

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

**Autumn Examination 2014**

**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. Tom O'Connor  
**Internal Examiner(s):** Dr. Fiona O Halloran

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

**Duration:** 2 Hours

**Sitting:** Autumn, 2014

**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 (40 Marks)

### Q1.

(a) Given the following data for an enzyme catalyzed reaction:

[S] (M)	$V_o$ (nmol/l/min)
$6.25 \times 10^{-6}$	15.00
$7.5 \times 10^{-5}$	56.25
$1.00 \times 10^{-4}$	60.00
$1.00 \times 10^{-3}$	74.90
$1.00 \times 10^{-2}$	75.00

- (i) Estimate the values of  $V_{max}$  and  $K_m$
- (ii) What would  $V_o$  be at  $[S] = 2.5 \times 10^{-5}$  M?
- (iii) What would  $V_o$  be at  $[S] = 5.0 \times 10^{-5}$  M if the enzyme concentration was doubled?  
Explain your answer.

20 marks

- (b) Differentiate between the terms ‘enzyme activity’ and ‘specific activity’ of an enzyme.

5 marks

In a reaction catalyzed by the enzyme  $\beta$ -galactosidase the activity of the enzyme was determined to be  $0.376 \mu\text{mol ONPG (substrate) hydrolysed / min / ml enzyme}$ . Using the following data calculate the specific activity of the enzyme:

Cuvette No	B-gal stock solution (ml)	H <sub>2</sub> O (ml)	Absorbance @ 280nm
1	1.0	1.0	0.429
2	0.4	1.6	0.173

Assume light path is 1cm and the molar absorptivity coefficient for  $\beta$ -galactosidase ( $\epsilon$ ) =  $0.8 (\text{mg/ml})^{-1} \text{cm}^{-1}$

15 marks

## Section B. Answer two questions (60 Marks)

### Q2.

(a) List the six enzyme classification groups

6 marks

(b) Explain, with the aid of a graph, each of the following:

- a. Energy of activation
- b. Transition-state structure
- c. Exothermic reaction.

12 marks

(c) For an enzyme that follows Michaelis Menten kinetics, use graphs to explain the relationship between initial velocity and (a) enzyme concentration and (b) substrate concentration.

12 marks

### Q3.

(a) Describe the method used by *E. coli* to regulate the activity of enzymes required to metabolise the disaccharide lactose.

20 marks

(b) List two other ways that can be used to regulate enzyme activity.

10 marks

### Q4.

‘An enzyme catalyst increases the rate of a biochemical reaction by stabilizing the transition-state (TS) structure, making it easier to form as it will be a lower energy structure’.

Discuss this statement making reference to the mechanisms that enzymes can use to stabilize the TS structure. Provide a detailed description of at least one of these mechanisms and name an enzyme you have studied that uses this mechanism of catalysis.

30 marks