SET B

[This question paper contains 3 printed pages]

Sr. No. of Question paper : **Roll No……………**

Unique Paper Code : 32171201_OC

Name of the Paper : Organic Chemistry-I: Basics and Hydrocarbons

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

Semester : II

Duration : 3 Hours

Maximum Marks : 75

Instructions for the students:

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.

1. (a) Giving the mechanism involved, write the structure of the alcohols formed from Cyclohexyl-ethene, $C_6H_{11}CH=CH_2$, under the following conditions: (9)

   (i) Hydroboration-oxidation
   (ii) Oxymercuration-demercuration
   (iii) Acid catalyzed hydration

   (b) How can a racemic mixture of Lactic acid be resolved using the method of diastereoisomeric salt formation? (4.75)

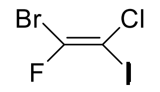
   (c) Giving reasons, arrange the following in increasing order of boiling points: (5)

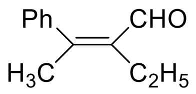
   (i) 2-methylhexane (ii) 2,2-dimethylpropane (iii) 2-methylbutane (iv) heptane (v) octane and (vi) hexane

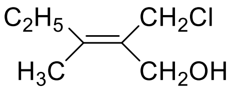
2. (a) Carry out the following conversions (any **four**) : (8)

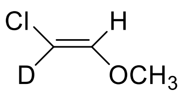
   (i) Chloroprene from acetylene
   (ii) cis-But-2-ene from propyne
   (iii) Pent-2-yne from pent-2-ene
   (iv) 2,3-Dimethylbutane from propane
   (v) p-Bromobenzoic acid from benzene

(b) Assign priorities and give E/Z notations to the following compounds: (6)

i) 

ii) 

iii) 

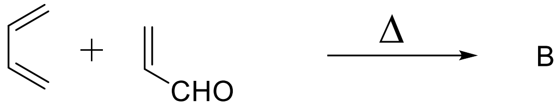
iv) 

(c) Write down all the staggered conformations for 1,2-dichloroethane? Why does dipole moment of this compound increase with increase in temperature? (4.75)

3. (a) Complete the following reactions : (7)

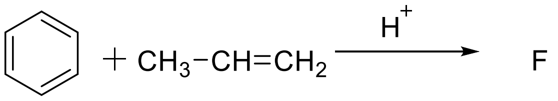
i) 

$$CH_3-CH_2-\underset{\substack{|\\ Br}}{CH}-CH_3 \xrightarrow{\text{alc.KOH}} A$$

ii) 

iii) $(CH_3)_2C=CH-CH=C(CH_3)_2 \xrightarrow{O_3} C + D$

iv) 

v) 

vi) $H_3C-C\equiv C-CH_3 \xrightarrow{Na/NH_3} G$

(b) Why does nitration of toluene take place more easily as compared to benzene? (3)

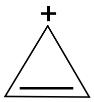
(c) Calculate the percentage of isomers formed on monochlorination of isobutane. Relative rates of hydrogens 3°: 2°: 1° towards chlorination at room temperature are 5.0 : 3.8 : 1.

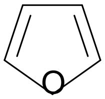
(4.75)

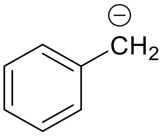
(d) A hydrocarbon C_4H_{10} (A) on monochlorination gives a compound C_4H_9Cl (B). Compound (B) on treatment with sodium metal gives 2,2,3,3-tetramethylbutane. What are the structural formulas for A and B. Write down all the reactions involved? (4)

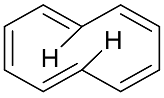
4. (a) Draw the Fischer projections for all possible stereoisomers of 3-Bromobutan-2-ol. Show how they are related to each other and assign R/S configuration to each of them. (8)

(b) Classify the following compounds as aromatic, anti-aromatic and non-aromatic with suitable explanation: (6)

i) 

ii) 

iii) 

iv) 

(c) Addition of hydrogen chloride to 3,3-dimethyl but-1-ene yields a mixture of 2-chloro-3,3-dimethylbutane and 2-chloro-2,3-dimethylbutane. Explain. (4.75)

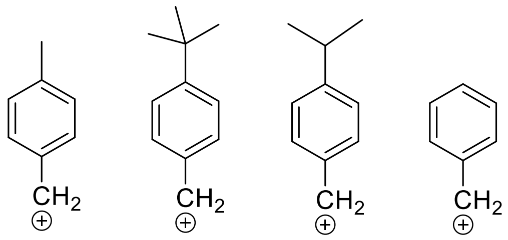
5. (a) How would you distinguish the following chemically? Give reactions. (6)

(i) But-1-yne from but-2-yne
(ii) Propene and propyne

(b) Draw the energy diagram for all the conformations of Cyclohexane. Write down the stability order of its various conformations with explanation. (5)

(c) Explain with mechanism that when Isobutyl chloride reacts with benzene using anhydrous $AlCl_3$ the product obtained is not Isobutyl benzene but t-butyl benzene. (4.75)

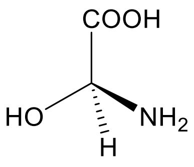
(d) Arrange the following carbocations in decreasing order of stability with suitable explanation. (3)

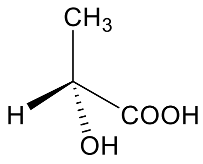


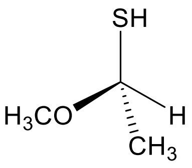
6. (a) Write a short note on any **three** : (9.75)

(i) Relative and Absolute Configuration
(ii) Inductive vs Electromeric effect
(iii) Corey House synthesis
(iv) Baeyer’s Strain theory

(b) Convert the following flying-wedge structures to Fischer projection, assign priority order and designate R/S configuration. (9)







Roll No……………..

