

CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Semester 2 Examinations 2012

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
Bachelor of Science (Honours) in Pharmaceutical Biotechnology – Year 2

Programme Code: SBIOS_7_Y2
SHERB_8_Y2
SPHBI_8_Y2

External Examiner(s): Dr. Don Faller, Dr. Julia Green, Dr. Jerry Bird
Internal Examiner(s): Dr. Heloise Tarrant

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

Duration: 2 hours

Sitting: Summer 2012

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) Draw graphs illustrating the relationship between the rate of an enzyme-catalyzed reaction (v_o) and
 - a. enzyme concentration
 - b. substrate concentration
 - c. pH
 - d. temperature.In each case offer a **brief** biochemical explanation for the shape of the curve.
- (c) Write brief notes on **irreversible** and **reversible** enzyme inhibitors.
- (d) What is an allosteric enzyme? Define the terms negative allosterism and positive allosterism.
- (e) Distinguish between **kinetic** (continuous-monitoring) and **fixed-time** enzyme assays; what factors would you consider when choosing one method over the other?
- (f) Distinguish between **substrate level phosphorylation** and **oxidative phosphorylation**, and give an example of where each occurs in the cell.
- (g) What are the three possible fates of pyruvate in living cells? Under what circumstances will each occur?
- (h) The respiratory redox chain is comprised of a series of proteins embedded in the inner mitochondrial membrane – name these proteins and explain their function.
- (i) What is the relationship between an **α -keto acid** (such as oxaloacetate) and an **α -amino acid** (such as aspartate)?
- (j) Under what conditions will the following hormones be released:
 - a. glucagon,
 - b. insulin and
 - c. adrenaline?

Section B (50 marks)

Answer any two questions.

- Q.2** (i) The kinetics of an enzyme were measured as a function of substrate concentration. Use a **Lineweaver-Burk** plot to determine the values of V_{\max} and K_m of the enzyme.

[Pyruvate] (mM)	v_o ($\mu\text{mol/min/ml}$)
1.5	0.21
2.0	0.24
3.0	0.28
4.0	0.33
8.0	0.40
16.0	0.45

(15 marks)

- (ii) The Enzyme Commission of the International Union of Biochemistry has classified enzymes according to the reaction they catalyse. List the six main categories of enzymes and briefly describe the general reaction catalysed.

(10 marks)

- Q.3** (i) Describe (using structural diagrams) the ten steps of the glycolytic pathway, indicating clearly the energy-consuming reactions and the energy-yielding reactions. (15 marks)

- (ii) Briefly explain how blood glucose levels, cellular energy levels and the supply of “building blocks” for anabolic pathways are all involved in the control of this pathway.

(10 marks)

- Q.4** (i) Draw a simple summary of the citric acid cycle, naming the different intermediates and the number of carbon atoms in each compound. Also show where in the cycle CO_2 and reducing power are produced. (15 marks)

- (ii) The citric acid cycle is often described as **amphibolic**. What does this mean? (5 marks)

- (iii) The citric acid cycle is a start point in the synthesis of many important biological macromolecules – list three of these. (5 marks)