

TY.BA/B.Sc

21/04/2022

[Time : 2 ½ Hours]

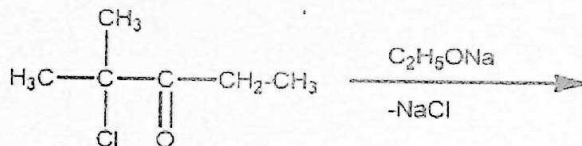
Sem. VI Reg.

[Total marks: 75]

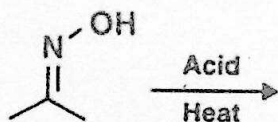
- N.B. : (1) All questions are compulsory.
 (2) Figures to the right indicate full marks.
 (3) Use of logarithmic table/non-programmable calculator is allowed.

1. Attempt Any Three of the following: 15
- A. a) Write a short note on enantiotopic faces. 3
 b) Explain the term prochiral centre by giving one example. 2
- B. Discuss the stereochemical outcome of the epoxidation reactions of *cis*-2-butene and *trans*-2-butene. 5
- C. A chiral alcohol is treated with thionyl chloride. Write the reaction, describe its mechanism, and discuss the stereochemistry involved. 5
- D. a) What are acidic and basic α -amino acids? Give one example of each type. 3
 b) Give the preparation of alanine by Strecker synthesis. 2
- E. a) Describe the β -pleated sheet structure of proteins. 3
 b) State two advantages of Merrifield's solid-phase peptide synthesis. 2

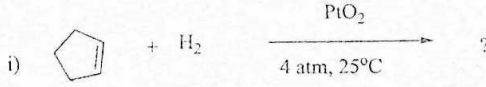
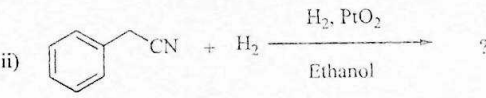

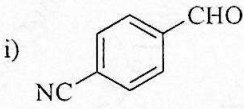
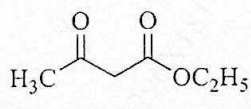
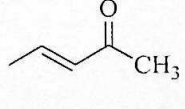
2. Attempt Any Three of the following: 15
- A. a) Explain Michael addition with a suitable example. 3
 b) Draw the chair conformations of α and β forms of D-glucopyranose. 2
- B. a) Complete the following reaction and give its name. 3



- b) Give the name of following rearrangement and write the product formed. 2



- C. a) What are carbohydrates? Explain D/L notations with one example. 3
 b) Write the reaction for oxidation of D-glucose using conc. HNO_3 . 2
- D. What are osazones? Explain the osazone formation reaction of D-fructose. 5
- E. Explain the stereoisomers in carbohydrates. 5
3. Attempt Any Three of the following: 15
- A. Describe stretching and bending vibrations 5
- B. Define Chemical Shift. Mention the unit in which it is expressed. Explain in brief the factors which influence the value of Chemical Shift with suitable examples. 5

- C. An organic compound with molecular formula $C_9H_{10}O_2$ exhibits the following spectral data. Calculate its index of hydrogen deficiency and deduce a suitable structure, providing justification based on the data-
 IR Spectrum (cm^{-1}): 3100 (broad), 1715, 1600, 750, 710
 PMR Spectrum (δ ppm): 1.5 (3H, d), 3.7 (1H, q), 7.5 (m, 5H), 11.8 (1H, s) 5
- D. Give a detailed account of DNA structure, emphasizing how specific base pairing occurs. 5
- E. a) Explain the terms – i) nucleic acids ii) nucleotides iii) nucleosides 3
 b) Predict the number of signals and their splitting patterns in the PMR spectrum of isopropyl chloride. 2
4. Attempt **Any Three** of the following: 15
- A. What is Ziegler-Natta catalyst? Explain its role in polymerisation of propene with mechanism. 5
- B. a) Give preparation and one use of polyurethane. 3
 b) Write the structure and one application of Neoprene rubber. 2
- C. a) Explain the biodegradable polymer with an example. 3
 b) Discuss Rosenmund reduction with a suitable example. 2
- D. a) Complete the following reactions: 3
- i)  5
- ii)  5
- iii)  5
- b) Write the reaction of allylic and benzylic bromination using *N*-Bromosuccinimide. 2
- E. a) What is the action of $NaBH_4$ on the following compounds? 3
- i)  ii)  iii) 
- b) Write the use of SeO_2 in oxidation of reactive methyl and methylene groups with an example. 2
5. **Answer the following:** 15
- A. Select whether the following statements are **true** or **false** (Any five) 5
- L-Valine is neutral α -amino acid.
 - Alkene undergo molecular addition of OsO_4 to form cyclic permanganate ester.
 - All monosaccharides are non-reducing sugars.
 - Wittig reaction involves organophosphorus compounds.
 - Presence of electron withdrawing group causes shielding effect on neighbouring protons.
 - Ribose sugar is present in DNA.
 - Teflon is polyvinyl chloride.

