

Elements, Compounds and Mixtures— Experiment Summaries and Concepts



Introduction to Electrochemistry—Electrolysis of Water

Build a simple electrochemical cell to introduce the basic principles of electrochemistry. All you will need are mechanical pencil leads, a 9-V battery, and a U-tube. The purpose of this experiment is to investigate the chemical reaction that takes place when an electric current is forced through water. Compare the amount of gas and indicator color changes at each electrode to identify the oxidation and reduction half-reactions and to determine the overall reaction. Safe and economical, this introductory-level experiment is also a great “classifying matter” activity!

Measuring Cell Potentials—Standard Reduction Potentials

In a voltaic cell, the flow of electrons accompanying a spontaneous oxidation–reduction reaction occurs via an external pathway, and an electric current is produced.



What factors determine the ability of a voltaic cell to produce electricity? In this unique microscale version of a classic experiment, students measure the voltage produced by micro-voltaic cells consisting of metals and metal ion solutions on a piece of filter paper. Use the results to calculate the standard reduction potential for each metal and to rank the metals from most active to least active.

Quantitative Electrochemistry—Coulombs, Electrons, and Moles

Principles of electricity and chemistry overlap in electrochemistry, the study of the interconversion of electrical and chemical energy in chemical reactions. What is the relationship between the quantity of electricity and the extent of a chemical reaction in an electrochemical process? The purpose of this experiment is to measure the mass of copper obtained in an electroplating reaction and to relate the amount of product to the amount of electricity that is used.



Electrolysis Reactions—Oxidation and Reduction

When an electric current is passed through an aqueous solution containing sodium sulfate (an electrolyte), the water molecules decompose to give hydrogen gas and oxygen gas. What happens if the electrolyte contains ions that are more easily oxidized or more easily reduced than water molecules? Use a simple and inexpensive “Petri dish” electrolysis set-up to investigate the oxidation and reduction reactions of potassium iodide, copper(II) bromide, and sodium chloride.

Concepts

- Electrochemistry
- Oxidation–reduction
- Electrolysis
- Anode vs. cathode

- Oxidation–reduction
- Voltaic cell
- Standard reduction potential
- Metal activity

- Electrolysis
- Current (amperes)
- Electrical charge (coulombs)
- Faraday constant

- Electrolysis
- Oxidation–reduction
- Anode vs. cathode
- Cell potential