

**CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ**

Autumn Examinations 2008/09

Module Title: Bioanalytical Science V

Module Code: BIOT7002

School: Science

Programme Title: Bachelor of Science in Applied Biosciences & Biotechnology

Programme Code: SBIBI_7_Y3

External Examiner(s): Prof Gary Walsh

Internal Examiner(s): Dr L Goold
Ms A Ward

Instructions: Attempt 2 questions from Section A and 2 questions from Section B

Duration: 2 Hours

Sitting: Autumn 2009

Requirements for this examination:

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

- Q1. The gas chromatographic analysis of sample mixture was carried out using temperature programming and a capillary column containing a non polar stationary phase. The sample was introduced to the column by the split injection technique. The chromatogram displayed a number of peaks. Two peaks were identified as compound A (retention time, $t_r=1.5$ minutes and base width, $W=30$ seconds) and compound B (retention time, $t_r=1.75$ minutes and base width, $W=45$ seconds)
- (a) Describe the process of temperature programming and explain why this process might be used in preference to isothermal analysis. (6 marks)
 - (b) Discuss the design and performance characteristics of capillary columns (6 marks)
 - (c) Briefly describe the split injection technique and explain why it is necessary in the analysis. (4 marks)
 - (d) Calculate the resolution, R between compounds A and B. (4 marks)
- Q2. (a) Construct a labelled block diagram of a High Performance Liquid Chromatography (HPLC) instrument and use it to **briefly** describe the function of each component. (10 marks)
- (b) Explain gradient, isocratic and reverse modes of HPLC analysis. (10 marks)
- Q3. (a) Describe the fundamental modes of vibration of the CO_2 molecule. For each mode of vibration, indicate whether the mode is infra-red active or infra-red inactive and explain why. (6 marks)
- (b) Sketch a labelled block diagram of a Fourier Transform Infra-Red Spectrophotometer and briefly describe its mode of operation. (Note:- a detailed explanation of the principles of operation of an interferometer is not necessary) (8 marks)
- (c) Identify the 4 main regions of an infra-red spectrum (4000 cm^{-1} - 400 cm^{-1}) where correlation between structural features(i.e bond types) in a molecule and transmittance peaks are made and give the significant types of bond vibrations associated with each region. (6 marks)

SECTION B

- Q4. (a) Describe, with the aid of a diagram the principle of a heterogeneous non-competitive Enzyme Linked Immunosorbent Assay (ELISA) (10 marks)
- (b) Outline the main optimisation parameters required for a non-competitive ELISA (10 marks)
- Q5. Write an overview of Polyacrylamide Gel Electrophoresis (PAGE) under the following headings:
- (a) Preparation of gels (3 marks)
- (b) Experimental design considerations (10 marks)
- (c) Analysis post electrophoresis (7 marks)
- Q6. (a) Write a brief overview of internal quality control in a bioanalytical laboratory. (10 marks)
- (b) Outline the main validation parameters required for an immunoassay validation protocol. (10 marks)