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QUESTION BANK

Title of the Paper

Organic chemistry –II

Course: B.Sc (CHE) III YEAR

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**SEMESTER VI
ORGANIC CHEMISTRY II**

UNIT I CHEMISTRY OF CARBOHYDRATES

- 1.1 Carbohydrate - classification, properties of mono saccharides (glucose and fructose), structure and configuration of mono saccharides, interconversion.
- 1.2 Ascending and descending series, mutarotation, epimerization- cyclic structure - determination of size of sugar rings.
- 1.3 Disaccharides - sucrose, maltose - structure elucidation - polysaccharide - starch and cellulose (elementary treatment).

UNIT II CHEMISTRY OF PROTEINS AND VITAMINS

- 2.1 Amino acids – Zwitter ion – isoelectric point - general methods of preparation and reactions of amino acids. Peptides - Peptide linkages – proteins - classification of proteins.
- 2.2 Structure of proteins - primary structure - end group analysis - Edman method - secondary structure - tertiary structure - denaturation - colour reactions of proteins.
- 2.3 Nucleic acids - elementary treatment of DNA and RNA - Vitamins - classification, structure and biological importance of vitamins A, B1, B2, B6, B12 and C.

UNIT III CHEMISTRY OF ALKALOIDS AND TERPENOIDS

- 3.1 Chemistry of natural products - alkaloids – classification, isolation - methods for synthesis of coniine, piperine, nicotine and quinine.
- 3.2 Terpenoids - classification - isoprene, special isoprene rule, methods for synthesis of citral, limonene, menthol, camphor.

UNIT IV MOLECULAR REARRANGEMENTS

- 4.1 Molecular rearrangements-types of rearrangement (nucleophilic and electrophilic) – mechanism with evidence for the following re-arrangements: pinacol – pinacolone.
- 4.2 Benzil - benzilic acid, benzidine, Claisen, Fries, Hofmann. Curtius, Lossen, Beckmann and dienone – phenol rearrangements.

UNIT V ORGANIC SPECTROSCOPY

- 5.1 UV - VIS spectroscopy - types of electronic transitions – Instrumentation- solvent effects on λ_{max} - Woodward - Fieser rules for calculation of λ_{max} :dienes only – bathochromic shift and hypsochromic shift.
- 5.2 IR spectroscopy - number and types of fundamental vibrations – selection rules- modes of vibrations and their energies. Instrumentation - position of IR absorption frequencies for functional groups like aldehyde, ketone, alcohol, acid, amine and amide.
- 5.3 NMR spectroscopy - principle - chemical shift- factors affecting the chemical shift - inductive effect and hydrogen bonding - TMS, delta scales, splitting of signals - spin-spin coupling, NMR spectrum of EtOH, n -propyl bromide and isopropyl bromide.

UNIT-I
CHOOSE THE CORRECT ANSWERS

1. Which is the simplest carbohydrate?
 - a) Dihydroxyacetone
 - b) Glycerldehyde
 - c) Glucose
 - d) sucrose
2. Which of the following are the examples of Epimers?
 - a) Glucose & Galactose
 - b) Glucose & Ribose
 - c) Mannose & Glucose
 - d) fructose and glucose
3. Which of the following is not adisaccharide?
 - a) Sucrose
 - b) Maltose
 - c) Lactose
 - d) Galactose
4. Which sugars are present in Sucrose?
 - a) Fructose and glucose
 - b) Glucose and glucose
 - c) Glucose and galatose
 - d) Fructose and galatose
5. Majority of the monosaccharides found in the human body are of which type stereoisomer?
 - a) L-type
 - b) D-type
 - c) neutral
 - d) racemic mixture
6. Which of the following carbohydrate do not have any essential nutritional value?
 - a) Sucrose
 - b) Cellulose
 - c) Dextrin
 - d) Glycogen
7. Which of the following will not be reactive towards seliwanoff reagent?
 - a) Maltose
 - b) Inulin
 - c) Fructose
 - d) Sucrose

