CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Autumn Examinations 2013

Metabolic Biochemistry – Continuous Assessment

Module Code: BIOL6017

School: Science

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

Programme Code: SBIOS_7_Y2
SHERB_8_Y2
SPHBI_8_Y2
SNHSC_8_Y2

External Examiner(s): Dr. Gillian Gardiner
Internal Examiner(s): Dr. Fiona O Halloran

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

Duration: 2 hours

Sitting: Autumn 2013

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 (40 marks)

Q1. *(compulsory)* Answer <u>all</u> parts.

(a) 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 Michaelis-Menten plot and a Lineweaver-Burke plot and determine the K_m and V_{max} for this reaction.

[Fumarate] (mM)	v_o **(µmol/ml/min)**
2.0	1.5
3.3	3.1
5.0	3.6
10.0	4.0

(10 marks)

(b) The enzyme invertase catalyses the hydrolysis of a disaccharide into its monosaccharide constituents at optimal reaction conditions.

a. Write a chemical reaction to represent this event, naming the substrate and products involved

b. What is meant by optimal pH? Draw a suitable graph that supports your answer.

c. Describe two other reaction conditions that affect the rate of an enzyme catalysed Reaction

d. Invertase is widely used in the food industry, describe one application of this enzyme.

(10 marks)

(c) The Glucose Hexokinase assay was used to measure blood glucose levels in two patient samples. A control sample and a glucose standard were simultaneously analysed. The following results were obtained:

Sample	**Absorbance @ 340nm**
Patient 1	0.38
Patient 2	0.60
Control sample	0.52
Glucose standard	0.45

Control reference range; 5.19-7.03 mmol/Lt
Normal blood glucose reference range (adult); 4.0 – 5.9mmol/Lt
Glucose standard: 5.5mmol/Lt

Using the information provided

a. Calculate the concentration of glucose present in each sample

b. Is the assay in control? Explain your answer

c. Based on the results obtained for each patient comment on the significance of these results

d. Describe the principle of the Hexokinase assay

(10 marks)

(d) An enzyme with a K_m of 5 mM yields 5 µmol of product per minute in the presence of saturating substrate concentration. A non-competitive inhibitor, at 10 µM, lowers the activity to 3 µmol/min. Calculate the K_i for the inhibitor.

(10 marks)

Section B (60 marks)

Answer any <u>three</u> questions.

Q2. (a) Explain the term energy of activation (E_a)?

(5 Marks)

(b) Differentiate, using suitable equations and graphs, between three types of reversible enzyme inhibitors.

(15 Marks)

Q.3 (a) List five general features of enzyme active sites

(5 Marks)

(b) Describe five mechanisms used by organisms to regulate the rate of enzyme-catalysed reactions.

(15 Marks)

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Q.4 The glucose transported into cells is almost all phosphorylated (by ATP) to form glucose-6-phosphate.

(a) Describe two reasons why glucose is phosphorylated in the cell? Name the enzyme responsible for phosphorylating glucose in glycolysis.

(10 Marks)

(b) Phosphofructokinase is a major metabolic control point in glycolysis. List the substrate and product associated with this enzyme. Describe two ways that the activity of this enzyme is regulated

(10 Marks)

Q5. (a) Describe two reasons why gluconeogenesis is an important pathway for humans.

(10Marks)

(b) Describe the role of glucagon in regulating blood glucose levels.

(10 Marks)