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| **PH 221 Homework Assignment Chapter on Ohm’s Law – 19 Problems Total** |
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| **1.** A current of $7.83 A$ flows in a wire. How many electrons are moving past a reference point per second? |
| [Solution for Problem 1](http://physics.nmu.edu/~ddonovan/classes/Nph221/Homework/IHOC/IHOCP01.pdf) |
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| **2.** What is the current in amperes if $1450 Na^{+}$ ions flow across a cell membrane in a time of $2.75 μs$ ? The charge on a sodium ion is the same as an electron only it is positive. |
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| [Solution for Problem 2](http://physics.nmu.edu/~ddonovan/classes/Nph221/Homework/IHOC/IHOCP02.pdf) |
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| **3.** A typical room sized space heater uses $15.0 A$ when plugged into a $110. V$ wall socket. |
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| **(a)** | What is the resistance of the space heater? |
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| **(b)** | If the current was direct current instead of alternating current how much charge would be moved through the heater in a $20.0 min$ time period? |

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| [Solution for Problem 3](http://physics.nmu.edu/~ddonovan/classes/Nph221/Homework/IHOC/IHOCP03.pdf) |
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| **4.** A bird is sitting on a high-power electrical transmission wire. The wire is carrying $5500. A$. The wire has a resistance per meter value of $3.00 x 10^{-5} ^{Ω}/\_{m}$. The bird’s feet are approximately $4.00 x 10^{-2} m$ apart. What is the potential difference between the bird’s feet? |
| [Solution for Problem 4](http://physics.nmu.edu/~ddonovan/classes/Nph221/Homework/IHOC/IHOCP04.pdf) |
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| **5.** An unknown electrical device is found to draw a current of $9.85 A$ when it is powered by a voltage of $365. V$. |
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| **(a)** | What is the effective resistance of the electrical device? |
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| **(b)** | Assuming nothing else changes, and the voltage powering the device increases by $25\%$, what is the new current being drawn? |
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| **(c)** | If the effective resistance were decreased by $35\%$, what would be the current drawn if the voltage supplied is $365. V ?$ |

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| [Solution for Problem 5](http://physics.nmu.edu/~ddonovan/classes/Nph221/Homework/IHOC/IHOCP05.pdf) |
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| **6.** The resistivity of copper is $ρ\_{Cu}=1.68 x 10^{-8} Ω m$. No 14-gauge wire has a diameter of $D=1.628 x 10^{-3} m$. What is the voltage drop along a $56.0 m$ length of wire which is carrying $14.0 A$ of current? |
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| [Solution for Problem 6](http://physics.nmu.edu/~ddonovan/classes/Nph221/Homework/IHOC/IHOCP06.pdf) |
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| **7.** Aluminum wire has a resistivity $\left(ρ\_{Al}=2.65 x 10^{-8} Ω m\right)$ and a temperature coefficient $\left(α\_{Al}=0.00429 /℃\right)$. A length of wire is connected to a constant voltage supply which is set to a value of $15.00 V$. At exactly $20.00℃$, a current is measured in the wire $\left(i\_{20}=0.5313 A\right)$. The wire is moved to a new location where the temperature has changed. Now a current $\left(i\_{New}=0.3945 A\right)$. What is the new temperature of the wire?? |
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| [Solution for Problem 7](http://physics.nmu.edu/~ddonovan/classes/Nph221/Homework/IHOC/IHOCP07.pdf) |
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| **8.** An old 1980’s boom box uses eight “D-Cell” batteries $\left(V\_{D-Cell}=1.50 V\right)$ to power it. These are used in series, so a total supply voltage of $\left(8 x 1.50 V=12.0 V\right)$. If the total power used is $28.0 W$. How much current is drawn from the batteries? |
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| [Solution for Problem 8](http://physics.nmu.edu/~ddonovan/classes/Nph221/Homework/IHOC/IHOCP08.pdf) |
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| **9.** What is the maximum voltage that can be applied across a $1200. Ω$ resistor which is rated for $^{1}/\_{4}$ watts? |
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| [Solution for Problem 9](http://physics.nmu.edu/~ddonovan/classes/Nph221/Homework/IHOC/IHOCP09.pdf) |
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| **10.** Consider two light bulbs. One is a $60.0 W$ light bulb. The other is a $1200. W$ floodlight. Both lights are powered by a standard wall outlet with a voltage of $110. V$. |
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| **(a)** | Determine the resistance of the light bulb. |
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| **(b)** | Determine the current used by the light bulb. |
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| **(c)** | Determine the resistance of the floodlight. |
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| **(d)** | Determine the current used by the floodlight. |

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| [Solution for Problem 10](http://physics.nmu.edu/~ddonovan/classes/Nph221/Homework/IHOC/IHOCP10.pdf) |
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| **11.** A thirty-gallon fish tank uses a $150. W$ water heater to maintain a temperature of the water to be $15.0℉$ above room temperature. The heater plugs into a standard wall outlet which has a voltage of $110. V$. |
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| **(a)** | Determine the resistance of the water heater. |
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| **(b)** | Determine the current used by the water heater. |

