



**NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY**

FACULTY OF HEALTH, NATURAL RESOURCES AND APPLIED SCIENCES

DEPARTMENT OF NATURAL AND APPLIED SCIENCES

QUALIFICATION: BACHELOR OF SCIENCE (MAJOR/MINOR)	
QUALIFICATION CODE: 07BOSH	LEVEL: 7
COURSE NAME: BIOCHEMISTRY: BIOCHEMICAL PRINCIPLES AND PRACTICE	COURSE CODE: BPP702S
SESSION: NOVEMBER 2022	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100

FIRST OPPORTUNITY QUESTION PAPER	
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MODERATOR	ASSOC PROF PETRINA KAPEWANGOLO

INSTRUCTIONS	
<ol style="list-style-type: none">1. Answer ALL the questions.2. Write clearly and neatly.3. Number the answers clearly.4. All written work MUST be done in BLUE or BLACK ink.	

PERMISSIBLE MATERIALS

None

THIS QUESTION PAPER CONSISTS OF FOUR (4) PAGES
(Including this front page)

QUESTION 1**[11]**

- a) Distinguish between Positive and Negative Allosterism (4)
- b) The Department of natural and applied sciences has developed two enzymes that degrade highly toxic compounds to non-toxic compounds. You have been tasked to degrade the greatest amount of the toxic compound in the shortest amount of time.

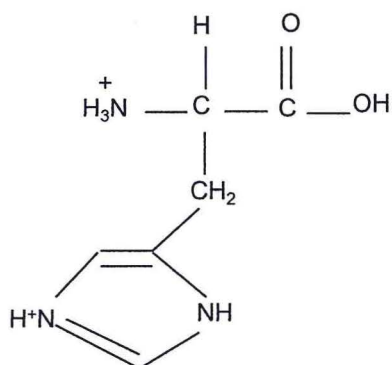
The kinetic properties of the two enzymes are shown below:

Enzyme	K_m	V_{max}
A	12 mM	700mM/sec
B	5 mM	400mM/sec

- I. At low concentrations of substrate which enzyme would be better to use based on the information given above? (Which enzyme binds the substrate better). Explain your answer. (2)
- II. At saturating concentrations of substrate, which enzyme would be better to use? Explain your answer. (2)
- c) The kinetics of facilitated diffusion can be described by the Michaelis-Menten equation. Plot a well labelled graph depicting both the facilitated and simple diffusion curves. (3)

QUESTION 2**[12]**

Histidine is one of 20 amino acids found in proteins. Shown here is the fully protonated structure of histidine molecule and the pK_a values for the acidic groups are 1.82, 6.00 and 9.17.



- a) What is the pI value of this amino acid? Show clearly how you arrive at the answer. (6)
- b) A buffer solution contains 0.25 M NH_3 ($K_b = 1.8 \times 10^{-5}$) and 0.40 M NH_4Cl . Calculate the pH of this solution. (3)
- c) Calculate the pH of a solution 0.75 M lactic acid ($K_a = 1.4 \times 10^{-4}$) and 0.25 M sodium lactate. (3)

QUESTION 3

[17]

- 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) Describe the mode of action of small interfering RNAs (siRNAs) (3)
- c) Briefly discuss the principles of metabolic pathways (8)

QUESTION 4

[15]

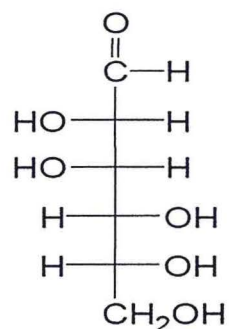
- a) Anaplerosis is the act of replenishing TCA cycle intermediates that have been extracted for biosynthesis. Describe the anapleurotic reaction that aids in the formation of oxaloacetate from pyruvate. (5)
- b) Oxidative phosphorylation is a process involving a flow of electrons through the electron transport chain, a series of proteins and electron carriers within the mitochondrial membrane. Briefly describe this process. (6)
- c) Using structural formulas, write the balanced chemical equation for the reactions where FADH_2 is produced in the Krebs cycle. (4)

QUESTION 5

[14]

a) Write the oxidation and reduction products of D-mannose below.

(4)



D-mannose

b) Discuss **THREE (3)** important parameters to consider during the planning of an ion exchange-based separation

(6)

c) State **FOUR (4)** factors affecting migration of nucleic acid in gel electrophoresis

(4)

QUESTION 6

[15]

a) Describe how acidification in the stomach takes place.

(4)

b) Briefly describe the hormonal regulation of gluconeogenesis

(5)

c) Discuss how fatty acids are activated and transported into the mitochondria

(6)

QUESTION 7

[16]

a) The toxicity of a drug candidate can be described in terms of the therapeutic index. Define therapeutic index.

(4)

b) Giving examples briefly describe **FIVE (5)** sources of drugs

(5)

c) Discovery and development is one of the steps involved in drug development. Give **SEVEN (7)** potential data that is gathered by researchers through conducting experiments once they have identified a promising compound for development at this step.

(7)

THE END