

**CORK INSTITUTE OF TECHNOLOGY  
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ**

**Autumn Examinations 2008/09**

**Module Title:      Applied Enzymology**

**Module Code:              BIOL 7001**

**School:                      Science**

**Programme Title:**

Bachelor of Science in Applied Biosciences and Biotechnology - Award  
Bachelor of Science (Honours) in Herbal Science – Stage 3

**Programme Code:              SBIBI\_7\_Y3  
   SHERB\_8\_Y3**

**External Examiner(s):      Dr. Don Faller**  
**Internal Examiner(s):      Dr. Heloise Tarrant**

**Instructions:                      Answer Section A (Compulsory) and TWO questions from Section B.**

**Duration:                        2 Hours**

**Sitting:                          Autumn 2009**

**Requirements for this examination:      Scientific calculator**

**Note to Candidates:** Please check the Programme Title and the Module Title to ensure that you have received the correct examination paper.  
If in doubt please contact an Invigilator.

## Section A (50 Marks)

Q1. (Compulsory) Answer ten parts

- (a) Draw a graph showing how the energy distribution of a population of molecules changes with increasing temperature.
- (b) For an enzyme that follows Michaelis Menten kinetics, draw graphs showing the relationship between initial velocity (a) enzyme concentration and (b) substrate concentration.
- (c) Explain, with the aid of a graph, each of the following:
  - a. energy of activation
  - b. transition-state structure
  - c. exothermic and endothermic reactions.
- (d) Write a brief note on enzyme active sites.
- (e) Define each of the following terms: holoenzyme, apoenzyme, cofactor, prosthetic group.
- (f) Distinguish between reversible and irreversible inhibitors of enzyme reactions.
- (g) Define positive and negative allosterism.
- (h) For a multisubunit enzyme showing **cooperative** binding of substrate, draw a graph of  $v_o$  versus substrate concentration.
- (i) What advantage, if any, does the cooperative binding of substrate present to the cell?
- (j) For an enzyme reaction that follows Michaelis-Menten kinetics, define the following terms:  $V_{\max}$ ,  $K_m$ ,  $v_o$ ,  $k_{\text{cat}}$  and  $k_{\text{cat}}/K_m$ .

## Section B (50 Marks)

Answer any two questions.

- Q2. The kinetics of an enzyme was measured as a function of substrate concentration, in the presence and absence of each of two inhibitors ( $I_1$  and  $I_2$ ). The following results were obtained:

[S] ( $\mu\text{M}$ )	$v_o$ ( $\mu\text{mol/l/min}$ )		
	No inhibitor	Inhibitor ( $I_1$ )	Inhibitor ( $I_2$ )
3	10.4	4.1	2.1
5	14.5	6.4	2.9
10	22.5	11.3	4.5
30	33.8	22.6	6.8
90	40.5	33.8	8.1

- (a) Draw a Lineweaver-Burke plot of these results. (10 Marks)
- (b) What are the values of  $V_{\max}$  and  $K_m$  in the absence and in the presence of each inhibitor? (10 Marks)
- (c) In each case state what type of inhibition is seen. (5 Marks)
- Q3. You are asked to determine the specific activity of an enzyme solution; outline the steps of the assay you would design for this purpose. (25 Marks)
- Q4. Write an essay describing the methods used, and the benefits arising, from enzyme immobilisation. (25 Marks)