

Cork Institute of Technology
Bachelor of Science in Applied BioSciences – Stage 1

(NFQ Level 7)

Summer 2007

Bioanalytical Science

(Time: 3 Hours)

Answer **FIVE** questions as follows:

Question 1 is compulsory

Answer **two** questions from section B

Answer **any other two** questions

Examiners: Ms. R. Kiernan

Ms. E. Flannery

Dr. M. Sheahan

Prof. R. Fitzgerald

Use separate answer books for each section

Relative atomic masses:

K-39; Br-79.9; Na-23; P-31; O-16; N-14; Ag-107.8

Section A

- Q1. (a) List two safety precautions that should be taken when using a strong acid in the laboratory.
- (b) (i) Convert 0.03ml to microlitres (μL)
- (ii) State which of the following pipettes would be used to deliver this volume:
P100, P1000 or P5000
- (c) Distinguish between the terms 'precision' and 'accuracy'.
- (d) (i) What is the weight in grams of 1ml of water?
- (ii) What is the weight in grams of 1 ml of glycerol (specific gravity = 1.26)?
- (e) (i) Give the quantities of glucose and water required to make up a 2.5% w/v glucose solution
- (ii) Explain why better accuracy is achieved by preparing this solution in a volumetric flask rather than a conical flask
- (f) (i) What is meant by the pH of a solution?
- (ii) List two ways in which the pH of a solution can be measured in the laboratory
- (g) Draw a rough graph to illustrate what is meant by the λ_{max} of a solution. Label the axes appropriately
- (h) Define the R_f value as used in thin layer chromatography

- (i) With the aid of a rough graph, illustrate the changes in pH that occur during an amino acid titration as 1ml aliquots of HCl are added to the amino acid. Indicate the pK_1 on your graph.
 - (j) (i) Why is dye used with the sample when loading an electrophoresis gel?
 - (ii) Give one precaution that should be taken at the loading stage to ensure good results.
- (20 marks)

Q2. Write an essay on the major sources of error in laboratory analyses. Comment on how these errors can be minimized to guarantee the quality of the results produced.

(20 marks)

- Q3. (a) Explain the meaning of each of the following terms: buffer, specific gravity, % w/v, % w/w and % v/v. (10 marks)
- (b) Calculate the weights of KH_2PO_4 (136g/mol) and Na_2HPO_4 (142g/mol) respectively required to prepare a phosphate buffer that has a concentration of 0.2M, a pH of 6.4 and a pK_a of 6.8 (10 marks)

Section B

- Q4. Use the underwritten guidelines to write a comprehensive note on fire safety in a laboratory environment
- (a) Identify the criteria that have to be considered when assessing the risk. (2 marks)
 - (b) What measures may be taken to minimize the fire hazard. (5 marks)
 - (c) List the different types of fire extinguishers available. Comment briefly on how the different types may be distinguished from each other. (3 marks)
 - (d) Comment on the suitability or otherwise of the different types of fire extinguishers for different classes of fire. (4 marks)
 - (e) Appropriate actions to be taken in the event of a laboratory fire. (6 marks)

- Q5. (a) Name four routes by which chemicals can enter the body. (2 marks)
- (b) Substance A is an acute toxin while substance B is a chronic toxin. Briefly comment on the consequences of exposure to both substances. (4 marks)
- (c) In terms of their toxic effects, differentiate between mutagens, teratogens and carcinogens. (6 marks)
- (d) How many grams of potassium bromide (KBr) are contained in 300cm^3 of 0.150M of KBr? (2 marks)
- (e) What volume (in cm^3) of 0.150M Na_3PO_4 contains 5.00g of solute? (3 marks)
- (f) Determine the molarity of an aqueous solution of silver nitrate (AgNO_3) which was prepared by dissolving 6.871g of AgNO_3 in water and diluting to a final volume of 250cm^3 (3 marks)
- Q6. (a) With acetic acid (CH_3COOH) as an example, differentiate between the empirical formula and the molecular formula for a compound. (4 marks)
- (b) In the case of each of the underwritten categories, identify specific criteria that have to be considered for their safe storage
- (i) Flammable materials. (3 marks)
- (ii) Corrosive substances. (3 marks)
- (iii) Poisonous materials. (3 marks)
- (iv) Explosive agents. (3 marks)
- (v) Water sensitive and air sensitive chemicals. (4 marks)

