

CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Semester 1 Examinations 2008/09

Module Title: Structural Biochemistry

Module Code: BIOL6024

School: Science

Programme Title: Bachelor of Science in Applied Biosciences – Stage 2
Bachelor of Science in Analytical and Pharmaceutical Chemistry –
Stage 2
Bachelor of Science (Honours) in Herbal Science – Stage 2

Programme Code: SBIOS_7_Y2
SCHEM_7_Y2
SHERB_8_Y2

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 2008

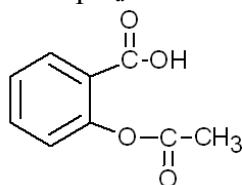
Requirements for this examination: Scientific Calculator

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) Name and draw five different functional groups that can be found on biomolecules.
- (b) What are stereoisomers? Name and draw a simple example.
- (c) Draw a diagram illustrating the linkage of two glucose molecules to form the disaccharide maltose. Name the bond that joins the two bonds.
- (d) Define protein denaturation and list four ways in which proteins may be denatured. Is the effect likely to be reversible in any of these cases?
- (e) Draw and name the structure of one amino acid in each of the following groups:
 - a. neutral and hydrophobic
 - b. sulphur-containing
 - c. acidic (negatively charged)
- (f) Use the Henderson-Hasselbach equation to determine the ionization state of acetylsalicylic acid (Asprin) at pH 7.4. The pK_a of the carboxylic acid group is 2.98.



- (g) Name two structural features that will affect the melting point of a fatty acid.
- (h) Draw the structure of a triglyceride and a phosphoglyceride.
- (i) Define the terms **pH**, **pK_a** and **pI**.
- (j) Draw a diagram illustrating how DNA is packaged to fit within the nucleus.
- (k) Draw the structure of ATP.
- (l) List the nitrogen-containing bases found in DNA and in RNA. In each case state whether the base is a purine or a pyrimidine.

Section B (50 marks)

Answer any two questions.

- Q2.** (a) List the main roles of proteins in biological systems. [5 marks]
- (b) Write notes on the different non-covalent interactions that drive protein folding. Explain how these weak interactions are responsible for the specificity of enzyme-substrate and antibody-antigen binding reactions. [10 marks]
- (c) Define the four levels of protein structure and write notes explaining how each contributes to the final biologically active structure of the protein. [10 marks]
- Q3** (a) Explain how the Meselson-Stahl experiment proved that DNA undergoes semi-conservative replication in *E. coli*. [10 marks]
- (b) Write a short essay describing the process of replication. Use diagrams wherever possible to illustrate your answer. [15 marks]
- Q4** (a) List the main biological roles of lipids. [5 marks]
- (b) Draw the full structure of decanoic acid. [5 marks]
- (c) Write brief notes on each of the different classes of lipids, using diagrams to illustrate your points. [15 marks]