



# Technical University of Mombasa

Faculty of Applied and Health Sciences

**DEPARTMENT OF PURE AND APPLIED SCIENCES**  
UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF  
TECHNOLOGY IN APPLIED CHEMISTRY  
**BTAC**

## **ACH 4314 : ELECTROCHEMISTRY**

SPECIAL/SUPPLEMENTARY EXAMINATION

MARCH 2014 SERIES

2 HOURS

Instructions to candidates:

This paper consists of **FIVE** questions

Answer question **ONE** (compulsory) and any other **TWO** questions

### Question ONE

- Write the cell reaction involved and expression of calculating  $E_{cell}$  for  $Cd/Cd^{2+} // KCl / Hg_2Cl_2/Hg$  **(4marks)**
- Calculate :-
  - Potential at  $25^\circ C$  for the cell  $Cu/Cu^{2+} 0.024/Ag^+ (0.0048m) /Ag$ . **(5marks)**
  - The solubility product at  $25^\circ C$  for  $Mg(OH)_2$  in  $Mg(OH)_2/Mg$  gives  $E^\circ_{red} = -2.69$   
 $Mg^{2+}(aq) /Mg(s)$   $E^\circ_{red} = -2.375V$  **(4marks)**
  - Time it will take to electrolysis water so as to produce 22.4ml  $H_2$  at STP under a current of 10A. **(4marks)**

- c) State :-
- (i) Different methods of preventing corrosion **(3marks)**
  - (ii) Basic design of a fuel cell **(3marks)**
- d) Differentiate between :-
- (i) And potential difference **(4marks)**
  - (ii) State electrolyte and flowing electrolyte as used as poisoning variants **(3marks)**

### Question TWO

- a) Calculate :-
- (i) EMF of the cells  $\text{Zn(s) / Zn}^{2+} (0.024\text{m} // \text{Zn}^{2+} / 2.4\text{m} / \text{Zn(s)})$  **(4marks)**
  - (ii) Time required to deposit 56grams of silver from a silver nitrate solution using a current of 4.5 A.  
Reaction  $\text{Ag}^+ + e \rightarrow \text{Ag(s)}$  **(4marks)**
- b) Write reaction involved and expression for calculating the EMF of Secondary battery **(4marks)**
- c) Define the use of:-
- (i) Electrochemical biosensor
  - (ii) Electrometallurgy **(5marks)**
- d) State characteristics of primary battery **(3marks)**

### Question THREE

- a) With the help of chemical reactions Diagram describe Zinc-Carbon battery **(9marks)**
- b) Aoristic cell consisting of  $\text{Ni/Ni}^{2+}$  and  $\text{Co/Co}^{2+}$  half cell is constructed with initial concentration of  $\text{Ni}^{2+} = 0.8\text{M}$  and  $\text{Co}^{2+} = 0.2\text{M}$  . Calculate the value of  $E_{\text{cell}}$  given  $E^{\circ}_{\text{Cell}} = 0.03\text{V}$ . **(5marks)**
- c) Sketch a well label diagrams of phosphoric acid cell PAFC **(3marks)**
- d) Explain mechanism of Electrolyte loss **(3marks)**

#### Question FOUR

- a) Outline different factors used to evaluate batter's performance. **(3marks)**
- b) Define the following
- (i) Migration of ions
  - (ii) Fuel cell
  - (iii) Self discharge
  - (iv) Concentration potential **(6marks)**
- c) Deduce and calculate solubility product for silver bromide in water at 25°C by considering the cell  $\text{Ag}/\text{Ag}^+/\text{Br}^-/\text{AgBr(s)}/\text{Ag}$  given  $E^\circ_{\text{Ag}/\text{Ag}^+} = 0.7981$  and  $\text{Ag}/\text{AgBr}/\text{Br}^-$  as 0.0711 **(6marks)**
- d) Outline
- (i) Importance of electrochemical process
  - (ii) Working of pH meter **(5marks)**

#### Question FIVE

- a) Define the following
- (i) Gas sensing electrodes
  - (ii) Glass membrane electrodes **(4marks)**
- b) Differentiate between Electrowinning and electrorefining **(4marks)**
- c) State different application of electroplating process **(2marks)**
- d) 30 minutes of electrolysis of  $\text{CuSO}_4$  solution produced 3.175g of copper at cathode. Calculate Amount of current passed **(4marks)**
- e) Explain limitations of Ostwald's dilution **(4marks)**