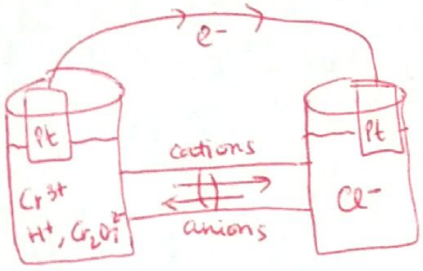
Ch. 18 – page 879 #37, 39, 41

37a. $\overset{+3}{Cr^{3+}} + \overset{0}{Cl_2} \rightleftharpoons \overset{+6}{Cr_2O_7^{2-}} + \overset{-1}{Cl^-}$

(39a)



Cl_2 gas is bubbled into sol'n at cathode.

Nonreactive metal is used as the electrode in both cells (e.g. Pt).

Anode ↓ $(Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O \quad E° = 1.33V)$ reverse

Cathode ↓ $(Cl_2 + 2e^- \rightarrow 2Cl^- \quad E° = 1.36V) \times 3$

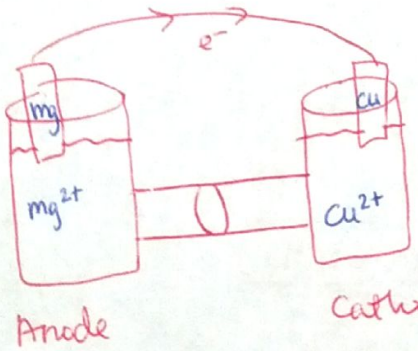
$3Cl_2 + 6e^- \rightarrow 6Cl^- \quad E° = 1.36V$

$2Cr^{3+} + 7H_2O \rightarrow Cr_2O_7^{2-} + 14H^+ + 6e^- \quad E° = -1.33V$

$2Cr^{3+} + 7H_2O + 3Cl_2 \rightarrow Cr_2O_7^{2-} + 14H^+ + 6Cl^- \quad E° = 0.03V$

37b. $\overset{+2}{Cu^{2+}} + \overset{0}{Mg} \rightleftharpoons \overset{+2}{Mg^{2+}} + \overset{0}{Cu}$

(39b)



Anode Cathode

reverse $(Mg^{2+} + 2e^- \rightarrow Mg)$ $Cu^{2+} + 2e^- \rightarrow Cu$

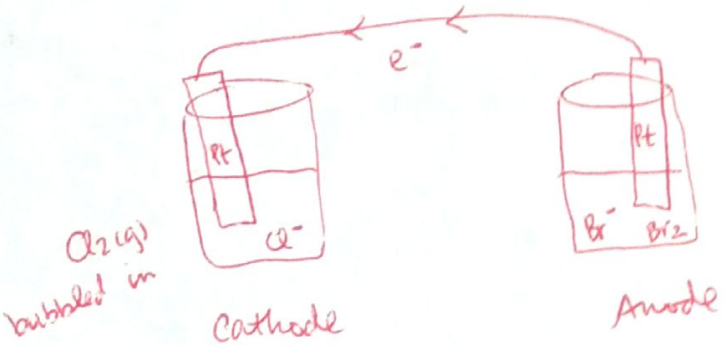
$Cu^{2+} + Mg \rightarrow Cu + Mg^{2+}$

$E°_{cell} = E°_{Cu^{2+} \rightarrow Cu} + E°_{Mg \rightarrow Mg^{2+}} = 0.34V + 2.37V = \boxed{2.71V}$

41a) $Cl_2 + 2e^- \rightarrow 2Cl^-$ $E° = 1.36V$ ← cathode

$Br_2 + 2e^- \rightarrow 2Br^-$ $E° = 1.09V$ ← anode

$E°_{cell} = 1.36V - (1.09V) = \boxed{0.27V}$



$\boxed{Cl_2 + 2Br^- \rightarrow Br_2 + 2Cl^-}$

42b) $Mn^{2+} + 2e^- \rightarrow Mn$ $E° = -1.18V$ ← anode

$Fe^{3+} + 3e^- \rightarrow Fe$ $E° = -0.036V$ ← cathode

$E°_{cell} = -0.036V - (-1.18V) = \boxed{1.144V}$

41b) $(MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O) * 2$ $E° = 1.51V$ ← anode

$(IO_4^- + 2H^+ + 2e^- \rightarrow IO_3^- + H_2O) * 5$ $E° = 1.60V$ ← cathode

$E°_{cell} = 1.60V - 1.51V = \boxed{0.09V}$

$5IO_4^- + 10H^+ + 10e^- \rightarrow 5IO_3^- + 5H_2O$

$2Mn^{2+} + 8H_2O \rightarrow 2MnO_4^- + 16H^+ + 10e^-$

$\boxed{3H_2O + 5IO_4^- + 2Mn^{2+} \rightarrow 5IO_3^- + 2MnO_4^- + 6H^+}$