WebAssign
CH20-HW03-SP12 (Homework)

Yinglai Wang
PHYS 272-FALL 2012, Fall 2012
Instructor: Virendra Saxena

Current Score : 20 / 20 **Due :** Friday, October 26 2012 11:59 PM EDT

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1. 2/2 points | Previous Answers MI3 20.3.X.014

In a certain circuit, a battery with an emf of 1.6 volts generates a current of 5 amperes. What is the output power of the battery? (If on the other hand you were charging a rechargeable battery with a charging current of 5 amperes, this would be the input power to the battery.)

8 ✓ watts ✓

- *Read the eBook*
- Section 20.3

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2. 6/6 points | Previous Answers MI3 20.4.P.087

A battery with internal resistance

(a) You short-circuit a 20 volt battery by connecting a short wire from one end of the battery to the other end. If the current in the short circuit is measured to be 18 amperes, what is the internal resistance of the battery?

1.11 ✓ Ω

(b) What is the power generated by the battery?

360 ✓ W

(c) How much energy is dissipated in the internal resistance every second? (Remember that one watt is one joule per second.)

359.64 ✓ W

(d) This same battery is now connected to a 12 Ω resistor. How much current flows through this resistor?

1.53 ✓ A

(e) How much power is dissipated in the 12 Ω resistor?

28.09 ✓ W

(f) The leads to a voltmeter are placed at the two ends of the battery of this circuit containing the 12 Ω resistor. What does the meter read?

18.36 ✓ V

- *Read the eBook*
- Section 20.4

3. 1/1 points | Previous Answers MI3 20.6.P.094

Establishing a potential difference

The deflection plates in an oscilloscope are 10 cm by 2 cm with a gap distance of 1 mm. A 100 volt potential difference is suddenly applied to the initially uncharged plates through a 1075 ohm resistor in series with the deflection plates. How long does it take for the potential difference between the deflection plates to reach 50 volts?

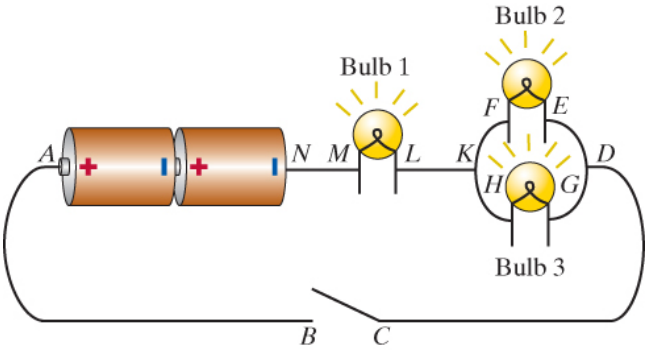
1.319e-8 ✓ s

- *Read the eBook*
- Section 20.6

4. 11/11 points | Previous Answers MI3 20.3.P.084

Three bulbs

A circuit is made of two 1.3 volt batteries and three light bulbs as shown in the figure. When the switch is closed and the bulbs are glowing, bulb 1 has a resistance of 11 ohms, bulb 2 has a resistance of 43 ohms, bulb 3 has a resistance of 28 ohms, and the copper connecting wires have negligible resistance. You can also neglect the internal resistance of the batteries.



(a) With the switch open, indicate the approximate surface charge on the circuit diagram. (Do this on paper. Your instructor may ask you to turn in this work.) Refer to your diagram to decide which of the following statements about the circuit (with the switch open) are true:

- [x] The electric field in the filament of bulb 3 is zero.
- [ ] There is a large gradient of surface charge between locations M and L.
- [x] The surface charge on the wire at location B is positive.
- [ ] There is no excess charge on the surface of the wire at location C.
- [ ] The electric field in the air between locations B and C is zero.

✓

(b) With the switch open, find these potential differences:

$V_B - V_C =$ 2.6 ✓ V

$V_D - V_K =$ 0 ✓ V

(c) After the switch is closed and the steady state is established, the currents through bulbs 1, 2, and 3 are I_1, I_2, and I_3 respectively. Which of the following equations are correct loop or node equations for this steady state circuit?

- [x] $I_1 = I_2 + I_3$
- [ ] $+2.6\text{V} + -I_1*(11\ \Omega) + I_3*(11\ \Omega) = 0$
- [x] $-I_2*(43\ \Omega) + I_3*(28\ \Omega) = 0$
- [x] $+2.6\text{V} + -I_1*(11\ \Omega) + -I_2*(43\ \Omega) = 0$
- [ ] $-I_1*(11\ \Omega) - I_2*(43\ \Omega) + I_3*(28\ \Omega) = 0$
- [ ] $I_2 = I_3$

✓

(d) In the steady state (switch closed), which of these are correct?

- [x] $V_L - V_A = -2.6\text{V} + I_1*(11\ \Omega)$
- [ ] $V_C - V_F = 0$
- [x] $V_C - V_F = +I_2*(43\ \Omega)$
- [ ] $V_C - V_F = +I_1*(11\ \Omega)$
- [x] $V_C - V_F = +I_3*(28\ \Omega)$

✓

(f) Now find the unknown currents, to the nearest milliampere. (I.e. enter your answer to three decimal places.)

$I_1 =$ 0.093 ✓ A

$I_2 =$ 0.0367 ✓ A

$I_3 =$ 0.0563 ✓ A

(g) How many electrons leave the battery at location *N* every second?

5.8125e17 ✓ electrons/s

(i) What is the numerical value of the power delivered by the batteries?

P = 0.2418 ✓ W

(j) The tungsten filament in the 43 ohm bulb is 5 mm long and has a cross-sectional area

of 2×10^{-10} m^2. What is the magnitude of the electric field inside this metal filament?

$|\vec{E}|$ = 315.62 ✔ V/m

- *Read the eBook*
- Section 20.3