Sample Exam #3 Electricity Physics 103 Spring 2011

1. An electric heater is constructed by applying a potential difference of 110 V across a wire with a resistance of 5.0 Ω. What is the power rating of the heater?

a. 2.0 kW
b. 2.4 kW
c. 1.7 kW
d. 1.5 kW
e. 60 kW

2. A 4.0-Ω resistor has a current of 3.0 A in it for 5.0 min. How many electrons pass through the resistor during this time interval?

a. 7.5×10^{21}
b. 5.6×10^{21}
c. 6.6×10^{21}
d. 8.4×10^{21}
e. 2.1×10^{21}

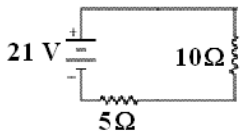
3. A wire (length = 2.0 m, diameter = 1.0 mm) has a resistance of 0.45Ω. What is the resistivity of the material used to make the wire?

a. $5.6 \times 10^{-7}\ \Omega \cdot \text{m}$
b. $1.2 \times 10^{-7}\ \Omega \cdot \text{m}$
c. $1.8 \times 10^{-7}\ \Omega \cdot \text{m}$
d. $2.3 \times 10^{-7}\ \Omega \cdot \text{m}$
e. $7.1 \times 10^{-7}\ \Omega \cdot \text{m}$

4. A small bulb is rated at 7.5 W when operated at 125 V. Its resistance (in ohms) is

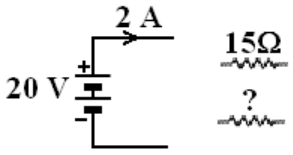
a. 0.45.
b. 7.5.
c. 17.
d. 940.
e. 2100.

5. What is the current in the 10-Ω resistor?



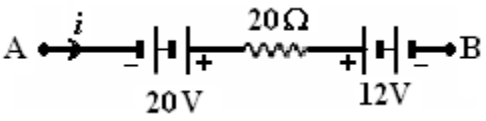
a. 0.60 A
b. 3.0 A
c. 1.2 A
d. 2.4 A
e. 0.30 A

6. A resistor of unknown resistance and a 15-Ω resistor are connected across a 20-V battery in such a way that a 2.0 A current is observed in the battery. What is the value of the unknown resistance?



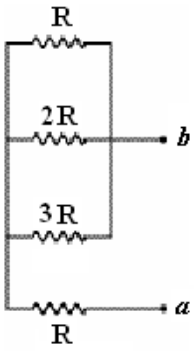
a. 75 Ω
b. 12 Ω
c. 7.5 Ω
d. 30 Ω
e. 5.0 Ω

7 What is the potential difference $V_B - V_A$ when the I= 1.5 A in the circuit segment below?



a. +22 V
b. –22 V
c. –38 V
d. +38 V
e. +2.0 V

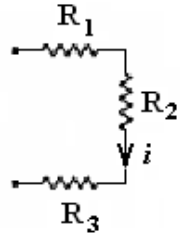
8. What is the equivalent resistance between points a and b when R = 13 Ω?



a. 29 Ω
b. 23 Ω
c. 26 Ω
d. 20 Ω
e. 4.6 Ω

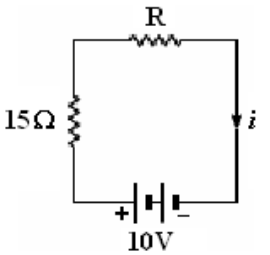
9. If $R_1 = 10\ \Omega$, $R_2 = 15\ \Omega$, $R_3 = 20\ \Omega$, and $I = 0.50$ A, at what rate is heat being generated in these resistors?

a. 29 W
b. 16 W
c. 22 W
d. 11 W
e. 1.1 W



10. A 10-V battery is connected to a 15-Ω resistor and an unknown resistor *R*, as shown. The current in the circuit is 0.40 A. How much heat is produced in the 15-Ω resistor in 2.0 min?

a. 0.40 kJ
b. 0.19 kJ
c. 0.29 kJ
d. 0.72 kJ
e. 0.80 kJ



____ 11. If body P, with a positive charge, is placed in contact with body Q (initially uncharged), what will be the nature of the charge left on Q?
a. must be equal in magnitude to that on P
b. must be negative
c. must be positive
d. must be greater in magnitude than that on P
e. must be negative and less in magnitude than that on P

____ 12. Two point charges are 4 cm apart. They are moved to a new separation of 2 cm. By what factor does the resulting mutual force between them change?
a. 1/2
b. 2
c. 1/4
d. 4
e. 1

____ 13. Two equal charges, each Q, are separated by some distance. What third charge would need to be placed half way between the two charges so that the net force on each charge would be zero?
a. –Q
b. –Q/2
c. –Q/4
d. –Q/8
e. –Q/16