S. No. of Question Paper :

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

Semester : **II**

Name of the Paper : GE-4, Chemistry of S & P Block Elements, States of Matter and Chemical Kinetics

Unique Paper Code : 32175913_OC

Duration: 3 Hours **Maximum Marks: 75**

Instructions for candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Attempt 2 questions from SECTION A, Question no 1 is compulsory.**
3. **Attempt 2 questions from SECTION B, Question no 4 is compulsory.**
4. Use separate sheets for section A and section B and indicate the section you are attempting by putting a heading.
5. The questions should be numbered in accordance to the number in the question paper.
6. Use of Scientific Calculator is permitted.

SECTION – A
(Inorganic Chemistry)

1. Answer the following questions:

(a) Why is Carbon used as most common reducing agent? What are its drawbacks.
(b) Oxygen exists as O_2 while sulphur as S_8 molecule. Explain
(c) Electronegativity of F is higher tht of Chlorine but reverse is the case with electron affinity. Explain
(d) What is Kroll's process?
(e) What is Liquation? Explain with example.
(f) Draw the structures of P_4O_{10} and show its hydrolysis.
(g) What is smelting? Describe the role of flux in smelting.

(3, 3, 3, 3, 3, 2, 2)

2. Answer the following questions:

(a) Describe the electrorefining of Aluminium from alumina. Give the importance of various additives used in the process.
(b) Write balanced equation for the following

1. Self reduction of Cu in bessemerisation
2. Phosphorous pentachloride with water
3. SO_2 with phosphorous pentachloride

(c) Explain

1. Puddling Process
2. Inert Pair Effect
3. Oxaacids of Chlorine

(d) Compare the following:

1. Concentration of ore and Reduction of ore
2. Black Phosphorous and White Phosphorous
3. Minerals and Ores

(3.5, 3, 6, 6)

3. Answer the following questions:

(a) Beryllium exhibit anomalous behavior. Explain.

(b) Give the structure of nitrogen hydrides. Which is more stable state?

(c) Define

1. Multi-center bonding
2. Boranes
3. Slag

(d) Write a short note on

1. Extraction of iron from haematite
2. Nitrides
3. Van Arkel and De Boer’s process

(3.5, 3, 6, 6)

SECTION – B
(Physical Chemistry)

*(Question **No. 4** is compulsory)*

(R = 8.314 J K^{-1} mol^{-1} ; k = 1.38 × 10^{-23} J K^{-1} ; N_A = 6.023 × 10^{23})

Q.4. (a) Why is liquification of ideal gas not possible?

(b) The fraction of total number of molecules having speeds between any definite ranges must be constant, even though the speeds of individual molecules may be changing due to the collision. Comment

(c)What do you understand by the term coefficient of viscosity.

(d)The Weiss indices of a plane are 2, 2, ∞. What are its Miller indices?

(e) What are the significance of van der waal's constant a and b?

(f) Order of a reaction cannot be predicted from its equation. Comment

(g)What is meant by symmetry operations and symmetry elements?

(2.5, 2.5, 2.5, 2.5, 2.5, 2.5, 2.5)

Q.5. (a) Derive the Vander Waal's equation of state. Explain the negative and positive deviation shown by real gas using Vander Waal's equation.

(b) 25 ml of water takes 120.5 seconds to flow through a viscometer and same volume of acetone requires 49.5 seconds. The densities of water and acetone at 25°C are 9.982 x 10^2 kg m^{-3} and 7.92 x 10^2 kg m^{-3} respectively. The viscosity of water at 25°C is 10.05 Pascal Second. Calculate the viscosity of acetone at 25°C.

(c) Calculate $\boldsymbol{\lambda}$ (Mean free path), Z_{11} (Bimolecular Collision) for O_2 at 25°C and 10^{-3} mmHg. (Provided $\boldsymbol{\sigma}$ = 3.61 x 10^{-8} cm)

(d) It is stated that the excluded volume, b is approximately four times the actual volume occupied by the molecules of one mole of a gas. How would you derive this conclusion?

Q.6. (a) What are three types of cubic crystals? How are they distinguished from each other?

(b) Derive an integrated rate equation of a first order reaction.

(c) Describe the symmetry elements of a crystal system.

(d) What is half- life period of a reaction? The half -life period of a reactant is 50 minutes at a certain concentration is reduced to one half of the initial concentration, the half-life period becomes 25 minutes. What is the order of the reaction?

(5, 5, 5, 5)

ONLINE OPEN BOOK EXAMINATION

Sr. No. of question Paper:

Unique Paper Code : **32171403_OC**

Name of the Paper : Physical Chemistry - IV

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

Semester : IV

Time: 2 hours Maximum marks: 75

Instructions for the candidates

1. Attempt any **Four** questions in all.
2. Each question carries equal marks.
3. Use of scientific calculator is permitted.

Q. 1. (a) What is zero order reaction? Give two examples. 6.75

Derive an expression for the rate constant and half-life period of a zero-order reaction using integrated rate law. What type of plots will you get for a zero order reaction for

(i) Concentration versus time?

(ii) Half-life period versus initial concentration?