8. Which of the following is a non-reducing disaccharide?
- Maltose
 - Galactose
 - Trehalose
 - Sucrose
9. The structural name of glucose is
- α -D-gulopyranose.
 - β -D-gulopyranose.
 - α -D-gulofuranose.
 - β -D-gulofuranose.
10. The molecular formula of sucrose is
- $C_6H_6O_{12}$
 - $C_6H_6O_6$
 - $C_{11}H_{22}O_{11}$
 - $C_{12}H_{22}O_{11}$

Answers: 1-b, 2-a, 3-a, 4-a, 5-b, 6-c, 7-a, 8-c, 9-c, 10-a

SHORT QUESTIONS (2 MARKS)

- Define carbohydrates.
- What are monosaccharides and disaccharides?
- Write notes on polymers?
- What is mutarotation?
- How would you convert glucose into fructose?
- Explain the reaction between glucose and bromine water.
- Define Barfoed's test.
- What is structural difference between glucose and fructose with any one reaction?
- What is synthesis of maltose?
- Define invert sugar?

PARAGRAPH QUESTIONS (5 MARKS)

- Explain properties of sucrose?
- What are uses of carbohydrates?
- Discuss about configuration of D-fructose with structure.
- Explain and mechanism of mutarotation.
- Write ring structures of the following
(i) Sucrose (ii) amylose (iii) amylopectin
- How is the structure of sucrose established?
- Write the pyranose structure. What is the action of phenylhydrazine on glucose?
- Describe the conversion of aldohexoses into aldopentoses by Wohl's degradation (oxime method).

- Describe the manufacture of sucrose from sugar feet.
- Give the mechanism of osazone formation of glucose.

ESSAY QUESTIONS (10 MARKS)

- Discuss the constitution of maltose.
- How does sucrose react with (a) lime water (ii) acetic anhydride (iii) Conc. HNO_3 (iv) Conc. And hot H_2SO_4 (v) Hydrolysis reaction
- Explain briefly the classification of carbohydrates?
- What happens when glucose is treated with
 - phenylhydrazine (ii) sodium amalgam and alcohol (iii) ammoniacal silver nitrate (iv) methanol and dry HCl (v) Tollen's reagent
- How is fructose obtained? How does it react with:
 - $\text{Na/C}_2\text{H}_5\text{OH}$ (ii) hydrazine (iii) Conc. HNO_3 (iv) phenylhydrazine
- Write notes on starch and cellulose.
- Explain why maltose is a reducing sugar while sucrose is not.
 - Discuss the evidence leading to the cyclic structure for D-(+) glucose.
- Explain: fructose does not contain any reducing group but it reduces Tollen's reagent and Fehling reaction.
 - Illustrate with examples the detailed steps of Killiani-Fischer synthesis.
- Explain briefly about maltose with detail.
- Explain the structural determination of sucrose, maltose, cellulose and glycogen.

UNIT –II

CHOOSE THE CORRECT ANSWERS

- The general structure of all amino acids are same except for _____
 - Lysine
 - Glycine
 - Proline
 - Alanine
- How is the secondary structure of a protein stabilized?
 - Vander wall forces
 - Hydrogen bonding
 - Covalent bond
 - Hydrophobic bond
- Which of the following is false?
 - Fats provide insulation

