Name: Key

MC 21 Prob 80

Chapters 20-21 Test 2015-2016

I. Matching:

A. Match each SI unit with the correct electrical parameter.

E	1. kilowatt-hour	A. current
B	2. volt	B. potential difference
D	3. ohm	C. power
C	4. watt	D. resistance
		E. energy

B. Match each SI unit with the correct electrical parameter.

D	5. ampere	A. resistivity
E	6. coulomb	B. drift velocity
A	7. ohm-meter	C. resistance
B	8. meters per second	D. current
		E. charge

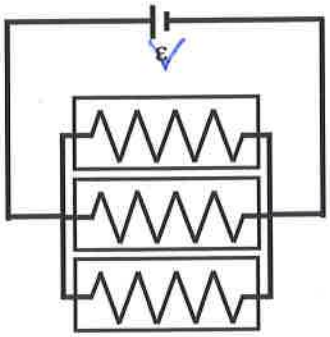
II. Multiple Choice: Select the one best answer for each question.

9. In a circuit, the indicated direction of the current is in the
   A. same direction as the net electron flow.
   B. direction from the negative battery terminal to the positive battery terminal.
   C. opposite direction as the net electron flow.
   D. is in the same direction that protons are moving through the wire.

10. If the potential difference across a resistor is doubled,
   A. only the current is doubled.
   B. only the current is halved.
   C. only the resistance is doubled.
   D. only the resistance is halved.
   E. both the current and resistance are doubled.

a voltage

11. Three identical light bulbs are connected to ~~an emf~~ source. What will happen if the top bulb burns out?



A. All the bulbs will go out.
B. The light intensity of the other two bulbs will decrease (but they won't go out).
C. The light intensity of the other two bulbs will increase.
D. The light intensity of the other two bulbs will remain the same.
E. More current will be drawn from the source emf.

12. Which of the following appliances consumes the most power when operating?

A. Appliance #1:	120 V	1.0 A	120W
B. Appliance #2:	240 V	0.5 A	120 W
C. Appliance #3:	240 V	2.0 A	480W
D. Appliance #4:	120 V	3.0 A	360W

P = IV

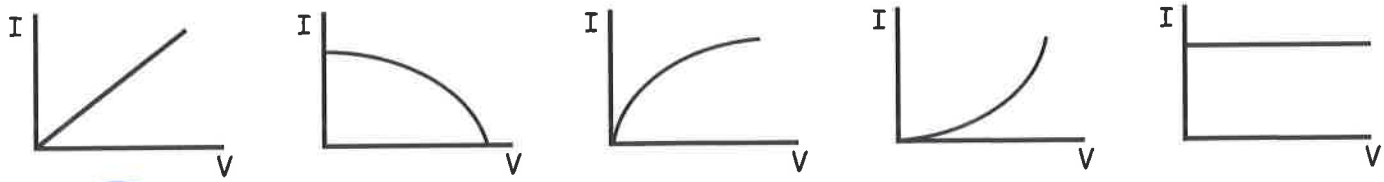
13. To measure the potential difference across a resistor, a voltmeter is connected in _____ because it has the _____.

A. series, same current flowing through it as the resistor
B. series, same potential difference across it as the resistor
C. parallel, same current flowing through it as the resistor
D. parallel, same potential difference across it as the resistor

14. Which of these equations is Ohm's Law?

A. V = IR B. I = VR C. R = IV D. P = IV

15. Which graph represents the current through a resistor that obeys Ohm's Law?



A. B. C. D. E.

16. The resistivity of a conductor depends upon:

A. the length of the conductor.
B. only on the specific material of the conductor.
C. the cross-sectional area of the conductor.
D. the current flowing through the conductor.

17. Current is a measure of:
    A. force that moves a charge past a point
    B. resistance to the movement of a charge past a point
    C. energy used to move a charge past a point
    D. amount of charge that moves past a point per unit time
    E. speed with which a charge moves past a point

18. In a simple circuit consisting of a battery and a resistor, if the resistance of the resistor increases, the current through the resistor will:
    A. increase B. decrease C. stay the same

19. If a circuit consists of a battery and two resistors connected in parallel with the battery and a third identical resistor is added in parallel, the current in the two initial resistors will:
    A. increase B. decrease C. stay the same

20. If a circuit consists of a battery and two resistors connected in series to each other and a third identical resistor is added in series, the current in the circuit will:
    A. increase B. decrease C. stay the same

21. In a string of holiday lights, when one bulb burns out the rest of the bulbs stay lit, the bulbs must be connected in
    A. series B. parallel

III. Problems: Answers all of these problems on a separate sheet of paper. Your answers should flow from top to bottom. Do not skip around or place answers horizontally next to previous work. Show your work. Circle or box your answer. Answers must have the correct number of significant figures and the correct units.

