011202

Name of the Paper : DSC – Haloalkanes, Arenes, Haloarenes, Alcohols, Phenols, Ethers and Epoxides

Name of the Course : B.Sc. (Hons.) Chemistry

Semester : II

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **four** questions in all.
3. Each question carries **15** marks.

Q.1 Answer the following (any five):

- (a) Explain why Friedel Crafts alkylation of benzene with *n*-propyl chloride and AlCl_3 does not yield *n*-propyl benzene? What modification can accomplish the reaction?
- (b) Out of *ortho*-nitrophenol and *para*-nitrophenol which one is more acidic and why?
- (c) Write the product(s) obtained upon oxidation of propylene glycol with periodic acid.
- (d) Starting with (*S*) 2-Bromobutane outline the synthesis (*R*) 2-ethoxybutane.
- (e) Explain the Kolbe-Schmidt reaction with mechanism.
- (f) Why haloalkanes undergo nucleophilic substitution reactions readily but alcohols undergo nucleophilic substitution in presence of strong acid as catalyst?

(3 X 5= 15)

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Q2 (a) For the reaction of 1-bromobutane with potassium tert-butoxide, predict whether S_N2 or $E2$ dominates. Justify your answer.

(b) What happens when phenol reacts with chloroform in the presence of sodium hydroxide? Name the reaction and give the mechanism involved.

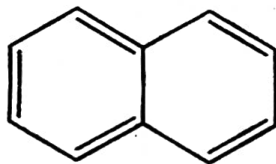
(c) Substitution nucleophilic unimolecular proceeds with racemization along with some net inversion. Justify the statement.

(5 x 3=15)

Q3. (a) *o*-Chlorotoluene reacts with potassium amide in liquid ammonia to yield a mixture of *o*-toluidine and *m*-toluidine. Explain giving mechanism.

(b) Explain why nucleophilic substitution in aryl halides do not follow S_N1 or S_N2 mechanism.

(c) Classify each of the following as aromatic, anti-aromatic and non-aromatic:



(5 x 3=15)

Q4. (a) Explain substitution nucleophilic internal (S_Ni) mechanism with a suitable example.

(b) Explain why halogens in aryl halides are ortho/para director but weak deactivator towards electrophilic substitution reactions.

(c) Choose the correct option:

(i) Primary alkyl halide in the presence of polar aprotic solvent and strong base would ideally undergo substitution nucleophilic _____ (unimolecular / bimolecular / intramolecular / aromatic).

(ii) Grignard reagents will react with CO_2 to give _____ (aldehyde / ketone / carboxylic acid / alcohol).

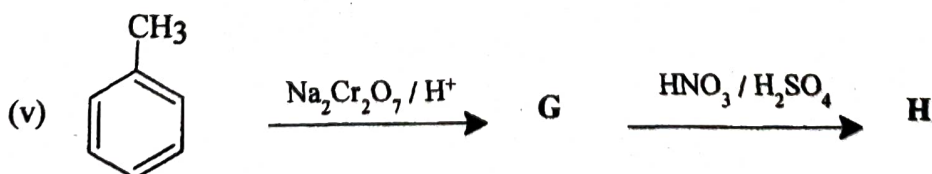
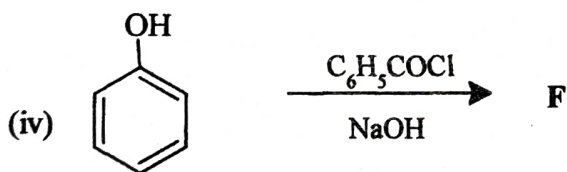
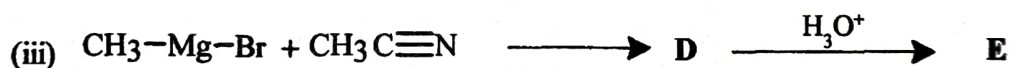
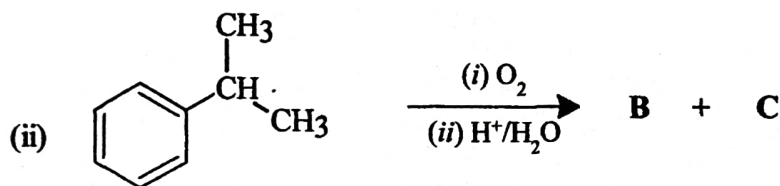
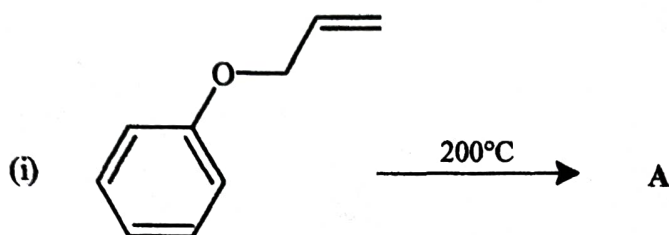
(iii) The least reactive towards an S_N1 reaction would be _____ (benzyl chloride / chlorobenzene / *t*-butyl chloride / allyl chloride).

(iv) Primary, secondary and tertiary alcohols can be distinguished by _____ (Ferric chloride test/ Lucas test/ Tollen's test)

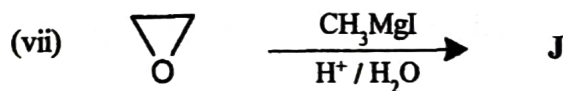
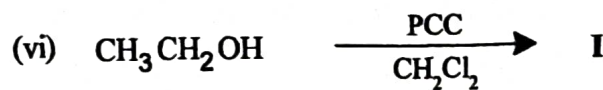
(v) Pyridine is _____ (aromatic with 6π electrons/ anti-aromatic with 8π electrons/ aromatic with 8π electrons/ non-aromatic 8π electrons)

(5 x 3=15)

Q5. Complete the following reactions:



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(1.5 x 10 = 15)

Q6. Write short notes on (any three):

- (i) Houben Hoesch Reaction
- (ii) Pinacol-Pinacolone rearrangement
- (iii) Fischer's Esterification
- (iv) Fries Rearrangement

(5 x 3 = 15)

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[This question paper contains 7 printed pages]

Your Roll No. :

Sl. No. of Q. Paper : **2069 I**

Unique Paper Code : **2172011203**

Name of the Paper : **DSC-Chemical
Thermodynamics and
its Applications**

Name of the Course : **B.Sc. (Hons.)**

Semester : **II**

Time : 3 Hours

Maximum Marks : 90

Instructions for Candidates :

- Write your Roll No. on the top immediately on receipt of this question paper.
- Attempt **six** questions in all. Q. No. 1 is compulsory.
- Use of a scientific calculator and Log Table is allowed.

1. Answer the following questions (Any five):

5×3=15

- Explain why μ_{JT} (Joule Thomson coefficient) negative value corresponds to warming and positive value corresponds to cooling.

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- (b) The entropy of crystalline ice is not zero at 0K. Explain.
- (c) Why is the work done in isothermal free expansion is zero.
- (d) In a mixture of two liquids usually why is $V_T \neq n_1 \bar{V}_1 + n_2 \bar{V}_2$. Here V_T is the total volume of the mixture, n_1, n_2 are the number of moles of the two liquids and $\bar{V}_1, \bar{V}_2$ are the molar volumes of liquid 1 and 2 respectively.
- (e) The Helmholtz free energy function is sometimes referred to as the work function.
- (f) Enthalpies of neutralization of different weak acids with the same strong base are different. Explain.

2. (a) (i) Prove $\left(\frac{p_2}{p_1}\right) = \left(\frac{T_2}{T_1}\right)^{\frac{\gamma}{\gamma-1}}$ 3

(ii) $\left(\frac{\partial U}{\partial V}\right)_p = \frac{C_v \gamma p}{nR}$ 2

(b) (i) Calculate the amount of heat supplied to Carnot's cycle working between 368K and 268 K if the maximum work obtained is 895 Joules. 3

(ii) Calculate the free energy change accompanying the compression of 1 mol of CO_2 from 5 atm to 50 atm. Assume that CO_2 behaves like an ideal gas. 2

(c) The partial molar volume of ethanol in a 60 mole % ethanol-water solution is $57.5 \text{ cm}^3 \text{ mol}^{-1}$. The density of solution is 0.849 g cm^{-3} . Calculate the partial molar volume of water in the solution. 5

3. (a) Derive the relationship between heat of reaction at constant pressure and at constant volume. For the reaction $2\text{A}_2(\text{s}) + 5\text{B}_2(\text{g}) \rightarrow 2\text{A}_2\text{B}_5(\text{g})$, what will be the enthalpy of reaction at 298K if its $\Delta U = 62.76 \text{ kJ}$. 5

(b) Derive the following relations: 5

$$(i) \left(\frac{\partial \frac{\Delta G}{T}}{\partial \frac{1}{T}} \right)_P = \Delta H$$

(ii) For adiabatic irreversible expansion

$$T_2 = T_1 \frac{\left(C_{v,m} + R \frac{P_2}{P_1} \right)}{C_{p,m}}$$

(c) Describe Joule's experiment with a diagram for ideal gas and the results obtained from it mathematically. 5

4. (a) Prove that isothermal reversible work of expansion is greater than isothermal irreversible expansion $W_{rev} > W_{irr}$

(b) Derive the following relation for an ideal gas:

$$\Delta S = nC_{p,m} \ln \frac{T_f}{T_i} - nR \ln \frac{P_f}{P_i} \quad 5$$

(c) (i) Derive the relations for the temperature dependence of enthalpy of reaction, when C_p is independent of temperature and dependent on temperature. 3

(ii) If the standard heat of formation of HCl gas at 25°C is - 22.6 kCal mol⁻¹, what would be its value at 60°C? C_p for $H_2(g)$ = 6.82 Cal mol⁻¹ deg⁻¹ 2

5. (a) Prove that heat (q) is not a state function and dq is not an exact differential. 5

(b) Show that $\left(\frac{dH}{dP}\right)_T = 0$ for an ideal gas and is equal to V for solids and liquids. 5

(c) (i) Define and explain the second law of thermodynamics. 3

(ii) What is Trouton's rule. 2

6. (a) Five moles of an ideal gas at 27°C expand from an initial pressure of 10 atm to a final pressure of 5 atm against a constant external pressure of 1 atm . Calculate ΔU , ΔH , w and q . 5

(b) (i) Show that the work done by an ideal gas in a reversible adiabatic expansion from

$$P_i V_i \text{ to } P_f V_f \text{ is given by } w = \frac{P_i V_i - P_f V_f}{\gamma - 1}$$

3

(ii) Define the standard state of substance. 2

(c) (i) How are absolute values assigned to entropies of different substances? 2

- (ii) Calculate the entropy change corresponding to transferring 2 mol of liquid ammonia at a pressure of 101.325 kPa from -40°C to the gaseous state at 200°C . Given

$$C_p(\text{NH}_3)(l) = 74.894 \text{ JK}^{-1}\text{mol}^{-1},$$

$$C_p(\text{NH}_3)(g) = 33.64 \text{ JK}^{-1}\text{mol}^{-1} \text{ and}$$

$$(\Delta H_{\text{vap}})_{\text{NH}_3} = 23.263 \text{ kJmol}^{-1} \text{ at } 239.7 \text{ K},$$

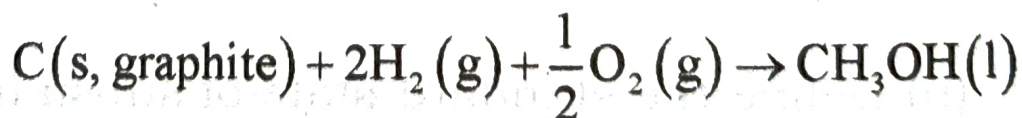
which is the boiling point of ammonia. 3

7. (a) Derive the following thermodynamic equation

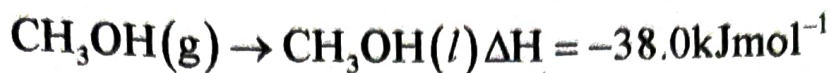
$$\text{of state } \left(\frac{\partial H}{\partial P} \right)_T = V - T \left(\frac{\partial V}{\partial T} \right)_P \quad 5$$

- (b) Derive w , ΔU , ΔH , q and T_2 for adiabatic irreversible expansion of an ideal gas. 5

