

Cork Institute of Technology  
Bachelor of Science in Cell & Molecular Biology – Award

(NFQ Level 7 )

Summer 2006

**Bioanalytical Science**

(Time: 3 Hours)

Instructions

Answer a total of FIVE questions.

Answer TWO questions from Section A.

Answer THREE questions from Section B.

Examiners: Dr. T. Beresford

Ms. C. Devaney

Dr. L. Goold

Ms. A. Ward

**Section A**

- Q1. (a) Describe the nature of the stationary phase as well as the underlying principles of separation in (i) ion exchange chromatography and (ii) size exclusion chromatography. (10 marks)
- (b) Indicate clearly how the following chromatographic data can be determined from a chromatogram.
- (i) Column Theoretical Plate Value,  $N$
  - (ii) Resolution,  $R$
  - (iii) Capacity Factor,  $k^1$
- (7 marks)
- (c) Describe the changes, if any, that are likely to occur to (i)  $N$  and (ii) retention time of a component when any one of the following chromatographic parameters are changed:-
- (1) Flow rate of mobile phase,  $F$
  - (2) Particle size of stationary phase,  $u$  and
  - (3) Length of column,  $L$ .
- (3 marks)
- Q2. (a) construct a labelled block diagram of a gas chromatographic instrument and use it to **briefly** describe the function of each component. (10 marks)
- (b) Compare the design and performance characteristics of packed and capillary (open tubular) columns in gas chromatographic analysis. (10 marks)

Q3. Write notes on the following topics:-

- (a) The role of mobile phase in developing separation in reverse phase HPLC analysis.  
(Your discussion should include reference to typical examples of mobile and stationary phase chemicals as well as the process of gradient elution). (10 marks)
- (b) Comparison of Fourier Transform and Dispersive Infra-Red Spectroscopy. (10 marks)

## Section B

- Q4. (a) Describe using diagrams where appropriate
- (i) a qualitative and
  - (ii) a quantitative immunoanalytical technique that involves immunoprecipitation. (10 marks)
- (b) Outline the principle of a non-competitive heterogeneous enzyme immunoassay system. (10 marks)
- Q5. (a) Outline the main parameters and important criteria to be considered for
- (i) an optimisation study
- OR
- (ii) a validation study
- For any immunoassay system. (10 marks)
- (b) Outline one method of assessing the accuracy of an analytical method. (10 marks)

- Q6. (a) Write short notes on the method of SDS-Polyacrylamide Gel Electrophoresis and its application as an important analytical technique. (10 marks)
- (b) Outline two methods used for the quantitation of proteins or nucleic acids after electrophoresis. (10 marks)
- Q7. (a) Radioisotopes are used as “labels” in analytical biochemistry.
- (i) Name two radioisotopes which are used for this purpose. (2 marks)
  - (ii) Write the decay equation for one of the radioisotopes you have named. (2 marks)
  - (iii) Distinguish between “internal” and ‘external’ labels. (2 marks)
  - (iv) Describe, with the aid of a diagram, the operation of a scintillation counter.  
Give one advantage of this detector. (8 marks)
- (b) (i) Compare, briefly, the fixed angle rotor centrifuge with the horizontal rotor centrifuge. (4 marks)
- (ii) The term RCF is used with reference to a centrifuge.  
What does it mean? What setting on a centrifuge determine the RCF? (2 marks)