WebAssign
CH20-HW02-FALL2010 (Homework)

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PHYS 272-FALL 2012, Fall 2012
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Current Score : 20 / 20 **Due :** Friday, October 26 2012 11:59 PM EDT

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1. 2/2 points | Previous Answers MI3 20.1.X.049

(a) Suppose you charge a 2.5 F capacitor with two 1.5 volt batteries. How much charge was on each plate?

7.5 ✓ C

(b) How many excess electrons were on the negative plate?

4.69e19 ✓ electrons

- *Read the eBook*
- Section 20.1

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2. 2/2 points | Previous Answers MI3 20.2.X.064

(a) In zinc at room temperature, the mobility of mobile electrons is about 1.6×10^{-3} (m/s)/(V/m), and there are about 6.6×10^{28} mobile electrons per m^3. Calculate the conductivity σ. In actual practice, it is usually easier to measure the conductivity σ and deduce the mobility u from this measurement.

1.69e7 ✓

(b) What are the correct units for σ?

- ○ (A•m)/V
- ◉ $(A/m^2)/(V/m)$
- ○ $(A/m)/(V/m^2)$
- ○ $(m/A)/(V/m^3)$

✓

- *Read the eBook*
- Section 20.2

3. 1/1 points | Previous Answers MI3 20.2.X.065

Consider a tungsten wire ($\sigma = 1.8 \times 10^7\ \Omega^{-1} \cdot \text{m}^{-1}$) with a cross-sectional area of 1 mm^2 (similar to your connecting wires) and carrying 0.3 amperes of current, which is about what you get in a circuit with a round bulb and two batteries in series. Calculate the strength of the very small electric field required to drive this current through the wire.

0.0167 ✓ V/m

- *Read the eBook*
- Section 20.2

4. 2/2 points | Previous Answers MI3 20.2.X.008

A carbon resistor is 2 mm long and has a constant cross section of 0.3 mm^2. The conductivity of carbon at room temperature is $\sigma = 3 \times 10^4$ per ohm·m. In a circuit its potential at one end of the resistor is 14 volts relative to ground, and at the other end the potential is 16 volts. Calculate the resistance R and the current I.

$R =$ 0.222 ✓ Ω

$I =$ 9 ✓ amperes

- *Read the eBook*
- Section 20.2

5. 4/4 points | Previous Answers MI3 20.2.X.010

(a) The current through a particular high-resistance (long) bulb when connected to two batteries in series (2.7 volts) is about 105 milliampere (mA); connected to one battery (1.35 volts) the current is about 75 mA; and connected to a small voltage of only 50 millivolts the current is about 6 mA. (Different high-resistance (long) bulbs may differ from these values somewhat.) Using the formula $I = |\Delta V|/R$, what is R for each of these cases?

$R_{2.7\ \mathrm{V}}$ = 25.7 Ω

$R_{1.35\ \mathrm{V}}$ = 18 Ω

$R_{50\ \mathrm{mV}}$ = 8.33 Ω

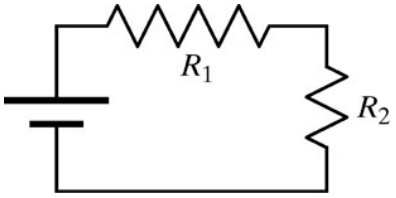
(b) Is a high-resistance (long) bulb an ohmic resistor over this whole range of currents?

- (•) The bulb is not ohmic, because its resistance changes if the current through the bulb changes.
- ( ) The bulb is ohmic because one can use the formula $R = |\Delta V|/I$.
- ( ) The bulb is ohmic, because light bulbs are ohmic.
- ( ) The bulb is ohmic, because it is not possible for the resistance of any resistor to change.

- *Read the eBook*
- Section 20.2

6. 2/2 points | Previous Answers MI3 20.2.X.068

In the circuit shown below, the emf of the battery is 7.3 volts. Resistor R_1 has a resistance of 26 ohms, and resistor R_2 has a resistance of 44 ohms. A steady current flows through the circuit.



(a) What is the absolute value of the potential difference across R_1?

$|\Delta V_1|$ = 2.71 ✓ V

(b) What is the conventional current through R_2?

