



QUALIFICATION : BACHELOR OF HUMAN NUTRITION	
QUALIFICATION CODE: 08BOHN	LEVEL: 5
COURSE: INTRODUCTION TO BIOCHEMISTRY	COURSE CODE: IBC521S
DATE: JANUARY 2024	SESSION: 2
DURATION: 3 HOURS	MARKS: 100 MARKS

SECOND OPPORTUNITY: QUESTION PAPER

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MODERATOR: Mr George Waliomuzibu Mukisa

INSTRUCTIONS:

11. Answer all questions on the separate answer sheet.
12. Please write neatly and legibly.
13. Do not use the left side margin of the exam paper. This must be allowed for the examiner.
14. No books, notes and other additional aids are allowed.
15. Mark all answers clearly with their respective question numbers.

PERMISSIBLE MATERIALS:

Non-Programmable Calculator

ATTACHMENTS:

None

This paper consists of 5 pages including this cover

QUESTION 1: MULTIPLE CHOICE QUESTIONS

[10 MARKS]

Evaluate the statements in each numbered section and select the most appropriate answer or phrase from the given possibilities. Fill in the appropriate letter next to the number of the correct statement/phrase on your ANSWER SHEET. [10]

- 1.1 Which types of bonds are found in sugars:
 - a) amide
 - b) acidic
 - c) glycosidic
 - d) non-covalent
- 1.2 Which type of carbohydrates lead to the formation of glycolipids and glycoproteins:
 - a) Oligosaccharides
 - b) Monosaccharides
 - c) Glycogen
 - d) Glucose
- 1.3 What are the monomers of lipids:
 - a) Amino acids
 - b) Simple sugars
 - c) Fatty acids and glycerol
 - d) Nucleic acids
- 1.4 When myoglobin is denatured using heat:
 - a) its amino acid composition will change.
 - b) its amino acid sequence will change.
 - c) its tertiary structure will change.
 - d) its C-terminal will change.
- 1.5 Which one of the following statements about starch is not correct:
 - a) Both amylose and amylopectin contain (α -1,6) glycosidic bonds
 - b) Both amylose and amylopectin are polymers of glucose
 - c) Both amylose and amylopectin yield maltose upon partial hydrolysis
 - d) Both amylose and amylopectin contain (α -1,4) glycosidic bonds
- 1.6 If heat energy is absorbed by the system during a chemical reaction, the reaction is said to be:
 - a) At equilibrium
 - b) Endergonic.
 - c) Exergonic.
 - d) Endothermic.
- 1.7 The isoelectric point of an amino acid is defined as the pH:
 - a) Where the molecule carries no electric charge
 - b) Where the amino group is uncharged
 - c) Of maximum electrolytic mobility

- d) Where the carboxyl group is uncharged
- 1.8 Which component is found in all sphingolipids:
 - a) a carbohydrate
 - b) a negative charge
 - c) a phosphate groups
 - d) an amino alcohol
- 1.9 The Na⁺-K⁺ ATPase pump.
 - a) is an example of a passive transport protein
 - b) is an example of active transport system
 - c) helps to pump Na⁺ out of the cell and K⁺ into the cell
 - d) B and C above
- 1.10 Which of the following described the quaternary structure of a protein:
 - a) helix or sheet stabilized by hydrogen bonds
 - b) formation of all four kinds of noncovalent bonds
 - c) a multi-peptide structures
 - d) requires disulfide bonds

QUESTION 2: TRUE/FALSE QUESTIONS

[10 MARKS]

Evaluate the statements and select whether the statement is true or false. Write the word 'True' or 'False' next to the corresponding number on your ANSWER SHEET. [10]

- 2.1 Prokaryotic cells do not contain cell membrane.
- 2.2 Glycolysis will occur ONLY in the presence oxygen.
- 2.3 Proteins are made from various amino acids bonded by ester bonds.
- 2.4 Metabolism of fats produces more ATP molecules per gram than the metabolism of carbohydrates or proteins.
- 2.5 The role of the CoA in acetyl CoA is to carry two carbon molecules (acetyl) to the Krebs cycle.
- 2.6 A lipid molecule in a membrane interacts with other membrane molecule through non-covalent forces.
- 2.7 Essential amino acids are synthesized in the human body.
- 2.8 Protein are polymers made of amino acid monomers.
- 2.9 Glycogen, starch, and cellulose are all chains of amino acids.
- 2.10 An uncompetitive inhibitor will bind to the enzyme substrate complex

QUESTION 3**[45]**

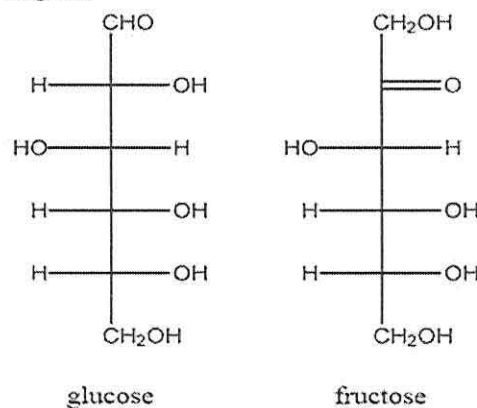
- 3.1 Explain how column chromatography works during protein purification (6)
- 3.2 List four products of the Krebs cycle? (4)
- 3.3 Differentiate between peripheral and integral protein (4)
- 3.4 Define cooperativity behaviour in terms of enzyme binding to a substrates (3)
- 3.5 Explain hydrophobic interactions (2)
- 3.6 Briefly explain the Cori cycle which is a linked metabolic pathway. (6)
- 3.7 Differentiate between saturated and unsaturated fatty acids. Given example of where they are found. (4)
- 3.8 Define gluconeogenesis? List the key enzymes involved in this process. (6)
- 3.9 List the four properties of water that makes it possible for life to exist (4)
- 3.10 Define the following terms (6)
- 3.10.1 Apoenzyme
- 3.10.2 Glycolysis
- 3.10.3 Active transport

QUESTION 4: PROTEIN STRUCTURES**[16]**

- 4.1 What kinds of noncovalent or/ and covalent interactions are important for primary, Secondary structure, and Tertiary structure? (7)
- 4.2 Do all proteins have quaternary structure? (1)
- 4.3 Does hemoglobin have a quaternary structure? (1)
- 4.4 Is hemoglobin a globular or a fibrous protein? (1)
- 4.5 What is protein denaturation? Is there any change in the primary structure when a protein is denatured? (3)
- 4.6 What are some factors that can lead to protein denaturation? (3)

QUESTION 5: CARBOHYDRATE**[11]**

Below is a reaction coordinate diagram



- 5.1 Identify the chiral Centre(s) on the two sugars (re-draw the structures and indicate the chiral centres with *) (4)

5.2 How many stereoisomers would each give rise to? (3)

5.3 State a test you could use to distinguish glucose from fructose. Which one would give a positive result and what does the result look like? (4)

QUESTION 6: CALCULATION [8]

6.1 Calculate the in pH of a buffer containing (0.4M) formic acid HCOOH ($K_a = 1.77 \times 10^{-4}$) and 1M sodium formate (HCOONa). (4)

6.2 Calculate the isoelectric point (pI) of lysine. Given the pKa of $\alpha\text{-NH}_3$ is 8.95, pKa of side chain NH_3 is 10.53 and pKa of $\alpha\text{-COOH}$ is 2.18. (4)

END OF QUESTION PAPER