

CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Semester 1 Examinations 2008/09

Module Title: Bioanalytical Science V

Module Code: BIOT 7002

School: Science

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

Programme Code: SBIBI_7_Y3

External Examiner(s): Prof. Gary Walsh

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

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

Duration: 2 Hours

Sitting: Winter 2008

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. (a) Construct a labelled block diagram of a gas chromatographic instrument and use the diagram to give a brief description of how a sample solution containing a mixture of volatile compounds is separated and analysed by this instrument. (8 Marks)

(b) An alcoholic beverage sample was analysed by gas chromatography for its ethanol content using the internal standard method of quantitation. Isopropanol was chosen as the internal standard and was added to the sample and standards of ethanol so that all solutions had a constant concentration of isopropanol. The following data were obtained for all solutions analysed:-

%(v/v) Ethanol	Area of Ethanol Peak (integration counts)	Area of Isopropanol Peak (integration counts)
2	660947	1812442
4	1269649	1800540
6	1861078	1799212
8	1709135	1652320
10	3081370	1803780
sample	1185944	1701250

(i) Use a graphical method to accurately determine the %(v/v) of ethanol in the sample. (8 Marks)

(ii) Comment on the usefulness of the internal method of quantitation in gas chromatographic analysis. (4 Marks)

- Q2. (a) Compare the processes of isocratic and gradient elution modes of HPLC analysis and explain why the latter mode might be required for successful separation when the former mode is unsatisfactory. (5 Marks)
- (b) Explain the following HPLC instrumental features and comment on their significance:-
(i) instrument dead volume (ii) detector wavelength programming (iii) guard column. (9 Marks)
- (c) Describe how resolution, R and theoretical plate value, N can be calculated from chromatographic data. Mention how retention times are increased in reverse phase HPLC analysis. (6 Marks)
- Q3. Write notes on the following:-
- (a) ion exchange chromatography (10 Marks)
- (b) Fourier Transform infra-red spectroscopy (10 Marks)

Section B

- Q4. (a) Outline the main optimisation parameters required for a non-competitive sandwich immunoassay. (10 Marks)
- (b) Write a brief overview of immunoassay validation. In your answer, outline the key parameters required to perform validation experiments for a newly developed immunoassay system. (10 Marks)
- Q5. (a) Define each of following terms:
- (i) Centrifugal force (3 Marks)
 - (ii) Relative Centrifugal Force (RCF) (3 Marks)
 - (iii) Revolutions per minute (RPM) (3 Marks)
- (b) Briefly outline the main types of centrifugal separations. (8 Marks)
- (c) List the main categories of rotors used in centrifugation. (3 Marks)
- Q6. (a) Outline the important experimental considerations in designing a Polyacrylamide Gel Electrophoresis (PAGE) system. (10 Marks)
- (b) Describe the principle of ONE of the following immunoassay systems:
- (i) Particle agglutination immunoassay
 - (ii) Heterogeneous reagent excess ELISA
 - (iv) Homogeneous EMIT immunoassay
- Illustrate your answer with diagrams. (10 Marks)