R2690

Sub. Code
536201

M.Sc. DEGREE EXAMINATION, APRIL – 2025

Second Semester

Chemistry

INORGANIC CHEMISTRY — II

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

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

1. What is the meaning of the word "catenate"? (CO1, K2)

   (a) Chain (b) Ring

   (c) Bond (d) Atom

2. What is the hybridization of phosphine? (CO1, K1)

   (a) sp hybridized (b) sp^2 hybridized

   (c) sp^3 hybridized (d) no hybridization

3. Which of the following is a nido-borane? (CO2, K3)

   (a) B_4H_{10} (b) B_5H_9

   (c) $[B_2H_6]^{2-}$ (d) B_5H_{11}

4. According to Wade's Rule $[C_2B_{10}H_{12}]$ adopts which type of structure? (CO2, K3)

   (a) Closo structure (b) Nido structure

   (c) Archono structure (d) Hypo structure

5. Which of the following statements regarding the S_N1 mechanism is wrong? (CO3, K3)

(a) S_N1 reactions are unimolecular

(b) S_N1 reactions are first order

(c) S_N1 mechanism involves a single step

(d) S_N1 reactions usually occur in two steps

6. The correct statement about base hydrolysis of $[Co(Py)_4Cl_2]$ + (Py = pyridine) is (CO3, K5)

(a) Rate expression is rate = $K[Co(Py)_4Cl_2]+[OH^-]$

(b) Reaction does not depend on hydroxide ion concentration

(c) Reaction proceeds through S_N1 CB mechanism

(d) Intermediate involved in this reaction is $[Co(Py)_4Cl_2(OH)]$

7. The number of carbonyl stretching modes observed in the IR spectra of $M(CO)_5X$ is (CO4, K4)

(a) 3 (b) 1

(c) 2 (d) 4

8. The Mo-Mo bond order in $[(Cn_{15}-C_5H_5)M_0(CO)_2]_2$ which obeys the 18-electron rule is (CO4, K6)

(a) 5 (b) 4

(c) 2 (d) 3

9. Among the following, the most stable isotope of radioactive decay is _____ (CO5, K5)

(a) $_{82}Pb^{206}$ (b) $_{82}Pb^{210}$

(c) $_{82}Pb^{212}$ (d) $_{82}Pb^{214}$

10. The source of energy in stars is (CO5, K2)

(a) Nuclear fission

(b) Nuclear fusion

(c) Dissociation of atoms

(d) Nuclear destruction

Part B (5 × 5 = 25)

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

11. (a) Write a short notes on phosphazines. (CO1, K1)

Or

(b) Explain the heteropolyanion of molybdenum. (CO1, K2)

12. (a) What are carboranes? Explain with suitable example. (CO2, K2)

Or

(b) What are Wade's rules? How can we use these rules to predict the structure of P_4 clusters? (CO2, K2)

13. (a) Discuss the S_N1 reaction and mechanism in octahedral complexes. (CO3, K3)

Or

(b) What are factors affecting the rate of substitution reaction? Explain it. (CO3, K4)

14. (a) Write a short notes on bonding in metal carbonyls. (CO4, K3)

Or

(b) Explain 18-electron rule with examples. (CO4, K6)

15. (a) What are nuclear fission and fusion reactions with examples? (CO5, K1)

Or

(b) Explain isotopic dilution analysis in nuclear chemistry. (CO5, K2)

Part C (5 × 8 = 40)

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

16. (a) Write the preparation and uses of alkali and alkaline earth metals with examples. (CO1, K1)

Or

(b) Explain the structure and reactivity of zeolites. (CO1, K3)

17. (a) Discuss the structure and bonding in polyhedral boranes. (CO2, K5)

Or

(b) Explain trinuclear cluster, tetranuclear clusters and hexanuclear cluster with each one examples. (CO2, K3)

18. (a) Write the reaction and mechanism of S_N1 and SNi reaction. (CO3, K2)

