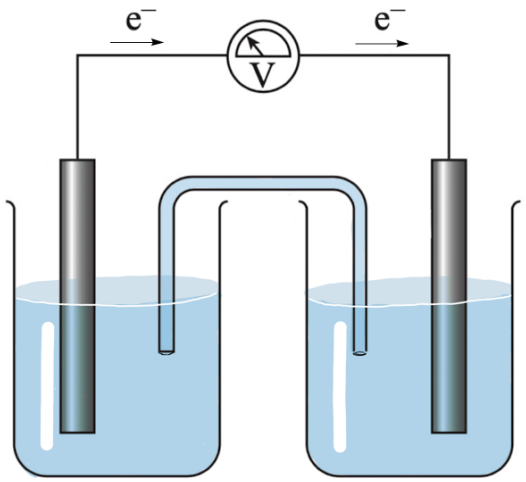
CONCEPT: GALVANIC CELLS

Galvanic/Voltaic Cell: A spontaneous cell that _____ or _____ electricity.

Ionization Energy _____

Electron Affinity _____



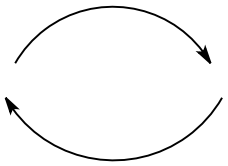
Anode _____

Cathode _____

Producing ⇧ Voltage

[Anode] _____

[Cathode] _____



Galvanic/Voltaic Cell

$$\text{Cathode}: \; 3\,Cu^{2+}(aq) + \cancel{6\,e^-} \rightleftharpoons 3\,Cu\,(s)$$

$$\text{Anode}: \quad 2\,Cr\,(s) \rightleftharpoons 2\,Cr^{3+}(aq) + \cancel{6\,e^-}$$

Reduction Half-Reactions	E° (V)
$F_2\,(g) + 2e^- \rightleftharpoons 2F^-$	2.890
$O_3\,(g) + 2H^+ + 2e^- \rightleftharpoons O_2\,(g) + H_2O$	2.075
$MnO_4^- + 8H^+ + 5e^- \rightleftharpoons Mn^{2+} + 4H_2O$	1.507
$Ag^+ + e^- \rightleftharpoons Ag\,(s)$	0.799
$Cu^{2+} + 2e^- \rightleftharpoons Cu\,(s)$	0.339
$2H^+ + 2e^- \rightleftharpoons H_2\,(g)$	0.000
$Cd^{2+} + 2e^- \rightleftharpoons Cd\,(s)$	-0.402
$K^+ + e^- \rightleftharpoons K\,(s)$	-2.936
$Li^+ + e^- \rightleftharpoons Li\,(s)$	-3.040

CONCEPT: ELECTROLYTIC CELLS

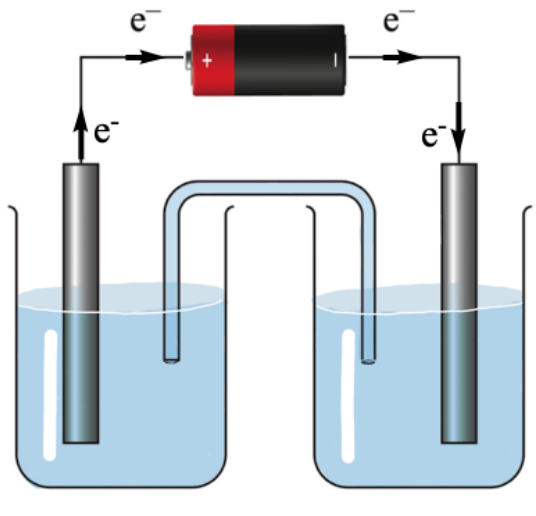
In terms of spontaneity the following correlations between the following variables can be made:

ΔG^o	K	E^o	ΔS^o	Q vs. K	Reaction Classification	Cell Type
< 0	> 1	> 0	> 0	Q < K		
> 0	< 1	< 0	< 0	Q > K		
= 0	= 1	= 0	= 0	Q = K		

Electrolytic Cell: A non-spontaneous electrochemical cell that _____ electricity and so requires a battery.

Electron Affinity _____

Ionization Energy _____



_____ (+)

_____ (—)

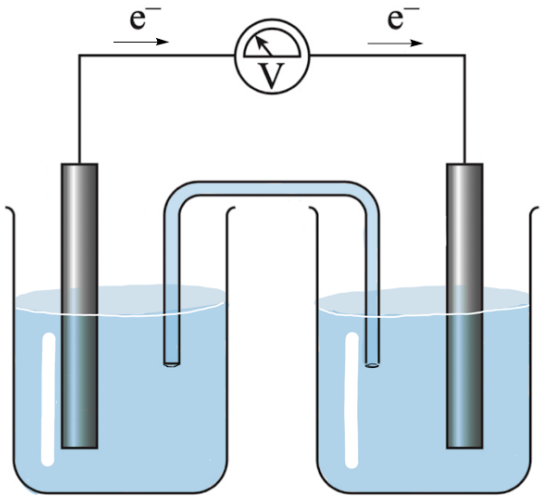
Electrolytic Cell

CONCEPT: LINE NOTATION

Line notation is a quick, simple method to describe an electrochemical cell without having to draw it out in detail.

| = _____ || = _____

Lower Oxidation State	Higher Oxidation State	Higher Oxidation State	Lower Oxidation State



Cathode : $3\,Cu^{2+}(aq) + 6\,e^- \rightleftharpoons 3\,Cu\,(s)$

Anode : $2\,Cr\,(s) \rightleftharpoons 2\,Cr^{3+}(aq) + 6\,e^-$

| | || | |

EXAMPLE: Write the half reactions as well as the overall net ionic equation for the following line notation:

$$Cu \mid Cu^{2+}\,(aq, 0.0050\ M) \parallel Ag^{+}(aq, 0.50\ M) \mid Ag$$

PRACTICE: LINE NOTATION CALCULATIONS 1

EXAMPLE: Sketch the galvanic cell and determine the cell notation for the following redox reaction:

$$2\,H^{+}(aq) + Fe\,(s) \rightleftharpoons H_2\,(g) + Fe^{2+}(aq)$$

PRACTICE: Sketch the galvanic cell and determine the line notation for the following redox reaction:

$$Ni^{2+}(aq) + Mg\,(s) \rightleftharpoons Ni\,(s) + Mg^{2+}(aq)$$