

Cork Institute of Technology
Bachelor of Science in Cell and Molecular Biology - Award
December 2004
Bioanalytical Science
(Time: 3 Hours)

Section A – Compulsory, attempt all parts
Section B – Answer TWO questions only
Section C – Answer THREE questions only

Examiners: Ms. A. Ward
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Prof. R. O'Kennedy

Section A (25 marks)

- Q1. (a) Define each of the following validation parameters:
- (i) Limit of quantitation
 - (ii) Specificity
 - (iii) Total error (3 marks)
- (b) Describe with the aid of simple diagrams the assay formats for:
- (i) a two site sandwich immunoassay for antigen
 - (ii) a two site antibody capture assay for antibody (3 marks)
- (c) Describe the principle of gel filtration chromatography. Give an example of this experimental technique. (3 marks)
- (d) Write a brief account with diagrams of an immunoanalytical technique which involves immunoprecipitation. (3 marks)
- (e) Define each of the following:
- (i) polyclonal antibody
 - (ii) monoclonal antibody
 - (iii) non specific binding in immunoassays (3 marks)
- (f) In each case state the class of the following enzymes
- a) 2.1.3.45 b) 3.1.4.11 c) 5.3.2.23 d) 1.4.6.11
 - e) 4.9.11.30 (2.5 marks)
- (g) Briefly describe the effect of a competitive inhibitor on enzyme activity. (2.5 marks)
- (h) Give an explanation for the term “steady state assumption” in relation to enzyme kinetics. (2.5 marks)
- (i) Briefly outline the importance of iso-enzymes in bio-analytical assays. (2.5 marks)

Section B (30 marks)

- Q2. Compare and contrast hyperbolic (Michaelis/Menten) and linear (Lineweaver/Burke) kinetics in terms of accurately assessing enzyme/substrate relationships. (15 marks)
- Q3. Describe 2 established models for explaining the phenomenon of sigmoidal kinetics. (15 marks)
- Q4. Outline the importance of column chromatography in protein purification experiments. (15 marks)

Section C (45 marks)

- Q5. (a) Describe using a diagram, the principle of a homogeneous enzyme immunoassay system. (8 marks)
- (b) Give a brief overview of the categories of labels in use in modern immunoassay systems. (7 marks)
- Q6. Write a brief account of the assessment of analytical methods under the following headings:
- (i) Precision
 - (ii) Accuracy
- Outline the statistical methods used for data comparison in both methods. (15 marks)
- Q7. (a) Describe the basic components of a biosensor (3 marks)
- (b) Give a brief description and an example of each of the following bio-catalytic membrane electrodes:
- (i) Enzyme electrodes
 - (ii) Bacterial electrodes
 - (iii) Immunosensors (6 marks)
- (c) Describe, with a simple diagram, the components and principle of an oxygen based electrochemical biosensor. (6 marks)
- Q8. Outline the principle and application of polyacrylamide gel electrophoresis as an important bio-analytical technique.
- In your answer, describe the common techniques used for the identification and quantitation of separated components after electrophoresis. (15 marks)