- (b) Fats maintain healthy skin and hair
(c) Vitamin A, D, E and K are fat soluble only
(d) Fats provide instant energy
4. Which proteins contain a better balance of essential aminoacids?
a) Plant protein
b) Animal protein
c) Both a and b
d) None of the above
5. Which of the following sentences is correct?
(a) Animal sources are high quality proteins
(b) Animal sources are low quality proteins
(c) Plant sources are high quality proteins
(d) None of the mentioned
6. Name the amino acid, which exists in two non-superimposable mirror images of each other.
a) Epimer
b) Anomer
c) Enantiomer
d) Chiralcarbon
7. Different types of Vitamins are:
a. Fat-Soluble
b. Water-Soluble
c. Both A and B
d. None of the above
8. Fat soluble Vitamins are:
(a). VitaminA
(b) VitaminD
(c) VitaminE
(d) All of the above
9. Retinol is the scientific name of which Vitamin?
a) VitaminA
b) VitaminD
c) VitaminK
d) VitaminC
10. Vitamin C is present in:
a) Tomatoes
b) Papaya
c) Guava
d) All of the above

Answers: 1-c, 2—b, 3-d, 4-a, 5-a, 6-c, 7-c, 8-d, 9-a, 10-d

SHORT QUESTIONS (2 MARKS)

11. Define protein.
12. Explain zwitter ion.
13. Define the term the “isoelectric point” of an amino acid.
14. What are nucleic acids?
15. Define peptide linkage.
16. Explain ninhydrin test for protein?
17. What are essential amino acids?
18. Define denaturation of protein.
19. What are vitamins with examples?
20. Define riboflavin.

PARAGRAPH QUESTIONS (5 MARKS)

21. Briefly indicate how you could arrive at the primary structure of protein.
22. Give four colour reactions of proteins.
23. Discuss the important characteristics of protein.
24. Write notes on simple and conjugated proteins.
25. Give the methods of preparation and properties of alpha amino acids.
26. What is the difference between the nucleotide and nucleoside?
27. Write the composition of DNA.
28. How would you determine the sequence of amino acids in peptides or proteins?
29. Describe the source, structure and deficiency of ascorbic acid?
30. What is the biological importance of vitamins?

ESSAY QUESTIONS (10 MARKS)

31. Detail structure determination of RNA and DNA.
32. Discuss the classification of amino acids.
33. Write notes on biological importance of peptide linkage.
34. Explain briefly structural classification of protein.
35. (i) Write the sources and biological importance of Riboflavin
(ii) Write the structural elucidation of ascorbic acid.
36. Explain briefly about vitamin B₆ and vitamin B₁₂.
37. Briefly discuss about fat soluble vitamins with examples.
38. Write about the deficiency of water soluble vitamins.
39. Write source, structure, biological role and deficiency of vitamin A.
40. What are the principles of proteins? How would you identify the given material as being a protein?

UNIT-III

Choose the correct answer

- The term alkaloid meaning
 - Alkali like
 - Alkali dislike
 - alkaline like
 - none of the above
- Which alkaloids are liquids innature
 - cocaine,quinine
 - conine, nicotine
 - piperine, nicotine
 - quinine, piperine
- Nicotine consists of
 - Malic acid
 - citric acid
 - both a and b
 - a only
- The uses of quinine
 - antimicrobial
 - antimalarial
 - antibacterial
 - antiviral
- The general formula of quinine is
 - $C_{22}H_{25}N_1O_1$
 - $C_{22}H_{24}N_2O_2$
 - $C_{21}H_{25}N_2O_2$
 - $C_{20}H_{24}N_2O_2$
- Terpenoids are
 - Soluble in organic solvent and usually insoluble in water
 - Insoluble in organic solvent and usually soluble in water
 - Soluble in organic solvent and always soluble in water
 - Insoluble in organic solvent and insoluble in water
- Which structure is that of isoprene?
 - $CH_3-CH_2-CH_2-CH=CH_2$
 - $CH_3-CH=CH-CH=CH_2$
 - $CH_2=CH-CH_2-CH=CH_2$
 - $CH_2=C(CH_3)-CH=CH_2$
- what is the isoprenerule
 - terpenes contain tail to tail connected isoprenes.
 - terpenes contain head to head connectedisoprene

