



Name :
Roll No. :
Invigilator's Signature :

CS/B.TECH(BT-OLD)/SEM-3/BT-303/2011-12

2011

STRUCTURAL CHEMISTRY OF BIOMOLECULES

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :
10 × 1 = 10
- i) The equation relating pH and pKa of a solution is known as
 - a) Helmholtz equation
 - b) Henderson equation
 - c) Gibbs Duhem equation
 - d) Carnot equation.
 - ii) The molecules which are mirror image to each other are called
 - a) diastereoisomer
 - b) mesomer
 - c) isomer
 - d) enantiomer.
 - iii) Benzene is converted to nitrobenzene by a mixture of H₂SO₄ and HNO₃. The catalyst for this reaction is
 - a) the nitronium ion
 - b) HNO₃
 - c) the sulphonium ion
 - d) H₂SO₄.

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- iv) The pKa value of a weak acid refers to
- its dissociation constant
 - the pH where the acid is completely dissociated
 - the pH where the acid is completely undissociated
 - the pH where the acid is 50% dissociated.
- v) Glucose is an example of
- adohexose
 - aldopentose
 - ketohexose
 - ketopentose.
- vi) Which of the following compound is an epimer to glucose ?
- Ribose
 - Allose
 - Mannose
 - Arabinose.
- vii) Ceruloplasmin is
- copper binding protein
 - calcium binding protein
 - iron binding protein
 - sodium binding protein.
- viii) Vitamin which has got reducing property is
- Vitamin D
 - Vitamin C
 - Vitamin A
 - Vitamin K.
- ix) Acidic amino acid is
- Aspartic acid
 - Glutamic acid
 - both (a) and (b)
 - Proline.
- x) Reduction product of glucose is
- Mannitol
 - Dulcitol
 - Gluconic acid
 - Sorbitol.
- xi) The complementary sequence (in the standard 5' → 3' notation) for GATCAA is
- TTGATC
 - CTAGTT
 - UUGAUC
 - CTGATT.
- xii) The famous biochemist who discovered the base ratios in DNA was
- Alfred Hersley
 - Erwin Chargaff
 - J.D. Watson
 - Francis Crick.
- xiii) NMR is
- Nuclear Molecular Response
 - Nuclear Molecular Resonance
 - Nuclear Magnetic Resonance
 - Neural Magnetic Resonance.



GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Draw the structures of a non-protein amino acid and a modified amino acid. State the two differences between them. 2 + 3
3. a) What is nuclein and who discovered it ?
 b) Write two chemical structure-differences between DNA and RNA.
 c) Write the chemical structure of (i) phosphoric acid, (ii) ribose and deoxyribose, (iii) adenine and cytosine. $1 + 1\frac{1}{2} + 2\frac{1}{2}$
4. Write the structures of (a) tryptophan (b) Glucose (c) ATP (d) Palmitic acid (e) Deoxyribose (Haworth projection formula).
5. Calculate pKa of lactic acid, when the concentration of lactic acid is 0.01 M, concentration of lactate is 0.087 M and the pH is 4.8. Calculate the isoelectric point of Glutamic acid, given $pK_1=2.19$ $pK_2 = 9.67$, $pK_R=4.8$. 3 + 2
6. What do you mean by secondary structure of a protein molecule ? Name the two major forms of secondary structure found in proteins. Length of an alpha-helix is 97.5 Å. Calculate the number of amino acid residues present in the helix. 2 + 1 + 2
7. a) State Chargaff's equivalence rule.
 b) In a sample of DNA isolated from a species of bacteria which contain 15.1 % adenine of the total bases on a molar basis. What are the percentage of the other bases present ? 2 + 3

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

8. What happens when : 5 × 3
 - a) Ninhydrin is added to an amino acid solution
 - b) Glucose is heated with alkaline copper sulfate solution
 - c) Glucose is treated with potassium dichromate and sulfuric acid
 - d) Cholesterol is treated with ferric chloride in presence of acetic acid and sulfuric acid
 - e) Albumin solution is heated for ten minutes.



9. Define enzyme, co-enzyme, co-factor with proper examples. All the enzymes are proteins but all proteins are not enzymes. Justify the statement. What are competitive and non-competitive inhibitors ? 6 + 5 + 4
10. A fatty acid is represented as $18:1^{A9}$. What information do you get about its structure ? Define : iodine number, saponification number and acid number. What is rancidity ? How does rancidity develop ? How can a fat sample be preserved from rancidity ? 3 + 6 + 2 + 2 + 2
11. a) What are the major structural studies of DNA, on the basis of which Watson and Crick proposed the double helix model of DNA ?
b) Describe the features of Watson & Crick double helix model of DNA with a diagram.
c) What is apurinic acid ? How you can get it in laboratory ?
d) Calculate the length of a double stranded DNA molecule of molecular weight 3×10^7 . The average molecular weight of a nucleotide pair is 660. How many helical turn does a molecule of this DNA contain ? 2 + 6 + 2 + 5
12. What is an electron microscope ? Write the differences of an electron microscope from a light microscope. Draw a representative diagram of an electron microscope. Discuss the importance of an electron microscope in study of biological samples. 2 + 6 + 7
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