- (c) Calculate the standard enthalpy change for the reaction 5



Given: Enthalpy of sublimation of graphite 716.68 kJ

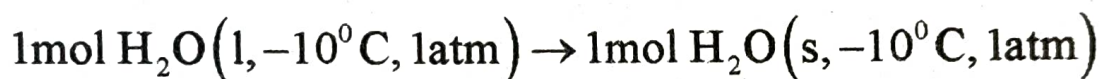


$$\epsilon_{\text{H-H}} = 431.79, \epsilon_{\text{O-H}} = 498.34, \epsilon_{\text{C-H}} = 410.87,$$

$$\epsilon_{\text{O-H}} = 463 \text{ and } \epsilon_{\text{C-O}} = 360 \text{ kJ respectively. } 5$$

8. (a) Define First law of Thermodynamics. Give its mathematical formula. Give in detail the physical significance of U . 5

- (b) Calculate the entropy change for the process represented by the following transformation: 5



$$\text{Given } (\Delta H)_{\text{fusion}, 273\text{K}} = 6008 \text{ J mol}^{-1}, C_p(\text{H}_2\text{O}, \text{l}) = 75.42 \text{ JK}^{-1} \text{ mol}^{-1}$$

$$(\Delta H)_{263\text{K}} = -6059 \text{ J mol}^{-1}, C_p(\text{H}_2\text{O}, \text{s}) = 37.2 \text{ JK}^{-1} \text{ mol}^{-1}$$

- (c) Derive Gibbs-Duhem equation and explain its significance. 5

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[This question paper contains 4 printed pages]

Your Roll No. :
Sl. No. of Q. Paper : **1805**
Unique Paper Code : **2172012401**
Name of the Paper : **DSC 10 (Coordination Chemistry and Reaction Mechanism)**
Name of the Course : **B.Sc.(Hons.) Chemistry**
Semester : **IV**
Time : 3 Hours **Maximum Marks : 90**

Instructions for Candidates :

- (a) Write your Roll No. on the top immediately on receipt of this question paper.
 - (b) Attempt any **SIX** questions in all.
 - (c) **All** questions carry equal marks.
1. (a) Write the name for the following complexes according to IUPAC rules.
- (i) $(\text{CH}_3)_4\text{N} [\text{Cr}(\text{NH}_3)_2(\text{NCS})_4]$ (ii) $[\text{Co}(\text{NH}_3)_5(\text{N}_3)]\text{SO}_4$
 - (iii) $[\text{Pt}(\text{py})_4][\text{PtCl}_4]$ (iv) $[\text{Rh}(\text{en})_3]_2(\text{SO}_4)_3$
 - (v) $[(\text{CO})_4\text{Fe}(\mu\text{-CO})_2\text{Fe}(\text{CO})_4]$
- (b) Write the formula for the following complexes according to IUPAC rules :
- (i) μ -amido- μ superoxobis [triamminechloridocobalt(III)] sulphate
 - (ii) Tetraamminedithiocyanato-N-chromium (III) tetrachlorozincate (II)

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- (iii) Sodium bis (thiosulphato) argentate (I)
 (iv) Potassium pentachloridonitridoosmate (VI)
 (v) Tris(propene 1.2-diamine) cobalt (III) sulphate
- (c) A compound $\text{CoCl}_3 \cdot 4\text{NH}_3$ contains only one Cl^- ion that precipitates as AgCl on the addition of Ag^+ ions. Based on Werner's coordination theory, give a brief explanation of the observation. How was it concluded that the complex is octahedral ? 5,5,5
2. (i) Draw the molecular orbital energy level diagram for σ - bonding in the case of $[\text{Co}(\text{CN})_6]^{3-}$ octahedral complex ion. Discuss the effect of metal to ligand pi bonding on the $10 Dq$ value.
 (ii) Use CFT to explain the following :
 (a) Tetrahedral complexes are always high spin.
 (b) $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ ion has purple colour.
 (iii) A complex, $\text{Co}(\text{NH}_3)_2(\text{H}_2\text{O})_2\text{Cl}_2\text{Br}_2$ exists in two isomeric forms, A and B. Form A gives two moles of AgBr when treated with AgNO_3 , while the other form yields one mole of AgBr . Give a proper explanation, identify the type of isomerism and write the structural formula of A and B. 5,5,5
3. (i) Which geometrical isomer of $[\text{Cu}(\text{en})_2(\text{H}_2\text{O})_2]^{2+}$ is thermodynamically more stable and why ? Also, compare and explain its stability with the $[\text{Cu}(\text{NH}_3)_4(\text{H}_2\text{O})_2]^{2+}$ complex.
 (ii) Draw a crystal field splitting diagram for a z-out octahedral complex and explain that square planar complexes are an extreme case of Jahn-Teller distortion.
 (iii) Which of the following complexes has a higher $10 Dq$ value and why ? 5,5,5
 (a) $[\text{Co}(\text{NH}_3)_6]^{3+}$ and $[\text{Rh}(\text{NH}_3)_6]^{3+}$

- (b) $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{4-}$ and $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}$
4. (i) The magnetic moment value of $[\text{Mn}(\text{CN})_6]^{3-}$ ion is 2.8 B.M. Predict the type of hybridisation of the central metal ion and lability of the complex according to VBT.
- (ii) Using VBT, explain $[\text{NiCl}_4]^{2-}$ is paramagnetic, but $[\text{Ni}(\text{CH}_3)_4]^{2-}$ is diamagnetic.
- (iii) $[\text{Co}(\text{en})_3]^{2+}$ and $[\text{Co}(\text{NO}_2)_6]^{4-}$ are easily oxidizable. Explain this observation according to VBT and CFT? 5,5,5
5. (i) Derive the relationship between stepwise formation constants (K_n) and overall formation constant (β_n).
- (ii) Predict and explain the lability or inertness of the following complexes :
- (a) $[\text{V}(\text{NH}_3)_6]^{3+}$ (b) $[\text{MnCl}_6]^{3-}$
- (iii) Use trans effect and write the steps involved in the synthesis of cis and trans isomers of $[\text{Pt}(\text{C}_2\text{H}_4)(\text{NH}_3)\text{Cl}_2]$ from PtCl_4^{2-} 5,5,5
6. (i) (a) Draw all possible geometrical isomers for $[\text{Pt}(\text{py})_2(\text{NH}_3)_2\text{Cl}_2]^{2+}$
- (b) How the Kurnakov test is used to distinguish between geometrical isomers of $[\text{PtCl}_2(\text{NH}_3)_2]$.
- (ii) Describe a simple method to distinguish between the following of complexes
- (a) $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{SO}_4$ and $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Br}$
- (b) $[\text{Cr}(\text{NH}_3)_6]$ $[\text{Cr}(\text{NO}_2)_6]$ and $[\text{Cr}(\text{NH}_3)_4(\text{NO}_2)_2]$
 $[\text{Cr}(\text{NH}_3)_2(\text{NO}_2)_4]$
- (iii) Explain why?
- (a) 4d and 5d elements usually form low-spin complexes

- (b) CN^- is a stronger ligand than Cl^- 5,5,5
7. (i) Describe the polarisation theory to explain the trans effect.
- (ii) The experimentally determined lattice energy for MnO agree with the calculated value; however, for FeO and CoO , the experimentally determined lattice energy values are higher than the calculated values. Why?
- (iii) For the complex $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ the mean pairing energy $P = 23500 \text{ cm}^{-1}$ and magnitude of $\Delta_0 = 13900 \text{ cm}^{-1}$ 5,5,5
- (a) Will the complex exist in a high or low Spin arrangement?
- (b) Write the electronic configuration of the complex ion.
- (c) Calculate CFSE of the complex in kJ mol^{-1} .
- (d) Will the complex be labile or inert?
- (e) Will it have a regular geometry or a distorted geometry?
8. (i) A complex is prepared by mixing CoCl_2 and NH_3 in the molar ratio of 1:4. A 0.01 molal solution of this complex was found to freeze at -0.0372°C . What is the formula of the complex and expected range of conductivity? Given that the molal depression constant of water $K_f = 1.86^\circ\text{C/m}$.
- (ii) Taking suitable example, explain the macrocyclic effect on the thermodynamic stability of complexes.
- (iii) A metal ion forms three complexes. $[\text{M}(\text{Br})_6]^{4-}$, $[\text{M}(\text{CN})_6]^{4-}$ and $[\text{M}(\text{H}_2\text{O})_6]^{2+}$. The colours of the complexes are red green and blue, but not necessarily in the same order. Match the complexes with the appropriate colour and explain. 5,5,5

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[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1837

L

Unique Paper Code : 2173012011

Name of the Paper : DSE: Reactions, Reagents and Chemical Processes

Name of the Course : B.Sc. (Hons) Chemistry

Semester : IV

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

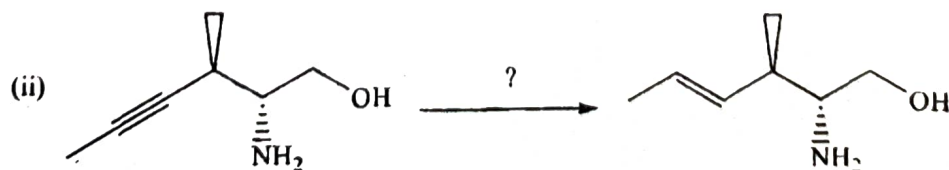
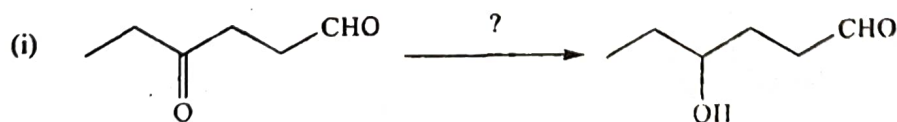
1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **six** questions.
3. **All** parts of a question should be attempted together.
4. Each question carries **15** marks.

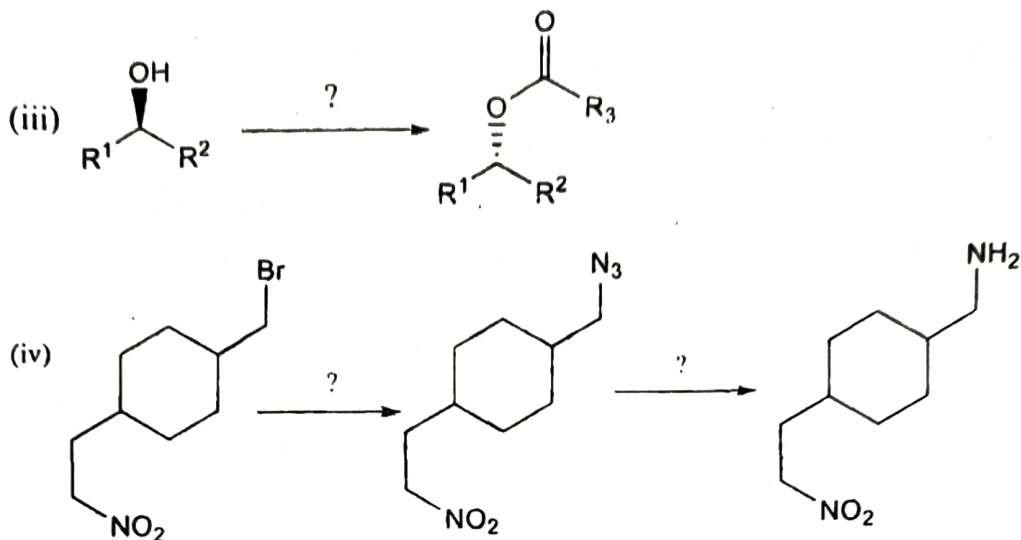
1. Explain **any three** of the following reactions with suitable mechanisms :

- (a) Suzuki Coupling Reaction
- (b) Mukaiyama Aldol Reaction
- (c) 1,3-dipolar cycloaddition Reaction
- (d) Mitsunobu Reaction

(5,5,5)

2. (a) Identify the most suitable reagents required to accomplish the following chemical transformation (**any three**) : (3×2)

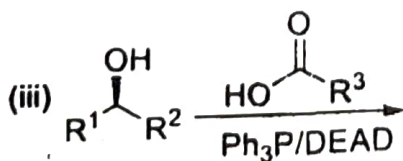
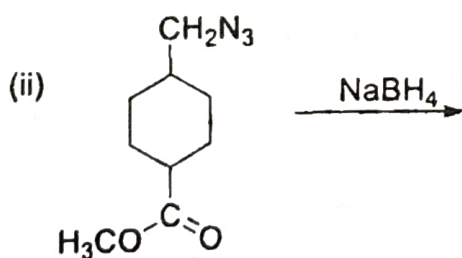
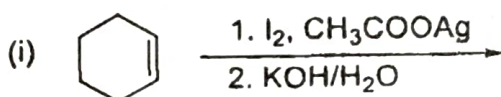