Or

(b) Explain the stereochemistry of substitution reaction in square planar complexes. (CO3, K4)

19. (a) Briefly explain the Nitrosyls. (CO4, K5)

Or

(b) Discuss the types, structure and bonding of polynuclear metal carbonyls. (CO4, K3)

20. (a) Explain photonuclear, spallation and thermonuclear reactions. (CO5, K4)

Or

(b) How radioactive waste materials are managed and disposed? Explain it. (CO5, K6)

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R2691	Sub. Code
	536202

M.Sc. DEGREE EXAMINATION, APRIL – 2025

Second Semester

Chemistry

ORGANIC CHEMISTRY – II

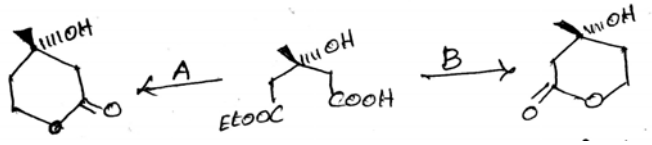
(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

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

1. Identify appropriate reagents A and B in the following reactions. (CO1, K3)



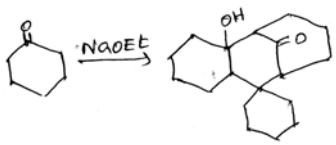
(a) A = $LiAlH_4$; B = BH_3, Me_2S

(b) A = $LiBH_4$; B = BH_3, Me_2S

(c) A = BH_3, Me_2S ; B = $LiAlH_4$

(d) A = BH_3, Me_2S ; B = $LiBH_4$

2. The correct sequence of reactions involved in the following transformation is (CO1, K3)



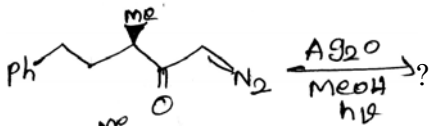
(a) Aldol condensation, Michael addition, Aldolcondensation

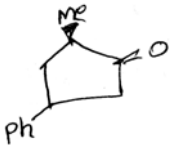
(b) Aldol condensation, Aldol condensation Michael addition

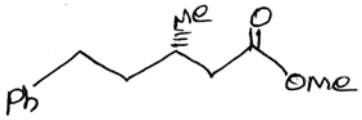
(c) Michael addition, Aldol condensation, Aldol condensation

(d) Aldol condensation, Michael addition, Michael addition

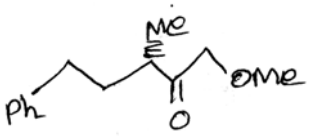
3. The major product formed in the following reaction is (CO2, K3)



(a) 

(b) 

(c) 

(d) 

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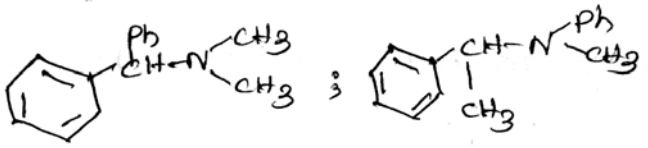
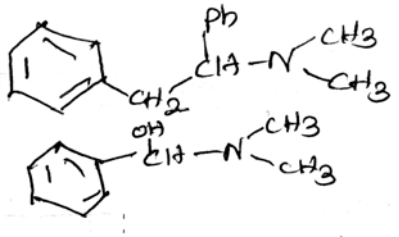
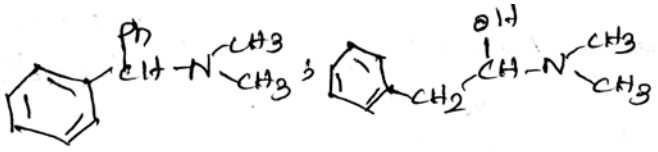
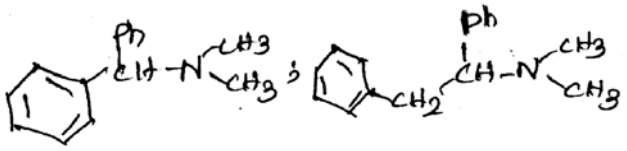
4. When dibenzyldimethyl ammonium salt is reacted with a strong base *phLi*, both steven's and sommlet-Hauser rearrangements were observed. Write the products from each rearrangements? (CO2, K3)

