

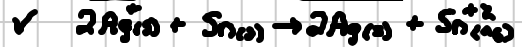
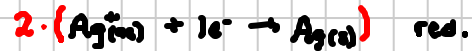
Lecture 21.4 Predicting Cell Potentials

Note Title

11/11/2011

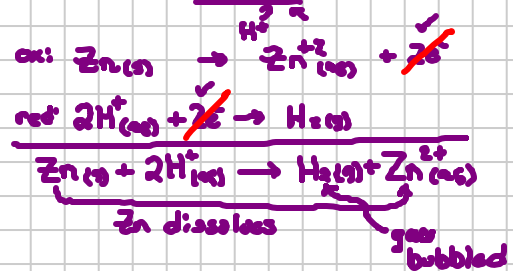
$\text{NO}_3^-(\text{aq}) + 4\text{H}^+(\text{aq}) + 3\text{e}^-$	$\longrightarrow \text{NO}(\text{g}) + 2\text{H}_2\text{O}(\text{l})$	0.96
$\text{ClO}_2(\text{g}) + \text{e}^-$	$\longrightarrow \text{ClO}_2^-(\text{aq})$	0.95
$\text{Ag}^+(\text{aq}) + \text{e}^-$	$\longrightarrow \text{Ag}(\text{s})$	0.80
$\text{Fe}^{3+}(\text{aq}) + \text{e}^-$	$\longrightarrow \text{Fe}^{2+}(\text{aq})$	0.77
$\text{O}_2(\text{g}) + 2\text{H}^+(\text{aq}) + 2\text{e}^-$	$\longrightarrow \text{H}_2\text{O}_2(\text{aq})$	0.70
$\text{MnO}_4^-(\text{aq}) + \text{e}^-$	$\longrightarrow \text{MnO}_4^{2-}(\text{aq})$	0.56
$\text{I}_2(\text{s}) + 2\text{e}^-$	$\longrightarrow 2\text{I}^-(\text{aq})$	0.54
$\text{Cu}^+(\text{aq}) + \text{e}^-$	$\longrightarrow \text{Cu}(\text{s})$	0.52
$\text{O}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l}) + 4\text{e}^-$	$\longrightarrow 4\text{OH}^-(\text{aq})$	0.40
$\text{Cu}^{2+}(\text{aq}) + 2\text{e}^-$	$\longrightarrow \text{Cu}(\text{s})$	0.34
$\text{SO}_4^{2-}(\text{aq}) + 4\text{H}^+(\text{aq}) + 2\text{e}^-$	$\longrightarrow \text{H}_2\text{SO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l})$	0.20
$\text{Cu}^{2+}(\text{aq}) + \text{e}^-$	$\longrightarrow \text{Cu}^+(\text{aq})$	0.16
$\text{Sn}^{4+}(\text{aq}) + 2\text{e}^-$	$\longrightarrow \text{Sn}^{2+}(\text{aq})$	0.15
$2\text{H}^+(\text{aq}) + 2\text{e}^-$	$\longrightarrow \text{H}_2(\text{g})$	0
$\text{Fe}^{3+}(\text{aq}) + 3\text{e}^-$	$\longrightarrow \text{Fe}(\text{s})$	-0.036
$\text{Pb}^{2+}(\text{aq}) + 2\text{e}^-$	$\longrightarrow \text{Pb}(\text{s})$	-0.13
$\text{Sn}^{2+}(\text{aq}) + 2\text{e}^-$	$\longrightarrow \text{Sn}(\text{s})$	-0.14
$\text{Ni}^{2+}(\text{aq}) + 2\text{e}^-$	$\longrightarrow \text{Ni}(\text{s})$	-0.23
$\text{Cd}^{2+}(\text{aq}) + 2\text{e}^-$	$\longrightarrow \text{Cd}(\text{s})$	-0.40
$\text{Fe}^{2+}(\text{aq}) + 2\text{e}^-$	$\longrightarrow \text{Fe}(\text{s})$	-0.45
$\text{Cr}^{3+}(\text{aq}) + \text{e}^-$	$\longrightarrow \text{Cr}^{2+}(\text{aq})$	-0.50
$\text{Cr}^{3+}(\text{aq}) + 3\text{e}^-$	$\longrightarrow \text{Cr}(\text{s})$	-0.73
$\text{Zn}^{2+}(\text{aq}) + 2\text{e}^-$	$\longrightarrow \text{Zn}(\text{s})$	-0.76

- Tin vs Silver $\frac{1}{2}$ cells
 - .. abbr. cell diagram
 - .. net cell reaction
 - ... E_{cell}

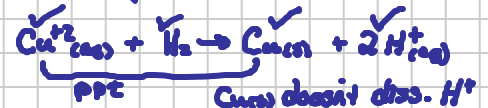


$\checkmark E_{\text{cell}} = E_{\text{cath. red}} - E_{\text{anod. ox}} = 0.80\text{V} - (-0.14\text{V}) = \underline{0.94\text{V}}$

- Spontaneous Zn/HCl reaction



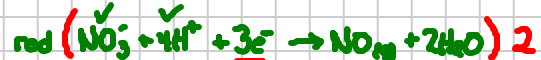
- Spontaneous Cu/HCl reaction



- Spontaneous Cu/HNO₃ reaction

nitric acid

H^+ , NO_3^-



Cu dissolves.

$E_{\text{cell}} = E_{\text{cath. red}} - E_{\text{anod. ox}}$

$= 0.96 - 0.34 = +0.62\text{V}$

pos. Spontaneous

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$\text{Sn}^{4+}(\text{aq}) + 2\text{e}^-$	$\longrightarrow \text{Sn}^{2+}(\text{aq})$	0.15
$2\text{H}^+(\text{aq}) + 2\text{e}^-$	$\longrightarrow \text{H}_2(\text{g})$	0