Lesson Check Answers

1. An electron is found only in specific circular paths or orbits around the nucleus.
2. It determines the allowed energy levels an electron can have and the likelihood of finding an electron in various locations around the nucleus.
3. The sublevels have different shapes.
4. by losing or gaining just the right amount of energy—a quantum
5. In an atom, the electrons can have certain fixed energy levels. To move from one energy level to another requires the emission or absorption of an exact amount of energy, or quantum. Thus the energy of the electron is said to be quantized.
6. **a.** 3 **b.** 1 **c.** 3 **d.** 5 **e.** 7
7. **BIG**IDEA The Bohr model limits electrons to specific circular paths. The quantum mechanical model expresses the probability of finding an electron in a given location within the electron cloud based on its current energy level.

8. **a.** $1s^2 2s^2 2p^2$
   b. $1s^2 2s^2 2p^6 3s^2 3p^6$
   c. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^8 4s^2$
9. **a.** $1s^2 2s^2 2p^1$; one unpaired electron
   b. $1s^2 2s^2 2p^6 3s^2 3p^2$; two unpaired electrons
   c. $1s^2 2s^2 2p^6 3s^2 3p^4$; two unpaired electrons

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10. aufbau principle, Pauli exclusion principle, Hund's rule
11. 3*d*, 4*s*, 3*p*, 3*s*, 2*p*
12. Half-filled sublevels and filled sublevels are more stable than other configurations.
13. The 3*s* and 3*p* orbitals are already filled, so the last electron must go to the next higher energy orbital, which is 4*s*.

14. $1s^2 2s^2 2p^6 3s^2 3p^6 \mathbf{4s^2} 3d^{10} \mathbf{4p^3}$ is the best electron configuration based on the aufbau principle (lowest energy rankings). You could write it: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^3$ when listing the electron configuration according to energy levels. The "valence" (outermost electrons in the highest energy level) for Arsenic (As) is 5 since As is in Group VA.

Sample Problems

15. c = fλ … therefore, λ = c/f → 3.00 x 10^{8} m/s / 1.50 x 10^{13} Hz = 2.00 x 10^{-5} m, which is a longer wavelength than red light (~7 x 10^{-7} m) [frequency = f or v)

16. c = fλ … therefore, f= c/ λ → 3.00 x 10^{8} m/s / 5.00 x 10^{-8} Hz = 6.00 x 10^{15} Hz, which is in the ultraviolet region of the EM spectrum

17. E = hv → (6.63 x $^{10-}$34 j·s)(5.00 x 10^{11}/s) = 3.31 x 10^{-22} j.

18. Since c = fλ, and f= c/ λ … replace frequency in the equation E = hv → so E = hc/ λ

    Also 260 nm = 260 x 10^{-9} m = 2.60 x 10^{-7} m

    E = (6.63 x $^{10-}$34 j·s)(3.00 x 10^{8} m/s) / 2.60 x 10^{-7} m = 7.6 x 10^{-19} j.

Figure 5.12 n = 4 to n = 3

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19. Electrons in atoms absorb energy as they move to higher energy levels, then lose the energy by emitting it as light as they drop back.

20. He proposed that light could be described as quanta of energy that behave as if they were particles.

21. The light emitted in an electronic transition from a higher to a lower energy level has a frequency that is directly proportional to the energy change of the electron.

22. Quantum mechanics describes the motions of atoms and subatomic particles; classical mechanics describes the motions of larger bodies.

23. *c, a, b*

24. $4.57 \times 10^{14}\ s^{-1}$

25. 4.32×10^{-19} J

26. **BIG**IDEA The colors, when separated by a spectroscope, are the colors of the identifying lines for strontium and barium and arise from electrons moving from higher energy levels to lower energy levels.