(b) The following mechanism was proposed for the thermal decomposition of acetaldehyde: 6

$$\text{Initiation:}\quad CH_3CHO \xrightarrow{k_1} {}^*CH_3 + {}^*CHO$$

$$\text{Propagation:}\quad {}^*CH_3 + CH_3CHO \xrightarrow{k_2} CH_4 + {}^*CH_2CHO$$

$$ {}^*CH_2CHO \xrightarrow{k_3} {}^*CH_3 + CO$$

$$\text{Termination:}\quad {}^*CH_3 + {}^*CH_3 \xrightarrow{k_4} CH_3CH_3$$

Using the steady state approximation, show that

$$\frac{d\,[CH_4]}{dt} = k\,[CH_3\,CHO]^{3/2}$$

(c) (i) According to the Collision theory, the rate of formation of products not only depends on E_0 but also on the orientation of molecules during collision. Explain giving example. 6

(ii) The given reaction is an example of first order with $k_1 = 2.2 \times 10^{-5}\ s^{-1}$ at 573 K.

$$SO_2\,Cl_2 \leftrightarrows SO_2 + Cl_2$$

What percent of SO_2Cl_2 is decomposed on heating at 573 K for 90 min?

Q.2. (a) Compare the rate constants as given by Arrhenius equation and the Collision theory and show that 6.75

$$E_a = E_0 + \frac{RT}{2}$$

(b) N_2O_5 gas decomposes according to the reaction 6

$$2N_2O_5(g) \longrightarrow 4NO_2(g) + O_2(g)$$

At 328 K, the rate of reaction under certain conditions is 0.75×10^{-4} mol $dm^{-3}s^{-1}$. Neglecting the concentrations of intermediates, determine the values of $d[N_2O_5]/dt$, $d[NO_2]/dt$ and $d[O_2]/dt$.

(c) Kinetics of enzyme catalyzed reactions are studied by Michaelis - Menten mechanism. Using the Steady State approximation, relate enzyme and substrate concentration to rate of the reaction. Also discuss when Michaelis Menten constant >> substrate concentration, how the rate variation takes place. 6

Q.3. (a) Discuss asymmetry effect and electrophoretic effect in Debye-Hückel-Onsager Theory. 6.75

(b) Explain Wien effect and Debye-Falkenhagen effect. 6

(c) A potential of 5.60 V is applied to two electrodes placed 11 cm apart; how far is an ammonium ion expected to move in 2 hours in a dilute solution of ammonium salt at 25^0C? 6
Given: $\lambda(NH_4^+) = 73.4$ ohm^{-1} cm^2 mol^{-1}

Q.4. (a) Define ionic mobility and show that the ionic mobilities of cation and anion at infinite dilution are respectively given by 6.75

$$\mu_+^\infty = \frac{\lambda_+^\infty}{z_+F} \quad and \quad \mu_-^\infty = \frac{\lambda_-^\infty}{z_-F}$$

where the symbols have their usual significance.

(b) Explain the Moving Boundary Method for determination of transport number of an ion. 6

(c) A Hittorf cell fitted with Ag-AgCl electrodes is filled with HCl solution which contains 0.3856×10^{-3} g of HCl/g water. A current of 2.0 mA is passed for exactly 3 hours. The solutions are withdrawn, weighed and analyzed. The total mass of the cathode solution is 51.7436 g which contains 0.0267 g of HCl. The anode solution weighs 52.0461 g and contains 0.0133 g of HCl. What is the transport number of H^+ ion? 6

Q.5. (a) Derive Stern -Volmer Equation. What is its significance? 6.75

(b) Define quantum efficiency. 6

What are the reasons for low and high quantum efficiency of a photochemical reaction?

(c) In the photochemical combination of $H_2(g)$ and $Cl_2(g)$, a quantum efficiency of about 1 x 10^6 is obtained with a wavelength of 480 nm. What amount of HCl(g) will be produced under these conditions if one calorie of radiant energy is absorbed? 6

Q.6. (a) An acid HA catalyzes the substrate S to products by the reaction: 6.75

$$S + HA \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} SH^+ + A^-$$

$$SH^+ + H_2O \xrightarrow{k_2} P + H_3O^+$$

Derive the rate law for the reaction. State the condition under which it becomes an example of ‘general acid catalysis’ and ‘specific hydrogen-ion catalysis’.

(b) The conductivity of a saturated solution of $[Co_2Fe(CN)_6]$ is 3.00 x10^{-6} Ω^{-1} cm^{-1} and that of water used is 4.1 x 10^{-7} Ω^{-1} cm^{-1}.The ionic molar conductivities of Co^{2+} and $Fe(CN)_6^{4-}$ are 87 Ω^{-1} cm^2 mol^{-1} and 444 Ω^{-1} cm^2 mol^{-1} respectively. 6
Calculate the solubility and solubility product of $[Co_2Fe(CN)_6]$ in water at 25°C.

(c) Write short note on (any two): 6

- (i) Ratio variation Method
- (ii) Chemiluminescence
- (iii) Fluorescence and Phosphorescence

Sr. No. of Question Paper :

Unique Paper Code : 32171401 (O/C)

Name of the Paper : Inorganic Chemistry-III: Coordination Chemistry

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

Semester : IV

Duration: 3 Hours **Maximum Marks: 75**

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. All questions carry equal marks.

1.(a) Write the name of the following complexes according to the IUPAC system **(A*ny four)*:**

- i. $[CoSO_4(NH_3)_4]NO_3$
- ii. $[CuCl_2(CH_3NH_2)_2]$
- iii. $[Pt(PPh_3)_4]$
- iv. $(N(CH_3)_4)[Cr(NH_3)_2Cl_4]$
- v. $[(en)_2Co\text{-}(\mu\text{-}NH_2)(\mu\text{-}NH)\text{-}Co(en)_2](NO_3)_3$

(b) Write down formulae of the following complexes as per IUPAC rules (***Any four***):

- i. Calcium bis(thiosulphato)argentate(I)
- ii. Tetrapyridineplatinum(II) hexachloridoplatinate(IV)
- iii. Triamminechloridocyanidonitrito(-N)cobalt(III)
- iv. Calcium trioxalatoaluminate(III)
- v. Bis(ethylenediammine)cobalt(III)-μ-amido-μ-chlorido-bis(ethylenediammine)cobalt(III) nitrate

(c) Indicate the type of isomerism exhibited by the following pairs of isomers.

