(8 pages) **Reg. No. :** .....

Code No. : 7053 **Sub. Code : PCHM 31**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023

Third Semester

Chemistry — Core

ORGANIC CHEMISTRY — III

(For those who joined in July 2017 onwards)

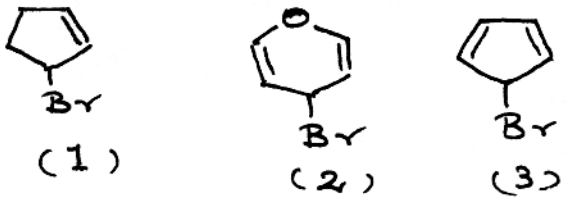
Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Arrange the following compounds in the order of increasing S_N1 reactivity.



(a) 2 > 1 > 3 (b) 2 > 3 > 1

(c) 1 > 2 > 3 (d) 3 > 2 > 1

2. Identify the ambident nucleophile from the following :

(a) $\overset{\ominus}{N}H_2$ (b) $\overset{\ominus}{C}N$

(c) $\overset{\ominus}{B}r$ (d) $\overset{\ominus}{O}H$

3. Which one of the complex is used as a NMR shift reagent?

(a) Sm (b) Eu

(c) Pm (d) La

4. How many carbon signals would you expect in the ^{13}C NMR spectrum of ethylbenzoate?

(a) 8 (b) 7

(c) 6 (d) 5

5. Benzylic cleavage involves the cleavage of a C – C bond which is ———— to the aromatic ring.

(a) δ (b) γ

(c) β (d) α

6. Ion-molecule collision can produce peaks of higher mass number that the ———— peak.

(a) Skeletal ion (b) Isotope satellite

(c) Molecular ion (d) Metastable ion

7. A thermal reaction involving $(4n+2)\pi$ electrons proceed with

(a) Conrotatory motion

(b) Disrotatory motion

(c) Both conrotatory and disrotatory reaction

(d) None of the above

8. Which of the following is the example of photoaddition of olefins to carbonyl compounds?

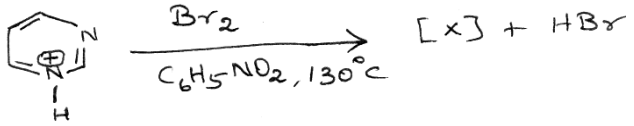
(a) Claisen reaction

(b) Norrish type-I

(c) Norrish type-II

(d) Paterno-Buchii reaction

9. In the given reaction



[X] will be

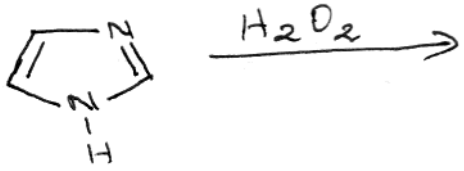
(a) 5-Bromopyrimidine

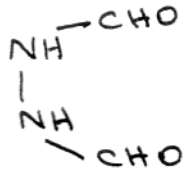
(b) 3-Bromopyrimidine

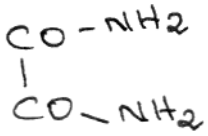
(c) 4-Bromopyrimidine

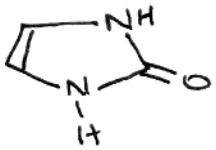
(d) 2-Bromopyrimidine

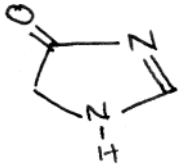
10. Pick the product for the reaction



(a) 

(b) 

(c) 

(d) 

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Describe the effect of solvent on S_N1 and S_N2 reactions.

Or

(b) Write short notes on :

(i) Chugaev reaction

(ii) Cope elimination (3 + 2)

12. (a) (i) Write notes on NOE.

(ii) Explain the principle of proton decoupled ^{13}C spectroscopy.

Or

(b) Write a brief account on Fourier technique in NMR spectroscopy.

13. (a) (i) In the mass spectrum of toluene, strong peaks are formed at $m/e = 91$ and $m/e = 65$ and also a broad peak at $m/e = 46.4$. Explain.

(ii) Explain Nitrogen rule.

Or

(b) Write notes on ESI-MS technique.

14. (a) By means of FMO approach, explain whether the Diels Alder reaction between ethylene and 1,3-butadiene is photochemically allowed or forbidden.

Or

(b) (i) Write a note on $Di-\pi$ methane rearrangement.

(ii) What is Barton reaction? Give an example.

15. (a) Explain the synthetic of (i) oxazole and (ii) Imidazole. (2.5 + 2.5)

Or

(b) Give an account of the preparation and properties of pyridazine.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) (i) Discuss $B_{AC}2$ and $A_{AC}2$ mechanisms of hydrolysis of esters.

(ii) Neomenthyl chloride undergoes faster E2 reaction than menthylchloride. Explain.

Or

(b) (i) Compare and contrast E1 and E2 eliminations.

(ii) Illustrate neighbouring group participation with an example.

17. (a) (i) What do you mean by proton exchange reaction? How does spin decoupling occurs in certain groups due to proton exchange.

(ii) Equatorial protons appear slightly downfield as compared to axial protons. Explain.

(iii) How will you distinguish between samples of para-xylene and meta-xylene by ^{13}C NMR spectroscopy?

Or

(b) Describe the uses of 2D NMR spectra. What are the advantages of COSY and DEPT spectra? Explain with examples

18. (a) Write notes on :

(i) McLafferty rearrangement

(ii) Metastable peak.

Or

(b) An organic compound of the formula C_8H_7N has an IR peak at 2260 cm^{-1} (KBr) and two sharp singlets in its ^1H NMR spectrum (δ, $CDCl_3$, TMS, 100 MHz machine) at 3.6 (2 H) and 7.2 (5 H). Its ^{13}C NMR spectrum reveals the following details : (δ, $CDCl_3$, TMS) 23.1 (t), 118.4 (s), 127.8 (d),

128.0 (d), 129.0 (d) and 130.6 (s). Its mass spectrum reveals bisides the molecular ion peak at m/e 117 , additional peaks at m/e 90, 91, 77, 63, 39 and 27. Suggest a structure for the compound.

19. (a) (i) By means of a correlation diagram approach, explain whether cyclisation of 1, 3, 5-hexatriene to give cyclohexadiene involving conrotation is thermally or photochemically allowed process.

(ii) Write a note on photosensitization.

Or

(b) (i) Illustrate Norrish type I and type II reactions with examples.

(ii) Discuss briefly about sigmatropic rearrangements.

20. (a) (i) Describe any two methods of synthesizing pyrimidine.

(ii) Write briefly on structure of lactose.

Or

(b) (i) Give the synthesis of pyrazine and flavonol.

(ii) Narrate the biosynthesis of flavonoids.

———————

(6 pages)

Reg. No. : .....

Code No. : 7055 **Sub. Code : PCHM 33**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

Third Semester

Chemistry – Core

PHYSICAL CHEMISTRY – III

(For those who joined in July 2017 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Point group of H_2O molecule is ————————

(a) C_3V

(b) C_2V

(c) Td

(d) Oh

2. The symmetry element which is performed by a clockwise rotation of a molecule followed by reflection perpendicular to the principal axis (ie) rotation followed by reflection

(a) Identity (E)

(b) Improper axis of rotation (Sn)

(c) Reflection (6)

(d) Inversion (i)

3. Which among the following not obey the rule of mutual exclusion?

(a) C_2H_4 (b) $PtCl_4^{2-}$

(c) NH_3 (d) trans $C_2H_2Cl_2$

4. Which electronic transition is not possible in C_2H_4 molecule?

(a) $6-6^*$ (b) $\pi-\pi^*$

(c) $\pi-6^*$ (d) $n-\pi^*$

5. When the magnetic field is applied to protons the magnetic energy level of protons split in to ——————— level

(a) 1 (b) 2

(c) 3 (d) 4

6. Which of the following is not used as solvent in NMR?

(a) Ccl_4 (b) H_2O

(c) D_2O (d) C_6H_6

7. The ESR spectrum of methyl radical consists of _____

(a) 2 (b) 3

(c) 4 (d) 6 lines

8. Filled electrons can contribute to EFG when they are polarized by outer electrons. It is called _____

(a) Sternheimer effect

(b) Townes - Dailey effect

(c) NQR effect

(d) All

9. Mass bauer spectra observer in _____

(a) Solid state

(b) liquid state

(c) Gaseous state

(d) liquid crystalline state

10. Which of the following rule is application for mass spectroscopy?

(a) Nitrogen rule

(b) Adamson rule

(c) Axial halo ketone rule

(d) Octant rule

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).
Each answer should not exceed 250 words.

11. (a) Explain the Great Orthogonality theorem.

Or

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

12. (a) Discuss in detail about Electronic spectra of formaldehyde molecule.

Or

(b) Explain the hybridisation of atomic orbitals in non-linear molecule $POCl_3$.

13. (a) Write notes on Nuclear overhauser effect.

Or

(b) Define chemical shift. What are the factors affecting the chemical shift in NMR spectroscopy.

14. (a) Discuss in detail about hyperfine splitting in ESR spectroscopy.

Or

(b) Write notes on basic principles and applications of NQR.

15. (a) Write down the basic principles photo electron spectroscopy.

Or

(b) Write notes on isomer shift in moss bauer spectroscopy.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b)

Each answer should not exceed 600 words.

16. (a) How will you construct a character table for C_2V point group by using GOT?

Or

(b) Discuss in detail about Reducible Representation and Irreducible Representation.

17. (a) Write notes on symmetry selection rules for infrared and Raman Spectra.

Or

(b) Calculate the delocalization energy for trans 1, 3 Butadiene using HMO theory.

18. (a) Discuss the theory and principles of $^{13}_{C}$ NMR.

Or

(b) Discuss in detail about "Magnetic Resonance Imaging" (MRI).

19. (a) Give an account on Kramer's degeneracy and zero field splitting. Explain how these phenomenon applies in the spectra of Mn (II)?

Or

(b) Give the EPR spectra of methyl radical and Benzene anion radical.

20. (a) Explain Franck - Condon principle.

Or

(b) Discuss in detail about base peak and metastable peak in mass spectroscopy.

———————

(6 pages) **Reg. No. :** .....

Code No. : 7057 **Sub. Code : PCHM 41**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

Fourth Semester

Chemistry — Core

ORGANIC CHEMISTRY — IV

(For those who joined in July 2017 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Which of the following reaction involve ylides?

   (a) Wittig reaction

   (b) Wilkinson reaction

   (c) Zeigler Natta reaction

   (d) Diels-Alder reaction

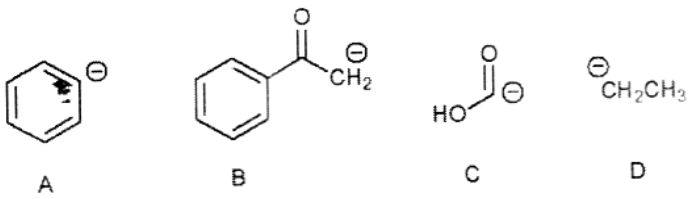
2. ———————— is an aryl-aryl coupling reaction with the help of diazonium salt.
   (a) Gomberg-Bachmann reaction
   (b) Bamford-Stevens reaction
   (c) Reimer-Tiemann reaction
   (d) Darzen reaction

3. The ———————— conformation of cyclohexane is not very stable form due to the torsional strain applied to the cyclohexane molecule.
   (a) boat (b) chair
   (c) axial (d) equtorial

4. The ———————— applies to systems in which different products are formed from two substrates in equilibrium with one another.
   (a) Chain-Ingold Prelog rule
   (b) Gram rule
   (c) Craig rules
   (d) Curtin-Hammett principle

5. Which of the following statements best describes a synthon?
   (a) A synthetic reagent used in a reaction
   (b) A key intermediate in a reaction sequence
   (c) A transition state involved in a reaction mechanism
   (d) A hypothetical structure that would result in a given reaction if it existed

6. Which of the following synthons is an example of Umpulong?



(a) Structure A (b) Structure B

(c) Structure C (d) Structure D

7. The ———————— is a widely employed transition metal catalyzed cross-coupling reaction.

(a) Still coupling (b) Suzuki coupling

(c) Negishi coupling (d) Heck coupling

8. The Heck reaction involves ————————

(a) Rhuthenium catalyst

(b) Palladium catalyst

(c) Platinum catalyst

(d) Nickel catalyst

9. Which of the following regulates the female reproductive cycle?

(a) Progesterone (b) Testosterone

(c) Estrogens (d) Glucocorticoids

10. All steroid hormones are derived from

(a) Carbohydrate (b) Protein

(c) Cholesterol (d) Vitamins

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Write the Stobbe condensation reaction.

Or

(b) Explain the Gomberg-Bachmann reaction.

12. (a) Explain why the chair conformation of cyclohexane is more stable than boat conformation.

Or

(b) Describe the Conformation and stereochemistry of Decalins.

13. (a) Narrate the protection and deprotection to Alcohol.

Or

(b) Write a comprehensive note on retrosynthetic analysis.

14. (a) State the role of osmium tetraoxide in organic synthesis.

Or

(b) Describe the function of DDQ in organic synthesis.

15. (a) Describe the stereochemistry of steroids.

Or

(b) Give the irradiated products of ergosterol.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Write the Darzen condensation and Wittig reactions with the mechanism.

Or

(b) Discuss the regioselectivity and stereospecificity of the Oxymercuration reaction.

17. (a) Discuss the conformation of 1, 3-disubstituted cyclohexanes. Also explain their stability.

Or

(b) Give a brief account of the conformational analysis of cyclohexane.

18. (a) Explain the following :

(i) Protecting Groups for Carbonyl compounds.

(ii) Protecting group for Amines.

Or

(b) Write a comprehensive note on functional group interconversions (FGI).

19. (a) Discuss the reaction of Borone with alkenes and alkynes.

Or

(b) Give a comprehensive note on 9-BBN and Adam's Catalyst.

20. (a) What are the chief sources of cholesterol? Establish the structure of DielsHydrocarbon.

Or

(b) How will you convert the following?

(i) Cholesterol to testosterone

(ii) Oestrone to Oestriol

———————

(6 pages)

Reg. No. : .....

Code No.: 7058 **Sub. Code: PCHM 42**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

Fourth Semester

Chemistry — Core

INORGANIC CHEMISTRY — IV

(For those who joined in July 2017 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Mossbauer Spectroscopy uses ———— radiation.

   (a) γ radiation

   (b) β radiation

   (c) Θ radiation

   (d) ϵ radiation

2. The combination of the appearance of circular dichrosim (and ellipticity) and an S-shaped ORD curve for an optically active compound inside its adsorption region is known as the ————————

(a) Faraday effect (b) Cotton effect

(c) Kerr effect (d) Bohr effect

3. ESCA can identify elements in the periodic table above which of the following?

(a) Carbon

(b) Boron

(c) Helium

(d) Mass of atoms

4. Which of the following is the detection limit of ESCA?

(a) 0.1% monolayer (b) 0.5% monolayer

(c) 1% monolayer (d) 2% monolayer

5. Chlorophyll is the complex of ————————.

(a) Fe^{3+} (b) Fe^{2+}

(c) Mg^{2+} (d) CO^{2+}

6. Vitamin B_{12} contains ————————.

(a) Fe (II) (b) Co (III)

(c) Zn (II) (d) Ca (II)

7. Carboxpeptidases contains

(a) Zn(II) and hydrolysis CO_2

(b) Zn(II) and hydrolysis peptide bonds

(c) Mg(II) and hydrolysis CO_2

(d) Mg(II) and hydrolysis peptide bonds

8. Superoxide dismutase contains the metal ions ————————.

(a) Zn(II) and Ni(II)

(b) Cu(II) and Zn(II)

(c) Ni(II) and Co(III)

(d) Cu(II) and Fe(III)

9. The extensively used nanoparticles as catalyst is ————————.

(a) Silver (b) Copper

(c) Gold (d) Cerium

10. Fabrics are extensively made out of nano materials like ————————.

(a) Carbon nano tubes

(b) Fullerenes

(c) Mega tubes

(d) Polymers

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Describe the quadrupole effect of magnetic field on Mossbauer spectra.

