

CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Semester 1 Examinations 2009/10

Module Title: Structural Biochemistry

Module Code: BIOL6024

School: Science

Programme Title: Higher Certificate in Applied Biosciences
Bachelor of Science in Analytical and Pharmaceutical Chemistry

Programme Code: CR006
CR007

External Examiner(s): Professor Gary Walsh
Internal Examiner(s): Dr. Heloise Tarrant, Dr. Brendan O'Connell

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

Duration: 2 hours

Sitting: Winter 2009

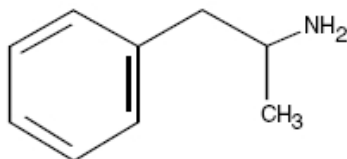
Requirements for this examination: Scientific Calculator

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) Draw and name the structure of one amino acid in each of the following groups:
- neutral and hydrophobic
 - basic (positively charged)
 - acidic (negatively charged)
- (b) Name two structural features that will affect the melting point of a fatty acid.
- (c) Outline the different levels of protein structure.
- (d) Derivatives of monosaccharides include sugar phosphates, deoxy sugars, amino sugars and sugar acids. Using D-glucose as your base molecule, draw an example of each of these derivatives.
- (e) Draw a diagram illustrating the condensation of two amino acids to form a dipeptide
- (f) Use the Henderson-Hasselbach equation to determine the ionization state of amphetamine at pH 7.4. The pK_a of the amino group is 9.8.



- (g) Draw a diagram illustrating how DNA is packaged to fit within the nucleus.
- (h) Draw the structure of ATP.
- (i) What is a thiol-reducing agent?
- (j) What is the T_m of a piece of DNA? How would you determine this in the lab? Why is it useful?

Section B (50 marks)

Answer any two questions.

Q2. (a) List the main roles of proteins in biological systems. [5 marks]

(b) Define protein denaturation. List five ways in which proteins may be denatured. Which of these is likely to be reversible? [10 marks]

(c) What is meant by the isoelectric point of a protein? Explain how isoelectric focusing may be useful in separating mixtures of amino acids and protein. [10 marks]

Q3 (a) Describe the classical experiment performed by Meselson and Stahl in 1958 which illustrates the semi-conservative nature of DNA replication. [10 marks]

(b) Give an account of DNA replication. Include in your answer the chain elongation reaction, replication fork and the synthesis of leading and lagging strands. [15 marks]

Q4 (a) List the main biological roles of carbohydrates. [5 marks]

(b) Draw a diagram illustrating the linkage of two glucose molecules to form the disaccharide maltose. Is maltose a reducing sugar? Explain your answer. [10 marks]

(c) Both cellulose and starch consist of D-glucose units linked by 1,4 glycosidic bonds. Despite this a person on a diet of starch will gain weight and a person on a diet of cellulose (grass) will starve. With the aid of diagrams, explain this fact. [10 marks]