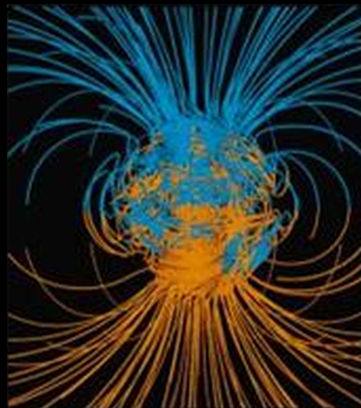


Phy2005
Applied Physics II
Spring 2018

Announcements:

January	29	M	**9**	1, 5, 8, 11, 13, 17	20.1 - 20.5	capacitor, field line in capacitor	
January	31	W	**10**	23, 25, 26, 30, 35	20.6 - 20.11	current, resistance, Ohm's law, R-network	Ohm's law, series/parallel ct.
February	2	F	**11**	37, 38, 39, 43, 47, 51	20.12 - 20.14	power, resistivity	copper-steel wire, electron drift

- Practice Test 1 posted on Tests page soon.
- Answers to chapter 20 problems posted on HW page soon
- On *Friday*, one Top Hat quiz problem will be “directly” from HW

Science news page

Crazy physicist Andreas Wahl – Stunt # 1

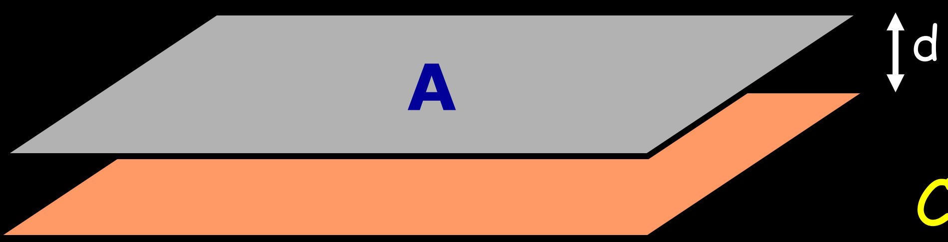
http://qz.com/602155/video-a-physicist-puts-his-life-on-the-line-for-the-love-of-science/

Last time: Capacitors

$$Q = CV$$

Unit of capacitance: $[C] = [Q/V] = C/V$ = F (farad)

Capacitance: measure of charge stored per unit potential difference

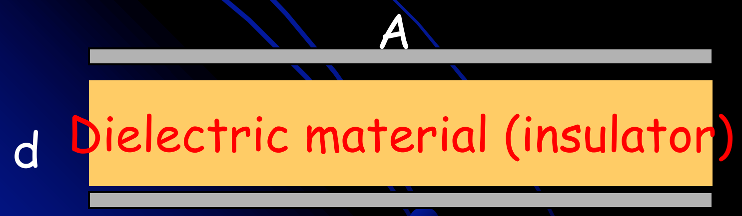


$C = \varepsilon_o A/d$

for a parallel plate capacitor

ε_o: permittivity of free space

8.85×10^{-12} F/m



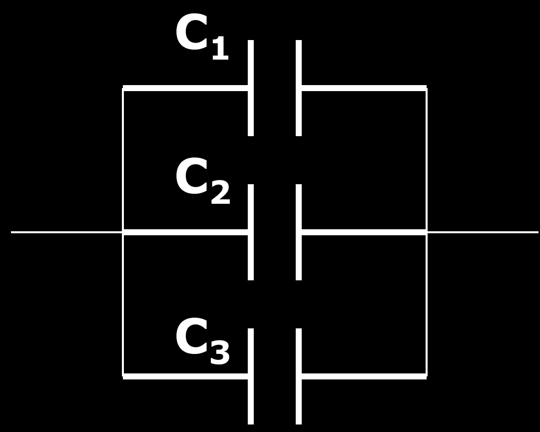
$C = K \varepsilon_o A/d$

K: dielectric constant

(material property)