- i. $[Co(NH_3)_4(NO_2)Cl]Cl$ and $[Co(NH_3)_4Cl_2]NO_2$
- ii. $[Co(NH_3)_4(H_2O)Cl]Cl_2$ and $[Co(NH_3)_4Cl_2]Cl\cdot H_2O$
- iii. $[Pt(NH_3)_4][PtCl_6]$ and $[Pt(NH_3)_4Cl_2][PtCl_4]$
- iv. $[Cr(NH_3)_3(SCN)_3]$ and $[Cr(NH_3)_3(NCS)_3]$

(d) The first purely inorganic chiral complex synthesized by Werner was $[Co\{(OH)_2Co(NH_3)_4\}_3]^{6+}$. Write the name and structure of this complex. (6, 6, 4, 2.75)

2.(a) Predict the hybridization involved, geometry and magnetic moment of the $[Ni(CO)_4]$ and $[Ni(CN)_4]^{2-}$ complexes using valence bond theory.

(b) In the crystal structure of CuF_2, the Cu^{2+} is six coordinate with four F^- at a distance of 1.93 °A and two F^- at 2.27 °A. Explain the, reason for this.

(c) Which of the following complexes are expected to be labile or inert according to VBT? Give reasons. $[V(NH_3)_6]^{3+}$, $[Ti(H_2O)_6]^{3+}$, $[MnCl_6]^{3-}$ and $[Co(CN)_6]^{3-}$.

(d) Calculate magnetic moment (μ) in B.M. of Pr^{3+} with outer configuration $4f^2$, $6s^0$.

(e) Addition of glycine to one mole of copper (II)-acetate solution decreases its conductivity. Explain. (4, 4, 4, 4, 2.75)

3.(a) An oxide (A) of an element when treated with Cl_2 in the presence of carbon gave compound (B) which fumes in moist air and hydrolyzed partially to give compound (C) when compound (B) is treated with alcohol in the presence of NH_3 compound (D) is formed. Identify compounds (A), (B), (C) and (D) and also write down the reaction involved it.

(b) Explain whether Fe_3O_4 and $NiFe_2O_4$ will adopt a normal spinel structure or inverse spinel structure.

(c) Arrange the following complex ions in the order of increasing Δ_o giving reasons. $[Co(F)_6]^{2+}$, $[Rh(NH_3)_6]^{3+}$, $[Co(NH_3)_6]^{3+}$, $[Co(NH_3)_6]^{2+}$ and $[Ir(NH_3)_6]^{3+}$.

(d) For a metal ion having d^6 configuration in an octahedral complex, the magnitude of crystal field splitting is 32,200, cm^{-1}, and the electron-pairing energy is 17,600 cm^{-1}. Predict whether, the complex will be high spin or low spin. Calculate the crystal field stabilization energy for the predictable spin state. (6, 4, 4, 4.75)

4. (a) Write the products A and B of following reactions based on trans-effect.

i. $[PtBr_4]^{2-} + NO_2^- \rightarrow [A]$; $[A] + NH_3 \rightarrow [B]$

ii. $[PtCl_4]^{2-} + PR_3 \rightarrow [A]$; $[A] + PR_3 \rightarrow [B]$

(b) Explain the ability of CN^- to produce large crystal field splitting energy based on molecular orbital theory.

(c) In general, UV-Visible absorption bands of transition metal ions are broad, whereas those of f-block metal ions are sharp.

(d) Arrange the following complex ions in the order of increasing value of magnetic moments. $[Cr(H_2O)_6]^{3+}$, $[Fe(H_2O)_6]^{2+}$, $[Ni(CN)_4]^{2-}$ and $[Zn(H_2O)_6]^{2+}$.

(e) Why is titanium (IV) chloride covalent in nature? (4, 4, 4, 4, 2.75)

5.(a) Consider the Latimer diagram for vanadium in acidic solution (pH = 0)

$$VO_2^+ (+5) \xrightarrow{+1.00\ V} VO^{2+} (+4) \xrightarrow{+\ 0.337\ V} V^{3+} (+3) \xrightarrow{-\ 0.255\ V} V^{2+} (+2) \xrightarrow{-1.33\ V} V\ (0)$$

i. Write half reactions for the conversion of

(a) VO_2^+ to VO^{2+} (b) VO^{2+} to V^{3+}

ii. Calculate skip step EMF for VO_2^+ to V^{2+}.

iii. Construct the Ebsworth diagram for vanadium from its latimer diagram given above.

iv. Which is the most stable species?

(b) Why is charge transfer transition give rise to more intense absorption? State the type of transition responsible for color in the following species.

i. $KMnO_4$,
ii. Cu_2O
iii. V_2O_5
iv. $[Ni(NH_3)_6]^{2+}$

(c) What is lanthanide contraction? Write the major consequences of lanthanide contraction. (9, 5.75, 4)

6.(a) Attempt ***<u>any five</u>*** of the following, giving reason.

(i) Transition metals and their compound possess good catalytic property.
(ii) Ce^{4+} is a good oxidizing agent whereas Sm^{2+} is a good reducing agent.
(iii) Sc^{3+} salts are diamagnetic.
(iv) Element of 4d and 5d series usually form low spin complexes.
(v) An aqueous solution of Mn^{2+} is oxidized with $NaBiO_3$ in acidic medium.
(vi) Actinides have a greater tendency to form complexes than lanthanides.