h. Lithium Aluminium Hydride (LAH) is a mild reducing agent.

B. Select the correct option and complete the following statements. (Any five)

5

- a. A carbon atom to which enantiotopic ligands are attached is calledcentre.
 a) chiral b) prochiral c) enantioselective d) diastereoselective
- b. When the peptide is derived from 10 to 100 molecules of amino acids it is known as.....
 a) Oligopeptide b) Polypeptide c) Dipeptide d) Tripeptide
- c. Pinacol-Pinacolone rearrangement iscatalysed.
 a) metal oxide b) acid c) base d) triphenyl phosphine
- d. The example of monosaccharide is.....
 a) Cellulose b) Maltose c) Raffinose d) D-Glucose
- e. Broad absorption band around 3200 cm^{-1} indicates presence of.....group.
 a) -OH b) -CN c) -CO- d) -SH
- f.signals are expected in NMR spectrum of propane.
 a) One b) Two c) Three d) Four
- g. Gutta percha is a polymer of
 a) Styrene b) Butadiene c) Vinyl Chloride d) Isoprene
- h. An alkene is oxidized by into an epoxide.
 a) *m*-CPBA b) SeO_2 c) Pd-BaSO₄ d) LiAlH_4

C.

Match the column: (Any five)

5

- | | |
|--------------------------|--------------------------------------|
| a. Zwitter ion | i. Nucleus |
| b. Bromination of Alkene | ii. IR active |
| c. D-Glucose | iii. α - Cyanoacrylate |
| d. D-Ribose | iv. Nylon |
| e. DNA | v. Aldohexose |
| f. CHCl_3 | vi. Aldopentose |
| g. Polyamide fibre | vii. Electrophilic addition reaction |
| h. Artificial skin | viii. Amphoteric |
| | ix. <i>trans</i> -Polyisoprene |
| | x. PVC |

Time : 2 ½ Hours

Total marks :75

- N.B. : (1) All questions are compulsory.
(2) Figures to the right indicate full marks.
(3) Use of logarithmic table/non-programmable calculator is allowed.

1. Attempt Any Three of the following: 15
- A. Explain polarizable electrode and non-polarizable electrode? with the help of examples.
 - B. State any five limitations of D.M.E.
 - C. Explain with the help of diagram, the need to remove dissolved oxygen from a solution before recording its polarogram.
 - D. Calculate the concentration of Cd^{2+} ions in a solution which gave a polarographic wave with a wave height of $65 \mu\text{A}$.
 $D = 7 \times 10^{-6} \text{ cm}^2 \text{ s}^{-1}$, $m = 3.5 \text{ mgs}^{-1}$, $t = 2 \text{ sec}$
 - E. With the help of neat diagram describe rotating platinum electrode.
2. Attempt Any Three of the following: 15
- A. Name the types of high-pressure pumps used in HPLC. Give any four requirements of high-pressure pumps.
 - B. Explain the construction and working of ultra violet detector used in HPLC with labelled diagram.
 - C. Give the comparison between TLC and HPTLC.
 - D. What is ion exchange capacity? How is it estimated for strong cation exchanger?
 - E. Explain the following factors affecting separation of ions in ion exchange chromatography.
i) presence of complexing agent ii) pH of the solution
3. Attempt Any Three of the following: 15
- A. What is food processing? Discuss the role of sulphur dioxide, sodium benzoate and sodium chloride in food preservation
 - B. Discuss the need for food preservation. Explain the role of pH in food preservation.
 - C. Describe Willstatter's method for the analysis of reducing sugars in honey.
 - D. Write the composition of face powder. Give any three properties of deodorants.
 - E. What are sensory properties of cosmetics? Explain ash analysis of lipstick with respect to carbonates and zinc oxide.
4. Attempt Any Three of the following: 15
- A. Give any five requirements of a good thermobalance used in TGA.
 - B. Discuss the DTA curve of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ with the help of reaction involved in it.
 - C. Explain working with the help of neat and labelled diagram of DTA system.
 - D. With respect to thermometric titration, explain
1) HCl vs. NaOH 2) Mixture of Ca^{2+} and Mg^{2+} vs. EDTA.
 - E. Write any five applications of NAA.