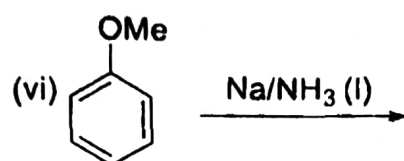
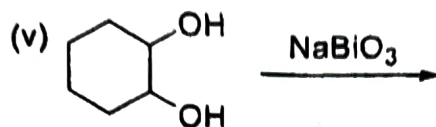
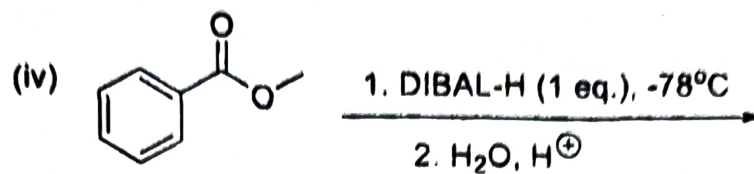


(b) Give the chemical structures of the following reagents and provide one application of each using a suitable reaction :

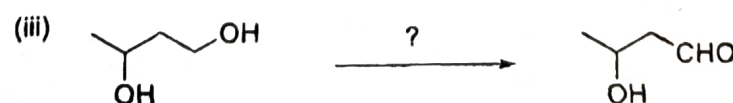
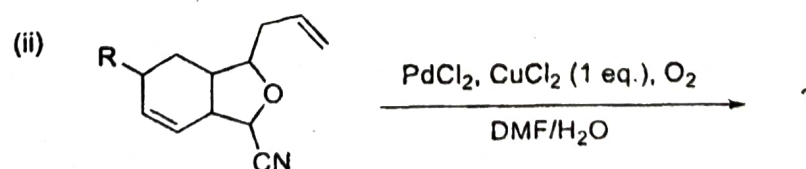
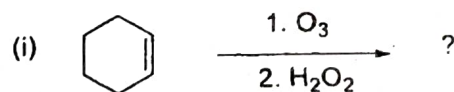
- (i) Catecholborane
- (ii) Red-Al
- (iii) Schwartz Reagent (3×3)

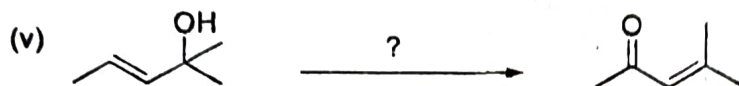
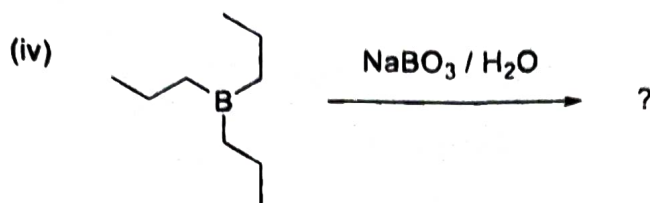
3. (a) Complete the following reaction by giving the suitable product. (6×2)





- (b) What is the Julia-Olefination Reaction? Explain with a suitable example. (3)
4. (a) What is the Heck coupling reaction? Write the steps involved in the mechanism of the Heck Coupling reaction.
- (b) Write the reaction and mechanism of the Wittig Reaction?
- (c) Discuss the Bischler-Napieralski Reaction with mechanism? (5,5,5)
5. (a) Complete the following transformations by giving the correct reagent/major product : (5×2)





(b) Write the chemical structure of the following reagents :

(i) TEMPO

(ii) DEAP

(iii) DIBAL-H

(iv) Dess-Martin reagent

(v) LDA

(5×1)

6. Explain the following with suitable mechanisms :

(a) Wacker oxidation

(b) TPAP oxidation

(c) Fetizon's oxidation

(5,5,5)

7. Write short notes on the following :

(a) Scale-up of an API

(b) Non-metallic oxidizing agents for oxidation process

(c) Halogenation reactions and its type.

(5,5,5)

8. (a) Define in-process control (IPC) and discuss its importance in ensuring quality in large-scale production.

(b) Discuss nitration process and its industrial applications.

(c) Describe the Swern oxidation? Discuss its advantages over other oxidation methods like Jones oxidation.

(5,5,5)

(500)

(6)
This question paper contains 6 printed pages]

Roll No.

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S. No. of Question Paper : 1924

Unique Paper Code : 2172012402

Name of the Paper : Carbohydrates, Lipids and Heterocyclic
Compounds

Name of the Course : B.Sc. (H) Chemistry

Semester : IV

Duration : 3 Hours

Maximum Marks : 90

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt six questions in all.

All questions carry equal marks.

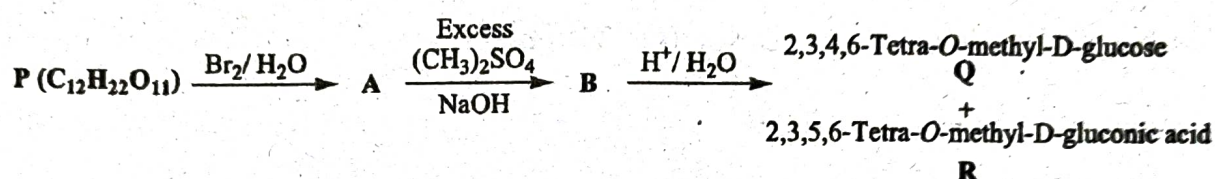
1. (a) An α -D-methylglycoside **X** (molecular formula $C_7H_{14}O_6$) consumes 2 moles of periodic acid (HIO_4) to give one mole of $HCHO$, and the product **A**. On subsequent oxidation with bromine/ H_2O in the presence of $SrCO_3$, **A** gives the crystalline salt **B**. With reactions, arrive at the possible structures for **X**, **A** and **B**.
- (b) Which is the anomeric carbon in fructose ? Draw the Fischer projection formula for the two anomeric forms of D-fructofuranose.
- (c) What are steroids ? Give an example and discuss its biological importance. What are good and bad cholesterols ?

5,5,5

P.T.O.

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2. (a) A carbohydrate **P** (molecular formula $C_{12}H_{22}O_{11}$) on enzymatic hydrolysis gives D-glucose. **P** reacts with bromine water as well as Benedict reagent. When **P** is subjected to the following sequence of reactions **Q** and **R** are obtained as products. Deduce the structure for **P**, **A** and **B** and explain the reaction involved.



- (b) Electrophilic substitution reactions in furan occur at C-2 position. Show the attack of the electrophile and justify.
- (c) (i) Write the products for the HIO_4 oxidation of the open chain form of D-fructose.
- (ii) Differentiate between amylose and amylopectin based on the glycosidic linkage and the monosaccharide units along with their structures.

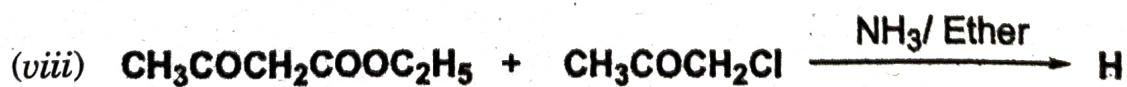
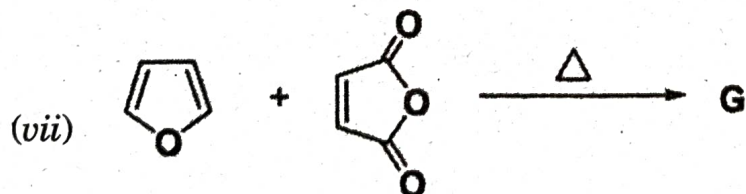
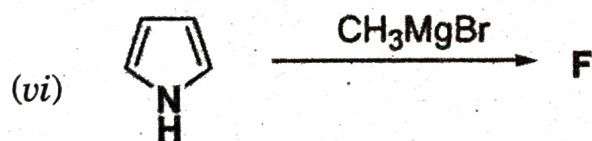
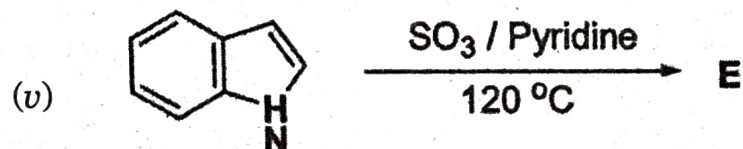
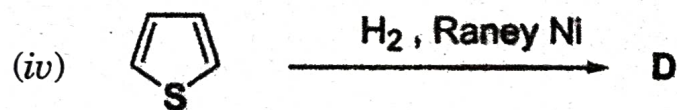
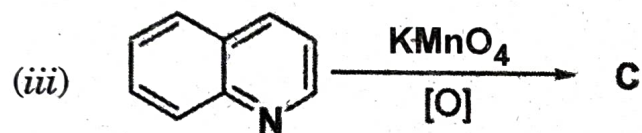
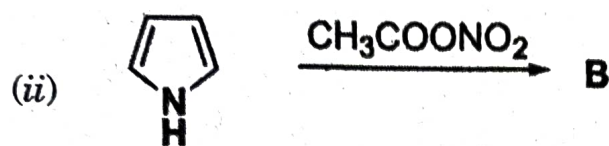
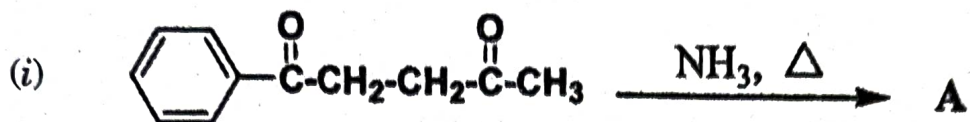
5,5,5

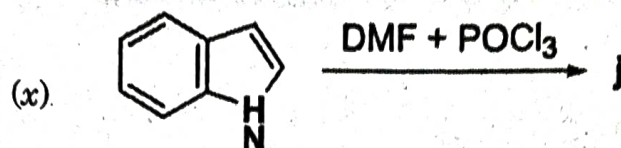
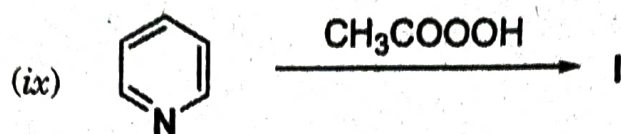
3. (a) Identify the two products formed when an aldohexose reacts with excess of acetic anhydride in the presence of sodium acetate. Will the two products obtained react with excess of phenylhydrazine ? Explain.
- (b) How will you confirm the ring size of glucopyranose by the methylation method ? Give the reactions involved.

- (c) An aromatic compound **A** (molecular formula C_5H_5N) on treatment with *n*-butyl lithium at $100^\circ C$ gives **B** ($C_9H_{13}N$). **B** on oxidation with alkaline $KMnO_4$ gives **C**, which on further treatment with PCl_5 followed by NH_3 gives **D**. **D** on Hofmann bromamide reaction gives 2-aminopyridine. Complete the sequence of the reactions giving the structures of **A**, **B**, **C** and **D**. 5,5,5
4. (a) Distinguish between the following with examples and structures wherever required :
- (i) Phospholipids and glycolipids
 - (ii) Omega-3-fatty acid and omega-6-fatty acid.
- (b) How many isomers can be drawn for a D-aldohehexose ? Draw their structures. Which of these on oxidation with nitric acid give *meso*-aldaric acid ?
- (c) Pyrrole undergoes ring expansion on treatment with $CHCl_3$ and aqueous KOH . Write the complete reaction and mechanism involved. 5,5,5
5. (a) What are epimers ? Suggest the method for the conversion of D-glucose to its epimer.
- (b) Write the product obtained when phenylhydrazone of acetone is treated with conc. H_2SO_4 . Give the name of the reaction and the mechanism involved.

