ELECTROLYSIS → using electrical energy to force a nonspontaneous reaction

"electrolytic cell"

① MOLTEN IONIC COMPOUNDS

$KI_{(s)} \longrightarrow K^+_{(l)} + I^-_{(l)}$

cathode: K^+ will not oxidize further ⇒ $K^+ + e^- \longrightarrow K$

anode: I^- will not reduce further ⇒ $2I^- \longrightarrow I_2 + 2e^-$

→ cation gets reduced (cathode) — anion gets oxidized (anode)

② AQUEOUS IONIC COMPOUND

$KI_{(aq)}$ — K^+, I^-, H_2O

* H_2O can be oxidized and/or reduced

anode: $2H_2O \longrightarrow O_{2(g)} + 4H^+ + \cancel{4e^-}$

cathode: $(2H_2O + \cancel{2e^-} \longrightarrow H_{2(g)} + 2OH^-)2$

$2\cancel{6}H_2O \longrightarrow 2H_2 + O_2 + \cancel{4H^+ + 4OH^-}$

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ANODE: $2I^- \rightarrow I_2 + 2e^-$ 0.53V

$2H_2O \rightarrow O_2 + 4H^+ + 4e^-$ 1.23V

cathode: $K^+ + e^- \rightarrow K$ -2.92V

$2H_2O + 2e^- \rightarrow H_2 + 2OH^-$ -0.83

→ lower red pot'l gets oxidized

→ higher red pot'l gets reduced

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electrode reactions: electrolyze $NiCl_{2(aq)}$

Ni^{2+}, Cl^-, H_2O

ANODE: $2H_2O \rightarrow O_2 + 4H^+ + 4e^-$

CATHODE: $Ni^{2+} + 2e^- \rightarrow Ni$

Metal plating

SO_4^{2-} non reactive in electrolysis

$CuSO_{4(aq)}$ Cu^{2+}, ~~SO_4^{2-}~~, H_2O

Metal plating

electrical current = flow of e^- I

unit = amperes, amp A

unit of electric charge = coulombs (C)   symbol q

1 mole e^- = 9.65×10^4 C $\mathcal{F}$

$$I = \frac{q}{t} \quad \text{Amp}$$

$$A = \frac{C}{S}$$

$$\frac{C}{A \mid S}$$

If a 5.00 hr flow of electric current plates out 0.404 g of Cu from $CuSO_{4(aq)}$, what was the current that was flowing?

$$Cu^{2+} + 2e^- \rightarrow Cu$$

$$A = \frac{C}{S}$$

5.00 hr = 18000 s

$$0.404\,g\ Cu \times \frac{1\ mol}{63.55\,g} \times \frac{2\ mole\ e^-}{1\ mol\ Cu} \times \frac{9.65 \times 10^4\,C}{1\ mole\ e^-}$$

$$= 1230\,C$$

$$A = \frac{1230\,C}{18{,}000\,s} = 0.0683\,A$$