Experiment No. 8. : Equivalent weight of metal

I Practical Significance

Diploma engineers have to work for various industrial processes related to metallurgy, electroplating, coating and cladding of various metallic substances. The determination of chemical equivalent of metal using Faraday's second law lead towards the minimization of metal corrosion by informing about the chemical equivalent of any metallic substance. That it highlights the electronic nature of the particular metal. This experiment may help to take preventive measures in metallic corrosion and various applications in industries.

II Relevant Program Outcomes (POs)

PO1 Basic knowledge
PO3 Experiments and practice

III Relevant Course Outcomes

d) Apply corrosion preventive measures in industry.

IV Practical Learning Outcome

Determine equivalent weight of metal using Faraday's second law.

V Practical Skills

Measurement skill
a) Weight of copper cathode
b) Weight of zinc cathode

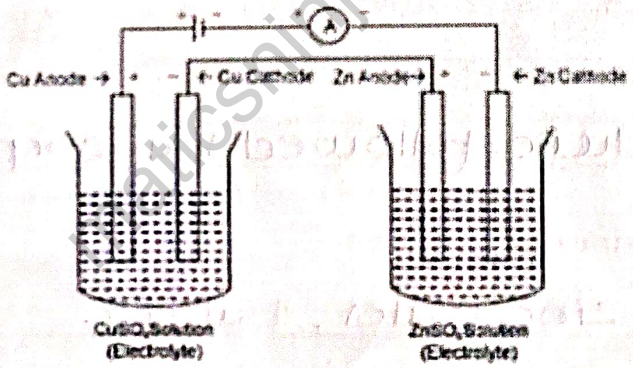
VI Relevant Affective domain related Outcomes

1. Follow safe practices
2. Practice good housekeeping.

VII Minimum Theoretical Background

1. Electrolysis mechanism.
2. The weight of substance liberated or deposited when current of one ampere is passed through a solution for one second is called electrochemical equivalent.
3. The weight of substance liberated or deposited is directly proportional to the quantity of electricity passed through an electrolyte.

VIII Experimental set-up



IX Resources required

Sr. No.	Resources	Specifications	Quantity	Remark
1	Copper plates	Given weight	20 plates	
2	Zinc plates	Given weight	20 plates	
3	$CuSO_4$ solution, $ZnSO_4$ solution	10 % concentration		
4	Glass beaker	1000 ml	20	
5	Battery	12 Volts	10	
6	Stop watch		10	
7	Chemical Balance	Scale range of 0.001g to 500gm pan size 100 mm; response time 3-5 sec.: power requirement 90-250 V, 10 watt	01	
8	Polish paper			
9	Drier		01	
10	Copper wires			
11	Ammeter	0-2 amp	10	

X Procedure

1. Clean the copper cathode and zinc cathode using polish paper, dilute HCl and then with water.
2. Dry the electrodes in oven or by using an air dryer.
3. Set up the apparatus as shown in diagram.
4. Adjust the current from 0.5 to 1.5 ampere using Rheostat.
5. Pass the current for 20 - 25 minutes.
6. Remove the copper cathode and Zinc cathode, dry it.
7. Weigh the copper cathode and zinc cathode.

XI Precautions

1. Clean the copper and zinc cathode.
2. Weigh the copper and zinc cathode accurately.
3. Connect the cleaned copper and zinc plate to negative terminal of the battery properly.

XII Actual procedure followed

Actual procedure followed by experiment 8

XIII Resources used (with major specifications)

Copper plats, zinc plates, battery.

XIV Precautions followed

1. Handle the instrument ~~carefully~~ correctly.

XV Observations and Calculations

Observation

Sr. No.	Observation	Symbol	Value
1	Wt. of Cu cathode before deposition	Wc_1	270 gm
2	Wt.of Cu cathode after deposition	Wc_2	300 gm
3	Wt. of Cu deposited	$W_{Cu}=Wc_2-Wc_1$	30 gm
4	Wt. of Zn cathode before deposition	Wz_1	610 gm
5	Wt.of Zn cathode after deposition	Wz_2	560 gm
6	Wt. of Zn deposited	$Wzn= Wz_2-Wz_1$	50 gm
7	Equivalent wt. of Cu	E_{Cu}	32.7
8	Time in second	t	20 min/sec

Calculations

$$\frac{\text{Wt. of Cu deposited (Wcu)}}{\text{Wt. of Zn deposited (Wzn)}} = \frac{\text{Eq. wt. of Cu (Ecu)}}{\text{Eq. wt. of Zn (Ezn)}}$$

$$\frac{30\text{gm (Wcu)}}{\text{(Wzn)}} = \frac{32.7 \text{ (Ecu)}}{\text{Eq. wt. of Zn (Ezn)}}$$

$$\text{Eq. wt. of Zn (Ezn)} = \frac{\text{(Wzn) } 50 \times \text{(Ecu) } 32.7}{\text{(Wcu) } 32.6}$$

XVI Results

Equivalent weight of Zinc (Ezn) = 32.6

XVII Interpretation of results

Decrease in the weight of Copper anode indicates the corrosion of copper anode.
Decrease in the weight of Zinc anode indicates the corrosion of Zinc anode.

XVIII Conclusions and Recommendations

Weight of Copper and Zinc cathode increases and weight of copper and Zinc anode decreases.

XIX Practical Related Questions

1. Explain the purposes of cleaning copper and zinc cathodes.
2. The weight of Copper anode and Zinc anode decreases. Explain
3. Describe the effect of time on the amount of substance deposited for which current is passed.
4. Describe the importance of increase in the weight of cathode.

XX References / Suggestions for further Reading

Sr. No.	Title of Book	Author	Publication
1	An Introduction to Electrochemistry	Samuel Glasstone	Maurice press, London, ISBN : 9781406717792
2	Engineering Chemistry	Dara, S. S.	S.Chand. Publication, New Delhi, 2013, ISBN: 8121997658
3	Engineering Chemistry	Shashi Chawla	S.Chand. Publication, New Delhi, 2013, ISBN: 1234567155036
4	Engineering Chemistry	A.D. Sharma, V. Thakur	Wiley International N. J.,2012, ISBN: 9788126537419

XXI Assessment Scheme

Process related assessment scheme

Sr. No.	Process related	Weightage(60%)
1	Process for removal of cathode from solvent	20%
2	Process for drying of cathode	20%
3	Weighing of Copper and Zinc cathode	10%
4	Cleaning of Copper and Zinc cathode	10%

Product related assessment scheme

Sr. No.	Product related	Weightage(40%)
1.	Weight of Copper and Zinc	40%

List of Student Team Members

1. .....
2. .....
3. .....
4. .....

Marks Obtained			Dated Signature of Teacher
Process Related (15)	Product Related (10)	Total (25)	
14	09	23	

[Space to Write Answers]

Q.1 ——— ?

copper zinc water filtration purity brass water filteration process that relese e water in the pressure of zinc anode and copper cathode.

Q 2 ——— ?

At Anode oxidation takes place so zinc and copper under gases oxidation are follows:

$Zn = Zn^{+2} + 2e^-$

$Cu = Cu^{+2} + 2e^-$

This zinc and copper anode keeps geeting thinner as they form to dissolve. $2A^{+2}$ and Ca^{+2} ions.

Q 3 ——— ?

A cathode is the electrode form which a conventional electrical device conventional current positive electron changes move.