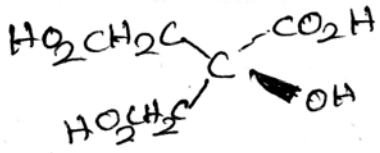
(a) 

(b) 

(c) 

(d) 

5. Label group/Faces homotopic, enantiotopic, or diastereotropic is following compounds. (CO3, K3)

(1) 

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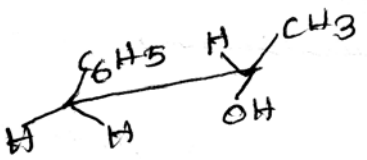
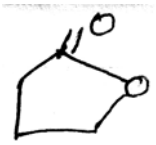
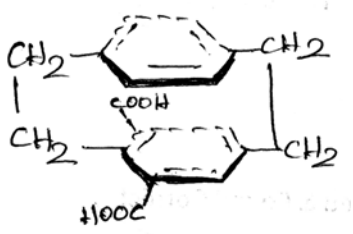
(2) 

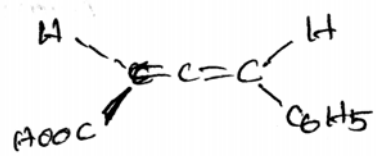
(3) 

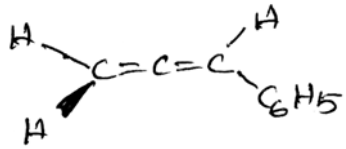
(a) homotopic, enantiotopic, diastereotopic
(b) diasterotopic, enantiotopic, homotopic
(c) enantiotopic, diastereotopic, homotopic
(d) enantiotopic, diastereotopic enantiotopic

6. Which of the following molecules are chiral?

(CO3, K3)

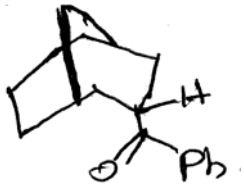
(1) 

(2) 

(3) 

(a) (2) only (b) (1), (2)
(c) (1), (3) (d) (3) only

7. Write the structure of product (with name of reaction) form from the irradiation of the following compound. (CO4, K4)



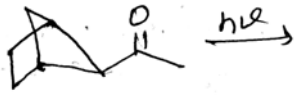
(a) Di-Pi-methane rearrangement; tetracyclooxetane

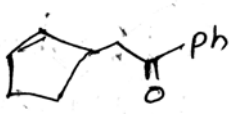
(b) Photooxidation ; tetracycloxetene

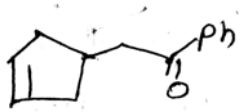
(c) Paterno-Buchireaction ; tetracycloxetane

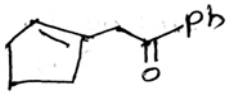
(d) Mcmurry coupling, tetracycloxetene

8. The major product formed in the following photochemical reaction is (CO4, K4)



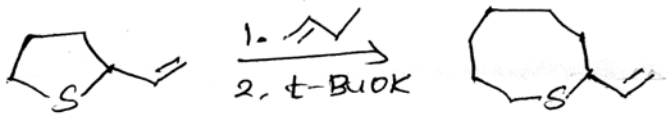
(a) 

(b) 

(c) 

(d) 

