Unit 12B – Electrodynamics

- **Current, Voltage and Power**
- **Ohm's Law and Resistance**
- **Simple Circuits**

Competencies

The student will be able to:

- define voltage J/C and power J/s.

- define the current and then define the resistance from the Ohm's Law V = IR.

- use Ohm's Law to solve simple circuits and well as series and parallel circuits.

- compute the amount of energy dissipated by a resistor over a given interval of time

- use the law of conservation of energy

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Current

Current: Flow of charge (Charge per time)

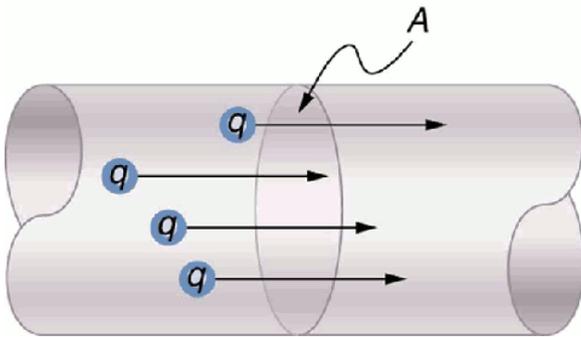$$I = \frac{\Delta Q}{\Delta t}$$

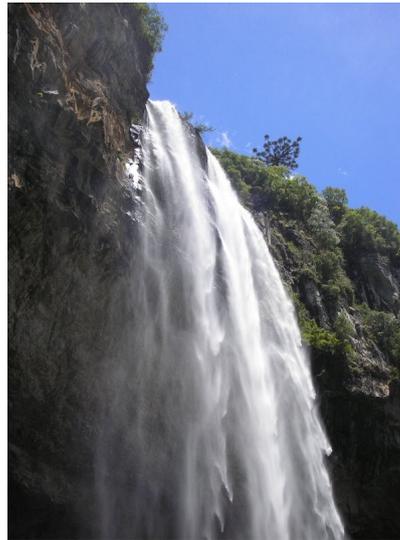**SI-Unit:**   Ampere [A], [A]=[C/s]

Direction of Current: Technical   +   →   -
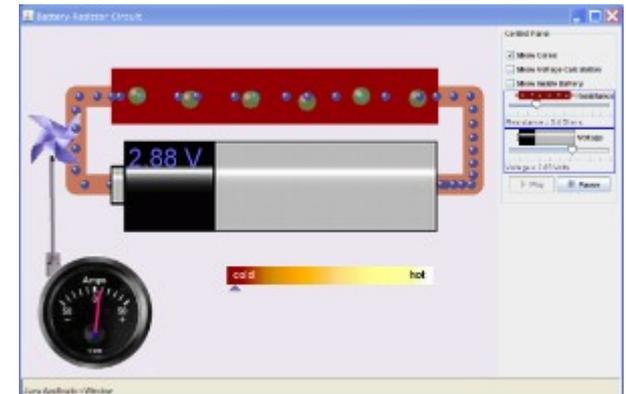   Electrons   -   →   +

[1]

[2]

Phet-Simulation: Battery Resistor Circuit
http://phet.colorado.edu/en/simulation/legacy/battery-resistor-circuit

[1]   **OpenStax, College Physics. OpenStax CNX. April 21, 2016**
        http://cnx.org/contents/Ax2o07UI@9.31:3ct4v3c5@4/Current
        Creative Commons 4.0 License http://creativecommons.org/licenses/by/4.0/
[2]   Cascata do Caracol, Canela, RS by Stefan Bracher

→ Do Unit XIIB Problem 3-4

3

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Electric Potential: Energy per Charge

SI-Unit: Volts [V], [V]=[J/C]

$$V = \frac{\Delta E}{\Delta Q}$$
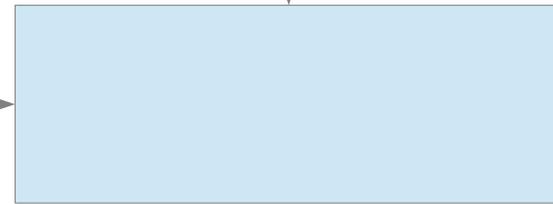

Cascata do Caracol, Canela, RS
by Stefan Bracher

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Power

Power:	Energy per Time
SI-Unit:	Watt [W], [W]=[J/s]

$$P = \frac{\Delta E}{\Delta t}$$

$$V = \frac{\Delta E}{\Delta Q}$$

$$I = \frac{\Delta Q}{\Delta t}$$

Photos: Cascata do Caracol, Canela, RS
            by Stefan Bracher

→ Do Unit XIIB Problem 1, 6-11, 23, 25

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Ohm's Law

Ohm's Law:	Electric Potential = Resistance times Current	$V = RI$
Resistance:	R=V/I	$R = V/I$
SI-Unit:	Ohm [Ω], [Ω]=[A/V]	$I = V/R$

