NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH AND APPLIED SCIENCES

DEPARTMENT OF NATURAL AND APPLIED SCIENCES

QUALIFICATION: BACHELOR OF SCIENCE	
QUALIFICATION CODE: 07BOSH	**LEVEL:** 7
COURSE NAME: BIOCHEMISTRY: BIOCHEMICAL PRINCIPLES AND PRACTICE	**COURSE CODE:** BPP702S
SESSION: NOVEMBER 2019	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER	DR LAMECH MWAPAGHA
MODERATOR	DR PETRINA KAPEWANGOLO

INSTRUCTIONS
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

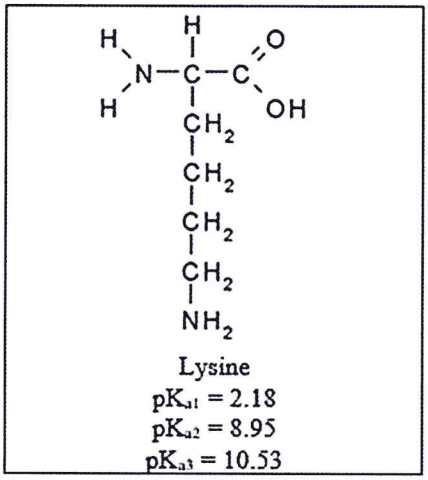
THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES
(Including this front page)

QUESTION 1 [14]

a) Calculate the pH of a solution 0.75 M lactic acid (Ka= 1.4×10^{-4}) and 0.25 M sodium lactate. (3)

b) Calculate the pH of a buffer solution that initially consists of 0.0500 M NH_3 and 0.0350 M NH_4^+. (Ka for NH_4^+ = 5.6 x 10-10). (5)

c) Given the structures of lysine and the pKa values as shown below:



Determine the pI value of lysine. Show clearly how you arrive at the answer. (6)

QUESTION 2 [14]

a) State **FOUR (4)** chemical reactions of amino acids that are due to the side chain (R) (4)

b) Describe the following techniques used for the separation and purification of amino acids and proteins (6)

I. Affinity Chromatography

II. Size Exclusion Chromatography

III. Gel Electrophoresis

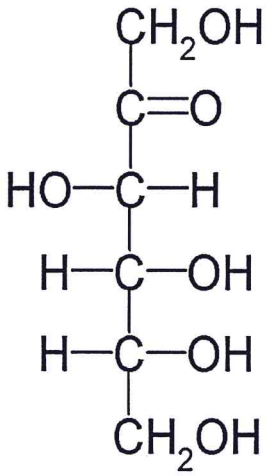
c) Briefly discuss the interplay between HCO_3, H_2CO_3 and CO_2 in blood buffering. (4)

QUESTION 3 **[12]**

a) Discuss the mode of action of small interfering RNAs (siRNAs) (4)

b) What are the special features found at the 5' end and the 3' end of mature eukaryotic mRNA? (4)

c) Draw the Haworth projection of the monosaccharide below in the α and β forms. (4)

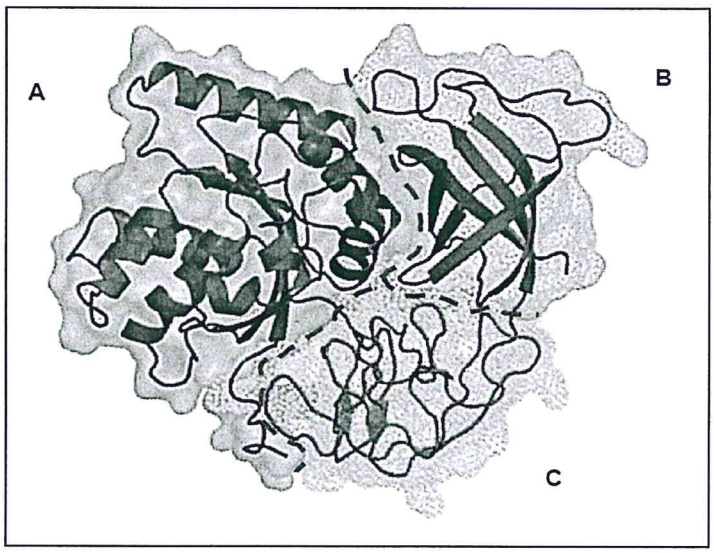


QUESTION 4 **[16]**

a) Briefly discuss **FOUR (4)** classes of enzyme specificity (4)

b) Describe the chemical basis of enzyme specificity (3)

c) The figure below shows a stable structure of a protein. The dashed line divides the structure into three regions labelled A, B, and C.



I. Does this protein have a quaternary structure and how do you reach that conclusion? (2)

II. Explain why it is likely that each of these three regions folds independently. (2)

III. Which one of the three parts of this protein is comprised mostly of α-helical secondary structure? (1)

IV. Which one of the three parts of this protein is comprised mostly of β-sheet secondary structure? (1)

V. For your answer to part IV above, what kind of β-sheet structure is present in this part of the protein? (3)

QUESTION 5 **[14]**

a) Describe the anabolic role of the TCA cycle in Gluconeogenesis. (4)

b) Using structural formulas, write the balanced chemical equation for the reactions where $FADH_2$ is produced in the Kreb cycle. (4)

c) Briefly explain the Electron Transport Chain/Oxidative Phosphorylation process. (6)

QUESTION 6 **[16]**

a) Describe how acidification in the stomach takes place. (4)

b) Briefly discuss how fatty acids are activated and transported into the mitochondria (6)

c) Match the phrase on the left with the letter of the answer on the right that bests matches the description of fatty acid (FA) metabolism (only one answer best matches each description) (6)

I. An oxidant in FA degradation pathway: .....

II. A reductant in FA synthesis pathway: .....

III. Catalyzes the commitment step in FA degradation: .....

IV. Building block of FA synthesis: .....

V. Subcellular location of FA degradation: .....

VI. Catalyzes the commitment step in FA synthesis: .....

A. Palmitoyl CoA
B. Acetyl CoA carboxylase
C. Cytosol
D. FAD/FADH2
E. Carnitine acyltransferase I
F. Phosphoenolpyruvate carboxykinase
G. Mitochondrial matrix
H. Coenzyme Q (QH2)
I. Malonyl CoA
J. NADPH/NADP+

QUESTION 7 **[14]**

a) Based on ADME properties, why is drug development a challenging task? (4)

b) Describe the two pathways utilized by the body for the excretion of compounds once they have entered the bloodstream (6)

c) Discuss how cholera toxin disrupts the regulation of intestinal secretion following GPCR Signalling. (4)

THE END