9. Following reaction is an example of (CO5, K4)



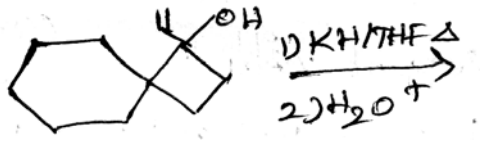
(a) [2, 3] - Sigmatropic rearrangement

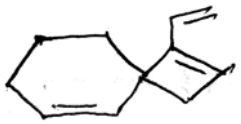
(b) [3, 3] - Sigmatropic rearrangement

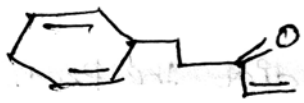
(c) Ranberg-backlund reaction

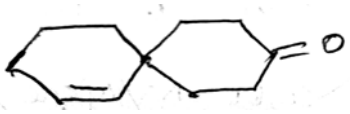
(d) Pummerer rearrangement

10. Predict the major product (CO5, K4)



(a) 

(b) 

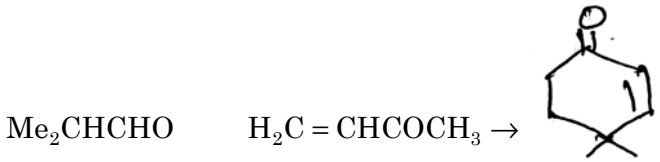
(c) 

(d) 

Part B (5 × 5 = 25)

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

11. (a) How a combination of (II & III) an lead to B. (CO1, K3)



Me_2CHCHO $H_2C = CHCOCH_3 \rightarrow$

II III

Or

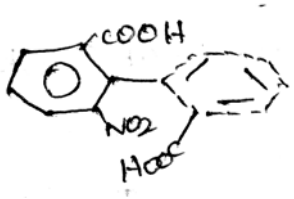
(b) Which major product would be formed by the reaction of enamine from 2-methylcyclohexanone and pyrrolidine and benzylchloride. (CO1, K3)

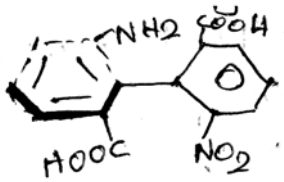
12. (a) Explain the mechanism of the reaction of ketene with diazomethane to give cyclopropanome. (CO2, K3)

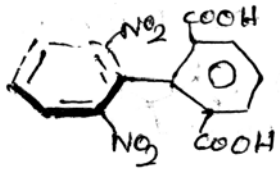
Or

(b) Write products from the reaction of a peracid with cyclohexanone reaction of diazomethane with HN_3/H_2SO_4. (CO2, K3)

13. (a) Comment on the chirality optical isomerism of following biphenyls (CO3, K3)

(i) 

(ii) 

(iii) 

Or

(b) Explain Felkin-Ahn rule. How its differ from Cram's rule. (CO3, K3)

14. (a) Cyclopentadiene adds readily to p-benzoquinon in [4+2] manner on heating what product will be formed on the irradiation of product (1) of this reaction? (CO4, K4)

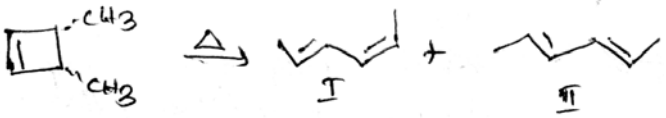
Or

(b) Predict the radical catalysed addition of carbon tetrachloride to β -pinene. (CO4, K4)

15. (a) The transition state of Diels-Alder pericyclic reaction is aromatic and compares with cope rearrangement. Explain. (CO5, K4)

Or

(b) On thermal ring opening cis 3, 4-dimethyl cyclobutene gives two diene ((I), (II)) one of these is formed almost exclusively which is this diene. How it is formed? (CO5, K4)

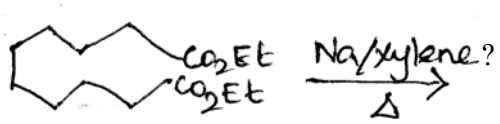


Part C (5 × 8 = 40)

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

16. (a) Explain Gillman reagents with this reagent with is reagent what is the product formed in the presence of THF with aryl and vinyl halides. (CO1, K3)

Or

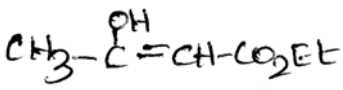
(b) 