"Bangkok traffic jam" by Keng Susumpow
https://www.flickr.com/photos/kengz/67187556/
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https://creativecommons.org/licenses/by/2.0/
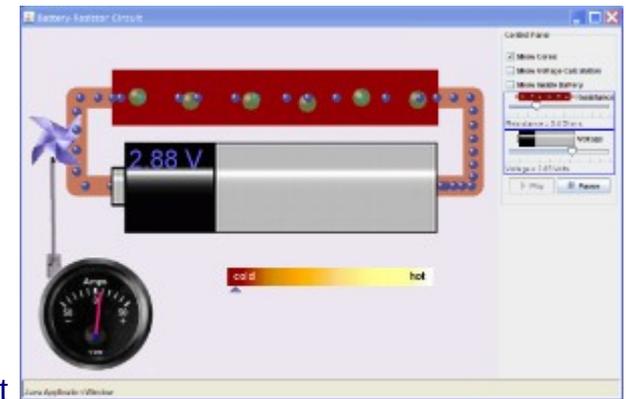
Phet-Simulation: Battery Resistor Circuit
http://phet.colorado.edu/en/simulation/legacy/battery-resistor-circuit

→ Do Unit XIIB Problem 2, 5, 12, 24

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Simple Circuits

Series
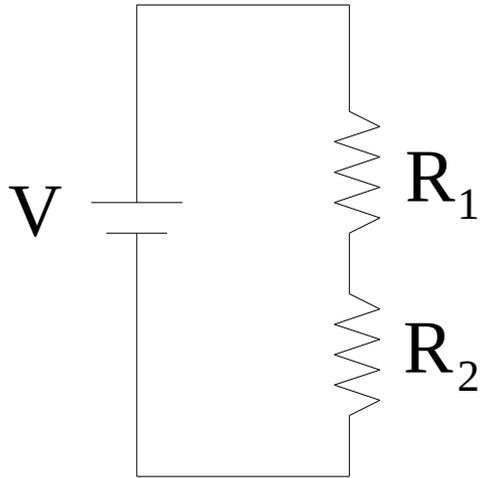
Parallel

Same current

Same Voltage

$$R_{eq} = R_1 + R_2$$
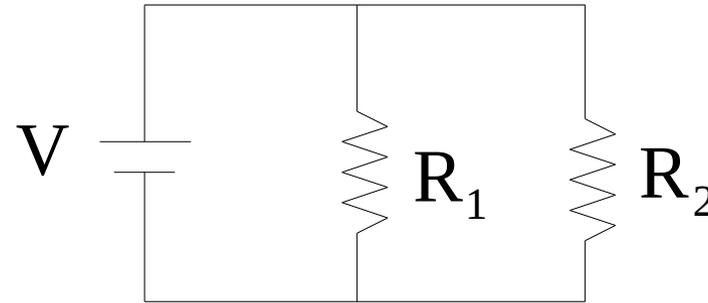
$$R_{eq} = \frac{1}{\left(\dfrac{1}{R_1} + \dfrac{1}{R_2}\right)}$$

→ Do Unit XIIB Problem 13-14

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Simple Circuits

Junction Rule: The sum of all currents at a junction is zero
(← Conservation of Charge)

Loop Rule: The sum of all voltages around a closed loop is zero
(← Conservation of Energy)

→ Do Unit XIIB Problem 15-22, 26-29

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Additional Resources

- Electric Current, Resistancel, and Ohm's Law, OpenStax „College Physics"
http://cnx.org/contents/Ax2o07UI@9.31:En9j99Z_@3/Introduction-to-Electric-Curre

- Circuits and DC Instruments, OpenStax „College Physics"
http://cnx.org/contents/Ax2o07UI@9.31:E74qWTpP@5/Introduction-to-Circuits-and-D

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