

Electrochemistry

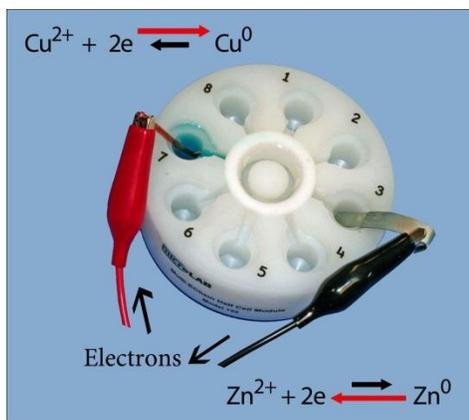


Electrochemistry is somewhat of a step-child in the general chemistry curriculum. Often left for quick treatment at the end of the semester, “hands-on” electrochemistry labs are thought difficult and expensive.

This need not be true. Here are some new tools that will make electrochemistry understandable, affordable, and easy and fun to teach.

- Oxidation – Reduction • Electroplating •

MicroLab’s inexpensive **Model 232 Electroplating Module** provides three volts DC battery power from two AA batteries and a lamp to monitor electron flow in basic electroplating experiments. It can also detect ionization and ionic conductivity.



- Half Cell Reactions • The Electrochemical Series •
- The Nernst Equation •

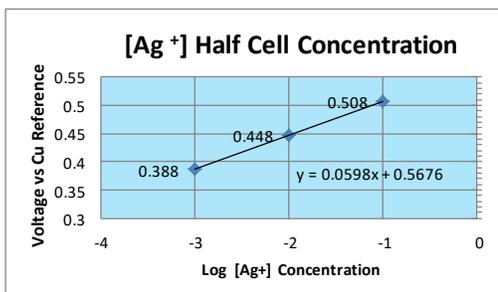
MicroLab’s **Model 152 Mult-EChem Half Cell Module** has space for eight metal/ion electrochemical half cells, each equally accessing a central aqueous salt bridge through a replaceable porous cylinder. Small (3 mL) samples and the aqueous salt bridge provide extremely stable electrochemical cell voltage measurements (± 1 mV/30 minutes) with a MicroLab FS-522/FS-524/528 Laboratory Data System (readout shown on next page), or with an inexpensive digital voltmeter.

The Electrochemical Series		
Volts	+0.34	$\text{Cu}^{2+} + 2e^- \rightleftharpoons \text{Cu}^0$
	0.0	$2\text{H}^+ + 2e^- \rightleftharpoons \text{H}_2$
	-0.76	$\text{Zn}^{2+} + 2e^- \rightleftharpoons \text{Zn}^0$

Getting Started in Electrochemistry

Because many of us work with limited equipment funds, or would like to explore a new lab topic before investing much in equipment, here’s how the five introductory topics illustrated above can be demonstrated and taught with inexpensive apparatus.

Exploration of concepts of oxidation, reduction, and electroplating require only a battery, a flashlight bulb to monitor current, two clip leads, (provided with the Model 232 Electrochemistry Module) and some copper wire and copper sulfate. The electrochemical series may be developed experimentally using small, safe, low-cost chemical samples using our inexpensive Model 152 half-cell module, our Model 151 Seven metal kit, and a common digital voltmeter. The Nernst Equation’s prediction of change in cell voltage with changing ion concentration may be demonstrated by holding one half cell ion concentration constant and changing the other by powers of ten (Ag+ data to the left). Note that the slope is 59 mv / decade, as predicted by the Nernst Equation constant RT/nF , concentration expressed with base 10 logs.

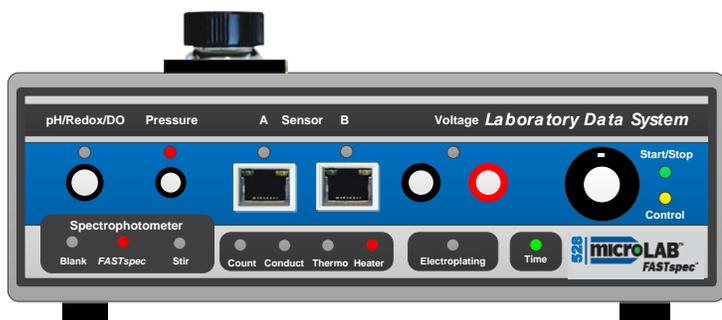
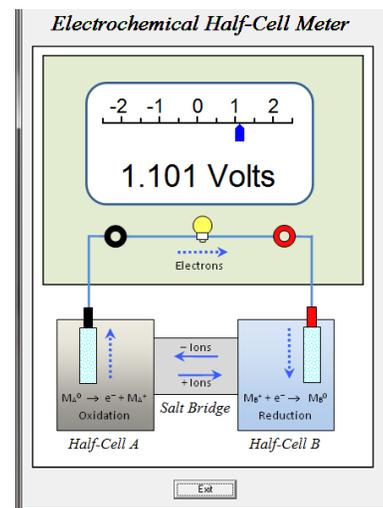




The MicroLab 528's black and red "Voltage" banana jacks play double duty. For **spontaneous electrochemical experiments** such as the electrochemical series and the Nernst equation, they measure DC voltage ± 2500 mV with a resolution of ± 0.076 mV. For **forced electrochemical experiments** such as electroplating, electrolysis, or coulometric titrations, these banana jacks provide an adjustable regulated 0-5 volt DC power supply delivering up to 750 mA. Software integrates current over time to calculate coulombs of charge or moles of electrons delivered.

- **Electroplating** • **Avogadro's Number** •
- **Atomic Mass** • **Ionic Charge** •

MicroLab
FS-522/524 /528
Electro-
chemistry
half-cell display.



MicroLab's NEW FS-528 FASTspec™ Laboratory Data System with its integrated 360-880nm scanning spectrophotometer and friendly software will make almost every instrumental measurement required in general and environmental chemistry and biology. It will serve college/university chemistry courses freshman through senior and undergraduate research.

The FS-528 supports electrochemistry experiments from the electrochemical series through Nernst equation experiments, plus coulometric titrations and cyclic voltammetry with our Model 170 cyclic voltammetry module.



Getting Started in Electrochemistry

Here is a quick, affordable way to get your students started with electrochemistry. The MicroLab electroplating power supply and half-cell modules are unique, rugged, require small amounts of chemicals, and will last a long time. They have been designed for inexpensive entry into this field. To explore electrochemical series and Nernst equation experiments, your students must be able to measure voltage. This can be done with a MicroLab FS-522/524/528, another brand of lab interface that measures voltage, or a simple digital voltmeter that you might have on hand, purchase locally, or purchase from MicroLab.



Model 232 Electrochemistry Module

The table below shows equipment packages for these several alternatives. The metal kit contains two each 5 cm lengths of wire representing seven elements: Ag, Cu, Ni, Fe, Pb, Zn, and Al. Sandpaper is provided to clean the metal samples before each measurement. Sample experiments are available on our web site.



Model 233 DVM

Model	Component	Electrochem Kit 235	Electrochem Kit 236	Electrochem Kit 237
151	Seven element metal kit Two each metal samples + sandpaper	The Electrochemical Series, Nernst Equation Models 151, 152	Add Electroplating Module 232	Add Digital Voltmeter Model 233 (+\$27)
152	Half-cell Module 			
232	Electroplating Module + clip leads + two copper foil anodes .			
233	Digital voltmeter + test leads and battery.			