ELECTROCHEMISTRY – ELECTROLYTIC CELL

A. Objective questions (5 marks)

1. When an aqueous solution of $AgNO_3$ is electrolyzed, a gas is observed to form at the anode. The gas is

   A. H_2 B. O_2

   C. NO D. NO_2

2. A current of 10 A is passed for 50 min through molten aluminium oxide using inert electrodes. What is the volume of gas liberated at the anode, measured at S.T.P.?

   A. 1.74 dm^3 B. 3.48 dm^3

   C. 5.22 dm^3 D. 10.44 dm^3

3. When 5.10 mol of electrons was passed through an electrolyte containing manganese ions, 1.70 mol of manganese was deposited on the cathode. Which of the following substances is the electrolyte?

   A. $Mn(NO_2)$ B. $MnSO_4$

   C. $KMnO_4$ D. $MnCl_3$

4. In the commercial electrolysis of brine, the products are chlorine, hydrogen and sodium hydroxide. What is the maximum yield of hydrogen and sodium hydroxide when y mol of chlorine gas is obtained from the electrolysis.

	Hydrogen	**NaOH**
A.	y	2y
B.	2y	y
C.	2y	2y
D.	y	y

5. In the electrolysis of molten aluminium oxide form bauxite, how many faradays are required to produce 560 cm^3 of gas at the anode, measured at S.T.P?

   A. F/2 B. F/10

   C. F/10 D. F/50

B. Subjective Questions

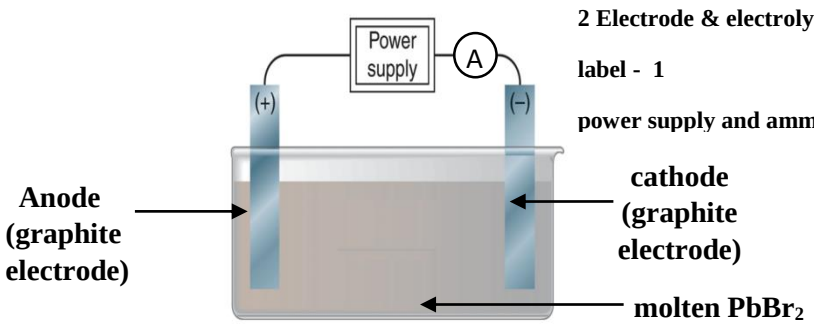
1. Draw and label the apparatus used to electrolyse molten (II) bromide in an evaporating basin using graphite electrodes and including an ammeter in the circuit. Give the equations for the half reactions occur at the anode and cathode. Determine the mass of lead obtained when a current of 3.0 A was passed through the circuit for 30 minutes,.

[10 marks]

2. In an electrolytic cell, a current of 0.250 ampere is passed through a solution of a chloride of Z, producing Z(s) and Cl_2 (g).
   (a) Write an equation for the reaction that occurs at the anode.
   (b) When the cell operates for 2.00 hr, 0.521 g of Z is deposited at one electrode. Determine the formula of the chloride of Z in the original solution.
   [Faraday's constant = 96500 C mol^{-1}; A_r Z = 56 g mol^{-1}] [10 marks]

ANSWER :

1.	2.	3.	4.	5.
B	**A**	**D**	**A**	**B**

NO.	PART	SUGGESTED ANSWER
1.		i.  **2 Electrode & electrolyte - 1** **label - 1** **power supply and ammeter -1**
		ii. Anode : $2Br^-(l) \longrightarrow Br_2(l) + 2e^-$ **1** **Cathode :** $Pb^{2+}(l) + 2e^- \longrightarrow Pb(l)$ **1**
		iii. Q = It **1** **= 3 × 30 × 60** **= 54000 C = 0.05596 F** **1** **2F ≡ 1 mol Pb** **1** **0.05596 F ≡ 0.02741 mol Pb** **1** **Mass of Pb obtained = 0.02741× 207.2** **= 5.679 g** **1**
		TOTAL = 10
2.	**(a)**	**Anode: $2Cl^-(aq) \rightarrow Cl_2(g) + 2e^-$** **1**
	(b)	**Q = It** **1** $= 0.250 \times 2.00 \times 60 \times 60$ **= 1800 C** **1** 96500 C ≡ 1F $1800\ C \equiv \frac{1800 \times 1}{96500}$ $= 0.0187\ F$ @ **0.0187 mol e^-** **1** $\text{No of moles of Z} = \frac{0.521\,g}{56.0\,g\,mol^{-1}} = 9.304 \times 10^{-3}$ **mol** **1** **Cathode: $Z^{n+}(aq) + ne^- \rightarrow Z(s)$** **1** **n F ≡ n mol e^- ≡ 1 mol Z** 9.304×10^{-3} mol Z ≡ 0.0187 F @ 0.0187 mol e^- **1** $1\ mol\ Z \equiv \frac{1 \times 0.0187}{9.304 \times 10^{-3}}$ **= 2F @ 2 mol e^-** **1** n = 2

		Cathode: $Z^{2+}(aq) + 2e^- \rightarrow Z(s)$ $2\ F \equiv 2\ mol\ e^- \equiv 1\ mol\ Z$ **Formula of Z ion = Z^{2+}** **1** **Formula of chloride of Z = ZCl_2** **1**
		TOTAL = 10