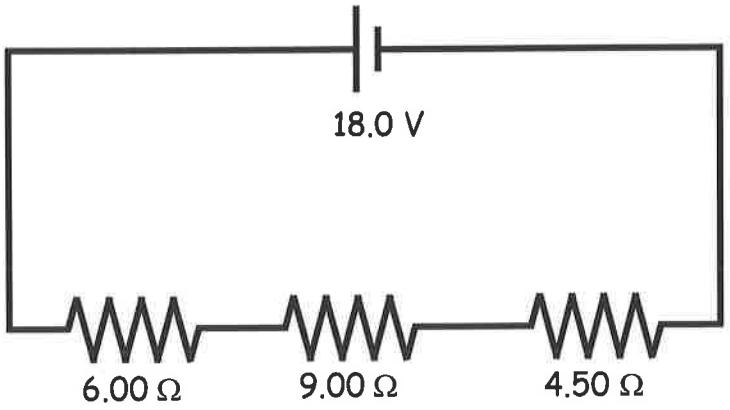
5 points each:

Starting equation:	**1 point**
Work and correct answer:	**3.5 points**
Boxed answer:	**0.5 points**

1. You have a 15.0-m-long piece of 14-gauge copper wire having a radius of 0.814 mm? ($\rho_{Cu} = 1.67 \times 10^{-8}\ \Omega \cdot m$)
   A. What is the resistance of this wire?
   B. How much current will flow through the wire if there is a 12.0 V potential difference between the ends (i.e. if it is hooked up to a 12.0 V battery)?

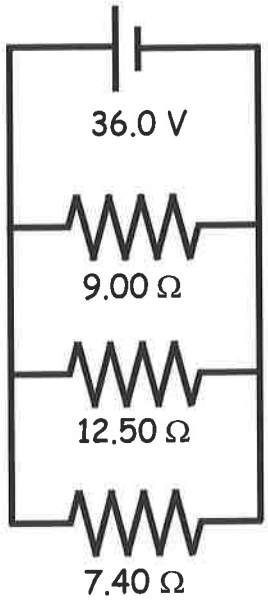
2. A clock battery wears out after moving 2.40×10^4 C of charge through the clock with an average current of 0.330 mA.
   A. How long did the clock run?
   B. How many electrons per second on average flowed through the clock?

3. A. Calculate the total equivalent resistance of this circuit.
   B. Calculate the current flowing through this circuit.

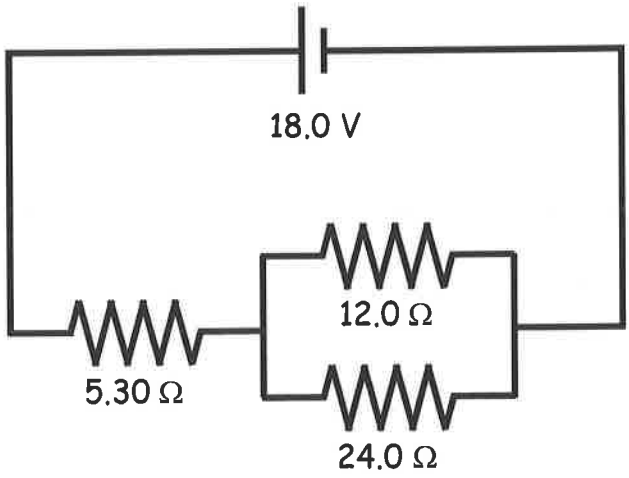


4. How much does it cost to run a 200.0 watt floodlight 13.0 hours a day for 30.0 days if the local electric company charges 14.0 cents per kilowatt-hour?

5. A. Calculate the total equivalent resistance of this circuit.
   B. Calculate the total current flowing through this circuit.
   C. Calculate the current flowing through the 7.40-Ω resistor.
   D. Calculate the power dissipated as heat through the 7.40-Ω resistor.



6. A. Calculate the total equivalent resistance of this circuit.
   B. Calculate the total current flowing through this circuit.
   C. Calculate the potential difference across the 5.30-Ω resistor.
   D. Calculate the current flowing through the 24.0-Ω resistor.
   E. Calculate the total power dissipated as heat in this circuit.