5. Answer the following:

15
5

A. Select whether the following statements are true or false (Any five)

- Amperometric titration curve is a plot of current vs volume of titrant.
- Hydrogen chloride is used as a supporting electrolyte in polarography.
- Detection of the component by refraction is available in HPTLC.
- Compressed air is used in reciprocating pumps.
- Irradiation is a chemical method of food preservation.
- Lactose is the primary sugar present in milk.
- Crucible geometry factor cannot affect TGA curve.
- Dewar flask is used in thermometric titration.

B. Select the correct option and complete the following statements. (Any five)

5

- Supporting electrolyte is used in Polarography to suppress _____
 a) diffusion current b) migration current
 c) convention current d) limiting current
- The concentration range for amperometric titration is _____
 a) 10^{-4} to 10^{-1} M b) 10^{-50} to 10^{-2} M c) 10^{-6} to 10^{-1} M d) 10^{-1} to 10^{-7} M
- _____ ion will be preferentially exchanged on cation exchanger in an aqueous solution.
 a) Li^+ b) Na^+ c) K^+ d) Rb^+
- Use of precolumn is required in _____
 a) GSC b) HPLC c) HPTLC d) column chromatography
- Chemically talc is _____
 a) Magnesium carbonate b) Magnesium silicate
 c) Calcium carbonate d) Sodium silicate
- The chemical in tea, having pharmacological significance is _____
 a) Amino acids b) Chlorophylls c) Methylxanthine d) Caffeine
- In NAA number of neutrons per square centimetre is called _____
 a) Neutron flux b) Neutron count
 c) Neutron cross section d) Fast neutrons.
- _____ is used as reference material in DTA.
 a) Sodium hydroxide b) Silicon carbide
 c) succinic acid d) Potassium hydroxide

C.

Match the column: (Any five)

5

Column A

Column B

- | | |
|-------------------|--|
| a. DME | i. Detector |
| b. RPE | ii. Additive in coffee |
| c. Densitometer | iii. Study phase transition of sulphur |
| d. Ion exchanger | iv. Honey |
| e. Chicory | v. 600 RPM |
| f. Antiperspirant | vi. Geiger-Muller counter |
| g. DTA | vii. Polymeric material |
| h. NAA | viii. Polarography |
| | ix. Reduces perspiration |
| | x. TGA |

18/04/2024

[Time : 2 ½ Hours]

[Total marks :75]

- N.B. : (1) All questions are compulsory.
(2) Figures to the right indicate full marks.
(3) Use of logarithmic table/non-programmable calculator is allowed.

1. Attempt Any Three of the following:

- A. What is crystal field splitting? Discuss the splitting of d-orbitals of the central metal in tetrahedral complexes. 5
B. Write note on Jahn-Teller distortions in octahedral complexes. 5
C. Explain the term crystal field stabilization energy [CFSE]. Calculate CFSE for d^8 and d^9 configurations in strong field octahedral complexes. 5
D. Discuss any five merits of crystal field theory. 5
E. Explain on the basis of Crystal field splitting, Δ_o value of $[\text{Co}(\text{NH}_3)_6]^{3+}$ is lower than that of $[\text{Ir}(\text{NH}_3)_6]^{3+}$. 5

2. Attempt Any Three of the following:

- A. Draw a labelled M.O diagram for the octahedral complex $[\text{FeF}_6]^{3-}$. Comment on its magnetic property. 5
B. Write a note on anation reactions. 5
C. What is thermodynamic stability? How does steric effect affect the stability of complexes? 5
D. Give the classification of inert and labile complexes with examples. 5
E. 1) Determine the term symbol of Helium (Atomic number =2) 2
2) What are charge transfer transitions? 3

3. Attempt Any Three of the following:

- A. What are organometallic compounds? Write note on Ionic organometallic compounds. 5
B. With respect to organometallics of elements of main group, discuss the following reactions- 5
i) Metallation reaction ii) Methylenation reactions
C. Discuss any five chemical reactions of ferrocene. 5
D. Describe the structure and bonding in ferrocene on the basis of Valence bond theory. 5
E. Explain the mechanism involved in hydrogenation of alkene using Wilkinsons catalyst. 5

