

**CORK INSTITUTE OF TECHNOLOGY**  
**INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ**

**Autumn Examinations 2012**

<b>Module Title:            Bioanalytical Science II</b>
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**Module Code:**        **BIOL 6004**

**School :**                Science

**Programme Title:**    Bachelor of Science in Applied Sciences – Year 1  
                                 Bachelor of Science in Nutrition and Health – Year 1  
                                 Bachelor of Science in Pharmaceutical Biotechnology – Year 1

**Programme Code:**    SBIOS\_7\_Y1  
                                 SNHSC\_8\_Y1  
                                 SPHBI\_8\_Y1

**External Examiner:**        Dr. Anne Nelson, Dr. Alison Gallagher, Dr. Jerry Bird

**Internal Examiner(s):**     Dr. M. Begley, Dr. M. Sheahan

**Instructions:** Answer **FOUR** questions as follows:

Section A: Answer *any two questions*

Section B: Answer Question 4 **and** either question 5 **or** 6

Use **separate answer book** for each section

**Duration:**        **2 Hours**

**Sitting:**            **Autumn 2012**

**Requirements for this examination:**        **Periodic Table**

<p><b>Note to Candidates:</b> Please check the Programme Title and the Module Title to ensure that you have received the correct examination paper. If in doubt please contact an Invigilator.</p>
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## Section A

### Q1.

- (a) Distinguish between *primary* and *secondary standards*? List the criteria a reagent must meet for it to be considered suitable for use as a primary standard (10 marks)
- (b) Explain each of the underwritten terms. Give examples to support your answers:
- (i) Solute
  - (ii) Saturated solution
  - (iii) Homogenous solution
- (6 marks)
- (c) Describe how 0.5L of a 20% w/v saline (NaCl) solution may be prepared in the laboratory. Highlight the precautions which must be taken to ensure accuracy.
- (6 marks)
- (d) What volume of the 20% w/v saline solution is required to prepare a liter of a 5% w/v solution? Show your calculations (3 marks)

### Q2.

- (a) Give the approximate wavelength range for the visible region in spectrophotometry. Write a step-by-step procedure which can be used to determine the  $\lambda_{\text{max}}$  of a coloured solution using a single beam spectrophotometer. Identify the materials required and state the precautions which should be taken to minimize errors (14 marks)
- (b) Distinguish between the *absorbance* of a sample and its *absorptivity*. (5 marks)
- (c) Name each term in Beer's Law. Determine the concentration (g/L) of a sample which has an absorbance of 0.3188 and an absorptivity of 6.376. Assume the measurement was made in a 1cm cuvette. Assign appropriate units to the absorptivity. (6 marks)

**Q3.**

- (a) Distinguish between reverse phase and normal phase chromatography. (4 marks)
- (b) What do you understand by the letters HPLC? Highlight the main advantages of HPLC over gravity column chromatography (6 marks)
- (c) The underwritten are important parameters in gas chromatography. Write a note on each parameter
  - (i) Sample injection and injection port temperature
  - (ii) Column temperature
  - (iii) How component separation is achieved

(15 marks)

**Section B****Q4.**

- (a) Explain how an agarose gel can separate DNA fragments of different lengths (3 marks)
- (b) What is the purpose of ethidium bromide in gel electrophoresis? (2 marks)
- (c) What is the relative centrifugal force? (2 marks)
- (d) Give two reasons why it is important to ensure that a centrifuge is balanced (2 marks)
- (e) What is the isoelectric point of an amino acid (pI)? How can a titration curve be used to determine pI? (3 marks)
- (f) What is distillation? (3 marks)
- (g) Name two applications of distillation (2 marks)
- (h) Identify two possible sources of error when using an analytical balance (2 marks)
- (i) Give an example of a chemical indicator, a biological indicator and a physical indicator that can be used for autoclave quality assurance (3 marks)
- (j) What is a standard operating procedure (SOP)? (3 marks)

(25 marks)

**Q5.**

- (a) Explain what a buffer is and give two applications of buffers (5 marks)
- (b) Calculate the weight of  $\text{Na}_2\text{CO}_3$  (106g/mol) and  $\text{NaHCO}_3$  (84g/mol) required to make 100ml of a 0.025M bicarbonate buffer which has a pH of 10 and a  $\text{pK}_a$  of 10.25 (10 marks)
- (c) Calculate the weight of  $\text{Na}_2\text{HPO}_4$  (142g/mol) and  $\text{KH}_2\text{PO}_4$  (136g/mol) required to make 100ml of a 0.01M phosphate buffer which has a pH of 6.5 and a  $\text{pK}_a$  of 6.8 (10 marks)

**Q6.**

- (a) What is a spectrophotometer? (5 marks)
- (b) What is the Beer-Lambert Law? Give a formula based on the Law and explain what each component is (10 marks)
- (c) What is a 'blank' solution and what is its purpose in spectrophotometry? (5 marks)
- (d) Explain what stray light is and why it is important to consider stray light in spectrophotometry experiments (5 marks)

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