- (c) terpenes contain head to tail connected isoprene
(d) terpenes contain $5n$ atoms.
9. Number of isoprene units in carotenoids
(a) 5
(b) 6
(c) 7
(d) 8
10. Which can be the best example of Monoterpenoids
(a) Chlorophyll
(b) Rubber
(c) Menthol
(d) Gibberellins

Answers: 1 (a), 2 (a), 3 (c), 4(b), 5 (d), 6 (b), 7 (d), 8 (c), 9. (d), 10 (c)

SHORT QUESTIONS (2 MARKS)

11. What are alkaloids?
12. What are alkaloidal reagents with one example?
13. Discuss the occurrence of piperine?
14. Explain the structure of quinine?
15. Give the synthesis of coniine compounds.
16. How alkaloids are classified?
17. How alkaloids are isolated from natural products.
18. Write note on: isoprene rule.
19. How are terpenes classified?
20. Write the structures of different geometrical isomers of citral.

PARAGRAPH QUESTIONS (5 MARKS)

21. Give the physical properties of alkaloids in general.
22. Discuss the occurrence and isolation of alkaloids from nature products.
23. Describe how the structure of nicotine was established.
24. Describe how the structure of coniine was established.
25. Describe the chemical properties of piperine.
26. What are general methods for the elucidation of structure of alkaloids?
27. Tell how the structure of citral has been established.
28. Write the structure of camphor and dipentene.
29. Discuss the general properties of menthol.
30. Write the occurrence and isolation of terpenes?

ESSAY QUESTIONS (10 MARKS)

31. Describe the occurrence, isolation and properties of coniine, how was its structure determined?
32. Describe the isolation, structure, physical and chemical properties of piperine.
33. Give the synthesis of the following compounds:

- (i) nicotine (ii) piperine (iii) quinine
34. Discuss about occurrence, isolation, structure and uses of nicotine.
 35. Give general occurrence, isolation, properties of alkaloids.
 36. Explain briefly about classification of alkaloids.
 37. Outline the synthesis, occurrence, isolation and properties of camphor.
 38. How will you established that
 - (i) Dipentene contains two double bonds.
 - (ii) Citral contains an aldehyde group
 - (iii) Write structures of different geometrical isomers of citral.
 39. Explain briefly classification of terpenes.
 40. Describe the occurrence, synthesis, structure and uses of menthol.

UNIT-IV
CHOOSE THE CORRECT ANSWERS

1. Which types of isomers are formed in rearrangement reactions?
 - a) structural isomers
 - b) Geometrical isomers
 - c) Optical isomer
 - d) Conformational isomers
2. What is the main difference between Hofmann and Curtius rearrangement?
 - a) Products are different
 - b) Intermediate formed is different
 - c) Reactants are different
 - d) Isomers
3. Which was the first molecular rearrangement identified as such by early chemists?
 - a) Wolff's rearrangement
 - b) Pinacole rearrangement
 - c) Favorskii rearrangement
 - d) Hofmann rearrangement
4. Which medium is used in benzylic acid rearrangement reaction?
 - a) Neutral
 - b) Strong acidic
 - c) Mild acidic
 - d) Strong basic
5. Which type of catalytic reaction, does Dienone phenol rearrangement reaction belong?
 - a) Acid catalysed
 - b) Base catalysed
 - c) Acidic
 - d) Neutral
6. The stability of carbocation is
(a) $3^\circ > 2^\circ > 1^\circ$

- (b) $1^\circ > 2^\circ > 3^\circ$
(c) $1^\circ < 2^\circ > 3^\circ$
(d) None
7. A ketoxime is treated with an acidic catalyst to give substituted amide, such rearrangement is known as
(a) Benzylic acid rearrangement
(b) Benzidine rearrangement
(c) Diazoamino benzene rearrangement
(d) Beckmann rearrangement
8. When treated with alpha diketones rearrange to give
(a) Benzylic acid rearrangement
(b) Benzidine rearrangement
(c) Diazoamino benzene rearrangement
(d) Beckmann rearrangement
9. The transformation of a quinoid structure to a benzenoid ring, such reaction called as
(a) Benzylic acid rearrangement
(b) Benzidine rearrangement
(c) Dienone phenol rearrangement
(d) Beckmann rearrangement
10. A phenolic ester to a hydroxyaryl ketone by catalysis of Lewis acids
(a) Benzylic acid rearrangement
(b) Fries rearrangement
(c) Dienone phenol rearrangement
(d) Beckmann rearrangement

