CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Examinations 2007/08

Module Title: Bioanalytical Science

Module Code: BASC S3001

School: Science

Programme Title: **Bachelor of Science in Applied Biosciences & Biotechnology - Award**

Programme Code: **SBIBI_7_Y3**

External Examiner(s): Prof. G. Walsh

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

Instructions: **Answer a total of FIVE questions. Anwer TWO questions from Section A. Answer THREE Questions From Section B.**

Duration: **3 HOURS**

Sitting: Winter 2007

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. Write an account of the 4 main classes of chromatography i.e adsorption, partition, ion exchange and size exclusion. In the case of each class, indicate the nature of the stationary phase, the possible physical states of the mobile phase and explain the basis for separation of a mixture of components based on their interaction with the stationary phase. (20 Marks)

Q2. 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, $\mathbf{t_r}$=1.5 minutes and base width,**W**=30 seconds) and compound B (retention time, $\mathbf{t_r}$=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.(3 marks)

(b) Discuss the design and performance characteristics of capillary columns (4 marks)

(c) Briefly describe the split injection technique and explain why it is necessary in the analysis. (3marks)

(d) The polarity and volatility of the components determine their elution order. Briefly explain (4 marks)

(e) Mention a practical procedure which would help to identify the 2 compounds. (3 marks)

(f) Calculate the resolution, R between compounds A and B. (3 marks)

Q3 (a) Describe the mull and KBr disc methods of solid sample preparation in infra-red analysis

(5 marks)

(b) In the case of ethanoic acid, CH_3COOH (non -linear molecule), predict the number of fundamental modes of vibration and briefly explain why the infra-red spectrum of this substance doesn't contain the same number of absorption bands. Mention two significant absorption bands in the infra-red spectrum that would confirm the presence of the –COOH functional group and indicate the nature and approximate location of these bands. (6 marks)

(c) Construct a labelled block diagram of a Fourier Transform Infra-Red Instrument and use it to explain how an infra-red spectrum of a compound is obtained (Note:- a detailed explanation of an interferometer is not necessary). What is the principal advantage of this type of instrument when compared to the older dispersive type instrument?

(9 marks)

Section B

Q4 (a) Write a brief overview of classification in immunoassay systems. (10 marks)

(b) Describe, using a labelled diagram, the principle of a heterogeneous competitive reagent limited enzyme immunoassay. (10 marks)

Q5. (a) Write short notes on each of the following;

(i) Random error (3 marks)

(ii) Systematic error (3 marks)

(iii) External Quality Assessment (2 marks)

(b) Outline how you would assess the accuracy of a bioanalytical laboratory method. (12 marks)

Q6. (a) Outline the main parameters required to validate an immunoassay. (10 marks)

(b) Write a short note on non-isotopic labels used in immunoassay. (10 marks)

Q7. (a) Centrifugation is an important preparatory technique used in biochemical research. Write a brief overview of the types and application of centrifugation used in the modern laboratory environment. (10 marks)

(b) Outline the main experimental considerations in the design of a Polyacrylamide Gel Electrophoresis (PAGE) system. (10 marks)