Chapter 7 Review Questions

Solutions can be found in Chapter 12.

Section I: Multiple Choice

1. A wire made of brass and a wire made of silver have the same length, but the diameter of the brass wire is 4 times the diameter of the silver wire. The resistivity of brass is 5 times greater than the resistivity of silver. If R_B denotes the resistance of the brass wire and R_S denotes the resistance of the silver wire, which of the following is true?

   (A) $R_B = \frac{5}{16} R_S$
   (B) $R_B = \frac{4}{5} R_S$
   (C) $R_B = \frac{5}{4} R_S$
   (D) $R_B = \frac{5}{2} R_S$

2. For an ohmic conductor, doubling the voltage without changing the resistance will cause the current to

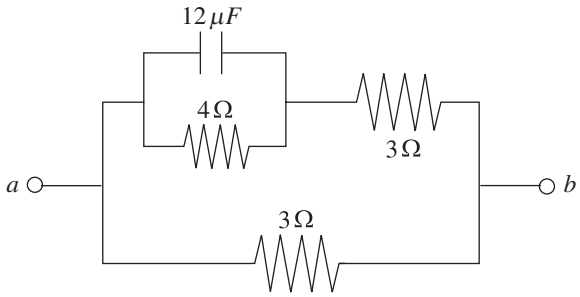
   (A) decrease by a factor of 4
   (B) decrease by a factor of 2
   (C) increase by a factor of 2
   (D) increase by a factor of 4

3. A capacitor, battery, and two resistors are to be arranged in a circuit. Which configurations allow there to be a current that is initially through one resistor and finally through the other resistor?

   (A) The capacitor should be in series with the battery and the resistors should be in parallel.
   (B) The capacitor should be in parallel with the battery and the resistors should be in series.
   (C) One resistor should be in series with the battery and the other should be in parallel with the capacitor.
   (D) One resistor should be in parallel with the battery and the other should be in series with the capacitor.

4. A student wants to determine the resistivity of copper. She has a voltmeter reading for a copper wire of known length. What other information will she need?

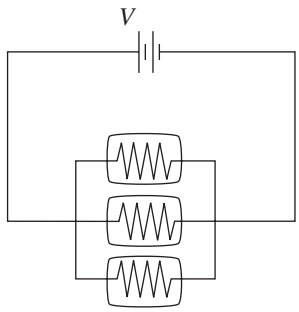
   (A) An ammeter reading
   (B) The diameter of the wire
   (C) Both an ammeter reading and the diameter of the wire
   (D) Neither an ammeter reading nor the diameter of the wire

5. 

   The circuit shown above has a constant voltage between points *a* and *b*. The voltage has been flowing for a long time. What is the resistance of the circuit?

   (A) 0.47 Ω
   (B) 1.5 Ω
   (C) 2.1 Ω
   (D) 10 Ω

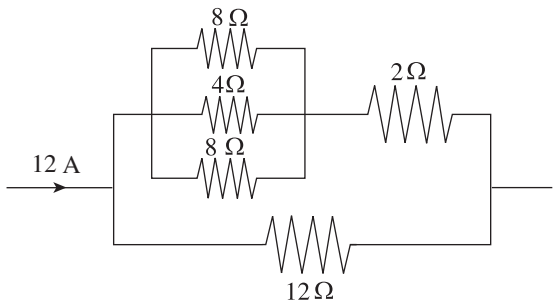
6.



Three identical light bulbs are connected to a source of emf, as shown in the diagram above. What will happen if the middle bulb burns out?

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

7.



What is the voltage drop across the 12 Ω resistor in the portion of the circuit shown above?

(A) 24 V
(B) 36 V
(C) 48 V
(D 72 V

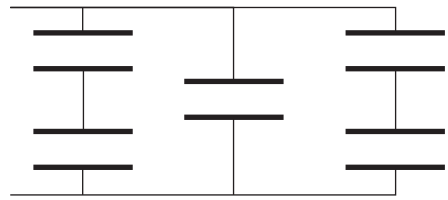
8. A simple DC circuit with a single Ohmic resistor is set up. A graph is produced of the voltage drop across the resistor versus current. For an ideal battery, the graph is directly proportional. If the battery has some internal resistance, how, if at all, would such a graph change?

(A) The graph would remain directly proportional.
(B) The graph would be linear, but would have a negative *y*-intercept.
(C) The graph would be linear, but would have a positive *y*-intercept.
(D) The graph would be nonlinear.

9. How much energy is dissipated as heat in 20 s by a 100 Ω resistor that carries a current of 0.5 A?

(A) 50 J
(B) 100 J
(C) 250 J
(D) 500 J

10.

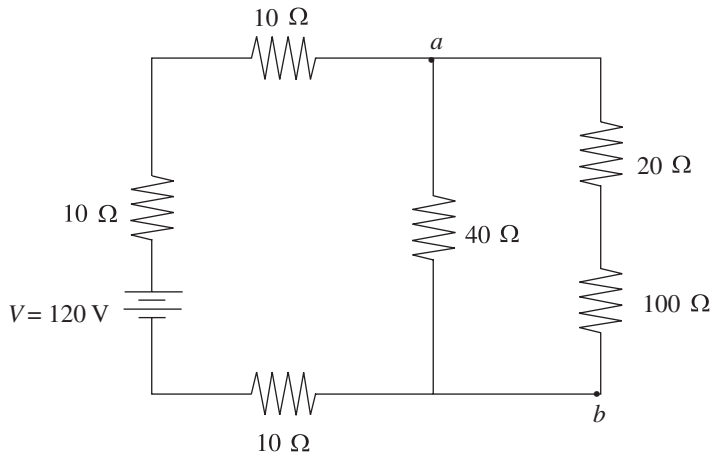


If each of the capacitors in the array shown above is *C*, what is the capacitance of the entire combination?

(A) $C/2$
(B) $2C/3$
(C) $5C/6$
(D) $2C$

Section II: Free Response

1. Consider the following circuit:



(a) At what rate does the battery deliver energy to the circuit?

(b) Find the current through the 40 Ω resistor.

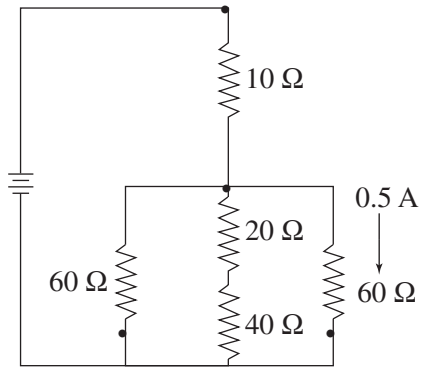
(c) (i) Determine the potential difference between points *a* and *b*.

(ii) At which of these two points is the potential higher?

(d) Given that the 100 Ω resistor is a solid cylinder that's 4 cm long, composed of a material whose resistivity is 0.45 Ω, determine its radius.

(e) Which resistor or resistors, if any, could be replaced with a capacitor so that when the capacitor is fully charged, no current flows out of the battery? Explain your answer.

2. Consider the following circuit:



(a) What is the current through each resistor?

(b) What is the potential difference across each resistor?

(c) What is the equivalent resistance of the circuit?

(d) The rightmost 60 Ω resistor is replaced with a fully charged capacitor.

(i) When the capacitor is empty and just beginning to fill, will the current in the leftmost 60 Ω resistor be greater than, equal to, or less than the 0.5 A it was before the capacitor was inserted into the circuit?

(ii) When the capacitor is fully charged, will the current in the leftmost 60 Ω resistor be greater than, equal to, or less than the 0.5 A it was before the capacitor was inserted into the circuit?