

CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Autumn Examinations 2009

Module Title: Enzymes and Metabolism

Module Code: BIOL6017

School: Science

Programme Title: Higher Certificate 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 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.

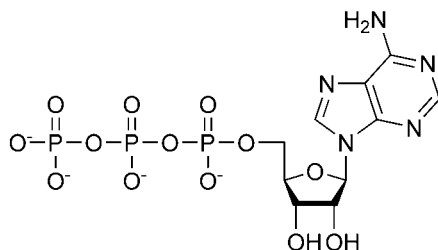
Section A (50 marks)

Q1. (Compulsory) Answer all parts

- (a) Explain the term energy of activation (E_a).
- (b) Define the term **inhibition constant** (K_i).
- (c) 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.

- (d) Enzymes are highly **efficient**, highly **specific** catalysts that are almost always **protein** in nature. Write brief notes elaborating on each of these characteristics.
- (e) Draw a table summarising three 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.
- (f) Name the following molecule. Use an arrow to show the location(s) of the high energy phosphoanhydride bond(s) in the structure.

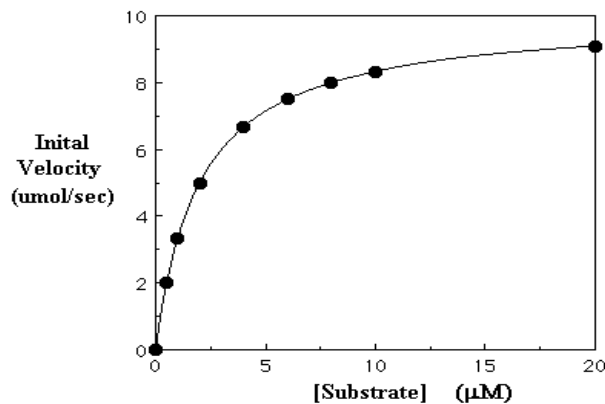


- (g) Draw a simple summary of the citric acid cycle, naming the different intermediates and the number of carbon atoms in each compound. Also show where in the cycle CO_2 and reducing power are produced.
- (h) The citric acid cycle is often described as amphibolic. What does this mean?
- (i) What are the three possible fates of pyruvate in living cells? Indicate under which conditions each one will occur.
- (j) Draw a diagram summarising the stages in the extraction of energy from foodstuffs.

Section B (50 marks)

Answer any two questions.

- Q.2 (a)** Use this graph of enzyme reaction rate (v_o) versus substrate concentration $[S]$, to indicate
- (i) the V_{\max} and K_m values of this enzyme,
 - (ii) the region of the graph where v_o is independent of substrate concentration, and
 - (iii) the region of the graph where v_o is first order (directly proportional) to substrate concentration.



(10 marks)

- (b)** The conversion of fumarate to L-malate is one of the reactions of the Citric Acid Cycle. It is catalysed by the enzyme fumarase. Use the following experimental data to construct a Lineweaver-Burk plot and determine the K_m and V_{\max} for this reaction.

[Fumarate] (mM)	v_o (mmol/l/min)
2.0	2.5
3.3	3.1
5.0	3.6
10.0	4.2

(15 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)