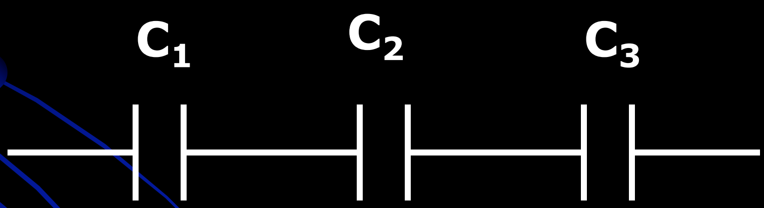
Reduction to equivalent capacitance

parallel



$$C_{eq} = C_1 + C_2 + C_3$$

series



$$1/C_{eq} = 1/C_1 + 1/C_2 + 1/C_3$$

Today: Resistance, resistors, Ohm's & Kichoff's laws

Top Hat Quiz Time

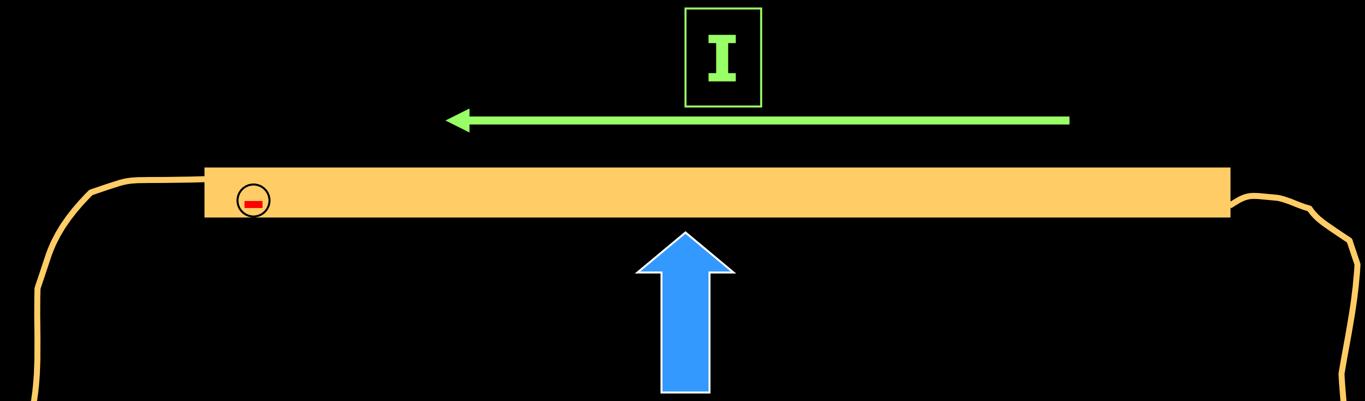
ACADEMIC HONESTY

Each student is expected to hold himself/herself to a high standard of academic honesty. Under the UF academic honesty policy. Violations of this policy will be dealt with severely. There will be no warnings or exceptions.

Have your phone ready!

Q1: What must be the capacitance of a device that is to hold a Charge of 2 μC when 1000V is connected across it?

1. 5×10^{8} F
2. 2 F
3. 5 F
4. 2×10^{6} F
5. 2×10^{-9} F



Count how many electrons are passing through this point per second.

N electrons in Δt seconds

$I = Ne/\Delta t$ [C/s = Ampere]

Michael Faraday
1791-1867
Farad = SI unit of *capacitance*

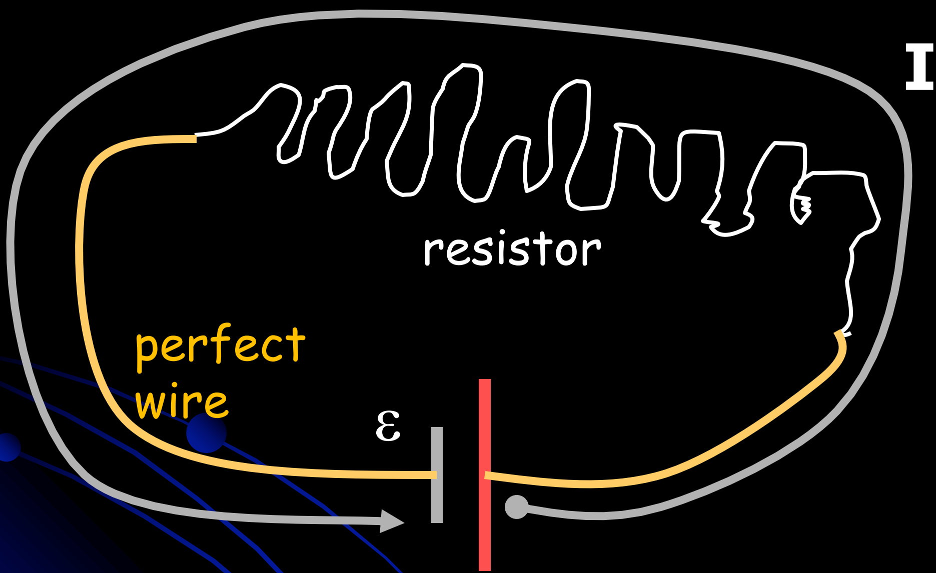
André-Marie Ampère
1775-1836
Ampere = SI unit of *current*