Or

(b) Determine the absolute configuration of complexes.

12. (a) Write the principle and applications of Auger electron spectroscopy.

Or

(b) Enumerate the Koopman's theorem.

13. (a) Explain the structure and function of Chlorophyll.

Or

(b) Illustrate the role of metal ions in biological systems.

14. (a) Write a comprehensives note on superoxide dismutase.

Or

(b) Describe the role of the Carbonic anhydrase in biological systems.

15. (a) What are Zeolites? Give its structure and properties.

Or

(b) Write a comprehensive note on graphite compounds.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Define isomer shift. Describe the Mossbauer spectra of tin (Sn) compounds.

Or

(b) Narrate the hyperfine splitting in Mossbauer spectra.

17. (a) Discuss the structure and bonding information in metal carbonyls.

Or

(b) Give the basic principles and applications of Nuclear Quadrupole Resonance spectroscopy (NQR)

18. (a) Discuss the applications of coordination compounds in bioinorganic chemistry.

Or

(b) Write a comprehensive note on Ferredoxins and rubredoxins.

19. (a) Give a brief account of copper proteins.

Or

(b) Discuss the role of metallothionins in bioinorganic chemistry.

20. (a) Briefly about the fullerenes in supramolecular chemistry.

Or

(b) How will you synthesize nanoparticles using the sol-gel method and hydrothermal methods?

———————

(7 pages)

Reg. No. : .....

Code No. : 7059 **Sub. Code : PCHM 43**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

Fourth Semester

Chemistry – Core

PHYSICAL CHEMISTRY – IV

(For those who joined in July 2017 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL the questions.

Choose the correct answer :

1. The spectra caused in the infrared region by the transition in vibrational levels in different modes of vibrations are called _____.

   (a) Rotational spectra

   (b) Electronic spectra

   (c) Vibrational spectra

   (d) None of these

2. The lowest energy of a quantum mechanical harmonic oscillator is 1/2 hv. It is referred to as _____.

   (a) Ground state energy

   (b) Zero-point energy

   (c) Vibrational energy

   (d) All of the above

3. The vibrations, without a center of symmetry, are, active in _____.

   (a) Infrared active but inactive in Raman

   (b) Raman and IR

   (c) Raman but inactive in IR

   (d) None of these

4. The intensity of an absorption band is always proportional to the _____.

   (a) Atomic population

   (b) Temperature

   (c) Molecular population of the initial state

   (d) Molecular population of the final state

5. Who put forward the collision theory of chemical reactions?

(a) Trautz and Lewis

(b) Luigi Galvani

(c) Henry Cavendish

(d) Alessandro Volta

6. In a chemical reaction, if the reactant requires a high amount of activation energy, then what is the behavior of the reaction?

(a) Fast

(b) Slow

(c) Instantaneous

(d) Doesn't depend on activation energy

7. Which of the following is not a direct factor affecting the rate of a reaction?

(a) Temperature

(b) Presence of catalyst

(c) Order of reaction

(d) Molecularity

8. What happens to the rate of the reaction on increasing its temperature?

   (a) Rate of reaction increases

   (b) Rate of reaction decreases

   (c) Rate of reaction fluctuates between its maxima and minima

   (d) Rate of reaction is independent of temperature

9. Which of the following decreases the rate of reactions?

   (a) Catalytic promoters

   (b) Homogeneous catalyst

   (c) Catalytic poison

   (d) Heterogeneous catalyst

10. Which of the following can result in a transition from physisorption to chemisorption?

   (a) Decrease in temperature

   (b) Increase in temperature

   (c) Decrease in pressure

   (d) Increase in surface area

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Write a comprehensive note on fundamental vibrations.

Or

(b) How many vibrational mode in H_2O molecule? Why symmetric vibration in CO_2 molecule causes no change in dipole moment?

12. (a) Explain the rule of Mutual Exclusion principle for CO_2 molecule.

Or

(b) Explain the Raman effect.

13. (a) Brief in detail about energy of activation.

Or

(b) Write the principle of flash photolysis.

14. (a) Give a brief account of composite reactions.

Or

(b) Narrate the transition state theory.

15. (a) What is adsorption? How will you distinguish between chemisorption and physisorption?

Or

(b) Write the Bronsted catalysis law.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Discuss briefly, the vibration-rotation spectra of polyatomic molecules.

Or

(b) Explain the Born Oppenheimer approximation of molecule spectra.

17. (a) What are LASERs? Describe its types.

Or

(b) Discuss the theories of Raman spectra.

18. (a) Enumerate the Lindemann's theory of unimolecular reactions.

Or

(b) Give a brief account of absolute reaction rate theory (ARRT) of bimolecular reactions.

19. (a) Explain briefly about consecutive reactions with example.

Or

(b) Discuss the kinetics for $H_2 - Br_2$ reaction.

20. (a) Enumerate the Michaelis-Menton kinetic theory of enzyme action.

Or

(b) Derive the Freundlich and Langmuir adsorption isotherms.

———————

(7 pages) **Reg. No. :** .....

Code No. : 7406 **Sub. Code : ZCHM 11**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

First Semester

Chemistry – Core

AROMATICITY AND ORGANIC REACTION MECHANISM

(For those who joined in July 2021-2022 onwards)

Time : Three hours Maximum : 75 marks

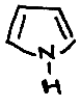
PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Which compound is not aromatic

(a) 

(b) 

(c) 

(d) 

2. The IUPAC name of  is

(a) Bicyclo [2.2.0] hexane

(b) Bicyclo [2.0.2] hexane

(c) Bicyclo [0.2.2] hexane

(d) Bicyclo [0.0.2] hexane

3. What was the reference used by Hammett to determine the substituent constant σ?

(a) Ester hydrolysis

(b) Sodium hydroxide dissociation

(c) Sulphuric acid dissociation

(d) Benzoic acid dissociation

4. What is the driving force in a reaction?

(a) Energy given (b) Energy released

(c) Free energy (d) None of these

5. Which of the following techniques, free radicals can be detected?

(a) ESR (b) IR

(c) NMR (d) UV

6. What is the hybridization of singlet carbene?

(a) sp (b) sp^3

(c) sp^3d (d) sp^2

7. Which of the following does not undergo S_N2 reaction?

(a) CH_3Br

(b) $H_3C - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_2Br$

(c) $CH_3CH_2CH_2Br$

(d) $H_3C - \underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}} - Br$

8. Cope elimination involves

(a) Cleavage of ethers to olefins

(b) Dehydration of alcohols to olefins

(c) Cleavage of amine oxide to olefin

(d) Pyrolysis of esters of carboxylic acid to olefins

9. Which of the following on reduction with the lithium aluminium hydride yields a secondary amine?

(a) Acetamide (b) Methyl isocyanide

(c) Nitroethane (d) Methyl cyanide

10. The sharpless asymmetric epoxidation is an ———— chemical reaction.

(a) Enantio specific (b) Enantioselective

(c) Moleculer (d) Atomic

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Outline the synthesis of (i) Azulene (ii) Congressane. (2.5+2.5)

Or

(b) (i) What are benzenoid and non-benzenoid aromatic compounds?

(ii) In which part of the ring of azulene electrophilic substitution preferentially takes place? Why? (2+3)

12. (a) Explain the use of stereochemical studies in determining the reaction mechanism.

Or

(b) Write a brief account on Swain-Lupton equation.

13. (a) What are nitrenes? Mention their synthetic utility.

Or

(b) What is Giese reaction? Discuss its mechanism.

14. (a) Narrate the solvent effects in nucleophilic substitution reactions.

Or

(b) Taking a suitable example, explain its elimination.

15. (a) Briefly discuss about the usefulness of $NaBH_4$.

Or

(b) Give the mechanism of Birch reduction.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Briefly describe the structure and synthesis of adamantane.

Or

(b) (i) Discuss briefly the aromaticity of syndromes.

(ii) Write a brief note on anti-aromaticity.

(iii) Which of the following are expected to show aromaticity in the Huckel sense.

(1) [26] annulene

(2) Cycloheptatriene? (4+2+2)

17. (a) (i) What is primary kinetic isotopic effect? How is it studied?

(ii) State the Hammond postulate. Explain its significance. (4+4)

Or

(b) (i) Write Hammett equation and explain the significance of the terms present in it. What are its limitations?

(ii) State the principle of microscopic reversibility. (6+2)

18. (a) Discuss the structure, generation and reactions of carbenes.

Or

(b) (i) What are free radicals? How are they generated?

(ii) Explain the structure of free radicals. (5+3)

19. (a) Describe the mechanism and stereochemistry of S_N1 reaction. Write any two characteristics of a good leaving group.

Or

(b) What is neighbouring group participation? Give any four reactions where neighbouring group participation due to different functional groups can be observed?

20. (a) Discuss the S_NAr and benzyne mechanims.

Or

(b) Write in detail the effect of substrate, leaving group and attacking nucleophile in aromatic nucleophilic substitution reactions.

———————

(6 pages) **Reg. No. :** .....

Code No. : 7407 **Sub. Code : ZCHM 12**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023

First Semester

Chemistry – Core

FUNDAMENTALS OF INORGANIC CHEMISTRY
NUCLEAR CHEMISTRY AND INORGANIC
POLYMERS

(For those who joined in July 2021–2022 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Consider the isoelectronic series, $K^+, S^{2-}, Cl^-, Ca^{2+}$. The correct sequence of radii is _____

(a) $S^{2-} > Cl^- > K^+ > Ca^{2+}$

(b) $S^{2-} < Cl^- < K^+ < Ca^{2+}$

(c) $Cl^- > S^{2-} > K^+ > Ca^{2+}$

(d) $K^+ > Cl^- > S^{2-} > Ca^{2+}$

2. Which has the least ionisation potential?

(a) Li (b) Cs

(c) Na (d) K

3. The structure of ClF_3 is ————————

(a) Tetrahedral (b) Square planar

(c) Trigonal planar (d) T -shaped

4. The number of unpaired electrons in NO is ————————.

(a) 4 (b) 3

(c) 1 (d) 2

5. ———————— is differentiating solvent for acids.

(a) Liquid SO_2 (b) CH_3COOH

(c) NH_3 (d) HF

6. The Correct sequence of acidity is ————————

(a) $H_3PO_4 > H_2PO_4^- > HPO_4^2 > PO_4^{3-}$

(b) $H_3PO_4 < H_2PO_4^- < HPO_4^{2-} < PO_4^{3-}$

(c) $H_3PO_4 > H_2PO_4^- < HPO_4^{2-} < PO_4^{3-}$

(d) $H_3PO_4 < H_2PO_4^- > HPO_4^{2-} < PO_4^{3-}$

7. The variation of nuclear energy with the energy of incident particle is called as ————————

(a) Excitation function

(b) Direct reaction

(c) Stellar energy

(d) Fission energy

8. ———————— is double magic nucleus

(a) $_{83}Bi^{209}$ (b) $_{82}Pb^{208}$

(c) $_{21}Sc^{45}$ (d) $_{50}Sn^{118}$

9. In $[Re_2Cl_8]^{2-}$ the hybridization of Re-Cl bond is ————————

(a) sp^2 (b) sp^3

(c) dsp^2 (d) sp

10. In chromium(II) acetate the M-M bond order is ————————

(a) 3 (b) l

(c) 2 (d) 4

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Explain the effect of chemical forces on boiling point and solubility.

Or

(b) Construct the reduction potential diagram for the following half cell reactions and find which of the oxidation state of copper undergoes disproportionation reaction?

$Cu^{+} \rightarrow Cu^{+2} + e$ Eo = –0.15V

$Cu^{+} + e \rightarrow Cu$ Eo = +0.5V

12. (a) Discuss the structure of PCl_5 and BrF_5 by VSEPR.

Or

(b) Explain the calculation of s and p characters of non-equivalent hybrid orbitals.

13. (a) Describe the levelling effect of acids and bases.

Or

(b) Discuss the general reactions of non-aqueous solvents.

14. (a) Write a note on radio chromatography.

Or

(b) Describe neutron evaporation and Stripping and pick-up reactions.

15. (a) Explain the structure and bonding one dimensional conductor.

Or

(b) Describe the structure and bonding of diborane.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Explain why:

(i) $-CH_3$ group is more electronegative than hydrogen?

(ii) O-nitro phenol is more stable than p-nitro-phenol and ethanol is a highly associated liquid?

Or

(b) Write a note on Slater rules and its applications.

17. (a) The structure of BeH_2 is linear rather than bent. Explain.

Or

(b) Describe Born Haber cycle and Kapustinski equation.

18. (a) Write a note on:

(i) Ionic and covalent bonding theory and

(ii) π – bonding theory of HSAB concept

(iii) Symbiosis

Or

(b) Describe the chemical reactions in NH_3.

19. (a) Write a note on mass distribution of fission products and neutron activation analysis.

Or

(b) Explain the thermonuclear reactions of Sun and Stars.

20. (a) Discuss the structure and bonding of phosphazenes.

Or

(b) Write a note on Capping rule and poly atomic Zintl ions–.

———————

(8 pages) **Reg. No. :** .....

Code No. : 7408 **Sub. Code : ZCHM 13**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

First Semester

Chemistry — Core

QUANTUM MECHANICS AND SPECTROSCOPY — I

(For those who joined in July 2021–2022 only)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 1 = 10$ marks)

Answer ALL questions.

Choose the correct answer :

1. Which of the following is a complex number?

   (a) 8i (b) 5

   (c) 0.3 (d) 5/8

2. Which of the following is an odd Function

   (a) $\sin x$ (b) $\cos x$

   (c) exponential($-ax^2$) (d) x^2

3. The number of nodel planes in a 'p_x' orbital is

(a) One (b) Two

(c) Three (d) Four

4. The system for which energy (E) increases quadratically with the quantum number 'n' is _____

(a) Particle in a one dimensional box

(b) Hydrogen atom

(c) One dimensional harmonic oscillator

(d) Rigid rotor

5. Which of the following combination of atomic orbitals give molecular orbitals?

(a) s and p_z (b) p_x and p_x

(c) p_y and d_{yz} (d) s and p_y

6. The bond order in O_2, O_2^+ , and O_2^- species follow the order

(a) $O_2^- < O_2 < O_2^+$

(b) $O_2^- < O_2^+ < O_2$

(c) $O_2^+ < O_2 < O_2^-$

(d) $O_2^- < O_2^+ < O_2^-$

7. Which of the following is microwave inactive?

(a) HCl (b) Cl_2

(c) NO (d) CO

8. The intensity of rotational spectral lines is determined by

(a) Influence of nuclear spin on population

(b) Degeneracy of rotational level

(c) Both (a) and (b)

(d) None of the above

9. Which of the following molecule have infrared active vibrations?

(a) NO (b) CH

(c) H (d) All of the mentioned

10. The elastic scattering of a photon is called as _____

(a) Atmospheric scattering

(b) Rayleigh scattering

(c) Conserved scattering

(d) Raman scattering

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) State the Heisenberg's uncertainity Principle. Calculate the uncertainity in the velocity of an electron with an uncertainity 10^{-15} m in its position.

Or

(b) Which of the following are Eigen Function with respect to the d^2/dx^2 operator? Find the Eigen values for the Eigen Functions

(i) $\cos x$

(ii) $\sin x$

(iii) Exponential (x^2)

(iv) x^3

(v) $\log x$

12. (a) Calculate the length of a one-dimensional box for which the difference between the lowest energy levels of a molecule becomes comparable to it's average kinetic energy at a given temperature.