(b) Two isomers A and B of $[Pt(NH_3)_2Cl_2]$ are made to react with oxalic acid. *A* on reaction with 1 mole of oxalic acid give 2 moles of HCl and *B* on treatment with 1 mole of oxalic acid gives 1 mole of HCl. Identify isomers *A* and *B*. (5x3, 3.75)

a) Name of Course : B Sc (Hons.) Chemistry
b) Semester : VI
c) Name of the Paper : Green Chemistry
d) Unique Paper Code : 32177908
e) Maximum marks : 75

Instruction for the candidates

1. All questions carry equal marks
2. Attempt any four questions

Q. 1 (a) State True or False: (6)
i) Green chemistry is also known as sustainable chemistry.
ii) Green solvents maximise atom efficiency.
iii) Paul Anastas and John Warner gave the 10 principles of green chemistry.
iv) Green methods should have low atom efficiency.
v) Enzymes are nature’s catalyst.
vi) Brown synthesis of ibuprofen has 77% atom economy.

(b) Fill in the blanks: (6)
i) ………………………. is a green solvent and also a greenhouse gas.
ii) Green chemistry tends to reduce the ………………………
iii) PPM stands for ………………………..
iv) Pollution Prevention Act of 1990 states that pollution should be ………….. at the source.
v) A chemical process with an E factor of 2 creates ....waste than of E factor of 20.
vi) Example of a photocatalyst …………

(c) What is microwave assisted synthesis? Discuss the theory of microwave heating. Give its application in Hofmann elimination reaction. (6.75)

Q. 2 (a) Compare between: (6)
(i) Heterogeneous and homogeneous catalysts
(ii) Traditional pigments and rightfit pigments

(b) Give the green synthesis of adipic acid and disodium iminodiacetate. (6)

(c) Define green solvents. Give four examples. How are they advantageous over conventional solvents? (6.75)

Q. 3 (a) Define sonochemistry. What do you understand by sonochemical switching. (6)

(b) The green chemistry principle design for degradation is not fulfilled by plastics and agrochemicals. Explain with suitable example. (6)

(c) Explain how environmental risk = f (h,e) is reduced using Sea Nine 211. (6.75)

Q. 4 (a) Discuss combinatorial chemistry and its benefits? How is it used in solid phase peptide synthesis? (6)

(b) Biocatalysts are different from traditional catalysts. Explain. Give two examples of reactions where biocatalysts are used. (6)

(c) What are enzymatic interesterification reactions? Describe how enzymatic interesterification helps for production of no trans-fats and oils. (6.75)

Q 5 (a) What is biofuel? Give examples of solid, liquid and gaseous biofuels. Give the issues related to usage of biofuels. (6)

(b) Give the goals of green chemistry. Mention any three practices to achieve them. (6)

(c) How is toxicity related to stereochemistry? Discuss with reference to thalidomide as an example. (6.75)

Q. 6 (a) What do you understand by atom economy? Calculate atom economy of the following two chemical reactions: (6)

$$CH_3Cl + KOH \longrightarrow CH_3OH + KCl$$

$$C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$$

(Mol mass: C=12, H=1, O=16, Cl =35.5, K =39)

(b) Write short notes on: (6)

(i) Cradle to cradle carpeting
(ii) Inherent safer chemistry

(c) Which chemical disaster is depicted in the following picture. What was the cause of this accident. Discuss effects of this disaster on environment. Give green synthesis of the pesticide to avoid such disasters. (6.75)

Unique Paper Code : 32171601

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

Semester : VI

Name of the Paper : Inorganic Chemistry IV: Organometallic Chemistry

Duration : 3 hours

Maximum Marks : 75 Marks

Instructions for the Candidates

Attempt **four** questions in all. **Question No.1 is compulsory**.

All questions carry equal marks.

Q1. (a) Answer the following very short type questions.

(i) The rhodium complex used as Wilkinson's catalyst has the formula ………………. and contains rhodium in oxidation state …….

(ii) Write the formula of the canary yellow precipitate obtained in the confirmatory test of phosphate ion.

(iii) Explain "hapticity" with the help of an example.

(iv) Define "Turnover number" of a Catalyst.

(v) A…….pH helps in releasing oxygen from oxygenated haemoglobin in the tissues.

(vi) Define Active transport. **(1 × 6)**

(b) Answer the following short answer type questions:

(i) The V-C bond lengths in $[V(CO)_6]$ and $[V(CO)_6]^-$ are 200 pm and 193 pm, respectively. Explain.

(ii) Define and give an example each of an essential and a non- essential element.

(iii) Predict whether the following compounds obey EAN rule or not.

(a) $[Fe(CO)_2(\eta^5\text{-}C_5H_5)(\eta^1\text{-}C_5H_5)]$

(b) $[Fe(CO)_2(NO)_2]$ **(2 × 3)**

(c) Answer the following :

(i) How are organometallic compounds classified on the basis of type of bonding? Explain giving examples.

(ii) What do you mean by homogeneous and heterogeneous catalysis? Out of these two, which one is preferred and why? **(3, 3.75)**

Q2. (a) What is Zeise's salt? Discuss the bonding in Zeise's salt on the basis of Dewar-Chatt-Duncanson model and IR studies. How is M-C bonding in Zeise's salt different from that in metal carbonyl complexes ? **(6)**

(b) Give the complete cycle describing each step to outline the working of the Ziegler-Natta catalyst for the polymerization of ethene**.** **(6)**

(c) What are Metalloenzymes and Metal Activated Enzymes? Give the name and the mechanism of action of the enzyme transporting CO_2 from the tissues to the lungs. **(6.75)**

Q3. (a) Give the use of the following reagents in the identification of ions along with the chemistry involved:

(i) Potassium hexacyanoferrate(II)

(ii) Dimethylglyoxime

(iii) Sodium Bismuthate **(6)**

(b) The Heam group in Haemoglobin cannot function as an oxygen carrier in the absence of the globin chain. Explain. Give the Hill's equation for the oxygenation of Haemoglobin.