Answers: 1. (a), 2 (d), 3 (b), 4 (d), 5(a), 6 (a), 7 (d), 8 (a), 9 (c), 10 (b)

SHORT QUESTIONS (2 MARKS)

1. What is molecular rearrangement reaction with examples?
2. Define migrating group with any one example.
3. What is intermolecular reaction?
4. Illustrate intramolecular rearrangement with an example
5. Explain the reaction between Hofmann and Curtius rearrangement?
6. What are Dienone phenol rearrangements?
7. What is intermediate product of Lossen rearrangement?
8. Define Beckmann rearrangement?
9. What is benzil-benzilic acid rearrangement?

10. Define nucleophilic reaction?

PARAGRAPH QUESTIONS (5 MARKS)

1. Explain electrophilic rearrangement with examples.
2. Describe nucleophilic rearrangement with examples.
3. Write the mechanism of pinacol-pinacolone rearrangement.
4. Explain Beckmann rearrangement.
5. With a suitable example explain the benzidine rearrangement reaction.
6. Illustrate intra-molecular Fries rearrangement reaction with one suitable example.
7. Compare the intermediate and final product of Hofmann, Curtius and Lossen rearrangements.
8. Write notes on Claisen rearrangements.
9. What is benzil-benzilic acid rearrangement with mechanism?
10. Give general mechanism for molecular rearrangements.

ESSAY QUESTIONS (10 MARKS)

1. Explain types of rearrangement for mechanism with evidence.
2. Explain the mechanism for Hofmann rearrangement.
3. Bring out the relationship between Hofmann, Curtius and Lossen rearrangements.
4. Explain the Beckmann rearrangement of ketoxime and describe the mechanism of the same.
5. Give the mechanism of Fries rearrangement with intra-molecular and intermolecular reactions.
6. Discuss briefly about the Claisen rearrangement reactions with their mechanism.
7. Give the mechanism of dienone-phenol rearrangement?
8. Explain the mechanism of Lossen rearrangement.
9. Write the mechanism of Curtius rearrangement reactions.
10. Illustrate the mechanism of Benzil-benzilic acid rearrangements.

UNIT-V

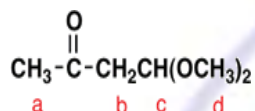
CHOOSE THE CORRECT ANSWERS

1. Which of the following statements is wrong?
 - (a) UV absorption is attributable to electronic transitions.
 - (b) UV spectra provide information about valence electrons
 - (c) IR absorption is attributable to transitions between rotational energy levels of whole molecules.
 - (d) NMR spectrometers use radiofrequency electromagnetic radiation.

2. How many signals does the aldehyde $(\text{CH}_3)_3\text{CCH}_2\text{CHO}$ have in ^1H NMR and ^{13}C NMR spectra?

- (a) Five proton and six carbon signals
- (b) Three proton and four carbon signals
- (c) Five proton and four carbon signals
- (d) Three proton and six carbon signals

3. Which of hydrogens a-d in the following molecule gives a triplet signal in a normal ^1H NMR spectrum?



- (a) Hydrogen a
 - (b) Hydrogen b
 - (c) Hydrogen c
 - (d) Hydrogen d
4. Which of the following statements regarding IR spectroscopy is wrong?
- (a) Infrared radiation is higher in energy than UV radiation
 - (b) Infrared spectra record the transmission of IR radiation.
 - (c) Molecular vibrations are due to periodic motions of atoms in molecules, and include bond stretching, torsional changes and bond angle changes.
 - (d) Infrared spectra give information about bonding features and functional groups in molecules.
5. The intensity of an absorption band is always proportional to which of the following factor?
- (a) Atomic population
 - (b) Molecular population of the initial state
 - (c) Molecular population of the final state
 - (d) Temperature