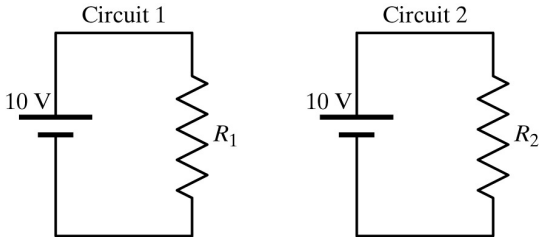
0.1043 ✓ A

- *Read the eBook*
- Section 20.2

7. 7/7 points | Previous Answers MI3 20.3.P.082

Two resistors

In circuit 1 (see the figure), ohmic resistor R_1 dissipates 4 watts; in circuit 2, ohmic resistor R_2 dissipates 19 watts. The wires and batteries have negligible resistance. The circuits contain 10V batteries.



(a) What is the resistance of R_1 and of R_2?

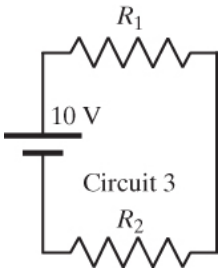
R_1= 25 ✓ Ω

R_2= 5.26 ✓ Ω

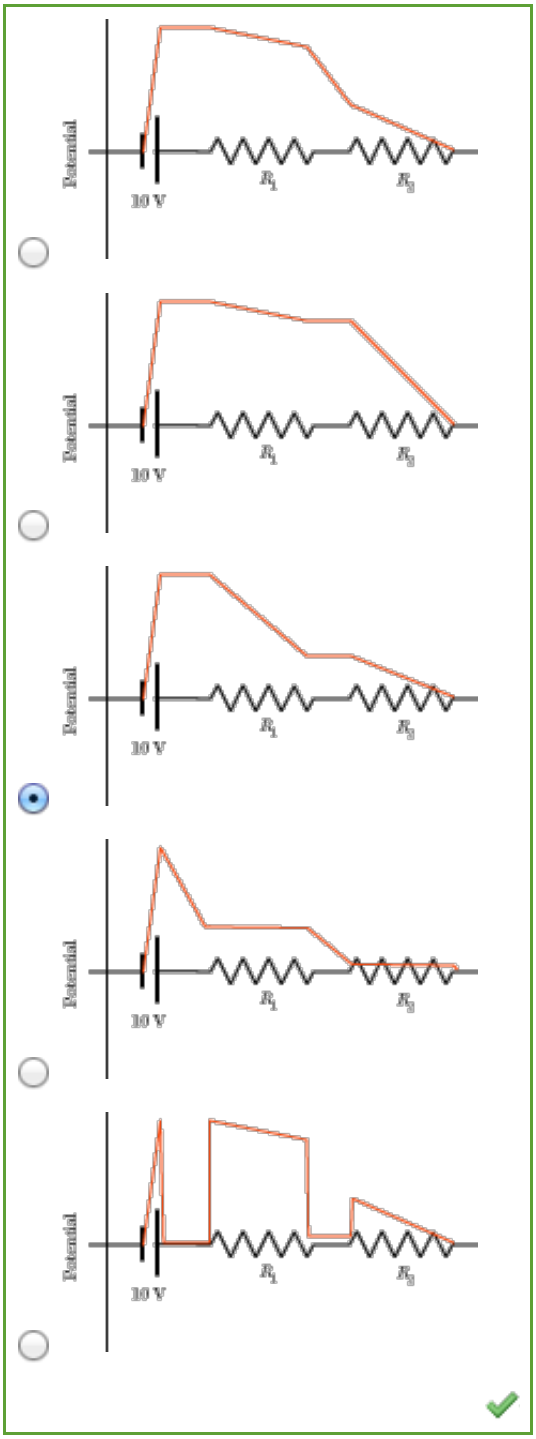
(b) Resistor R_1 is made of a very thin metal wire that is 4 mm long, with a diameter of 0.1 mm. What is the electric field inside this metal resistor?

2500 ✓ V/m

(c) The same resistors are used to construct circuit 3, using the same 10V battery as before.



Which of the following graphs best represents the potential as a function of position around circuit 3?



(d) In circuit 3, calculate the number of electrons entering R_1 every second, and the number of electrons entering R_2 every second.

2.07e18 ✔ electrons/s (R_1)

2.07e18 ✔ electrons/s (R_2)

(e) What is the power output of the battery in circuit 3?

3.3 ✔ W

- *Read the eBook*
- Section 20.3