

Week #1 Homework

1. You have a 5k resistor and a 10k resistor. What is their combined resistance in a) series; and b) parallel?
2. If you place a 1Ω resistor across a 12V car battery, how much power will it dissipate?
3. Show that it is not possible to exceed the power rating of a $\frac{1}{4}W$ resistor of resistance greater than 1k, no matter how you connect it, in a circuit operating from a 15V battery.
4. New York City requires about $10^{10}W$ of electrical power at 110 volts (10 million people averaging a kW each). A heavy power cable might be an inch in diameter. Let's calculate what will happen if we try to supply the power through a cable one foot in diameter made of pure copper. Its resistance is $0.05\mu\Omega$ (5×10^{-8} ohms) per foot. Calculate: a) the power lost per foot from " I^2R " losses; b) the length of cable over which you would lose all $10^{10}W$; and c) how hot the cable would get, if you know the physics involved (hint: $\sigma = 6 \times 10^{-12}W/K^4cm^2$). If you have done your computations correctly, the result should seem preposterous. What is the solution to this puzzle?