

## AP Chem - 9.7 and 9.8 - Electrochemical Cells

### Extra Reference Sheet

An electrochemical cell is a device that can convert energy released by a thermodynamically favorable reduction-oxidation (redox) reaction into electrical energy - OR - One that can use electrical energy to drive a thermodynamically unfavorable redox reaction.

<b>Galvanic Cell</b> <b>(Also called Voltaic Cell)</b>	<b>Electrolytic Cell</b>
<p style="text-align: center;"><b>Galvanic (Voltaic) Cells</b></p> $\text{Zn}_{(s)} + \text{Cu}^{2+}_{(aq)} \rightarrow \text{Zn}^{2+}_{(aq)} + \text{Cu}_{(s)}$ <p style="text-align: center;"> <math>\text{Zn}_{(s)} \rightarrow \text{Zn}^{2+}_{(aq)} + 2e^-</math>      <math>\text{Cu}^{2+}_{(aq)} + 2e^- \rightarrow \text{Cu}_{(s)}</math>  Oxidation <math>\frac{1}{2}</math> reaction      Reduction <math>\frac{1}{2}</math> reaction </p> <p style="text-align: center;"><small>Copyright © 2019, 2013, 2009, 2008 AP Chem Solutions. All rights reserved.</small></p>	<p style="text-align: center;"><b>Electrolysis of Molten NaCl</b></p> <p style="text-align: center;"> <math>2\text{Cl}^{-}_{(l)} \rightarrow \text{Cl}_{2(g)} + 2e^-</math>      <math>\text{Na}^{+}_{(l)} + e^- \rightarrow \text{Na}_{(l)}</math>  Oxidation      Reduction </p> <p style="text-align: center;"><small>Copyright © 2019, 2013, 2009, 2008 AP Chem Solutions. All rights reserved.</small></p>
<p><b><u>Thermodynamically favorable reaction:</u></b>  It convert energy released by a thermodynamically favorable reduction-oxidation (redox) reaction into electrical energy</p>	<p><b><u>Thermodynamically unfavorable reaction:</u></b>  It uses electrical energy to drive a thermodynamically unfavorable redox reaction.</p>
<p>The anode and cathode are in <b><u>separate chambers, often called half-cells or half-reactions</u></b>. Usually these are in two different beakers</p>	<p>The anode and cathode are in the <b><u>same chamber</u></b> (typically a beaker)</p>
<p>A <b><u>salt-bridge</u></b> is needed for the reaction to occur</p>	<p>A <b><u>power source</u></b> is needed for the reaction to occur (typically a battery)</p>
<p><b><u>Produces</u></b> electrical energy  (Positive voltage value)</p>	<p><b><u>Uses</u></b> electrical energy  (Negative voltage value)</p>

<b>Both Types of Cells</b>	
<p style="text-align: center;"><b>Oxidation occurs at the anode -- Reduction occurs at the cathode</b>  (Remember LEO the lion says GER? Lose of electrons is oxidation. Gain electrons is reduction.)  <b>Require ion flow in the cell for the reaction to occur (cations → cathode, anions → anode)</b></p>	