

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)
6.25×10^{-6}	15.00
7.5×10^{-5}	56.25
1.00×10^{-4}	60.00
1.00×10^{-3}	74.90
1.00×10^{-2}	75.00

- (i) Estimate the values of V_{max} and K_m
- (ii) What would V_o be at $[S] = 2.5 \times 10^{-5} \text{ M}$?
- (iii) What would V_o be at $[S] = 5.0 \times 10^{-5} \text{ M}$ 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 β -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 ₂ 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 β -galactosidase (ϵ) = $0.8 (\text{mg/ml})^{-1} \text{ cm}^{-1}$

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