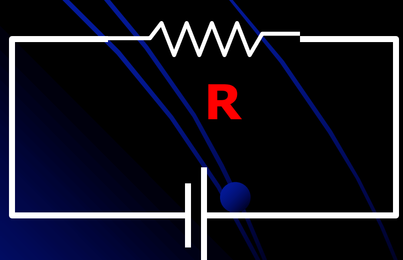
Current (I):

amount of charge flowing through a point per unit time

[I] = C/s = A (ampere)

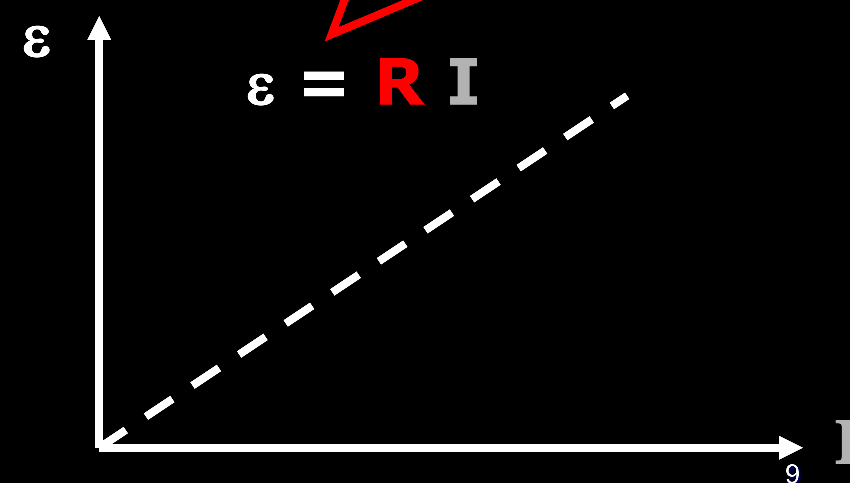
Current flows from higher potential to lower potential.





