Federal University of Technology, Minna
Department of Chemistry
Second Semester Examination 2021/2022 Academic Session
Course Code: CHM321 unit: 2
Course Title: Electrochemistry
Instruction: Answer any three (3) questions Time: 2 hours

Q1a. Write short notes on the following terms:

(i) Redox reactions **(5 Marks)**

(ii) Electrochemical cells **(5 Marks)**

b. In a redox titration involving $KMnO_4$ and oxalic acid, if the volume of the permanganate solution required to completely react with 10.00 cm^3 of a 0.1 $moldm^{-3}$ oxalic acid was 15.60 cm^3, calculate, using appropriate reaction equations;

(i) the concentration of the $KMnO_4$ solution in $moldm^{-3}$ **(7 Marks)**

(ii) the concentration of the permanganate solution in gdm^{-3} **(3 Marks)**

[K = 39, Mn = 55, O = 16, C =12, H =1]

Q2ai.What is a salt bridge? **(3 marks)**

ii. State the significance of a salt bridge (**3 marks)**

bi. How does a salt bridge help to maintain electrical neutrality of Galvanic cell? (**4 marks)**

ii. Justify why a voltmeter is not suitable for the measurement of EMF of a cell (**2 marks)**

ci. Using the given cell notation below;

$Zn_{(s)}/ Zn^{2+}_{(aq)} //Cu^{2+}_{(aq)} /Cu_{(s)}$, explain the concept of cell potential reversibility.(**6marks)**

ii. Why is cell potential reversibility difficult to attain with a large current? **(2marks)**

Q3a. Explain the term electrode potential **(7 Marks)**

b. Calculate the standard half-cell reduction potential of lead if the measured E^O of the cell

$Pb(s)/Pb^{2+}(1\ moldm^{-3})//H^+(1\ M)/H_2(atm)/Pt(s)$ is +0.13 V? **(5 Marks)**

c. Given a hypothetical cell as $I_2(s)/I^-(1\ M)//Au^{3+}(1\ M)/Au(s)$,

(i) State whether the reaction of the cell as presented is spontaneous or not. **(1 Mark)**

(ii) Write the spontaneous chemical reaction that occurs in the cell. **(7 Marks)**

Q4a. Explain the concept of:

i. Electrochemical cell without transference (**4 marks)**

ii. Concentration cell with transference (**4 marks)**

bi. For the given cell notation

$H_{2(a,PH2)}/HCl_{(aq)}//AgCl_{(s)}/Ag_{(s),}$ show that the EMF of the cell depends on the activity of the HCl solution and the pressure of the hydrogen. (**6 marks)**

c. From the given electrochemical cell notation;

$M\text{-}Hg_{(a1)}/Mn^{+}_{(aq)}/M\text{-}Hg_{(a2)}$,

Prove that the cell EMF is independent of the activity of the metal ion in solution but dependent only on the ratio of the activities of the metals in the two amalgams. (**6 mark)**