6. On which factors the vibrational stretching frequency of diatomic molecule depend?
- Force constant
 - Atomic population
 - Temperature
 - Magnetic field
7. The vibrations, without a center of symmetry are active in which of the following region?
- Infrared but inactive in Raman
 - Raman but inactive in IR
 - Raman and IR
 - Inactive in both Raman and IR
8. The distance between the centers of the peaks of doublet is called as?
- Coupling constant
 - Spin constant
 - Spin-spin coupling
 - Chemical shift
9. Which of the following are considered to be the lowest form of Electromagnetic radiation?
- IR radiation
 - Microwaves
 - UV radiation
 - Radiowaves
10. The amount of energy available in radio frequency radiation is sufficient for which of the following?
- Excite an atom
 - Vibrate an atom
 - Vibrate a molecule
 - Affect the nuclear spin of an atom

Answers: 1. (c), 2 (b), 3 (c), 4 (a), 5(b), 6 (a), 7 (c), 8 (a), 9 (c), 10 (d).

SHORT QUESTIONS (2 MARKS)

- What is spectroscopy?
- What are electromagnetic radiations?
- Write note on IR spectroscopy?
- What is the selection rule for IR spectrum?
- What is the condition for spinning of nuclei?
- What is the condition for rotational and vibrational spectra?
- Which molecules give both IR spectrum?
(i) HCl (ii) O₂ (iii) H₂O
- Define finger print region.

19. What are the principles of spectroscopy?
20. Define chemical shift.

PARAGRAPH QUESTIONS (5 MARKS)

21. What are the principles and theory of NMR spectroscopy?
22. Explain instrumentation of UV spectroscopy?
23. What are types of fundamental vibrations with diagram?
24. What are factors affecting the chemical shift?
25. Define term (i) delta scales (ii) spin-spin coupling
26. Define bathochromic shift and hypsochromic shift.
27. Explain the principles of UV-Visible spectrum.
28. What do you understand by shielding and deshielding effect in NMR spectrum?
29. How IR spectroscopy is used to distinguish between:
(i) $\text{RC}=\text{ONHR}$ and $\text{RCH}_2\text{-NHCH}_3$
(ii) R-OH and R-NH_2
30. How will you distinguish between the following pairs of compounds on the basis of IR spectroscopy
(i) Ethyl alcohol and diethylether
(ii) Acetic acid and ethylacetate

ESSAY QUESTIONS (10 MARKS)

31. Explain the instrumentation of IR spectroscopy?
32. Explain briefly the application IR and UV spectra.
33. How many signals give in n-propyl bromide and isopropyl bromide with explanation?
34. What are the types of transition in UV spectrum with neat diagram?
35. Write notes on UV and NMR spectroscopy?
36. How many signals in NMR spectra of:
(i) $\text{CH}_3\text{C}=\text{OCH}_3$
(ii) $\text{CH}_3\text{CH}_2\text{CHO}$
(iii) $\text{CH}_2=\text{CH-CH}_2\text{OH}$
(iv) $\text{CH}_3\text{CH}_2\text{OH}$
37. (i) Define solvent effect in UV spectrum.
(ii) Woodward- fisher rule
(iii) Calculation of λ_{max} for butadiene.
38. Explain the detail application of NMR in organic compounds.
39. Explain shielding mechanism, what are advantages of TMS as internal standard?
40. Distinguish between the following pairs with help of IR spectroscopy;
(i) Saturated and unsaturated ketones
(ii) Ketone and aldehydes
(iii) Amine and amide
(iv) Alcohols and acids

