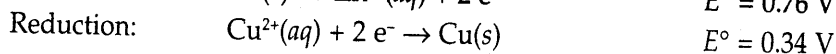
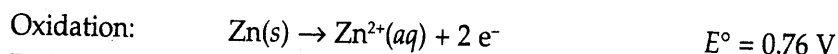
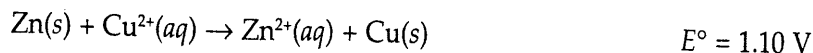


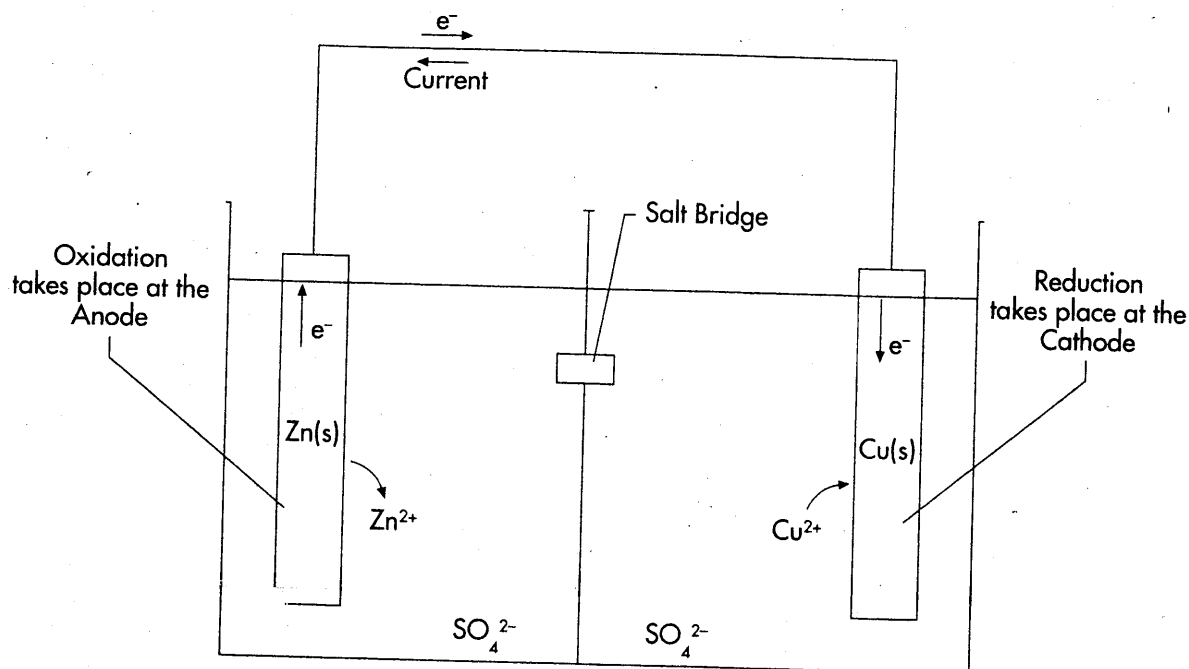
GALVANIC CELLS

In a galvanic cell (also called a voltaic cell), a spontaneous redox reaction is used to generate a flow of current.

Look at the following spontaneous redox reaction:



A galvanic cell using this reaction is shown below.



In a galvanic cell, the two half-reactions take place in separate chambers and the electrons that are released by the oxidation reaction pass through a wire to the chamber where they are consumed in the reduction reaction. That's how the current is created. Current, by the way, is defined as the flow of positive charge, so current is always in the opposite direction from the flow of electrons.

In any electric cell (either a galvanic cell or an electrolytic cell, which we'll discuss in a moment) oxidation takes place at the electrode called the **anode**. Reduction takes place at the electrode called the **cathode**.

There's a mnemonic device to remember that.

AN OX
RED CAT

The salt bridge maintains electrical neutrality in the system by providing enough negative ions to equal the positive ions being created at the anode (during oxidation) and providing positive ions to replace the Cu^{2+} ions being used up at the cathode (during reduction). The salt bridge can be an actual salt, or it can be a slim passage that allows ions to move between the two chambers.