4. Attempt Any Three of the following:

- A. Define metallurgy. Explain Hydrometallurgy with suitable example. 5
B. How are inert gases isolated by Charcoal Adsorption method? 5
C. What are the different processes involved in extraction of copper? Explain the electrolytic refining of copper. 5
D. Give any one method of preparation, structure and geometry of XeF_6 on the basis of VSEPR theory. 5
E. Write a note on importance of sodium potassium ion pump in biological system. 5

5. Answer the following:

A. Select whether the following statements are true or false (Any five) 5

- a. Weak field ligands produce small degree of splitting.
- b. $[\text{Fe}(\text{CN})_6]^{3-}$ is less stable than $[\text{FeF}_6]^{3-}$.
- c. Fluoride ligand exhibits $L \rightarrow M\pi$ interactions.
- d. Kinetic stability is related to the strength of metal ligand bond,
- e. Cobalt catalyst is used in manufacture of ammonia by Haber's process.
- f. Ferrocene is orange colour solid.
- g. Electromagnetic separation process is used for separating magnetic ore.
- h. Azurin is non blue copper protein.

B. Select the correct option and complete the following statements. (Any five) 5

- a. In octahedral complexes, when $10Dq > P$, then usually form ----- complexes.
 - a) low spin
 - b) high spin
 - c) spin free
 - d) zero spin
- b. ----- is a strong field ligand.
 - a) S^{2-}
 - b) Cl^-
 - c) CO
 - d) F^-
- c. d^1 electronic configuration shows ----- microstates.
 - a) 24
 - b) 15
 - c) 30
 - d) 10
- d. Acid hydrolysis in cobalt ammine complex follows ----- mechanism.
 - a) SN^1
 - b) SN^2
 - c) SN^1/CB
 - d) addition
- e. ----- reactions are favoured by electropositive metals as they show strong affinity towards halogen
 - a) Transmetallation
 - b) Metathesis
 - c) Metallation
 - d) Oxidative-addition
- f. In β hydride elimination hydrogen that is transferred is formally considered as --
 - a) H^+
 - b) H_3^+
 - c) H_2
 - d) H
- g. Roasting in metallurgy is generally done in case of -----
 - a) carbonate ores
 - b) sulphide ores
 - c) oxide ores
 - d) nitride ores
- h. The noble gas used for radioactive research is -----
 - a) helium
 - b) neon
 - c) xenon
 - d) radon

C. Match the column: (Any five) 5

	Column A		Column B
a.	Square planar complex	i.	π bonding in complex
b.	ESR Spectrum of $[\text{IrCl}_6]^{2-}$	ii.	Electron deficient Organometallic Compound
c.	Chelate effect	iii.	Serrated curve
d.	t_{2g} orbitals	iv.	Iron Deficiency
e.	Cyclopentadienyl group	v.	Split into four levels
f.	$\text{Al}(\text{CH}_3)_3$	vi.	Source of β radiation
g.	Krypton Clathrates	vii.	Pentahapto ligand
h.	Anaemia	viii.	Increase in entropy
		ix.	Plane curve
		x.	Dihapto ligand

[Time : 2 ½ Hours]

[Total marks :75]

- N.B. : (1) All questions are compulsory.
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Physical Constants:

