

# Discover the Secrets of Standard Potentials in Aqueous Solution Monographs in Electroanalytical!

**Cu/Ag Voltaic Cell**

Cell diagram

Anode      Cathode

$\text{Cu}_{(s)} | \text{Cu}^{2+}_{(aq)} || \text{Ag}^{+}_{(aq)} | \text{Ag}_{(s)}$

Half Cell (Oxidation)      Half Cell (Reduction)

Salt Bridge      Flow electrons

Cu/Ag half cell

Cu half cell (-ve) Oxidation      Ag half cell (+ve) Reduction

$E^{\ominus}_{\text{cell}} = E^{\ominus}_{\text{cathode}} - E^{\ominus}_{\text{anode}}$

Find  $E^{\ominus}_{\text{cell}}$  (use formula)

$\text{Cu}^{2+} + 2e \leftrightarrow \text{Cu} \text{ (anode)} \quad E^{\ominus} = +0.34\text{V}$   
 $\text{Ag}^{+} + e \leftrightarrow \text{Ag} \text{ (cathode)} \quad E^{\ominus} = +0.80\text{V}$

$E^{\ominus}_{\text{cell}} = E^{\ominus}_{\text{cathode}} - E^{\ominus}_{\text{anode}}$   
 $E^{\ominus}_{\text{cell}} = +0.80 - (+0.34) = +0.46\text{V}$

Find  $E^{\ominus}_{\text{cell}}$  (use reduction potential)

$\text{Cu}^{2+} + 2e \leftrightarrow \text{Cu} \quad E^{\ominus} = +0.34\text{V}$   
 $\text{Ag}^{+} + e \leftrightarrow \text{Ag} \quad E^{\ominus} = +0.80\text{V}$

$\text{Cu} + 2\text{Ag}^{+} \rightarrow \text{Cu}^{2+} + 2\text{Ag} \quad E^{\ominus} = \text{????}$

$\text{Cu} \leftrightarrow \text{Cu}^{2+} + 2e \quad E^{\ominus} = -0.34\text{V}$   
 $2\text{Ag}^{+} + e \leftrightarrow 2\text{Ag} \quad E^{\ominus} = +0.80\text{V}$

+

$\text{Cu} + 2\text{Ag}^{+} \rightarrow \text{Cu}^{2+} + 2\text{Ag} \quad E^{\ominus} = +0.46\text{V}$

$E^{\ominus} \text{ Cu/Ag} = 0.46\text{V}$

Half cell - High electrode potential is cathode (+)  
 Half cell - low electrode potential is anode (-)  
 Electrons flow from anode (-) to cathode (+)

Std electrode potential as std reduction potential

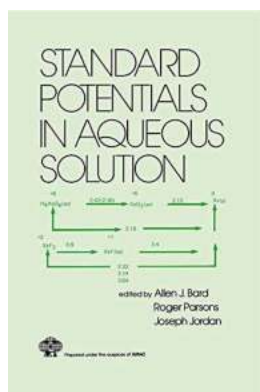
Oxidized sp	↔	Reduced sp	$E^{\ominus}/\text{V}$
$\text{Li}^{+} + e^{-}$	↔	Li	-3.04
$\text{K}^{+} + e^{-}$	↔	K	-2.93
$\text{Ca}^{2+} + 2e^{-}$	↔	Ca	-2.87
$\text{Na}^{+} + e^{-}$	↔	Na	-2.71
$\text{Mg}^{2+} + 2e^{-}$	↔	Mg	-2.37
$\text{Al}^{3+} + 3e^{-}$	↔	Al	-1.66
$\text{Mn}^{2+} + 2e^{-}$	↔	Mn	-1.19
$\text{H}_2\text{O} + e^{-}$	↔	$1/2\text{H}_2 + \text{OH}^{-}$	-0.83
$\text{Zn}^{2+} + 2e^{-}$	↔	Zn	-0.76
$\text{Fe}^{2+} + 2e^{-}$	↔	Fe	-0.45
$\text{Ni}^{2+} + 2e^{-}$	↔	Ni	-0.26
$\text{Sn}^{2+} + 2e^{-}$	↔	Sn	-0.14
$\text{Pb}^{2+} + 2e^{-}$	↔	Pb	-0.13
$\text{H}^{+} + e^{-}$	↔	$1/2\text{H}_2$	0.00
$\text{Cu}^{2+} + e^{-}$	↔	$\text{Cu}^{+}$	+0.15
$\text{SO}_4^{2-} + 4\text{H}^{+} + 2e^{-}$	↔	$\text{H}_2\text{SO}_3 + \text{H}_2\text{O}$	+0.17
$\text{Cu}^{2+} + 2e^{-}$	↔	Cu	+0.34
$1/2\text{O}_2 + \text{H}_2\text{O} + 2e^{-}$	↔	$2\text{OH}^{-}$	+0.40
$\text{Cu}^{+} + e^{-}$	↔	Cu	+0.52
$1/2\text{I}_2 + e^{-}$	↔	$\text{I}^{-}$	+0.54
$\text{Fe}^{3+} + e^{-}$	↔	$\text{Fe}^{2+}$	+0.77
$\text{Ag}^{+} + e^{-}$	↔	Ag	+0.80
$1/2\text{Br}_2 + e^{-}$	↔	Br	+1.07
$1/2\text{O}_2 + 2\text{H}^{+} + 2e^{-}$	↔	$\text{H}_2\text{O}$	+1.23
$\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^{+} + 6e^{-}$	↔	$2\text{Cr}^{3+} + 7\text{H}_2\text{O}$	+1.33
$1/2\text{Cl}_2 + e^{-}$	↔	$\text{Cl}^{-}$	+1.36
$\text{MnO}_4^{-} + 8\text{H}^{+} + 5e^{-}$	↔	$\text{Mn}^{2+} + 4\text{H}_2\text{O}$	+1.51
$1/2\text{F}_2 + e^{-}$	↔	F	+2.87