(6)

(c) CO does not bind to Lewis acids like BF_3 or $AlCl_3$; yet it binds to transition metals in low oxidation states. Explain with reference to MO diagram of carbon monoxide.

(6.75)

Q4. (a) (i) Predict the products of the following reactions:

1. $Cr(CO)_6 + C_6H_6 \rightarrow$
2. $VCl_3 + 3Na + 6CO \rightarrow$
3. $[Mn_2(CO)_{10}] + Cl_2 \rightarrow$

(ii) Arrange the following in the increasing order of CO stretching frequencies in the IR spectrum. Explain the order.

$$[Mn(CO)_6]^+ , [Cr(CO)_6] , [V(CO)_6]^- , [Fe(CO)_6]^{2+}, [Ti(CO)_6]^{2-}$$

(3, 3)

(b) Define toxic elements. Give the sources, symptoms associated with and antidotes for Cadmium poisoning**.**

(6)

(c) (i) The hydrochloric acid solution of a salt of metal M gives white turbidity when diluted with water. A compound of M is used in the confirmatory test of a Group IV metal ion. Identify M and explain the reactions mentioned with equations.

(ii) Explain the steps involved in the identification of NO_2^- and NO_3^- when present together in a salt mixture. **(3, 3.75)**

Q5. (a) How is iron transported and stored in the human body ? Where is it stored? **(6)**

(b) Using 18 electron rule as a guide, identify/find:

(i) the 3*d* metal in

$$[(\eta^6\text{-}C_6H_6)\ M\ (CO)_3]$$

(ii) the probable number of carbonyl ligands in

$$[Co_4(CO)_n]$$

(iii) the number of Fe-Fe bonds in $[Fe_3(CO)_{12}]$ **(6)**

(c) (i) Mn^{2+} ions are not precipitated as MnS on passing H_2S gas in group II but precipitate as MnS on passing H_2S gas in Group IV of qualitative analysis. Explain.

(ii) A mixture of anions gives brown vapours with concentrated H_2SO_4, which are intensified on adding copper turnings. A rod dipped in ammonia solution gives white dense fumes when brought near the mouth of the test tube. The sodium carbonate extract gives a white precipitate with silver nitrate after acidification, which is completely soluble in ammonium hydroxide solution. Explain with reactions how will you confirm the anions present.

(3, 3.75)

Q6. (a) Ferrocene shows both similarities as well as differences from benzene. Illustrate with examples. **(6)**

(b) What are interferring anions ? How do they interfere in the cation analysis. Why do they interfere only after the second group of the cations analysis scheme and not before?

(6)

(c) Why does only *cisplatin* and not t*ransplatin*, act as an anti cancer drug. Give its mechanism of action.

(6.75)

SET B

Unique Paper Code : 32171602

Name of the Paper : Organic Chemistry V: Spectroscopy

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

Semester : VI

Duration : 3 hours

Maximum Marks : 75

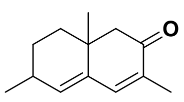
<u>Instructions for Candidate</u>

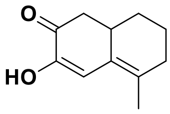
Answer any FOUR questions. All questions carry equal marks.

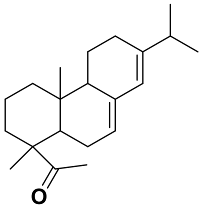
1. a) Explain why $\nu_{c=o}$ frequency in IR spectroscopy for m-chlorobenzoic acid is higher than that for p-chlorobenzoicacid?
b) Differentiate between 3-pentanone and 2-pentanone using proton NMR spectroscopy.
c) An organic compound with molecular formula $C_6H_{12}O$ showed the following data:
UV (λ_{max}) 288 nm, $\epsilon = 24$
IR very strong band at 1715 cm^{-1}
NMR: δ 2.0 (3H, s), 1.0 (9H, s)
Calculate the double bond equivalent (DBE) and explain UV, IR and NMR peaks and give the structure of the compound.

(5, 4, 9.75)

2. a) What is spin-spin coupling in NMR spectroscopy? Discuss with an example.
b) Calculate the λmax (nm) for the following compounds: (any two)







Base value for α, β-unsaturated ketones = 215 nm
<u>Increment for each substituent</u>
Alkyl substituent or ring residue at the α-position = 10 nm, β-position = 12 nm, γ- or δ- or higher position = 18 nm,
Increment for hydroxyl (-OH) group at α-position = 35 nm, β-position = 30 nm, δ-position = 50 nm
Exocyclic double bond = 5 nm, Double bond extended conjugation = 30 nm.
Base value for acyclic/ heteroannular diene = 214 nm**,** Homoannular diene = 253 nm
<u>Increment for each substituent: Alkyl</u> substituent or ring residue = 5 nm, Exocyclic double bond = 5 nm**,** Double bond extending conjugation = 30 nm.
c) Differentiate between hypsochromic and bathochromic shift with examples.

d) What are fundamental and non-fundamental molecular vibrations? Discuss by taking CO_2as an example.

(4, 6, 3, 5.75)

3. a) How was the configuration of (+) - Glucose established?
b) Mechanistically explain the formation of Glucosazone. Why does the reaction not proceed beyond C-2?
c) Draw the structure of Lactose and write its systematic name. Mention the structural differences between Lactose and Sucrose.

(6.75, 6, 6)

4. a) Write brief description of:
- i. Edible Dyes
- ii. Biodegradable Polymers

b) A carbohydrate X, $C_{12}H_{22}O_{11}$, shows reducing behaviour. Hydrolysis by emulsin yields only D-Glucose. Methylation of X followed by hydrolysis gives 2, 3, 4, 6-tetra-O-methyl-D-Glucose and 2, 3, 4-tri-O-methyl-D-Glucose. Elucidate the structure of X**.**
c) Outline and explain the reactions that establish that D-Glucose exists in cyclic hemiacetal forms.

