M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

First Semester

Chemistry

INORGANIC CHEMISTRY – I

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A $(10 \times 1 = 10)$

Answer **all** the following objective questions
by choosing the correct options.

1. The shape of the molecule depends on the   (CO1, K2)

    (a)   Adjacent atom   (b)   Valence electrons

    (c)   Surroundings   (d)   Atmosphere

2. Which of the following parameters cannot be estimated
    by using the Born-haber cycle?   (CO1, K2)

    (a)   Lattice energy

    (b)   Hydration energy of the ion

    (c)   Electron gain enthalpy

    (d)   Electronegativity

3. CFSE for high spin d^4 octahedral complex is   (CO2, K3)

    (a) $-1.8\Delta_o$ (b) $-0.6\Delta_o$

    (c) $-1.6\Delta_o + p$ (d) $-1.2\Delta_o$

4. Which is the strongest Jahn-Teller distortion?   (CO2, K3)

    (a)   Z-in   (b)   Z-out

    (c)   Both (a) and (b)   (d)   None of the above

5. The O_2 molecule is paramagnetic. It can be explained by

(CO3, K4)

(a) Resonance

(b) Hybridisation

(c) Molecular orbital theory

(d) Valence bond theory

6. As a ligand, Cl^- is (CO3, K4)

(a) σ – donor

(b) π – donor

(c) Both σ and π donor

(d) σ donar and π acceptor

7. In $NaCl$ crystal, the radius ratio is (CO4, K5)

(a) 0.4   (b) 0.98

(c) 1.0   (d) 0.52

8. The structure of Zinc blende is (CO4, K5)

(a) FCC   (b) BCC

(c) HCP   (d) SC

9. What is the most common oxidation state of lanthanides?

(CO5, K6)

(a) +2   (b) +3

(c) +6   (d) +4

10. Which property of actinides cannot be explained?

(CO5, K6)

(a) Radioactive   (b) Oxidation

(c) Magnetic   (d) Acidic

R1798

Part B $(5 \times 5 = 25)$

Answer **all** the questions not more than 500 words each.

11. (a) Explain the shape of H_2O and CO_2 molecules.
(CO1, K2)

Or

(b) State HSAB principle with example. (CO1, K2)

12. (a) Differentiate VBT and CFT theory. (CO2, K3)

Or

(b) Discuss about Jahn-Teller distortion. (CO2, K3)

13. (a) Write a brief note on the advantages of MoT.
(CO3, K4)

Or

(b) Enumerate the recent advances in theories of Co-ordination Complexes. (CO3, K4)

14. (a) Predict the crystal structures of NaCl and CsCl.
(CO4, K5)

Or

(b) Point the differences between graphite and diamond. (CO4, K5)

15. (a) Comment on the position of f-block elements.
(CO5, K6)

Or

(b) Elaborate the spectral properties of actinides.
(CO5, K6)

3

R1798

Part C $(5 \times 8 = 40)$

Answer **all** the questions not more than 1000 words each.

16. (a) Discuss the concept of hybridization of inorganic molecules. (CO1, K2)

Or

(b) Write the steps involved in Born-Haber Cycle. (CO1, K2)

17. (a) Elucidate the salient features of CFT. (CO2, K3)

Or

(b) Describe the d-d splitting in tetrahedral and octahedral complexes. (CO2, K3)

18. (a) State and explain extended Huckel theory. (CO3, K4)

Or

(b) Give a detailed note on bonding in co-ordination complexes. (CO3, K4)

19. (a) Justify how ions are packed in HCP, FCC and BCC Crystals. (CO4, K5)

Or

(b) Comment on the structure of AB_2 and A_2B type of crystals. (CO4, K5)

20. (a) Validate the applications of lanthanide compounds. (CO5, K6)

Or

(b) Comment on the magnetic properties of lanthanides and actinides. (CO5, K6)

————————

4

R1798

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

First Semester

Chemistry

ORGANIC CHEMISTRY — I

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. When an atom withdrawn electronic cloud towards itself through σ bond, it is referred to possess —————.
                                                                (CO1, K2)

    (a) No bond resonance

    (b) Inductive effect (–I)

    (c) Inductive effect (+I)

    (d) Resonance effect

2. According to Huckle's rule the aromatic cyclopropenyl cation should have 'n' value = —————.   (CO1, K3)

    (a) 0   (b) 1

    (c) 2   (d) 3

3. In case of thermodynamically controlled reactions, the product formation depends on ————— of the products.   (CO2, K3)

    (a) Relative stability (b) Rate of reaction

    (c) Solid nature   (d) Mass

4. ———————— is a tool to exhibit the significance of breaking to formation of bonds in the rate determining step. (CO2, K1)

(a) Taft equation

(b) Hammett equation

(c) LFER

(d) Hammond postulate

5. In E_1CB mechanism, the β-carbon is ———————— to give its conjugate base of the substrate. (CO3, K4)

(a) Hydrolysed

(b) Protonated

(c) Deprotonated

(d) Alkylated

6. ———————— stated that the double bonds in the bridged head positions are unstable. (CO3, K2)

(a) Zaitsev's rule   (b) NGP

(c) Ziegler   (d) Bredt's rule

7. Chirality means ————————. (CO4, K2)

(a) No elements of symmetry

(b) No alternate axis of lll[try]

(c) No plane of symmetry

(d) No centre of symmetry

R1799

8. The correct Fischer projection formula glyceraldehyde is
——————. (CO4, K4)

(a)

(b)

(c)