$E^{\ominus}$  value DO NOT depend on stoichiometric coefficient  
 (Independent of stoichiometric eqn)

Welcome to this fascinating journey into the world of electroanalytical chemistry, where we unravel the mysteries of standard potentials in aqueous solution monographs. In this article, we will explore the fundamentals, applications, and significance of standard potentials, providing you with valuable insights and knowledge in this field.

## Understanding Standard Potentials

Standard potentials, often referred to as standard electrode potentials or redox potentials, are crucial parameters in electroanalytical chemistry. They represent the equilibrium potential difference between a half-reaction occurring at an electrode and the standard hydrogen electrode (SHE), which acts as a reference electrode. These potentials offer a quantitative measure of a species' affinity for gaining or losing electrons and provide critical information about the thermodynamics and kinetics of electrochemical processes.



## Standard Potentials in Aqueous Solution (Monographs in Electroanalytical Chemistry and Electrochemistr Book 6)

by Neil Southorn (1st Edition, Kindle Edition)

★★★★★ 5 out of 5

Language	: English
File size	: 99027 KB
Text-to-Speech	: Enabled
Screen Reader	: Supported
Enhanced typesetting	: Enabled
Print length	: 848 pages



## Applications of Standard Potentials

The applications of standard potentials are vast and wide-ranging. Let's explore some of the key areas where standard potentials find relevance in electroanalytical studies:

### 1. Determination of Equilibrium Constants

By using standard potentials, we can determine the equilibrium constants of redox reactions. The relationship between the equilibrium constant and the

standard potential is mathematically expressed through the Nernst equation, enabling us to predict the direction and feasibility of a given reaction at different conditions.

## **2. Quantifying Species Concentrations**

Standard potentials can be utilized to quantify the concentration of various electroactive species present in a solution. This allows for the determination of analyte concentration in diverse fields such as environmental, medical, and industrial analyses. Electroanalytical techniques like voltammetry and potentiometry rely on standard potentials for accurate concentration measurements.

## **3. Electrochemical Thermodynamics**

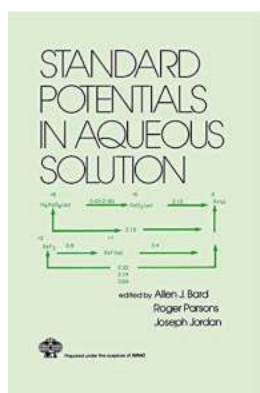
Standard potentials form the foundation for understanding the thermodynamics of electrochemical reactions. They help reveal valuable information about the energy changes, enthalpy, entropy, and Gibbs free energy associated with the redox processes occurring at electrodes. This knowledge contributes to the development of efficient electrochemical devices, such as batteries and fuel cells.

