

CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Autumn Examinations 2016

Metabolic Biochemistry (continuous assessment module)

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: CR_SBIOS_7_Y2
CR_SHERB_8_Y2
CR_SPHBI_8_Y2
CR_SNHSC_8_Y2

External Examiner(s): Dr Brendan O'Donnell

Internal Examiner(s): Dr Fiona O'Halloran
Dr Karen Finn

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

Duration: 2 hours

Sitting: Autumn 2016

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 all parts.

(a) In an experiment involving the enzyme invertase the effect of pH on enzyme activity was investigated. The substrate of the reaction was sucrose, which was hydrolysed into its constituent monosaccharides (reducing sugars) under defined conditions, with a reaction time of 5 minutes.

(i) Name the monosaccharides of sucrose. (2 marks)

(ii) What is meant by the term 'reducing' sugar'? (4 marks)

(iii) Using the data in Table 1, draw a standard curve of absorbance (@540nm) vs amount reducing sugars liberated ($\mu\text{mol}/1.5\text{ml}/5\text{min}$). (6 marks)

(iv) From the standard curve determine the amount of reducing sugars liberated in the enzyme assays at the different pH's investigated ($\mu\text{mol}/1.5\text{ml}/5\text{min}$) and add this data to Table 1. (7 marks)

(v) Express your results in units of enzyme activity and add this data to Table 1. (5 marks)

(vi) Using a graph, show how you can estimate the optimum pH for the enzyme invertase. (6 marks)

Table 1: Absorbance data (@540nm) for reducing sugar standards and enzyme assays investigating effect of pH change on enzyme activity

Standard Curve		Enzyme Assays			
Reducing sugars ($\mu\text{mol}/1.5\text{ml}/5\text{min}$)	A ₅₄₀	pH	A ₅₄₀	Reducing sugars ($\mu\text{mol}/1.5 \text{ ml}/5 \text{ min}$)	Enzyme Activity (_____)
0	0	2.5	0.293		
1.5	0.304	3.5	0.602		
3.0	0.653	4.5	1.018		
4.5	1.010	5.5	0.766		
6.0	1.324	6.5	0.628		

(b) An enzyme has a K_m of 0.35mM and a maximum velocity of 10 μ mol/min

- (i) What is the initial velocity at a substrate concentration of 0.2mM? (6 marks)
- (ii) In the presence of an inhibitor the V_{max} decreases to 5 μ mol/min but K_m remains unchanged. What is the nature of the inhibition? (2 marks)
- (iii) Define the meaning of K_m (2 marks)

Section B (60 marks)

Answer any three questions.

Q2.

- a) Enzymes can be classified based on the type of reaction catalysed. List three of these categories and briefly describe the type of reaction catalysed, giving examples of an enzyme in each category. (8 marks)
- b) Describe four mechanisms used by organisms to regulate enzyme activity. (12 marks)

Q3.

- a) List two types of reversible inhibitors. (2 marks)
- b) For each type of reversible inhibitor named above, briefly describe its mechanism of action and how it effects the K_m and V_{max} of an enzyme. (18 marks)

Q4.

- a) Explain the purpose of homolactic fermentation in animal cells (e.g. skeletal muscle cells) with respect to glycolysis. (4 marks)

- b) Compare and contrast the three metabolic control points of both glycolysis and gluconeogenesis. Include the substrate, enzyme and product for each control point in your answer. (16 marks)

Q5.

- a) State the 'Chemiosmotic theory'. (5 marks)
- b) Describe, with the aid of a labelled diagram, the sequence of events that occur within the electron transport chain to facilitate the transfer of electrons to the terminal electron acceptor. (15 marks)