Or

(b) What do you mean by Radial distribution function? Represent graphically the radial parts of the atomic orbitals, 1s, 2s, 3s and 3p of the hydrogen atom.

13. (a) What are symmetric and antisymmetric wave functions? Formulate the Pauli Principle for a many-electron atom in the determinantal form and explain it's meaning.

Or

(b) Why does He_2^+ exist, while He_2 does not?

14. (a) In which region of electromagnetic spectrum do the following frequencies exist?

(i) 5 cm^{-1}

(ii) 1000 cm^{-1}

(iii) 12500 cm^{-1}

(iv) 60000 cm^{-1}

(v) 700 MHz

Or

(b) Classify following molecules according to the type of molecular rotor. Which of them will give pure rotational spectra in microwave or far infrared region?

(i) CH_3F

(ii) CH_2F_2

(iii) C_6H_6

(iv) SF_4

(v) C_2H_6-Staggered Form

15. (a) Explain the mutual exclusion principle with example.

Or

(b) Explain the effect of anharmonicity on the vibrational spectra of diatomic molecules.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Prove that P_x and L_z operators are hermitian.

Or

(b) Show that if two operators $\hat{A}$ and $\hat{C}$ are Hermitian then the product $(\hat{A}\ \hat{C})$ is also Hermitian if and only if $\hat{A}$ and $\hat{C}$ commute.

17. (a) For a particle in a cubic box of edge 'L'

(i) How many states have energies in the range '0' to $16h^2/8mL^2$?

(ii) How many energy levels lie in the range?

(iii) Draw the energy level diagram indicating degenerate states.

Or

(b) Derive an expression for the energy of a rigid rotator using Schrodinger wave equation.

18. (a) State Harte's Fock Self Consistent Field theory.

Or

(b) Discuss the salient Features of HMO method and explain it's application to 1,3-butadiene.

19. (a) Discuss about the rotational spectra of rigid diatomic molecules.

Or

(b) (i) Describe the non rigid rotator model in rotational spectra.

(ii) HCl, but not Cl_2, absorbs microwave radiation and gives pure rotational spectrum. Explain.

20. (a) Explain the quantum theory of Raman spectroscopy.

Or

(b) Discuss the applications of IR and Raman spectroscopy.

———————

(6 pages)

Reg. No. : .....

Code No. : 7409 **Sub. Code : ZCHE 11**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

First Semester

Chemistry – Elective

GREEN CHEMISTRY – TECHNIQUES AND APPLICATIONS

(For those who joined in July 2021-2022 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL the questions.

Choose the correct answer :

1. Which of the following is not a principle of green chemistry?

   (a) Design for energy efficiency

   (b) Hazardous chemical synthesis

   (c) Green solvents and auxiliaries

   (d) Use of renewable feed stock

2. Green chemistry is also called as ————

(a) Organic chemistry

(b) Sustainable chemistry

(c) Environmental chemistry

(d) Life chemistry

3. Natural zeolites are ————

(a) Non-durable (b) Porus

(c) Amorphous (d) Possess get structure

4. Which one of the following is used as phase transfer catalyst?

(a) Primary amine

(b) Quaternary ammonium salt

(c) Tertiary nitroalkane

(d) Tertiary amine

5. A desirable green solvent should be ————

(a) Synthetic (b) Readily available

(c) Toxic (d) Costly

6. Which of the following is a green solvent used for bleaching clothes?

(a) Toluene (b) Benzene

(c) Tetrachloro ethene (d) Hydrogen peroxide

7. ———— are greener than the conventional methods.

(a) Microwaves

(b) Radio waves

(c) Ultra violet waves

(d) Electromagnetic waves

8. In photo chemical reactions, absorption of ———— radiations takes place.

(a) Radio

(b) Ultraviolet and visible

(c) Only visible

(d) Visible and X-rays

9. The term biomass most commonly refers to ————

(a) Organic matter

(b) Ammonium compounds

(c) Chemicals

(d) Inorganic matter

10. Which kind geothermal plant is most common type?

(a) Dry steam (b) Flash

(c) Wet steam (d) Binary

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).
Each answer should not exceed 250 words.

11. (a) Define atom economy. Provide an example of a chemical reaction and calculate its atom economy.

Or

(b) Why do protecting groups reduce the atom economy of a reaction?

12. (a) Write any three green reactions carried out by clayfen.

Or

(b) Write notes on phase-transfer catalysis and its advantage.

13. (a) Discuss any two organic reactions carried out in supercritical CO_2.

Or

(b) (i) Explain the properties of ionic liquids.

(ii) Water is environmentally benign solvent for organic reactions, but it has some disadvantages. Comment on it. (3+2)

14. (a) (i) Why are solvents like benzene, toluene and hexane unsuitable for microwave reactions? (3+2)

(ii) What are focused microwave reactors?

Or

(b) Write briefly on mechanism of microwave heating.

15. (a) Distinguish between renewable and non-renewable energy sources.

Or

(b) Describe the applications of solar cells.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b)
Each answer should not exceed 600 words.

16. (a) Discuss the role of catalytic reagents and blocking groups in green chemistry.

Or

(b) Write notes on:

(i) Effective mass yield

(ii) Reaction mass efficiency (4+4)

17. (a) Explain how biocatalysts applied in hydrolytic reaction and in reduction reactions.

Or

(b) Describe the applications of cyclodextrim and solid supported catalysts in green chemical reactions.

18. (a) Discuss the green synthetic protocols for the following reactions.

(i) Wurtz reaction,

(ii) Knoevenagel reaction. (4+4)

Or

(b) Explain the applications of ionic liquids as catalysts and solvents.

19. (a) Illustrate any four microwave assisted organic reactions in organic solvents.

Or

(b) Discus the role of ultrasound technique and its advantages in organic synthesis with atleast four different examples.

20. (a) Explain the working principle and applications of biofuel cells.

Or

(b) (i) What are the advantages of fuel cells?

(ii) What are the merits and demerits of geothermal power? (4+4)

———————

(6 pages) **Reg. No. :** .....

Code No. : 7410 **Sub. Code : ZCHE 12**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

First Semester

Chemistry – Elective

CHEMISTRY OF INDUSTRIAL PRODUCTS AND FORMULATION

(For those who joined in July 2021-2022 only)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. In paints, the change characterized by an appreciable reduction in the initial flexibility, cohesion and adhesion of the film

(a) Brittleness (b) Viscosity loss

(c) Fracture (d) Rupture

2. Which of the following is the most durable varnish?

(a) Turpentine varnish (b) Spirit varnish

(c) Oil varnish (d) Water varnish

3. The reasons for the resins used in the nail polish preparation

(a) As film former

(b) To give film more gloss and adhesion

(c) To give colour to nail polish

(d) As a diluents

4. What is the role of Triclosan agents that has been widely used in toothpaste, deodorants and soaps

(a) Surfactant (b) Antibacterial

(c) Foaming agent (d) Cleansing agent

5. What are the environmental impacts of kraft pulp production mainly result from the chemicals used for both cooking and bleaching

(a) Sulfur

(b) Chlorine

(c) Organic and inorganic materials

(d) All of the above

6. Pulp from bamboo is utilized in fine papers and the resulting paper is ———————— than paper of straw pulp.

(a) Weaker (b) Stronger

(c) Thicker (d) Thinner

7. Anhydrous milk fat is more commonly known as

(a) Butter oil (b) Butter fat

(c) Butter (d) None of the above

8. Which of the following is not a diary product?

(a) Custard (b) Ice Cream

(c) Fermented milk (d) Coconut milk

9. The main constituent of wool fiber is ————————.

(a) Cellulose (b) Casien

(c) Reformation (d) Keratin

10. Dacron is a trade name of which fiber?

(a) Nylon (b) Polyester

(c) Spandex (d) Acrylic

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).
Each answer should not exceed 250 words.

11. (a) Differentiate resins and drier.

Or

(b) Give detailed information about oil and alkyd paints.

12. (a) Explain the term surfactants.

Or

(b) Write sort note on skin colorant.

13. (a) Explain the process of papermaking in detail.

Or

(b) Write a note on semichemical pulping.

14. (a) Write the physicochemical properties of minerals.

Or

(b) Give detailed information about the composition of milk powder.

15. (a) Write the chemical properties of wool.

Or

(b) Discuss the enzyme treatment.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b)
Each answer should not exceed 600 words.

16. (a) Give the detailed preparation methods and properties of Lacquers.

Or

(b) Elaborate the terms - Luminous paints.

17. (a) Write down the sources of perfumes and its classification.

Or

(b) Discuss cosmetic soaps in detail.

18. (a) Explain the woody and non woody fibres used in paper industry.

Or

(b) Discuss about the physical and chemical properties of paper.

19. (a) Explain the milk processing techniques.

Or

(b) Distinguish between the toned and double toned milk.

20. (a) Write the physical and chemical properties of wool.

Or

(b) Explain the antimicrobial treatment. Which is used to enhance the fibre properties?

———————

(6 pages) **Reg. No. :** .....

Code No. : 7411 **Sub. Code : ZCHE 13**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

First Semester

Chemistry–Elective

FORENSIC CHEMISTRY

(For those who joined in July 2021-2022)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 1 = 10$ marks)

Answer ALL questions.

Choose the correct answer.

1. The total number of bones in the human adult is

   (a) 206 (b) 208

   (c) 205 (d) 203

2. How many biological principles are followed by fingerprints?

   (a) 5 (b) 1

   (c) 3 (d) 7

3. At the crime scene, a blood-Stained handprint is observed by the crime scene investigator. What type of evidence will it be called

(a) Latent print evidence

(b) Plastic prints

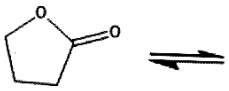
(c) Patent print evidence

(d) None of the above.

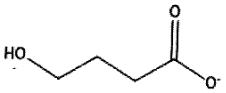
4. Ninhydrin is used to detect

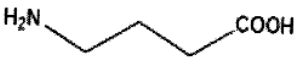
(a) Bloodstains (b) Fingerprints

(c) Saliva stains (d) All of the above

5. Find the following equation 

(a) 

(b) 

(c) 

(d) 

6. In TLC, initially the sample is

   (a) In contact with a mobile phase

   (b) Not in contact with mobile phase

   (c) Coated at the level of the mobile phase

   (d) Coated below the level of mobile phase

7. Color of blood is cherry red color due to

   (a) Hydrogen sulfide

   (b) Methane

   (c) Carbon monoxide

   (d) Carbon Tetrachloride

8. Hollow Cathode Lamp (HCL) is used in the following:

   (a) Atomic Absorption Spectrometer

   (b) Atomic Emission Spectrometer

   (c) Infra-Red Spectrometer

   (d) X-ray Fluorescence Spectrometer

9. Computer forensics also known as?

   (a) digital forensic science

   (b) computer crime

   (c) computer forensic science

   (d) computer forensics investigations

10. CCFP stands for?

(a) Cyber Certified Forensics Professional

(b) Certified Cyber Forensics Professional

(c) Certified Cyber Forensics Program

(d) Certified Cyber Forensics Product

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Explain the concepts of Biometric Authentication.

Or

(b) Write a note on

(i) Hand Geometry

(ii) Speaker recognition

12. (a) Explain the details of the dry powder method.

Or

(b) Write note on laser tests.

13. (a) Explain about the analysis of selected drug classes.

Or

(b) Write a short note on Chemical analysis of Inks and Paper.

14. (a) Describe the analytical methods in Forensic Technology.

Or

(b) Write a note on Forensic DNA typing.

15. (a) Explain the uses of networks in forensic science.

Or

(b) Describe the computer-related crimes and its types.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Explain the role of person identification and Techniques in detail.

Or

(b) Explain Global Poisoning System and its application.

17. (a) Summarize the interpret vacuum metal deposition and their applications.

Or

(b) Write a note on characterization of blood stains and bloodstain patterns.

18. (a) Briefly explain Gamma hydroxybutyric acid and its uses.

Or

(b) Explain the following forensic analysis of Inks and Paints.

19. (a) Elaborate the procedure of DNA Typing methods.

Or

(b) Briefly describe the application of DNA Testing methods.

20. (a) Explain video image processing and animation software.

Or

(b) Illustrate the framework for investigating computer related crime.

———————

(6 pages) **Reg. No. :** .....

Code No. : 7412 **Sub. Code : ZCHM 21**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

Second Semester

Chemistry – Core

STEREOCHEMISTRY, ORGANIC REAGENT AND PHOTOCHEMISTRY

(For those who joined in July 2021-2022)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL the questions.

Choose the correct answer :

1. Compounds that are mirror images of each other are called ————————

   (a) Diasteromers

   (b) Coformers

   (c) Stereomers

   (d) Enantiomers

2. A molecule has three chiral centers. How many stereisomers of this compound will have different boiling points compared to the original molecule?.

(a) One (b) Seven

(c) Six (d) Two

3. Conformations are different arrangements of atoms that can be converted into one another by rotation about ————————

(a) Covalent bond (b) Double bond

(c) Single bond (d) Triple bond

4. Gauche conformation is less stable due to ————————

(a) Hydrogen bonding

(b) Covalent bonding

(c) Vander Waal's repulsion

(d) Torsional strain

5. Lemieux reagent is ————————

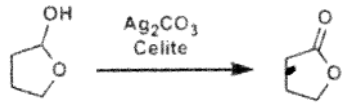
(a) Combination of $NaBH_4$ and $CeCl_3$

(b) Sodium periodate ($NaIO_4$) and a trace of $KMnO_4$

(c) $RhI\ (PPh_3)_3(CI)$

(d) $Cis\text{-}PtII(NH_3)_2Cl_2$

6. In, the following reaction, which reagent has been used?



(a) Fetizon's reagent

(b) Johnson reagent

(c) Von Rudloff reagent

(d) Luche reagent

7. ———— is a photochemical reaction that involves the photochemical an alkyl nitrite to form a δ-nitroso alcohol.

(a) Norrish type I reaction

(b) Norrish type II reaction

(c) Barton reaction

(d) Paterno Buchi reaction

8. ———— is the photochemical cleavage or homolysis of aldehydes and ketones into two free radical intermediates

(a) Norrish type I reaction

(b) Norrish II reaction

(c) Barton reaction

(d) Paterno Buchi reaction

9. Which one is correct as per selection rule of electrocyclic reations?

(a) 4n, Thermally $\rightarrow$ Conrotatory

(b) 4n, Thermally $\rightarrow$ Disrotatory

(c) 4n+2, Thermally $\rightarrow$ Conrotatory

(d) 4n+2, Photochemically $\rightarrow$ Disrotatory

10. Claisen rearrangement is ————————

(a) 1,3- Sigmatropic reaction

(b) 3,3-Sigmatropic reaction

(c) 1,5-Sigmatropic reaction

(d) 1,7-Sigmatropic reaction

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b)

Each answer should not exceed 250 words.

11. (a) Write a brief note on asymmetric synthesis.

Or

(b) Describe the enatitopic, diastereotopic hydrogen and prochiral centres.

12. (a) In monosubstituted cyclohexanes, why does a substituent prefer to occupy an equatorial position?

Or

(b) Describe the stereochemistry of cis-and *trans*-decalines.

13. (a) Write a note on DCC reagent.

Or

(b) Write the Umpolung synthesis.

14. (a) Describe the Barton and Paterno Buchi reaction.

Or

(b) Write a comprehensive note on Quantum efficiency.

15. (a) Explain the Woodward-Hoffman rules.

Or

(b) Describe the cycloadditon reaction.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b)

Each answer should not exceed 600 words.

16. (a) Discuss the chemoselectivity, stereoselectivity and regioselectivity in selective organic transformations.