(6, 6, 6.75)

5. a) Phenolphthalein is colorless in acidic medium, deep pink in alkaline solution but again colorless in stronger alkaline solution. Explain using structure and give its synthesis.
b) How was the structure of Alizarin elucidated? Give the synthesis of Alizarin starting from anthracene.
c)What is PVC? Give one synthesis of its monomer from acetylene and explain the formation of polymer using free radical mechanism.

(6.25, 6.25, 6.25)

6. a) Explain the following
- (i) Fingerprint region in IR spectroscopy
- (ii) Addition and condensation polymer

b) What is a leucobase? Explain giving an example.
c) What are syndiotactic, atactic and isotactic polymers? Explain using one example.
d)Give the structure and synthesis of polyamide and polyester fibers.

(6, 2, 4.5, 6.25)

Unique Paper code: 32173910 _ OC

Name of the Paper: SEC-10 Chemistry of Cosmetic &Perfumes

Name of the Course: B. Sc. Hons.

Semester: IV

Duration: 3 Hours **Maximum Marks: 38**

Instructions to Students

Attempt any **two** questions.

1. (i) Discuss the fundamental of cosmetic science. 5

   (ii) What are the ideal properties for a sun screen agent? Explain formulation and method of Preparation of suntan lotion. 5

   (iii) How are cosmetics different from medicine. 5

   (iv) Classified surfactants. 4

2. (i) What are the properties of shampoo which forms basis for its evaluation. Explain any one. 5

   (ii) Give a detailed outline of the method of preparation of lipstick. 5

   (iii) Define lather shaving cream.What are their ideal characteristics. 5

   (iv) Discuss the characteristics of Essential oil.Give two examples. 4

3. (i) What are the common ways to reduce or eliminate body odor ? Give relevance of the use of Antiperspirants as a cosmetic preparations. 5

   (ii) Name the various hair preparations used as a cosmetics. 5

   (iii) What is role of Shellac in Nail preparation ? 4

   (iv) What is the role Paraformaldehyde and Magnesium carbonate in antiperspirants ? 5

4. (i) What are flavours ? Name the chemicals which give flavour of almond, banana ,apple,orange and grapes. 5

(ii) Discuss the cosmetic properties and uses of Sandalwood oil and Jasmone. 5

(iii) Classify various skin cream. How are they evaluated ? 5

(iv) Name the preservatives used in various powder preparations. 4

SET I

Roll No………………………..

Unique Paper Code	:	**32173909_OC**
Name of the Paper	:	**SEC-9, Pharmaceutical Chemistry**
Name of the Course	:	**B.Sc.(H) Chemistry**
Semester	:	IV

Duration: 3 hrs Maximum Marks: 38

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper
2. Attempt any **two** questions

1 a) Answer the following (Any five) (3x5)

   i. Define Pharmacophore.
   ii. What is AZT and give its structure and the utility?
   iii. Define antiviral drugs? Give any one example with structure
   iv. With suitable example explain sulpha and Sulphur drugs.
   v. How will you differentiate between drugs and medicine?
   vi. What are antipyretic drugs? Give any one example with structure.

b) Differentiate between (2x2)

   i. Aerobic and anaerobic fermentation.
   ii. Narcotics and Non-narcotic analgesics.

2. a) Discuss the Target specificity and target selectivity in drug designing. (6)

b) What are antilaprosy drugs and give the synthesis of dapsone. (6)

c) Discuss the production of penicillin in fermentation process and Structure Activity Relationship of penicillin? (7)

3. a) Define anaerobic Fermentation? Discuss the synthesis of Vitamin B_2 by fermentation.

OR

Explain synthesis of glutamic acid through fermentation process? (6)

b) Discuss the synthesis of Chloromycetin or Streptomycin? (6)

c) Explain the various steps involved in drug designing? Explain the retrosynthesis of Aspirin? (7)

4. a) What do you mean by High Therapeutic Index. (4)

b) Write down the synthesis of sulphacetamide. (4)

c) What are Non-steroidal anti-inflammatory drugs (NSAIDS). (5)

d) What are Phenobarbitals? Discuss any one drugs synthesis of Phenobarbitals. (6)

Unique Paper Code	**: 32177904**
Name of the Paper	**: DSE-Analytical Methods in Chemistry**
Name of the Course	**: B.Sc. (Hons.) Chemistry**
Semester	**: VI**
Duration	**: 3 hours**
Maximum Marks	**: 75**

<u>Instructions for the candidates:</u>

1. ***Attempt any FOUR questions in all.***
2. ***All questions carry equal marks.***

1. **(5, 5, 5, 3.75)**

(a) During analysis of an analytical data, which statistical parameters are needed for ensuring the quality and reliability of data? Explain any two with proper examples?

(b) What are the types of errors in chemical analysis? How do they enter in any instrumental analysis? What are the ways to minimize them?

(c) Classify various types of sampling methods in analytical chemistry. Why sampling is important in chemical analysis? Explain different steps involved during sampling.

(d) Define significant figures. How many significant figures does each of the following numbers have?

(i) 1.6350
(ii) 0.0541
(iii) $2.5x10^6$

2. **(5, 5, 5, 3.75)**

(a) How a single beam spectrophotometer is different from double beam spectrophotometer in terms of sample holder? Explain with the help of a block diagram. Explain the importance of monochromator in UV-Visible spectrophotometry?

(b) How Lambert-Beer's law helps to analyze metal ion, both qualitatively and quantitatively in an alloy sample? Explain the standard addition method?

