



*(University of Choice)*

**MASINDE MULIRO UNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)**

**MAIN CAMPUS**

**UNIVERSITY EXAMINATIONS (MAIN PAPER)  
2023/2024 ACADEMIC YEAR**

**MAIN EXAMINATION**

**FOR THE DEGREES  
OF  
BACHELOR OF SCIENCE IN MEDICAL LABORATORY  
SCIENCES, BACHELOR OF SCIENCE IN MEDICAL  
BIOTECHNOLOGY AND BACHELOR OF SCIENCE IN  
OPTOMETRY AND VISUAL SCIENCES**

**COURSE CODE: PML 211**

**COURSE TITLE: STRUCTURAL BIOCHEMISTRY**

**DATE: 8<sup>TH</sup> DECEMBER 2023**

**TIME: 2.00-4.00PM**

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**INSTRUCTIONS TO CANDIDATES**

This paper is divided into three sections, **A B** and **C**, carrying respectively: Multiple Choice Questions (**MCQs**), Short Answer Questions (**SAQs**) and Long Answer Questions (**LAQs**). Answer all Questions. **DO NOT WRITE ON THE QUESTION PAPER.**

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over

**SECTION A: Multiple Choice questions (20 Marks)**

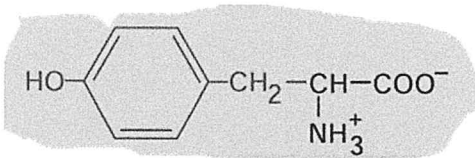
1.  $\alpha$ -D-glucose and  $\beta$ -D-glucose are related by \_\_\_\_\_
  - A. Epimers
  - B. Anomers
  - C. Mutarotation
  - D. Ketoaldo pair
2. Mucic acid is produced by oxidation of \_\_\_\_\_
  - A. Glucose
  - B. Galactose
  - C. Fructose
  - D. Mannose
3. Acid catalyzed dehydration of pentose gives \_\_\_\_\_
  - A. Uronic acid
  - B. Furfural
  - C. Galactosamine
  - D. Sialic acid
4. A constituent of the heteropolysaccharide of cartilage is \_\_\_\_\_
  - A. Muramic acid
  - B. Furfural
  - C. Galactosamine
  - D. Sialic acid
5. A derivative of neuraminic acid is .....
  - A. Aldaric acid
  - B. Furfurals
  - C. Glycosides
  - D. Sialic acid
6. Mild alkaline treatment of glucose yields \_\_\_\_\_
  - A. Fructose and mannose
  - B. fructose and galactose
  - C. Galactosamine and Mannosamine
  - D. Sialic acid and muramic acid
7. The repeating unit in hyaluronic acid is.....
  - A. Glucuronic acid and galactose
  - B. Glucuronic acid and galactosamine
  - C. Glucuronic acid and glucosamine
  - D. Glucuronic acid and N-acetyl glucosamine
8. Sphingosine is the backbone of all the following, except-----
  - A. Cerebroside
  - B. Ceramide
  - C. Sphingomyelin
  - D. Lecithin
9. Phospholipids are important cell membrane components because: \_\_\_\_\_
  - A. They have glycerol
  - B. They can form bilayers in water
  - C. They have both polar and nonpolar portions
  - D. They combine covalently with proteins
10. Which one of the following is not a phospholipid?
  - A. Lecithin
  - B. Plasmalogen
  - C. Lysolecithin

- D. Gangliosides
11. Which one of the following is not essential fatty acid?
- A. Oleic acid
  - B. Linoleic acid
  - C. Arachidonic acid
  - D. Linolenic acid
12. When choline of lecithin is replaced by ethanolamine the product is.....
- A. Spingomyelin
  - B. Cephalin
  - C. Plasmalogens
  - D. Lysolecithin
13. All Prostaglandins have a structure based on prostanoic acid which contains a cyclopentane ring and has-----carbon atoms:
- A. 10
  - B. 15
  - C. 18
  - D. 20
14. An amino acid that does not form an  $\alpha$ -helix is.....
- A. Asparagine
  - B. Tyrosine
  - C. Tryptophan
  - D. Proline
15. Which one of the following amino acid is optically inactive
- A. Amino acetic acid
  - B. Serine
  - C. Methionine
  - D. Lysine
16. All of the following are sulfur containing amino acids found in proteins, except:-----
- A. Cysteine
  - B. Threonine
  - C. Cystine
  - D. Methionine
17. The Phosphoprotein present in the egg yolk is: -----
- A. Ovalbumin
  - B. Avidin
  - C. Ovomuroid
  - D. Ovovitellin
18. An enzyme that catalyzes the conversion of an aldose sugar to a ketose sugar would be classified as one of the: -----
- A. Transferases
  - B. Isomerases
  - C. Oxidoreductases
  - D. Hydrolases
19. In competitive inhibition which one of the following kinetic effect is true?
- A. Decreases both  $K_m$  and  $V_{max}$
  - B. Increases both  $K_m$  and  $V_{max}$
  - C. Decreases  $K_m$  without affecting  $V_{max}$
  - D. Increases  $K_m$  without affecting  $V_{max}$
20. Increased carbohydrate consumption increases the dietary requirement for:
- A. Thiamine
  - B. Riboflavin

- C. Pyridoxine
- D. Folic acid

**SECTION B: Short Answer Questions (40 Marks)**

1. List the components of Di-phosphatidylglycerol (cardiolipin) (4mks)
2. Define the term Acid number of a fat or an oil and state its significance (4mks)
3. I) List two selenoproteins (2mks)  
II) Explain the following terms as related to amino acids
  - A. Isoelectric point (1mk)
  - B. Zwitterion (1mk)
4. Arginine and Histidine are semi-essential amino acids. Explain (4mks)
5. Differentiate simple triglycerides from mixed triglycerides, giving examples (4mks)
6. Describe the structural features of glycosides (4mks)
7. The pK-values for ionizable groups of tyrosine at 25° C are:
  - pK( $\alpha$ -COOH) = 2.2
  - pK ( $\alpha$ -NH<sub>3</sub><sup>+</sup>) = 9.11
  - pK<sub>R</sub> = 10.07



Derive protonation equilibrium equation and determine its pI (4mks)

8. Differentiate Amylose and amylopectin (4mks)
9. A) List 4 major classes of conjugate proteins (2mks)  
B) Proteins have buffering property. Explain (2mks)
10. State the class of enzymes that catalyze the following reactions:
  - I. Citrate + CoA → Acetyl-CoA + H<sub>2</sub>O + OAA (1mk)
  - II. ATP + Acetate + CoA → AMP + pyrophosphate + Acetyl-CoA (1mk).
  - III. Lactate + NAD<sup>+</sup> → Pyruvate NADH + H<sup>+</sup> (1mk)
  - IV. Acetyl-CoA + H<sub>2</sub>O → CoA + Acetic acid (1mk)

**SECTION C: Long Answer Questions (60 Marks)**

1. Discuss
  - A. Stress response proteins (10mks)
  - B. Functions and properties of amino acids (10mks)
2. Describe the structure and properties of the following disaccharides
  - I. Maltose (4mks)
  - II. Sucrose (4mks)
  - III. Lactose (4mks)
  - IV. Cellobiose (4mks)
  - V. Trehalose (4mks)
3. Discuss
  - A. Classes of enzymes giving examples (10mks)
  - B. Competitive and non-competitive inhibitors of enzymes, giving examples (10mks)