Or

(b) Explain the Cram's and Prelog rule.

17. (a) Discuss the conformational analysis and stereo chemical features of disubstituted cylohexanes.

Or

(b) Discuss the Conformations of Decalin.

18. (a) Explain with mechanism, SeO_2 as art oxidizing agent.

Or

(b) Discuss the Woodward and Prevost hydroxylation.

19. (a) Draw and explain the Jablonski diagram.

Or

(b) Discuss the Norrish type I and II reactions.

20. (a) What do you understand by Sigmatropic rearrangements? Give example of [1,3], [1,5-] and [3,3-] sigmatropic rearrangements.

Or

(b) Discuss the general features of pericyclic reactions.

———————

(8 pages) **Reg. No. :** .....

Code No. : 7413 **Sub. Code : ZCHM 22**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

Second Semester

Chemistry – Core

COORDINATION COMPOUNDS AND SOLID STATE CHEMISTRY

(For those who joined in July 2021 – 2022 onwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 1 = 10$ marks)

Answer ALL questions.

Choose the correct answer.

1. According to CFT, the bond between metal cation and the ligand is

   (a) covalent bond

   (b) ionic bond

   (c) coordinate bond

   (d) coordinate covalent bond

2. Identify the order representing increasing π-acidity of the following ligands : C_2F_4, NEt_3, CO and C_2H_4

(a) $C_2F_4 < NEt_3 < CO < C_2H_4$

(b) $C_2F_4 < C_2H_4 < NEt_3 < CO$

(c) $C_2H_4 < NEt_3 < CO < C_2F_4$

(d) $NEt_3 < C_2H_4 < C_2F_4 < CO$

3. The rate of exchange of cyanide ligands in the complexes

(i) $[Ni(CN)_4]^{2-}$

(ii) $[Mn(CN)_6]^{3-}$

(iii) $[Cr(CN)_6]^{3-}$ by ^{14}CN

follow the order

(a) (ii) > (i) > (iii) (b) (iii) > (i) > (ii)

(c) (i) > (iii) > (ii) (d) (i) > (ii) > (iii)

4. Cis and trans complexes of the type $[PtA_2X_2]$ are distinguished by

(a) chromyl chloride test

(b) carbylamine test

(c) kurnakov test

(d) ring test

5. The magnetic moments (in BM) of $[Co(H_2O)_6]^{3+}$ and $[Co(NH_3)_6]^{3+}$ are ———— and ———— respectively.

(a) 2, 5 (b) 5, 2

(c) 0, 3.87 (d) 3.87, 0

6. Magnetic susceptibility of ferromagnetic and anti-ferromagnetic substances can be calculated by ———— law.

(a) Ohm's law (b) Curie weiss

(c) Faraday law (d) Kirchoff's

7. An example for metal deficiency defect is

(a) NaCl (b) AgCl

(c) FeS (d) CsCl

8. Which among of the following metallic elements have hexagonal close packing arrangement?

(a) Cu (b) Ag

(c) Ca (d) Zn

9. ———— may be considered as a new particle having twice the mass and charge of an electron.

(a) proton (b) neutron

(c) antineutron (d) cooper pair

10. Which of the following theory explains the electrical property of semiconductors?

(a) BCS

(b) Photovoltaic

(c) Hall effect

(d) Isotopic effect

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Explain the merits and demerits of CFT.

Or

(b) Write a note on spectrochemical series with examples.

12. (a) How will you prepare cis and trans isomer of a square planar complex using trans effect?

Or

(b) Explain inner sphere mechanism of electron transfer in complexes.

13. (a) Explain the following :

(i) Cu^{2+} ions are coloured and paramagnetic whereas Zn^{2+} ions are colourless and diamagnetic

(ii) Molar susceptibility.

Or

(b) Write short notes on the determination of magnetic susceptibility of Guoy balance method.

14. (a) Draw a neat sketch of perovskite and comment on the structure.

Or

(b) Discuss briefly about the non-stoichiometric defects in solids.

15. (a) What is Photovoltaic effect? Explain its working.

Or

(b) Write short notes on BCS theory.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) (i) Discuss the nature of d-orbital splitting in the following complexes $[Cr(Cn_6)]^{3-}$ and $[Ni(CN)_4]^{2-}$.

Indicate their geometries and magnetic properties.

(ii) Give an account on why most of the tetrahedral complexes possess high spin.

Or

(b) Write a detailed note on MOT for square planar complexes.

17. (a) Explain the potentiometric and spectrophotometric methods of determination of stability constants of the complexes.

Or

(b) Explain polarization and π-bonding theories of trans effect.

18. (a) Describe the magnetic properties of first row of transition metal complexes having A and E ground states using spin only formula.

Or

(b) Explain the application of magnetic moment in determination of spin crossover phenomenon and structure of complexes.

19. (a) (i) In silicates, the oxygen atom forms a tetrahedral void. The limiting radius ratio for tetrahedral void is 0.22. The radius of oxide is 1.4 Å. Find out the radius of the cation.

(ii) Describe the radius ratio values for tetrahedral and octahedral arrangement.

Or

(b) (i) Discuss the crystal structure in spinels.

(ii) Give an account on Powder method for crystal structure determination.

20. (a) (i) What are superconductors? Explain different types of high temperature superconductors with transition temperature achieved.

(ii) Write short notes on levitation.

Or

(b) Give an account on n-p-n transistor and p-n-p transistors. Briefly explain their working.

———————

(7 pages) **Reg. No. :** .....

Code No. : 7414 **Sub. Code : ZCHM 23**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

Second Semester

Chemistry – Core

ELECTROCHEMISTRY AND SPECTROSCOPY – II

(For those who joined in July 2021 – 2022 only)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 1 = 10$ marks)

Answer ALL questions.

Choose the correct answer.

1. What is the unit of ionic mobility?

(a) $m^2 s^{-1} volt^{-1}$ (b) $m^{-2} s\ volt$

(c) $m\ s^{-1}\ volt^{-1}$ (d) $m^{-1} s\ volt$

2. Counter Currents slow down the ions in the same way as counter currents in a stream, slow down swimmer this effect is known as

(a) Doppler effect

(b) Inter ionic effect

(c) Electrophoretic effect

(d) Wein effect

3. What do fuel cells emit?

(a) hydrogen (b) nitrogen

(c) oxygen (d) water vapour

4. Given that $E_0(Fe^{3+}/Fe) = -0.04\ V$, $E_0(Fe^{2+}/Fe) = -0.44\,V$, the value of $E_0(Fe^{3+}/Fe^{2+})$ is

(a) –0.40 V (b) 0.40 V

(c) –0.76 V (d) 0.76 V

5. Which one among the following spectra is a complementary to X-ray Photoelectron spectroscopy?

(a) Auger spectroscopy

(b) Flourescence

(c) Phosphorescence

(d) Electronic energy loss

6. Which among the following electronic transitions is a forbidden transition?

(a) $\sigma \rightarrow \sigma^*$ (b) $\pi \rightarrow \pi^*$

(c) $n \rightarrow \pi^*$ (d) None of the above

7. What is the reference compound used in proton NMR spectroscopy?

(a) CDCI 3

(b) DMSO

(c) Tetra Methyl silane

(d) Silane

8. Electromagnetic radiation used for recording ESR spectroscopy is

(a) Microwave (b) Radio frequency

(c) Gamma ray (d) Infra red

9. Mossbauer transitions that occur within the nucleus are accompanied by a change in

(a) Nuclear magnetic quantum number

(b) Nuclear spin quantum number

(c) Nuclear Quadrapole moment

(d) Mass number

10. The unit of electric quadrapole moment is

(a) Hz (b) per second

(c) Barn (d) J

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Derive Nernst-Einstein equation. Give its applications.

Or

(b) Discuss on polarisable and non polarisable electrodes.

12. (a) Explain the construction and functioning of fuel cell.

Or

(b) Find the emf of the cell between Hydrogen electrodes at 25°C

$Pt, H_2(g)(1atm), HCl\ (0.01m), AgCl\,(s), Ag \| Ag,$

$AgCl\,(s) : HCl\,(0.1\,m), H_2(g)(1atm), Pt$

The activity coefficients of 0.01 m and 0.1 m solutions are 0.95 and 0.85 respectively.

13. (a) A diatomic molecule AB has the following features in the UV-photoelectron spectrum. The first shows only one sharpline and the other is a cluster of peaks separated by $2300\,cm^{-1}$. Interpret the nature of orbitals from which these features arise. The fundamental vibrational frequency of the neutral molecule in the ground state is about $2100\ cm^{-1}$.

Or

(b) Apply Franck-Condon principle to evaluate the intensity of electronic transitions.

14. (a) Differentiate geminal and viscinal coupling in NMR spectra.

Or

(b) A free radical has a g value of 2.0025. Calculate the magnetic field at which the resonance would occur in ESR spectrometer operating at 9,300 MHz.

15. (a) Distinguish Sn(II) and Sn (IV) organo tin compounds with the help of Mossbauer spectroscopy.

Or

(b) The nuclear Quadrapole coupling constant values of Cl-35 in FCl, BrCl, ICl and Cl_2 are 109, 146, 103 and 83 MHz respectively. Explain the trend.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Explain in detail the electrokinetic phenomena.

Or

(b) Derive Debye-Huckel Onsager equation.

17. (a) Discuss the principle and applications of

(i) Pulse Polarography

(ii) Coloumetry.

Or

(b) Discuss the applications of EMF measurements.

18. (a) Discuss

(i) Population inversion

(ii) Q-Switching in LASER

(iii) Dye LASER.

Or

(b) Discuss :

(i) Fortrat Parabola

(ii) Birge-Sponer extrapolation.

19. (a) (i) Why are FT-NMR preferred over Continuous Wave NMR spectrometers?

(ii) Why does the chemical shift range of C-13 NMR is about 200 ppm while that of proton NMR is 10-15 ppm with TMS assigned at 0 ppm?

Or

(b) (i) Discuss the EPR spectrum of Triplet States.

(ii) Discuss the nuclear hyper fine splitting in ESR spectra of isotropic systems.

20. (a) (i) Establish Nuclear Quadrupole transitions in axially symmetric molecules with I = 3/2 and I = 1.

(ii) Discuss the Fast atom bombardment and Electron spray ionisation techniques used in mass spectra.

Or

(b) Discuss the factors affecting Isomer Shift in Mossbauer Spectroscopy.

———————

(6 pages) **Reg. No. :** .....

Code No. : 7415 **Sub. Code : ZCHE 21**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

Second Semester

Chemistry – Elective

NANO SCIENCE AND NANOTECHNOLOGY

(For those who joined in July 2021 – 22 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Who coined the word nanotechnology?

   (a) Richard smally (b) Sumio Tijima

   (c) Eric Drexler (d) Richard Feymann

2. Natural Bone is a ————————.

   (a) Composite (b) Nano composite

   (c) Nanofiber (d) Whisker

3. Which gas serves as buffer gas in Laser ablation?

(a) Helium (b) Oxygen

(c) Nitrogen (d) Neon

4. Which of the following is an example of Bottom-Up Approach?

(a) Attrition (b) Etching

(c) Miling (d) Colloidal disperson

5. Synthesis of Nanomaterials from the bulk materials is called ————————.

(a) Top down method

(b) Bottom up Approach

(c) Synchronised method

(d) Sonolysis method

6. Which of the following exhibits thermal stability better than pure monomer?

(a) Polystyrene-clay nanocomposite

(b) Polyamide-clay nanocomposite

(c) Polythiophene-clay nanocomposite

(d) Polybutgene-clay nanocomposite

7. Carbon nanotubes are also called as ————————.

(a) Bulky tubes (b) Bucky tubes

(c) Bulk tubes (d) Bulk balls

8. Fullerenes are soluble in ————————.

(a) Water (b) Aromatics

(c) Carbon disulfide (d) Both (b) and (c)

9. The processing of separation, consolidation and deformation of materials by one atom or one molecule is called as ————————.

(a) Biotechnology (b) Physics

(c) Nanobiotechnology (d) Chemistry

10. Branched polymers are ————————.

(a) Spions (b) Liposomes

(c) Dendrimers (d) Block copolymer

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Define nanoparticles. What is surface energy? How does it affect the property of materials?

Or

(b) Give a comprehensive note on Nanowires.

12. (a) How are Nanomaterials synthesized by Laser Ablation method?

Or

(b) Give the synthesis of nano particles by Physical Vapor Deposition (PVD) method.

13. (a) Explain the classification of Nanocomposites.

Or

(b) Write notes on physical and chemical properties of Nanocomposites.

14. (a) Discuss in detail about structure of carbon nano tubes.

Or

(b) Write a brief note on Graphene Nano Ribbon (GNRS).

15. (a) Discuss in detail about Nano medicines.

Or

(b) What are dendrimers? Mention its Biomedical application.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b)
Each answer should not exceed 600 words.

16. (a) Explain surface area to volume ratio in Nanomaterials. How does this ratio reflect on properties of nanomaterials?

Or

(b) Write short notes on

(i) Quantum dots

(ii) Nano capsules.

17. (a) Discuss the bottom-up and Top down approaches in Nanoparticle synthesis.

Or

(b) Give the synthesis of Nanomaterials using Laser Ablation and chemical vapor deposition methods.

18. (a) Describe the synthesis, characterization and properties of Nylon-6-clay nanocomposites.

Or

(b) Discuss the polybutylene terephthalate (PBT) based Nanocomposites.

19. (a) Give a brief account on mechanical and optical properties of CNT.

Or

(b) Give a brief account on functionalized graphene polymer Nanocomposites.

20. (a) Discuss the Nano materials used in tissue engineering.

Or

(b) Discuss in detail about Nano robots and their biomedical applications.

———————

(6 pages) **Reg. No. :** .....

Code No. : 7416 **Sub. Code : ZCHE 22**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023

Second Semester

Chemistry - Elective

MEDICINAL CHEMISTRY

(For those who joined in July 2021-2022)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 1 = 10$ marks)

Answer ALL questions.

Choose the correct answer :

1. Which of the following terms is used to describe a drug that has the same effect on a receptor as the endogenous chemical messenger?

   (a) Agonist (b) antagonist

   (c) partial agonist (d) partial antagonist

2. Which among the following is isostere for methyl group?

   (a) NH_2 (b) CO

   (c) NH_3 (d) CH_2

3. What is the symbol π in a QSAR equation?

   (a) The hydrophobicity of the molecule

   (b) The electronic effect of a substituent

   (c) Lipophilicity Constant

   (d) A measure of the steric properties for a substituent

4. A measure of the electron withdrawing or electron-donating ability of a substituent is

   (a) Dissociation constant

   (b) equlilibrium constant

   (c) Hammet substitution constant

   (d) electronic constant

5. Which of the following statements is accurate in explaining why Gram negative bacteria are generally more resistant to penicillins than Gram positive bacteria?

   (a) Gram negative bacteria have a thicker cell wall

   (b) Gram negative bacteria have an outer hydrophilic membrane that acts as an extra barrier

   (c) Gram negative bacteria can concentrate β-lactamase enzymes in the periplasmic space

   (d) Gram negative bacteria produce smaller quantities of transpeptidase enzyme

6. Which one among the following comes under the class of polypeptide antibiotic?

(a) Penicillin (b) Cephalosporin

(c) Tereacycline (d) Bacitracin

7. Chinconine derivatives are used as

(a) Antimalarial (b) Anti inflammatory

(c) Sedative (d) Hypnotics

8. Phenylbutazone is an _____ drug

(a) Antimalarial (b) Antipyretic

(c) Antihistaminic (d) Antiseptic

9. Most widely used antimetabolites in cancer chemotherapy

(a) Methotrexrate (b) cyclophospamide

(c) Uracil (d) sorbitrate

10. Cyclophosphamide is commonly used in anticancer therapy. Which of the following statements is not true?

(a) It is relatively non-toxic

(b) It acts as a prodrug

(c) It cannot be taken orally

(d) The structure is inetabolised to release acrolein

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Discuss the concept of bioisosterism with example

Or

(b) What is Molecular Docking? Discuss Lock and Key method of docking.