(c) An aqueous solution of a substance X shows 80 % transmittance at 500 nm in a 1.0 cm cell. If the molar absorptivity of this substance at this wavelength is 4×10^4 $mol^{-1}Lcm^{-1}$, what is the concentration of the solution?

(d) Explain the origin of spectra for UV- Visible spectroscopy. Why absorbance has no unit whereas absorptivity has?

3. **(5, 5, 5, 3.75)**

(a) Describe the various atomization techniques used in atomic absorption spectroscopy (AAS). What are the various oxidants used in AAS? How does the combination of fuel gases and oxidants affect the temperature?

(b) Explain the various processes that occur when a sample is injected into the flame in flame photometry. What are the methods of background correction in flame photometry?

(c) State the principal involved in TGA, DTA and DSC thermal analysis techniques. Give nature of thermograms in all three techniques.

(d) Explain the effect of the following on the thermogravimetric results: (i) rate of increase of temperature in the furnace (ii) nature of atmosphere in the furnace and (iii) particle size of the sample?

4. **(5, 5, 5, 3.75)**

(a) Explain the nature of the graphs obtained in the conductometric titration of

(i) Strong acid against Strong base

(ii) Mixture of Strong acid and weak acid against Strong base

(b) Define pH. Explain the working of a glass electrode employed for the determination of pH of an analytical sample.

(c) Draw and explain a typical arrangement for a potentiometric titration. Give the names of two electrodes used in potentiometric titrations.

(d) The initial weight, 150 mg of a compound of magnesium was decreased to 54 mg when subjected to thermal analysis. Find out whether the compound is an oxide, carbonate or an anhydrous oxalate of magnesium?

5. **(5, 5, 5, 3.75)**

(a) What are chromatograms? Discuss the frontal, elution and displacement methods of development of chromatograms.

(b) Define chromatography. Explain the following terms used in chromatographic analysis:

(i) Retardation factor
(ii) Retention time
(iii) Resolution of a chromatographic separation

Suggest any two methods for improving the resolution of a chromatographic separation.

(c) Discuss the various equilibrium processes in the solvent extraction of metal ion from an aqueous phase by solvation.

(d) A substance A is 99.0 % extracted from its 80 ml aqueous solution using 30 ml of an organic solvent. Calculate the distribution ratio.

6. **(3 × 5 = 15, 3.75)**

(a) Write short notes on **(any three)**:

(i) Adsorption and Partition chromatography
(ii) Cation and anion exchange resin
(iii) Photomultiplier tube
(iv) Confidence interval and confidence limit
(v) Q Test for the rejection of a data point

(b) Differentiate between **(any one)**:

(i) Prism and gratings
(ii) F-test and t-test

(OPEN BOOK EXAMINATION)

[This question paper contains 2 printed pages] Roll No. ....

S. No. of Question Paper:

Unique Paper Code : 32173908

Name of the Paper : SEC-Green Methods in Chemistry

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

Semester : VI

Duration: 1 Hours Maximum Marks: 38

Instructions for the Candidates

Write your Roll No. on the top immediately on receipt of this question paper.
All questions carry equal marks (Attempt any two questions).

1. (a) Traditional and Safer Route towards Caprolactum from Benzene

   (b) Discuss the following (*Any Two*):

   (i) Photochemical assisted reactions with two examples.

   (ii) Homogenous Vs Heterogenous Catalyst in Green Chemistry

   (iii) Write any four goals of green chemistry

   (7, 12)

2. (a) Explain the Principal 12: Inherently Safer Chemistry for Accident Prevention.

   (b) What is the Environmental impact of Right-fit Pigments and Draw any two molecular structure of Right-fit Pigments.

   (c) What do you understand by the term "Green Solvent"? Which green solvent is now used by dry cleaning industry? List four of its advantages over traditional organic solvents?

   (d) What are antifouling agents? Name and draw the structure of an environmentally friendly antifouling agent.

   (4, 5, 5, 5)

3. (a) Provide an example of the following types of reaction carried out under Ultrasound

conditions: (Any *two*)

(i) Saponification Reaction

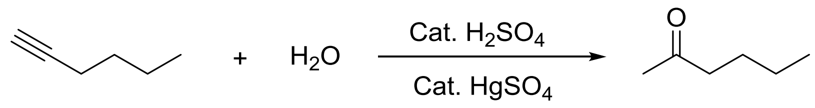
(ii) Simmon-smith Reaction

(iii) Oxidation Reaction

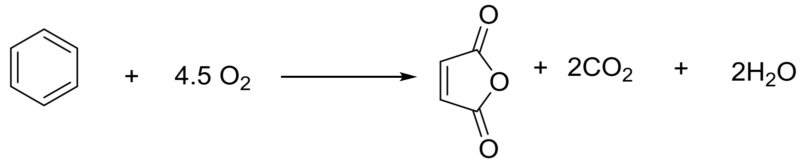
(b) Explain the different terms used in the Pollution Prevention Act of 1990 by US EPA: Risk = f (hazard × exposure)

(c) Calculate the percentage of atom Economy of below reaction.

1.



2.



(8, 5, 6)

4. (a) Write Short note (any three) with one example of the following:

(i) Persistent chemical

(ii) Organic transformation in Supercritical Fluid (SCF)

(iii) Ionic liquid

(iv) Phase Transfer Catalyst

(b) Which is the preferred route to synthesize the acetophenone? Justify.

$$PhCH(OH)Ph + 2CrO_3 + 3H_2SO_4 \rightarrow PhCOPh + Cr_2(SO_4)_3 + 6H_2O$$

OR

$$PhCH(OH)Ph + 0.5\ O_2 \rightarrow PhCOPh + H_2O$$

(15, 4)