- (c) Carry out the following conversions :
- (i) Pyrrole to 2-formylpyrrole
 - (ii) Thiophene to thiophene-2-carboxylic acid. 5,5,5
6. (a) Draw the resonating structures for quinoline. Explain the orientation of electrophilic substitution in quinoline.
- (b) Draw the structure for the triglyceride **A**, which on hydrolysis gives glycerol and 3 equivalents of oleic acid. Write the complete reaction. Further, write the products obtained when **A** reacts with :
- (i) $\text{Br}_2/\text{CH}_2\text{Cl}_2$
 - (ii) H_2/Pd
 - (iii) O_3 and $\text{Zn}/\text{CH}_3\text{COOH}$.
- (c) Arrange the following and justify :
- (i) Pyrrole, pyrrolidine and pyridine in increasing order of basicity.
 - (ii) Furan, thiophene and pyrrole in increasing order of their reactivity toward electrophiles. 5,5,5
7. Write short notes on (any three) :
- (a) Skraup synthesis of quinoline
 - (b) Hantzsch pyridine synthesis
 - (c) Saponification value and its significance
 - (d) Mutarotation in glucose. 5,5,5

8. (a) Complete the following reactions :





(b) Write short notes on (any *two*) :

(i) Inversion of sugar

(ii) Chichibabin reaction

(iii) Fischer projection of lactose.

10,5

(7)
[This question paper contains 4 printed pages]

Your Roll No. :

Sl. No. of Q. Paper : **2031**

Unique Paper Code : **2172012403**

Name of the Course : **DSC : B.Sc.(H.)
Chemistry**

Name of the Paper : **Electrochemical cells
Chemical Kinetics and
Catalysis**

Semester : **IV**

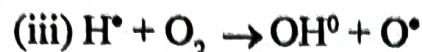
Time : 3 Hours

Maximum Marks : 90

Instructions for Candidates :

- (a) Write your Roll No. on the top immediately on receipt of this question paper.
 - (b) Attempt any **Six** questions in **all**.
 - (c) Question **NO.1** is compulsory.
 - (c) Use of scientific calculators is allowed.
1. Explain giving reason. Attempt any **five**. 3×5=15
- (a) Why is the polarity of electrodes reversed in galvanic and electrolytic cells ?
 - (b) Will Pb react with AgNO_3 if $E^\circ_{\text{Ag}^+/\text{Ag}} = 0.799\text{V}$ and $E^\circ_{\text{Pb}^{2+}/\text{Pb}} = -0.126\text{V}$
 - (c) Why is there a potential jump at the equivalence point in the titration of $\text{K}_2\text{Cr}_2\text{O}_7$ with Mh's salt ?
 - (d) What will be the order of the reaction $\text{A} + 2\text{B} \rightarrow \text{C}$?
 - (e) Why does the rate of a reaction usually increase on increasing temperature ?
 - (f) Identify the following as initiation, propagation, branching or termination reaction

P.T.O.



2. (a) The following data were obtained for dimerization of

butadiene according to the equation $\text{C}_4\text{H}_6 \rightarrow \frac{1}{2}\text{C}_8\text{H}_{12}$ 5

t/min 0 6.12 12.18 17.30 29.18

P_t/torr 632 606.6 584.2 567.3 535.4

Show that the reaction is of second order and determine the rate constant.

- (b) Describe Lindemann mechanism for unimolecular reactions. Under what conditions does the reaction becomes of second order? 5
- (c) Explain the terms enzyme selectivity and specificity giving suitable examples. 5
3. (a) The half life of a first order decomposition reaction is 363 min at 298K and the energy of activation is 217.6 kJmol⁻¹. Calculate the time required for 75% of the reactant to be decomposed at 650K. 5
- (b) Setup mechanism of a unimolecular surface catalyzed reaction and derive its rate law. 5
- (c) Explain the following briefly giving example of each : catalyst, promoter and Inhibitor. 5
4. (a) The enzyme catalase catalyses the reaction $2\text{H}_2\text{O}_2(\text{aq}) \rightarrow 2\text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g})$ It has a Michaelis Menten constant of $25 \times 10^{-3} \text{ mol dm}^{-3}$ and a turnover number of $4 \times 10^7 \text{ s}^{-1}$. If the total concentration of the enzyme is $1.6 \times 10^{-8} \text{ mol dm}^{-3}$ and the initial substrate concentration is $4.32 \times 10^{-6} \text{ mol dm}^{-3}$ calculate the initial rate and the maximum rate of the reaction. 5
- (b) The following mechanism has been suggested for the pyrolysis of monosilane 5



Show that

$$\frac{d[\text{H}_2]}{dt} = \frac{d[\text{Si}_2\text{H}_6]}{dt} = \left\{ k_3 \left(\frac{k_1}{k_4} \right)^{\frac{1}{2}} [\text{SiH}_4]^{\frac{1}{2}} + k_1 \right\} [\text{SiH}_4]$$

- (c) What are stationary and non-stationary chain reactions ?
Explain briefly. 5
5. (a) Consider the reaction $2\text{MnO}_4^- + 6\text{H}^+ + 5\text{H}_2\text{C}_2\text{O}_4 \rightarrow 2\text{Mn}^{2+} + 8\text{H}_2\text{O} + 10\text{CO}_2$. Construct the cell with this cell reaction, write electrode reactions and calculate the standard equilibrium constant given that $E^\circ_{\text{MnO}_4^-/\text{Mn}^{2+}} = 1.51\text{V}$ and $E^\circ_{\text{H}_2\text{C}_2\text{O}_4/\text{CO}_2} = -0.49\text{V}$
- (b) Write activity of $(\text{NH}_4)_2\text{SO}_4$ in terms of its molality. If molality of a solution of $(\text{NH}_4)_2\text{SO}_4$ is 1.2 mol kg^{-1} and the mean activity coefficient is 0.85 calculate the activity. 5
- (c) Explain the working of a potentiometer for measurement of cell potential. Why is it essential to use potentiometer instead of a voltmeter for measuring cell potential ? 5
6. (a) For the cell $\text{Pt}/\text{H}_2(\text{g}, 1 \text{ bar})/\text{HCl}(\text{aq})/\text{AgCl}(\text{s})/\text{Ag}$ $E^\circ = 0.222\text{V}$ and $E_{\text{cell}} = 0.332\text{V}$ at 298 K. Calculate the pH of the solution ? Assume that the activities can be replaced by concentration. 5

- (b) Construct cell having the reaction $\text{H}_2(\text{g}) + \frac{1}{2} \text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l})$. Write half-cell reactions and expression for cell potential. 5
- (c) Why does a potential develop at the boundary of two electrolyte solutions having same chemical composition but different concentrations? How can this potential be removed? 5
7. (a) Write the electrode reactions, transference reactions and cell reaction and calculate cell potential for the cell 5
 $\text{Pb}/\text{PbSO}_4(\text{s}), \text{CuSO}_4(0.2\text{mol Kg}^{-1}, \gamma_{\pm} = 0.110) : \text{CuSO}_4(0.02\text{mol kg}^{-1}, \gamma_{\pm} = 0.32)/\text{PbSO}_4(\text{s})/\text{Pb}$ given that $t_{\text{Cu}^{2+}} = 0.37$.
- (b) Compute standard reduction potential for the reaction $\text{Cr}^{2+} + 2\text{e} \rightarrow \text{Cr}$ from the following data and derive the Nernst equation for the half cell with above reaction. 5
 $\text{Cr}^{3+} + 3\text{e} \rightarrow \text{Cr} \quad E^0 = -0.74\text{V}$
 $\text{Cr}^{3+} + \text{e} \rightarrow \text{Cr}^{2+} \quad E^0 = -0.74\text{V}$
- (c) What are reference electrodes? Give an example of reference electrode along with an expression for its reduction potential. Give one application of a reference electrode. 5
8. (a) Consider the following reaction $\text{A} \xrightarrow{k_1} \text{B} \xrightarrow{k_2} \text{C}$. If $k_1 = 40\text{s}^{-1}$ and $k_2 = 15\text{s}^{-1}$ and the reaction is carried out with pure A at initial concentration of 1mol dm^{-3} what will be the composition of the reaction mixture after an interval of 10 mins? 5
- (b) Describe the salient features of collision theory for bimolecular reactions? 5
- (c) What are secondary cells? Explain its working using a suitable example. 5

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1725

L

Unique Paper Code : 2172013601

Name of the Paper : DSC : Principles in qualitative analysis and bioinorganic chemistry

Name of the Course : B.SC. (HONS) CHEMISTRY (UGCF-NEP)

Semester : VI

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any four questions. All questions carry equal marks.

1. (a) Draw the percentage oxygen saturation curves for Haemoglobin. Explain how a change influences it?

(b) A test tube contains an aqueous solution of Cr(III) and Al(III) ions. Suggest reagent/reagents to separate the cations. Give confirmatory tests to detect the two cations with equations.

(c) Identify the ions that are detected by the following reagents. Also, write the chemical reactions involved.

(i) Dimethyl glyoxime

(ii) Zirconium nitrate

(5,5,5)

2. (a) Distinguish between essential and non-essential elements. Draw the dose-response curve for an essential element and a toxic element.

(b) How are nitrate and nitrite ions tested when present together in a mixture? Give equations to support your answer.

(c) Define Therapeutic Index. Why is cisplatin a preferred anti-cancer drug in contrast to transplatin? Explain the mechanism of action.

(5,5,5)

3. (a) What are ionophores? How are they different from ion channels? Give one example.

(b) Which specialized proteins are used for the transport of iron in the bloodstream? Can free iron be transported in the bloodstream?

(c) A metal 'M' is capable of existing in two oxidation states, +III and +V. An aqueous solution of its salt in the lower oxidation state gives a white precipitate on the addition of concentrated ammonia, which, however, disappears on adding hydrochloric acid. 'X' is a compound of 'M' in the higher oxidation state. It is used to detect Mn(II). Identify 'M' and 'X' and give the reactions.

(5,5,5)

4. (a) Explain the mechanism of conduction of nerve impulses? Draw a well-labeled action potential graph.

(b) An aqueous solution of sodium sulphide cannot be used to separate Group IIA and Group IIB. Explain. Why are cadmium ions frequently missed in group II analysis?

(c) Why NH_4Cl is added with NH_4OH in Group III of Cation Analysis?

(d) Explain the role of cytochrome-C-oxidase in humans? Where is it present?

(5,2.5, 2.5,5)

5. (a) What do you understand by compartmentalization in the context of a living cell? Explain the calcium ion pump diagrammatically.

(b) Give confirmatory tests for Borate and Fluoride ions in a salt mixture. Why are they called interfering ions?

(c) What are the special properties of zinc that make it an excellent biocatalyst? What is the role of the enzyme carbonic anhydrase? What is the coordination number and geometry of zinc ions in carbonic anhydrase?

(5,5,5)

6. (a) Give the chemistry behind the flame test for cations? What colour do Ca(II) and Ba(II) ions show in the flame?

(b) What is chelation therapy? What special properties should a ligand possess so that it can be used in this therapy?

(c) Why do Pb(II) ions sometimes precipitate in Group I as well as Group II in qualitative mixture analysis for cations? Give one confirmatory test for the detection of Pb(II) ions in Group I?

(5,5,5)

(2000)

9
[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1744

L

Unique Paper Code : 2172013602

Name of the Paper : DSC: Polynuclear Hydrocarbons, Photochemistry, Pericyclic Reactions, and Spectroscopy of Organic Compounds

Name of the Course : B.Sc. (Hons) Chemistry

Semester : VI

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **six** questions in all.
3. Each question carries **15** Marks.
4. Attempt sub-parts of each question together.

1. (a) Sulphonation of naphthalene with conc. H_2SO_4 at 40°C and 160°C yields two different products Explain using a suitable energy diagram.

(b) (i) Anthracene is less aromatic and more reactive than benzene and naphthalene. Explain.

(ii) How will you prepare anthracene from o-bromobenzyl bromide?

(c) Carry out the following conversions : (Any two)

(i) Anisole(methoxybenzene) to 7-methoxy-1-methylnaphthalene

(ii) Naphthalene to anthracene

(iii) Anthracene to 1-ethylantracene (5,5,5)

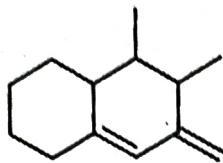
2. (a) Define ξ_{max} and explain why the intensity of $\pi \rightarrow \pi^*$ transitions are 10 to 100 times higher than $n \rightarrow \pi^*$ transitions.

(b) Differentiate between a bathochromic and a hypsochromic shift using a suitable example.

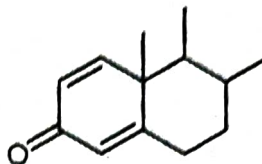
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- (c) Using Woodward-Fieser rules, calculate the $\lambda_{\max}$ values for the following compounds :

i.



ii.



