Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	: ENZYME TECHNOLOGY
COURSE CODE	: BNN 30503
PROGRAMME CODE	: BNN
EXAMINATION DATE	: JULY/AUGUST 2023
DURATION	: 3 HOURS
INSTRUCTION	: 1. ANSWER **ALL** QUESTIONS.
	2.THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK.**
	3.STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 Enzymes are complex proteins that act as biological catalysts in living organisms.

(a) Ali conducted an experiment on an enzyme-catalyzed reaction at varying temperatures and pH levels. He then plotted his results and obtained a bell-shaped curve diagram for both varying temperature and pH. Analyze his findings on:

(i) Rate of reaction for different temperature.

(7 marks)

(ii) Rate of reaction for different pH.

(7 marks)

(b) Urease enzyme hydrolyzed urea at [S]= 0.03 mmol/L with a Km value of around 0.06 mmol/L. The initial velocity observed was $1.5x10^{-3}$ mmol/L.min^{-1}. Calculate the maximum velocity of the enzymatic reaction.

(5 marks)

(c) An enzyme hydrolyzed a substrate concentration of 0.03 mmol/L, the initial velocity was $1.5x10^{-3}$ mmol/L.min^{-1} and the maximum velocity was $4.5x10^{-3}$ mmol/L.min^{-1}. Calculate the Km value.

(6 marks)

Q2 An enzyme plays a crucial role in the chemical reactions that occur within cells, as they help to speed up these reactions without being consumed or altered in the process.

(a) Define the term 'enzyme regulation'.

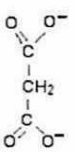
(2 marks)

(b) Explain the reasons why enzymes require regulation.

(5 marks)

(c) The enzyme succinate dehydrogenase catalyzes the conversion of succinate ions to fumarate ions as depicted in **Figure Q2(c).** Malonate ions are a competitive inhibitor of this enzyme reaction. Determine the category of the inhibitor with reasoning.

Succinate ion Fumarate ion



Malonate ion

Figure Q2(c)

(4 marks)

(d) Competitive inhibition is reversible. What measures would you suggest to overcome this type of inhibition and facilitate the desired enzymatic reaction?

(6 marks)

(e) Heavy metal poisoning by ions such as Ag^{+} or Hg^{2+} is an example of non-competitive inhibition. Explain briefly how these ions have an effect on enzyme structures which causes non-competitive inhibition.

(8 marks)

Q3 Biologically active enzymes may be extracted from any living organism.

(a) A very wide range of sources are used for commercial enzyme production from *Actinoplanes to Zymomonas*, from spinach to snake venom. Of the hundred or so enzymes being used industrially, over a half are from fungi and yeast and over a third are from bacteria with the remainder divided between animal (8%) and plant (4%) sources. Justify why microbes are preferred compared to plants and animals as sources of enzymes.

(5 marks)

(b) **Figure Q3(b)** shows the process of enzyme production for sale. Propose **FOUR (4)** methods for each process involved (fermentation, cell separation, enzyme concentration, enzyme purification, enzyme formulation).

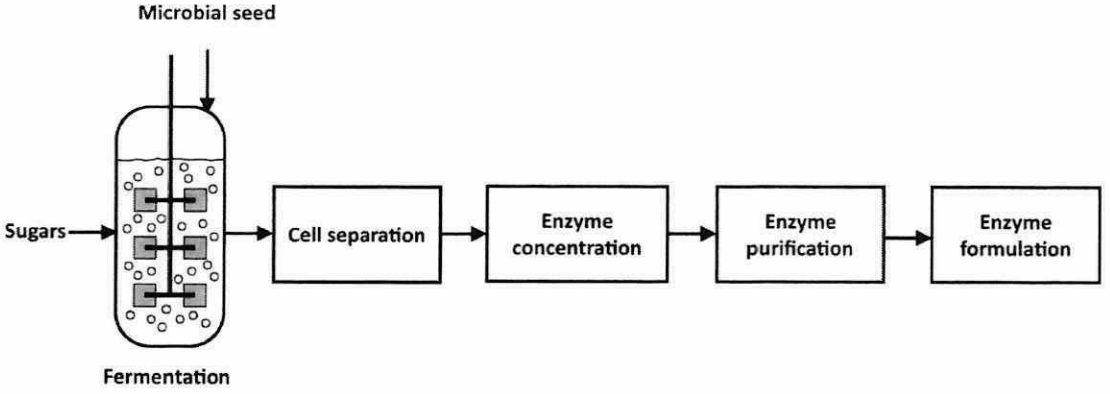


Figure Q3(b)

(20 marks)

Q4 Enzyme activity refers to the general catalytic properties of an enzyme, and enzyme assays are standardized procedures for measuring the amounts of specific enzymes in a sample.

(a) List **THREE (3)** approach to maintain enzyme activity.

(3 marks)

(b) Propose **SEVEN (7)** factors that must be considered by the experts for the revision of the safety evaluation of enzyme preparations for use in foods.

(14 marks)

(c) Discuss the application of enzyme in the:
(i) Food industries.
(ii) Detergent industries.

(8 marks)

-END OF QUESTIONS –