Electrolytic Cells, Faraday's Laws

Tuesday, March 06, 2007
1:30 PM

Purpose:

Procedure: Procedure listed in "Electrolytic Cells, Faraday's Laws" handout. Author unknown.

Data:

Solution	Electrodes	Initial Litmus Red / Blue results	Final Litmus Red / Blue results	Observations	Equations for reactions
1.8g NaCl/100mL	Carbon (graphite)	Red: no change Blue: no change	Red: no change Blue: turned rose pink	Gas evolved and bubbles stuck to both anode and cathode. Far more bubbles on the anode.	Anode: $2Cl^- \rightarrow Cl_2 + 2e^-$ Cathode: $Na^+ + e^- \rightarrow Na$ Cell: $2Cl^- + 2Na^+ \rightarrow 2Na + Cl_2$
2.8g NaBr/100mL	Carbon (graphite)	Red: no change Blue: no change	Red: turned blue Blue: no change	Bubbles evolved mostly on the cathode. Yellow aqueous substance is coming off of anode.	Anode: $2Br^- \rightarrow Br_2 + 2e^-$ Cathode: $Na^+ + e^- \rightarrow Na$ Cell: $2Br^- + 2Na^+ \rightarrow 2Na + Br_2$
2.7g KI/100mL	Carbon (graphite)	Red: no change Blue: no change	Red: turned blue Blue: no change	Bubbles on cathode. Yellow coming of anode.	Anode: $2I^- \rightarrow I_2 + 2e^-$ Cathode: $K^+ + e^- \rightarrow K$ Cell: $2I^- + 2K^+ \rightarrow 2K + I_2$
0.1M $CuSO_4$	Carbon (graphite)	Red: no change Blue: turned pink	Red: no change Blue: turned pink	No gas/bubbles. Yellow coming off of anode.	Anode: $SO_4^{2-} \rightarrow 2e^- + SO_2 + O_2$ Cathode: $Cu^{2+} + 2e^- \rightarrow Cu$ Cell: $Cu^{2+}\ SO_4^{2-} \rightarrow SO_2 + O_2 + Cu$
0.1M $CuSO_4$	Polished copper metal strips	Red: no change Blue: turned pink	Red: no change Blue: turned pink	No gas/bubbles. No visible movement or reaction	Anode: $SO_4^{2-} \rightarrow 2e^- + SO_2 + O_2$ Cathode: $Cu^{2+} + 2e^- \rightarrow Cu$ Cell: $Cu^{2+}\ SO_4^{2-} \rightarrow SO_2 + O_2 + Cu$

1. Initial mass of copper anode (g)	0.1394g
2. Initial mass of copper cathode (g)	0.1296g
3. Time of electrolysis (s)	900 s
4. Current (or average current) (A)	.009
5. Final mass of copper anode (g)	.0674
6. Final mass of copper cathode (g)	.1737
7. Mass of copper reduced at cathode (g)	.0441 g Cu
8. Amount of copper reduced (mol)	6.9399×10^{-4} mol Cu

$15\,min \times \frac{60\,sec}{1\,min} = 900\,sec$

Our results had a large percent error because the more than half of the anode broke off into solution. Our calculated mass of Cu from the anode was far larger than it actually should have been.

9. Amount of electrons transferred (mol e^-)	.00138797 mol e^-
10. Coulombs passed through cell (C)	86836500 C
11. Electrons passed through cell (e^-)	$1.08545625 \times 10^{27}$
12. Avogadro's number (e^-/mole e^-)	$6.022 * 10^{23}$
13. Average value of Avogadro's number	7.82×10^{28}
14. Literature value of Avogadro's number	6.022×10^{23}
15. Percent error	Really large
16. Faraday value (C/mol e^-)	62563672125.5
17. Average Faraday value (C/mol e^-)	NA
18. Literature value of Faraday value	96485
19 Percent error	Really large