(d)
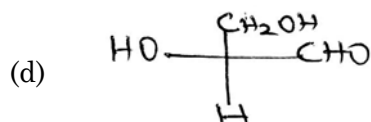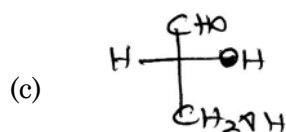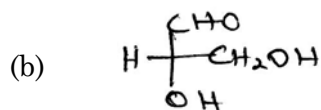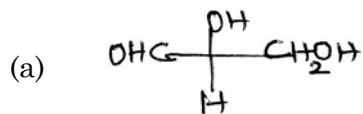
9. The anomeric effect in carbohydrates, assist the orientation of hydroxyl group in ——————. (CO5, K3)

(a) Equatorial rather than axial

(b) Axial rather than equatorial

(c) Equatorial

(d) None

10. Trans annular strain is also known as ——————. (CO5, K1)

(a) Prelog's strain   (b) Bayer's strain

(c) Torsional strain   (d) Bond angle strain

R1799

Part B $(5 \times 5 = 25)$

Answer **all** the questions not more than 500 words each.

11. (a) In the 'H NMR spectrum, explain the significance of protons resonating in the region of 6.5-8.0,ppm.
                                                    (CO1, K4)

Or

   (b) Differentiate electromeric effect from inductive effect.   (CO1, K2)

12. (a) Analyse and illustrate Lewis concepts of acids and bases.   (CO2, K3)

Or

   (b) Write a short note on non-kinetic methods of determining reaction mechanism.   (CO2, K2)

13. (a) Compare S_E1 and S_E2 mechanisms.   (CO3, K4)

Or

   (b) Demonstrate Benzyne mechanism.   (CO3, K2)

14. (a) Compare and contrast the concepts of configuration and conformation with suitable examples. (CO4, K4)

Or

   (b) Sketch the structure of D & L – threose and assign R/S to every chiral centre in them.   (CO4, K3)

15. (a) Illustrate First Plattner rule.   (CO5, K2)

Or

   (b) Choose the most stable conformer for 1,2-dimethyl ethane and compare its stability with its other conformers.   (CO5, K4)

4   **R1799**

Part C $(5 \times 8 = 40)$

Answer **all** the questions not more than 1000 words each.

16. (a) Analyse which of the following can exhibit hyperconjugation. Why?   (CO1, K4)

    (i)   Toluene   (4)

    (ii) Ethyne   (4)

                        Or

    (b) Identify the type of aromatic character in the following and explain.   (CO1, K3)

    (i)   Annulenes   (4)

    (ii) Fullerens   (4)

17. (a) Discuss the factors affecting the strength of organic acids.   (CO2, K2)

                        Or

    (b) Analyse the primary and secondary kinetic isotopic effects suggesting suitable cases.   (CO2, K4)

18. (a) Demonstrate the S_N1 and S_E1 mechanisms with suitable substrates.   (CO3, K2)

                        Or

    (b) Write a detailed note on stereochemical outcome of E_1 and E_2 mechanisms.   (CO3, K4)

                                    (4 marks each)

19. (a) Summarize the chirality based on   (CO4, K2)

    (i)   Plane and   (4)

    (ii) Centre of symmetry   (4)

                        Or

R1799

(b) Analyze the configuration of the following: (CO4, K4)

(i)

(2)

(ii)

(2)

(iii)

(2)

(iv)

(2)
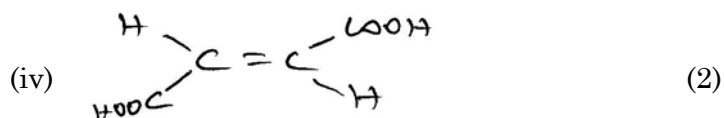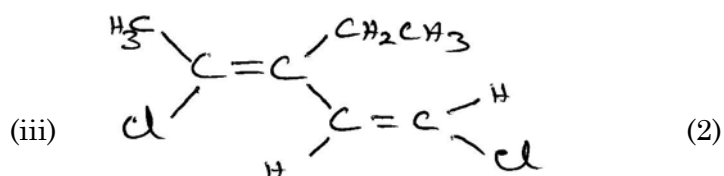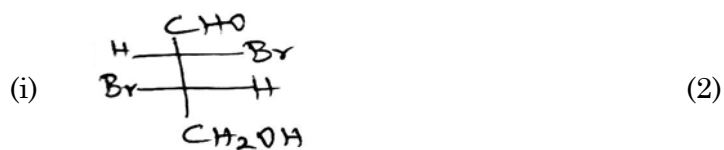
20. (a) Analyze the various conformations of cyclohexane (unsubstituted) in terms of their stabilities and energies. (CO5, K4)

Or

(b) Suggest suitable hydroxylation reactions to differentiate woodward and prevost reactions. (CO5, K2)

———————

R1799

R1800

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

First Semester

Chemistry

PHYSICAL CHEMISTRY — I

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A $(10 \times 1 = 10)$

Answer **all** the following objective type questions by choosing the correct option.

