CHAPTER 3—ELECTRICITY

MULTIPLE CHOICE

1. The resistance in a wire decreases as its
   a. diameter increases.
   b. diameter decreases.
   c. temperature increases.
   d. surface area decreases.

   ANS: A PTS: 1 DIF: Medium

2. If the total resistance in a circuit is 9 ohms and the total voltage is 3 volts, the current is
   a. 1/27 ampere.
   b. 1/3 ampere.
   c. 3 amperes.
   d. 27 amperes.

   ANS: B PTS: 1 DIF: Medium

3. If a DC circuit is
   a. in series, the currents are different for each component (e.g., resistors).
   b. in series, the voltages are the same for each component.
   c. in parallel, the currents are equal for all paths of the circuit.
   d. in parallel, the voltages are equal for all paths of the circuit.

   ANS: D PTS: 1 DIF: Medium

4. Electric current is defined as
   a. time/charge.
   b. charge/time.
   c. (charge)(time).
   d. charge/time^2.

   ANS: B PTS: 1 DIF: Easy

5. Coulomb's law of electrical forces is mathematically described as
   a. $F = q_1q_2/r^2$.
   b. $F = q/r^{2.}$.
   c. $F = q_1q_2/r$.
   d. $F = q_2/r$.

   ANS: A PTS: 1 DIF: Medium

6. A current of 2 amperes and a resistance of 8 ohms require what voltage in a series circuit?
   a. 1/16 volt
   b. 1/4 volt
   c. 4 volts
   d. 16 volts

   ANS: D PTS: 1 DIF: Medium

7. When an electric current flows through a wire with resistance, energy is
   a. liberated as x-rays.
   b. liberated as heat.
   c. liberated as light.
   d. absorbed as heat.

   ANS: B PTS: 1 DIF: Medium

8. Ohm's law is mathematically described as
   a. $C = Q/V$.
   b. $L = -V/It$.
   c. $R = V/I$.
   d. $V = I^2R$.

   ANS: C PTS: 1 DIF: Medium

9. Electric potential is measured in

a. coulombs.
b. joules.
c. volts.
d. ohms.

ANS: C PTS: 1 DIF: Easy

10. Electric insulators
    a. convert electrical energy into heat.
    b. consist of materials like silicon.
    c. inhibit movement of electrical charge.
    d. permit movement of electrical charge.

    ANS: C PTS: 1 DIF: Medium

11. If 20 volts of potential difference causes a current of 5 amperes to flow in a parallel circuit, the resistance produced is
    a. 1/100 ohm.
    b. 1/4 ohm.
    c. 4 ohms.
    d. 100 ohms.

    ANS: C PTS: 1 DIF: Medium

12. When the atomic valence and conductance bands overlap,
    a. an insulator is created.
    b. electrical flow easily occurs.
    c. electrical flow is inhibited.
    d. Ohm’s law no longer applies.

    ANS: B PTS: 1 DIF: Difficult

13. A charge would lose most of its energy when it passes through a
    a. resistor.
    b. battery.
    c. generator.
    d. all of the above

    ANS: A PTS: 1 DIF: Medium

14. If the distance between two electrical charges is doubled, the force between them is
    a. decreased by 1/4.
    b. decreased by 1/2
    c. doubled.
    d. quadrupled.

    ANS: A PTS: 1 DIF: Medium

15. A 100 W light bulb with an amperage of 0.91 A is operating at a potential difference of
    a. 110 volts.
    b. 100 volts.
    c. 11 kilovolts.
    d. 110 ohms.

    ANS: A PTS: 1 DIF: Difficult

16. An ampere is
    a. coulomb/sec.
    b. (coulomb)(sec).
    c. (volt)(ohm).
    d. ohm/volt.

    ANS: A PTS: 1 DIF: Easy

17. Resistance is
    a. the opposition to the flow of electrons.
    b. the opposition to the generation of electromotive force.
    c. the location of storage of electrons.

d. measured in amperes.

ANS: A PTS: 1 DIF: Easy

18. The charge on each of two objects is doubled, and they are moved twice as far apart. The force between them is
   a. increased by a factor of 4.
   b. increased by a factor of 2.
   c. increased by a factor of 1/2.
   d. unchanged.

ANS: D PTS: 1 DIF: Medium

19. A circuit has a current of 2 amperes and a resistance of 4 ohms. The maximum power that can be delivered is
   a. 16 watts.
   b. 8 watts.
   c. 2 watts.
   d. 1/2 watt.

ANS: A PTS: 1 DIF: Medium

20. The unit of electrical power is
   a. joule.
   b. volt.
   c. ampere.
   d. watt.

ANS: D PTS: 1 DIF: Easy

21. If 10 coulombs pass a point in 2 seconds, the current is
   a. 0.20 amp.
   b. 5 amps.
   c. 20 amps.
   d. 200 amps.

ANS: B PTS: 1 DIF: Medium

22. In a parallel circuit,
   a. Ohm’s law does not apply.
   b. total current flow is equal across its parallel branches.
   c. the voltage is equal across all branches of the circuit.
   d. as more resistors are added total resistance increases.