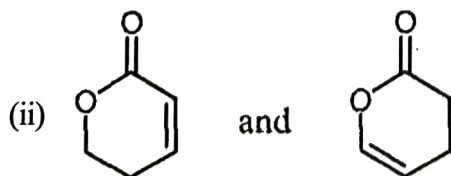
Given :

Heteroannular Dienes	215 nm
Homoannular Dienes	253 nm
α , β -unsaturated ketones (six-membered)	215 nm
Alkyl group (dienes and polyenes)	+ 5 nm
Exocyclic Double bond	+ 5 nm
Increments for extended conjugation	+ 30 nm

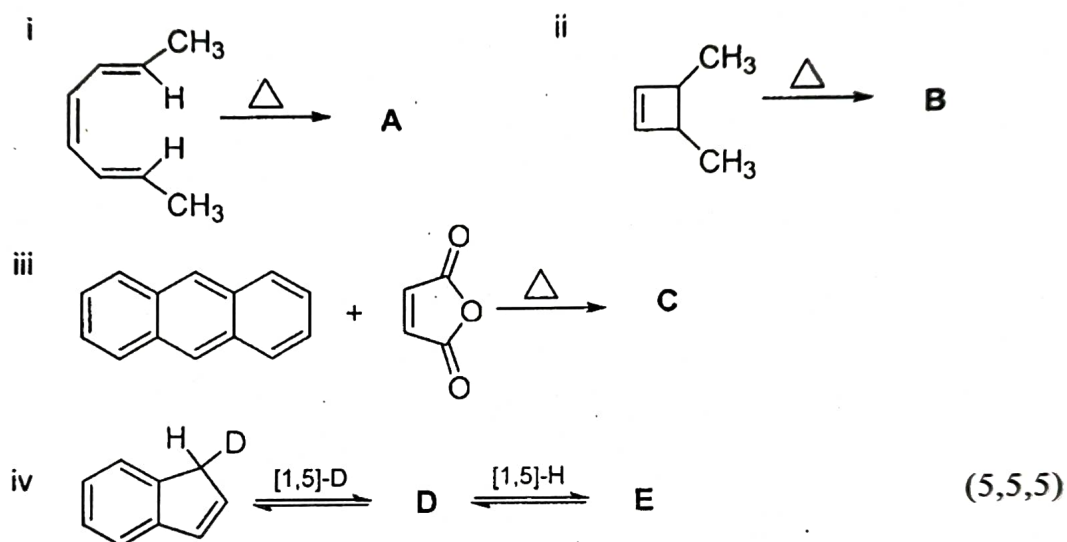
α , β , γ , δ ring residues or alkyl groups for α , β -unsaturated carbonyl compound: + 10, 12, 18, 18 nm respectively.

- (d) Give the frequency ranges for the functional and fingerprint regions in the IR spectrum and explain their importance to IR spectroscopy, taking a suitable example.
- (e) With the help of suitable diagrams, explain why alkenes absorb in the range 4.5 to 6.5 ppm, and aromatic compounds absorb in the range 6.5-8.0 ppm in the NMR spectrum, when both have C=C bonds. (3×5=15)
3. (a) What do you mean by the terms IR-active and IR- inactive? Give reasons and explain which of the following compounds would be IR active and which would be IR inactive?
- (i) 2,3-Dimethylbut-2-ene
- (ii) 1-Butyne
- (b) How will you differentiate between the following compounds using IR spectroscopy?

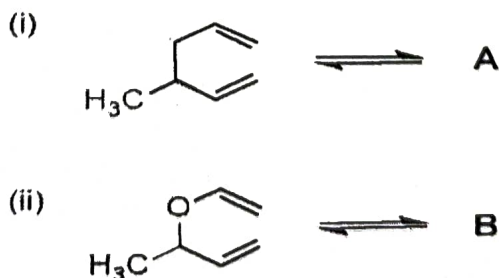
- (i) $\text{CH}_2\text{CO}_2\text{H}$ and CH_3COCH_3



- (c) Define chemical shift in ppm and give its mathematical expression. Explain why all protons in a molecule do not absorb at the same frequency in the NMR region? (5,5,5)
4. (a) Define coupling constant. Explain how you will distinguish between *cis* and *trans*-crotonic acid ($\text{MeCH}=\text{CHCOOH}$) by their NMR spectra?
- (b) Discuss the correlation diagram for conrotatory and disrotatory cyclization of butadiene to cyclobutene.
- (c) Predict the product(s) of the following reactions :



5. (a) The combination of a carbonyl compound and an alkene leads to the formation of a photoadduct. Give the name and discuss the mechanism of this reaction in detail.
- (b) Complete the following reaction :



Draw the aromatic transition state for each reaction and illustrate the product formation using curved arrow notation. Mention the name of the reactions.

P.T.O.

- (c) Thermal [4+2] cycloaddition of 1,3-butadiene and ethylene is symmetry-allowed. Explain. (5,5,5)
6. (a) Calculate DBE and write the structural formulae for the compounds with the following molecular formulae, showing the mentioned signals in their NMR spectra :
- (i) $C_2H_4Cl_2$; one
 - (ii) C_8H_{18} ; one
 - (iii) C_9H_{12} ; two
- (b) How would you distinguish between the following pairs of compounds based on their NMR spectra?
- (i) Geometric isomers of 1,2-dimethylcyclopropane
 - (ii) But-1-yne and but-2-yne
- (c) Draw the PMR spectrum of ethyl acetate and explain multiplicity and approximate chemical shift values for each signal. (5,5,5)
7. (a) An organic compound, A, with molecular formula $C_{10}H_{12}O_2$, shows the following spectral data: UV absorption at λ_{max} 220 nm (ϵ_{max} 1800); IR absorption bands at 3077, 2976, 1745, 1608, 1497, 1456 cm^{-1} ; PMR absorption bands at δ 7.3 s; 4.3 (t, $J=7$ Hz); 3.0 (t, $J=7$ Hz); 2.1 (s) in the ratio 2.5:1: 1: 1.5.
- (i) Calculate DBE.
 - (ii) Explain UV, IR, and PMR Data.
 - (iii) Give the structure of the compound A.
 - (iv) Write the products (B) obtained when A is hydrolyzed with concentrated sulphuric acid.
- (b) Paracetamol is hydrolyzed in a basic medium to a compound, A, with molecular formula C_6H_7NO . Write the structure of A and explain how IR and NMR data (only main peaks) can be used to distinguish between the reactant and the product. (10,5)
8. Write short notes on the following (Any three) :
- (a) Molecular orbital theory of color and constitution
 - (b) Effect of inter- and intramolecular H-bonding on IR absorptions
 - (c) Photosensitization
 - (d) Howarth's synthesis of anthracene (5,5,5)

(2200)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1763

L

Unique Paper Code : 2172013603

Name of the Paper : DSC: PHOTOCHEMISTRY AND SPECTROSCOPY

Name of the Course : B.Sc. (H) Chemistry

Semester / Scheme : VI / NEP-UGCF-2022

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **four** questions out of **six**.
3. Question no. 1 is compulsory'
4. Attempt all parts of a question together.
5. Use of scientific calculators and log tables is allowed.

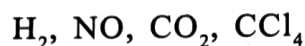
Physical constants

Atomic mass unit	:	$1.66 \times 10^{-27} \text{ kg}$
Planck's constant	:	$6.626 \times 10^{-34} \text{ J s}$
Velocity of Light	:	$3 \times 10^8 \text{ m s}^{-1}$
Boltzmann constant	:	$1.381 \times 10^{-23} \text{ J K}^{-1}$
Mass of Electron	:	$9.1 \times 10^{-31} \text{ kg}$
Avogadro's number	:	$6.022 \times 10^{23} \text{ mol}^{-1}$
Nuclear magneton	:	$5.047 \times 10^{-27} \text{ J T}^{-1}$
Bohr magneton	:	$9.274 \times 10^{-24} \text{ J T}^{-1}$

1. Attempt **any five** of the following :

- (a) Explain why aromatic protons generally resonate at higher chemical shift values (δ 7-8 ppm) than aliphatic protons in NMR spectroscopy.

- (b) Why is DPPH used as the practical reference standard in ESR spectroscopy instead of a free electron? Mention the properties that make it suitable for this purpose.
- (c) Explain Fermi resonance with appropriate example.
- (d) Which of the following molecules will be microwave active and why?



- (e) Photosynthesis is a photosensitized reaction. Explain.
- (f) Why phosphorescence is delayed and has a longer lifetime than fluorescence. (3×5=15)

2. (a) Determine the value of the rotational quantum number J for which $\frac{N_J}{N_0}$ is maximum for the molecule $^{12}\text{C}^{16}\text{O}$ at 25°C , given that the rotational constant is 1.9302 cm^{-1} . Which transition will be most intense?

- (b) What is the essential condition for a molecule to be infrared active? Give the selection rule and the energy expressions for a molecule undergoing (i) harmonic oscillation (ii) anharmonic oscillation.

- (c) Assuming that the force constants of HCl and DCl are same calculate the fundamental vibrational frequency of DCl if the fundamental vibrational frequency of HCl is 2890 cm^{-1} . Calculate the zero-point energies of both the molecules if the vibration is assumed to be harmonic in nature.

(5,5,5)

3. (a) Differentiate between dissociation and predissociation. Explain their spectral significance with the help of a diagram.

- (b) Two molecules A and B absorb one photon each of same energy. Molecule A dissociates directly while molecule B undergoes predissociation. Explain the difference in their excited state behaviour with the help of potential energy diagram.

- (c) Describe how the Beer-Lambert law is used in determining concentration of a coloured solution. Under what conditions does it fail. (5,5,5)
4. (a) State the selection rules for pure rotational and pure vibrational Raman spectroscopy and the condition for the molecule to be Raman active. Explain why symmetric vibrational modes are often intense in Raman spectra but weak or absent in infrared spectra.
- (b) For A_2B , the following spectroscopic data are available. Giving proper explanation predict the geometry of the molecule. Assign the wave number to specific vibrations.

Wavenumber (cm^{-1})	Infrared	Raman
589	Active (PQR)	Inactive
1285	Active (PR)	Active (polarized)
2224	Active (PR)	Active (depolarized)

- (c) Define quantum yield and discuss the role of chemical actinometer in its measurement. Explain the factors responsible for high and low quantum yield. (5,5,5)
5. (a) Draw and explain the low-resolution and high-resolution PMR spectra of (i) methanol and (ii) acetone, indicating the chemical shift positions of different proton environments, relative signal intensities, and splitting patterns observed in each case.
- (b) What is meant by chemical shift in NMR spectroscopy? Calculate the resonance frequency(ν) for ^1H in a magnetic field of 1.50 T. Given: $g_n = 5.585$, $\beta_n = 5.050 \times 10^{-27} \text{ JT}^{-1}$.

- (c) Draw the ESR spectrum of methyl radical and explain the observed hyperfine splitting pattern on the basis of electron-nuclear spin interaction.

(5,5,5)

6. Write short notes on **any three** of the following :

- (a) Frank-Condon Principle
- (b) Factors affecting the intensity of spectral lines
- (c) Photostationary state and Quenching
- (d) Larmor precession

(5×3=15)

(2000)

11
This question paper contains 4 printed pages]

Roll No.

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S. No. of Question Paper : **1962**

Unique Paper Code : **2173012019**

Name of the Paper : **Research Methodology for Chemists**

Name of the Course : **B.Sc. (H) Chemistry**

Semester : **VI**

Duration : **3 Hours**

Maximum Marks : **90**

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt any six questions.

All questions carry equal marks.

Use of a calculator is allowed.