1.   Wave function ψ of a particle is   (CO1, K2)

   (a)   Real quantity

   (b)   A complex quantity

   (c)   An imaginary quantity

   (d)   None

2.   The probabity density of a particle is   (CO1, K2)

   (a)   Negative   (b)   Negative or positive

   (c)   Always positive   (d)   Complex quantity

3.   The number of elements in a group is called its (CO2, K3)

   (a)   Degree   (b)   Order

   (c)   Power   (d)   None

4.   Which one is belongs to C_2V group.   (CO2, K3)

   (a) NH_3 (b) H_2O

   (c) CH_4 (d)   CO

5. When the temperature increases to 10°C the rate of the reaction (CO3, K2)

   (a) No change   (b) Doubles

   (c) Decreases   (d) Ten times

6. Altering of rate due to non reacting ionic species is
                                            (CO3, K2)

   (a) Primary salt effect (b) Secondary salt effect

   (c) Catalysis   (d) Ionic reaction

7. The ideal gas equation for 1 mole of gas is   (CO4, K2)

   (a) $P_1V_1 = P_2V_2$ (b) $\dfrac{P_1}{P_2} = \dfrac{\pi}{T_2}$

   (c) $P_V = nRT$ (d) $P_V = RT$

8. Which is absolute temperature   (CO4, K2)

   (a) $-272°C$ (b) $-273.15°C$

   (c) $0°C$ (d) $100°C$

9. Which one is non radiative process?   (CO5, K5)

   (a) Phosphorosence

   (b) Fluoresence

   (c) Internal conversion

   (d) All of the above

10. Which molecule is mainly used to collect solar light.
                                            (CO5, K5)

   (a) CeO_2 (b) TiO_2

   (c) ZnO (d) NiO

2

R1800

Part B $(5 \times 5 = 25)$

Answer **all** the questions not more than 500 words each.

11. (a) State the basic principles of Quantum mechanics.

                                              (CO1, K2)

                    Or

    (b) Explain Bohr model.   (CO1, K2)

12. (a) Write short notes on various symmetry operations.

                                              (CO2, K3)

                    Or

    (b) Write great orthogonality theorem.   (CO2, K3)

13. (a) Explain kinetic isotopic effect.   (CO3, K2)

                    Or

    (b) Differentiate primary and secondary salt effect.

                                              (CO3, K2)

14. (a) Construct Carnot principle with example. (CO4, K2)

                    Or

    (b) What is Fermi energy? Explain its significance.

                                              (CO4, K2)

15. (a) Differentiate fluoresence and phosphorosence.

                                              (CO5, K5)

                    Or

    (b) Construct a dye senstised solar cell. Enumerate its uses.   (CO5, K5)

                    3   R1800

Part C $(5 \times 8 = 40)$

Answer **all** the following questions not more than
1000 words each.

16. (a) Derive schordinger wave equation. Why it is an eigen equation. (CO1, K2)

Or

(b) Explain (CO1, K2)

(i) Photoelectric effect

(ii) Wave particle duality

17. (a) Construct the character table for C_2V point group. (CO2, K3)

Or

(b) Discuss various symmetry elements. (CO2, K3)

18. (a) Derive Nernst – Einstein equation. (CO3, K2)

Or

(b) Discuss activated complex theory. (CO3, K2)

19. (a) Derive Maxwell relations. (CO4, K2)

Or

(b) Explain free electron model for solids. (CO4, K2)

20. (a) Draw and explain Jablonski diagram. (CO5, K5)

Or

(b) Discuss Marcus theory for electron transfer reactions. (CO5, K5)

————————

4

R1800

R1801

Sub. Code
536052

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

First Semester

Chemistry

Elective — INSTRUMENTAL METHODS OF ANALYSIS

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 1 = 10)

Answer **all** the questions by choosing the correct option.

1. Paper Chromatography is a separatory technique that is used to separate   (CO1, K1)

    (a) Simple mixtures   (b) Complex mixtures

    (c) Viscous mixtures   (d) Metals

2. Which of the following is used to pack columns in adsorption chromatography?   (CO1, K1)

    (a) Carbon

    (b) Silica gel

    (c) Potassium hydroxide

    (d) Aluminium oxide

3. In an experiment, it is found that the experimental value is very close to actual value, hence the experimental value can be called —————.   (CO2, K2)

    (a) Accurate   (b) Precise

    (c) Suitable   (d) Mean

4. Usually how many types of errors are present in scientific measurements?   (CO2, K2)

    (a) 2   (b) 3

    (c) 4   (d) 5

5. The potassium salts are placed in a Bunsen flame to obtain the line spectrum, the colour of the light emitted is   (CO3, K2)

    (a) Yellow   (b) Violet

    (c) Green   (d) White

6. Atomic spectra is also known as   (CO3, K2)

    (a) Continuous spectra

    (b) Line spectra

    (c) Spectra of absorption

    (d) The emission spectrum

7. What are the two main techniques for thermal analysis?
                                                (CO4, K2)

    (a) FTG AND DGG   (b) MSP AND FCT

    (c) TGA AND DTA   (d) TSA AND DGF

8. In thermo gravimetric analysis, the result obtained appear as a —————.   (CO4, K1)

    (a) Continuous chart

    (b) Continuous parabola

    (c) Continuous circular positions

    (d) Discontinuous chart

9. A potentiometer does not —————.   (CO5, K2)

    (a) Measure the Emf of two cells

    (b) Measure the unknown temperature

    (c) Measure the cell Internal Resistance

    (d) Compare the emf of two cells

2   **R1801**

10. Biosensors which measures the light output is known as

(CO5, K2)

    (a) Optical biosensor

    (b) Electrochemical biosensor

    (c) Calorimetric biosensor

    (d) Piezoetectric biosensor

                    Part B $(5 \times 5 = 25)$

    Answer **all** the questions not more than 500 words each.

