

CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Semester 2 Examinations 2009

Module Title: Enzymes and Metabolism

Module Code: BIOL6017

School: Science

Programme Title: Bachelor of Science in Applied Biosciences – Year 2
Bachelor of Science (Honours) in Herbal Science – Year 2

Programme Code: SBIOS_7_Y2
SHERB_8_Y2

External Examiner(s): Dr. Don Faller
Internal Examiner(s): Dr. Heloise Tarrant

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

Duration: 2 hours

Sitting: Summer 2009

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 (50 marks)

Q1. (compulsory) Answer all parts

- (a) Write brief notes on the general features of enzyme active sites.
- (b) Define the terms v_o , V_{max} , K_m and k_{cat} .
- (c) Draw a graph of the reaction progress curve for an enzyme catalysed reaction. How would you determine v_o from this graph?
- (d) Draw graphs illustrating the relationship between the rate of an enzyme catalysed reaction (v_o) and
 - a. enzyme concentration
 - b. substrate concentration
 - c. pH
 - d. temperature

In each case, give a biochemical explanation for the shape of the curve.

- (e) List five mechanisms used by organisms to regulate the rate of enzyme-catalysed reactions. Write brief notes on each mechanism.
- (f) Define the terms **anabolism** and **catabolism**.
- (g) Draw a diagram summarising the three stages in extraction of energy from food stuffs in humans.
- (h) Draw the structure of ATP and explain why the hydrolysis of the phosphodiester bonds is thermodynamically such a favourable reaction.
- (i) Distinguish between **substrate level phosphorylation** and **oxidative phosphorylation**, and give an example of where each occurs in the cell.
- (j) What is a coenzyme? What are the roles of NADH and $FADH_2$ in metabolism?

Section B (50 marks)

Answer any two questions.

- Q.2** The kinetics of an enzyme are measured as a function of substrate concentration in the presence and absence of an inhibitor.

[S] (μM)	Rate of Reaction ($\mu\text{mol/ml/min}$)	
	No inhibitor	Inhibitor
3	10.4	4.1
5	14.5	6.4
10	22.5	11.3
30	33.8	22.6
90	40.5	33.8

Use a Lineweaver-Burk plot to determine the values of K_m and V_{\max} , in the presence and absence of the inhibitor. (20 marks)

What type of inhibition is this? (5 marks)

- Q.3** Write an essay on glycolysis, indicating clearly the energy-consuming reactions and the energy-yielding reactions. Include a discussion of the mechanisms used to control the rate of this pathway. (25 marks)

- Q.4** In all organisms, pyruvate is the end-product of glycolysis. However, the fate of pyruvate will differ under aerobic and anaerobic conditions. Describe, in detail, the three possible fates of pyruvate and the circumstances under which each will occur. (25 marks)