1. (a) Discuss the role of the TRIPS agreement in protecting intellectual property.
- (b) Write short notes on any two :
 - (i) Sci finder
 - (ii) PubMed
 - (iii) Web of science
- (c) What is the difference between qualitative and quantitative data ?
Give examples. 5,5,5

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2. (a) Explain :
- (i) i-10 index
 - (ii) Self-plagiarism
- (b) ResearchGate is a social network for researchers. Justify the statement, giving arguments based on its usage and utility.
- (c) A company from Hyderabad makes perfumes using traditional distillation methods. They sell it under a brand name "Itr-e-Hyderabad" and in a uniquely shaped glass bottle. The exact ratio of flower extracts is kept confidential. Identify the four forms of IPRs which can be used for protection and state the validity period for each protection in India. 5,5,5
3. (a) Differentiate between primary and secondary sources of information. Give *two* examples for each one.
- (b) Riya, an M.Sc. Chemistry student, was working on a project to develop an eco-friendly dye. She submitted her project report to the department. In her report, she copied two paragraphs about dye chemistry from Wikipedia without any reference. She also did not mention her classmate Arjun. Who helped her with the UV-Vis spectra.
- Based on the above case, answer the following :
- (i) Discuss the *two* unethical practices done by Riya.
 - (ii) Why is it important to give credit to sources and co-workers in research ?
- (c) Differentiate between Copyright and Patent. 5,5,5

4. (a) How does the h-index help in assessing the quality of a researcher's publications ? A researcher has citation counts : 25, 20, 15, 8, 6, 4, 2 for the seven research papers. Calculate the h-index of the researcher.
- (b) Describe the role of software tools like Turnitin and Urkund in upholding research ethics.
- (c) What do you understand by search techniques ? How do search techniques improve the literature survey ? 5,5,5
5. (a) Give the journal abbreviations (any five) :
- (i) Journal of Physical Chemistry A
 - (ii) Chemical Reviews
 - (iii) Journal of the American Chemical Society
 - (iv) Bioorganic Medicinal Chemistry Letters
 - (v) Journal of Organic Chemistry
 - (vi) Chemical Physics Letters.
- (b) What is binomial distribution ? Represent it graphically.
- (c) What is a digital database in research ? Why are databases like Science Direct and Google Scholar important for researchers ? 5,5,5

P.T.O.

6. (a) How should a scientific oral presentation be planned and delivered to effectively communicate research findings ?
- (b) Discuss the structure of a thesis. What is the layout of a standard thesis chapter ?
- (c) A researcher wants to publish a paper. What factors should be considered while selecting a journal and outline the complete submission process. 5,5,5
7. (a) Write a short note on SPSS and Microsoft excel.
- (b) The percent purity of a gold sample was determined experimentally as :
10.2, 10.4, 10.3, 10.5, 10.6.
Calculate mean and standard deviation.
- (c) A project proposal includes strong methodology but very weak literature review :
- (i) How does a poor literature review affect the proposal ?
- (ii) What steps should be taken to strengthen it ? 5,5,5
8. (a) The percentage of uranium in pitchblende ore was found to be 1.2, 1.4, 1.8, 2.0, 2.4. Using the t test whether the result differs significantly from the true value = 1.0 at 95% confidence level. Degrees of freedom, $df = 4$, $t(\text{table})$ at 95% confidence = 2.776.
- (b) What is short communication in scientific writing ? How is it different from a full-length research paper ?
- (c) What is Correlation ? Explain the different types of correlation with graphical representation. 5,5,5

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1706

L

Unique Paper Code : 2172014801

Name of the Paper : Advanced Chemistry – II

Name of the Course : B.Sc. (Hons) Chemistry

Semester : VIII

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are **three** sections in this paper.
3. Attempt any **two** questions from each section.
4. In total, you must answer **six** out of **nine** questions.
5. **All** questions carry equal marks.
6. Attempt all parts of a question, and all questions of a section together.

SECTION – A

1. (a) Discuss the role of biomineralization in the formation of bones, teeth, and shells.
(b) Explain the role of biocatalysts in metabolism of carbon.
(c) Describe the biological significance of nickel ions in living systems.
(5,5,5)
2. (a) Describe the composition and function of dentin in natural teeth.
(b) Discuss the antimicrobial role of silver nanoparticles in biomedical applications.
(c) Differentiate between hydroxyapatite and tricalcium phosphate in bone repair.
(5,5,5)
3. (a) Discuss the biomedical applications of stainless steel as an implant material.
(b) Compare natural bone with synthetic calcium phosphate ceramics.
(c) Give the role of metal ions in medicines.
(5,5,5)

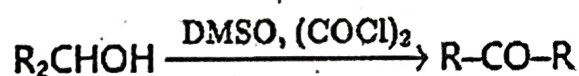
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SECTION – B

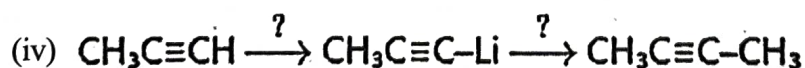
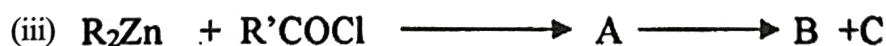
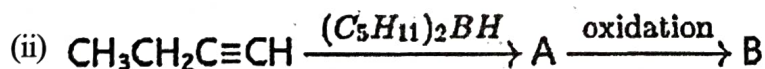
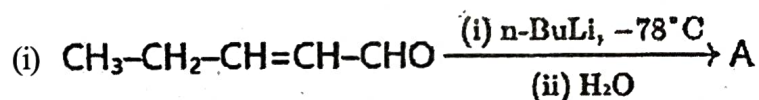
1. (a) How is iodomethyl zinc chloride prepared? Give its reaction with propene with mechanism and name of the reaction.
- (b) Discuss the role of Collin's reagent and PCC in oxidation.
- (c) Write the full form and structure of DIBAL-H. Complete the following reaction and write its mechanism.



2. (a) Discuss with mechanism the polyhydroxylation of trans-crotonic acid in presence of KMnO_4 with stereochemistry involved.
- (b) Give the name and mechanism of the following reaction.



- (c) Complete the following reactions :



3. Write short notes on the following (Attempt **any three**)

- (a) Oxidation by thallium nitrate
- (b) Hydroboration-oxidation
- (c) PTC and crown ether
- (d) Organo aluminium compounds (5,5,5)

SECTION – C

1. (a) Derive the Stirling's approximation. Write its significance in statistical mechanics. Calculate $\ln 100!$ using Stirling's approximation.

(b) Explain the concept of Microcanonical and Canonical ensemble. Discuss their main features and assumptions. To study an isolated system which ensemble would you choose and what will be its characteristic thermodynamic function?

(c) Why is the partition function also known as the store house of information. Give examples to justify it. (5,5,5)
2. (a) Derive the condition under which Maxwell-Boltzmann statistics becomes valid for a quantum system (Fermi-Dirac and Bose Einstein Statistics).

(b) For a system whose internal energy is zero and partition function is 10 at 300 K. Calculate Gibbs free energy. Helmholtz free energy and entropy of the system in a canonical ensemble.

(c) What are the key features of a random walk problem in 1-Dimension? Which real life problem does it mimic? If a particle starts from the origin and takes N steps, does it ever return to origin? Under what condition will returning to origin become impossible? (5,5,5)

P.T.O.

3. (a) A polydisperse sample of polymethyl methacrylate (PMMA) is prepared by mixing three monodisperse samples in the following proportions:

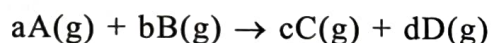
$$1g = 10,000 \text{ g/mol}$$

$$2g = 50,000 \text{ g/mol}$$

$$2g = 100,000 \text{ g/mol}$$

Using this information calculate the number average molecular weight, weight average molecular weight and polydispersity index of the mixture.

- (b) Why is the Conventional Transition State Theory (CTST) also known as the Activated Complex Theory (ACT)? Derive an expression of rate constant in terms of partition function for a given general reaction :



- (c) Calculate the ratio of translation partition functions for same volume of two gases A & B at 300 K and 900 K. If the temperature is kept constant and volume increased from 2 L to 8 L, how do this ratio change? (5,5,5)

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7258

L

Unique Paper Code : 2173550008

Name of the Paper : DSE: Transition Metal Cluster - Introduction and Applications

Name of the Course : B.Sc. (Hons.) Chemistry

Semester : VIII

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **four** questions.
3. All questions carry equal marks.

1. a) Briefly explain the Polyhedral Skeletal Electron Pair Theory (PSEPT).
 b) Discuss the general methods of preparation of metal cluster compounds.
 c) Explain why the metal-metal bond length change is very small for the metal clusters of rhenium even though the bond order changes. $\text{Re}_2\text{Cl}_4(\text{PMe}_2\text{Ph})_4$, $\text{Re}_2\text{Cl}_4(\text{PMe}_2\text{Ph})_4^+$, $\text{Re}_2\text{Cl}_4(\text{PMe}_2\text{Ph})_4^{2+}$.

(5, 5, 5)

2. a) Using the 18 electron rule, calculate the total no. of M-M bonds, no. of M-M bonds per metal and draw the structure of
 i) $\text{Fe}_2(\text{CO})_9$
 ii) $\text{Os}_3(\text{CO})_{12}$
 b) Briefly outline the differences between Metal-Ligand Complex and Heteronuclear Cluster.
 c) Define Wade's rules. Discuss their application in analyzing the structure of the metal clusters.

(5, 5, 5)

P.T.O.

3. a) With suitable equations give the synthesis of multidecker Sandwich complexes of metallocarboranes.
b) Discuss the mechanistic aspects of Water gas shift reaction catalyzed by $\text{Ru}_3(\text{CO})_{12}$.
c) Using $(14n+2)$ rule, predict the structure of following high nuclearity carbonyl compounds
i) $\text{Rh}_6(\text{CO})_{16}$
ii) $\text{Os}_5\text{C}(\text{CO})_{15}$

(5, 5, 5)

4. a) Define quadruple bond and give one example. Using molecular orbital theory and suitable example, explain the formation of quadruple bond.
b) Define zintl ion clusters. Why they are referred as naked clusters? Explain with one example.
c) Define isolobality. What is the significance of this concept? What are isolobal fragments and frontier orbitals?

(5, 5, 5)

5. a) Define intercalation. Why $\text{Mo}_4\text{Ru}_2\text{S}_8$ fails to form intercalated compounds?
b) Compare a multi-decker sandwich complex with a standard metallocene. Which organic ligands are most commonly used to "bread" these sandwiches?
c) Give the electron count in Pb_5^{2-} and Sn_9^{4-} and indicate the type of structure possessed by these zintl ions.

(5, 5, 5)

6. Write short notes on any **three**

- a) Carboranes
b) Metalloboranes
c) Chevrel compounds
d) Infinite metal chains

(5, 5, 5)

(14)
[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7941

L

Unique Paper Code : 2173550014

Name of the Paper : DSE - Fundamentals of Solid State and Materials Chemistry

Name of the Course : B.Sc. (Hons.)

Semester : VIII

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **FOUR** question in all.
3. Question 1 is compulsory.
4. **All** the questions carry equal marks.

Q1. Give reasons why (Do any 5):

(3 × 5 = 15)

- (a) Cubic Symmetry exhibits higher symmetry than triclinic systems.
- (b) PXRD is called a fingerprint technique.
- (c) NaCl adopts 6:6 coordination and CsCl adopts 8:8.
- (d) Some vibrational modes are IR inactive.
- (e) Diffraction occurs only at specific angles.
- (f) Peak broadening occurs in nanocrystalline materials.

Q2. (a) What is Bragg's Law? Explain all the terms involved in it.

- (b) Differentiate between solid state reaction and wet chemical synthesis routes for synthesis of nanomaterials.
- (c) How can you distinguish between paramagnetic, ferromagnetic, ferrimagnetic and antiferromagnetic materials ?

P.T.O.

- Q3. (a) Discuss IR spectroscopy: principle, molecular vibrations and applications.
(b) What are electronic transitions in UV-Visible Spectroscopy ? Discuss various types of electronic transitions.
(c) Explain Powder X-Ray Diffraction with instrumentation and applications. (5,5,5)
- Q4. (a) Explain SEM and TEM with working principles and applications. Compare both Techniques.
(b) Discuss the advantages and disadvantages of the Top down and Bottom up approach to prepare different kinds of nanomaterials ?
(c) Discuss the deshielding and shielding in Nuclear Magnetic Resonance (NMR) spectroscopy. (5,5,5)
- Q5. (a) Explain the role of characterization techniques for bulk materials.
(b) What are thermal methods of analysis? Briefly discuss the various classification of thermal methods of analysis.
(c) (i) Define chromophore and Auxochrome with suitable examples.
(ii) Explain Williamson-Hall method to determine lattice strains from diffraction patterns. (5,5,5)
- Q6. Write short notes (any three):
(i) Photoluminescence
(ii) Single Crystal X-ray Diffraction
(iii) Band theory of solids
(iv) Atomic Force Microscopy (AFM) (5,5,5)

[This question paper contains 4 printed pages.]

Your Roll No.....

L

Sr. No. of Question Paper : 2942

Unique Paper Code : 2172512401

Name of the Paper : DSC: Chemistry of Carboxylic Acids & their Derivatives, Amines and Heterocycles

Name of the Course : B.Sc. (Prog.)