11. (a) What is Rf value? - Explain it.   (CO1, K3)

                    Or

    (b) Write short note on Thin layer chromatography.
                                                  (CO1, K3)

12. (a) Explain the student-t test curves.   (CO2, K4)

                    Or

    (b) Discuss about Significant figures.   (CO2, K3)

13. (a) Explain the Principles and applications of Atomic Absorption Spectrometry (AAS).   (CO3, K4)

                    Or

    (b) Discuss briefly about the Flame photometry.
                                                  (CO3, K4)

14. (a) Explain the working principle of TGA.   (CO4, K3)

                    Or

    (b) Write short notes on Differential Scanning Calorimetry (DSC).   (CO4, K4)

15. (a) Discuss the working principle of Cyclic Voltammetry.   (CO5, K4)

                    Or

    (b) Explain briefly about the Principles of Amperometry.   (CO5, K3)

                    3

Part C   (5 × 8 = 40)

Answer **all** the questions not more than 1000 words each.

16. (a) Discuss in detail about the High Performance Liquid Chromatography (HPLC).   (CO1, K5)

Or

(b) Explain in detail about the Ion Exchange Chromatography.   (CO1, K5)

17. (a) What is meant by error? Explain the different types errors.   (CO2, K5)

Or

(b) Write short note on   (CO2, K5)

     (i) Significant figures   (4)

     (ii) Correlation co-efficient   (4)

18. (a) Discuss in detail about the Atomic Fluorescence Spectrometry.   (CO3, K5)

Or

(b) What is meant by atomic emission? How the atomic emission spectrometer works?-Explain it.   (CO3, K6)

19. (a) Discuss the working principle of Transmission Electron Microscopy (TEM) with schematic diagram.   (CO4, K5)

Or

(b) Discuss in detail about the X-ray diffraction meter (XRD).   (CO4, K5)

20. (a) What is sensors? How the Electrochemical sensors working-Explain in detail.   (CO5, K5)

Or

(b) Discuss the following   (CO5, K5)

     (i) Working principle of Potentiometer   (5)

     (ii) Biosensors   (3)

————————

R1801

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

Third Semester

Chemistry

ADVANCED INORGANIC CHEMISTRY

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct options.

1. What is the spin multiplicity of Fischer carbene?

   (CO1, K2)

   (a) 3   (b) 2

   (c) 1   (d) 0

2. What is the other name for metathesis reaction?

   (CO1, K2)

   (a) Addition reaction

   (b) Substitution reaction

   (c) Halogenation reaction

   (d) Double displacement reaction

3. Name the catalyst used in Wacker process?   (CO2, K4)

   (a) $Pdcl_2/Cucl_2$ (b) $MoBr_2/Cucl_2$

   (c) $Pdcl_2/Crcl_2$ (d) $Pocl_2/Cdcl_2$

4. Which is the suitable reagent for hydroformylation reaction?   (CO2, K4)

    (a) Tungsten   (b) Palladium

    (c) Rhodium   (d) Molybdenum

5. Out of the following ligand which has higher position in Nephelauxatic effect?   (CO3, K3)

    (a) I^- (b) CN^-

    (c) Br^- (d) en

6. Orgel diagram can be applied only for   (CO3, K3)

    (a) High spin complexes

    (b) Low spin complexes

    (c) Both (a) and (b)

    (d) None of the above

7. How much ATP does sodium – Potassium pump consume?
                                                          (CO4, K4)

    (a) $3/4^{th}$ (b) $1/4^{th}$

    (c) $1/3^{rd}$ (d) $1/2^{th}$

8. Photosystem – I has a   (CO4, K4)

    (a) Cholorophyll – a

    (b) M – dihydro porphyrin compelx

    (c) Both (a) and (b)

    (d) None of the above

9. The ligand system present in Vitamin B-12 is   (CO5, K5)

    (a) Porphyrin   (b) Corrin

    (c) Phthalocyanine   (d) Crownether

R1802

10. Which one of the following is a non-heme protein?

(CO5, K5)

(a) Hemoglobin   (b) Cytochrome P-450

(c) Myoglobin   (d) Hemocyanin

Part B $(5 \times 5 = 25)$

Answer **all** the questions not more than 500 words each.

11. (a) Write the mechanism of ring opening and closing metathesis.   (CO1, K2)

Or

(b) Comment on the structure of ferrocene.   (CO1, K2)

12. (a) What is oxidative addition? Give example. (CO2, K4)

Or

(b) State Ziegler – Natta polymerisation.   (CO2, K4)

13. (a) Derive the term symbol for d^2 configuration.

(CO3, K3)

Or

(b) Differentiate Para, ferro and antiferro magnetism.

(CO3, K3)

14. (a) Explain the therapeutic applications of cisplatin.

(CO4, K4)

Or

(b) Comment on the toxicity of inorganic metals like Al, Cd and Cr.   (CO4, K4)

15. (a) Draw the structure of Haemoglobin.   (CO5, K5)

Or

(b) Enumerate the steps involved in Nitrogen fixation.

(CO5, K5)

3

R1802

Part C (5 × 8 = 40)

Answer **all** the questions not more than 1000 words each.

