

Subject Name - Chemistry

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Experiment No. 6

Determination of the Electrochemical
Equivalent (ECE) of copper

* Aim - To determine the electrochemical equivalent (ECE) of copper.

* Objective - To determine electrochemical equivalent of copper using copper voltameter, which is an electrolytic cell and the measurement is made by weighing the copper deposited at the cathode in a specific time.

* Apparatus :- Copper plates, voltameter, Ammeter, Rheostat etc.

* chemicals :- 15% $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, 5% H_2SO_4

* Questions -

Q 1) Define electrochemical equivalent (ECE)

Ans → when a specific quantity of electric charge is passed through an element, the mass of the element that gets either evolved or deposited is known as electrochemical equivalent. Its abbreviated as z or eq and can be measured with the help of a voltmeter. The ECE here is directly proportional to the quantity of charge passed through the element.

Q 2) Explain the significance of electrochemical equivalent (ECE) determination?

Ans → The ECE obtained is used for

- ① Determination of the kinetics of corrosion rates.
- ② Estimating oxidizing powers in specific environments.

Q 3) what is the effect of temperature on the determination?

Ans → Kinetic energy is gained as the movement of the ions rapidly fastens with increasing temperatures supplementing to higher energy states. Thus, increase in temperature increases the electrolytic conductivity.

Q 4) what do you understand from the values of electrochemical equivalent (ECE) of following elements?

Element	Electrochemical equivalent
Silver	0.0011181
copper	0.0003281
Hydrogen	0.000104

Ans → The table values show that for each second, if we pass an ampere worth of current → the mentioned amount of element gets deposited or evolved would be equal to its ECE.

For example:

① $\text{Ag}^+_{(\text{aq})} + e^- \rightarrow \text{Ag}_{(\text{s})}$ 0.0011181 g would be deposited when 1A current is passed for each second.

② $\text{Cu}^{2+} + 2e^- \rightarrow \text{Cu}_{(\text{s})}$ 0.0003281 g of Cu would be deposited when 1A current is passed through it for each second

③ $2\text{H}^+ + 2e^- \rightarrow \text{H}_{2\uparrow}$ 0.000104 g of H_2 would evolve when 1A of current is passed for each second.

Q 5) Name and state the law which forms the basis of ECE.

Ans → The base of ECE is formed by Faraday's first law which states that:

"weight of a substance deposited on an electrode during electrolysis is directly proportional to the quantity of electricity passed through the electrolyte."

If $w \Rightarrow$ weight of substance deposited,

$Q \Rightarrow$ Quantity of electricity in coulombs.

Then $\Rightarrow w \propto Q \Rightarrow Q = It; w \propto It, w = It \Rightarrow Q = \frac{w}{\text{constant ECE}}$