Chapter 18: Electric Current and Electric Resistance

1. Be able to describe the metallic bond model for metal, including its components and their behavior.
2. Be able to describe what electric current is verbally and mathematically, including the basic units for electric current.
3. Be able to distinguish between the actual, physical electric current and conventional current in a metal wire.
4. Distinguish among “potential,” “potential difference,” and “voltage.”
5. Be able to describe what is meant by each term in $V_{a,b} = iR$ and to solve for an unknown in this relationship.
6. Be able to articulate what drift velocity is for electrons in a wire and to give a “ballpark” value for typical drift velocities in ordinary circuits.
7. Be able to describe the role of the power supply or battery in an electric circuit.
8. Be able to explain why creating a difference in potential between two ends of a metal wire causes electrical current.
9. Be able to explain why flipping on a light switch results in lights turning on immediately even though the drift velocity of electrons in the wires is much less than 1 mm/s.
10. Be able to explain why a longer conductor has more resistance than a shorter one.
11. Be able to explain why a thinner conductor has more resistance than a thicker one.
12. Be able to find the unknown among $R, \rho, l,$ and A for a wire of length l and cross-sectional area A.
13. Be able to create an $i - V$ plot for a component such a resistor, a light bulb, or a diode, in a real electric circuit.
14. Be able to find the resistance of an electrical component from its $i - V$ plot.
15. Be able to identify $i - V$ plots for metals as they become hot, for resistors, and for diodes and to describe how the shapes of the curves can be explained by the physical properties of these materials.
16. Be able to describe what is meant by “emf”, including its basic units, and to distinguish it from “terminal voltage,” “potential difference” and from “potential.”
17. Be able to calculate the amount of electric energy passing any point ‘a’ in a circuit in a second using $P = iV_a$.
18. Be able to calculate the energy *received* by any circuit element per second using $P = iV_{a,b}$.
19. Be able to describe the difference between $P = iV_a$ and $P = iV_{a,b}$.

20. Be able to explain why energy is transported via electrical power lines at high potential rather than low potential.

21. Be able to determine how much energy, expressed in both Joules and in kilowatt-hours, a household appliance receives in a typical month. By the way, what happens to this energy, ultimately?