B.TECH/BT/3rd SEM /BIOT 2101/201

2015

Chemistry of Biomolecules
(BIOT 2101)

Time Allotted : 3 hrs   Full Ma

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.
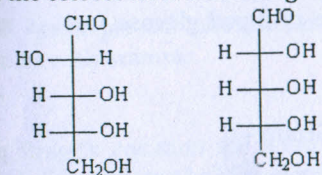
Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following: 10 x 1=10

(i) Alpha helix is broken by
   (a) Valine   (b) Phenyl alanine   (c) Proline   (d) Isoleucine.

(ii) The following sugar is NOT a disacccahride
   (a) sucrose   (b) lactose   (c) maltose   (d) ribos.

(iii) Example of a saturated fatty acid is
   (a) Palmitic acid   (b) Oleic acid
   (c) Palmitoleic acid   (d) Linoleic acid.

(iv) If a species contains 23% adenine in its DNA, then the percentage of guanine in it's DNA would be
   (a) 23 %   (b) 46 %   (c) 27 %   (d) 54 %.

(v) Assign the correct term describing the relationship to the following two isomers

$$\begin{array}{c} CHO \\ HO{-}H \\ H{-}OH \\ H{-}OH \\ CH_2OH \end{array} \qquad \begin{array}{c} CHO \\ H{-}OH \\ H{-}OH \\ H{-}OH \\ CH_2OH \end{array}$$

   (a) enantiomers   (b) diastereomers   (c) mesomers   (d) isomers.

(vi) The set that includes components of weak interaction is
   (a) Vander Waals force, ion-ion interaction, ion-dipole interaction
   (b) Peptide bonds, hydrophobic interaction, ion-ion interaction
   (c) Peptide bond, disulfide bind, hydrogen bonds
   (d) Disulfide bond, hydrophobic interaction, ion-ion interaction.

(vii) Hydrophobic amino acid residues are likely to be found
   (a) in the interior of a protein   (b) on the surface of a protein
   (c) both in the interior and on the surface (d) difficult to predict.

(viii) The microscopic technique applied to analyze topographical changes is
    (a) Scanning electron microscopy
    (b) Transmission electron microscopy
    (c) Phase contrast microscopy
    (d) Fluorescence microscopy.

(ix) A BSA stock solution is diluted 10 folds with phosphate buffer. The abso[...] the solution in a quartz cuvette of path length 1 mm at 280 nm is 0.3[...] extinction coefficient of the protein is 0.66 ml/mg.cm, concentration of [...] protein would be:
    (a) 5 mg/ml   (b) 20 mg/ml
    (c) 33 mg/ml   (d) 50 mg/ml.

(x) The absorption of infrared light by a molecule results in transition to higher[...]
    (a) magnetic field   (b) electron spin
    (c) emission   (d) vibration.

Group – B

2.(a) Name the major weak interactions that occur within a biomolecule. Disc[...] importance with respect to biomolecular structure.

(b) Derive Henderson equation.
                             (2+6)[...]

3.(a) Describe the structure of a starch molecule. How starch can be identifi[...] chemical reaction? Write the basic structural difference between starch and g[...]

(b) Explain why enzymatic detection of blood glucose level is more accura[...] chemical method.
                             (4+2+2)[...]

Group – C

4.(a) Draw the structure of a representative triacylglycerol molecule. Discuss th[...] triacylglycerols for production of soap.

(b) What do you mean by rancidity of fats and oils? Discuss the mechanism resp[...] for rancidity. How fats and oils can be protected from rancidity?
                         (2+3) + (2+3[...]

5.(a) Define saponification value and iodine number. Explain why iodine number[...] oil is higher than that of coconut oil.

(b) What are phospholipids? Draw a representative structure.
                             (4 + 4)[...]

Group – D

[...]. (a) Draw and explain the titration curve of Glutamic acid.

(b) The pK_1, pK_2 and pK_R values of Lysine are 2.18, 8.95 and 10.79 respectively. What is its pI?

(c) Describe the structure of an alpha helix with a figure.

(d) What do you mean by denaturation of a protein?   4 + 2 + 4 + 2 = 12

[...]. (a) 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 490?

(b) Derive the equation for renaturation kinetics of a ssDNA molecules into dsDNA.

(c) Explain why DNA is resistant to alkali hydrolysis but RNA is not.

(d) Determine the melting point of DNA, which has a total % (G+C) content value 35.
                             4 + 4 + 2 + 2 = 12

Group – E

8.(a) Derive the mathematical form of Lambert & Bears law. What are its limitations?

(b) Describe the basic steps of crystallization of proteins.

(c) Describe principle of phosphorescence and luminescence in estimation of biomolecules with example.   (4+1) + 3 + 4 = 12

9.(a) Derive Bragg's equation for X-ray diffraction. Describe the whole methods of structure determination of a biomolecule by X ray crystallography.

(b) Define chromophore. Discuss the major chromophores present in proteins and nucleic acids with examples.   (4+4) + (2+2) = 12