12. (a) Relate physico chemical properties to biological activity using Hansch equation. Explain the terms in it

Or

(b) State the general factors that need to be considered when designing a drug.

13. (a) Compare bacterial and fungal cell wall.

Or

(b) Classify antibiotics based on their mechanism of action.

14. (a) What are anxiolytics? Give an example with its structure.

Or

(b) How does aminobenzoic acid act as local anasthetics?

15. (a) Write a note on mitotic inhibitors in cancer therapy.

Or

(b) Write the synthesis of amyl nitrate.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) What are agonist and antagonist? Give their mode of action.

Or

(b) Discuss Transdermal drug delivery system and its advantage.

17. (a) Explain the Structure activity relationship of Morphine.

Or

(b) Lipophilicity, Partition coefficient and electron distribution all have a major influence drug activity. State and explain the parameters that are commonly used as a measure these properties in the QSAR approach to drug design.

18. (a) What are antiseptics and disinfectants? Discuss their mode of action

Or

(b) What are β-lactam antibiotics? Discuss their mode of action against bacteria.

19. (a) How will you synthesise piperidinediones? How do they act as hypnotics?

Or

(b) How will you synthesise aminoquinolines? How do they act as antimalarial?

20. (a) Discuss the role of alkylating agents and antimetabolites in the treatment of cancer

Or

(b) Write the synthesis of (i) Sorbitrate (ii) verapamil

———————

(7 pages) **Reg. No. :** .....

Code No. : 7417 **Sub. Code : ZCHE 23**

M.Sc.(CBCS) DEGREE EXAMINATION,
NOVEMBER 2023

Second Semester

Chemistry - Elective

INDUSTRIAL PROCESSES AND CATALYSIS

(For those who joined in July 2021-2022 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Which of the following best describes the difference between unit operations and unit processes?
   (a) Unit operations involve the physical changes of materials, while unit processes involve chemical reactions.
   (b) Unit processes involve the physical changes of materials, while unit operations involve chemical reactions.
   (c) Unit operations and unit processes are interchangeable terms.
   (d) Unit operations and unit processes are entirely unrelated concepts

2. Which of the following is a type of size reduction equipment?

(a) Refrigerator (b) Ball mill

(c) Oven (d) Microwave

3. What is the principle of reverse osmosis?

(a) Filtration of water using a semipermeable membrane

(b) Filtration of water using a reverse osmotic pressure

(c) Separation of water and solutes using a pressure gradient

(d) Separation of water and solutes using a chemical gradient

4. Which of the following is a basic term in reverse osmosis that refers to the amount of solutes that are rejected by the membrane?

(a) Flux

(b) Recovery

(c) Rejection

(d) Concentration polarization

5. Which of the following is an example of an industrial application of catalysts?

   (a) Baking bread in an oven

   (b) Purifying drinking water

   (c) Making gasoline from crude oil

   (d) Growing plants in a greenhouse

6. What is catalytic deactivation?

   (a) The loss of catalytic activity over time

   (b) The destruction of the catalyst by the reactants

   (c) The loss of selectivity of the catalyst

   (d) None of the above

7. Which type of catalyst is commonly used in petrochemical refining?

   (a) Platinum (b) Nickel

   (c) Palladium (d) Zeolites

8. What is the role of zeolites in petrochemical refining?

   (a) To increase the yield of desired products

   (b) To reduce the time required for the reaction

   (c) To improve catalytic selectivity

   (d) None of the above

9. Which of the following is not a source of aquatic pollution caused by chemical industries?

(a) Discharge of untreated wastewater

(b) Oil spills

(c) Runoff of pesticides ad fertilizers

(d) Emission of greenhouse gases

10. What is the primary reason for controlling hazards in chemical plants?

(a) To minimize government regulations

(b) To protect workers and nearby communities from chemical exposure and toxicity

(c) To increase production output

(d) To reduce company expenses

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) What is azeotropic distillation, and when is it used?

Or

(b) What is the difference between single effect and multiple effect evaporation?

12. (a) Define dead-end filtration in reverse osmosis? What is cross-flow filtration in reverse osmosis?

Or

(b) What is concentration polarization in reverse osmosis? Give some industrial applications of reverse osmosis.

13. (a) Explain the difference between homogeneous and heterogeneous catalysis.

Or

(b) What are the advantages of using heterogeneous catalysis in industry?

14. (a) What are the different types of catalytic selectivity in petrochemical processes?

Or

(b) How is shape selectivity used in hydrocracking?

15. (a) What are the sources of atmospheric pollution caused by chemical industries?

Or

(b) What are the best methods of disposing of solid wastes from industrial sites?

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) What is Crystallization, and what are the different types of crystallization used in industry?

Or

(b) What is Bond's law, and how is it used in comminution?

17. (a) What is reverse osmosis and how does it work? Discuss the industrial applications of reverse osmosis.

Or

(b) Describe fouling and pretreatment in reverse osmosis.

18. (a) What do you mean by chemisorption in heterogeneous catalysis?

Or

(b) Define catalyst, and discuss its general features? Provide examples of industrial applications of catalysts

19. (a) How do zeolites and zeotypes play a role in the petrochemical industry?

Or

(b) What is the importance of shape-selective catalysis in the conversion of methanol to hydrocarbons?

20. (a) What is the environmental impact of chemical industries on human health and ecosystems?

Or

(b) What are the benefits of sustainable practices in chemical industries?

———————

(7 pages) **Reg. No. :** .....

Code No. : 7418 **Sub. Code : ZCHM 31**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023

Third Semester

Chemistry – Core

ORGANIC SPECTROSCOPY AND
REARRANGEMENT

(For those who joined in July 2021–2022 onwards)

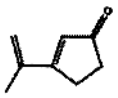
Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. λ_{max} for the following compound is



(a) 262nm (b) 298nm

(c) 245nm (d) 255nm

2. Solution of Iodine in benzene shows an intense band around 300nm due to ————————.

(a) $\pi - \pi^*$ transition

(b) $n - \pi^*$ transition

(c) charge transfer complex

(d) extensive conjugation

3. The separation between the centers of the peaks of a doublet (in Hz) is called as ————————.

(a) spin constant

(b) coupling constant

(c) spin-spin coupling

(d) chemical shift

4. The ^{1}H-NMR spectrum of $CH_3OCHClCH_2Cl$ will exhibit

(a) 3 proton doublet, 1 proton singlet and 2 proton doublet

(b) 3 proton singlet, 1 proton singlet and 2 proton doublet

(c) 3 proton singlet, 1 proton triplet and 2 proton doublet

(d) 3 proton triplet, 1 proton triplet and 2 proton triplet

5. Which of the following compounds undergoes McLafferty rearrangement?

(a) acetone (b) butanone

(c) pentan-3-one (d) pentan-2-one

6. The mass of metastable ion produced when a fragment of mlz 77 decomposes by loss of acetylene to a fragment of m/z 51 is ————.

(a) 116.25 (b) 0.66

(c) 33.7 (d) 26

7. Signals are not visible for ———— in HETCOR.

(a) methyl carbon

(b) methylene carbon

(c) quarternary carbon

(d) all the above

8. Which of the following carbons produces a negative peak in DEPT-135 spectrum?

(a) CH (b) CH_2

(c) CH_3 (d) R_4C

9. Reagent used in Dakin rearrangement is ————.

(a) H_2O_2/NaOH (b) CF_3CO_3H

(c) SeO_2 (d) HIO_4

10. Oxidation of acetophenone using perbenzoic acid gives

(a) acetone

(b) phenyl acetate

(c) benzaldehyde

(d) methylbenzoate

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) State Axial haloketone rule. Discuss two applications of the rule.

Or

(b) What are the factors that affect IR absorption frequency of Carbonyl compounds?

12. (a) How is NOE useful in stereochemical analysis?

Or

(b) Briefly explain chemical exchange.

13. (a) Write a short note on McLafferty rearrangement.

Or

(b) With examples explain the fragmentation pattern in alcohols and acids.

14. (a) Explain ^{1}H-^{13}C COSY spectrum with an example.

Or

(b) Write a short note on DEPT.

15. (a) Discuss the mechanism and migratory aptitude of groups in dienone-phenol rearrangement.

Or

(b) Describe the steps involved in Von-Richter rearrangement.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Discuss the effect of solvents and hydrogen bonding on λ_{max} values.

Or

(b) State octant rule. Explain how it is used to determine stereochemistry of steroids.

17. (a) Explain the factors influencing chemical shift of protons.

Or

(b) Write short notes on non-first order spin-spin splitting.

18. (a) Explain the following techniques

(i) FAB

(ii) CI

Or

(b) How is MALDI-MS and TOF techniques useful in ionization?

19. (a) Propose a structure for a compound of molecular formula C_9H_8O, whose mass spectrum shows molecular ion peak at m/z 132, base peak at m/z 131 and a significant peak at m/z 103. Its IR spectrum has a strong absorption at 1690cm^{-1}. The UV spectrum has an intense band at 284nm and weak band at 308nm. The compound shows following ^{1}HNMR absorptions: δ 6.7(1H dd, J = 16Hz J = 8Hz), 7.4 (5H m), 7.45 (1H d, J = 16Hz), 9.75 (1H d, J = 8Hz).

Or

(b) A compound with molecular formula $C_8H_8O_2$ shows bands at 3200cm^{-1} and 1700cm^{-1} in its IR spectrum. The ^{1}HNMR spectrum shows peaks at δ = 10.9ppm (1H s), 7.2ppm (5H s) and 3.6ppm (2H s). The ^{13}CNMR has four peaks at δ = 130ppm, one peak at δ = 178.3ppm and another peak at δ = 41 ppm. Its mass spectrum shows a strong molecular ion peak at m/z 136 and base peak at m/z 91. Suggest a structure for the compound.

20. (a) (i) Explain the term memory effect.

(ii) Show Ring contraction or enlargement in rearrangement with Demjanov reaction as example.

Or

(b) Discuss the mechanism and migratory aptitude of groups in

(i) Dakin rearrangement

(ii) Benzilic acid rearrangement

———————

(6 pages) **Reg. No. :** .....

Code No. : 7419 **Sub. Code : ZCHM 32**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023

Third Semester

Chemistry – Core

SPECTRAL METHODS – I, ORGANO METALLIC AND ANALYTICAL METHODS

(For those who joined in July 2021 – 2022 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Which of the following shift leads to the decreased intensity of absorption?

   (a) Hypochromic

   (b) Hyperchromic

   (c) Hypsochromic

   (d) Bathochromic

2. The ground state of d^2 configuration is _____

(a) $^3F_2$ (b) $^3F_3$

(c) $^2D_1$ (d) $^2D_0$

3. In ESCA process, the photon ejects which of the following?

(a) 1s electron (b) 1p electron

(c) 2s electron (d) 2p electron

4. Auger electron spectroscopy involves the irradiation of the surface to be analysed with a beam of electrons of energy in the _____ range.

(a) 1–2 KeV (b) 2–4 KeV

(c) 4–8 KeV (d) 1–8 KeV

5. Which of the following is the neutral complex which follows the 18- electron rule?

(a) $(\eta^5 - C_5H_5)Fe(CO)_2$

(b) $(\eta^5 - C_5H_5)2Mo(CO)_3$

(c) $(\eta^5 - C_5H_5)_2Co$

(d) $(\eta^5 - C_5H_5)2Re(\eta^6 - C_6H_6)$

6. The oxidation state of iron in ferrocene is

(a) +1 (b) +2

(c) +3 (d) +4

7. The reaction in which both oxidation number and coordination increases is called ————————

(a) Oxidative addition

(b) Insertion

(c) Oligomerisation

(d) Reductive elimination

8. Synthesis gas is a mixture of ————————

(a) $CO + N_2$ (b) $CO + CO_2$

(c) $CO + H_2$ (d) $N_2 + H_2$

9. In thermogravimetric analysis, the result obtained appear as a ————————

(a) Continuous chart

(b) Continuous parabola

(c) Continuous circular positions

(d) Discontinuous chart

10. Differential scanning colorimetry is used to measure ————————

(a) specific heat

(b) electrical coductivity

(c) impact energy

(d) Thermal expansion

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) What is Orgel diagram?

Or

(b) What are charge transfer spectra?

12. (a) Explain the application of Koopmans theorem.

Or

(b) State the principle of Auger electron spectroscopy.

13. (a) Discuss Structure of metal nitrosyls.

Or

(b) Write notes on metal alkyne complexes.

14. (a) Explain Tolman Catalytic loop.

Or

(b) Explain hydrofromylation reaction.

15. (a) Explain principles of thermogram of $CuSO_4 \cdot 5H_2O$.

Or

(b) Explain Principle of Differential thermal analysis.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Explain determination of absolute configuration of complexes from ORD and CD.

Or

(b) Discuss Optical isomerism in octahedral complexes.

17. (a) Explain shake-up and shake-off processes.

Or

(b) Explain vertical and adiabatic transitions in photo electron spectroscopy.

18. (a) Discuss structure of trinuclear carbonyl complexes.

Or

(b) Discuss synthesis, structure and bonding in beryllocene.

19. (a) Compare homogeneous catalysis and heterogeneous catalysis.

Or

(b) What is Wilkinson's catalyst? Write its role in organic synthesis.

20. (a) Explain the Characteristic features of DTA CURVES. Explain the factors affecting DTA CURVES.

Or

(b) Explain the principle and applications of Atomic absorption spectroscopy.

———————

(7 pages) **Reg. No. :** .....

Code No. : 7420 **Sub. Code : ZCHM 33**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

Third Semester

Chemistry — Core

GROUP THEORY AND CHEMICAL THERMODYNAMICS

(For those who joined in July 2021-2022 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Which pairing of molecule and point group is correct?

(a) CH_2Cl_2,T_d (b) $CHCl_3$, C_{3v}

(c) CCl_4, D_{4d} (d) CCl_2Br_2, C_{2h}

2. Which of the following molecules or ions belongs to the C_{4v} point group?

(a) SF_5Cl (b) $[BH_4]^-$

(c) XeF_4 (d) trans-WCl_2,F_4

3. Which of the following symmetry elements does cis-N_2F_2 contain?

(a) a C_2 axis

(b) a σ_h plane

(c) an inversion centre, i

(d) an S_2 axis

4. The number of degrees of vibrational freedom possessed by CH_4 is :

(a) 10 (b) 6

(c) 4 (d) 9

5. Thermodynamics mainly deals with

(a) Interrelation of various forms of energy and their transformation from one form to another

(b) The system in equilibrium state or moving from one equilibrium state to another equilibrium state

(c) Both of these

(d) None of these

6. Thermodynamics is not concerned about ————————.

(a) energy changes involved in a chemical reaction

(b) the extent to which a chemical reaction proceeds

(c) the rate at which a reaction proceeds

(d) the feasibility of a chemical reaction

7. Ensemble averaging represents the average of

(a) unsteady quantities

(b) steady quantities

(c) identical quantities

(d) mean quantities

8. Maxwell-Boltzmann law is for the ————————

(a) Distinguishable particles

(b) Indistinguishable Particles

(c) Particles with half integral spin

(d) Particles with integral spin

9. Irreversibility of a process may be due to

(a) lack of equilibrium during the process

(b) involvement of dissipative effects

(c) both of the mentioned

(d) non feasibility of the process

10. All actual heat transfer processes are

(a) irreversible

(b) take place through a finite temperature difference

(c) both of the mentioned

(d) none of the mentioned

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Construct a multiplication table for C_{2h} point group.

