Redox Reactions Review

35(a) $Cr_2O_7^{2-} + Fe^{2+} \longrightarrow Cr^{3+} + Fe^{3+}$ acidic

(+12 −14)

Reduction - $14H^+ + Cr_2O_7^{2-} + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$ 1

Oxidation - $Fe^{2+} \rightarrow Fe^{3+} + e^-$ × 6

$6Fe^{2+} \rightarrow 6Fe^{3+} + 6e^-$

$14H^+ + Cr_2O_7^{2-} + 6e^- + 6Fe^{2+} \rightarrow 2Cr^{3+} + 7H_2O + 6Fe^{3+} + 6e^-$ ✓

35(b) $Ni + MnO_4^- \rightarrow NiO + MnO_2$

(+7 −8) Basic (+4 −4)

Oxid. $Ni + 2OH^- \rightarrow NiO + 2e^- + H_2O$ ×3

Red. $2H_2O + MnO_4^- + 3e^- \rightarrow MnO_2 + 4OH^-$ ×2

$3Ni + 5OH^- \rightarrow 3NiO + e^- + 3H_2O$

$4H_2O + 2MnO_4^- + 6e^- \rightarrow 2MnO_2 + 8OH^-$

Predicting Spontaneous Electrochemical Reactions

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Predict if a given reaction is spontaneous or not (using a table of reduction half reactions table.

e.g. $Fe_{(s)} + Cu^{2+}_{(aq)} \rightarrow Cu_{(s)} + Fe^{2+}_{(aq)}$

Write as half reactions -

$Cu^{2+} + 2e^- \rightarrow Cu$ 0.34 V

$Fe \rightarrow Fe^{2+} + 2e^-$ 0.45 V

0.79 V

Positive → i.e. spontaneous

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