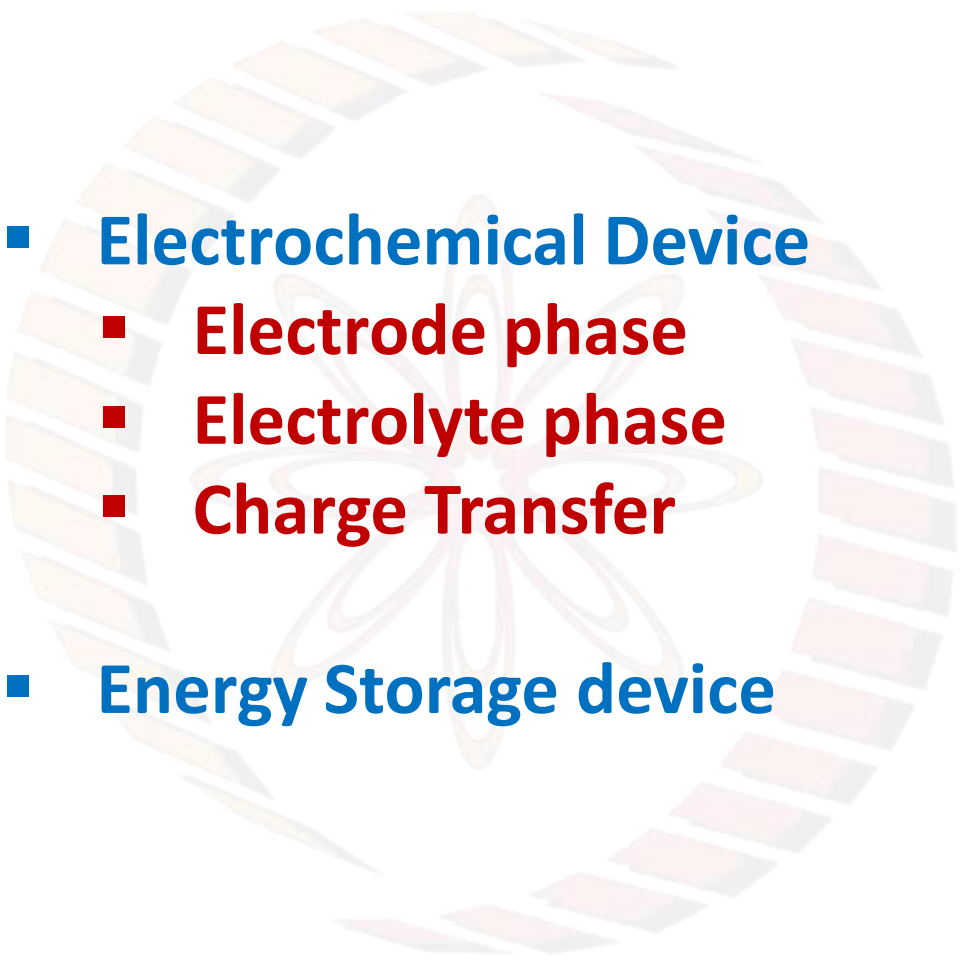




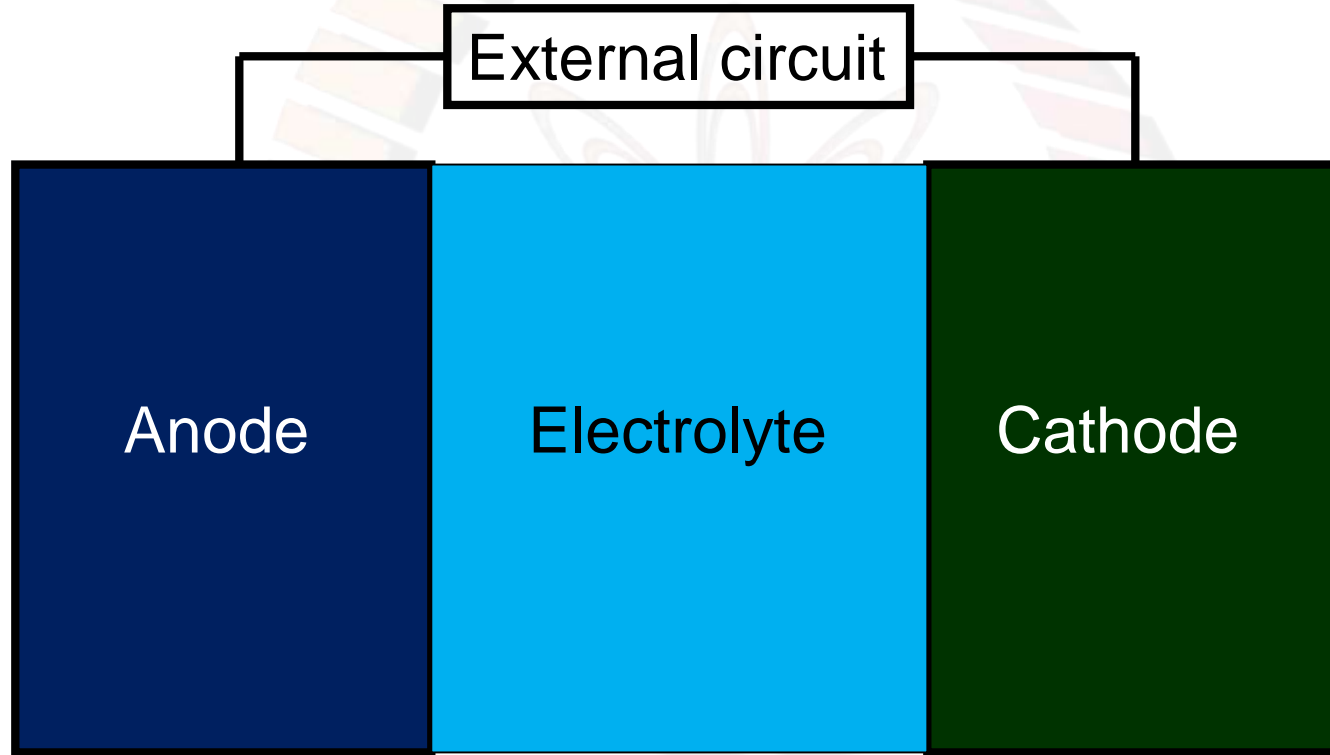
Battery Basics

Learning Objectives

- 1) To state the various parts of the battery and their functions
- 2) To indicate the use of the electrochemical series
- 3) To distinguish between primary and secondary batteries
- 4) To indicate the meaning of terms used in the context of battery technology

- 
- **Electrochemical Device**
 - **Electrode phase**
 - **Electrolyte phase**
 - **Charge Transfer**
 - **Energy Storage device**

