

BIOPHYSICS OF MACROMOLECULES
(BIOT 3232)

Time Allotted : 2½ hrs

Full Marks : 60

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 4 (four) from Group B to E, taking one from each group.*

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

Group – A

1. Answer any twelve:

12 × 1 = 12

Choose the correct alternative for the following

- (i) Which of the following is a polar and uncharged amino acid
(a) Histidine (b) Proline
(c) Glycine (d) Threonine
- (ii) The non-proteinogenic amino acid is
(a) Selenocysteine (b) Pyrrolysine
(c) N-formyl methionine (d) GABA
- (iii) Number of base pairs per helical turn in a Z-DNA is
(a) 10 (b) 11 (c) 11.6 (d) 12
- (iv) Cot curve helps to study the
(a) Complexity of the DNA (b) Length of the DNA
(c) A, B or Z form of the DNA (d) Presence of metal ions in the DNA solution
- (v) Which type of interaction takes place between a Lys and Glu residue?
(a) Salt bridge (b) Hydrogen bond
(c) Hydrophobic interaction (d) Solvation
- (vi) The major stabilizing force for a double stranded DNA is
(a) Base stacking interaction (b) Hydrophobic force
(c) Hydrogen bond (d) Solvation
- (vii) Lambert-Beer Law is applicable for
(a) UV-visible spectroscopy (b) IR spectroscopy
(c) NMR spectroscopy (d) Scanning electron microscopy
- (viii) Order of the electromagnetic waves in terms of wavelength is
(a) UV > visible > IR > microwave > Radio wave
(b) UV < visible < IR < microwave < Radio wave
(c) UV < visible < IR < Radio wave < microwave
(d) UV < visible < microwave < IR < Radio wave

- (ix) In a Mass Spectrometry, Faraday's Cup is used as
 (a) Ion analyser (b) Ion detector
 (c) Ion production (d) None of the above
- (x) The presence of a heavy metal within a tissue can be determined by which of the following technique
 (a) Transmission Electron Microscopy (b) Scanning Electron Microscopy
 (c) Mass spectroscopy (d) Surface Plasmon resonance

Fill in the blanks with the correct word

- (xi) The number of residues per turn in a Poly-proline is _____.
- (xii) If no. of amino acid residues is 170, molecular weight of the protein is _____.
- (xiii) Base stacking interaction in DNA consists of hydrophobic interaction and _____.
- (xiv) In the UV-Visible spectroscopy, proteins absorb at _____ nm.
- (xv) The movement of microbes can be studied by _____ microscope.

Group - B

2. (a) Amino acids are known as Ampholytes-explain. [[CO3](Analyse/HOCQ)]
 (b) Comment on EF hand. [[CO3](Remember/LOCQ)]
 (c) Torsion Angles About Glycosidic Bonds Have Only One or Two Stable Positions – Explain. [[CO1](Apply/IOCQ)]
4 + 4 + 4 = 12
3. (a) Draw and explain the titration curve of Glycine. [[CO3](Explain/HOCQ)]
 (b) What do you mean by a helical structure of a protein? [[CO1](Remember/LOCQ)]
 (c) Discuss the factors effecting α -Helix stability. [[CO3](Apply/IOCQ)]
5 + 2 + 5 = 12

Group - C

4. (a) The amino acid residue Serine can be found both on the surface and in the core of a protein molecule. Comment. [[CO3](Comment/HOCQ)]
 (b) Given is a list of compounds that can act as denaturing agents: a) detergent, b) acid, c) alcohol. Explain how do they destroy the three dimensional structure of a protein molecule. [[CO3](Understand/IOCQ)]
 (c) What is melting point of an alpha helix? [[CO4](Understand/IOCQ)]
4 + (2 × 3) + 2 = 12
5. (a) What is an allosteric enzyme? Draw the graph showing kinetics of an allosteric enzyme. [[CO4](Understand/LOCQ)]
 (b) With the symmetry model, explain the cooperative nature of an allosteric enzyme. State one limitation of the symmetry model. [[CO4](Understand/IOCQ)]
 (c) Haemoglobin is an allosteric protein. Justify the statement. [[CO4](Justify/HOCQ)]
(2 + 2) + (3 + 1) + 4 = 12

Group - D

6. (a) Draw and explain the different types of bending vibrations of a molecule. [[C05](Understand/IOCQ)]
 (b) Which region of IR is important for identification of functional groups of a molecule? [[C05](Remember/LOCQ)]
 (c) Both UV-Visible and IR spectroscopy belong to the category of absorption spectroscopy. Justify the statement. [[C05](Justify/HOCQ)]
 (d) How IR can be used for determination of the shelf life of a substance? [[C05](Understand/IOCQ)]
6 + 1 + 3 + 2 = 12
7. (a) State the importance of the components of a spectrofluorometer: (i) excitation filter, (ii) detector. [[C05](Remember/LOCQ)]
 (b) Discuss how fluorescence molecules are used in quantitative PCR technique. [[C05](Remember/LOCQ)]
 (c) The excitation wavelength of a compound is 531nm and the emission wavelength is 552nm. Calculate Stoke's shift. [[C05](Understand/LOCQ)]
(3 + 3) + 4 + 2 = 12

Group - E

8. (a) Describe a process of ion analysis in Mass Spectrometer. [[C06](Describe/HOCQ)]
 (b) What do you mean by a Resolution of a Microscope? [[C06](Remember/LOCQ)]
 (c) What do you mean by Evanescent waves? [[C06](Remember/LOCQ)]
5 + 4 + 3 = 12
9. (a) Enumerate the process of protein crystallization. [[C06](Enumerate/IOCQ)]
 (b) Briefly describe the sample preparation in SEM. [[C06](Analyze/IOCQ)]
 (c) What do you mean by Surface Plasmon Resonance? [[C06](Remember/LOCQ)]
4 + 4 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	37.5	37.5	25.0

