UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA
SECOND SEMESTER EXAMINATIONS. MAY
COURSE NO: MR 472
COURSE NAME: **ELECTROMETALLURGY**
CLASS: **MR IV** TIME: 3 HRS

Name**:** _____Index Number: _____

Answer all Questions

Question 1

(a) Explain (briefly) 4 factors that influence the transport numbers of an electrolyte (***10 marks)***

(b) In an electrodeposition process, the current efficiency when calculated was found to be less than 100%. State five possible cause for this. ***(5 marks)***

(c) Differentiate between galvanic and electrolytic cell using the voltage-current dependence curve ***(5 marks)***

(d) Discuss the significance of Al_2O_3 and the ratio of NaF to AlF_3 in aluminium electrometallurgy. ***(10 marks)***

Question 2

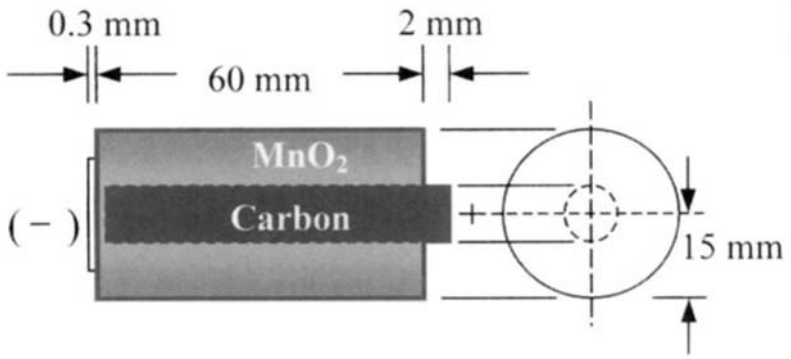
(a) Explain the influence of pH, temperature and cathode surface area on the efficiency of gold electrowinning process. ***(9 marks)***

(b) what is electroplating and state three importance of electroplating ***(5 marks)***

(ii) A jewellery company wishes to coat one of their product, copper chain, with silver using an electrolyte solution of silver nitrate. With the aid of a diagram, describe how this can be done. ***(6 marks)***

(c) Calculate (i) the mass and number of moles of a zinc battery casing, (ii) the mass and number of moles of the manganese dioxide in the electrolyte if the battery has a stored charge and power of 36000 C and 3 Watts respectively. (iii) Find the time it takes to consume the stored energy if the battery operates at a current of 2 A and the potential (voltage). The thickness of the cell is x= 1 mm, density of zinc as 7.13 g/cm^3, Molar masses of Zn, Mn and O_2 respectively are 67.37, 54.94 and 16 g/mol). Other dimensions, such as length (L) and radius are indicated below. The discharging reaction is

$$MnO_2 + H^+ + e \longrightarrow MnOOH$$



(14 marks)

Question 3

(a) Explain the following terms ***(6 marks)***

(i) Overpotential

(ii) Polarization

(iii) Decomposition potential

(b) State 2 differences and 2 similarities between Molten Salt Electrolysis versus Aqueous Solution Electrolysis ***(4 marks)***

(c) An electrowinning cell produces 10 Kg/h of nickel at a current efficiency of 80%. The cell contains 20 cathodes and operates at a current of 215 A/m^2 and a potential of 2 V. Calculate;

(i) the energy consumption rate (Kw.h/kg) ***(5 marks)***

(ii) flow rate of the electrolyte (l/min) ***(2marks)***

(iii) The cathode length for a width of 1 m ***(2 marks)***

(iv) Generate an expression relating the production rate and current efficiency in Kw.h/kg) ***(2 marks)***

(Assume the concentration of nickel cations as 35 g/l, molar mass of nickel as 58.71g/mol).

Examiner: Dr Clement K. Owusu