



MANICALAND STATE UNIVERSITY OF APPLIED SCIENCES

FACULTY OF ENGINEERING, SCIENCE AND TECHNOLOGY

DEPARTMENT OF CHEMICAL AND PROCESSING ENGINEERING

BIOCHEMICAL ENGINEERING

CODE: CHEP 322

SESSIONAL EXAMINATIONS

APRIL 2023

DURATION: 3 HOURS

EXAMINER: MR W. CHIPANGURA

INSTRUCTIONS

- 1. Answer any **four** questions.*
 - 2. Each question carries 25 marks.*
 - 3. Start each question on a fresh page*
 - 4. Show all your steps clearly in your calculations.*
 - 5. Use of scientific calculators is permitted.*
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QUESTION 1

- a) In metabolism, what is meant by catabolism? [1]
- b) Draw structures of straight chain glucose and amino acid. [4]
- c) Construct a fully labeled diagram representing the citric acid/kreb cycle. [8]
- d) Identify any four lipids and state their biological functions. [8]
- e) Explain the stages involved in a typical biochemical processes. [4]

QUESTION 2

- a) Define the terms: *biochemical engineering* and *taxonomy*. [2]
- b) Identify **five** industrial applications of biochemical engineering. [5]
- c) With the aid of a specific biological organism describe the **eight** major taxonomic ranks. [16]
- d) Distinguish between prokaryotes and eukaryotes organisms. [2]

QUESTION 3

- a) Describe **two** proposed models explaining the specificity of interaction between enzymes and substrates. [4]
- b) Draw a fully labeled saturation curve for an enzyme showing the variation of substrate concentration with speed of reaction. [6]
- c) Construct Michaelis Menten plots and Lineweaver plots for *competitive*, *noncompetitive* and *uncompetitive* enzyme inhibitors. [6]
- d) Name any **four** inhibitors that are crucial in pharmaceuticals. [4]
- e) Fully describe the action of ethanol as an important enzyme inhibitor in pharmaceutical industry. [5]

QUESTION 4

- a) What is meant by a bioreactor? [2]
- b) List **four** key differences between a chemical reactor and a bioreactor. [4]
- c) Identify **nine** bioreaction parameters that are important in bioreactor design. [9]
- d) Fully describe the steps involved in downstream processing. [10]

QUESTION 5

- a) What is meant by *bacterial growth*? [2]
- b) Fully describe the processes involved during the five stages of bacterial growth. [15]
- c) Derive an equation for the exponential growth of bacteria. [5]
- d) The specific growth rate of yeast cells at a yeast manufacturing company is 0.03 per hour. Calculate the time required to double the colonies of the yeast cells. [3]

END OF EXAMINATION