16. (a) Discuss the reactivity of metal carbene complexes.
(CO1, K2)

Or

(b) State and explain cyclopentadienyl complexes.
(CO1, K2)

17. (a) Write the mechanism of hydrogenation and hydroformylation. (CO2, K4)

Or

(b) Write a detailed note on Monsanto Process.
(CO2, K4)

18. (a) Discuss the electronic spectra of transition metal complexes. (CO3, K3)

Or

(b) Describe the magnetic susceptibility using SQUID magnetometry. (CO3, K3)

19. (a) Summarize the role of trace elements in human life.
(CO4, K4)

Or

(b) Validate how radioisotopes are used in medicine.
(CO4, K4)

20. (a) Formulate the structure of Zinc based enzyme carboxy peptidase-A. (CO5, K5)

Or

(b) Determine the structure and properties of chlorophyll. (CO5, K5)
————————

4

R1802

R1803	Sub. Code
	536302

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

Third Semester

Chemistry

ADVANCED ORGANIC CHEMISTRY

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A $(10 \times 1 = 10)$

Answer **all** the following objective questions by choosing the correct option.

1.   The correct combination of reagents A and B to effect following transformations are   (CO1, K4)
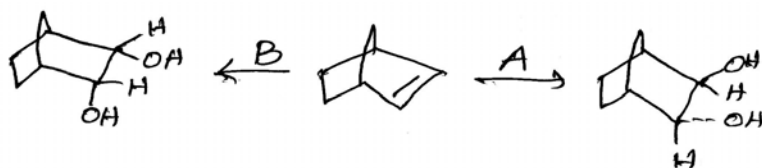
(a)   A = cat.OSO_4, NMO; B = (i) I_2, phCO_2Ag, (ii) aq.NaOH

(b)   A = alkaline $KMNO_4$; B = (i) I_2, phCO_2Ag, H_2O, (ii) aq.NaOH

(c)   A = (i) I_2, phCO_2Ag, (ii) aq.NaOH; B = cat-OSO_4, TMEDA, NMO

(d)   A = (i) m = cpBA; (ii) aq.NaOH; B = alkaline $KMNO_4$

2. Select/predict suitable reagent. (CO1, K4)
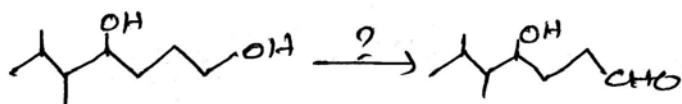
(a) MnO_2 . CH_2Cl_2

(b) TEMPO (20%) (Naocl) (1.25eq), CH_2Cl_2

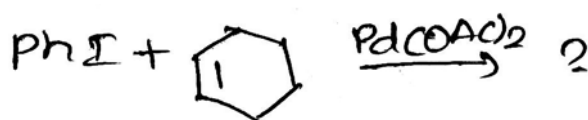(c) Pyridinium dichromate, CH_2Cl_2

(d) Dimethyblioxirane, CH_2Cl_2

3.

(CO2, K4)

(a)

(b)

(c)

(d)

R1803
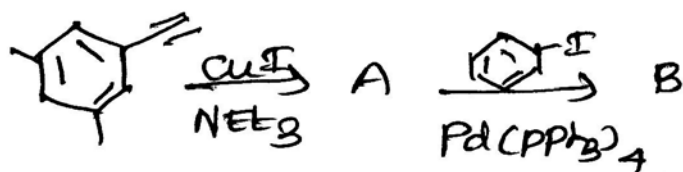
4. Identify the reaction (CO2, K4)
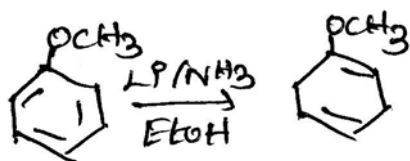
(a) Pinacol formation

(b) Corey-Bakshi-Shibata

(c) Luche-reduction
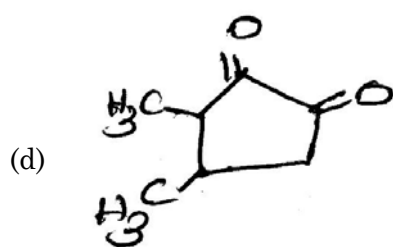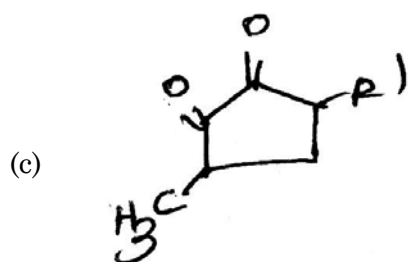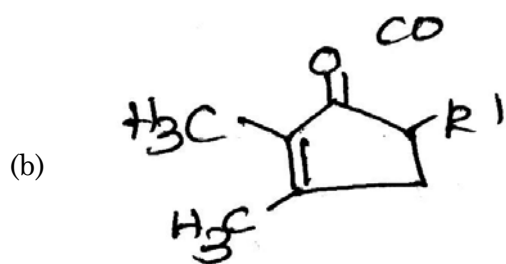
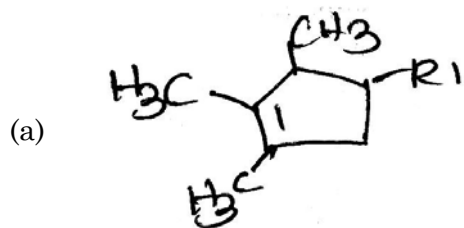(d) Birch reduction

5. Predict the product (CO3, K3)
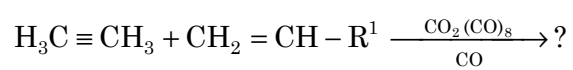

(a)   (b)

(c)   (d)