STANDARD REDUCTION POTENTIALS IN AQUEOUS SOLUTION AT 25°C

Half-reaction	$E^\circ(\text{V})$
$\text{F}_2(\text{g}) + 2 e^- \rightarrow 2 \text{F}^-$	2.87
$\text{Co}^{3+} + e^- \rightarrow \text{Co}^{2+}$	1.82
$\text{Au}^{3+} + 3 e^- \rightarrow \text{Au}(\text{s})$	1.50
$\text{Cl}_2(\text{g}) + 2 e^- \rightarrow 2 \text{Cl}^-$	1.36
$\text{O}_2(\text{g}) + 4 \text{H}^+ + 4 e^- \rightarrow 2 \text{H}_2\text{O}(\text{l})$	1.23
$\text{Br}_2(\text{l}) + 2 e^- \rightarrow 2 \text{Br}^-$	1.07
$2 \text{Hg}^{2+} + 2 e^- \rightarrow \text{Hg}_2^{2+}$	0.92
$\text{Hg}^{2+} + 2 e^- \rightarrow \text{Hg}(\text{l})$	0.85
$\text{Ag}^+ + e^- \rightarrow \text{Ag}(\text{s})$	0.80
$\text{Hg}_2^{2+} + 2 e^- \rightarrow 2 \text{Hg}(\text{l})$	0.79
$\text{Fe}^{3+} + e^- \rightarrow \text{Fe}^{2+}$	0.77
$\text{I}_2(\text{s}) + 2 e^- \rightarrow 2 \text{I}^-$	0.53
$\text{Cu}^+ + e^- \rightarrow \text{Cu}(\text{s})$	0.52
$\text{Cu}^{2+} + 2 e^- \rightarrow \text{Cu}(\text{s})$	0.34
$\text{Cu}^{2+} + e^- \rightarrow \text{Cu}^+$	0.15
$\text{Sn}^{4+} + 2 e^- \rightarrow \text{Sn}^{2+}$	0.15
$\text{S}(\text{s}) + 2 \text{H}^+ + 2 e^- \rightarrow \text{H}_2\text{S}(\text{g})$	0.14
$2 \text{H}^+ + 2 e^- \rightarrow \text{H}_2(\text{g})$	0.00
$\text{Pb}^{2+} + 2 e^- \rightarrow \text{Pb}(\text{s})$	-0.13
$\text{Sn}^{2+} + 2 e^- \rightarrow \text{Sn}(\text{s})$	-0.14
$\text{Ni}^{2+} + 2 e^- \rightarrow \text{Ni}(\text{s})$	-0.25
$\text{Co}^{2+} + 2 e^- \rightarrow \text{Co}(\text{s})$	-0.28
$\text{Tl}^+ + e^- \rightarrow \text{Tl}(\text{s})$	-0.34
$\text{Cd}^{2+} + 2 e^- \rightarrow \text{Cd}(\text{s})$	-0.40
$\text{Cr}^{3+} + e^- \rightarrow \text{Cr}^{2+}$	-0.41
$\text{Fe}^{2+} + 2 e^- \rightarrow \text{Fe}(\text{s})$	-0.44
$\text{Cr}^{3+} + 3 e^- \rightarrow \text{Cr}(\text{s})$	-0.74
$\text{Zn}^{2+} + 2 e^- \rightarrow \text{Zn}(\text{s})$	-0.76
$\text{Mn}^{2+} + 2 e^- \rightarrow \text{Mn}(\text{s})$	-1.18
$\text{Al}^{3+} + 3 e^- \rightarrow \text{Al}(\text{s})$	-1.66
$\text{Be}^{2+} + 2 e^- \rightarrow \text{Be}(\text{s})$	-1.70
$\text{Mg}^{2+} + 2 e^- \rightarrow \text{Mg}(\text{s})$	-2.37
$\text{Na}^+ + e^- \rightarrow \text{Na}(\text{s})$	-2.71
$\text{Ca}^{2+} + 2 e^- \rightarrow \text{Ca}(\text{s})$	-2.87
$\text{Sr}^{2+} + 2 e^- \rightarrow \text{Sr}(\text{s})$	-2.89
$\text{Ba}^{2+} + 2 e^- \rightarrow \text{Ba}(\text{s})$	-2.90
$\text{Rb}^+ + e^- \rightarrow \text{Rb}(\text{s})$	-2.92
$\text{K}^+ + e^- \rightarrow \text{K}(\text{s})$	-2.92
$\text{Cs}^+ + e^- \rightarrow \text{Cs}(\text{s})$	-2.92
$\text{Li}^+ + e^- \rightarrow \text{Li}(\text{s})$	-3.05

GO ON TO THE NEXT PAGE.