

**CORK INSTITUTE OF TECHNOLOGY**  
**INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ**

**Autumn Examinations 2016**

**Module Title: Structural Biochemistry (continuous assessment module)**

**Module Code:** BIOL6024

**School:** Science

**Programme Title:** BSc in Applied Biosciences  
BSc (Honours) in Herbal Science  
BSc (Honours) in Pharmaceutical Biotechnology  
BSc (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) You are provided with stock solutions of 0.1M Acetic Acid and 0.1M Sodium Acetate. Using the Henderson-Hasselbach equation, calculate the volumes of acid and base required to prepare 500 ml of a 0.03M Acetate buffer, pH 4.5, using these stock solutions. Mention any precautions you would take to ensure your buffer has the correct pH ( $pK_a$  of Acetic Acid = 4.75). Show all calculations.

(10 marks)

(b)

- (i) State the Beer-Lambert Law and explain its application in determining unknown concentrations.

(5 marks)

- (ii) A solution of NADH shows an absorbance of 0.42 at 340 nm. What is the concentration of the solution? Assume light path of 1cm and the Molar Absorption Coefficient ( $\epsilon$ ) =  $6220 \text{ M}^{-1} \text{ cm}^{-1}$ . Show all calculations.

(5 marks)

- (c) In an experiment to estimate the glucose concentration of two test solutions (T1 and T2) the Glucose oxidase assay was applied and the following absorbance data was generated:

**Table 1: Absorbance data @ 500nm for Glucose standards (0-20mM) and tests solutions**

Tube Number	Standard (mM) / Test sample	Absorbance @500nm
1	0 mM Glucose	0
2	4 mM Glucose	0.15
3	8 mM Glucose	0.30
4	12 mM Glucose	0.45
5	16 mM Glucose	0.60
6	20 mM Glucose	0.75
7	T1 (undiluted)	0.375
8	T1 (2-fold dilution)	0.192
9	T2 (undiluted)	1.0
10	T2 (2-fold dilution)	0.58

- (i) Using the data in Table 1 estimate the glucose concentrations of T1 and T2 test samples. (10 marks)
- (ii) Write the enzyme catalysed reactions that the glucose oxidase assay is based on and indicate which component of the reactions is monitored for absorbance change with a  $\lambda_{\text{max}}$  of 500nm. (6 marks)
- (iii) Name one compound that can interfere with the glucose oxidase assay and explain how this interference occurs. (4 marks)

## Section B (60 marks)

Answer any three questions.

### Q2.

- (a) Using diagrams describe two types of secondary structures in proteins (8 marks)
- (b) Describe three different types of non-covalent chemical interactions that give rise to protein secondary and tertiary structure. (6 marks)
- (c) In relation to protein structure what is meant by the term '*protein denaturation*' and explain how changing temperature can cause this effect. (6 marks)

### Q3.

- (a) Draw the 'Haworth' and 'Fisher' projection of D-glucose. (8 marks)
- (b) Draw a diagram illustrating the linkage of two glucose molecules to form the disaccharide maltose. What is the by-product of this reaction? (6 marks)

(c) Explaining your selection, which of the following are reducing sugars?

- Maltose, Sucrose, Starch

(6 marks)

**Q4.**

(a) Describe, with the aid of a labelled diagram, the process of DNA replication in prokaryotic cells. (15 marks)

(b) Briefly describe a repair mechanism/repair pathway that can be used by cells to repair damaged DNA. (5 marks)

**Q5.**

(a) List four biological functions of lipids. (4 marks)

(b) Explain why oleic acid (18 carbons, one *cis* bond) has a lower melting point than arachidic acid (20 carbons, saturated). (6 marks)

(c) Describe the general structure and function of triglycerides (triacylglycerols) and phosphoglycerides, illustrating your answer with appropriate diagrams. (10 marks)