

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

**Autumn Examinations 2014/15**

**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:** Autumn 2015

**Requirements for this examination:** Scientific calculator, graph paper

**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 (40 Marks)

### Q1.

- (a) Define each of the following terms:  $V_{\max}$ ,  $K_m$ ,  $V_o$ , and  $K_i$

(10 Marks)

- (b) An enzyme that follows Michaelis-Menten kinetics has a  $K_m$  of 7mM and yields 10 $\mu$ mol product per minute at saturating substrate concentration. A non-competitive inhibitor lowers the activity to 5  $\mu$ mol/min. Given that the concentration of the inhibitor is 810 $\mu$ M, calculate the  $K_i$  for the inhibitor.

(10 Marks)

- (c) In an enzyme catalyzed reaction investigating the effect of temperature on initial velocity rates the following data was generated:

Table 1

Reaction tube	Temp ( $^{\circ}$ C)	$V_o$ ( $\mu$ mol/min)
1	25	0.105
2	30	0.155
3	37	0.159
4	48	0.139

- (i) Using the data in Table 1 draw a graph of the natural log of initial velocity ( $\ln V_o$ ) versus  $1/\text{temperature}$  (Kelvin units).
- (ii) Determine the slope of the line through the linear portion of the curve
- (iii) From the slope calculate the Arrhenius activation energy ( $E_a$ ) for the enzyme catalyzed reaction

Information provided:  $0^{\circ}\text{C} = 273.16\text{K}$ ;  $R$  (gas constant) = 8.3Joules /mol.K

(20 Marks)

## Section B. Answer two questions

Q2.

- (a) Explain, using appropriate graphs, the difference between the effects of a non-competitive inhibitor and an uncompetitive inhibitor on the kinetics of an enzyme.

(20 marks)

- (a) List four additional strategies that are available to a cell to regulate enzyme activity

(10 marks)

Q3.

‘Allosteric enzymes frequently do not show Michaelis-Menten kinetics due to cooperative binding of substrate molecules’.

Discuss this statement, using graphs to support your answer and explaining the underlined terms.

(30 Marks)

Q4.

- (a) Discuss the techniques available to extract enzymes from cells

(20 Marks)

- (b) List five ways to protect enzymatic activity during enzyme extraction procedures.

(10 Marks)