

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

**Semester 3 Examinations 2007/08**

**Module Title: Bioanalytical Science 2**

**Module Code:** BIOL 6004

**School:** Science

**Programme Title:** Bachelor of Science in Applied Biosciences – Year 1

**Programme Code:** SBIOS\_7\_Y1

**External Examiner(s):** Prof. G. Walsh

**Internal Examiner(s):** Ms. R. Kiernan, Dr. M. Sheahan

**Instructions:** Answer **TWO** questions from each section

Question 1 is **compulsory**

Use **Separate Answer Books** for each Section

**Duration:** 2 hours

**Sitting:** Autumn 2008

**Requirements for this examination:**

**Note to Candidates:** 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.

## Section A

Q1. Answer **all** the following:

- (a) List two safety precautions that should be taken when working with strong acids in the laboratory. (2 marks)
- (b) What is the weight of (i) 1 ml of water and (ii) 1 ml of glycerol (spec. gravity 1.26g)? Express your answer in grams. (4 marks)
- (c) Give labelled diagrams to illustrate the appearance of a suspension of bacteria **before** and **after** centrifugation at 4 000 rpm for 15 minutes. (4 marks)
- (d) List three buffers commonly used in biological systems. (2 marks)
- (e) What solution can be added to an amino acid to give its  $pK_2$  value? (2 marks)
- (f) List two safety precautions that should be taken when dealing with a minor outbreak of fire in the laboratory. (2 marks)
- (g) Why is the dye used with the sample when loading an electrophoresis gel? What precautions should be taken at the loading stage to ensure good results? (5 marks)
- (h) Convert 0.05ml to microlitres. (1 mark)
- (i) Comment on the precision of the following set of data (units are in grams): 5.0, 5.01, 4.99, 5.0, 5.01, 6.02, 4.99, 5.0, 5.01, 5.0 (3 marks)

Q2.

- (a) Calculate the weight of  $KH_2PO_4$  (136g) and  $Na_2HPO_4$  (142g) required to make 0.05M phosphate buffer ( $pH = 6.2$ ,  $pK_a = 6.8$ ) (12 marks)
- (b) What volume of HCl (spec. gravity  $1.18g/cm^3$ , purity 36%, mol. mass 36.5g) should be taken to give  $500cm^3$  of 0.1M HCl (10 marks)
- (c) Explain the following: % w/v, % w/w and % v/v. (3 marks)

Q3. Write notes on **all** of the following:

- (a) The autoclave
- (b) Preparation of standard solutions
- (c) Culture media
- (d) Analytical balances
- (e) Centrifuges (25 marks)

## Section B

Q4.  $10\text{cm}^3$  of magnesium hydroxide,  $\text{Mg}(\text{OH})_2$  is neutralized by  $23.30\text{cm}^3$  of  $0.081\text{M}$  nitric acid ( $\text{HNO}_3$ ).  $\text{Mg}(\text{NO}_3)_2$  and water are products of the reaction

- (a) Write a balanced equation for the reaction. (2 marks)
- (b) Calculate the volume of conc. nitric acid (72% w/w, density  $1.42\text{gcm}^{-3}$ ) which must be diluted to  $250\text{cm}^3$  to produce a  $0.162\text{M}$   $\text{HNO}_3$  solution. Then determine the volume of the  $0.162\text{M}$   $\text{HNO}_3$  that must be diluted to  $100\text{cm}^3$  to produce the  $0.081\text{M}$  solution required for the titration. Show all calculations. (9 marks)
- (c) Determine the molarity of the magnesium hydroxide solution; hence calculate the weight of magnesium hydroxide required to produce  $250\text{cm}^3$  of this solution. Show all calculations. (8 marks)
- (d) What weight (in grams) of  $\text{Mg}(\text{NO}_3)_2$  are produced when  $12.50\text{g}$  of magnesium hydroxide are reacted with nitric acid. Report your answer to 2 significant figures. (6 marks)

Q5.

- (a) Write a note which distinguishes between primary standard grade, reagent grade and special purpose grade chemicals in terms of their purity and application. (9 marks)
- (b) Outline the precautions which must be taken in the handling of reagents and solutions in the laboratory. (6 marks)
- (c) Distinguish clearly between a *standard solution* and a *homogeneous solution*. (4 marks)
- (d) List the criteria a reagent must satisfy before it can be classified as a primary standard reagent. (6 marks)

Q6. Discuss in detail two methods for the purification of laboratory chemicals. Support your answer with sketches of the relevant apparatus. (25 marks)

# Periodic Table

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1 <b>H</b> 1.01																	2 <b>He</b> 4.00
3 <b>Li</b> 6.94	4 <b>Be</b> 9.01															9 <b>F</b> 19.0	10 <b>Ne</b> 20.2
11 <b>Na</b> 23.0	12 <b>Mg</b> 24.3															17 <b>Cl</b> 35.5	18 <b>Ar</b> 40.0
19 <b>K</b> 39.1	20 <b>Ca</b> 40.1	21 <b>Sc</b> 45.0	22 <b>Ti</b> 47.9	23 <b>V</b> 50.9	24 <b>Cr</b> 52.0	25 <b>Mn</b> 54.9	26 <b>Fe</b> 55.9	27 <b>Co</b> 58.9	28 <b>Ni</b> 58.7	29 <b>Cu</b> 63.5	30 <b>Zn</b> 65.4	31 <b>Ga</b> 69.7	32 <b>Ge</b> 72.6	33 <b>As</b> 74.9	34 <b>Se</b> 79.0	35 <b>Br</b> 79.9	36 <b>Kr</b> 83.8
37 <b>Rb</b> 85.5	38 <b>Sr</b> 87.6	39 <b>Y</b> 88.9	40 <b>Zr</b> 91.2	41 <b>Nb</b> 92.9	42 <b>Mo</b> 95.9	43 <b>Tc</b> (99)	44 <b>Ru</b> 101	45 <b>Rh</b> 103	46 <b>Pd</b> 106	47 <b>Ag</b> 108	48 <b>Cd</b> 112	49 <b>In</b> 115	50 <b>Sn</b> 119	51 <b>Sb</b> 122	52 <b>Te</b> 128	53 <b>I</b> 127	54 <b>Xe</b> 131
55 <b>Cs</b> 133	56 <b>Ba</b> 137	57 <b>La</b> 139	72 <b>Mf</b> 179	73 <b>Ta</b> 181	74 <b>W</b> 184	75 <b>Re</b> 186	76 <b>Os</b> 190	77 <b>Ir</b> 192	78 <b>Pt</b> 195	79 <b>Au</b> 197	80 <b>Hg</b> 201	81 <b>Tl</b> 204	82 <b>Pb</b> 207	83 <b>Bi</b> 209	84 <b>Po</b> (210)	85 <b>At</b> (210)	86 <b>Rn</b> (222)
87 <b>Fr</b> (233)	88 <b>Ra</b> (226)	89 <b>Ac</b> (227)	104 <b>Rf</b> (261)	105 <b>Db</b> (262)	106 <b>Sg</b> (263)	107 <b>Bh</b> (264)	108 <b>Hs</b> (265)	109 <b>Mt</b> (268)	110 <b>110</b> (269)	111 <b>111</b> (272)	112 <b>112</b> (277)		114 <b>114</b> (285)		116 <b>116</b> (289)		