Ohm's law

$\varepsilon = R\, I$

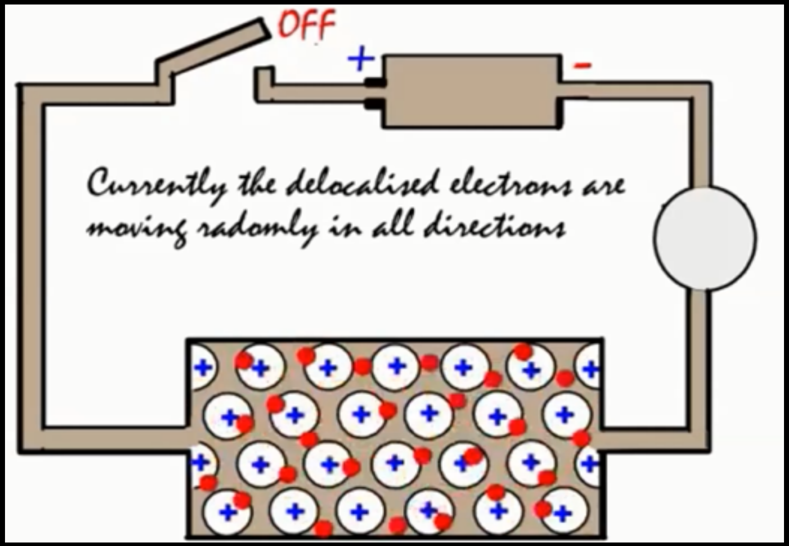


Electrical conduction in a metal

Electrons initially attached to atoms in metal become free to move

Their flow can be started, e.g. by a battery

Collisions with various things slow the flow down



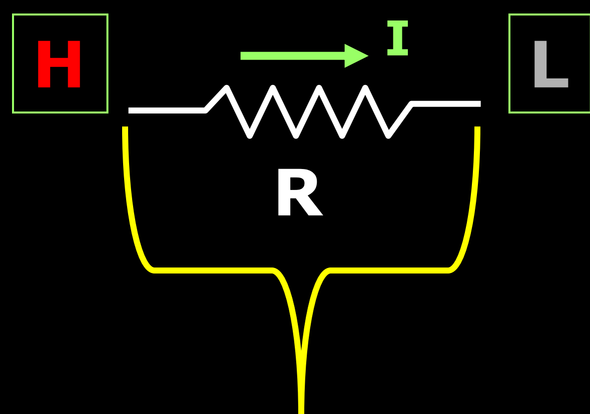
https://www.youtube.com/watch?v=DbKECtWNm8k

$$V = I\,R$$

Resistance, $R = V/I$

$[R] = V/A = \Omega$ (Ohm)

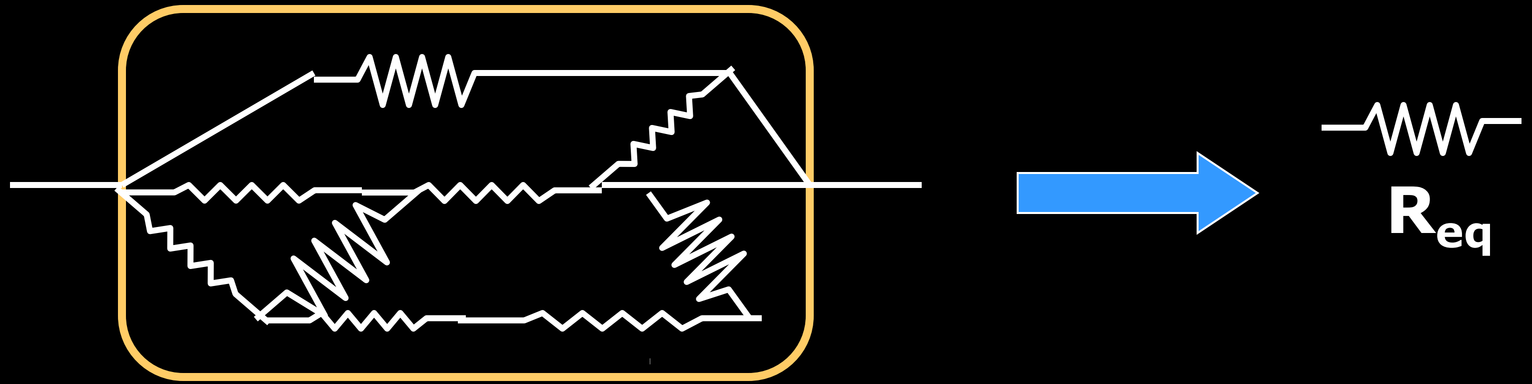
- For a fixed potential difference across a resistor, the larger R, the smaller current passing through it.



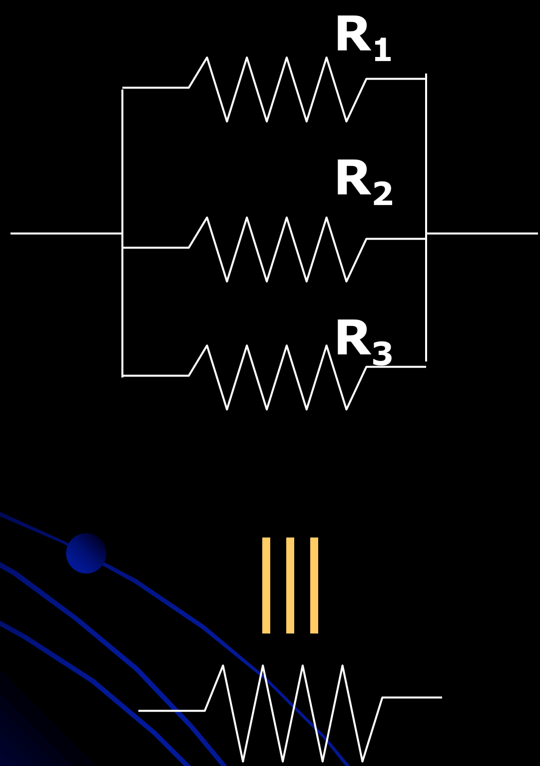
Develop a potential difference

$V = RI$

Know how to reduce resistor network to “equivalent resistance”