6. In Net reaction which group is converted in acidic conditions to product (CO3, K3)

(a) Methyl into carbonyl

(b) Nitro into carbonyl
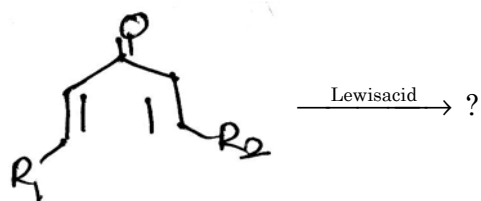
(c) Nitro into Methyl

(d) Chloro into Methyl

3

R1803

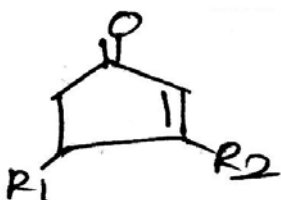7. Identify the product   (CO4, K4)

$$H_3C \equiv CH_3 + CH_2 = CH - R^1 \xrightarrow[\text{CO}]{\text{CO}_2\,(\text{CO})_8} ?$$

(a)

(b)

(c)

(d)

R1803

8.   Identify the product   (CO4, K4)

Lewisacid ⟶ ?

(a)

(b)

(c)

(d)

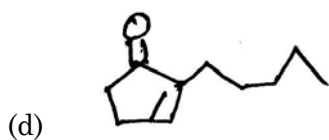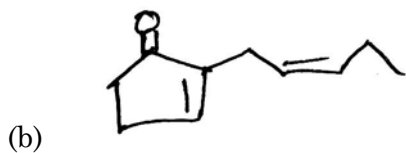5   R1803
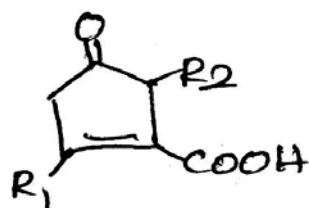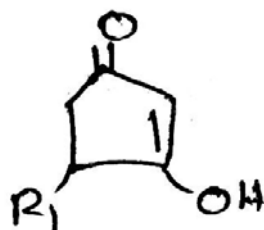
9. Identify the structure of Jasmone (CO5, K4)

(a)

(b)

(c)

(d)
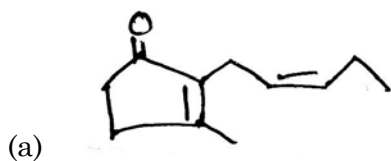
10. Which of following is true? (CO5, K4)

(a) Absolute assymetric synthesis is synthesis of optically active product from optically inactive substrate using enantiomer

(b) Absolute assymetric synthesis is synthesis of optically active product from optically active substrate using diastereomer

(c) Absolute assymetric synthesis is synthesis of optically active product from optically inactive substrate without using enantiomer

(d) Absolute assymetric synthesis is synthesis of optically inactive product from optically active substrate using enantiomer

6 **R1803**

Answer **all** the questions not more than 500 words each.

11. (a) Why trifluoroperacetic acid is an effective reagent compared to peracetic acid for epoxidation of alkens? (CO1, K4)

Or

(b) Write the mechanism of ozonolysis of an α, β - unsaturated carboxylic acid which proceeds bytheloss of CO_2. (CO1, K4)

12. (a) (i) Explain the mechanism behind reduction of esters to aldehydes with DIBAL-H.

(ii) Write the uses of DIBAL-H. (CO2, K4)

Or

(b) Predict the product (CO2, K4)
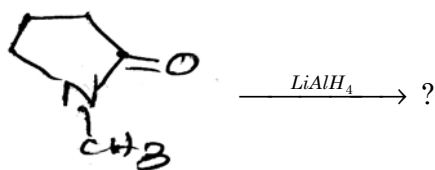
13. (a) Explain the mechanism of Heck reaction. (CO3, K3)

Or

(b) Write a short note on crownethers in phase transfer catalyst. (CO3, K3)

R1803

14. (a) Write the mechanism of Bergman cyclization using cydodeca-3-ene-1,5-diyne. (CO4, K4)

Or

(b) Discuss the construction o/s maceocyclic rings and ring closing metathesis. (CO4, K4)

15. (a) Explain synthetic route of jasmone and retinol. (CO5, K4)

Or

(b) Write short note on important strategies of reteosynthesis. (CO5, K4)

Part C $(5 \times 8 = 40)$

Answer **all** the questions not more than 1000 words each.

16. (a) Predict the products from each of unsymmetrical ketones on Baeyer-villiger reaction. (CO1, K4)

$Me_3C - CO - CH_3$ $Ph - CO - CH_3$
(I) (II)

Or

(b) Predict the product and explain the reaction. (CO1, K4)

8

R1803
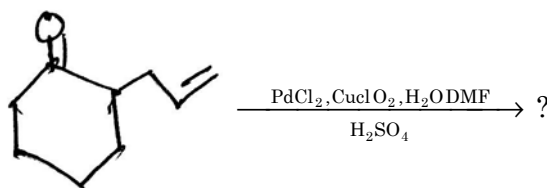
17. (a) Comment on the reaction outcome   (CO2, K4)
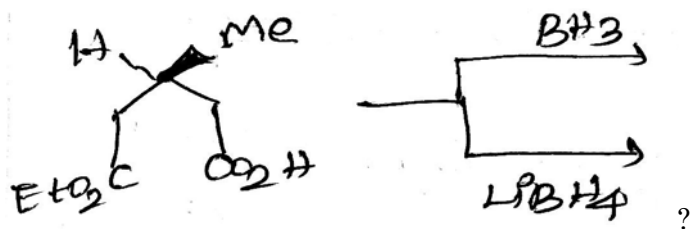
Or