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| [Solution for Problem 11](http://physics.nmu.edu/~ddonovan/classes/Nph221/Homework/IHOC/IHOCP11.pdf) |
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| **12.** A D-Cell battery has a capacity of $8.00 A hr$. The voltage across the battery is of course $1.50 V$. What is the amount of energy stored in the battery? |
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| [Solution for Problem 12](http://physics.nmu.edu/~ddonovan/classes/Nph221/Homework/IHOC/IHOCP12.pdf) |
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| 13. A small flashlight with an incandescent filament bulb uses two C-Cell batteries $\left(V\_{C-Cell}=1.50 V\right)$ connected in series. The flashlight bulb draws a current of $51.7 mA.$ |
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| **(a)** | Determine the resistance of the light bulb. |
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| **(b)** | Determine the power dissipated by the light bulb. |
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| **(c)** | If you could wire in two more C -Cell batteries so that all four batteries are wired in series, by what factor would the power expended by the light bulb change? |

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| [Solution for Problem 13](http://physics.nmu.edu/~ddonovan/classes/Nph221/Homework/IHOC/IHOCP13.pdf) |
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| **14.** A power company delivers $9.80 kW$ of power to a factory over a collection of wires with a total resistance of $4.00 Ω$. |
| [Solution for Problem 14](http://physics.nmu.edu/~ddonovan/classes/Nph221/Homework/IHOC/IHOCP14.pdf) |
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| **15.** A person’s SUV has a batter that has a charge capacity of $75.0 A hr$ and a terminal voltage of $12.0 V$. The vehicle’s head lights use $55.0 W$ of power. The tail lights use $8.00 W$. So, adding these lights up assuming two each of headlights and tail lights, a vehicle uses $126. W$ of power. If the driver leaves the lights on while the SUV is not running its motor, how long will it take to drain a fully charged battery? |
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| [Solution for Problem 15](http://physics.nmu.edu/~ddonovan/classes/Nph221/Homework/IHOC/IHOCP15.pdf) |
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| **16.** What is the average current drawn by an electric clothes dryer which uses a $0.500 hp$ motor that is attached to a standard wall socket which has a voltage of $110. V$ ? Note: $1.00 hp = 746. W$ . |
| [Solution for Problem 16](http://physics.nmu.edu/~ddonovan/classes/Nph221/Homework/IHOC/IHOCP16.pdf) |
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| **17.** Fuses and circuit breakers are placed in building wiring circuits are to prevent current carrying wires from getting hot enough to cause a fire in the building materials they are attached to. For copper, the electrical resistivity is $\left(ρ\_{Cu}=1.68 x 10^{-8} Ω m\right)$. Assume the copper wires might carry up to $40.0 A$ of current. Further assume, that the heat generated per time is below $1.25 W$ per meter of wire. What is the minimum diameter of the copper wire being used? |
| [Solution for Problem 17](http://physics.nmu.edu/~ddonovan/classes/Nph221/Homework/IHOC/IHOCP17.pdf) |
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| **18.** Consider two wires made of aluminum. The electrical resistivity of aluminum is $\left(ρ\_{Al}=2.72 x 10^{-8} Ω m\right)$. Wire A has a length of $\left(L\_{A}\right) and a radius \left(R\_{A}\right)$. Wire B has a length of $\left(L\_{B}=2L\_{A}\right)$ and a radius $\left(R\_{B}=2R\_{A}\right)$. Assume both wires have the same voltage $\left(V\_{S}\right)$ across their lengths. What is the ratio $\left(\frac{P\_{B}}{P\_{A}}\right)$of the power transmitted along the wires? |
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| [Solution for Problem 18](http://physics.nmu.edu/~ddonovan/classes/Nph221/Homework/IHOC/IHOCP18.pdf) |
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| **19.** The electrical resistivity of copper is $\left(ρ\_{E-Cu}=1.68 x 10^{-8} Ω m\right)$. The mass density of copper is $\left(ρ\_{m-Cu}=8.90 x 10^{3} ^{kg}/\_{m^{3}}\right)$. A resistor is needed that should have a resistance of $\left(R\_{Cu}=14.6 Ω\right)$. The resistor is to be made from wrapping copper wire into a coil, and the total mass of copper is to be $\left(m\_{Cu}=17.9 x 10^{-3} kg\right)$ . |
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| **(a)** | What is the length of the copper wire used? |
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| **(b)** | What is the diameter of the copper wire used? |

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| [Solution for Problem 19](http://physics.nmu.edu/~ddonovan/classes/Nph221/Homework/IHOC/IHOCP19.pdf) |
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| **Please send any comments or questions about this page to** ddonovan@nmu.edu |
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