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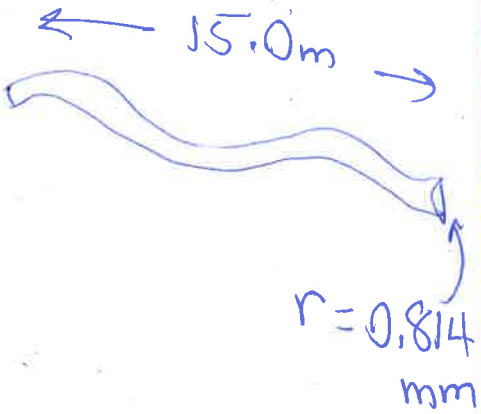
① A. $R = \frac{\rho L}{A} = \frac{(1.67\times10^{-8}\ \Omega\text{-cm})(15.0\ \text{m})}{\pi(0.814\times10^{-3}\ \text{m})^2}$

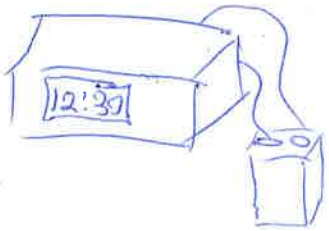
$= \boxed{0.120\ \Omega}$ $0.1203\ \Omega$



B. $I = \frac{V}{R} = \frac{12.0\ \text{V}}{0.1203\ \Omega} = \boxed{99.7\ \text{A}}$

② A. $I = \frac{Q}{t} \Rightarrow t = \frac{Q}{I} = \frac{2.40\times10^{4}\ \text{C}}{0.330\times10^{-3}\ \text{A}}$

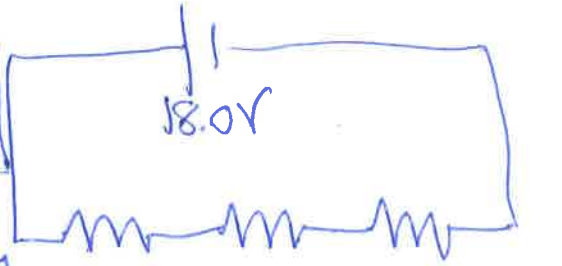
$= \boxed{7.27\times10^{7}\ \text{s}}$



B. $0.330\times10^{-3}\ \frac{\text{C}}{\text{s}}\left(\frac{1e^-}{1.60\times10^{-19}\ \text{C}}\right) = \boxed{2.06\times10^{15}\ \frac{e^-}{\text{s}}}$

③ A. $R_{eq} = R_1 + R_2 + R_3$

$= (6+9+4.5\ \Omega) = \boxed{19.50\ \Omega}$



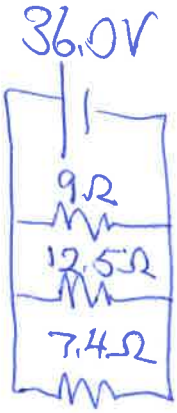
B. $I = \frac{V}{R} = \frac{18.0\ \text{V}}{19.50\ \Omega} = \boxed{0.923\ \text{A}}$

(4) $200.0\,W\left(\frac{1\,kW}{1000\,W}\right)\left(\frac{13.0\,h}{d}\right)(30\,d)\left(\frac{\$0.14}{kWh}\right)$

$= \boxed{\$10.92}$

(5) A. $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{9.00} + \frac{1}{12.50} + \frac{1}{7.40}$

$\Rightarrow \boxed{R_{eq} = 3.07\,\Omega}$ 3.065Ω



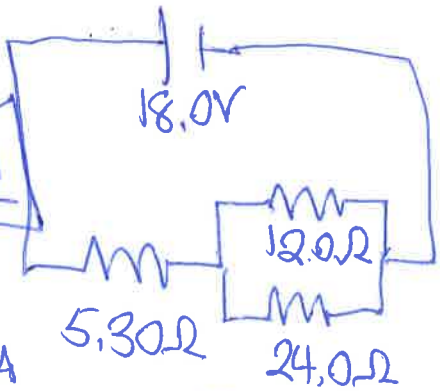
B. $I = \frac{V}{R_{eq}} = \frac{36.0\,V}{3.065\,\Omega} = \boxed{11.7\,A}$ 11.74A

C. $I_{7.40\Omega} = \frac{V}{R} = \frac{36.0\,V}{7.40\,\Omega} = \boxed{4.86\,A}$ 4.865A

D. $P = IV = (4.865\,A)(36.0\,V) = \boxed{175\,W}$

(6) A. $\frac{1}{R_{12/24}} = \frac{1}{12.0} + \frac{1}{24.0} \Rightarrow R_{12/24} = 8.00\,\Omega$

$R_{TOT} = 5.30\,\Omega + 8.00\,\Omega = \boxed{13.30\,\Omega}$



B. $I = \frac{V}{R_{TOT}} = \frac{18.0\,V}{13.30\,\Omega} = \boxed{1.35\,A}$ 1.353A

C. $V_{5.30\Omega} = IR = (1.353\,A)(5.30\,\Omega) = \boxed{7.17\,V}$ 7.173V

D. $I = \frac{V}{R} = \frac{18.0\,V - 7.173\,V}{24.0\,\Omega} = \boxed{0.451\,A}$

E. $P = \frac{V^2}{R} = \frac{(18.0\,V)^2}{13.30\,\Omega} = \boxed{24.4\,W}$