(b) Convert I-butyne into the is-epoxide (II)–How the same epoxide with transgeometry (III) could be prepared.   (CO2, K4)

18. (a) Explain the preparation process of cyclohexanone derivatives using Robinson Annulation.   (CO3, K3)

Or

(b) Explain the mechanism.   (CO3, K3)
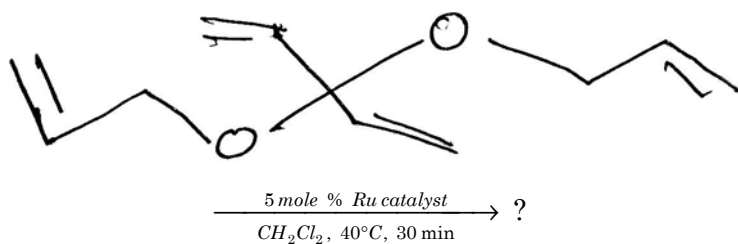
19. (a) Write an essay about Pauson-Knad reaction for synthesis of cyclopentanones.   (CO4, K4)

Or

9   R1803

(b) Guess the reaction and product write briefly. (CO4, K4)
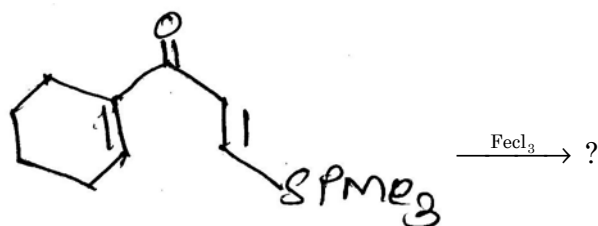
20. (a) Discuss a brief note on protection and deprotection of alkene, 1, 3-butadiene. (CO5, K4)

Or

(b) Predict the synthetic route of ascorbic acid. (CO5, K4)

————————

10

R1803

R1804

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

Third Semester

Chemistry

ADVANCED PHYSICAL CHEMISTRY

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1.   Slater-type orbitals are particularly useful in which type of calculations?   (CO1, K2)

   (a)   Molecular dynamics simulations

   (b)   Quantum chemical calculations

   (c)   Classical mechanics problem

   (d)   Thermodynamic calculations

2.   According to the Hellmann-Feynman theorem, the force on a nucleus in a module is given by   (CO1, K2)

   (a)   The gradient of the potential energy

   (b)   The gradient of the electron density

   (c)   The gradient of the total energy with respect to the position of the nucleus

   (d)   The gradient of the kinetic energy with respect to the position of the nucleus

3.   Raman scattering is particularly useful for studying.
                                                    (CO2, K1)

     (a)   Nuclear magnetic resonance

     (b)   Molecular vibration and chemical composition

     (c)   Thermal conductivity

     (d)   Electronic band structure

4.   In the context of the Boltzmann distribution, the term
     $e\{- E / K_B T\}$ is often referred to as   (CO2, K2)

     (a)   The degeneracy factor

     (b)   The energy factor

     (c)   The Boltzmann factor

     (d)   The partition function

5.   Electro chemistry is the study of   (CO5, K1)

     (a)   Chemical reactions involving light

     (b)   Chemical processes involving heat

     (c)   Chemical reactions that produce electrical effects
           and vice versa

     (d)   Chemical reactions involving sound

6.   The potential drop in the electric double layer is
     primarily associated with which part of the double layer
     structure?   (CO3, K2)

     (a)   Only the Helmholtz layer

     (b)   Only the diffuse layer

     (c)   Both the helmholtz layer and the diffuse layer

     (d)   Neither the Helmholtz layer nor the diffuse layer

R1804

7. In statistical mechanics, Entropy is a measure of (CO4, K1)

    (a) The total energy of a system

    (b) The disorder or randomness of a system

    (c) The workdone by a system

    (d) The heat capacity of a system

8. RRKM theory is most applicable to which type of reactions. (CO4, K2)

    (a) Bimolecular reactions in the gas phase

    (b) Line molecular reactions in the gas phase

    (c) Bimolecular reactions in solution

    (d) Photo chemical reactions

9. If a plane does not intersect the x-axis but Intersects the y-axis at b and the z-axis (CO5, K1)

    (a) (011) (b) (010)

    (c) (100) (d) (110)

10. The conductivity of a semiconductor increases with (CO5, K1)

    (a) Decreasing temperature
    (b) Increasing temperature
    (c) Increasing band gap
    (d) Increasing impurity concentration

Part B $(5 \times 5 = 25)$

Answer **all** questions not more than 500 words each.

11. (a) State and prove the Hellman-Feynman theorem. (CO1, K1)

                  Or

    (b) Outline the Hartee-Fock SCF theory of polyatomic molecules. (CO1, K4)

3   R1804

12. (a) Explain the following : (CO2, K4)

    (i) Fermi's Golden rule

    (ii) Transition Dipole moment

              Or

   (b) Write short note on Nuclear Quadrupole resonance spectroscopy. (CO2, K2)

13. (a) Discuss in detail Helmholtz-perrin model of electric field interface. (CO3, K4)

              Or

   (b) Write a note on Ion-solvent Interactions. (CO3, K4)

14. (a) Using appropriate diagrams discuss the role of potential energy surfaces in reaction kinetics. (CO4, K2)

              Or

   (b) Derive Fermi-Dirac statistics. (CO4, K4)

15. (a) Derive Bragg's equation for the diffraction of X-rays by crystals? (CO5, K4)

