

CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Semester 2 Examinations 2010

Module Title: Enzymes and Metabolism

Module Code: BIOL6017

School: Science

Programme Title: Bachelor of Science in Applied Biosciences
 Bachelor of Science in Herbal Science

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 2010

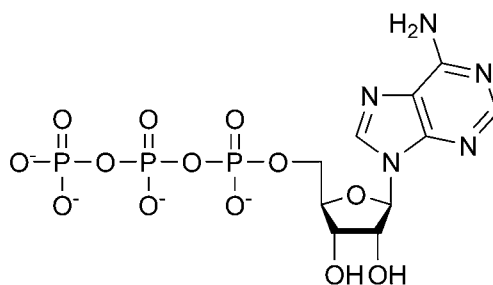
Requirements for this examination: Scientific Calculator, Graph Paper

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) Draw a graph illustrating the relationship between reaction rate and temperature for an enzyme-catalysed reaction. Explain why increasing temperature will eventually inactivate an enzyme.
- (d) Give an example of a biotechnical application of a thermo-stable enzyme.
- (e) Draw a table summarising three main types of reversible enzyme inhibition under the following headings;
 - i. type of inhibition,
 - ii. effect on V_{\max} and K_M of an enzyme-catalysed reaction,
 - iii. Lineweaver-Burke plot obtained in the presence of increasing concentrations of inhibitor.
- (f) What is an allosteric enzyme? Define the terms negative allosterism and positive allosterism.
- (g) Distinguish between **substrate level phosphorylation** and oxidative phosphorylation, and give an example of where each occurs in the cell.
- (h) What are the three possible fates of pyruvate in living cells? Indicate under which conditions each one will occur.
- (i) What is the function of the Cori cycle?
- (j) Name the following molecule. Use an arrow to show the location(s) of the high energy phosphoanhydride bond(s) in the structure.



Section B (50 marks)

Answer any two questions.

- Q2.** (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

(20 marks)

- (ii) Given that each assay was performed using 1 mg of pure enzyme in a 3 ml reaction mixture, use your value of V_{\max} to calculate the specific activity ($\mu\text{mol/min/mg}$) of the LDH preparation. (5 marks)

- Q3.** (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)

- Q4.** (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 some of these. (5 marks)