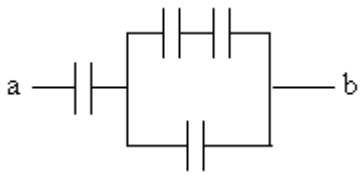
____ 14. A 9.0-V battery is connected between two parallel metal plates 4.0 mm apart. What is the magnitude of the electric field between the plates?
a. 2.3×10^3 N/C
b. 9.0 N/C
c. 2.3 N/C
d. 0.75×10^{-6} N/C

e. 0.56×10^{-9} N/C

____ 15. A uniform electric field, with a magnitude of 600 N/C, is directed parallel to the positive *x-axis*. If the potential at $x = 3.0$ m is 1 000 V, what is the change in potential energy of a proton as it moves from $x = 3.0$ m to $x = 1.0$ m? ($q_p = 1.6 \times 10^{-19}$ C)
a. 8.0×10^{-17} J
b. 1.9×10^{-16} J
c. 0.80×10^{-21} J
d. 500 J
e. 2.2×10^{-15} J

____ 16. An electron in a cathode ray tube is accelerated through a potential difference of 5.0 kV. What kinetic energy does the electron gain in the process? ($e = 1.6 \times 10^{-19}$ C)
a. 1.6×10^{-16} J
b. 8.0×10^{-16} J
c. 1.6×10^{-22} J
d. 8.0×10^{22} J
e. 1.6×10^{16} J

____ 17. What is the equivalent capacitance between points a and b? All capacitors are 1.0 μF.



a. 4.0 μF
b. 1.7 μF
c. 0.60 μF
d. 0.25 μF
e. 0.50 μF

____ 18. A metallic conductor has a resistivity of 18×10^{-6} Ω·m. What is the resistance of a piece that is 30 m long and has a uniform cross sectional area of 3.0×10^{-6} m^2?
a. 0.056 Ω
b. 180 Ω
c. 160 Ω
d. 90 Ω
e. 60 Ω

____ 19. A 60-W light bulb is in a socket supplied with 120 V. What is the current in the bulb?
a. 0.50 A
b. 2.0 A
c. 60 A
d. 7 200 A
e. 10 000 A

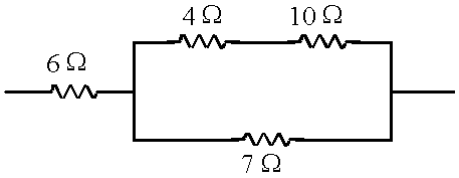
____ 20. A resistor is connected to a battery with negligible internal resistance. If you replace the resistor with one that has twice the resistance, by what factor does the power dissipated in the circuit change?
a. 0.50
b. 0.25
c. 4.0

d. 2.0
e. 1.0

____ 21. The heating coil of a hot water heater has a resistance of 20 Ω and operates at 210 V. How long a time is required to raise the temperature of 200 kg of water from 15°C to 80°C? (The specific heat for water = 10^3 cal/kg·°C and 1.0 cal = 4.186 J.)
a. 1.7 h
b. 3.8 h
c. 5.1 h
d. 6.9 h
e. 8.8 h

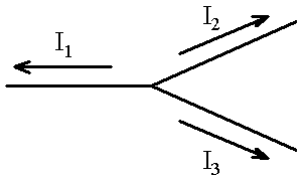
____ 22. An 8.00-Ω resistor is dissipating 100 watts. What are the current through it, and the difference of potential across it?
a. 12.5 A, 28.3 V
b. 3.54 A, 12.5 V
c. 3.54 A, 28.3 V
d. 28.3 A, 3.54 V
e. 12.5 A, 3.54 V

____ 23. Resistors of values 6.0Ω, 4.0Ω, 10.0Ω and 7.0Ω are combined as shown. What is the equivalent resistance for this combination?



a. 2.3 Ω
b. 3.0 Ω
c. 10.7 Ω
d. 27 Ω
e. 30 Ω

____ 24. What is Kirchhoff's 1st equation for this junction?



a. $I_1 = I_2 + I_3$
b. $I_2 = I_1 + I_3$
c. $I_3 = I_1 + I_2$
d. $I_1 + I_2 + I_3 = 0$
e. $I_2 = I_3$

Answer Section

1B 2B 3C 4E 5C 6D 7B 8D 9D 10C

11.	ANS: C	TOP:	Insulators and Conductors
12.	ANS: D	TOP:	Coulomb's Law
13.	ANS: C	TOP:	Coulomb's Law
14.	ANS: A	TOP:	Potential Difference and Electric Potential
15.	ANS: B	TOP:	Potential Difference and Electric Potential
16.	ANS: B	TOP:	Potential Difference and Electric Potential
17.	ANS: C	TOP:	The Parallel-Plate Capacitor, Combinations of Capacitors
18.	ANS: B	TOP:	Resistivity
19.	ANS: A	TOP:	Electrical Energy and Power
20.	ANS: A	TOP:	Electrical Energy and Power
21.	ANS: D	TOP:	Electrical Energy and Power
22.	ANS: C	TOP:	Electrical Energy and Power
23.	ANS: C	TOP:	Sources of emf, Resistors in Series, Resistors in Parallel
24.	ANS: D	TOP:	Kirchhoff's Rules and Complex DC Circuits