

Cork Institute of Technology

Higher Certificate in Science in Applied Biology-Stage I

(NFQ – Level 6)

Summer 2006

Bioanalytical Science

(Time: 3 Hours)

Answer **five** questions
Answer **two** from each Section
Answer the **5th question** from either A or B

Examiners: Ms. R. Kiernan
Dr. M. Sheahan
Prof. R. Fitzgerald

Use **separate answer books** for each Section

Section A

Q1. (a) Describe the appropriate actions to be taken in each of the following cases:

- (i) Safe handling and treatment of spillages in a chemistry laboratory
 - (ii) Safe and appropriate disposal procedures for chemical reagents
- (10 marks)

- (b) As their supervisor, list the instructions you would give laboratory personnel with regard to their behaviour and conduct in the laboratory
- (4 marks)

- (c) Diethyl ether ($C_4H_{10}O$) is a clear, colorless, highly flammable liquid. It is used as a common solvent and has been used as a general anaesthetic. It is commercially prepared by heating Ethanol (C_2H_5OH) in the presence of acid according to the following reaction equation



- (i) How many grams of diethyl ether (74g / mole) are produced when 1.5 moles of ethanol (46g / mole) are heated? Assume 100% conversion of the alcohol to the ether.
- (2 marks)
- (ii) Determine the percent yield of the reaction if 0.445 moles of diethyl ether are obtained from 50.0g of ethanol
- (4 marks)

- Q2. (a) Write a comprehensive note on laboratory safety signs. Use the following guidelines: their purpose, the different categories of safety signs available in terms of shape, color schemes and type of information they contain. Support your answer with examples (10 marks)
- (b) Write a brief note on two of the following:
(i) Radiation hazards in the laboratory
(ii) Flammability hazards in the laboratory
(iii) Carcinogens (10 marks)
- Q3. (a) Distinguish between primary standard grade, reagent grade and special purpose grade chemicals on the basis of their purity and application (6 marks)
- (b) List the different mechanisms by which electrocution can occur AND clearly differentiate between them? (8 marks)
- (c) Explain the importance of using the correct fuse and appropriate cable both for the operation of a device and the safety of its users (6 marks)

Section B

- Q4. What first aid treatment would you administer to a colleague who suffered severe burns in a laboratory accident? Comment on the depth and extent of burns in determining danger to life and the outcome of the accident (20 marks)
- Q5. (a) Calculate the weight of Sodium Carbonate (106g/mol) and Sodium Hydrogen Carbonate (84g/mol) required to make a 0.2 M bicarbonate buffer of pH 10 and pK_a of 10.25 (10 marks)
- (b) Prepare 50cm³ of a 0.4 M Hydrochloric acid (36.5g/mol) solution from concentrated HCl (36% w/w) given s.g. = 1.18g cm⁻³ (5 marks)
- (c) Comment on the possible sources of error in the preparation of the reagents in parts (a) and (b) above (5 marks)
- Q6. The decontamination of cultures and items contaminated by bio hazardous agents is a vital step towards protection of laboratory personnel from infectious disease. Discuss (20 marks)