Or

(b) Write briefly about classes of symmetry operations.

12. (a) Explain briefly about Symmetry selection rule for Raman and Infrared spectra.

Or

(b) Give brief account on determination of hybridisation of atomic orbitals in non-linear Molecule XeF_4.

13. (a) Derive any two Maxwell relations.

Or

(b) Write a note on Fugacity and its determination by graphical method.

14. (a) Write briefly about Partition functions.

Or

(b) Give a note on heat capacities of diatomic gases.

15. (a) Write briefly about phenomenological laws and their applications in Chemistry.

Or

(b) Discuss application of irreversible thermodynamics to non-linear system.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) What is The Great Orthogonality theorem and apply it to construct character table for C_{2v}.

Or

(b) Give a detailed account on constructing character table for C_{4v} using The Great Orthogonality theorem.

17. (a) Give a detailed account on determination of hybridisation of atomic orbitals in non-linear Molecule methane and PF_5.

Or

(b) Write a note on electronic Spectra of Ethylene and Formaldehyde.

18. (a) Discuss the significances of free energy concepts.

Or

(b) Write a note on chemical potential and derive Gibbs-Duhem equation.

19. (a) Give the derivation of Fermi-Dirac statistics.

Or

(b) Give the derivation of Maxwell-Boltzmann. Statistics.

20. (a) Discuss Onsager reciprocal relations and application of irreversible thermodynamics to biological system

Or

(b) Discuss the entropy changes due to coupling of chemical reaction.

———————

(6 pages)

Reg. No. : .....

Code No. : 7421 **Sub. Code : ZCHM 34**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

Third Semester

Chemistry — Core

SCIENTIFIC RESEARCH METHODOLOGY

(For those who joined in July 2021-2022 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)
Answer ALL questions.

Choose the correct answer :

1. What is the purpose of doing research?
   (a) To identify problem (b) To find solution
   (c) Both (a) and (b) (d) None
2. Research means
   (a) To identify problem
   (b) To find solution
   (c) Working in a scientific way to search the truth of any problem
   (d) None

3. Literature collected is reviewed and preferably arranged

(a) Alphabetically (b) Chronologically

(c) Randomly (d) None of these

4. Literature collected for review includes

(a) Primary and secondary sources

(b) Secondary and tertiary sources

(c) Primary and tertiary sources

(d) None of these

5. Bibliography means

(a) Foot notes

(b) Index

(c) List of referred books

(d) Quotations

6. The list of special terms and phrases used be in a form of

(a) Foot notes (b) Index

(c) Glossary (d) Quotations

7. This software is plagiarism checker

(a) Fast pencil (b) Grammarly

(c) Turnition (d) Standards

8. Plagiarism in research is

(a) Creative use of previous data

(b) Copying unscrupulously and making use of it

(c) Quoting some one and citing him

(d) Refering previous data

9. Which of the following microscope is best suited for studying ultrastructure of cell?

(a) TEM (b) SEM

(c) Confocal (d) Bright field

10. Atomic force microscopy uses ————

(a) X-rays (b) Infrared light

(c) Nanosized tip (d) All of the above

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).
Each answer should not exceed 250 words.

11. (a) Give a brief note on significance of research.

Or

(b) Write briefly about selection of research problem.

12. (a) Write briefly on primary and secondary sources.

Or

(b) Write a note on science citation index and other ISI.

13. (a) Write briefly about types of research paper.

Or

(b) Write a note on process of giving oral presentation in seminar.

14. (a) Write briefly about cyber and digital plagiarism.

Or

(b) Write briefly about patent and copyright.

15. (a) Write briefly about HRTEM.

Or

(b) Write briefly about energy dispersive X-ray analysis.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b)
Each answer should not exceed 600 words.

16. (a) Give a detailed account on characteristic of a good research problem.

Or

(b) Write the explanations on sources of research problems and funding agencies.

17. (a) Write a note on database. Scifinder, Scopus and impact factor.

Or

(b) Give a detailed account on Beilstein and chemical abstracts.

18. (a) Write a note on style of writing the research report.

Or

(b) Give a detailed account on ways of communicating the research paper both postal and oral.

19. (a) Discuss different forms of intellectual property rights.

Or

(b) Give a note on techniques to avoid plagiarism.

20. (a) Discuss about x-ray photo electron spectroscopy and single crystal XRD.

Or

(b) Discuss about transmission electron microscopy and difference between SEM and TEM.

———————

(6 pages) **Reg. No. :** .....

Code No. : 7422 **Sub. Code : ZCHM 41**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023

Fourth Semester

Chemistry – Core

SYNTHETIC STRATEGIES IN ORGANIC CHEMISTRY

(For those who joined in July 2021–2022)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Which of the following is used as a reagent in a witting reaction?

   (a) Mono phenyl phosphonium ylide

   (b) Diphenyl phosphonium ylide

   (c) Triphenyl phosphonium ylide

   (d) None of the above

2. What is the precursor used for Acyloin condensation?

(a) Alcohol (b) Ester

(c) Phenol (d) Aldehyde

3. Which of the following statement best describes retrosynthesis?

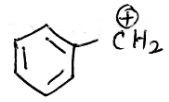
(a) The reaction conditions required to convert the product of a reaction back to the original starting materials

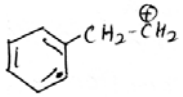
(b) A strategy used by design a synthesis of a target molecule by working back from the target to simple starting material

(c) The design of a synthetic scheme using cheap traditional reagents rather than expensive modern reagents

(d) The design of reaction conditions such that an equilibrium reaction is pushed towards the products rather than the starting materials

4. Which of the following synthon is most stable?

(a) 

(b) 

(c) $\ominus CH_3$

(d) 

5. Which of the following is Adam's catalyst?

(a) Platinum dioxide (b) Selenium dioxide

(c) Titanium dioxide (d) Manganese dioxide

6. Reduction of isoquinoline with Lithium tetraethyl borohydrid gives ————————

(a) Quindine

(b) Octahydro isoquinoline

(c) Piperidine

(d) Tetrahydro isoquinoline

7. When oestriol is heated with potassium hydrogen sulphate, it undergoes dehydration to yield ————————

(a) Oestrone (b) Oestradiol

(c) Hexoestrol (d) Oestradiol – 17 α

8. When bile acid is dehydrated by heating in a vaccum followed by catalytic reduction gives _____

(a) 5α – cholanic acid (b) 5β – Cholanic acid

(c) Coprostane (d) Both (a) and (b)

9. When camphor is distilled with iodine, it yields _____

(a) Carvacrol (b) Cymene

(c) α – Pinene (d) Menthol

10. The chemical name of vitamin C is _____

(a) Ascorbic acid (b) Niacin

(c) Riboflavin (d) Biotin

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Explain the mechanism of Hofmann–Loffler freytag reaction.

Or

(b) Write down the mechanism of wittig reaction.

12. (a) Write short notes on synthon – synthetic equivalent.

Or

(b) Write short notes on one group disconnection of alcohols.

13. (a) Write down the applications of DMSO.

Or

(b) Explain Heck and Negishi reaction.

14. (a) Write short notes on Diels hydrocarbon.

Or

(b) Write down the conversion of oestrone to oestriol.

15. (a) Write down the synthesis of squalene.

Or

(b) Write down the synthesis of vitamin A_1.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Discuss Peterson olefination reaction and its applications.

Or

(b) Explain Ugi reaction.

17. (a) Discuss the Reterosynthesis of Ci – Jasmone.

Or

(b) Discuss the Reterosynthesis of Trihexyl phenydyl.

18. (a) Explain the Preparation and applications of DDQ.

Or

(b) Discuss the preparation and applications of Adam's catalyst.

19. (a) Write down the conversion of cholesterol to progestrone, testosterone, $5-\beta-$ cholanic acid.

Or

(b) How is the constitution of sidechain established in cholesterol?

20. (a) Write down the syntehsis of $\alpha-$ pinene.

Or

(b) Explain the structural elucidation and synthesis of Zingiberene.

———————

(7 pages) **Reg. No. :** .....

Code No. : 7423 **Sub. Code : ZCHM 42**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

Fourth Semester

Chemistry–Core

BIO INORGANIC, SPECTRAL METHODS – II AND PHOTOCHEMISTRY

(For those who joined in July 2021-2022)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 1 = 10$ marks)

Answer ALL questions.

Choose the correct answer.

1. What is the physiological role of cytochromes?
   (a) Electron transfer
   (b) Oxygen transport
   (c) Iron storage
   (d) Antimicrobial

2. The correct set of biologically essential elements is _____

(a) Fe, Cu, Co, Ru (b) Cu, Mn, Zn, Ag

(c) Fe, Ru, Zn, Mg (d) Fe, Mo, Cu, Zn

3. Super oxide dismutase contains the metal ions _____

(a) Zn II and Ni (II)

(b) Cu (II) and Zn (II)

(c) Ni (II) and Co (III)

(d) Cu (II) and Fe(III)

4. Azurin is ———— containing protein.

(a) Zn (b) Cu

(c) Fe (d) Mg

5. In which state, Mossbauer spectroscopy can be recorded?

(a) liquid state

(b) gaseous state

(c) liquid crystalline state

(d) Solid state

6. The mossbauer spectrum of K_4 [Fe $(CN)_6$] consists of a ————————

(a) Single sharp resonance line

(b) Two peaks

(c) Broad resonance line

(d) All the above

7. EPR spectra of $[Cr F_6]^{3-}$ complex shows ———————— lines

(a) 56 lines (b) 57 lines

(c) 58 lines (d) 59 lines

8. The NMR spectra of $[HNi(PPh_3)_4]^+$ Complex gives ———————— signals.

(a) 5 (b) 6

(c) 3 (d) 4

9. Which of the following is an incorrect statement?

(a) Photochemical reactions are caused by absorption of Ultraviolet only

(b) When a molecule or atom in the ground state (So) absorbs light, one electron is excited to a higher orbital level.

(c) It is possible for the excited state S_1 to undergo spin inversion.

(d) First step in photochemistry is excited state (photo excitation).

10. In which reactions, molecules absorbing light do not themselves react but induce other molecules to react

(a) Photo sensitized (b) Dark

(c) Thermal (d) Irreversible

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Explain the Iron binding by transferrin.

Or

(b) Explain in vivo and in vitro nitrogen fixation.

12. (a) Write notes on blue copper proteins.

Or

(b) Write note on the following

(i) Plasto cyanin

(ii) Azurin

13. (a) Write note on isomer shit.

Or

(b) Write down the applications Mossbauer spectroscopy in studying tin compounds.

14. (a) Explain the ^{19}F NMR spectra of $PF_3(NH_2)_2$

Or

(b) Predict and explain the number of signals in the EPR spectra of the following compound

(i) $CO_3(CO)_9Se$

(ii) $[COF_6]^{4-}$

15. (a) Write notes on photochemistry of Co III complex.

Or

(b) Write notes on photochemistry of Cr III complex.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Draw the structure of chlorophyll and explain its role in phtosynthesis.

Or

(b) Discuss in detail about ferredoxin and rubredoxin.

17. (a) Discuss in detail about Metal complexes as drugs anticancer and anti arthritic agents.

Or

(b) Discuss in detail about super oxide dismutase.

18. (a) Discuss in detail about the applications of Moss bauer spectroscopy to study Iron compounds.

Or

(b) Write briefly on Quadrupole and Magnetic splitting in Mossbauer spectroscopy.

19. (a) Discuss the number of signals and Multiplicity of the ^{19}F and ^{31}P NMR spectra of following compounds

(i) $Br\ F_5 - {}^{19}F_{nmr}$

(ii) $^{31}P - H_3PO_3$

(iii) $^{31}P - H_3PO_2$

(iv) $P_4S_3 - {}^{31}P_{nmr}$

Or

(b) Write briefly about zero filed splitting and Kramer's degeneracy.

20. (a) Discuss in detail about photochemical conversion and storage of solar energy.

Or

(b) Explain the photo physical and photochemical properties of $[Ru(bpy)_3]^{2+}$ and $[cr(bpy)_3]^{3+}$ complexes.

———————

(6 pages)

Reg. No. : .....

Code No. : 7424 **Sub. Code : ZCHM 43**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

Fourth Semester

Chemistry – Core

CHEMICAL KINETICS, PHOTOCHEMISTRY AND SURFACE CHEMISTRY

(For those who joined in July 2021 – 2022)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Which of the following is true?
   (a) Viscosity coefficient increases with pressure
   (b) Viscosity coefficient decreases with temperature
   (c) Viscosity coefficient is independent of pressure
   (d) Viscosity coefficient decreases with pressure

2. On increasing the pressure of the gas, the mean free path

   (a) decreases

   (b) increases

   (c) remains unaffected

   (d) either increases or decreases

3. According to the Hammet equation the e value is

   (a) Positive (b) Negative

   (c) Zero (d) All

4. If the rate of reaction does not depends upon the initial concentration of reactant the order of reaction is

   (a) First (b) Second

   (c) Zero (d) Third

5. For a unimolecular reaction

   (a) the order and molecularity of the slowest step are equal to one

   (b) molecularity of the reaction can be zero one or two

   (c) molecularity of the reaction can be determined only experimentally

   (d) more than one reacting species are involved in one step

6. Which of the following slows down the reaction rate?

(a) Catalytic Promoters

(b) Homogeneous Catalyst

(c) Catalytic Poison

(d) Heterogeneous Catalyst

7. Electronically excited molecules that return to the ground state with the same multiplicity are called _____.

(a) Phosphorescence

(b) Fluorescence

(c) Photosensitisation

(d) Luminescence

8. Which of the following are excited state property?

(a) Dipolement (b) Pka

(c) Redox potential (d) All of these

9. At CMC the surface molecules _____.

(a) Dissociate

(b) Associate

(c) Become bigger in size due to adsorption

(d) Become smaller in size due to decomposition

10. Which of the following kinds of catalysis can be explained by the adsorption theory?

(a) Enzyme catalysis

(b) Homogeneous catalysis

(c) Acid base catalysis

(d) Heterogeneous catalysis

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Write short notes on the mean free path in a gas.

Or

(b) Write short notes on Maxwell's distribution of kinetic energies.

12. (a) Explain the chemical kinetics of decomposition of Acetaldehyde.

Or

(b) Explain salt effects.

13. (a) Write down RRKM theory of unimolecular reaction.

Or

(b) Explain how the kinetics of a fast reaction studied by stopped flow method.

14. (a) Discuss the difference between Fluorescence and Phosphorescence.

Or

(b) Write stern-volmer equation and its applications.

15. (a) Explain Langmuir's adsorption isotherm.

Or

(b) Write down the difference between chemisorption and physisorption.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Define phase rule. Derive the phase rule from the concept of chemical potential. Explain some special cases of phase rule.

Or

(b) Discuss the different types of molecular velocities.

17. (a) Explain ARR theory of reaction rate.

Or

(b) Discuss Hammett equation.

18. (a) Discuss Michaelis-Menten Kinetics activation energies of enzyme catalysed reaction.

Or

(b) Discuss Lindemann theory of unimolecular reactions.

19. (a) Discuss in detail about Jablonski diagram.

Or

(b) Write notes on the following :

(i) Flash photolysis

(ii) Photosensitisation.

20. (a) Define catalysis. Explain the types of catalysis.

Or

(b) Explain BET equation and its applications.

———————

(6 pages) **Reg. No. :** .....

Code No. : 7425 **Sub. Code : ZCHM 44**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

Fourth Semester

Chemistry — Core

SELECTED TOPICS IN CHEMISTRY

(For those who joined in July 2021–2022 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. How many Gaussian functions are there is 6-31G basis set?