Predict the product? Explain mechanism. (CO1, K3)

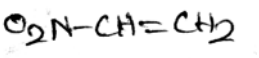
17. (a) Give the mechanizm of reaction of Ketene with diazomethane to give cyclopropanone. (CO2, K3)

Or

(b) Write the mechanism for the formation of a ketone on addition of bromine to the *enol* (I) and the addition of *HCl* to (II). (CO2, K3)

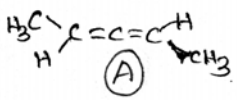
(i) 

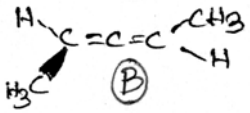
(I)

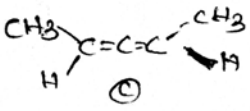
(ii) 

(II)

18. (a) Comment on identity and chirality of the following structure of penta-2, 3 diene. (CO3, K3)

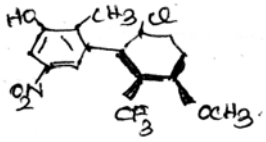
(i) 

(ii) 

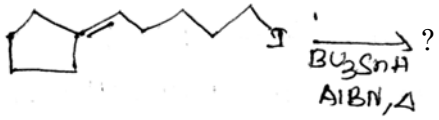
(iii) 

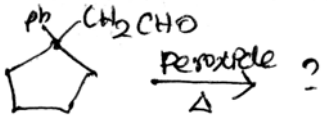
Or

(b) The following biphenyl is chiral or not designate its configuration. (CO3, K3)



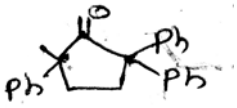
19. (a) Write the product of reactions. (CO4, K4)

(i) 

(ii) 

Or

(b) Write the structure of products from photochemical reaction of the following compound. (CO4, K4)

(i) 

(ii) 

R2691

20. (a) Benzocyclobutene on heating with dimethyl trans-2-butenediolate(1) gives bicyclic product. Explain the reaction. (CO5, K4)

Or

(b) A [3, 3] sigmatropic rearrangement is thermally allowed via hypothetically formed allyl radicals explain. (CO5, K4)

———————

R2692

Sub. Code
536203

M.Sc. DEGREE EXAMINATION, APRIL – 2025

Second Semester

Chemistry

PHYSICAL CHEMISTRY – II

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

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

1. For a simple harmonic oscillator, the acceleration of the mass is directly proportional to : (CO1, K1)

   (a) The velocity of the mass

   (b) The displacement of the mass

   (c) The square of the displacement of the mass

   (d) The square of the velocity of the mass

2. The Jahn-Teller effect is observed in which type of complexes? (CO1, K2)

   (a) Square planar complexes

   (b) Tetra hedral complexes

   (c) Octahedral complexes

   (d) Linear complexes

3. An IR absorption band around 3300 cm^{-1} is characteristic of which type of bond? (CO2, K2)

(a) C – H (b) O – H

(c) N – H (d) Both (b) and (c)

4. In the SALC procedure, which character table is used for ethylene (C_2H_4)? (CO2, K2)

(a) C_3V (b) C_2V

(c) D_2h (d) D_4h

5. In homogenous acid-base catalysis, the catalyst : (CO3, K1)

(a) Is in the same phase as the reactants

(b) Is in a different phase than the reactants

(c) Does not interact with the reactants

(d) Changes the phase of the reactants

6. The relaxation time in a T – jump or P – jump experiment is defined as : (CO3, K1)

(a) The time taken for the reaction to compute

(b) The time taken to reach 63% of the way to equilibrium

(c) The time taken to change the temperature or pressure

(d) The time at which the reaction starts

7. A reversible process in thermodynamics is one that (CO4, K1)

(a) Can occur in only one direction

(b) Can not be reversed

(c) Can be reversed without leaving any net change in the system and surroundings