$$N = 6.022 \times 10^{23}$$

$$R = 8.314 \text{ J/K mol}$$

$$c = 3.0 \times 10^8 \text{ m/s}$$

$$h = 6.626 \times 10^{-34} \text{ Js}$$

1. Attempt **Any Three** of the following: 15
- Derive emf of the following electrode concentration cell
 $\text{Pt}, \text{Cl}_{2(g)}(P_1) / \text{NaCl (aq)} / \text{Cl}_{2(g)}(P_2), \text{Pt}^+$
 - What is liquid junction potential? Explain its origin and describe how it can be minimized.
 - Derive an expression for the emf of the following cell with transference
 $\text{Pt}, \text{H}_{2(g)}(1 \text{ atm}) / \text{HCl } a_1(\text{aq}) // \text{HCl } a_2(\text{aq}) / \text{H}_{2(g)}(1 \text{ atm}), \text{Pt}^+$
 - Define overvoltage. Write a short note on factors affecting overvoltage
 - In the electrolysis of 2N H_2SO_4 , the hydrogen overvoltage at lead cathode was found to be 0.64V at 298K for a given current density. What will be hydrogen overvoltage if the current density is increased to twice its present value for the same cathode under the same condition (Given $b=0.12$).
2. Attempt **Any Three** of the following: 15
- Discuss the classification of polymers based on source.
 - Explain the determination of molecular weight of polymer by Ultra centrifuge method
 - The intrinsic viscosity of a solution of polymer at 298K is 2.9 dl/g. The constants in Mark Houwink equation are $K = 3.6 \times 10^{-3}$ and $\alpha = 0.72$. Calculate the molecular weight of the polymer
 - Discuss the method of preparation and applications of light emitting polymer.
 - Explain the phase diagram of three component system with the formation of one pair of partially miscible liquids (Type I)
3. Attempt **Any Three** of the following: 15
- What is Compton Effect? How is it justified by quantum theory?
 - Discuss wave particle duality of matter. Derive De-Broglie's wave equation.
 - State whether the following functions are eigen functions with respect to operator \int and dx and find its eigen value if any for (i) $2\cos 3x$ (ii) $4e^{kx}$
 - Explain how semiconductor is used as solar energy convertors
 - Explain production of hydrogen gas using electrolysis of water

4. Attempt **Any Three** of the following: 15
- Explain importance of Magnetic moment in NMR spectroscopy. Give its relation with angular momentum and energy of the nucleus.
 - Explain Larmor precession of nuclei using suitable diagram. Also explain its importance in resonance to happen.
 - What do you understand by Relaxation processes? What are their different types? What is its importance in NMR Spectroscopy?
 - Explain principle, construction and working of the ESR spectrometer.
 - Draw and explain hyperfine spectra of deuterium.

5. Answer the following: 15
- A. Select whether the following statements are **true or false (Any five)**
- Polarization can be reduced by stirring.
 - Ionic strength of 0.1M KCl and 0.1M CuSO_4 will be same
 - UV stabilizers in a polymer is added to protect the polymer from degradation
 - Sides of the equilateral triangular phase diagram of a three component system is a pure component
 - $\sqrt{(\quad)}$ is a linear operator
 - Germanium is having band gap 0.7 eV
 - Spinning nucleus acts minute bar magnet.
 - ESR spectra are observed in radio frequency region.

- B. Select the correct option and complete the following statements. (Any five)
- Ionic Strength of 0.1m MgSO_4 is _____
 a) 0.1 b) 0.2 c) 0.3 d) 0.4
 - Activity of electrolyte KNO_3 with 'm' as molality and ' γ ' as activity co efficient is _____
 a) $m^2\gamma^2$ b) $2m^3\gamma^3$ c) $3m^4\gamma^4$ d) $4m^5\gamma^5$
 - _____ polymer can be remoulded again from waste.
 a) Crosslinked b) Thermosetting c) Thermoplastic d) Branched
 - The curve in the phase diagram of a three component system is called as _____ curve.
 a) parabola b) descending c) binodal d) ascending
 - The fundamental equation of de Broglie's theory of wave-particle duality is _____.
 a) $\lambda = h/mc$ b) $\lambda = mc/h$ c) $\lambda = h/m$ d) $\lambda = h/c$
 - _____ is a renewable source of energy.
 a) natural gas b) solar energy c) oil d) coal
 - Nuclear spin of Deuterium is _____
 a) 0 b) $\frac{1}{2}$ c) 1 d) $\frac{3}{2}$
 - Resonance occurs when energy difference between energy levels($h\nu$) is equal to _____
 a) μ b) γH c) $2\mu H_0$ d) μH_0

C. Match the column: (Any five)

- | | |
|--|---|
| a. Salt Bridge | i. Antioxidant |
| b. Concentration cells | ii. Anti-parallel orientation |
| c. Prevent polymer degradation caused by exposure to oxygen | iii. Gallium arsenide |
| d. Degree of freedom for a three component system at constant temperature and Pressure | iv. Minimizes liquid junction potential |
| e. Operator | v. Two |
| f. Solar cell | vi. $F = 3 - P$ |
| g. High energy spin | vii. $E_{cell}^0 = 0$ |
| h. Peaks in ESR hyperfine spectra of hydrogen | viii. $P = 5 - F$ |
| | ix. $E_{cell}^0 = 1$ |
| | x. Mathematical procedure |
-