Electrochemical Device



Anode

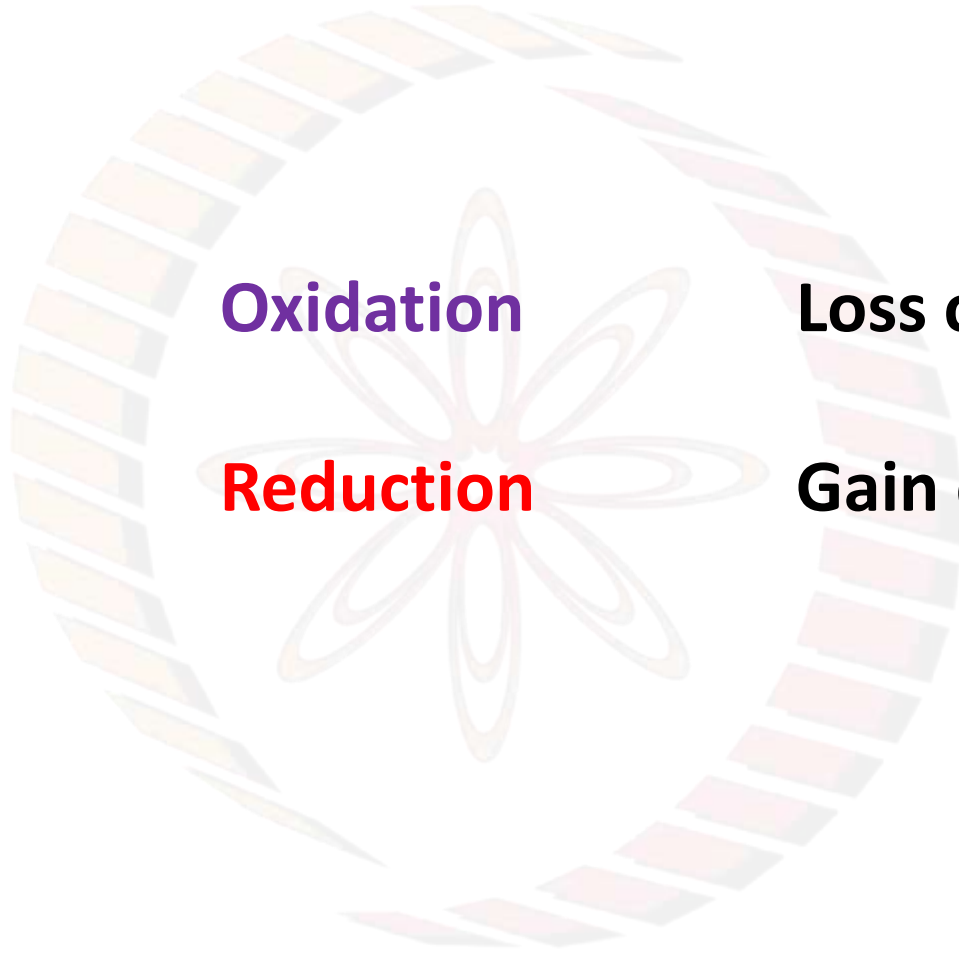
Oxidation

Loss of electrons

Cathode

Reduction

Gain of electrons



The Electrochemical Cell



Standard Electrode Potential

Standard Electrochemical Series





Energy Storage Device:

Fuel and oxidant are stored within the device.

Energy Conversion Device:

Fuel and oxidant are stored external to the device



Cell:

A single electrochemical unit; i.e. one anode, one cathode, and the electrolyte

Battery:

A collection of cells in series or parallel



Primary Cell:

Single use power source

Secondary Cell:

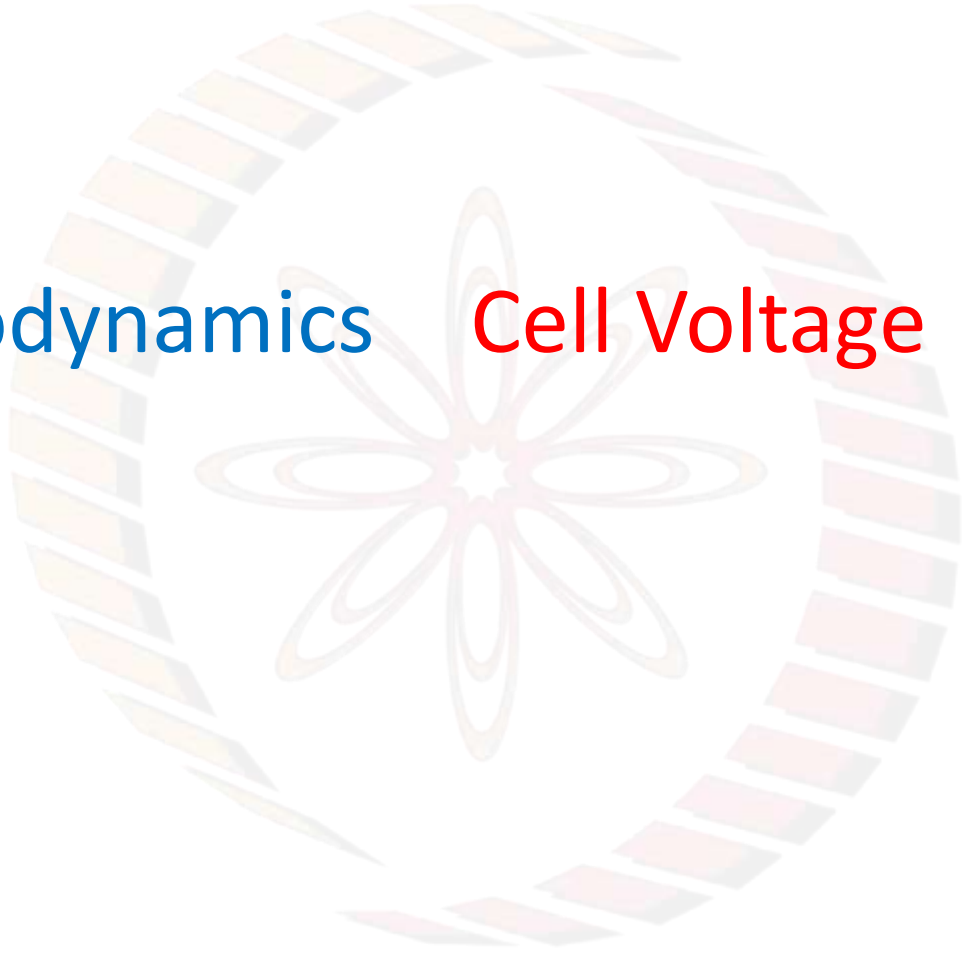
Can be recharged

Thermodynamics



Thermodynamics

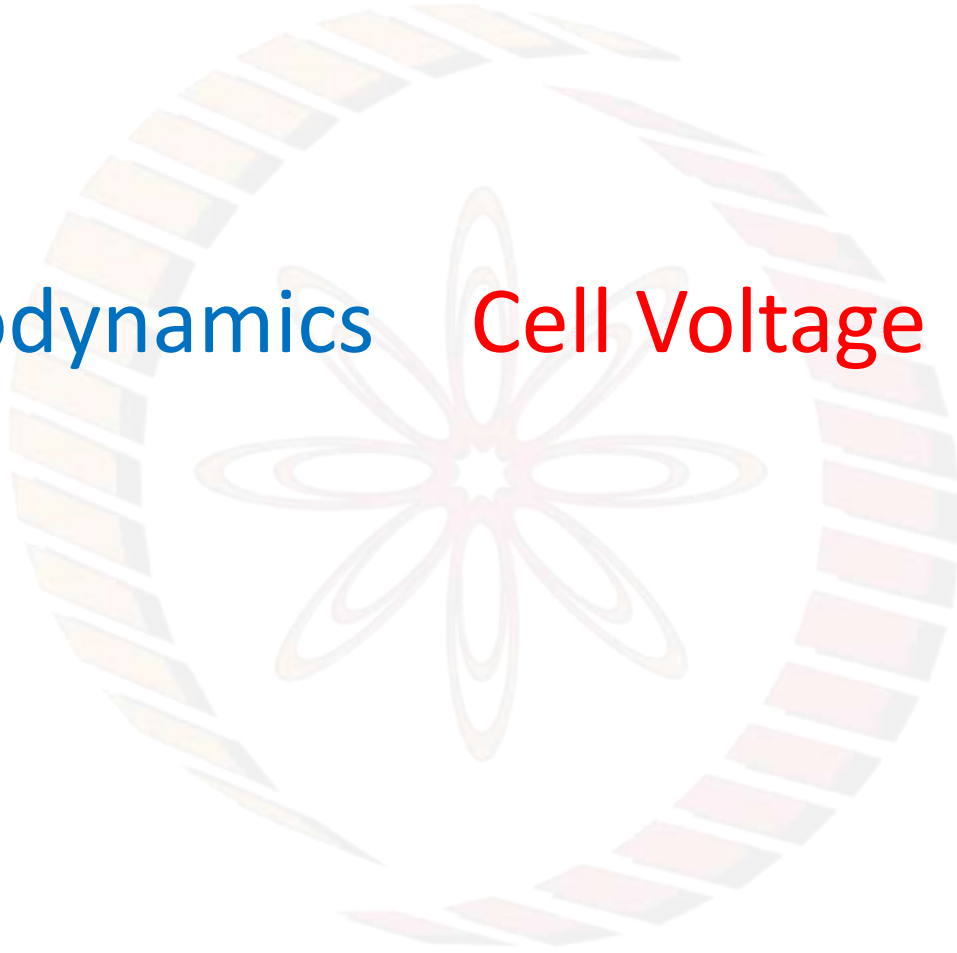
Cell Voltage



Thermodynamics

Cell Voltage

Kinetics

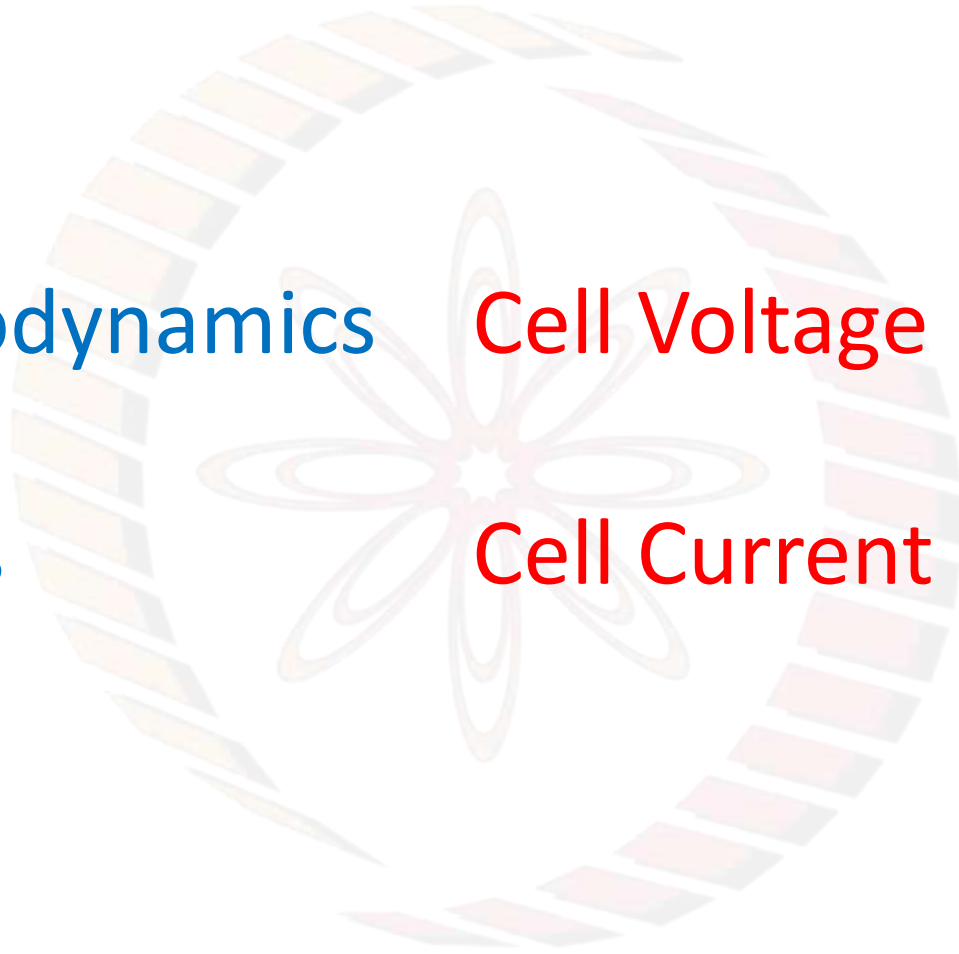


Thermodynamics

Cell Voltage

Kinetics

Cell Current



Cell characteristics:

Capacity: Total charge in cell
Coulombs or Ah

Voltage

Current

Time

Energy:

Power = $V * I$
Watts

Power * Time
Joules or Wh

Conclusions

- 1) Batteries have specific parts that can have dramatically opposite functions
- 2) The electrochemical series is the starting point to understand Battery voltages
- 3) Primary and secondary batteries are both commonly used



Common Battery Types



Battery Testing and Performance

A large, faint, stylized graphic in the background. It consists of a circular arrangement of rectangular segments, resembling a battery cell or a flower's petals, with a central flower-like pattern. The colors are muted, including shades of yellow, orange, and pink.

Lithium ion Batteries