Electrochemistry Review

1. (a) +4 (e) +3
(b) +4 (f) -1
(c) +3 (g) 0
(d) +6 (h) +1

2. $(NH_4)_2CO_3$
$-3\ \ +1\ \ +4\ \ -2$

3. no - no transfer of e^-

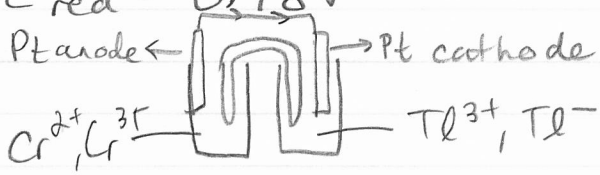
4. (a) $SO_3^{2-} + H_2O \rightarrow SO_4^{2-} + 2H^+ + 2e^-$ oxidation
(b) $CrO_4^{2-} + 4H_2O + 3e^- \rightarrow Cr^{3+} + 8OH^-$ reduction
(c) $2I^- \rightarrow I_2 + 2e^-$ oxidation

5. (a) $6NO + 2AsH_2O \rightarrow 2AsO_2^- + 3N_2O + 2H^+$
(b) $6Ce^{4+} + I^- + 6OH^- \rightarrow 6Ce^{3+} + IO_3^- + 3H_2O$

6. (a) $Sn \rightarrow Sn^{2+} + 2e^-$ anode $E^\circ_{ox} = 0.136V$
$2Ag^+ + 2e^- \rightarrow Ag$ cathode $E^\circ_{red} = 0.799V$
(b) $E^\circ_{cell} = 0.935\ V$

7. (a) B is oxidized, A is reduced
(b) $B \rightarrow B^+$ at anode
$A \rightarrow A^-$ at cathode
(c) $A \rightarrow A^-$
(d) $\Delta G < 0$

8. (a) $Tl^{3+} + 2e^- \rightarrow Tl^+$
$2Cr^{2+} \rightarrow 2Cr^{3+} + 2e^-$
(b) $E^\circ_{ox} = 0.41V$
$E^\circ_{red} = 0.78V$
(c) Pt anode ← → Pt cathode



9. (a) $2Fe^{2+} + S_2O_6^- + 4H^+ \rightarrow 2Fe^{3+} + 2H_2SO_3$

$E^\circ = -0.17V$

$N_2O + 2H^+ + 2Fe^{2+} \rightarrow N_2 + H_2O + 2Fe^{3+}$

$E^\circ = -2.54V$

$VO_2^+ + 2H^+ + Fe^{2+} \rightarrow VO^{2+} + H_2O + Fe^{3+}$

$E^\circ = 0.23V$

(b) $\Delta G^\circ = -nFE^\circ$

$\Delta G^\circ_{S_2O_6^-} = 32.8\ kJ$ } non spontaneous

$\Delta G^\circ_{N_2O} = 490.\ kJ$ }

$\Delta G^\circ_{VO_2^+} = -22.2\ kJ$ } spontaneous

(c) $\Delta G^\circ = -RT\ln K$

$K_{S_2O_6^-} = 1.78 \times 10^{-6}$

$K_{N_2O} = 1.28 \times 10^{-86}$

$K_{VO_2^+} = 7.8 \times 10^{3}$

10. (a) decreases
(b) decreases
(c) decreases
(d) no change.

11. (a) $\frac{52.00\ g}{mol\ Cr} \times \frac{1\ mol\ Cr}{3\ mole^-} \times \frac{1\ mole^-}{96485\ C} \times \frac{7.60\ C}{s} \times 172800\ s$

$m = 234\ g$

(b) $\frac{C}{s}$ $I = \frac{96485\ C}{mole^-} \times \frac{3\ mole^-}{1\ mol\ Cr} \times \frac{0.250\ mol\ Cr}{28800\ s} = 2.51\ A$