

PHY 1120 - Dr. Rowley

Chapter 20 - Electric Current

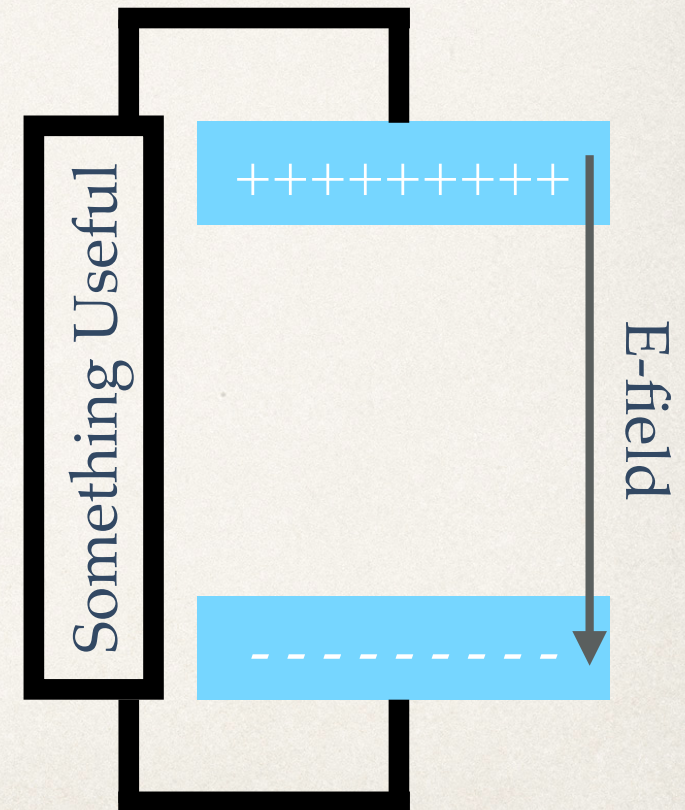
Summer 2020

Objectives

- ❖ Demonstrate understanding of conventional and electron current.
- ❖ Use Ohm's Law, resistance, and resistivity to determine current.
- ❖ Calculate electric power and energy.
- ❖ Show understanding of the differences between DC and AC current.