## **Significance of Standard Potentials**

Standard potentials hold immense significance in the field of electroanalytical chemistry. They provide a standardized and reliable measure of a species' redox activity, allowing for accurate comparison and prediction of electrochemical behavior. These potentials aid in the identification of unknown substances, elucidate reaction mechanisms, and contribute to the design and optimization of electrochemical processes.

Standard potentials in aqueous solution monographs play a pivotal role in electroanalytical chemistry. They serve as key indicators of a species' electron

transfer ability, enabling scientists to unlock a myriad of applications and understand the underlying principles of electrochemical reactions. By appreciating the importance of standard potentials, researchers can further advance their knowledge and contribute to the exciting field of electroanalytical chemistry.



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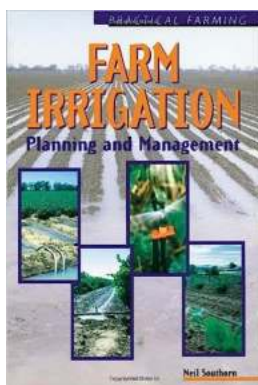
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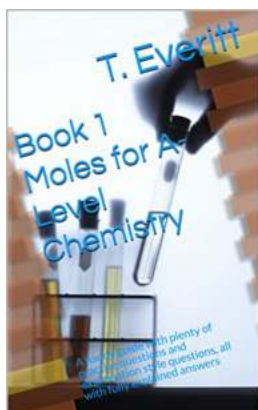
The best available collection of thermodynamic data!The first-of-its-kind in over thirty years, this up-to-date book presents the current knowledge on Standard Potentials in Aqueous Solution.Written by leading international experts and initiated by the IUPAC Commissions on Electrochemistry and Electroanalytical Chemistry, this remarkable work begins with a thorough review of basic concepts and methods for determining standard electrode potentials. Building upon this solid foundation, this convenient source proceeds to discuss the various redox couples for every known element.The chapters of this practical, time-saving guide are organized in order of the groups of elements on the periodic table, for easy reference to vital material . AND each chapter also contains the fundamental chemistry of elements ... numerous equations of chemical reactions ... easy-to-

read tables of thermodynamic data . . . and useful oxidation-statediagrams. Standard Potentials in Aqueous Solution is an ideal, handy reference for analytical and physical chemists, electrochemists, electroanalytical chemists, chemical engineers, biochemists, inorganic and organic chemists, and spectroscopists needing information on reactions and thermodynamic data in inorganic chemistry . And it is a valuable supplementary text for undergraduate- and graduate-level chemistry students.



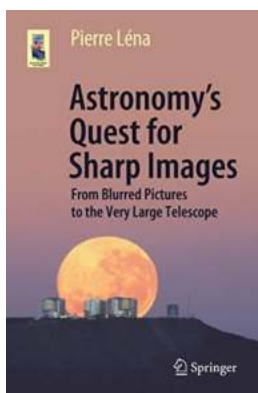
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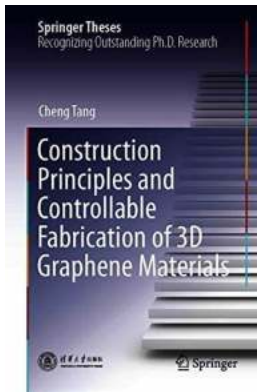
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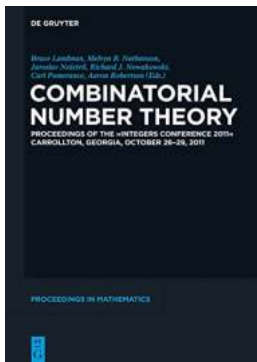
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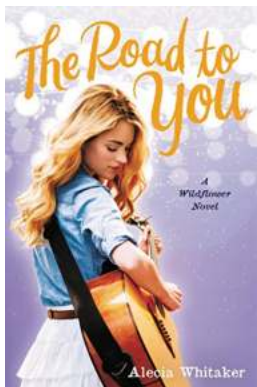
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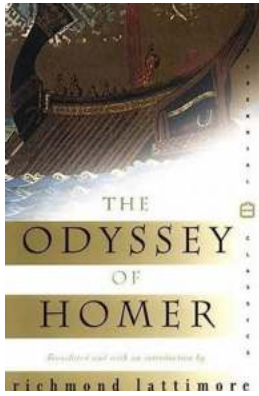
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