

**CHEMISTRY OF BIOMOLECULES
(BIOT 2101)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

**Group – A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) An aqueous solution of HCl having concentration of 0.1 M has a pH of
(a) 1.0 (b) 10
(c) 0.10 (d) 0.01
- (ii) A dipeptide has
(a) two amino acids and one peptide bond
(b) two amino acids and two peptide bonds
(c) two amino acids and three peptide bonds
(d) two amino acids and four peptide bonds
- (iii) Which of the following is not true for lipids
(a) They are either hydrophobic or amphipathic
(b) They are insoluble in water
(c) They can be extracted using chloroform methanol mixture
(d) They are present in membrane
- (iv) Which amino acid breaks an alpha helix?
(a) Leucine (b) Histidine
(c) Proline (d) Glutamic acid
- (v) The protein that contains entirely beta sheet structure is
(a) Hemoglobin (b) Insulin
(c) Collagen (d) Fibroin
- (vi) Which of the following compounds is different from others?
(a) GMP (b) deoxy-guanosine-monophosphate
(c) gulanylic acid (d) guanosine-5'- monophosphat

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- (vii) The X-ray crystallography studies of Rosalind Franklin and Maurice Wilkins showed that
- (a) DNA contains only four kinds of nucleotides
 - (b) DNA has helix major regularity of 0.34 nm
 - (c) The amount of adenine found in DNA is equal to the amount of thymine
 - (d) the same base pairing rules apply to all species
- (viii) $O.D_{260}$ of DNA sample (50 $\mu\text{g}/\text{ml}$) is maximum if it is
- (a) Double stranded DNA
 - (b) Single stranded DNA
 - (c) Free deoxynucleotide
 - (d) none of these
- (ix) DNA binding protein histones are rich in
- (a) Lys and Arg
 - (b) Arg, His
 - (c) Cys, Lys
 - (d) Lys, His
- (x) The absorption of infrared light by a molecule results in transition to higher levels of
- (a) magnetic field
 - (b) Electron spin
 - (c) emission
 - (d) vibration

Group – B

2. (a) The pKa value of acetic acid is 4.76. State the physical significance.
- (b) Name the buffer systems that maintains in physiological pH in our body. Discuss how $\text{H}_2\text{CO}_3/\text{HCO}_3^-$ acts as a buffer in a living system.
- (c) Consider two weak acids having pKa values of 4.0 and 6.0. Which one dissociates to a greater extent? Explain your answer.

$$4 + 4 + (2 + 2) = 12$$

3. (a) Define with example: i) disachharide, ii) aldose, iii) reducing sugar.
- (b) Human beings cannot digest cellulose and therefore it is often used as a component of laxatives. Which structural phenomenon of cellulose is responsible for this behaviour?

$$(2 + 2 + 4) + 4 = 12$$

Group – C

4. (a) Triglycerides are so named because of some common features. Describe the features they have in common.
- (b) Fats like butter and lard are solid at room temperature. What nature of the fatty acids in their structure would support this trend?
- (c) If a sample of a lipid contains fatty acids that are 89% saturated, would you expect the lipid to be solid at room temperature or liquid? Define: wax and sphingolipids.

$$3 + 3 + (2 + 2 + 2) = 12$$

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5. Draw the chemical structure of a representative phospholipid.
Discuss the importance of the following compounds in living system:
(i) phospholipids, (ii) triglycerides, (iii) steroids

3 + (3 × 3) = 12**Group – D**

6. (a) Define with example: non protein amino acid, acidic amino acid, modified amino acid.
(b) Draw the titration curve of aspartic acid. The pK₁, pK₂ and pK_R values of Aspartic acid are 2.1, 9.9 and 3.9 respectively. Calculate the pI of aspartic acid.

(2 + 2 + 2) + (3 + 3) = 12

7. (a) Write four differences between A, B, and Z forms of DNA.
(b) What is T_m of a DNA molecule and what is melting curve of a DNA? Write the names of factors on which the T_m of a ds-DNA molecule depends and tell how?
(c) What is supercoiling of DNA? How many base pairs per turn would there be in the DNA, if the DNA was not able to adopt any supercoil structure for this length of DNA with a linkage number of 690?
(d) Derive the integral equation for renaturation kinetics of two complementary ssDNA molecules into dsDNA.

2 + (1 + 2) + (1 + 2) + 4 = 12**Group – E**

8. (a) What is the difference between absorption and emission spectroscopy?
(b) Define bathochromic, hypochromic, hypsochromic and hyperchromic shifts.
(c) Explain the principle of NMR spectroscopy of to study the structure of protein molecules.

3 + 4 + 5 = 12

9. (a) Derive the expression of Bragg's equation for X-ray diffraction.
(b) Describe the method of structure determination of biomolecules by X-ray crystallography.
(c) Define fluorophore with an appropriate example existing as biomolecules. Write the application of this biomolecules in biotechnology.

4 + 4 + 4 = 12

Department & Section	Submission Link
BT	https://classroom.google.com/c/MTM4OTI3ODkzMjA5/a/MjkyNTA1NzI1OTQ2/details