

**BIOPHYSICS OF MACROMOLECULES
(BIOT 3232)**

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) Examples of basic amino acids are
 - (a) Glutamic acid, Aspartic acid, Glycine
 - (b) Glycine, Leucine, Arginine
 - (c) Histidine, Lysine, Arginine
 - (d) Methionine, Lysine, Histidine
- (ii) In a Mass Spectrometry, Electron multiplier is used as
 - (a) Ion analyser
 - (b) Ion detector
 - (c) Ion production
 - (d) None of the above
- (iii) Number of amino acid residues in a protein of molecular weight 12100 is
 - (a) 110
 - (b) 253
 - (c) 530
 - (d) 330
- (iv) Real, inverted and small size image than that of the object is formed in
 - (a) Telescope
 - (b) Photocopier
 - (c) Camera
 - (d) Spotlight
- (v) Number of base pairs per helical turn in a Z-DNA is
 - (a) 10
 - (b) 11
 - (c) 11.6
 - (d) 12
- (vi) Which of the following statement is NOT correct regarding melting of a DNA
 - (a) Melting point of a DNA depends on its base composition
 - (b) Melting curve of a DNA is hyperbolic in nature
 - (c) Salt concentration of the DNA solution influences the melting point
 - (d) The melting process can be monitored by measuring absorbance at 320 nm.
- (vii) Renaturation occurs with proteins which
 - (a) Have lower energy in the denatured state
 - (b) Have lower energy in the native state
 - (c) Have very low energy level in both the native and the denatured state
 - (d) Have almost equal energy level in the native and the denatured state

- (viii) Bohr effect states that
(a) Hemoglobin binds more oxygen in low pH
(b) Hemoglobin binds more oxygen in high pH
(c) The allosteric nature of hemoglobin's oxygen binding property is lost in presence of protons
(d) All the above.
- (ix) Dichromate ion absorbs near 500 nm. Based on this information, it can be concluded that
(a) dichromate ion absorbs in the visible region
(b) solution of dichromate salt is colourless
(c) dichromate ion absorbs in the UV region
(d) dichromate ion absorbs outside the visible region
- (x) Light emitted from glow worm and fireflies is an example of
(a) Photoluminiscence (b) Bioluminiscence
(c) Electroluminiscence (d) Radioluminiscence

Group – B

2. (a) Describe any one super-secondary structure.
(b) Discuss the factors effecting α -Helix stability.
- 6 + 6 = 12**
3. (a) Draw and explain the titration curve of Glycine.
(b) Write notes on Ribose ring puckering.
(c) Torsion angles about Glycosidic bonds have only one or two stable positions – Explain.
- 6 + 3 + 3 = 12**

Group – C

4. (a) Where do you expect the following amino acids to be present (on the surface or in the interior) in a protein molecule? State the reason. (i) Phenylalanine, (ii) Threonine, (iii) Glutamic acid.
(b) What is melting of an alpha helix? State a physical parameter that can be used to monitor the melting of alpha helix. Derive the equation describing the relation between melting point of an alpha helix and thermodynamic parameters.
- (2 × 3) + (1 + 1 + 4) = 12**
5. (a) What is an allosteric enzyme? Draw the graph showing kinetics of an allosteric enzyme.
(b) With the symmetry model, explain the cooperative nature of an allosteric enzyme. State one limitation of the symmetry model.
- (2 + 3) + (5 + 2) = 12**

Group – D

6. (a) Discuss the basic principles of UV/visible spectroscopy.
- (b) Cytosine has a molar extinction coefficient of $6 \times 10^3 \text{ M}^{-1}\text{cm}^{-1}$ at 270 nm at pH 7. Calculate the absorbance and % transmittance of $1 \times 10^{-3} \text{ M}$ cytosine in a 1 mm cell.
- (c) State the criteria an analyte should have to be tested with fluorescence spectroscopy.

4 + 4 + 4 = 12

7. (a) State the frequency region in the electromagnetic wave that gives the IR spectrum. Discuss the basic principle of IR spectroscopy.
- (b) Define and illustrate the major types of vibrations in a molecule.

(2 + 6) + 4 = 12**Group – E**

8. (a) Briefly describe the detection processes in SEM.
- (b) Derive the Bragg's law.
9. (a) Explain with a diagram the working principle of Surface Plasmon Resonance. Give Example.
- (b) Describe the different processes of ion production in Mass Spectrometer.

8 + 4 = 12**6 + 6 = 12**

Department & Section	Submission Link
BT	https://classroom.google.com/c/MzAxNjYwNzg0NDEEx/a/MzY1MzU3MzQ5NjA0/details