

# Cork Institute of Technology

Higher Certificate in Science in Applied Biology – Stage 1

(National Certificate in Science in Applied Biology – Stage 1)

(NFQ – Level 6)

Summer 2005

## Laboratory Practice

(Time: 3 Hours)

### Instructions

Answer **FIVE** questions.

Answer **TWO** from each Section.

Answer the **5<sup>th</sup> question** from either A or B.

Use **separate answer books** for each Section.

Examiners: Ms. R. Kiernan

Dr. M. Sheahan

Dr. T. Beresford

## Section A

Q1. A  $10.00\text{cm}^3$  sample of an aqueous solution of Calcium Hydroxide  $\{\text{Ca}(\text{OH})_2\}$  is neutralized by  $23.30\text{cm}^3$  of  $0.02\text{M}$  nitric acid ( $\text{HNO}_3$ ) to produce Calcium Nitrate  $\{\text{Ca}(\text{NO}_3)_2\}$  and water as a liquid.

- (a) Write a balanced equation for the reaction showing the states of each species in the reaction. (2 marks)
- (b) Determine the molarity of the  $\text{Ca}(\text{OH})_2$  solution. (4 marks)
- (c) Based on the molarity of the  $\text{Ca}(\text{OH})_2$  determined in part (b), calculate the weight of solid Calcium Hydroxide  $\text{Ca}(\text{OH})_2$  that must be dissolved and diluted to  $250\text{cm}^3$  to produce this solution. Show all calculations. (5 marks)
- (d) Determine the volume of  $0.1\text{M}$   $\text{HNO}_3$  that must be diluted to  $100\text{cm}^3$  to produce the  $0.02\text{M}$  solution required for the above titration. Show the necessary formula and/or calculations. (3 marks)
- (e) How many grams of  $\text{Ca}(\text{NO}_3)_2$  are produced when  $12.50\text{g}$  of  $\text{Ca}(\text{OH})_2$  are reacted with nitric acid. Report your answer to 4 significant figures. (6 marks)

Atomic Masses: Ca (40.078); N (14.006); O (15.999); H (1.0079)

- Q2. Discuss radiation hazards in the laboratory using the following as guidelines:
- (i) Possible sources in a chemistry, physics or biology laboratory. (2 marks)
  - (ii) The different types of ionizing and non-ionizing radiation and the relative hazards of each type. (6 marks)
  - (iii) The significance of whether a radioactive source is inside or outside the body and the type of tissue exposed. (4 marks)
  - (iv) Handling and Protective measures to minimize and/or eliminate exposure. (8 marks)
- Q3. (a) Write a comprehensive note on safety statements using the following points as guidelines: a clear explanation of what a safety statement is and what it should contain, who writes it and why one is written. (12 marks)
- (b) Define each of the following pairs of terms to show the difference between them:
- (i) Flash Point and Auto-ignition temperature
  - (ii) Threshold Limit Value and LD<sub>50</sub> (8 marks)

## Section B

- Q4. Outline the first aid treatment you would administer for the following:
- (a) Corrosive chemical splash in eyes. (5 marks)
  - (b) A cut obtained from broken glass in the laboratory. (5 marks)
  - (c) Minor external bleeding. (5 marks)
  - (d) Corrosive chemical splash on the skin. (5 marks)

- Q5. (a) Define what is meant by a buffer and explain its relevance in biological systems. (5 marks)
- (b) Calculate the weights of  $\text{Na}_2\text{CO}_3$  (106g/mole) and  $\text{NaHCO}_3$  (84g/mole) respectively required to prepare  $250\text{cm}^3$  of a bicarbonate buffer that has a concentration of 0.05M, a pH of 10 and a  $\text{pK}_a$  of 10.25. (10 marks)
- (c) 0.4g of solid NaOH (40g / mole) are required to prepare  $50\text{cm}^3$  of a 0.02M NaOH solution. Express the concentration in N, g/L and % w/v. (5 marks)
- Q6. Write notes on ALL of the following:
- (a) The compound microscope. (5 marks)
- (b) The atomic absorption spectrophotometer. (5 marks)
- (c) The pH meter. (5 marks)
- (d) Centrifuges. (5 marks)