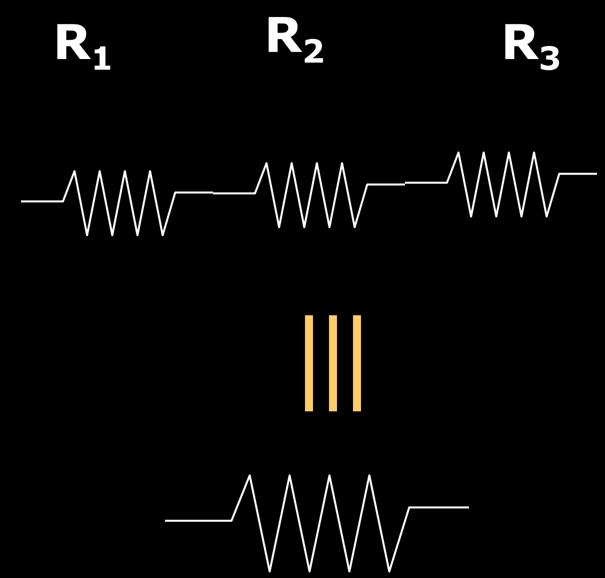


Parallel connection



$$1/R_{eq} = 1/R_1 + 1/R_2 + 1/R_3$$

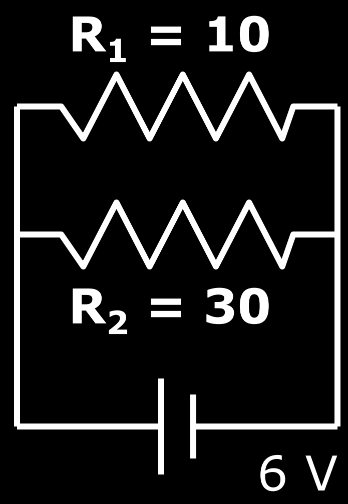
Series connection



$$R_{eq} = R_1 + R_2 + R_3$$

Rules are "opposite" to those for capacitors!

Ex. 10-1. What is the ratio of the current flowing through each resistor (I_1:I_2) in the circuit?



1. 1:1
2. 3:1
3. 1:4
4. Need more info.

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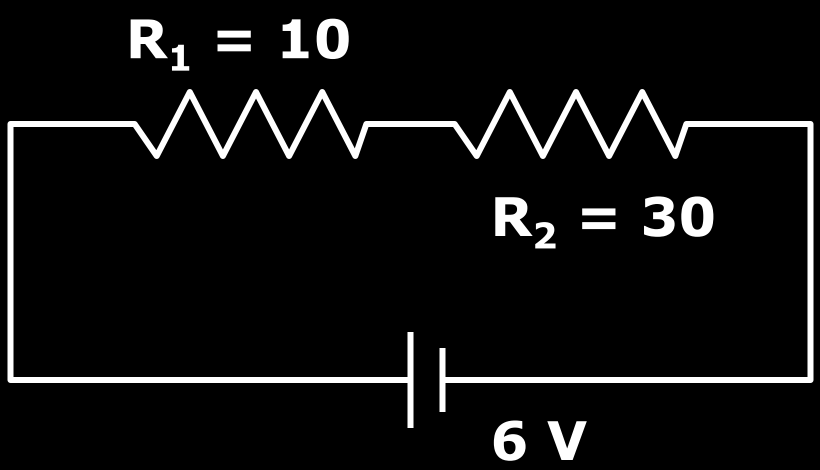
Ex. 10-2. What is the ratio of the current flowing through each resistor (I_1:I_2)?



1. 1:1
2. 3:1
3. 1:4
4. None of above

- No potential difference along the electrical wire (assume R = 0).
- Electrical wires can be bent and/or stretched.
- A Node point (branching point) can be moved arbitrarily along the wire (but cannot cross circuit elements).