   (a) 6 (b) 3

   (c) 1 (d) 10

2. Ab initio is a Latin term it means

   (a) From beginning (b) From inception

   (c) From scratch (d) All the above

3. Difficult to monitor and very dangerous form of corrosion

(a) Galvanic (b) Pitting

(c) Crevice (d) Stress

4. When Pt and Co are electrically connected, which one gets corroded?

(a) Pt (b) Co

(c) None (d) Both (a) and (b)

5. The Kd values of the following protein are given below. Protein A = 2 protein X = 6 protein Z = 9 protein Y = 4. If the mixture of these protein will be laded onto a chromatography column, the protein elute at last will be

(a) Protein A (b) Protein X

(c) Protein Y (d) Protein Z

6. The commercially available cation exchanger are

(a) Amberlite 1 RC-120

(b) Dowex1-X8

(c) Dowex21-k

(d) All the above

7. Which of the following represents active transducers

(a) Strain gauge (b) Thermistor

(c) Thermocopule (d) LVDT

8. Rochelle salts are used as a ———— in hearing aid devices.

(a) Multivibrator (b) Oscillator

(c) Transducer (d) Strain gauge

9. The paramagnetic properties of gadolinium that makes it suitable for a contrasting agents derive from its

(a) odd number of protons

(b) odd number protons and neutrons together

(c) unpaiured inner shell electron

(d) paird electrons in bonding orbitals

10. The T_1 and T_2 relaxivities of a contrasting agents are given in what units

(a) L/mmol s (b) $mmols^{-1}$

(c) L/mmol (d) unitless

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) What is computational chemistry? List out the structural information obtained from computational chemistry software.

Or

(b) How will you single point energy calculated from computational software?

12. (a) Discuss the electrochemical principles of corrosion.

Or

(b) Give a brief account of potentiodynamic polarisaiton.

13. (a) Describe the typical HPLC instrumentation unit.

Or

(b) What are the sequences of steps involved in solid-phase extraction?

14. (a) What is transducer? Sketch and explain block diagram of transducer.

Or

(b) How do field-effect transistors operate as sensors?

15. (a) Write short note on Teslascan.

Or

(b) Write any five applications of ^{99m}Tc nuclear imaging agents.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b)

Each answer should not exceed 600 words.

16. (a) Describe the salient features, advantages and disadvantages of Ab initio method.

Or

(b) Discuss the following basis sets (i) minimal basis sets (ii) split valence basis sets (iii) polarized basis sets. (3+3+2)

17. (a) Discuss the following corrosion monitoring methods. Electrical and gasometric methods.

Or

(b) Define corrosion inhibitors. Explain in detail about the classification of corrosion inhibitors.

18. (a) Give the characteristics of ion exchange resins.

Or

(b) Explain the following detectors used in gas chromatography.

(i) Thermal conductibity detectors

(ii) Flame ionization detector

(iii) Electron capture detectors

(iv) Thermoionic detector.

19. (a) Differentiate analog and digital transducer.

Or

(b) How will you characterize the performance factor of chemical sensors?

20. (a) Examine the salient features and clinical uses of PET scan.

Or

(b) Explain the following :

(i) Organ specific contrast agents

(ii) Development of MRI contrasting agents.

———————

(8 pages)

Reg. No. : .....

Code No. : 7770 **Sub. Code : WCHM 11**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

First Semester

Chemistry – Core

ORGANIC REACTION MECHANISM – I

(For those who joined in July 2023 onwards)

Time : Three hours Maximum : 75 marks

PART A — (15 × 1 = 15 marks)

Answer ALL questions.

Choose the correct answer :

1. The value of K_H/K_D, is less than one in the case of

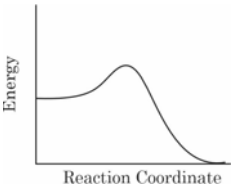
   (a) primary isotope effect

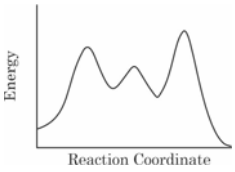
   (b) secondary isotope effect

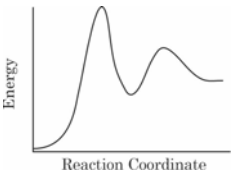
   (c) inverse isotope effect

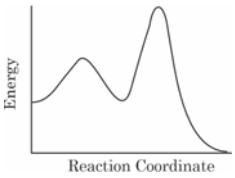
   (d) hyperconjugative effect

2. Which reaction coordinate diagram represents a mechanism where the second step is the rate determining step?

(a) 

(b) 

(c) 

(d) 

3. Carbene gives _____ when trapped with alkene.

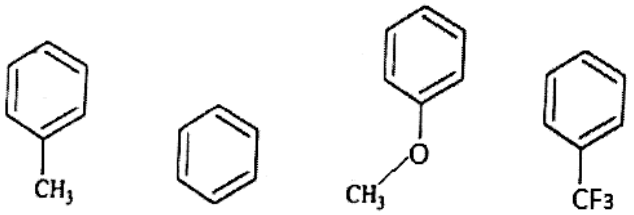
(a) dienes

(b) azo compounds

(c) cyclopropane

(d) bicyclobutane

4. What is the decreasing order of reactivity of following compounds in electrophilic substitution?



I II III IV

(a) III > I > II > IV (b) IV > I > II > III

(c) II > III > II > IV (d) I > III > II > IV

5. Nitro group is meta-directing in electrophilic aromatic substitution reactions because it

(a) increases electron density at meta-position

(b) increases electrons density at ortho and para-positions

(c) decreases electron density at meta-position

(d) decreases electron density at ortho and para-positions

6. Tropolone is

(a) non-aromatic (b) antiaromatic

(c) aromatic (d) homoaromatic

7. I^- is a better leaving group than other halides because I^- is a _____.

(a) Weak base (b) Strong base

(c) Weak acid (d) Strong acid

8. Which among the following is an ambident nucleophile?

(a) OH^- (b) CN^-

(c) Cl^- (d) NH_2^-

9. The rate of S_N2 reactions are higher in allyl chloride due to _____.

(i) stabilization of transition state by resonance

(ii) stabilization of carbocation by electron releasing group

(iii) overlapping of the nucleophile

(iv) steric effect

(a) Both (i) and (ii) (b) Both (i) and (iii)

(c) Both (ii) and (iv) (d) All the above

10. Which of the following is optically active due to presence of chiral plane?

(a) Allene (b) Spiranes

(c) Biphenyls (d) ANSA compounds

11. Which of the following has chiral axis

(a) Binaphthyl (b) Biphenyl

(c) ANSA compounds (d) Annulene

12. When HCHO reacts with CH_3MgI it gives same ethanol as it has

(a) homotopic faces (b) diastereotopic faces

(c) enantiotopic faces (d) inactive faces

13. In cyclohexane, the dihedral angle between the C-C bonds are _____.

(a) 56° (b) 60°

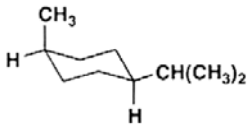
(c) 180° (d) 120°

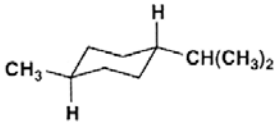
14. Anti-conformation of 1, 2-diol is less stable than _____ conformation.

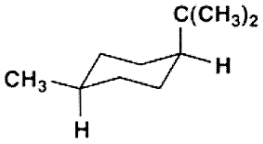
(a) eclipsed (b) gauche

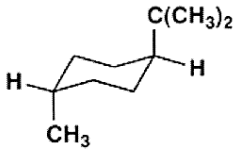
(c) both (a) and (b) (d) none of the above

15. Which is the most stable structure of 1-isopropyl-4-methylcyclohexane?

(a) 

(b) 

(c) 

(d) 

PART B — ($5 \times 4 = 20$ marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) State and explain Hammonds Postulate with an example.

Or

(b) Comment on the types, structure and stability of carbenes.

17. (a) Write a short note on aromaticity in annulenes.

Or

(b) What are the factors that influence the orientation of disubstitution in phenol and nitrobenzene?

18. (a) Discuss the mechanism of Von Richter rearrangement.

Or

(b) Write a short note on Benzyne mechanism.

19. (a) Differentiate stereoselective and stereospecific reactions with examples.

Or

(b) Explain Cram's rule with an example.

20. (a) List and discuss the conformations and relative energies of disubstituted cyclohexane.

Or

(b) Describe the conformations and properties of decalin.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

21. (a) Derive Hammett equation. How does the value of σ and ρ help in determining mechanism of a reaction?

Or

(b) Describe how the rate of a reaction helps in determining the mechanism.

22. (a) Discuss the mechanism of Friedel Crafts alkylation and acylation. Explain the reaction with nitrobenzene and aniline.

Or

(b) Discuss the mechanism of (i) S_E2 (ii) S_Ei. Give evidences.

23. (a) Give the mechanism for (i) Smiles rearrangement (ii) Bucherer reaction.

Or

(b) Explain the use of Grunwald-Winstein equation.

24. (a) Using Cahn – Ingold – Prelog's rules How can we assign RJS configuration for allenes and biphenyls.

Or

(b) Illustrate with examples (i) asymmetric synthesis (ii) asymmetric transformation.

25. (a) Discuss the conformations of cyclohexane and ring inversion.

Or

(b) State octant rule. With examples show how to predict the sign of cotton effect in decalones and steroids.

———————

(7 pages) **Reg. No. :** .....

Code No. : 7771 **Sub. Code : WCHM 12**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

First Semester

Chemistry — Core

STRUCTURE AND BONDING IN INORGANIC COMPOUNDS

(For those who joined in July 2023 onwards)

Time : Three hours Maximum : 75 marks

PART A — (15 × 1 = 15 marks)

Answer ALL questions.

Choose the correct answer :

1. Methane has a bond angle 109.5^0. The percentage of P and S character in hybridisation of methane is respectively

(a) 75 and 25 (b) 70 and 30

(c) 60 and 40 (d) 50 and 50

2. More electronegative substituent occupy the low electro negativity P_Z, d_z^2 orbital in TBP structures. This is known as ————————

(a) Hybridisation (b) Orbital capture

(c) Ionisation (d) Apicophilicity.

3. Madelung constant is a measure of

(a) The summation of all the geometrical interactions

(b) Ionisation energy

(c) Electron affinity

(d) Electro negativity.

4. S_4N_4 has a ———————— structure

(a) Extreme cradle (b) Chair

(c) Half chair (d) Hexagonal

5. Phosphate can be qualitatively analysed using ————————

(a) isopolymolypdate

(b) isopolyvanadate

(c) isopolytungstate

(d) Both (a) and (b)

6. The enthalpy of formation of an ionic compound can be calculated by means of

(a) Born Haber cycle

(b) Born Lande equation

(c) Kapustinki equation

(d) All the above

7. Radius ratio for square planar symmetry with coordination number 4 is ————————

(a) 0.414 – 0.732

(b) 0.225 – 0.414

(c) 0.732 -1.0

(d) Above 1.0

8. Bragg's law is represented by

(a) $\sin\theta = n\lambda/2d$ (b) $\sin\theta = h\lambda/2d$

(c) $n\lambda = 2d\cos\theta$ (d) (a) and (b)

9. Which one of the following crystal type has maximum void?

(a) HCP? (b) FCC

(c) BCC (d) Both (a) and (b)

10. Which of the following crystal has sheet like structure

(a) Cadmium iodide

(b) Zinc blende

(c) Spinels

(d) Both (a) and (c)

11. Which of the following metal oxides do not adopt spinel structure?

(a) CO_3O_4 (b) Fe_3O_4

(c) Mn_3O_4 (d) None

12. For rock salt the radius ratio is

(a) 0.52 (b) 0.414

(c) 0.225 (d) 0.761

13. When silicon is doped with phosphorous we get ————————semiconductor

(a) n type (b) p type

(c) n-p type (d) p-n type

14. Which of the following crystal defect is rare?

(a) positive ion absent

(b) extra interstial negative ions

(c) interstial positive ions and electrons

(d) negative ion absent

15. Diamond is an example of ————————

(a) Semiconductor

(b) Insulator

(c) Conductor

(d) Super conductor

PART B — (5 × 4 = 20 marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Write a note on Kaputstinski equation.

Or

(b) Using the following data predict why $NaCl_2$ does not occur?

U_0 = − 2180 kj/mole

ΔH_{IE1} = + 496 kj/mole

ΔH_{IE2} = + 4562 kj/mole

$2\Delta H_{EA}$ = − 698 kj/mole

ΔH_{ANa} = +108 kj/mole

ΔH_{AC1} = + 242 kj/mole

17. (a) Write a note on poly molybdate? Give its analytical applications in chemistry.

Or

(b) Discuss the structure of Borazine and differentiate it from benzene using its chemical reactions (two reactions).

18. (a) Calculate the void space for hexagonal close packing.

Or

(b) What is a glide plane? Explain it with one example.

19. (a) Illustrate the hydrothermal method of the synthesis with an example.

Or

(b) Most of the super conductors crystallises in Perovskite structure. Explain the Perovskite structure with an example.

20. (a) Colour centres are crystal defects. Discuss.

Or

(b) Differentiate the conductivities of conductor, semiconductor and insulator with the help of band theory of solids.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

21. (a) Derive the Born Lande equation for the lattice energy of an ionic compound.

Or

(b) What is Bent's rule? Apply Bent's rule to explain the structure of mixed chloro fluorides $PCl_x F_{5.X}$.

22. (a) Predict the structure of B_4H_{10}, $C_2B_{10}H_{12}$ and B_6H_{10} using Wade's rule.

Or

(b) Explain the structure of main group clusters.

23. (a) Calculate packing fraction of FCC close packing.

Or

(b) Calculate the limiting radius ratio values for tetrahedral and octahedral arrangements.

24. (a) Explain the structural features of Nickel arsenide and rock salt.

Or

(b) Bring out four differences between

(i) Normal spinels and Inverse Spinels

(ii) Fluorite and antifluorite.

25. (a) What are metal excess and deficiency defects? Explain their types with an example.

Or

(b) Discuss the electrical and optical properties of semi conductor devices.

———————

(7 pages) **Reg. No. :** .....

Code No. : 7772 **Sub. Code : WCHE 11**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

First Semester

Chemistry

Elective I — PHARMACEUTICAL CHEMISTRY

(For those who joined in July 2023 onwards)

Time : Three hours Maximum : 75 marks

PART A — (15 × 1 = 15 marks)

Answer ALL questions.

Choose the correct answer :

1. Refractive index $n = c/v$ where c is

   (a) concentration

   (b) angle of incidence

   (c) velocity of light in vacuum

   (d) velocity of light in substance

2. Intrinsic viscosity is

(a) directly proportional to molecular weight

(b) inversely proportional to molecular weight

(c) independent of molecular weight

(d) proportional to temperature and pressure

3. The term *Es* in the Taft equation stands for

(a) Steric substituent constant

(b) Equilibrium state

(c) Excitation energy

(d) Reaction constant

4. I – 125 is used to detect

(a) thyroid functioning (b) anemia

(c) blood clot (d) cholesterol

5. Which of the following properties is responsible for deciding the form of dosage?

(a) Solubility (b) Distribution

(c) Toxicity (d) Metabolism

6. The ratio of drug in oil phase to that in aqueous phase is called ————————.

(a) pKa value (b) partition coefficient

(c) dissolution (d) permeation

7. The process in which drug enters the body through skin is called ————————.

(a) nasal (b) otic

(c) topical (d) buccal

8. A suppository is administered in

(a) ear (b) nose

(c) mouth (d) rectum

9. The best method of administering a medicine that exists in gaseous form is

(a) Transdermal (b) Rectal

(c) Inhalation (d) Oral

10. Bioisosterism is the process of

(a) replacement of similar group

(b) replacement of similar valence group

(c) replacement of similar mass number group

(d) addition of group of different mass number

11. Which one of the following is an example of the chemical modification of an active pharmaceutical ingradient?

(a) Converting a crystalline API into an amorphous form

(b) Combining a basic API with citric acid to produce the citrate salt of the API

(c) Mixing a poorly soluble API with water to produce a suspension

(d) Mixing a soluble API with water to produce a solution

12. Which of the following QSAR is performed manually?

(a) Hansch (b) Fujita-Ban

(c) Topliss (d) Free Wilson

13. Which of the following terms predicts the biological activity of molecules?

(a) Molecular docking

(b) Molecular dynamics simulation

(c) Quantitative Structure-Activity Relationship (QSAR)

(d) Molecular visualization

14. Protein data can be extracted from

(a) Chemspider (b) Swissdock

(c) PDB (d) ChemBL

15. Which of the following is not a docking software?

(a) Autodock (b) Autodock-vina

(c) Swiss dock (d) DeepTox

PART B — ($5 \times 4 = 20$ marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Explain how optical activity is measured using Polarimeter.