(d) Occur spontaneously

8. According to the Debye-Huckel limiting law, the activity coefficient (υ) of an ion is related to the Ionic strength (I) by : (CO4, K1)

(a) $\log \upsilon = -AI$ (b) $\log \upsilon = -AI_2$

(c) $\log \upsilon = AI$ (d) $\log \upsilon = AI_2$

9. Physiorption is characterized by (CO5, K1)

(a) The formation of a monolayer only

(b) The potential formation of multilayers

(c) Chemical specificity between adsorbent and adsorbate

(d) Strong and specific interactions

10. The hydrogenation of carbon monoxide primarily produces (CO5, K2)

(a) Methane (b) Methanol

(c) Ethanol (d) Propane

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

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

11. (a) Discuss the following (CO1, K2)

(i) Harmonic oscillator

(ii) Zeropoint energy.

Or

(b) Write briefly on John-teller effect. (CO1, K1)

12. (a) Mention the group theoretical selection rule for vibrational IR and Raman spectra. (CO2, K2)

Or

(b) Deduce the Hybridization of carbon in methane by using group theory. (CO2, K2)

13. (a) Discuss the kinetics of acid-base catalysis. (CO3, K4)

Or

(b) Illustrate the influence of Ionic strength and the nature of the solvent on the rates on Ionic reaction. (CO3, K4)

14. (a) Explain chemical potential. How it will vary with respect to temperature and pressure? (CO4, K4)

Or

(b) State the difference between a reversible reaction and an Irreversible reaction. (CO4, K2)

15. (a) Explain the following (CO5, K2)

(i) Physisorption

(ii) Chemisorption.

Or

(b) Explain on Langmuir Hinshel wood mechanism. (CO5, K2)

Part C (5 × 8 = 40)

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

16. (a) Set up and solve the schrodinger have equation for a particle in an infinite one-dimensional box with potential energy zero inside the box. (8)
(CO1, K5)

Or

(b) Using the first-order time – Independent perturbation theory solve the schrodinger wave equation for the ground state energy of helium atom. (8)
(CO1, K5)

17. (a) (i) Highlight the salient features of Molecular orbitals. (2)

(ii) Find the symmetries of normal modes of vibration of ammonia molecule using group theory. (6)
(CO2, K2)

Or

(b) Discus in detail. Application of SALC procedure to ethylene and butadiene molecules. (8)
(CO2, K2)

18. (a) Describe the stopped how method for studying kinetics of fast reaction. (8)
(CO3, K4)

Or

(b) (i) Briefly discuss flash photolysis. (2)

(ii) For $A + B \underset{K\text{-}1}{\overset{L_1}{\rightleftharpoons}} C$

$C \xrightarrow[Slow]{K_2} P$ applying steady state treatment

obtain the rate law. (6)
(CO3, K2)

19. (a) (i) Briefly explain the concept of entropy. (4)

(ii) Derive Gibb's Dutem equation. (4)

(CO4, K2)

Or

(b) Give an account of the Debye-Huckel theory of strong electrolytes. Explain clearly what is meant by asymmetry effect and Electrophoresis effect. (CO4, K2)

20. (a) (i) Comment on unimolecular reaction. (2)

(ii) Obtain Gibb's adsorption isotherm and mention how surface area can be determined. (6)

(CO5, K4)

Or

(b) Briefly describe semiconductor catalysis and applications. (8)

(CO5, K4)

