

AP Physics 1 Unit #7 Pretest Problem

Name _____

Period _____

You have been hired as a consultant for a company that produces strings of small lights to be used as accent lighting in houses. The company is interested in maximizing their profit by reducing the cost of the lights and has come up with two designs that you are to analyze. The first design involves connecting the lights in series and the second involves connecting the lights in parallel. You begin by testing an individual light and find that it draws 150.0 mA of current when connected to a 12.0 V power supply. Assume the lights obey Ohm's Law for the rest of this problem.

1. What is the resistance of one bulb?
2. What will be the resistance of ten bulbs connected in series?
3. The company wishes for the bulbs to each have 0.3 W of power. What would be the total voltage required for a string of ten bulbs connected in series? Ignore any effects of the wiring in this calculation.
4. What will be the resistance of ten bulbs connected in parallel?
5. The company wishes for the bulbs to each have 0.3 W of power. What would be the total current required for a string of ten bulbs connected in series? Ignore any effects of the wiring in this calculation.

6. The resistivity of the copper used in the wiring is $1.7 \times 10^{-8} \Omega \cdot \text{m}$. The desired length of the string of lights is 2.5 m. Calculate the volume of copper needed to connect the lights in series if the power loss due to the wiring is limited to 3.0W.

7. The resistivity of the copper used in the wiring is $1.7 \times 10^{-8} \Omega \cdot \text{m}$. The desired length of the string of lights is 2.5 m. Calculate the volume of copper needed to connect the lights in parallel if the power loss due to the wiring is limited to 3.0W.

8. The current price of copper is \$6.00 per kilogram and the density of copper is 8933 kg/m^3 . What recommendation would you make to the company in terms of the cost of wiring the lights in series versus parallel? Be sure to include clear calculations of the price of the copper for each option.