

ECET 211 Electric Machines & Control Hw 1
Homework Period: Jan. 18-25
(Solution)

Visit the following web sites and study/review the topics on basic electricity

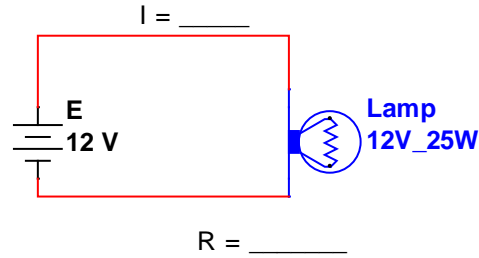
- Electricity Basic – Voltage, Current, Resistance, and Ohm’s Law, <https://learn.sparkfun.com/tutorials/voltage-current-resistance-and-ohms-law>
- Ohm’s Law, https://en.wikipedia.org/wiki/Ohm%27s_law
- Ohm’s Law, NASA Glenn Research Center, https://www.grc.nasa.gov/www/k-12/Sample_Projects/Ohms_Law/ohmslaw.html
- Power in Electrical Circuit, <http://www.allaboutcircuits.com/textbook/direct-current/chpt-2/power-electric-circuits/>
- How Voltage, Current, and Resistance Relate, <http://www.allaboutcircuits.com/textbook/direct-current/chpt-2/voltage-current-resistance-relate/>
- Introduction to Electrical Circuits: http://www.etcs.ipfw.edu/~lin/ECET102-CPET101/2012-Spring/Lectures/ECET-102_Lecture_1-2012-Spring.htm

The equations needed:

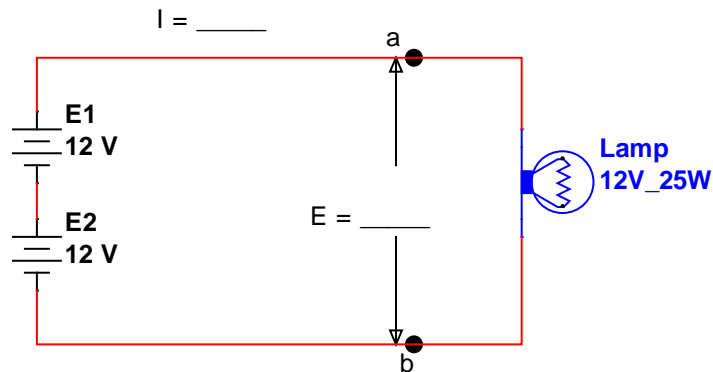
- Ohm’s Law $I = \frac{E}{R}$ (*amperes, A*), $E = IR$ (*volts, V*), $R = \frac{E}{I}$ (*ohms, Ω*)
- DC Power Equation $P = E \cdot I$, or $P = E^2/R$, or $P = I^2 \cdot R$
- Wire resistance $R = \rho \frac{\ell}{A}$

Questions: 100 point

1. Converts the following units.
 - a. 3300 V = _____ kV (volt)
 - b. 50 mA = _____ A
 - c. 5 HP = _____ Kw
2. How long will a D cell battery of 3.7 V, with an ampere-hour rating of 2200mAH, that is connected in a circuit which requires a current of 20 mA?
3. Assume that both wire#1 and wire#2 are made from the same copper material, with the same diameter, but wire#1 is three times longer than wire#2. If the wire resistance of wire#2 is 10 Ω , what is the expected resistance of wire#1?
4. For the DC circuit as shown below with a 12V power supply, and a 12V 25W lamp on an automotive circuit. Find (a) the current I (in Ampere) that passing through the circuit, and (b) the resistance (in Ohms) of the lamp.



5. Use the same circuit as shown in problem 1, except that we are series two 12V battery power supply, as shown below. Find (a) What is the voltage across the terminals a-b? (b) What is the current I. (c) What will actually happen to the circuit, let say after 5 seconds or longer?



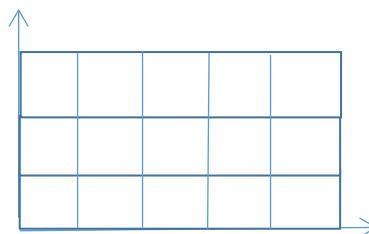
6. Determine the resistance of a 100 W bulb if a current of 0.9A results from an applied voltage of 120V.
7. An AC 240V, 2500 watts electric heater has a resistance of about _____?
8. Complete the following table using Ohm's law.

E (volts)	R (ohms)	I (amperes)
0	10	
2	10	
5	10	

9. Plot the resistance line using the values from following table.

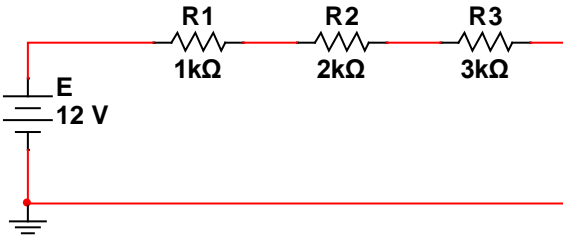
E (volts)	R (ohms)	I (amperes)
0	10	0.0
5	10	0.5

I (amperes)



10	10	1.0
15	10	1.5

10. For the DC circuit as shown below, find the total resistance R_t , and the circuit current I_t .



11. A single-phase sine wave power source from utility company can be represented by the following equation:

$$E(t) = 120 \cdot \sqrt{2} \cdot \sin(2\pi ft)$$

Where 120 is called _____ voltage, and $120 \cdot \sqrt{2}$ is called _____ voltage, and f called the frequency of the sine wave voltage is equal to _____ Hz.

12. A three-phase sine wave power (220V, 60Hz), can be represented three single-phase voltage each is separated by 120 electrical degree or $2/3 \pi$. The three phases are

$$E_a = 220 \cdot \sqrt{2} \sin(2\pi ft + 0^\circ)$$

$$E_b = 220 \cdot \sqrt{2} \sin(2\pi ft + 120^\circ), \text{ and}$$

$$E_c = \underline{\hspace{4cm}}.$$