———————

R2693

Sub. Code
536051

M.Sc. DEGREE EXAMINATION, APRIL – 2025

Second Semester

Chemistry

Elective: NATURAL PRODUCTS AND INTRODUCTORY BIOCHEMISTRY

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

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

1. Glycoxal reacts with formal dehyde in presence of ammonia to produce ————————. (CO1, K2)

   (a) Oxazole (b) Caffeine

   (c) Imidazole (d) Indole

2. The Nitrogen in thaizole is ———————— hybridized. (CO1, K3)

   (a) sp^3 (b) sp

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

3. The octant rule deals with the ———————— of cotton effect of optically active ketones. (CO2, K2)

   (a) Energy (b) Limitations

   (c) Sign and Intensity (d) Assignments

4. Andresterone is a/an ————————. (CO2, K4)

(a) Anabolic steroid

(b) Cortico steroid

(c) Mineralo corticoids

(d) Gluco corticoids

5. The 1, 7, 7 – Trimethyl bicyclo [2.2.1] heptan-2-one is ————————. (CO3, K3)

(a) Camphoric acid (b) Lysergic acid

(c) Camphor (d) Campharomic acid

6. Quinine is a ————————. (CO3, K1)

(a) Chinchona alkaloid

(b) Monoterpenoid

(c) Sex hormone

(d) Steroid

7. Cobalamin is a/an ————————. (CO4, K3)

(a) Folic acid (b) Vit. B_{12}

(c) Carbohydrate (d) Antibiotic

8. Cephalasporins are ————————. (CO4, K1)

(a) β -lactams (b) Flaronoids

(c) Cyanidins (d) Purines

9. ———————— is the building of complex molecular from simpler ones. (CO5, K3)

(a) Catabolism (b) Catalyin

(c) Anabolism (d) Metabolism

10. Photosynthesis is ————————. (CO5, K1)

(a) Chemiluminescence reaction

(b) Bio-energetic reaction

(c) Steroidal reaction

(d) None of the above

Part B (5 × 5 = 25)

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

11. (a) Write any two synthetic router for the following: (2 ½ marks each) (CO1, K2)

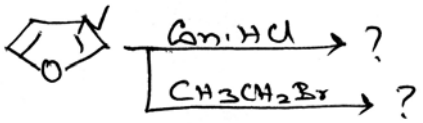
(i) indole

(ii) caffeine

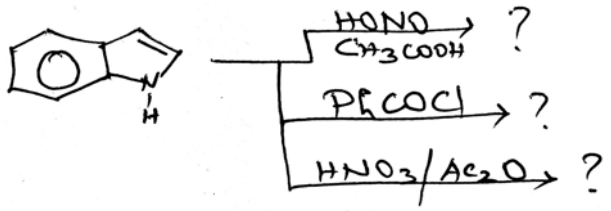
Or

(b) Predict the products for the following reaction. (1 marks each) (CO1, K5)

(i)



(ii)



12. (a) Write a short note on stereochemical structure of cholesterol. (CO2, K2)

Or

(b) Demonstrate the significance and differences of ORD and CD. (CO2, K4)

13. (a) Discuss the structure of morphine with its sterochemical features. (CO3, K3)

Or

(b) Outline the bio-synthesis of terperoids. (CO3, K2)

14. (a) Explain the stero-structure of Griseofulvin. (CO4, K2)

Or

(b) Analyze the structural features of Streptomycin. (CO4, K4)

15. (a) Describe the nuances of TCA Cycle. (CO5, K4)

Or

(b) Write a short note on regulation of gene expression. (CO5, K2)

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

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

16. (a) Outline the synthesis of the following: (CO1, K2)

(i) Uric acid

(ii) Cyanidin

Or

(b) Construct any four electrophilic substitution reactions of imidazole. (2 marks each) (CO1, K4)

17. (a) Evaluate (4 marks each) (CO2, K4)

(i) Axial haloketone rule.

(ii) Cotton effect curves.

Or

(b) Write a detailed note on structure of ergosterol. (CO2, K2)

18. (a) Write a detailed note on general method of structural elucidation of alkaloids. (CO3, K2)

Or

(b) Discuss the structure of zingiberene with its stereochemical features. (CO3, K3)

19. (a) Detail the structural features of Penicillin-G. (CO4, K2)

Or

(b) Analyze the chemistry and physiological functions of riboflavin and ascorbic acid. (CO4, K4)

20. (a) Outline the regulating steps in glycolysis. (CO5, K4)

Or

(b) Explain the classification, structure and functions of nucleic acids. (CO5, K2)
