



**NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY**

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QUALIFICATION : BACHELOR OF SCIENCE	
QUALIFICATION CODE: 07BOSC	LEVEL: 7
COURSE: BIOCHEMISTRY: BIOCHEMICAL PRINCIPLES AND PRACTICE	COURSE CODE: BPP702S
DATE: NOVEMBER 2023	SESSION: 1
DURATION: 3 HOURS	MARKS: 100

FIRST OPPORTUNITY: QUESTION PAPER

EXAMINER: *PROF LAMECH MWAPAGHA*

MODERATOR: *PROF PETRINA KAPEWANGOLO*

INSTRUCTIONS:

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

PERMISSIBLE MATERIALS:

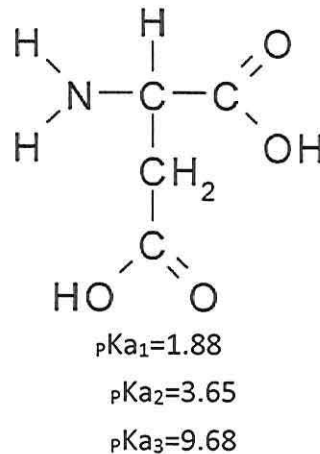
1. Non-Programmable Calculator

This question paper consists of four (4) pages including this front page.

Question 1

[14]

- a) Calculate the pKa of lactic acid, given that when the concentration of free lactic acid is 0.01M and the concentration of lactate is 0.087M, the pH is 4.80. (3)
- b) A buffer solution contains 0.25 M NH₃ ($K_b = 1.8 \times 10^{-5}$) and 0.40 M NH₄Cl. Calculate the pH of this solution. (5)
- c) Given the structure of aspartic acid and the pKa values as shown below:



Determine the pI value of aspartic acid and show clearly how you arrive at the answer. (6)

Question 2

[16]

- a) The genetic code is the set of rules defining how the four-letter code of DNA is translated into amino acids, which are the building blocks of proteins. Discuss **THREE (3)** characteristics of the genetic code (6)
- b) The 2020 Nobel Prize in Chemistry was jointly awarded to two scientist Emmanuelle Charpentier and Jennifer A. Doudna for the development of a method for genome editing known as CRISPR/Cas9. As a third year Biochemistry research student you would like to modify genes in cells in order to edit parts of the genome using this technique. Discuss in detail the mechanism behind this technique. (10)

Question 3

[14]

- a) Using structural formulas, write the balanced chemical equation for the reaction where substrate level phosphorylation takes place in the Krebs cycle. (6)
- b) Briefly describe the anabolic role of the TCA cycle in fatty acid synthesis (8)

Question 4

[13]

- a) Inositol triphosphate (IP3) and diacylglycerol (DAG) are all small molecules that can be found inside most cells, yet they are known to be important second messengers that can increase or decrease in response to a wide variety of signals. However, each signal often produces completely different responses. Describe how such responses are regulated following GPCR signalling. (5)
- b) Briefly discuss how the irreversible steps in glycolysis are bypassed by alternate enzymes specific to gluconeogenesis. (8)

Question 5

[15]

- a) The Michaelis-Menten equation illustrates how the initial substrate concentration ([S]) affects the initial rate of reaction (V). It is assumed that the reaction is in a steady state, with the concentration of enzyme - substrate (ES) remaining constant. Draw a well-labelled Eadie-Hofstee plot using the Michaelis-Menten equation. (8)
- b) Briefly state **SEVEN (7)** functions of the amino acid threonine (7)

Question 6

[16]

- a) Briefly describe how the movement of sodium and potassium ions takes place across the cell membrane. (8)
- b) Briefly explain the Cori Cycle (4)
- c) What are Ketone bodies? State the three types of ketone bodies (4)

Question 7

[12]

- a) Based on ADME properties, why is drug development a challenging task? (3)
- b) Describe the two pathways utilized by the body for the excretion of compounds once they have entered the bloodstream (4)
- c) Give **FIVE (5)** reasons as to why the knowledge of mechanism of action of drugs is important (5)

THE END