Determining the Voltage of Electrochemical Cells

Chemical reactions often involve the movement of electrons. The driving force that moves the electrons can be measured. It is the voltage. The voltage of an electrochemical cell can be determined using the *Standard Reduction Table*.

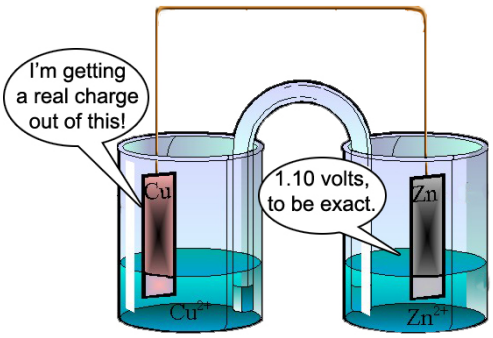
Procedure

1. All half reactions on the *Standard Reduction Potentials Table* are compared to hydrogen ($E^0 = 0$)
2. All half reactions can be read in reverse as oxidations in which case the sign of the voltage, E^0, is changed
3. The net voltage is the sum of the voltages of the oxidation half reactions and the reduction half reactions (see chart)

Example

What voltage is associated with the reaction $CuSO_4 + Zn \rightarrow ZnSO_4 + Cu$?

			$Zn^0 \rightarrow$	Zn^{2+}	+	$2e^-$	$E^0 = 0.76v$
Cu^{2+}	+	$2e^-$	$\rightarrow$			Cu^0	$E^0 = 0.34v$
Cu^{2+}	+	Zn^0	$\rightarrow$	Zn^{2+}	+	Cu^0	$E^0 = 1.10v$



Existential discussions in voltaic cells

Write the half reactions for each of the following reactions, balance them, and determine the voltage (E^0) associated with the reaction by using the *Standard Reduction Table*.

1. $Cu + AgNO_3 \rightarrow Ag + Cu(NO_3)_2$

2. $K_2Cr_2O_7 + SnCl_2 + HCl \rightarrow CrCl_3 + SnCl_4 + KCl + H_2O$

3. $SnCl_2 + HgCl_2 \rightarrow SnCl_4 + Hg_2Cl_2$

4. $Sn + HNO_3 + H_2O \rightarrow H_2SnO_3 + NO$

5. $KBr + Fe_2(SO_4)_3 \rightarrow Br_2 + K_2SO_4 + FeSO_4$

6. $Fe + CuSO_4 \rightarrow Cu + Fe_2(SO_4)_3$

7. $KMnO_4 + HCl \rightarrow KCl + MnCl_2 + H_2O + Cl_2$

8. $Na + H_2O \rightarrow NaOH + H_2$

9. $HBr + MnO_2 \rightarrow MnBr_2 + H_2O + Br_2$

10. $HCl + K_2SO_4 \rightarrow KCl + SO_2 + H_2O + Cl_2$