



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCE

DEPARTMENT OF APPLIED CHEMISTRY

ANALYTICAL CHEMISTRY II

SCH 2106

First Semester Examination Paper

December 2014

This examination paper consists of 3 pages

Time Allowed: 3 hours

Total Marks: 100

Examiner's Name: DR H. Chiririwa

INSTRUCTIONS

1. Answer any four (4) questions
2. Each question carries 25 marks
3. Use of calculators is permissible

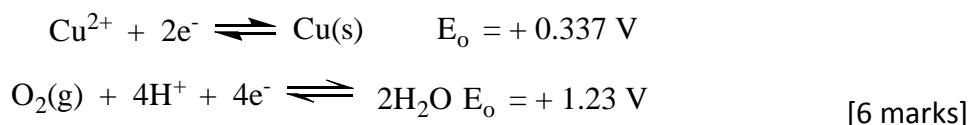
MARK ALLOCATION

QUESTION	MARKS
1.	25
2.	25
3.	25
4.	25
5.	25
TOTAL	100

Copyright: National University of Science and Technology, 2014

SCH 2106

1. (a) What is electrochemistry and what are the 2 advantages of electroanalytical methods? [5 marks]
- (b) Define the two types of electrochemical cells. [4 marks]
- (c) Draw a basic electrochemical cell. [6 marks]
- (d) Define the following terms:
- (i) Reference electrode
 - (ii) Indicator electrode
 - (iii) Salt bridge
 - (iv) Liquid junction potential [8 marks]
- (e) Why is potassium chloride nearly an ideal electrolyte for the salt bridge? [2 marks]
2. (a) What is Ohmic potential? Determine its Units. How is it related to cell potential and applied potential? [8 marks]
- (b) Calculate the time needed for a constant current of 0.96 A to deposit 0.5 g of Co(II) as elemental cobalt on the surface of a cathode. Relative molar mass of cobalt = 58.93 [5 marks]
- (c) A solution containing 0.25 g of copper as Cu^{2+} requires 20 minutes for complete deposition of copper at 1.25 A. Calculate the coulombs required and efficiency of the process ($M_r = 63.54$). [6 marks]
- (d) Calculate the potential required to initiate deposition of copper from a solution that is 0.01 M in CuSO_4 and the pH of the solution is 2.0. Given:



Copyright: National University of Science and Technology, 2014

3. (a) State the *five* useful applications of standard electrode potentials [10 marks]
- (b) Consider the historic Daniell cell in which zinc and copper were used as electrodes. The data from table of standard electrode potential is:

Cathode (Reduction) Half-Reaction	Standard Potential E° (volts)
$\text{Zn}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Zn}(\text{s})$	-0.76
$\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu}(\text{s})$	0.34

- (a) Write an expression for the cell potential and calculate this value [4 marks]
- (b) Calculate the Maximum work performed by this cell. [5 marks]
- (c) Calculate the equilibrium constant K for this reaction and what does the value of the equilibrium constant tell you about the reaction [6 marks]
4. (a) What are the 4 main uses of potentiometric measurements? [8 marks]
- (b) What are Electrodes of the first kind and why are they not popular? [10 marks]
- (c) What is a potentiometric titration? [3 marks]
- (d) What instruments are used for measuring cell potential? [4 marks]
5. (a) What is coulometry? [2 marks]
- (b) Distinguish between concentration polarization and kinetic polarization. [8 marks]
- (c) List the importance of overvoltage. [8 marks]
- (d) State Faraday's first and second laws of electrolysis [5marks]
- (e) What is the practical unit of electricity? [2 marks]