Semester : IV

Duration : 2 Hours

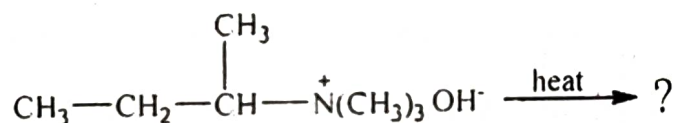
Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **four** questions.
3. All questions carry equal marks.

1. (a) How will you prepare ethylamine from Gabriel Phthalimide Synthesis?

(b) Complete the following reaction :-

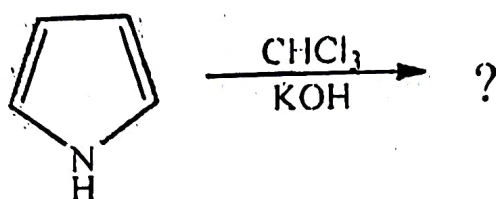
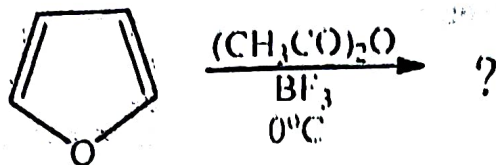
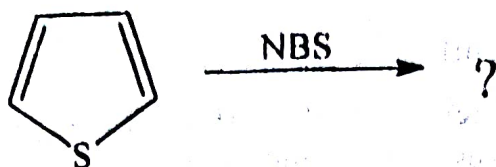


Name the reaction and write the mechanism involved.

- (c) Write the mechanism of alkaline hydrolysis of ethylacetate.
 - (d) Furan is the only five membered heteroaromatic compound which undergo Diels-Alder reaction. Justify the statement. (4,4,4,3)
2. (a) How will you separate the mixture of ethylamine and trimethylamine?
 - (b) What happens when aniline is treated with benzoyl chloride in presence of NaOH? Name the reaction and write the mechanism involved.
 - (c) Write short note on Reformatsky reaction.

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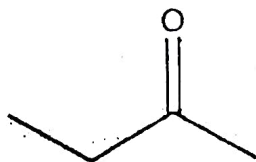
(d) Complete the following reactions :-



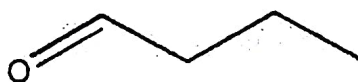
(4,4,4,3)

3. (a) Write the product/s formed on oxidation of the following carbonyl compounds with hot alkaline KMnO_4 followed by treatment with dil. HCl :

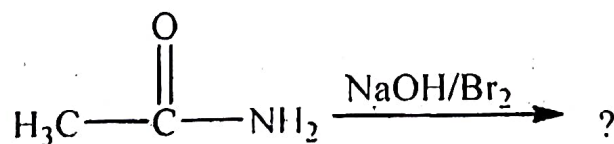
(i)



(ii)



(b) Name the following reaction and complete it with mechanism involved



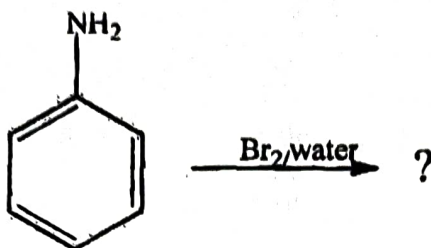
(c) How will you convert the following :-

(i) Furan to Furoic acid

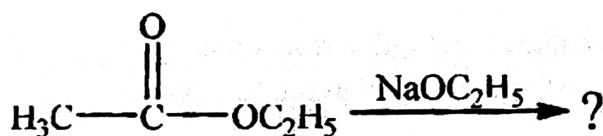
(ii) Pyridine to 2-ethyl pyridine

(d) Which of the form, keto or enol of ethylacetoacetate is steam volatile and why? (4,4,4,3)

4. (a) Explain the product formed in the following reaction with mechanism :-



(b) Complete the following reaction :-



Write the name of the reaction and the mechanism involved.

(c) How will you synthesize furan from Paal Knorr synthesis?

(d) How will you distinguish aniline and diethylamine? (4,4,4,3)

5. (a) Explain the order of reactivities of the following acid derivatives towards nucleophilic acyl substitution reactions acid chloride, acid amide, acid anhydride and esters.

(b) Explain Perkin's reaction with its mechanism.

(c) How will you convert ethyl acetoacetate into

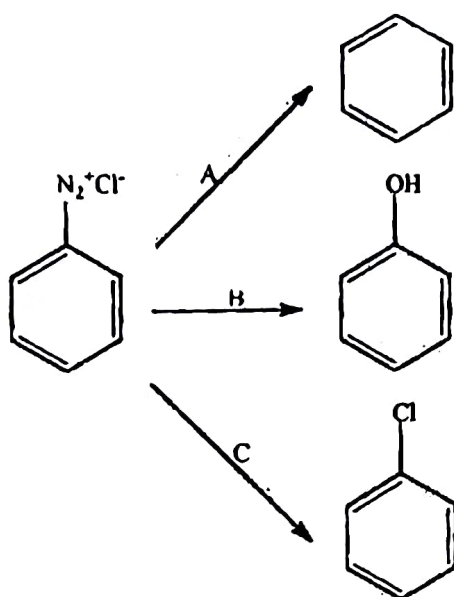
(i) 2,4-hexadione and

(ii) Succinic acid

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(d) Write the reagents A, B and C in the following reactions :-

(4,4,4,3)



6. (a) Pyridine undergoes nucleophilic substitution reaction in addition to electrophilic substitution reaction. Justify the dual behaviour of Pyridine.

(b) How will you prepare crotonic acid from ethyl acetoacetate?

(c) Write down the increasing order of the basic strength of the following bases in gaseous phase:-

Ph-NH_2 , Ph-NH-Me and Ph-N(Me)_2

Explain the order.

(d) Why does aniline not undergo Friedel-Crafts reaction despite having a strongly activating $-\text{NH}_2$ group? (4,4,4,3)

(5000)

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This question paper contains 3 printed pages]

Your Roll No. :

Sl. No. of Q. Paper : **2953** **I**

Unique Paper Code : 2173522006

Name of the Paper : DSE: Biomolecules-I

Name of the Course : **B.Sc. (Porg.)**

Semester : IV/VI

Time : 2 Hours

Maximum Marks : 60

Instructions for Candidates :

- (a) Write your Roll No. on the top immediately on receipt of this question paper.
 - (b) Attempt any **FOUR** questions out of **six**.
 - (c) Each question carries **15 marks**.
 - (d) Attempt all parts of a question together.
1. (i) What are oil and fats? Explain the reason for their physical state.
- (ii) Explain mutarotation taking glucose as an example.
- (iii) Write the components present in DNA and RNA. (5,5,5)

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2. (i) Carry out the following reactions, give complete reaction involved in it (any **two**):
- (a) D-Glucose to n-Hexane
 - (b) D- Glucose to Sorbitol
 - (c) D-Glucose to Glucosazone
- (ii) Define Iodine number. What is its significance? Calculate the iodine number for triolein (Molecular weight=885 g/mol).
- (iii) Name the different types of RNAs and explain their biological roles. (5,5,5)
3. (i) Explain the structure of DNA (Watson-Crick model).
- (ii) What is acid value and saponification value for oil/fats? Write the formula for calculating the both values.
- (iii) Draw and compare the structure of maltose and lactose based on composition and type of bonding. (5,5,5)
4. (i) What is the relationship between glucose, mannose and galactose.

- (ii) Define genetic code and its nonsense codons.
- (iii) What are liposomes and how are they utilized in various field. (5,5,5)
5. (i) What do you mean by hardening of oil? Explain with reaction.
- (ii) What is the difference between Adenine, Adenosine and Adenylic acid.
- (iii) Draw Fischer and Haworth projection for fructose. (5, 5, 5)
6. Write short notes on any **three** of the following : (5, 5, 5)
- (i) Steroid hormones
- (ii) Polysaccharides
- (iii) Reversion and rancidity
- (iv) Transcription

[This question paper contains 4 printed pages.]

Your Roll No.

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Sr. No. of Question Paper : 2956

Unique Paper Code : 2173522009

Name of the Paper : DSE : Biomolecules-II

Name of the Course : B.Sc. (Prog)

Semester : IV / VI

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

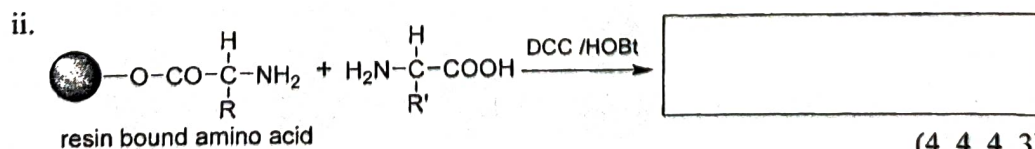
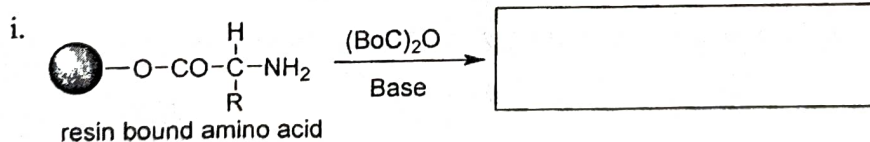
1. Write your Roll No. on the top immediately on receipt of this question paper.
2. All questions have equal marks.
3. Attempt any **four** questions in all.

Q1. (a) Draw the zwitterionic structure of lysine and explain how its net charge changes with pH.

(b) Define the isoelectric point (pI) of an amino acid. Illustrate it with one suitable example and explain its significance.

(c) Describe the Ninhydrin reaction and briefly explain the formation of Ruhemann's purple.

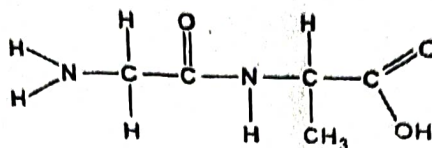
(d) In Merrifield solid-phase synthesis, complete the following steps: Draw the missing structures in each step and write the role of the reagents mentioned above the arrow.



(4, 4, 4, 3)

P.T.O.

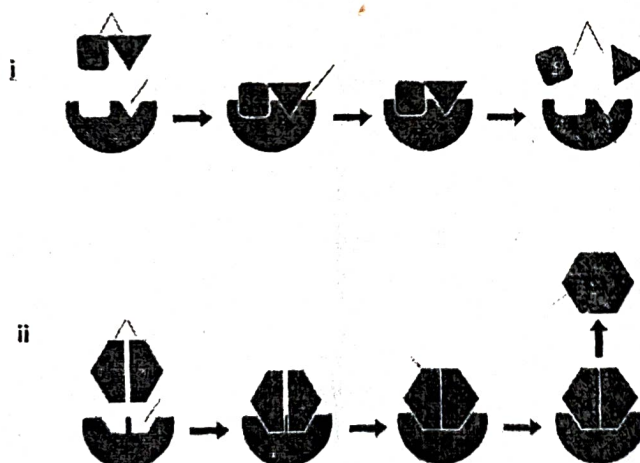
- Q2. (a) In the figure provided, identify the amino acids present and clearly label the peptide bond, N-terminal, and C-terminal ends.



- (b) A dipeptide Val-phe is subjected to Edman degradation.
- Identify which amino acid is released first?
 - Briefly justify your answer based on the principle of the reaction.
- (c) Define metabolism and differentiate between catabolism and anabolism using flowchart.
- (d) Complete the following sentences for the formation of amide bond between two amino acids using the appropriate word:
- The carboxyl group ($-\text{COOH}$) of one amino acid reacts with the _____ group of another amino acid.
 - The reaction involves the removal of a molecule of _____, so it is called a _____ reaction.
 - During the mechanism, the lone pair on the nitrogen atom attacks the _____ of the carboxyl group. The final product formed is a _____.
(4, 4, 4, 3)

- Q3. (a) Classify enzymes with suitable examples.

- (b) The figure shows below the two models of enzyme action. Identify which diagram represents the Lock-and-Key model or Induced Fit model. Justify your answer based on structural features of enzyme-substrate interaction.



(c) Define coenzymes and cofactors with suitable examples.