Or

(b) Define dielectric constant. How is it determined?

17. (a) What are radiopharmaceuticals? Give few examples.

Or

(b) Illustrate the principle of isotopic dilution analysis.

18. (a) What is the function of drug regulation and control?

Or

(b) How are drugs classified based on their sources?

19. (a) What are lead compounds? Give an example for lead modification.

Or

(b) Explain induced-fit theory with an example.

20. (a) What is molecular docking? How is it useful in pharma industry?

Or

(b) What is RCSB-PDB? How is it useful in drug designing?

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

21. (a) Explain how viscosity is measured for Newtonian Systems.

Or

(b) Describe the different types of Non-Newtonian flow with rheograms.

22. (a) Name few radiopharmaceuticals used in diagnostics and their action.

Or

(b) Explain why partition coefficient and solubility are important properties of drugs.

23. (a) Discuss the different routes of drug administration.

Or

(b) How are drugs classified based on the dosage form? Give the advantages of the various forms.

24. (a) What are the factors affecting bio-sensitivity? Explain with examples.

Or

(b) How does Lipophilicity and Chelation affect drug-receptor interaction?

25. (a) How are the ADMET properties estimated using software?

Or

(b) What is the role of computers in drug designing?

———————

(6 pages) **Reg. No. :** .....

Code No. : 7773 **Sub. Code : WCHE 12**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

First Semester

Chemistry

Elective I — NANO MATERIALS AND NANO TECHNOLOGY

(For those who joined in July 2023 onwards)

Time : Three hours Maximum : 75 marks

PART A — (15 × 1 = 15 marks)

Answer ALL questions.

Choose the correct answer :

1. The first talk about Nanotechnology was given by

   (a) Albert Einstein (b) Newton

   (c) Gordon E. Moore (d) Richard Feynman

2. State Braggs Law

   (a) $n\lambda = 2d\cos\theta$ (b) $n\lambda = 2d\sin^2\theta$

   (c) $n\lambda = 2d\cos^2\theta$ (d) $n\lambda = 2d\sin\theta$

3. Greeks and Romans had used nanoparticles in the manufacturing of

(a) Cosmetics for eyes (b) Medicines

(c) Metal articles (d) Hair dye

4. Ionic, Covalent and Coordinate Covalent bond are collectively found in which the following compounds

(a) Ammonium chloride

(b) Sodium chloride

(c) Diamond

(d) Nitrate ion

5. An ionic solid consists of atoms held together by

(a) Ionic bond (b) Covalent bond

(c) Metallic bond (d) Plasmonic nature

6. Approximate surface energy of diamond is

(a) 9820 (b) 3000

(c) 1250 (d) 800

7. Which one of the following is an amorphous materials?

(a) Lead (b) Glass

(c) Brass (d) Zinc

8. Which is the most important properties of nanomaterial?

(a) Pressure (b) Friction

(c) Temperature (d) Force

9. The ability of a materials to withstand bending without fracture is known as

(a) Mechanical strength (b) Melting

(c) Toughness (d) Ductility

10. Which types of electron pair exists in a semiconductors?

(a) Ionic (b) Non Ionic

(c) Homopolar (d) Hetropolar

11. Which of the following is not a semiconductor?

(a) Se (b) SiC

(c) Silica (d) GaAs

12. Silicon doped with gallium is ———— semiconductor.

(a) Intrinsic (b) Extrinsic

(c) n-type (d) p-type

13. Electron microscope can give magnification upto

(a) 400,000 X (b) 100,000 X

(c) 15,000 X (d) 100 X

14. Resolving power of TEM is determined by ———————— equation.

(a) Abbe's (b) Snell's

(c) Faraday's (d) Wie's

15. The cathode of transmission electron microscope consists of

(a) Tungsten wire (b) Bulb

(c) Iron filament (d) Gold wire

PART B — ($5 \times 4 = 20$ marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Describe the salient features of one dimensional Nanoparticles.

Or

(b) Expand the following acronyms and give anyone analytical value :

(i) STM (ii) XRD

(iii) FTIR (iv) AAS

17. (a) Write short note on Microwave Assisted Synthesis.

Or

(b) Prepare the gold nanoparticles by Brust-Schiffrin method.

18. (a) Write any four thermal properties of nanomaterials.

Or

(b) Deduce the solution based chemical synthesis of iron oxide.

19. (a) Discuss synthetic route of CdS and GaAs nanoparticles.

Or

(b) Locate the three configuration with neat circuit in the transistor amplifier.

20. (a) Define metal-ceramic and polymer matrix Nanocomposites.

Or

(b) Summarize the principle and advantages of SEM.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

21. (a) Describe the four methods of formulating consolidation of Nanopowders.

Or

(b) Discuss the use of nanomaterials in biomedical field.

22. (a) Discuss the principles, synthesis, advantages and disadvantages of electrochemical synthesis.

Or

(b) Compare the arc discharge, laser ablation and CVD methods used to produce carbon nanotubes.

23. (a) Discuss briefly about the techniques to study mechanical properties of nanomaterials.

Or

(b) Write down synthesis of following nanoparticles :

(i) Silica (ii) Alumina

24. (a) (i) Classify the materials based on conductivity with suitable examples.

(ii) Define Resistivity.

Or

(b) Define Hall effect. Derive an expression for the Hall voltage.

25. (a) Examine the principle, instrumentation and mode of operation of AFM.

Or

(b) Discuss the principle, instrumentation and application of TEM.

———————

Reg. No. : .....

(6 pages)

Code No. : 7774 **Sub. Code : WCHE 13**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

First Semester

ELECTIVE – II – Chemistry

ELECTROCHEMISTRY

(For those who joined in July 2023 onwards)

Time : Three hours Maximum : 75 marks

PART A — (15 × 1 = 15 marks)

Answer ALL questions.

Choose the correct answer :

1. Cooking time of food is reduced in a pressure cooker because

   (a) Boiling point of water is lowered.

   (b) Higher pressure softens the food.

   (c) Boiling point of water is raised.

   (d) Uniform distribution of heat.

2. Calculate the ionic strength of 0.15 M KCL

   (a) 0.30 (b) 0.15

   (c) 0.075 (d) 0.015

3. If liquid A and B ideal behavior

(a) Enthalpy of mixing is zero.

(b) Entropy of mixing is zero.

(c) Free energy of mixing is zero.

(d) Free energy as well as entropy mixing are each zero.

4. The Gouy–Chapman theory is applicable to

(a) Diluted colloid (b) Concentrated colloid

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

5. A typical Surface tension (γ) versus V electrocapillary curve is almost a

(a) Parabola (b) Circle

(c) Ellipsoid (d) Rectangular

6. Sedimentation potential is also called

(a) Gold number (b) Dorn effect

(c) Colloidal disperson (d) Zeta potential

7. The standard reduction potential values of three metallic cation X, Y, Z are 0.52, -3.03 and -1.18 V respectively. The order of the reducing power of corresponding metals is

(a) Y>Z>X (b) X>Y>Z

(c) Z>Y>X (d) Z>X>Y

8. Which of the following metal ion is more reactive?
   (a) Cu (b) Ag
   (c) Hg (d) K

9. Primary reference electrode is
   (a) SHE
   (b) Calomel
   (c) Glass
   (d) Ion selective electrode

10. The rate determining step is the _____ step in a chemical reaction.
   (a) Fastest (b) Slowest
   (c) Barrier (d) None of the above

11. The stoichiometric number of the rate-determining step was first introduced by
   (a) Horiuti (b) Evans
   (c) Nernst (d) Kohlrausch's

12. The hydrogen over voltage for palladium is
   (a) 0.21 V (b) 0.48 fuel cells
   (c) 0.15 V (d) 0.00 V

13. What is the type of cell used for building laptop battery pack?
   (a) Lithium ion (b) Ni-Cd
   (c) Zn-Silver oxide (d) Led acid

14. Which types of water used in electrolyte

(a) Ordinary water (b) Distilled water

(c) Coolant (d) None of the above

15. Fuel cell performance is not limited by _____ thermodynamics.

(a) First law (b) Second Law

(c) Third law (d) All the three law

PART B — ($5 \times 4 = 20$ marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Define Van't Hoff factor and its relation to colligative properties.

Or

(b) Calculate the mean activity coefficient $\gamma \pm$ of 0.01 M Nacl in aqueous solution at 25° C. [For water at 25° constant A=0.509]

17. (a) Write any four evidence of electrical double layer.

Or

(b) Discuss the term Electro-Osmosis.

18. (a) Discuss the factors affecting discharge of ions.

Or

(b) Explain briefly about anodic and cathode currents.

19. (a) Explain Pourbiax diagram.

Or

(b) Write short note on polarization and depolarization.

20. (a) Explain supporting electrolyte with suitable examples.

Or

(b) List out any four applications of fuel cell.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b)

21. (a) Derive DHLL equation.

Or

(b) Differentiate positive and negative deviation from ideal behavior.

22. (a) Discuss briefly about the measurement and application of zeta potential.

Or

(b) Explain the Helmholtz perrin models of electrical double layer.

23. (a) Examine the different types and measurement of over voltage.

Or

(b) Derive Butler-Volmer equation for single step one electron transfer electrode reaction.

24. (a) The Tafel anodic and cathodic slopes $\partial\Delta\phi/\partial$ logi for a two electron process were found to be 0.04 & 0.12 respectively. Determine the transfer coefficients and Stoichiometric number for the reaction.

Or

(b) Derive an expression for transfer coefficient and its significance.

25. (a) Discuss the following fuel cells.

(i) Alkaline fuel cells.

(ii) Phosphoric acid fuel cells.

Or

(b) Describe the principles and application of polarography.

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(8 pages) **Reg. No. :** .....

Code No. : 7775 **Sub. Code : WCHE 14**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

First Semester

Chemistry

Elective II — MOLECULAR SPECTROSCOPY

(For those who joined in July 2023 onwards)

Time : Three hours Maximum : 75 marks

PART A — (15 × 1 = 15 marks)

Answer ALL questions.

Choose the correct answer :

1. Raman effect is

   (a) Elastic scattering of light

   (b) Inelastic scattering of light

   (c) Emission of light

   (d) Absorption of light

2. The difference between incident and scattered frequencies in the Raman spectrum is called

(a) Raman Frequency (b) P-Branch

(c) Stokes line (d) Anti-Stokes line

3. When all the three principle moment of inertia of a molecule are equal it is called

(a) Symmetry Top

(b) Prolate Symmetry Top

(c) Asymmetry Top

(d) Spherical Top

4. The spectra caused in the infrared region by the transition in vibrational levels in different modes of vibrations are called

(a) Vibration spectra (b) Electronic Spectra

(c) Rotational spectra (d) None of the above

5. The frequency of vibration of a bond is a function of

(a) Force constant (b) Mass of bonded atom

(c) Both (a) and (b) (d) Bond order

6. The vibrations, without a center of symmetry are active in

(a) IR inactive and Raman active

(b) IR active and Raman inactive

(c) IR and Raman

(d) None of the above

7. $\sigma \rightarrow \sigma^*$ transition wavelength lies in ———— region.

(a) IR (b) Visible

(c) UV (d) NMR

8. Surface spectrometer, which of the following beam is analyzed?

(a) Reflected beam (b) Absorbed beam

(c) Refracted beam (d) Incident beam

9. Pick out Liquid laser.

(a) Europium chelate laser

(b) InP Laser

(c) Ruby laser

(d) Coumarin dye laser

10. Proton NMR spectra are usually run at

(a) 40 MHz (b) 20 MHz

(c) 10 MHz (d) 60 MHz

11. How many signals will vinyl chloride have in ^{1}H NMR spectrum?

(a) 1 (b) 2

(c) 4 (d) 3

12. The distance between the center of the peak of doublet is called as

(a) Coupling constant (b) Chemical shift

(c) Spin coupling (d) Spin-Spin Splitting

13. For an unbound electron, value of Lande' factor (g-factor) will be equal to

(a) 1.0098 (b) 2.0023

(c) 3.0015 (d) 6.0821

14. Magnetic field strength of 0.1 Tesla is equal to

(a) 10 Gauss (b) 100 Gauss

(c) 1000 Gauss (d) 10 000 Gauss

15. As operating frequency increases, hyperfine splitting constant

(a) Increases

(b) Decreases

(c) Remains same

(d) Either decreases or increases

PART B — (5 × 4 = 20 marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Describe briefly about the Vibrational Raman Spectra of simple molecules.

Or

(b) When 435.8 nm line of mercury arc lamp was used as the source of radiation, a Raman line was observed at 444.7 nm. What is the Raman shift?

17. (a) Derive an expression for vibrational energy for anharmonic oscillator of simple molecule.

Or

(b) Show that the perpendicular vibration of symmetrical top molecule exhibit R branch sequence.

18. (a) List the all possible electronic transition possible for

(i) Methane

(ii) Chloromethane

(iii) Formaldehyde

(iv) Chlorine.

Or

(b) Elaborate the Predissociation spectra.

19. (a) An organic compound having molecular formula $C_5H_{11}Cl$ gave the following ^1H NMR data : δ 1.0 (t, 3H), 1.5 (s, 6H) and 1.8 (q, 3H) Deduce the structure of compound.

Or

(b) Describe the salient features of DEPT Spectrum.

20. (a) Explain Kramer's degeneracy with suitable examples.

Or

(b) Explain this statement : Low and high spin complex can be differentiated by Mossbauer spectroscopy.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

21. (a) Describe the classical theory of Raman effect.

Or

(b) Show that for a rigid diatomic rotor the moment of inertia is given by $I = \mu r^2$.

22. (a) Show that the parallel and perpendicular vibration of Linear HCN molecule exhibit PR and PQR branch sequence respectively.

Or

(b) Compare the IR and Raman spectra.

23. (a) Discuss the principles and application of XPS.

Or

(b) Describe the principle and construction of Ruby and Helium-Neon laser.

24. (a) Discuss the factors affecting chemical shift in ^{1}H NMR spectroscopy.

Or

(b) Explain the following spectral data systematically and deduce the structure of an organic molecule containing C, H and O

UV : λ max 278 and 319 nm.

IR : Significant absorption bands at 3070-3010, 2970-2860, 1685, 1605, 1580 and 1450 cm^{-1}.

PMR : 82.1 (3H, s) and 7.5 (5H, m).

^{13}C NMR : δ 198 and 137 (two singlets), 134, 129 and 128 (three doublets) and 26 (one quartet).

Mass Spectrum : m/e 120 (M^{+}), 105, 77, 51 and 43.

25. (a) Discuss Zero and Non-Zero field splitting with suitable examples.

Or

(b) Sketch and explain the Mossbauer spectrum of following iron complexes.

(i) $FeSO_4.7H_2O$

(ii) $FeCl_3$

(iii) $K_4[Fe(CN)_6].3H_2O$

(iv) $K_3[Fe(CN)_6]$.

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