

Physics 202, Lecture 10

Today's Topics

- DC Circuits (Chapter 26)
 - Circuit components
 - Kirchhoff's Rules
 - RC Circuits

Basic Circuit Components

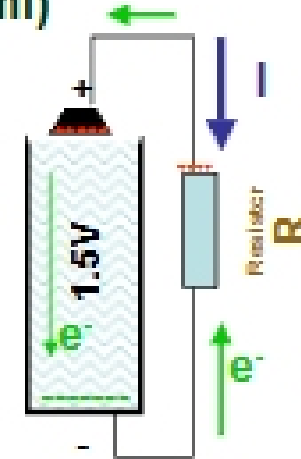
Component	Symbol	Behavior in circuit
Ideal battery, emf		$\Delta V = V_+ - V_- = \mathcal{E}$
Resistor		$\Delta V = -IR$
Realistic Battery		\rightarrow
(Ideal) wire		$\Delta V = 0$ ($\rightarrow R=0, C=0$)
Capacitor		$\Delta V = V_+ - V_- = -q/C$
Inductor		We'll see this later
(Ideal) Switch		$C=0, R=0$ (on), $R=\infty$ (off)
Transformer	Future Topics	
Diodes, Transistors,...		

emf: Electromotive “Force”

Battery: source of Electromotive “force” (emf)

Chemicals inside the battery maintains a charge distribution which provides a persistent potential difference \rightarrow emf. Emf also produced by changing magnetic flux (later in semester).

emf is a potential difference, it is not a force!



Ideal batteries: emf $\mathcal{E} = V$ (voltage provided by battery)

Non-ideal batteries:
“internal resistance” r

$$V = \mathcal{E} - Ir$$

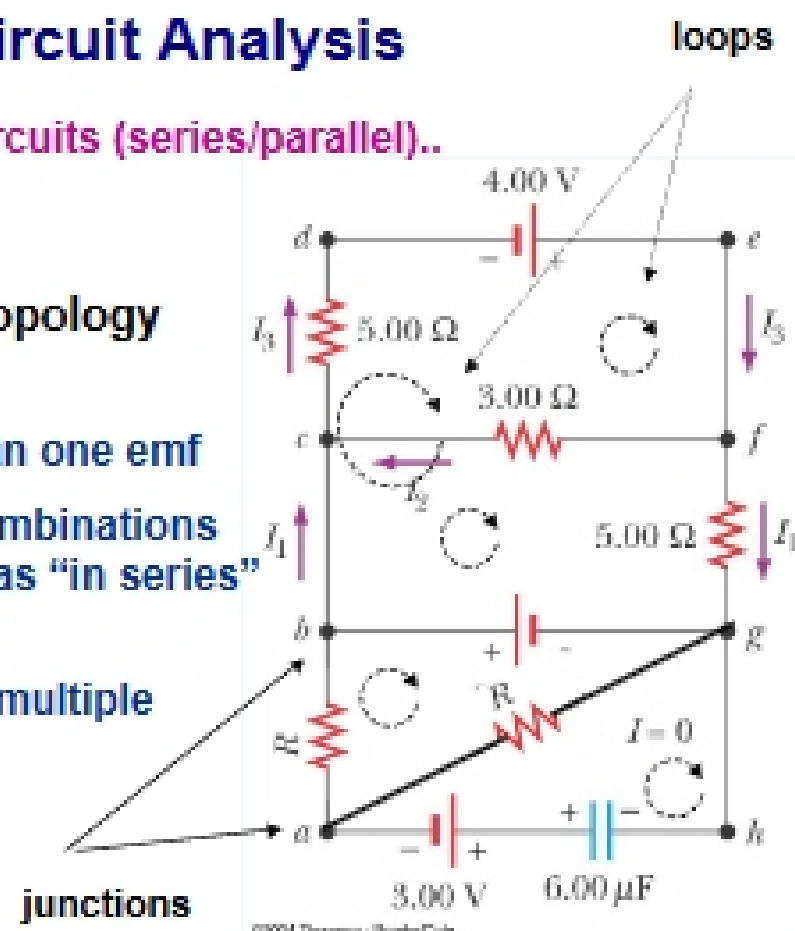
❖ Direct Current (DC) Circuit: Circuit driven by $\mathcal{E} \sim$ constant

Circuit Analysis

We’ve seen simple circuits (series/parallel)..

General case:
more complicated topology

- may contain more than one emf
- Resistor/capacitor combinations may not be as simple as “in series” or “in parallel”
- Circuits may contain multiple loops and junctions.



Circuit Analysis

Kirchoff's Laws

#1 Conservation of electric charge

All the charge that flows into a junction of conductors per unit time, the same amount must leave in the same time interval.

#2 Conservation of energy

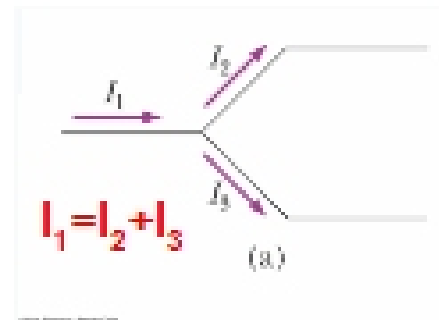
A complete trip around the circuit (the end point is the same as the beginning point) must result in zero net energy change.

Kirchhoff's Rules: Junction Rule

Rule #1: Junction Rule

The net current entering **any** junction equals the net current leaving that junction.

$$\Sigma I_{in} = \Sigma I_{out}$$



Determined by **assigned direction** for each current:

- "in" : current with **assigned direction** towards junction
- "out" : current with **assigned direction** off junction