

Cork Institute of Technology

Bachelor of Science in Applied BioSciences – Stage 1

(NFQ Level 7)

Autumn 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: S-32; O-16; H-1

Section A

Q1. Answer **all** of the following: *each part carries 2 marks*

- (a) List **two** safety precautions that should be taken when dealing with a minor fire outbreak in the laboratory
- (b) (i) Convert 0.025ml to microlitres (μL)
(ii) State which of the following pipettes would be used to deliver this volume: P100, P1000 or P5000?
- (c) Comment on the precision of the following set of data (units are in g):
5.0, 5.01, 4.99, 5.0, 5.01, 5.0, 6.02, 5.01, 4.99, 5.0

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- (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 sodium chloride (NaCl) and water required to make up a 5% (w/v) NaCl solution
- (ii) Describe the correct procedure for the preparation of this solution.

- (f) (i) Give the names of two pH indicators commonly used in the laboratory
- (ii) Give two reasons why a pH meter gives a more accurate measurement of pH than indicators.

- (g) Sketch a rough graph to illustrate what is meant by the λ_{\max} of a solution. Label the axes appropriately

- (h) In a thin layer chromatography experiment, the solvent moved 5cm and the test sample spot moved 1cm. Calculate the R_f value of the test sample

- (i) With the aid of a rough graph, illustrate the changes in pH that occur during an amino acid titration as 1ml aliquots of NaOH are added to the amino acid. Indicate the pK_2 on your graph.

- (j) Give labelled diagrams to illustrate the appearance of a suspension of bacteria **before** and **after** centrifugation at 5000rpm for 15 minutes

(20 marks)

Q2. (a) In the event of a laboratory accident, outline the first aid treatment that would be administered for the following injuries:

- (ii) Corrosive chemical splash to the eyes (5 marks)
- (iii) A cut obtained from broken glass (5 marks)

(b) List the contents of a first aid box (4 marks)

(c) Discuss the role of first aid personnel (6 marks)

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Q3. Write detailed notes on all of the following:

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|--------------------------------------|-----------|
| (a) Biological Safety Cabinets (BSC) | (5 marks) |
| (b) pH meter | (5 marks) |
| (c) Accuracy and precision | (5 marks) |
| (d) Laboratory safety | (5 marks) |

Section B

Q4. (a) Perform and show all the appropriate calculations for parts (i) to (iii):

- (i) Determine the molarity of concentrated sulphuric acid (H_2SO_4) given the % composition is 96% w/w and the density is 1.84 g/cm^3 (4 marks)
- (ii) What volume of the conc. sulphuric acid indicated in (i) above needs to be diluted to 1000 cm^3 to give a $1.6\text{M H}_2\text{SO}_4$ solution? (2 marks)
- (iii) The following aliquots of $1.6\text{M H}_2\text{SO}_4$ were transferred to a series of 50cm^3 volumetric flasks: 30cm^3 , 20cm^3 , 10cm^3 , and 5cm^3 . Determine the concentration of each solution (2 marks)
- (iv) Outline the precautions that need to be taken for safe handling and accurate preparation of the sulphuric acid solutions (3 marks)

(b) (i) Give four properties of a primary standard reagent. Give an example of one such agent (3 marks)

(ii) Differentiate between primary standard grade, reagent grade and special purpose grade chemicals on the basis of their purity and application (6 marks)

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Q5. (a) Discuss carcinogens by elaborating on each of the following points:

- (ii) Methods for their identification (6 marks)
- (iii) Primary, secondary and cocarcinogens (6 marks)
- (iv) Measures to prevent exposure (3 marks)

(b) Briefly explain how exposure to radiation can lead to a variety of different cancers. In your answer identify the type(s) of radiation that are most likely to lead to cancer (5 marks)

Q6. (a) Outline the main functions of the Health and Safety Authority (4 marks)

(b) Give an account of the responsibility of (i) the employer and (ii) the employee as outlined by the Safety, Health and Welfare Act (1989) (8 marks)

(c) Write a comprehensive note on safety statements (8 marks)