

Physics I preAP
Resistance and Ohms Law Investigation

Name _____ Period _____

This is your problem set for Ch. 19

Objectives:

1. Discover what parameters affects the resistance, R, in a circuit
2. Investigate Ohm's Law and discover what conditions maximize current flow.

I. Resistance

Go to <http://phet-web.colorado.edu>

Click "Simulations"

- "Physics"
- "Electricity, magnets, and circuits"

Select "Resistance in a Wire" simulation

Investigate each variable by manipulating the values and in your own words state what it represents and indicate the unit.

1. ρ (Greek letter rho) :
2. L :
3. A :

Data Tables -

- a. Note the beginning values for each variable. As you increase the indicated variable by regular increments, hold the others constant.
- b. Fill in the three tables. For each table, write a statement describing how that variable relates to the resistance, R. Use the terms "direct" or "indirect" to describe the relationship.

Resistance in a Wire: In the first row, record the beginning values listed on the simulation.

I. Change "L" by regular increments leaving ρ and A constant. Record changing values of R.

R	ρ	L	A

Statement of relationship between L and R

II. Change "A" by regular increments leaving ρ and L constant. Record changing values of R

R	ρ	L	A

Statement of relationship between A and R

III. Change " ρ " by regular increments leaving L and A constant. Record changing values of R

R	ρ	L	A

Statement of relationship between ρ and R

In this simulation what factor(s) increase resistance? Decrease resistance?

II. Ohms Law Sim

1. Close the "Resistance in a Wire" Sim
2. Open the "Ohm's Law" Sim

A. From this sim explain what each variable represents and give its units

1. V
2. I
3. R

B. Manipulate the buttons. What conditions maximize current?

C. What conditions minimize current?

Questions:

1. Predict what will happen to the current in a circuit if the voltage is kept constant but the wire diameter is increased.
2. Predict what will happen to the current in a circuit if the voltage is kept constant but the wire length is increased.
3. Predict what will happen to the current if the resistance is unchanged but
 - a. the voltage is increased?
 - b. the voltage is decreased?
4. Predict what will happen to the resistance if you change from a copper wire, which is a good conductor, to an iron wire, which does not conduct as well.

Problems Assignment: Show all your work

1. Tungsten has a resistivity, ρ , of $5.6 \times 10^{-8} \Omega \cdot \text{m}$. Determine the electrical resistance of a 20.0 m length of tungsten wire of radius 0.200 mm. (**8.89 Ω**)

2. What is the diameter of a 1.00 m length of tungsten wire whose resistance is 0.22Ω ?
3. Wire 1 has a length L and a diameter D . Wire 2 is constructed from the same material as wire 1 and has the same shape, but its length is $2L$, and its diameter is $2D$. Is the resistance of wire 2 (a) the same as that of wire 1, (b) twice that of wire 1, or (c) half that of wire 1?
4. Which of the following combinations of length and cross-sectional area will give a certain volume of copper the least resistance? _____
- a) L and A
 - b) $2L$ and $\frac{1}{2} A$
 - c) $\frac{1}{2} L$ and $2A$
 - d) does not matter since the volume of copper is the same

From the text: Answer on your own paper and show your work

- Section 19.2: a. Is resistance dependent or independent of potential difference? current?
b. What is "critical temperature"?

- Section 19.3: a. What is electric power? Show that from $P = \text{work}/\text{time}$ that $P = IV$.
b. What is the SI unit of power and to what is it equivalent?
c. What is "power rating"?
d. What is "joule heating"? Also referred to as an _____.
e. Define the "kilowatt-hour".

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