



**MASINDE MULIRO UNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)**

**(MAIN CAMPUS)**

**UNIVERSITY EXAMINATIONS  
2022/2023 ACADEMIC YEAR**

**THIRD YEAR SECOND SEMESTER MAIN EXAMINATIONS**

**FOR THE DEGREE  
OF  
BACHELOR OF SCIENCE, MEDICAL BIOTECHNOLOGY**

**COURSE CODE: BMB 325**

**COURSE TITLE: ENZYMOLOGY AND ENZYME  
TECHNOLOGY**

**DATE: 18<sup>TH</sup> APRIL 2023**

**TIME: 08.00 – 10.00AM**

---

**INSTRUCTIONS TO CANDIDATES**

This paper is divided into three sections, **A B** and **C**, carrying respectively: Multiple Choice Questions (**MCQs**), Short Answer Questions (**SAQs**) and Long Answer Questions (**LAQs**). **Answer all questions. DO NOT WRITE ON THE QUESTION PAPER.**

**TIME: 2 Hours**

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over

### SECTION A: Multiple Choice Questions (20 Marks)

- In non – competitive enzyme action:
  - $V_{\max}$  is increased
  - Apparent  $K_m$  is increased
  - Apparent  $K_m$  is decreased
  - Concentration of active enzyme molecule is reduced
- Which of the following regulatory actions involves a reversible covalent modification of an enzyme?
  - Phosphorylation of serine – OH on the enzyme
  - Allosteric modulation
  - Competitive inhibition
  - Non – competitive inhibition
- When (S) is equal to  $K_m$ , which of the following conditions exists?
  - Half the enzyme molecules are bound to substrate
  - The velocity of the reaction is equal to  $V_{\max}$
  - The velocity of the reaction is independent of substrate concentration
  - Enzyme is completely saturated with substrate
- In which of the following types of enzymes an inducer is not required?
  - Inhibited enzyme
  - Cooperative enzyme
  - Allosteric enzyme
  - Constitutive enzyme
- Lock and Key model of enzyme action proposed by Fisher implies that:
  - The active site is flexible and adjust to substrate
  - The active site requires removal of  $PO_4$  group
  - The active site is complementary in shape to that of the substrate
  - Substrates change conformation prior to active site interaction
- In competitive inhibition of enzymes actions
  - The apparent  $K_m$  is decreased
  - The apparent  $K_m$  is increased
  - $V_{\max}$  is decreased
  - Apparent concentration of enzyme molecules decreased
- In cases of ethylene glycol poisoning and its characteristics metabolic acidosis, treatment involves correction of the acidosis, removal of any remaining ethylene glycol, and administration of an inhibitor of alcohol dehydrogenase (ADH, alcohol:  $NAD^+$  oxidoreductase), the enzyme that oxidizes ethylene glycol to the organic acids that cause the acidosis. Ethanol (grain alcohol) frequently is the inhibitor given to treat ethylene glycol poisoning; it works by competitively inhibiting ADH. As a competitive inhibitor, ethanol:
  - Increases apparent  $K_m$  without affecting  $V_{\max}$ .
  - Decreases apparent  $K_m$  without affecting  $V_{\max}$
  - Increases apparent  $V_{\max}$  without affecting  $K_m$ .
  - Decreases apparent  $V_{\max}$  without affecting  $K_m$ .
- A 70 – year – old man was admitted to the emergency room with a 12 – hour history of chest pain. Serum creatine kinase (CK) activity was measured at admission (day 1) and once daily. On day 2 after admission, he experienced cardiac arrhythmia, which was

- terminated by three cycles of electric cardio-conversion, the latter two at maximum energy. Cardioconversion is performed by placing two paddles, 12 cm in diameter, in firm contact with the chest wall and applying a short electric voltage. Normal cardiac rhythm was reestablished. He had no recurrence of arrhythmia over the next several days. His chest pain subsided and he was released on day 10. Which one of the following is most consistent with the data presented?
- The patient had a myocardial infarction 48 to 64 hours prior to admission.
  - The patient had a myocardial infarction on day 2.
  - The patient had angina prior to admission
  - The patient had damage to his skeletal muscle on day 2
9. The coenzyme is:
- Often a metal
  - Always a protein
  - Often a vitamin
  - Always an inorganic compound
10. Which of the following is produced with the combination of apoenzyme and coenzyme:
- Holoenzyme
  - Enzyme substrate complex
  - Prosthetic group
  - Enzyme product complex
11. Blocking of enzyme action by blocking its active site is called as:
- Allosteric inhibition
  - Feedback inhibition
  - Competitive inhibition
  - Non – competitive inhibition
12. Enzyme catalyzing rearrangement of atomic grouping without altering molecular weight or number of atom is:
- Ligase
  - Isomerase
  - Oxidoreductase
  - Hydrolase
13. Zymogen or proenzyme is a:
- Modulator
  - Vitamin
  - Enzyme precursor
  - Hormone
14. Enzymes are polymers of:
- Hexose sugar
  - Amino acids
  - Fatty acids
  - Inorganic phosphate
15. This enzyme was first isolated and purified in the form of crystals:
- Urease
  - Pepsin
  - Amylase
  - Ribonuclease

16. The enzyme minus its coenzyme is known as:
  - a. Apoenzyme
  - b. Metalloenzyme
  - c. Isoenzyme
  - d. All of these
17. An uncatalyzed reaction involved:
  - a. High activation energy
  - b. Low activation energy
  - c. Balanced activation energy
  - d. All of these
18. Choose the incorrect statement about active site of an enzyme:-
  - a. The active site is a three dimensional cleft
  - b. The active site takes up a large part of the total volume of an enzyme
  - c. Substrates are bound to enzymes by multiple weak attractions
  - d. The specificity of binding depends on the precisely defined arrangement of atoms in an active site
19. A given substrate may be acted upon by a number of different enzymes, each of which uses the same substrate(s) and produces the same product(s). the individual members of a set of enzymes sharing such characteristics are known as:-
  - a. Group – specific enzymes
  - b. Isoenzymes
  - c. Substrate specific enzymes
  - d. Allosteric enzymes
20. Which statement out of the followings is incorrect about the effect of increasing temperature on enzyme activity:-
  - a. A ten – degree centigrade rise in temperature will increase the activity of most enzymes by 50 to 100%
  - b. Most animal enzymes rapidly become denatured at temperatures above 40°C
  - c. The storage of enzymes at 5°C or below is generally not suitable
  - d. Can affect the enzyme activity either positively or negatively

**SECTION B: Short Answer Questions (40 marks)**

1. Briefly describe the characteristics of an enzyme active site (8 marks).
2. Citing relevant examples briefly explain the meaning of  $K_m$  and indicate its significance (8 marks).
3. Briefly explain the meaning of feedback inhibition and give four (4) examples of enzymatic reactions where it is experienced (8 marks).
4. Using a suitable diagram, demonstrate the effect of pH enzymatic activity (8 marks).
5. Demonstrate the effects on competitive inhibition on both  $V_{max}$  and  $K_m$  using Michaelis plot (8 marks).

**Section C: Long Answer Questions (60 marks)**

1. Demonstrate six (6) major classes of enzymes with an appropriate chemical reaction they are involved in (20 marks).
2. Discuss in detail the laboratory techniques protocol employed in enzyme –linked immuno adsorbent assay and discuss its medical importance (20 marks).
3. Citing relevance examples, discuss seven (7) enzymes of clinical importance (20 marks).