

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

**Autumn Examinations 2010**

**Module Title: Enzymes and Metabolism**

**Module Code:** BIOL6017

**School:** Science

**Programme Title:** B.Sc. in Applied Biosciences  
Bachelor of Science in Herbal Science, Stage 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:** Autumn 2010

**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) What is the pH optimum of an enzyme? Draw a graph illustrating the relationship between reaction rate and pH for an enzyme-catalysed reaction. Offer a biochemical explanation for the shape of the curve.
- (c) Using an example, explain the term **zymogen**.
- (d) Distinguish between **kinetic** (continuous monitoring) and **fixed-time** enzyme assays.
- (e) Write brief notes on **irreversible** and **reversible** enzyme inhibitors.
- (f) Define the term **inhibition constant** ( $K_i$ ).
- (g) Define the terms **anabolism** and **catabolism** and give an example of
  - a. an anabolic pathway and
  - b. a catabolic pathway.
- (h) What are the three possible fates of pyruvate in living cells? Indicate under which conditions each one will occur.
- (i) What is the relationship between an  **$\alpha$ -keto acid** (such as oxaloacetate) and an  **$\alpha$ -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 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)

(ii) Draw a graph of  $v_o$  versus substrate concentration and indicate how you would determine  $V_{max}$  and  $K_m$  from this graph. On the curve, indicate where the reaction rate is

- i. First order with respect to substrate concentration?
- ii. Zero order with respect to substrate concentration? (5 marks)

(iii) Explain how you would set up an assay to determine the activity of an enzyme in a test sample. (10 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** Oxidative phosphorylation is the final stage in the energy-yielding metabolism of aerobic organisms. Write an essay on this process making use of diagrams to illustrate your answer. (25 marks)