

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 μmol of product per minute in the presence of saturating substrate concentration. A non-competitive inhibitor, at 8 μM , 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.