

Cork Institute of Technology

Bachelor of Science in Applied Biosciences and Biotechnology - Award

(NFQ – Level 7)

Autumn 2007

Biochemistry

(Time: 3 Hours)

Section A – Compulsory, attempt all 12 parts

Section B – Answer TWO questions only

Section C – Answer TWO questions only

Examiners:

Dr. Jim O'Mahony

Prof. R. J. Fitzgerald

Use a separate answer book for each section

Section A - Attempt all questions in this section (3 marks each)

- Q1. (a) Write a short note on the main characteristics of enzymes.
- (b) Draw a graph which clearly shows the relationship that exists between $[E]$, $[ES]$, $[S]$ and $[E_{\text{total}}]$ during a typical enzyme catalysed reaction.
- (c) Write an equation for any linearised derivation of the Michaelis Menten equation and show how it can be used to determine V_{max} and k_m from a straight line graph.
- (d) To what classes do the following enzymes belong?
- (i) 4.1.2.16 (ii) 5.1.3.81 (iii) 1.2.5.14
- (e) Briefly outline the phenomenon of excess substrate inhibition.
- (f) In relation to the monomeric enzyme units, what is the principle difference between the MWC and the KNF model for allosteric enzymes.
- (g) Outline the usefulness of the ELISA to a modern biochemistry laboratory.
- (h) Describe the benefits of immobilising enzymes.
- (i) Write a brief note on primary purification strategies.
- (j) Briefly, what needs to be considered in formulating an enzyme for sale?
- (k) Describe what you understand by the term “structural activity relationship”.
- (l) What types of changes may occur to a biological molecule during manufacture?

Section B

Answer 2 questions

(16 marks each)

- Q2. Write a detailed account of enzyme inhibition under the following headings:
- (i) Competitive V non-competitive inhibition (8 marks)
 - (ii) Linearised graphs (4 marks)
 - (iii) Applications for enzyme inhibitors (4 marks)
- Q3. (a) Clearly outline the experimental steps required to determine the effect of substrate concentration on enzyme activity for a conventional enzyme. (10 marks)
- (b) Why are these useful? (3 marks)
- (c) In an experiment we measure the initial rate of an enzyme reaction, v , with various concentrations of substrate, $[S]$. The concentration of enzyme is $8 \mu\text{M}$. We plot $1/v$ vs. $1/[S]$ and observe a straight line in which the y-intercept is 0.035 s and the slope is $29 \text{ s } \mu\text{M}$. What are the K_M and the V_{\max} values for this enzyme reaction? What is the turnover number for this enzyme? (3 marks)
- Q4. (a) Write a brief note highlighting the main characteristics of an allosteric enzyme. (8 marks)
- (b) Using a named example demonstrate how allosteric effectors can influence enzyme activity. (8 marks)

Section C

Answer 2 questions

(16 marks each)

- Q5. Using suitable examples, write an essay on the use of enzymes as analytical reagents.
(16 marks)
- Q6. “Drug design is largely dependant upon High Throughput Screening approaches”. Discuss this statement in detail using examples and suitable flowcharts to support your answer.
(16 marks)
- Q7. (a) Using appropriate diagrams to support your answer, write an essay on column chromatography from the perspective of purifying a protein. (10 marks)
- (b) Write the equations for calculating the following parameters which would be needed for protein purification experiments (i) specific activity, (ii) fold purification, (iii) % yield.
(6 marks)