CHAPTER REVIEW

The Development of a New Atomic Model

SECTION 1 REVIEW

1. a. List five examples of electromagnetic radiation.
   b. What is the speed of all forms of electromagnetic radiation in a vacuum?
2. Prepare a two-column table. List the properties of light that can best be explained by the wave theory in one column. List those best explained by the particle theory in the second column. You may want to consult a physics textbook for reference.
3. What are the frequency and wavelength ranges of visible light?
4. List the colors of light in the visible spectrum in order of increasing frequency.
5. In the early twentieth century, what two experiments involving light and matter could not be explained by the wave theory of light?
6. a. How are the wavelength and frequency of electromagnetic radiation related?
   b. How are the energy and frequency of electromagnetic radiation related?
   c. How are the energy and wavelength of electromagnetic radiation related?
7. Which theory of light—the wave or particle theory—best explains the following phenomena?
   a. the interference of light
   b. the photoelectric effect
   c. the emission of electromagnetic radiation by an excited atom
8. Distinguish between the ground state and an excited state of an atom.
9. According to Bohr's model of the hydrogen atom, how is hydrogen's emission spectrum produced?

PRACTICE PROBLEMS

10. Determine the frequency of light whose wavelength is 4.257×10^{-7} cm.
11. Determine the energy in joules of a photon whose frequency is 3.55×10^{17} Hz.
12. Using the two equations $E = h\nu$ and $c = \lambda\nu$, derive an equation expressing E in terms of h, c, and λ.
13. How long would it take a radio wave whose frequency is 7.25×10^{5} Hz to travel from Mars to Earth if the distance between the two planets is approximately 8.00×10^{7} km?
14. Cobalt-60 is an artificial radioisotope that is produced in a nuclear reactor and is used as a gamma-ray source in the treatment of certain types of cancer. If the wavelength of the gamma radiation from a cobalt-60 source is 1.00×10^{-3} nm, calculate the energy of a photon of this radiation.

The Quantum Model of the Atom

SECTION 2 REVIEW

15. Describe two major shortcomings of Bohr's model of the atom.
16. a. What is the principal quantum number?
    b. How is it symbolized?
    c. What are shells?
    d. How does n relate to the number of electrons allowed per main energy level?
17. a. What information is given by the angular momentum quantum number?
    b. What are sublevels, or subshells?
18. For each of the following values of n, indicate the numbers and types of sublevels possible for that main energy level. (Hint: See **Table 2.**)
    a. $n = 1$
    b. $n = 2$
    c. $n = 3$
    d. $n = 4$
    e. $n = 7$ (number only)
19. a. What information is given by the magnetic quantum number?
    b. How many orbital orientations are possible in each of the *s*, *p*, *d*, and *f* sublevels?
    c. Explain and illustrate the notation for distinguishing between the different *p* orbitals in a sublevel.