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989

Your Roll No.

B.Sc. (Hons.) / I

C

BIOCHEMISTRY – Paper V

Introductory Biology

(Admissions of 2000 and onwards)

Time : 3 Hours

Maximum Marks : 60

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

*Attempt five questions in all, including
Q. No. 1 which is compulsory.*

1. (a) Indicate whether each of the following pairs of sugars are best described as enantiomers, diastereomers, epimers or anomers :
- (i) D-allose & D-talose
 - (ii) D-galactose & D-mannose
 - (iii) L-fructose & D-fructose
 - (iv) α -D glucose & β -D glucose (2)
- (b) Arrange the following fatty acids in the order of their increasing melting point: Oleic acid, stearic acid, linoleic acid, palmitic acid and linolenic acid. (2)

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- (c) What is the approximate molecular weight of a protein with 682 amino acid residues? (2)
- (d) Polysaccharides do not give positive Fehlings's test. why? (2)
- (e) In the presence of HCHO, the shape of the titration curve of glycine changes. How does this observation support the zwitterionic structure of amino acids? (4)
- (f) Calculate the pI of glutamic acid. The pK_a of the three functional groups capable of donating protons are $pK_1 = 2.19$; $pK_2 = 9.67$ and $pK_3 = 4.25$. (2)
- (g) Consider two hexoses, D-galactose and D-glucose. Both of them exist as six-membered rings (pyranose form). How many disaccharides are theoretically possible? (2)

2. Explain Why?

- (i) DNA cannot be hydrolyzed by dilute alkali.
- (ii) Arachidonic acid is not an essential fatty acid in animals.
- (iii) Kiliani-Fisher synthesis yields two different sugars starting from a given precursor.

- (iv) The α -carboxyl group of an amino acid is a stronger acid than the carboxyl group of corresponding aliphatic acids.
 - (v) Sperm whales in spite of their weight are able to adjust with ease both at the surface and in deep sea waters.
 - (vi) Populations that subsist on a corn rich diet often suffer from pellagra.
 - (vii) Trehalose does not exhibit mutarotation.
- (1.5 × 6 + 2)

3. Give an example of the following biomolecules :

- (i) An amino acid found in proteins that can be converted to another amino acid on treatment with a strong base.
- (ii) A biomolecule other than nucleic acids with phosphodiester bonds.
- (iii) A biologically active product derived from tryptophan.
- (iv) A lipid with signal transducing activity.
- (v) A modified base in t-RNA.
- (vi) A structural polysaccharide.

- (vii) Pro vitamin D
- (viii) A plant sterol.
- (ix) A deoxy hexose.
- (x) Amino acid(s) that is responsible for the UV absorption by proteins.
- (xi) An $\omega 3$ series of fatty acid. (1×11)

4. (a) Fill in the blanks :

- (i) _____ is a polysaccharide in insect exoskeleton and is made up of repeating _____ units.
- (ii) _____ is a vitamin that contains glutamate residues.
- (iii) In nucleic acids sugars are linked to the base by _____ linkage.
- (iv) The predominant constituent of lung surfactant is _____.
- (v) _____ is a methyl donor in biological reactions.
- (vi) _____ gives a yellow color with ninhydrin reagent. (1×6)

(b) Define the following terms :

(i) Zwitterion

(ii) Saponification number

(iii) Essential amino acids.

(iv) Homoglycans

(v) Lipoproteins

(1×5)

5. (a) Indicate whether each of the following statements is true or false. If you think the statement is false, explain why.

(i) L- ribitol-1 phosphate is identical with D- ribitol-5 phosphate.

(ii) Threonine has only one asymmetric carbon atom.

(iii) Nucleosides are less soluble in water than their corresponding bases.

(iv) Fructose on reduction gives a mixture of mannitol and sorbitol.

(v) In PUFA, the double bonds are generally unconjugated.

(vi) All linear polymers of D - glucose can be digested by humans.

(vii) mRNA sequence is complementary to the template DNA. (1×7)

(b) Give one significant contribution of the following investigators :

(i) C. Funk

(ii) Emil Fisher

(iii) Erwin Chargaff

(iv) Linus Pauling (1×4)

6. Write the structures of the following :

(i) Sialic acid

(ii) Cyclic AMP

(iii) Isomaltose

(iv) Histidine at pH 4.0

(v) Cardiolipin

(vi) A deoxy hexose

(vii) Erucic acid

(viii) Pseudo uridine

(ix) Glutamic acid

(x) Galactitol

(xi) Leucotriene LTB_4 (1×11)

7. Compare the following pairs :

(i) Essential and non-essential amino acids.

(ii) Plant and animal sterols.

(iii) Phospholipids and neutral fat.

(iv) Starch and cellulose.

(v) B- and Z-DNA. (2×4+3)

8. (a) Write the outcome of the following reactions (draw structures) :

(i) Glucose is treated with concentrated HNO_3 (1)

(ii) Methionine is oxidized with performic acid. (1)

(iii) Alanine is reacted with Sanger's reagent. (1)

(iv) RNA is treated with alkali. (1.5)

(v) Glucose is synthesized starting from D-arabinose. (1.5)

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(vi) Oleic acid is reacted with KMnO_4 under vigorous conditions. (1)

(vii) Xylose is treated with hydroxyl amine. (1)

(b) Name the coenzyme that best describes the statements below :

- (i) It is the most versatile one carbon donor.
- (ii) It is required for intra molecular rearrangements.
- (iii) It acts as an electron sink to promote catalysis. (1×3)