

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

**Semester 1 Examinations 2009/10**

**Module Title:     Applied Enzymology**

**Module Code:**                BIOL7001

**School:**                        School of Science

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

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

**External Examiner(s):**     Dr. D. Faller  
**Internal Examiner(s):**     Dr. H. Tarrant

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

**Duration:**                    2 hours

**Sitting:**                        Winter 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) Define each of the following terms: holoenzyme, apoenzyme, cofactor, prosthetic group.
- (b) Write a note on enzyme active sites.
- (c) The Michaelis-Menten and Briggs-Haldane models of enzyme reactions make a number of assumptions, designed to keep kinetic measurements and calculations as simple as possible. List these assumptions.
- (d) List the five main strategies used by living organisms to regulate enzyme activity.
- (e) Distinguish between competitive, uncompetitive and mixed inhibition of enzyme activity. Use reaction schemes to illustrate your point.
- (f) For a multisubunit enzyme showing **cooperative** binding of substrate:
  - i. Draw a graph of  $v_o$  versus substrate concentration
  - ii. Explain the shape of the curve in terms of the enzyme's transition between T and R states
  - iii. On this graph, indicate the changes you might expect to see in the presence of an allosteric activator and an allosteric inhibitor.
- (g) What advantage, if any, does the cooperative binding of substrate present to the cell?
- (h) An enzyme with a  $K_m$  of 7 mM yields 10  $\mu\text{mol}$  of product per minute in the presence of saturating substrate concentration. A non-competitive inhibitor, at 8  $\mu\text{M}$ , lowers the activity to 5  $\mu\text{mol}/\text{min}$ . Calculate the  $K_i$  for the inhibitor.
- (i) Draw Cleland plots showing the different mechanisms by which multisubstrate enzyme reactions can occur. Give an example in each case.
- (j) Distinguish between the catalytic rate constant and the specificity constant of an enzyme. What information might the specificity constant yield?

## Section B (50 marks)

Answer any two questions.

- Q.2** Discuss in detail the advantages and disadvantages of three different methods for monitoring the rate of an enzyme-catalyzed reaction. Illustrate your answer with practical examples.
- Q.3** Critically discuss the techniques and considerations when extracting enzymes from cells.
- Q.4** Write an essay describing the methods used, and the benefits arising, from enzyme immobilisation.