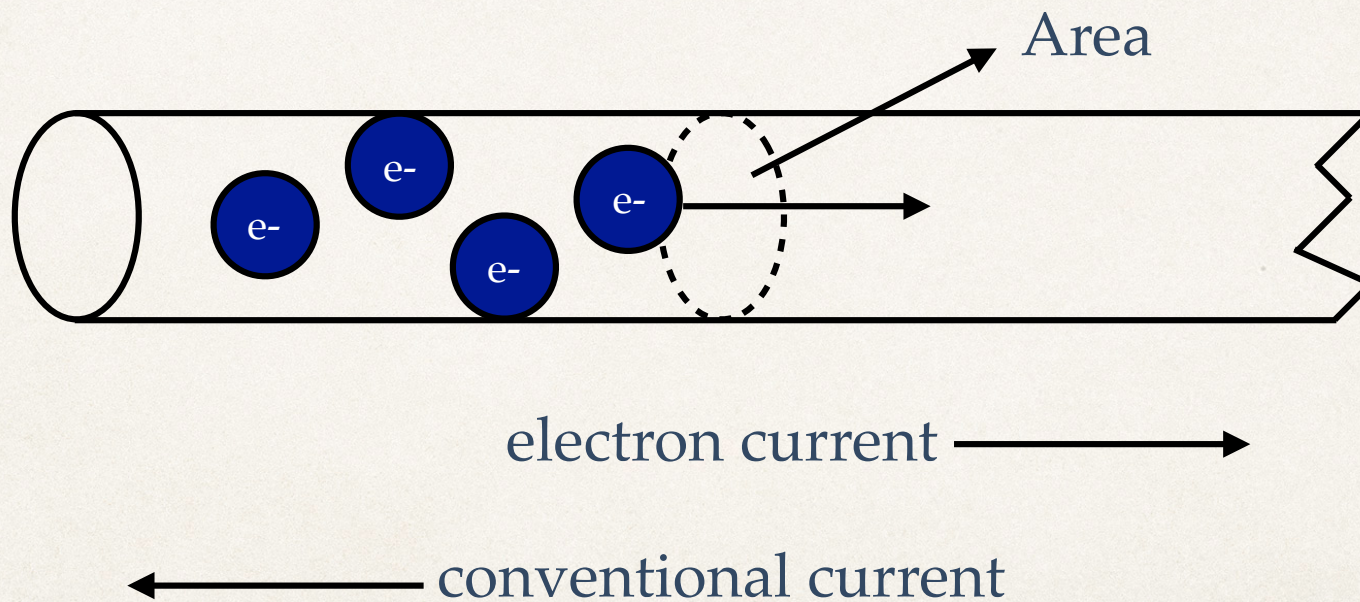
Current Connection

- ❖ How to make E-Fields and Potential Differences useful?

