

**CORK INSTITUTE OF TECHNOLOGY**  
**INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ**

**Examinations 2007/08**

**Module Title:     Biochemistry**

**Module Code:**       **BICH S3002**

**School:**             Science

**Programme Title:**   Bachelor of Science in Applied Biosciences & Biotechnology - Award

**Programme Code:**   SBIBI\_7\_Y3

**External Examiner(s):**   Prof. G. Walsh  
**Internal Examiner(s):**   Dr. J. O'Mahony

**Instructions:**       Section A – Compulsory, attempt all 12 parts.  
                          Section B – Answer TWO questions only.  
                          Section C – Answer TWO questions only.  
                          **Use a separate answer book for each section**

**Duration:**       **2.5 HOURS**

**Sitting:**         Winter 2007

**Requirements for this examination:** N/A

**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

### **Attempt all questions in this section**

(3 marks each)

- Q1. (a) Sketch the active site from a typical enzyme and outline the main features.
- (b) Describe 2 ways to determine  $V_{\max}$  (at least one must involve an equation).
- (c) “Recording enzyme activity measurements is usually based on gathering indirect data”. State briefly what this means.
- (d) From the perspective of Enzyme nomenclature discuss briefly what you understand by the “Enzyme class”.
- (e) Write a brief account on the usefulness of “coupled assays”.
- (f) Explain briefly why spectrophotometry is used so extensively for enzyme analysis.
- (g) List 5 important criteria which should be met when designing analytical assays.
- (h) Outline the main advantages offered by enzyme immobilisation.
- (i) “The physical properties of an enzyme largely influence its purification strategy”. Explain ***briefly*** if you agree with this statement.
- (j) Outline the main hazards that may be likely to damage an enzyme during cell disruption.
- (k) Identify the key strategies employed during the initial cloning of insulin.
- (l) Outline the main modifications that may occur to a peptide after protein synthesis .

## Section B

### **Answer 2 questions**

(16 marks each)

- Q2. Using suitable examples describe in detail the importance of **graphs** in capturing information during enzyme analysis in relation to the following:
- (a) Michaelis Menten kinetics (4 marks)
  - (b) Linearised graphs (4 marks)
  - (c) Competitive inhibition (4 marks)
  - (d) Allostery (4 marks)
- Q3. Write a detailed account on reversible inhibition under the following 2 headings:
- (a) mode of action (8 marks)
  - (b) applications (8 marks)
- Q4. Write an essay on the principle and application of high throughput screening in the bio-pharmaceutical industry. (16 marks)

## Section C

### Answer 2 questions

(16 marks each)

- Q5. Using L-glutamate oxidase as an example, outline in detail a typical enzyme isolation, purification, and characterisation strategy from a micro-organism. (16 marks)
- Q6. Describe the principles and applications of protein engineering in relation to biopharmaceutical products. (16 marks)
- Q7. (a) From the following table calculate the (i) specific activity, (ii) fold purification & (iii) % yield for each purification step (3 marks each)

Starting material	Protein (mg)	Enzyme (units)	<i>Specific activity</i>	<i>Fold purified</i>	<i>% yield</i>
30% (NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	508	4144	?	?	?
Gel filtration	206	3885	?	?	?
Affinity Chromatography	37	2873	?	?	?

- (b) In an experiment we measure the initial rate of an enzyme reaction,  $v$ , with various concentrations of substrate,  $[S]$ . The concentration of enzyme is  $7.3 \mu\text{M}$ . We plot  $1/v$  vs.  $1/[S]$  and observe a straight line in which the y-intercept is  $0.0189_s$  and the slope is  $9.25_s \mu\text{M}$ . What are the  $K_M$  value and the  $V_{\max}$  for this enzyme reaction? What is the turnover number for this enzyme?  $33 \mu\text{M}$  of an inhibitor,  $E$ , is added and we observe that the y-intercept is  $0.0455_s$  and the slope is  $22.27 s \mu\text{M}$ . What kind of inhibition is this? (7 marks)