

Standard Potentials

- **Standardized potentials (E°), listed as reductions, for all half-reactions**
- **Measured versus the S.H.E (0)**
- **Used in predicting the action in either a galvanic cell or how much energy would be needed to force a specific reaction in a non-spontaneous cell**
- **Assumes an activity of one for the species of interest (usually a fair approximation) at a known temperature in a cell with the S.H.E.**
- **Assumes that the cell of interest is connected to the (+) terminal of the potentiometer (voltmeter) and the S.H.E. is connected to the (-) terminal**

TABLE 22-1 Standard Electrode Potentials*

Reaction	E^0 at 25°C, V
$\text{Cl}_2(g) + 2e^- \rightleftharpoons 2\text{Cl}^-$	+1.359
$\text{O}_2(g) + 4\text{H}^+ + 4e^- \rightleftharpoons 2\text{H}_2\text{O}$	+1.229
$\text{Br}_2(aq) + 2e^- \rightleftharpoons 2\text{Br}^-$	+1.087
$\text{Br}_2(l) + 2e^- \rightleftharpoons 2\text{Br}^-$	+1.065
$\text{Ag}^+ + e^- \rightleftharpoons \text{Ag}(s)$	+0.799
$\text{Fe}^{3+} + e^- \rightleftharpoons \text{Fe}^{2+}$	+0.771
$\text{I}_3^- + 2e^- \rightleftharpoons 3\text{I}^-$	+0.536
$\text{Cu}^{2+} + 2e^- \rightleftharpoons \text{Cu}(s)$	+0.337
$\text{Hg}_2\text{Cl}_2(s) + 2e^- \rightleftharpoons 2\text{Hg}(l) + 2\text{Cl}^-$	+0.268
$\text{AgCl}(s) + e^- \rightleftharpoons \text{Ag}(s) + \text{Cl}^-$	+0.222
$\text{Ag}(\text{S}_2\text{O}_3)_2^{3-} + e^- \rightleftharpoons \text{Ag}(s) + 2\text{S}_2\text{O}_3^{2-}$	+0.010
$2\text{H}^+ + 2e^- \rightleftharpoons \text{H}_2(g)$	0.000
$\text{AgI}(s) + e^- \rightleftharpoons \text{Ag}(s) + \text{I}^-$	-0.151
$\text{PbSO}_4(s) + 2e^- \rightleftharpoons \text{Pb}(s) + \text{SO}_4^{2-}$	-0.350
$\text{Cd}^{2+} + 2e^- \rightleftharpoons \text{Cd}(s)$	-0.403
$\text{Zn}^{2+} + 2e^- \rightleftharpoons \text{Zn}(s)$	-0.763

**Better Oxidizing Agents
in upper left hand corner.**



**Better Reducing
Agents in lower
Right hand corner**

*See Appendix 3 for a more extensive list.

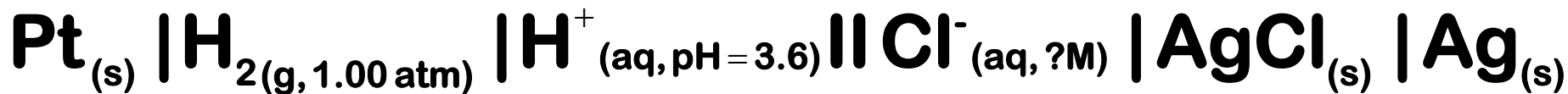
What is $E^{\circ'}$??

- $E^{\circ'}$ is used in biochemistry to express the standard reduction potentials (E°) for conditions at pH 7.
- $E^{\circ'}$ is more useful for biochemists since most biological systems are near pH 7.
- Many redox reactions involved H^+ -- by expressing E° as $E^{\circ'}$, then it is understood that the $[H^+] = 10^{-7}$ M.
- Table 14-2 (pg. 303) lists the E° and $E^{\circ'}$ for various reduction reactions of interest in biochemistry.

Using the Nernst Equation to Solve for a Species Concentration

(Chemical Sensor)

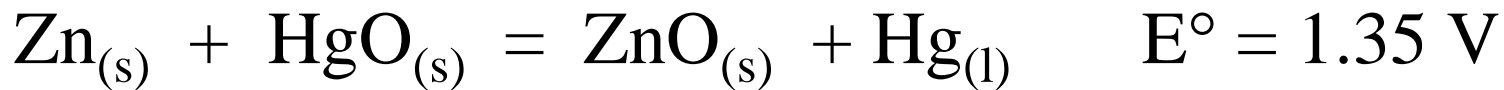
The cell is described as follows. Solve for the concentration of chloride if the measured cell voltage is 0.485 V



Problem - Calculate the E_{cell} for the following:



Problem - A mercury cell used to power pacemakers runs on the following reaction:



If the power required to operate the pacemaker is 0.0100 W, how many kilograms of HgO (FM 216.59) will be consumed in 365 days? How many pounds of HgO is this (1 lb = 453.6 g)?

Applications of electrochemistry in analytical chem:

http://www.env.plymouth.ac.uk/eim/eat_home.htm