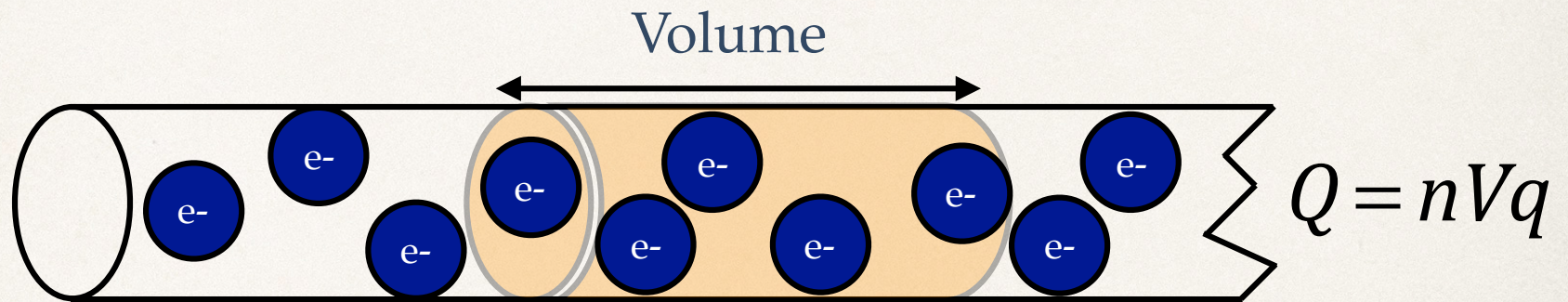


Current

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

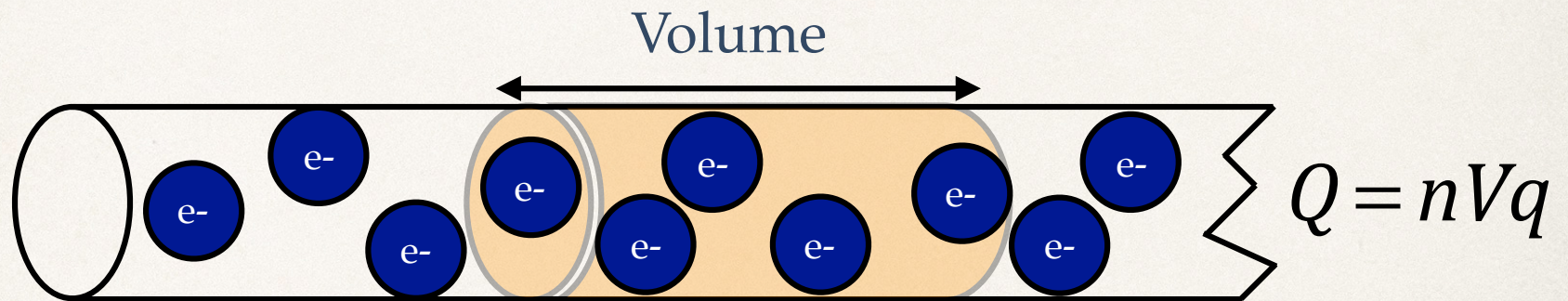


Current



n = free charge per unit volume

Current



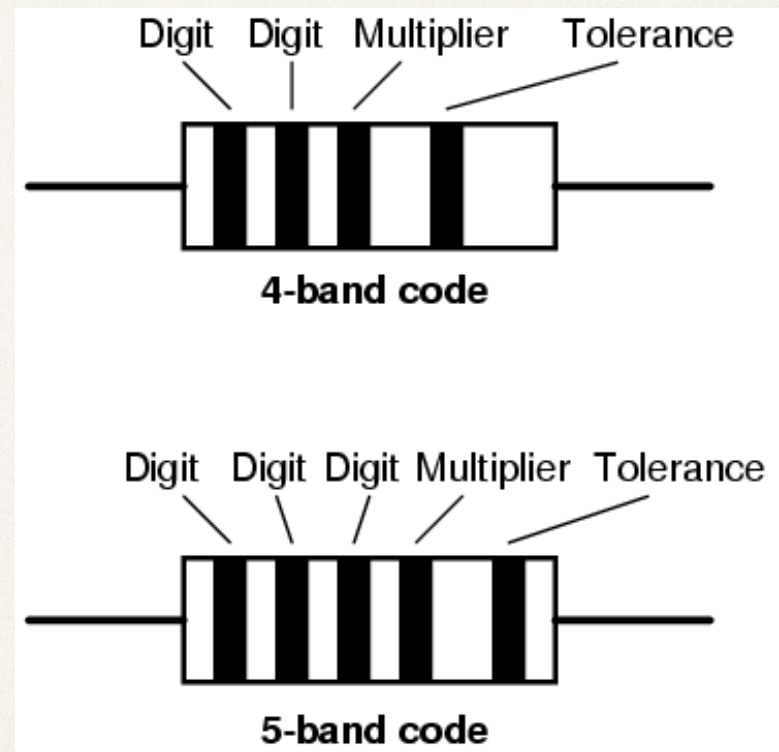
$$I = \frac{\Delta Q}{\Delta t} = \frac{\Delta(nAxq)}{\Delta t} = nqA \left(\frac{\Delta x}{\Delta t} \right)$$

$$I = nqAv_{\text{drift}}$$

Resistance

Resistor Color Code

Color	Digit	Multiplier	Tolerance (%)
Black	0	10^0 (1)	
Brown	1	10^1	1
Red	2	10^2	2
Orange	3	10^3	
Yellow	4	10^4	
Green	5	10^5	0.5
Blue	6	10^6	0.25
Violet	7	10^7	0.1
Grey	8	10^8	
White	9	10^9	
Gold		10^{-1}	5
Silver		10^{-2}	10
(none)			20



Resistors

❖ What is the value of a resistor with the following bands (Violet, Red, Orange)?

A. $7.2 \times 10^3 \Omega$

B. $3.2 \times 10^7 \Omega$

C. $7.2 \times 10^4 \Omega$

D. $3.2 \times 10^8 \Omega$

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Resistors

- ❖ What is the tolerance of the previous resistor
 - A. $\pm 0\%$
 - B. $\pm 5\%$
 - C. $\pm 10\%$
 - D. $\pm 20\%$

Resistors

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 - A. $\pm 0\%$
 - B. $\pm 5\%$
 - C. $\pm 10\%$
 - D. $\pm 20\%$ (only 3 bands)**

Ohm's Law

$$V = IR$$

$$I = \frac{V}{R}$$

$$R = \frac{V}{I}$$

Resistance and Resistivity

$$R = \rho \frac{\ell}{A}$$

Resistivity

$$\rho_T = \rho_o \left[1 + \alpha (T - T_o) \right]$$

Power

$$P = IV$$

$$P = \frac{V^2}{R}$$

$$P = I^2 R$$

Test yourself...

- ❖ What is the current through a (brown, red, brown, silver) resistor if connected to a 9.0 V battery?
- ❖ What is the range (Minimum and Maximum) of current I can expect through a (brown, red, brown, silver) resistor if connected to a 9.0 V battery?
- ❖ What is the average power dissipated by the resistor when connected to a 9.0V battery?