Multiple Choice

Identify the choice that best completes the statement or answers the question.

1. (1 point) A wire carries a steady current of 0.1 A over a period of 20 s. What total charge passes through the wire in this time interval?
   a. 200 C  
   b. 20 C  
   c. 2 C  
   d. 0.005 C

2. (1 point) In a certain material there is a current of 16 A flowing through a surface to the right, and there is an equal amount of positive and negative charge passing through the surface producing the current. How much negative charge passes through the surface?
   a. 8 C/s toward the right  
   b. 8 C/s toward the left  
   c. 16 C/s toward the right  
   d. 16 C/s toward the left

3. (2 points) A high voltage transmission line of diameter 2 cm and length 200 km carries a steady current of 1 000 A. If the conductor is copper with a free charge density of $8 \times 10^{28}$ electrons/m$^3$, how long does it take one electron to travel the full length of the cable? ($e = 1.6 \times 10^{-19}$ C)
   a. $8 \times 10^2$ s  
   b. $8 \times 10^4$ s  
   c. $8 \times 10^6$ s  
   d. $8 \times 10^8$ s

4. (1 point) You measure a 25.0-V potential difference across a 5.00-Ω resistor. What is the current flowing through it?
   a. 125 A  
   b. 5.00 A  
   c. 4.00 A  
   d. 1.00 A

5. (2 points) How long is a wire made from 100 cm$^3$ of copper if its resistance is 8.5 ohms? The resistivity of copper is $1.7 \times 10^{-5}$ Ω·m.
   a. 7.1 m  
   b. $1.7 \times 10^2$ m  
   c. $2.2 \times 10^2$ m  
   d. $3.0 \times 10^3$ m
6. (1 point) Two wires with the same resistance have the same diameter but different lengths. If wire 1 has length \( L_1 \) and wire 2 has length \( L_2 \), how do \( L_1 \) and \( L_2 \) compare if wire 1 is made from copper and wire 2 is made from aluminum? The resistivity of copper is \( 1.7 \times 10^{-5} \, \Omega \cdot m \) and the resistivity of aluminum is \( 2.82 \times 10^{-5} \, \Omega \cdot m \).
   a. \( L_1 = 1.7 \, L_2 \)
   b. \( L_1 = 0.60 \, L_2 \)
   c. \( L_1 = 2.8 \, L_2 \)
   d. \( L_1 = 0.36 \, L_2 \)

7. (1 point) A nichrome wire has a radius of 0.50 mm and a resistivity of \( 1.5 \times 10^{-6} \, \Omega \cdot m \). If the wire carries a current of 0.50 A, what is the potential difference per unit length along this wire?
   a. 0.003 V/m
   b. 0.95 V/m
   c. 1.6 V/m
   d. 1.9 V/m

8. (1 point) A metal wire has a resistance of 25.00 \( \Omega \) under room temperature conditions of 25\(^\circ\)C. When the wire is heated to 85\(^\circ\)C the resistance increases by 0.75 \( \Omega \). What is the temperature coefficient of resistivity of this metal?
   a. \( 5.0 \times 10^{-4} \, (^\circ C)^{-1} \)
   b. \( 1.3 \times 10^{-3} \, (^\circ C)^{-1} \)
   c. \( 1.5 \times 10^{-3} \, (^\circ C)^{-1} \)
   d. \( 2.5 \times 10^{-3} \, (^\circ C)^{-1} \)

9. (1 point) If a 9.0-V battery, with negligible internal resistance, and an 18-\( \Omega \) resistor are connected in series, what is the amount of electrical energy transformed to heat per coulomb of charge that flows through the circuit?
   a. 0.50 J
   b. 3.0 J
   c. 9.0 J
   d. 72 J

10. (1 point) 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
11. (1 point) A 500-W heater carries a current of 4.0 A. How much does it cost to operate the heater for 30 min if electrical energy costs 6.0 cents per kWh?
   a. 1.5 cents
   b. 9.0 cents
   c. 18 cents
   d. 36 cents

12. (2 points) An electric clothes dryer draws 15 A at 220 V. If the clothes put into the dryer have a mass of 7.0 kg when wet and 4.0 kg dry, how long does it take to dry the clothes? (Assume all heat energy goes into vaporizing water, $L_v = 2.26 \times 10^6$ J/kg.)
   a. 55 min
   b. 34 min
   c. 20 min
   d. 16 min

13. (1 point) A steam turbine at an electric power plant delivers 4 500 kW of power to an electrical generator which converts 95% of this mechanical energy into electrical energy. What is the current delivered by the generator if it delivers at 3 600 V?
   a. $0.66 \times 10^3$ A
   b. $1.0 \times 10^3$ A
   c. $1.2 \times 10^3$ A
   d. $5.9 \times 10^3$ A

14. (2 points) The heating coil of a hot water heater has a resistance of 20 $\Omega$ 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

15. (2 points) If electrical energy costs 5.5 cents per kWh, what does it cost to heat 200 kg water from 15°C to 80°C? (The specific heat of water = $10^3$ cal/kg·°C and 1.0 cal = 4.186 J.)
   a. 48 cents
   b. 83 cents
   c. 16 cents
   d. 80 cents