ANS: C PTS: 1 DIF: Difficult

23. In a battery circuit with several resistors of different values connected in series,
   a. the voltage drop is the same across all the resistors.
   b. the current through each resistor is different.
   c. the power dissipated through each resistor is the same.
   d. none of the above

ANS: D PTS: 1 DIF: Difficult

24. If a conductor is positively charged, it
   a. has too many electrons.
   b. is deficient in electrons.
   c. has more neutrons than electrons.
   d. is deficient in protons.

ANS: B PTS: 1 DIF: Medium

25. The milliampere(mA) is a unit of
    a. EMF.
    b. voltage.
    c. current.
    d. potential difference.

    ANS: C PTS: 1 DIF: Easy

26. Neon lights illustrate the fact that electrons will flow
    a. in a gaseous environment.
    b. in a vacuum.
    c. in an ionic solution.
    d. in a solid conductor.

    ANS: A PTS: 1 DIF: Medium

27. All of the following choices are considered good metallic electrical conductors **EXCEPT**
    a. gold.
    b. silver.
    c. carbon.
    d. copper.

    ANS: C PTS: 1 DIF: Medium

28. The current flow from a dry cell battery source would be
    a. direct current.
    b. alternating current.
    c. variable current.
    d. oscillating current.

    ANS: A PTS: 1 DIF: Medium

29. Electrical components possess a negative and a positive side. This polarity permits the application of
    a. resistance across the poles to inhibit electron flow.
    b. an electromotive force (emf) to enable current flow.
    c. a spark gap to check amperage.
    d. all of the above

    ANS: B PTS: 1 DIF: Difficult

30. When 6.24×10^{18} electrons travel in one second producing a joule (j) of work,
    a. one volt has been created.
    b. one ohm has traveled through the circuit.
    c. an ampere of resistance has been created.
    d. alternating current has been generated.

    ANS: A PTS: 1 DIF: Difficult

PROBLEM

1. If a circuit has potential difference of 80 kV and a current of 400 mA, what is the resistance?

   ANS:
   2.0×10^5 ohms
   200,000 ohms

   PTS: 1 DIF: Difficult

2. A 25 watt lightbulb operates on 120-volt household voltage. How much current does the lightbulb draw?

   ANS:
   0.21 amp

PTS: 1 DIF: Difficult

3. A 100 watt lightbulb operates on 120-volt household voltage. How much resistance does the lightbulb offer?

   ANS:
   144.6 ohms

   PTS: 1 DIF: Difficult

4. What is the total resistance of a circuit with two resistances of 3 and 5 ohms in series and two resistances of 4 ohms each in parallel?

   ANS:
   10 ohms

   PTS: 1 DIF: Difficult

5. Calculate the current supplied to a circuit with two resistances of 3 and 5 ohms in series and two resistances of 4 ohms each in parallel.

   ANS:
   2 amperes

   PTS: 1 DIF: Difficult

6. Parallel resistors of 3 ohms and 6 ohms would result in a total resistance of how many ohms?

   ANS:
   2.0 ohms

   PTS: 1 DIF: Difficult

MATCHING

Match the terms relating to electricity with the correct statement.

a. watt (W)	e. electrification by contact
b. semiconductor	f. potential difference
c. titanium	g. rheostat
d. circuit breaker	h. electrification by induction

1. a device to control resistance
2. an expression of electrical power
3. superconductor
4. receiving an electrical shock from touching a doorknob
5. silicon
6. the production of lightning

1. ANS: G PTS: 1 DIF: Medium
2. ANS: A PTS: 1 DIF: Medium
3. ANS: C PTS: 1 DIF: Medium
4. ANS: E PTS: 1 DIF: Medium

5. ANS: B PTS: 1 DIF: Medium
6. ANS: H PTS: 1 DIF: Medium

Match the terms relating to electric current flow with the correct statement.

a. semiconductor
b. conductor
c. insulator
d. ampere
e. volt
f. Ohm's law
g. series circuit
h. parallel circuit

7. V = I x R
8. a wide band gap
9. 6.24 x 10^{18} electrons /sec
10. $I_t = I_1 + I_2 + I_3 + I_n$
11. 10V + 5V + 12V + 3V = 30V
12. Z = 32

7. ANS: F PTS: 1 DIF: Difficult
8. ANS: C PTS: 1 DIF: Difficult
9. ANS: D PTS: 1 DIF: Difficult
10. ANS: H PTS: 1 DIF: Difficult
11. ANS: G PTS: 1 DIF: Difficult
12. ANS: A PTS: 1 DIF: Difficult

SHORT ANSWER

1. The shape of door knobs has been an ever-changing process over the history of architecture and home design. A popular door opener design currently used is a flat, lever-type handle that you can use to open a door. Aside from the aesthetic issues, the flat design is intended to take advantage of what law of electrostatics?

   ANS:
   The flat, lever style of door handle is designed to take advantage of the law of distribution of charges on a curved surface. Old-style door knobs that were round, naturally concentrated charge on the surface of the knob based upon its curvature. Flat lever openers have a lower concentration of charge as the area of curvature is diminished. The net effect is to minimize the shock one receives when the handle is touched. This design feature takes advantage of the law of distribution of charge being greatest where the curvature is greatest.

   PTS: 1 DIF: Difficult