CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Semester 2 Examinations 2011

Module Title: Enzymes and Metabolism

Module Code: **BIOL 6017**

School: Science

Programme Title: Bachelor of Science in Applied Biosciences
Bachelor of Science (Honours) in Herbal Science
Bachelor of Science (Honours) in Pharmaceutical Biotechnology

Programme Code: **SBIOS_7_ Y2**
SHERB_8_Y2
SPHBI_8_Y2

External Examiner(s): **Dr. D. Faller**
Internal Examiner(s): **Dr Siobhán O' Sullivan, Dr. Olivia Cashman**

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

Duration: 2 Hours

Sitting: Semester 2 2011

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.
If in doubt please contact an Invigilator.

Section A (50 marks)

Q1. (compulsory) Answer **all** parts.

a) Draw an energy activation diagram and on it show how activation energy is determined in the presence and absence of a catalyst.

b) Define the terms v_o, V_{max}, K_m and k_{cat}.

c) Define the units of the terms V_{max}, v_o and K_m

d) Draw a table summarising two main types of reversible enzyme inhibition under the following headings:

   a. Type of Inhibition
   b. Effect on V_{max} and K_m of an enzyme-catalysed reaction
   c. Lineweaver Burke plot obtained in the presence of increasing concentrations of inhibitor

e) What is the significance of kcat/K_m ratios? Give an example to demonstrate your understanding of the importance of this ratio.

f) Distinguish between a holoenzyme, an apoenzyme, cofactors and coenzymes

g) Enzymes are highly **efficient**, highly **specific** catalysts that are almost always **protein** in nature. Write brief notes on each of these characteristics.

h) Define the terms anabolism, catabolism and amphibolic pathway.

i) Draw the structure of ATP and explain why the hydrolysis of the phosphodiester bonds is thermodynamically such a favourable reaction.

j) Distinguish between substrate level phosphorylation and oxidative phosphorylation and give an example of where each occurs in the cell.

Section B (50 marks)

Q2. Describe in detail the steps involved in the glycolytic pathway. Indicate clearly the energy consuming reactions and the energy yielding reactions. Discuss the mechanisms used to control the rate of this pathway.

Q3. Oxidative phosphorylation is the end point in the energy-yielding metabolism of aerobic organisms. Using **illustrations** discuss the steps involved in this process. Comment how uses of inhibitors have aided in our understanding of the sequential steps in this process.

Q4. The kinetics of an enzyme is measured as a function of substrate concentration in the presence and absence of an inhibitor. The rate of the reaction is measured using the following units: μmol/ml/min.

[S] (μM)	Rate of Reaction (-I)	Rate of Reaction (+I)
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 Burke plot to determine the values of K_m and V_{max}, in the presence and absence of the inhibitor. What type of inhibition is evident from the graph?