              Or

   (b) What are the difference between isotropic and an isotropic solids. (CO5, K2)

Part C (5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Discuss LCAO-MO treatment of Hydrogen molecule. (CO1, K4)

              Or

   (b) Explain the following : (CO1, K4)

    (i) Spin-Orbit Coupling (4)

    (ii) Term symbols. (4)

4

R1804

17. (a) (i) Comment on the stark effect in microwave spectra. (2)

       (ii) How is microwave spectroscopy used in investigating (1) internal rotation and (2) the inversion spectrum of NH_3? (6)

                                (CO2, K1)

Or

   (b) Discuss SRS, Inverse Raman scattering and CARS emphasizing the salient features. (CO2, K4)

18. (a) Write explanatory note on the following : (CO3, K2)

       (i) Butter-Volmer equation. (4)

       (ii) Tafel equation and Tafel plot. (4)

Or

   (b) Discuss the structure of electrified interfaces with reference to the Gouy-Chapman model. (CO3, K2)

19. (a) (i) Give a short account of Maxwell-Botzmann's distribution of energies. (4)

       (ii) Compare Bose-Einestein, Fermi-Dirac statistics. (4)

                                (CO4, K3)

Or

   (b) Discuss the Absolute reaction rate theory. Explain how ARRT is superior to collision theory. (8)

                                (CO4, K3)

R1804

20. (a) Describe the experimental details of the various methods employed for the study of crystals by means of X-rays. (8)

(CO5, K1)

Or

(b) What are n-type and p-type semi conductors? Explain how their combinations find application in the fabrication of transistors. (CO5, K1)

————————————

R1804

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

Third Semester

Chemistry

Elective : SPECTROSCOPIC METHODS OF ANALYSIS

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 1 = 10)

Answer **all** the following objective questions by choosing the correct option.

1.   Surface enhanced Raman scattering involves   (CO1, K2)

     (a)   Complex   (b)   Nano material

     (c)   Catalyst   (d)   Raman activity

2.   The deep color of the $K_2Cr_2O_7$ is due to   (CO1, K2)

     (a)   Conjucation   (b)   Delocalisation

     (c)   Charge transfer   (d)   Absorbance

3.   Which in NMR inactive?   (CO2, K2)

     (a) ^{13}C (b) ^{31}P

     (c) ^{19}F (d) ^{12}C

4.   Identify the NMR standard   (CO2, K2)

     (a)   TEOS   (b)   TMS

     (c)   APS   (d)   All

5. Signal splitting in NMR arises from   (CO3, K4)

    (a) Shielding effect

    (b) Spin-spin decoupling

    (c) Spin-spin coupling

    (d) Deshielding effect

6. Spin-spin coupling is not observed when the protons are separated by more than   (CO3, K4)

    (a) One single bond   (b) Two sigma bond

    (c) Three sigma bond (d) Four sigma bond

7. In mass spectra the peak with highest intensity is
                                                     (CO4, K4)

    (a) Molecular ion peak

    (b) Base peak

    (c) Fragmented peak

    (d) None

8. Mossbauer spectroscopy uses   (CO4, K4)

    (a) Radio frequency   (b) Gamma rays

    (c) Infra red   (d) Microwave

9. Beers Lambert law associated with   (CO5, K3)

    (a) IR   (b) Mass

    (c) UV-visible   (d) NMR

10. Scattering is studied in   (CO5, K3)

    (a) UV-visible   (b) IR

    (c) Raman   (d) EPR

R1805

Part B $(5 \times 5 = 25)$

Answer **all** the following questions not more than 500 words each.

11. (a) Write Woodward-fisher rule with example.

    (CO1, K2)

    Or

    (b) Explain the principle of resonance Raman spectra.

    (CO1, K2)

12. (a) What is chemical shift? How it is affected by various factors? (CO2, K2)

    Or

    (b) Explain NOE with example. (CO2, K2)

13. (a) Differentiable Zeeman and zero field splitting.

    (CO3, K4)

    Or

    (b) Explain the principle and EPR spectroscopy.

    (CO3, K4)

14. (a) Write McLafferty rearrangement with example.

    (CO4, K4)

    Or

    (b) State about hyperfine incretion in EPR. (CO4, K4)

15. (a) Comment on the spectral line brodening. (CO5, K3)

    Or

    (b) Draw and explain the instrumentation of double beam UV-visible spectrometer. (CO5, K3)

3

R1805

Part C   (5 × 8 = 40)

Answer **all** the following questions not more than 1000 word each.

16. (a) Discuss the principle of IR spectroscopy.   (CO1, K2)

                              Or

     (b) Explain the mechanism of SERS.   (CO1, K2)

17. (a) How NMR spectroscopy useful in structural elucidation of organic compounds.   (CO2, K2)

                              Or

     (b) Explain off-resonance and double resonance.
                                                      (CO2, K2)

18. (a) Discuss COSY and NOESY spectra.   (CO3, K4)

                              Or

     (b) Write a detailed note on EPR of cu complex.
                                                      (CO3, K4)

19. (a) Explain the principle and application of MALDI-MS.   (CO4, K4)

                              Or

     (b) Write a note on mossbare of $K_4[Fe(CN)_6]$ and $K_3[Fe(CN)_6]$.   (CO4, K4)

20. (a) Draw the important components of a optical spectrometer.   (CO5, K3)

                              Or

     (b) Write a note on sample preparation involved in IR, NMR and UV-visible spectroscopy.   (CO5, K3)

————————

R1805