# MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY

## UNIVERSITY EXAMINATIONS 2022/2023 ACADEMIC YEAR

### SECOND YEAR MAIN EXAMINATION

FOR THE DEGREES OF

**BACHELOR OF SCIENCE (CHEMISTRY)/BACHELOR OF INDUSTRIAL CHEMISTRY**

COURSE CODE:     **SCH 232**

COURSE TITLE:     **CHEMISTRY OF 1° BIOMOLECULES**

DATE: **THURSDAY, 27TH APRIL 2023**          TIME: **3.00-5.00PM**

INSTRUCTIONS

- *Answer ALL Questions within Two (2) Hours.*
- *Candidates are encouraged to provide chemical equations, relevant examples or illustrations (where necessary) for clarity of their answers.*

This paper consists of 4 printed pages. Please turn over.

**Q1.**                                                                   **[19 marks]**

(a) (i) Giving any three (3) examples / illustrations, precisely define a primary biomolecule [2]

(ii) Outline any four (4) classes of living organisms from which biomolecules haven been isolated / produced giving a real example (s) of the biomolecule (s) for each source. [9]

(b) Primary metabolic processes in plants lead to various products. The following are descriptions of these products. Carefully comprehend these descriptions and answer the accompanying questions.

(i) For the mother nature process (Photosynthesis) to occur it requires three key ingredients label them **A**, **B** and **D** interchangeably. Identify these important ingredients **A**, **B** and **D**.
[1½]

(ii) Photosynthesis gives rise to a major class of biomolecules label it **E** and also releases a gaseous product label it **C**. Identify **C** and **E** products. **[1]**

(iii) Product **E** is normally stored in form of **F** and **G** which are further transformed into cells in the presence another biomolecule label it **H**. Identify the products marked **F**, **G** and **H**.[1½]

(iv) The key products of photosynthesis earlier labelled **E** in the presence of soil minerals are metabolised into various other primary metabolites label them **J**, **K**, **L** and **M** interchangeably. Give the possible identities of the products labelled **J-M**. **[2½]**

(v) The key products of photosynthesis **E** above does undergo respiration in the presence of photosynthesis product labelled **C** above to result into products label them **N**, **P** and **Q** . **Q** is also important in the biosynthesis of primary metabolites label them **H-M**. Propose identity of the products **N**, **P** and **Q**. **[1½]**

**Q2.**                                                                   **[18 marks]**

CH₂OH
|
C=O
|
HO—C—H
|
H—C—OH
|
H—C—OH
|
CH₂OH
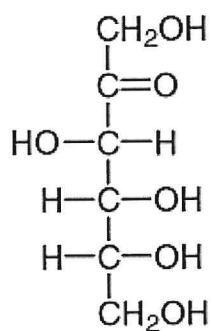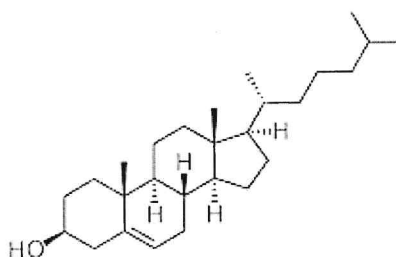
**A**                                          **B**

You are given chemical structures of primary biomolecules marked **A** and **B** above. Study and use these structures to answer the following questions.

(a)    Identify the classes of molecule **A** and **B**                                [1]

(b) Outline four (4) key functions each of **A** and **B** as examples of key classes of primary biomolecules [4]

(c) Calculate the possible number of stereoisomers of molecules **A** and **B** [3]

(d) While giving a valid reason, indicate whether molecules **A** and **B** polar or non-polar [2]

(e) Most molecules of type **A** are found naturally in bound form rather than as simple sugars. List four (4) bound forms of **A**. [2]

(f) Molecule **A** does cyclize to form two (2) products. Outline the reaction mechanism of this cyclization. [5]

(g) Molecule **B** is associated with a major health condition. Explain. [1]

## Q3. [15 marks]

(a) Using relevant examples or illustrations to point to differentiate between the following terminologies [4]

    (i) Enantiomers and Epimers

    (ii) Triglycerides and Phospholipids

(b) Express the following bio membrane / cell process in form of chemical equations

    (i) Oxidation of glucose [2]

    (ii) Photosynthesis and Cellular Respiration [3]

## Q4. [18 marks]

(a) Below are two (2) chemical structures of biomolecules marked **X** and **Y** below. Use these structures to answer the following questions.



**X**



**Y**
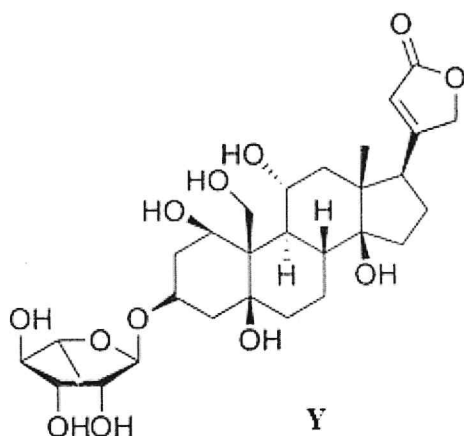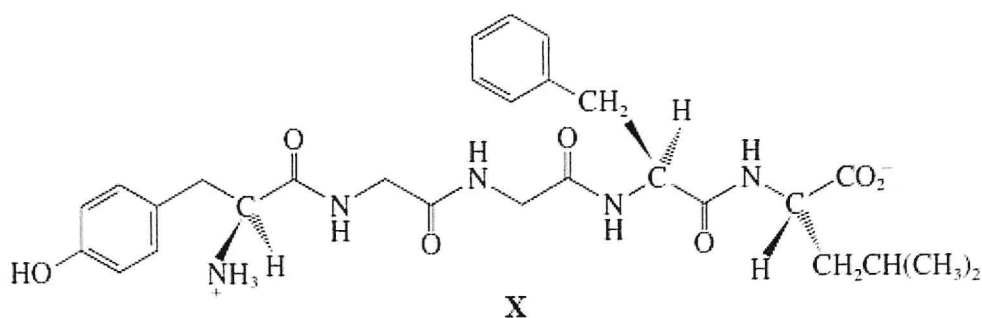
(i) To which classes of biomolecules do **X** and **Y** belong to? [2]

(ii) Molecules **X** and **Y** are related in terms of existing prominent linkages in their structures. Explain and identify the linkages of **X** and **Y**. [2]

(iii) Molecule **X** is polymeric in nature. State the chemical structures and identity of the monomers of **X**. [2½]

(iii) Outline any Four (4) analytical techniques used in the analysis of molecules of type **X** and **Y** (TWO (2) for each). [8]

(iv) State any two (2) key functions of **X**. [2]

(v) State a pharmaceutical use of **Y**. [1½]