(d) Match the following:

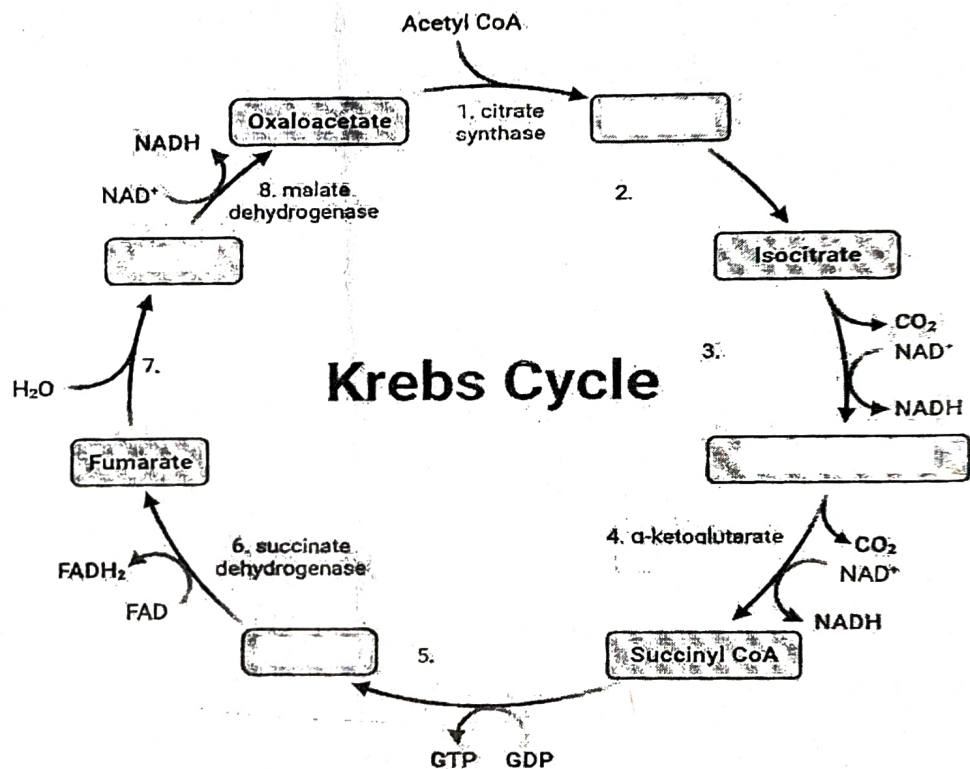
Column A (Factor)

- a) Vitamin B deficiency
- b) High temperature
- c) Ribozyme

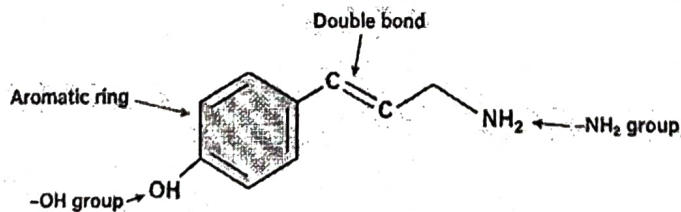
Column B (Effect)

- i) Catalytic RNA
 - ii) Denaturation or instability
 - iii) Reduced coenzyme A formation
- (4, 4, 4, 3)

Q4. (a) Identify the missing compounds in the following Krebs's cycle and name the enzymes (2, 3, 5 and 7) in the metabolic pathways shown in the figure below.



(b) A drug molecule contains the following groups (as indicated in figure below):



P.T.O.

Answer the following:

- i. Which group helps in hydrogen bonding?
- ii. Which group contributes to basic (ionic) interaction?
- iii. Which part makes the molecule rigid?
- iv. Which part is responsible for hydrophobic interaction?

(c) Explain drug action-receptor interaction with suitable structural examples.

(d) Define allosteric inhibition and explain its mechanism of action.

(4, 4, 4, 3)

Q5. (a) Draw the structure of ATP and explain its role as energy currency of the cell.

(b) Represent glycolysis pathway as a flowchart indicating key intermediates and ATP yield.

(300)

(18)
[This question paper contains 4 printed pages]

Your Roll No. :
Sl. No. of Q. Paper : **3028** **I**
Unique Paper Code : 2173550007
Name of the Paper : DSE : Research Methodology for Chemists
Name of the Course : **B.Sc.(Prog.)**
Analytical Chemistry
Semester : VI

Time : 3 Hours

Maximum Marks : 90

Instructions for Candidates :

- (a) Write your Roll No. on the top immediately on receipt of this question paper.
 - (b) Attempt any **six** questions from the total of **eight** provided in the question paper.
 - (c) Answer **all** parts of a question together.
1. Attempt any **three** of the following and write short notes : 5×3=15
- (a) What are Chemical Abstracts, discuss their importance ?
 - (b) Explain the Beilstein database and its use in research.

P.T.O.

- (c) Discuss ethics involved in scientific publications.
 - (d) Define plagiarism and explain its significance in academic writing.
2. (a) Explain in detail the different types of information sources primary, secondary, and tertiary. Provide appropriate examples for each category. 5
- (b) Discuss the role and significance of electronic resources such as e-consortiums, UGC-Infonet Digital Library Consortium, e-journals, and e-books in promoting academic and scientific research. 5
- (c) What is Google Scholar? Describe its main features, for chemical research. Briefly compare it with Scopus. 5
3. (a) What is the historical significance of print resources in libraries, and how have they contribute to research and education? 5
- (b) Explain how discussion groups and online communities benefit researchers. 5
- (c) Discuss the relevance of TOC alerts and Hot Articles in keeping researchers updated. 5

4. (a) Write short notes on Chemindustry and ChemSpider. Discuss their role as sources of chemical information. 5
- (b) What is meant by the h-index? How it is determined and comment on its significance with a suitable example. 5
- (c) What are review articles? Discuss their importance in scientific research and literature. 5
5. (a) Discuss the role of descriptive statistics in summarizing experimental data and outcomes. 5
- (b) Describe the application of the scientific method in the design and conduct of experiments. 5
- (c) Discuss the importance of using protective apparel during experimental activities in the laboratory. 5
6. (a) Discuss the ventilation requirements and safety standards necessary in chemistry laboratories, when handling hazardous gases. 5

- (b) What are SI units? Explain their importance in scientific measurements with suitable examples. 5
- (c) Summarize the emergency response procedures for managing a chemical fire in a laboratory. 5
- 7. (a) Explain the safe practices for the storage of chemical waste prior to its disposal. 5
- (b) Discuss the significance of curve fitting in the analysis of experimental data. 5
- (c) Outline the first-aid procedures to be followed in case of chemical exposure to the eyes in a laboratory. 5
- 8. (a) Discuss the precautions that should be considered while interpreting the results of regression analysis. 5
- (b) Describe the first-aid measures to be followed in cases of exposure to corrosive chemicals. 5
- (c) Explain the concept and significance of standard deviation and variance in data analysis. 5

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7181

L

Unique Paper Code : 2173540017

Name of the Paper : DSE- Fundamentals of medicinal Chemistry

Name of the Course : B.Sc Prog.

Semester : VIII

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **four** out of six.
3. **All** questions carry equal marks i.e. **15** marks.
4. Attempts **all** parts of the questions together.

Attempt any **four** questions in all

- Q1
- a) Give three examples with structure of natural products acting as a drug.
 - b) What is the difference between Lead identification and Lead optimisation. Explain with examples
 - c) Briefly explain how solubility affects a drug's ability to reach its target
 - d) Give two examples to discuss the stereochemical aspects of drug.
 - e) Give the difference between pharmacophore and pharmacodynamics

(3,3,3,3,3)

- Q2
- a) Briefly explain the target site for the drug? Discuss the importance of the target's location (extracellular vs. intracellular)
 - b) What is the significance for the systematic screening of drugs?
 - c) Explain briefly the two types of drug designing with relevant examples

(5, 5, 5)

P.T.O.

- Q3 a) How the drug has been eliminated from the body? Discuss the process briefly?
b) Why there is need for a drug to be metabolised in the body? Discuss the process of metabolism of drug also?
c) What is the clinical significance of half -life of drug. Discuss atleast one example
(5, 5, 5)
- Q4 a) How drug absorption and distribution within the human body.
b) What chemical modifications are typically performed during lead optimization to improve potency and reduce side effects? Discuss SAR by taking appropriate example
c) What are the pre requisite conditions for the drug to undergo the clinical trials.
(5, 5, 5)
- Q5 a) Outline the synthesis of fluconazole and give its therapeutic uses
b) Give two examples of antibiotic drug with its structure and their therapeutic uses
c) Discuss briefly the Structure activity relationship of drug.
(5, 5, 5)
- Q6 a) How are computational tools used in modern drug design? Provide a brief overview of their application in bioinformatics.
b) Define molecular docking and explain its utility in the identification and refinement of a Lead compound.
c) Give the name of computational tools used for Lead identification, QSAR, and Molecular docking?
(5, 5, 5)

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7261

L

Unique Paper Code : 2173550011

Name of the Paper : DSE-Fundamentals of Medicinal Chemistry

Name of the Course : B.Sc. (Prog.)

Semester : VIII

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **four** questions in all.
3. **All** questions carry equal marks.
4. Attempt **all** parts of the questions together.

1. (i) Explain the importance of target validation in drug discovery.
(ii) Why do clinical trials require several years for completion?
(iii) Define the therapeutic index (therapeutic ratio) of a drug.
(iv) What is the importance of drug formulation and stability studies?
(v) What is meant by the chemical stability of a drug? (3×5)
2. (i) Define partition coefficient, and explain its significance in drug development.
(ii) Discuss the major sources of drugs? Give the names and structures of any two drugs obtained from natural sources.
(iii) Explain pharmacokinetics and pharmacodynamics and highlight the difference between them. (5×3)

3. (i) What does ADME stand for? Describe drug metabolism in detail.
(ii) What are prodrugs? Explain with suitable examples.
(iii) What do you understand by drug half-life? Explain its significance. (5×3)
4. (i) Discuss the role of SAR in drug design.
(ii) Explain the importance of bioinformatics in drug design.
(iii) Describe any one technique used for drug screening. (5×3)
5. Write short notes on the following (Any three) :
(i) Bioisosters and their importance
(ii) Role of Stereochemistry in drug design.
(iii) Stages of drug discovery
(iv) Phase II clinical trials (5×3)
6. (i) Describe structure and synthesis of penicillin V.
(ii) What are antifungal drugs ? Give the structure and mode of action of Fluconazole.
(iii) Describe the synthesis of isoniazid starting from 4-picoline and discuss its SAR. (5×3)

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 8612

L

Unique Paper Code : 2173550008

Name of the Paper : DSE: Transition Metal Cluster - Introduction and Applications

Name of the Course : B.Sc. (Hons.) Chemistry

Semester : VIII

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **four** questions.
3. **All** questions carry equal marks.

1. a) Briefly explain Wade's rules and their significance.
b) How is quadruple bond different from classical chemical bond? Explain with the help of an example.
c) Define chevreton phase. What is the basic unit of chevreton compounds? Which rule is used to calculate total electron count in such compounds?

(5, 5, 5)

2. a) Using the 18-electron rule calculate the total no. of M-M bonds, no. of M-M bonds per metal and draw the structure of
i) $\text{Fe}_3(\text{CO})_{12}$
ii) $\text{Ir}_4(\text{CO})_{12}$

b) Briefly outline the differences between Metal-Ligand Complex and Heteronuclear Cluster.

c) Briefly explain the capping rules in polyhedral skeletal electron pair theory (PSEPT).

(5, 5, 5)

3. a) Define a multi-decker molecule. What role do multi-decker molecules play in Molecular Electronics?
b) Discuss the mechanistic aspects of Water gas shift reaction catalyzed by $\text{Ru}_3(\text{CO})_{12}$.
c) Using $(14n+2)$ rule, predict the structure of following high nuclearity carbonyl compounds
i) $\text{Ni}_5(\text{CO})_{12}^{2-}$
ii) $\text{Co}_6(\text{CO})_{16}$

(5, 5, 5)

P.T.O.

4. a) Define quadruple bond and give one example. Using molecular orbital theory and suitable example, explain the formation of quadruple bond.
b) What is isolobality? Discuss its importance. Also explain what is meant by isolobal fragments and frontier orbitals.
c) What are Zintl ion clusters? Why are they called "naked clusters"? (5, 5, 5)
5. a) Give the general formula to represent chevrel compounds. Calculate the electron count in Mo_6S_8 .
b) Discuss with examples any three exceptions of isolobal analogy.
c) Define zintl ion clusters. Give the electron count in Pb_5^{2-} and Sn_9^{4-} and indicate the type of structure they possess. (5, 5, 5)
6. Write short notes on any three
a) Carboranes
b) Zintl ion clusters
c) Chevrel compounds
d) $(14n+2)$ rule (5, 5, 5)