

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

**Semester 1 Examinations 2012/2013**

**Module Title: Applied Enzymology**

**Module Code:** BIOL7001

**School:** Science

**Programme Title:** Bachelor of Science in Applied Biosciences and Biotechnology  
Bachelor of Science (Honours) in Pharmaceutical Biotechnology  
Bachelor of Science (Honours) in Herbal Science

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

**External Examiner(s):** Dr. Gillian Gardiner  
**Internal Examiner(s):** Dr. Fiona O Halloran

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

**Duration:** 2 Hours

**Sitting:** Winter, 2012

**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 – compulsory

Answer **eight** of the following (each question carries equal marks)

**Q1.**

- (a) Distinguish between competitive and uncompetitive enzyme inhibition
- (b) Describe five common features of enzyme active sites
- (c) Define each of the following terms:  $V_{\max}$ ,  $K_m$ ,  $K_{\text{cat}}$ ,  $V_o$ ,  $K_i$
- (d) An enzyme that follows Michaelis-Menten kinetics has a  $K_m$  of 2  $\mu\text{M}$ . The initial velocity is 0.2  $\mu\text{mol/min}$  at a substrate concentration of 200  $\mu\text{M}$ . What is the initial velocity when substrate concentration is equal to (a) 2 mM and (b) 1  $\mu\text{M}$ ?
- (e) An enzyme has a  $K_m$  of 0.5 mM and a maximum velocity of 15  $\mu\text{mol/min}$ . What is the initial velocity when substrate concentration is 0.2 mM?
- (f) An enzyme with a  $K_m$  of 5 mM yields 5  $\mu\text{mol}$  of product per minute in the presence of saturating substrate concentration. A non-competitive inhibitor, at 10  $\mu\text{M}$ , lowers the activity to 3  $\mu\text{mol/min}$ . Calculate the  $K_i$  for the inhibitor.
- (g) List five ways to protect enzymatic activity during enzyme extraction procedures.
- (h) Using an example you have studied, describe what is meant by a 'coupled-enzyme assay'.
- (i) Describe, using graphs where appropriate, factors that can increase reaction rates
- (j) List five strategies that are available to a cell to regulate enzyme activity

**(40 Marks)**

**Section B. Answer two questions**

**Q2.**

- (a) Covalent immobilization is the most important enzyme immobilization method. Describe this method in detail.

**(15 Marks)**

- (b) List five advantages of enzyme immobilization technology.

**(15 marks)**

**Q3.** Spectrophotometric methods are routinely used to detect changes in substrate or product concentrations that occur during enzyme catalyzed reactions. Using examples of specific assays you have studied discuss how these concentration changes can be monitored spectrophotometrically.

**(30 marks)**

**Q4.** 'Cells can achieve a substantial change in catalytic activity with small changes in substrate concentration by using a combination of allosteric modulation and cooperative binding of substrate'.

Discuss this statement using the regulation of the enzyme Phosphofructokinase in the glycolytic pathway to support your answer.

**(30 marks)**