BOWEN UNIVERSITY IWO, OSUN STATE
COLLEGE OF AGRICULTURE, ENGINEERING AND SCIENCE
INDUSTRIAL CHEMISTRY PROGRAMME
2022/2023 B.SC DEGREE SECOND SEMESTER EXAMINATION
Course Code: CHM 312     Course Title: Introductory Electrochemistry     Credits: 2
Date: 19/062023                                    Time Allowed: 2 hours

Instructions: (a) Answer any THREE (3) questions in ALL
(b) Each Question carries 25 Marks each ,
(c) Answer each complete question on a fresh page.

## QUESTION 1

(a)i. Define corrosion.                                                                                                 (2 marks)

ii. Give two examples of corrosion and explain the economic and social consequences of the phenomenon.                                                                                                 (6 marks)

(b)i. Using the Pilling-Bedworth rule, explain why alkali and alkaline earth metals are susceptible to corrosion while metals like Al are less susceptible.                                          (4 marks)

ii. Why is oxidation corrosion not possible with noble metals?                           (2 marks)

(c) In tabular form, state at least five differences between dry and wet corrosion.   (6 marks)

(d) Calculate the volume of oxygen produced (measured at room temperature and pressure - rtp) during the electrolysis of sodium sulphate solution if you use a current of 0.50 amp for 30 minutes given that $1F = 9.65 \times 10^4$ C mol$^{-1}$ (or 96500 C mol$^{-1}$) and the molar volume of a gas at rtp = 24 dm$^3$ mol$^{-1}$.                                                                                         (5 marks)

## QUESTION 2

(a) Write short notes on the following:
(i) Characteristics of a good paint.                                                               (5 marks)
(ii) Constituents of paint and the detailed functions of each constituent.       (12 marks)
(b) Explain the process of electroplating and its objectives.                           (4 marks)
(c) How long would it take to deposit 0.635 g of copper at the cathode during the electrolysis of copper (II) sulphate solution if you use a current of 0.200 amp given that 1 F = 96500 C mol$^{-1}$) and Mw of Cu = 63.5.                                                                                     (4 marks)

## QUESTION 3

(a) Define the following terminologies:
(i) A galvanic cell                                                                                         (2 marks)
(ii) An electrolytic cell                                                                                  (2 marks)
(b) Differentiate between a primary and a secondary cell, hence state one application of each. .
                                                                                                                      (5 marks)

(a) State Debye Hukel's limiting law and define all terminologies. Also mention its application.

1

(b) Water is a universal solvent. Classify water with respect to electrolytes with reason(s).

(2 marks)

(d) Differentiate between resistivity and conductivity. (3 marks)

(b) The resistance of a copper sulfate of the concentration $c = 0.02$ mol dm$^{-3}$ is R = 1440 $\Omega$, and the conductivity cell constant is C = 541 m$^{-1}$. Calculate the molar conductivity of the solution.

(5 marks)

## QUESTION 4

(a) An aqueous solution of aluminium sulfate was electrolyzed for one hour by an electric current of 0.2 A. The molar mass of aluminium is $M_{Al} = 27$ g mol$^{-1}$ and the molar mass of aluminium sulfate is M = 343 g mol$^{-1}$.

(i) Calculate the mass of aluminium discharged at the cathode.

(ii) Calculate the mass of aluminium sulfate that dissociated at the electrodes. (5 marks)

(b) State two factors that affect molar conductivity and their trends (4 marks)

(c) The density of water at the standard pressure and a temperature of 298.15 K is 997.07 kg m$^{-3}$. its relative permittivity is 78.303, the permittivity of a vacuum is 8.8542×10$^{-12}$ C$^2$ N$^{-1}$ m$^{-2}$, and the electron charge is 1.602×10$^{-19}$ C. Calculate the value of the parameter A for water at the given temperature and pressure. (5 marks)

(d)i. Differentiate between the various classes of electric current conductors (5 marks)

(ii) The resistance R = 100 $\Omega$ was measured in a potassium chloride solution. Each of the electrodes had a surface area of 4 cm$^2$, and the distance between them was 2 cm. Calculate the conductivity. (3 marks)

(iii) Several strong electrolytes do help various human body systems. Cite one common example with reason(s).

(3 marks)