Chapter 7

Supplementary *Check for Understanding* Problems

Electromagnetic Radiation

1. How are the different types of electromagnetic radiation similar? How do they differ?

2. Which of the following colors of visible light has the longest wavelength?

   A. blue

   B. yellow

   C. orange

   D. violet

   E. green

3. Which of the following wavelengths of electromagnetic radiation has the highest frequency?

   A. 425 nm

   B. 200 μm

   C. 1.8×10^{-5} mm

   D. 5 cm

Bohr Atom

1. What experimental evidence do scientists have that the electron energy levels of an atom are quantized?

2. What does it mean to say that an atom is in an "excited state".

3. How is the average distance of an electron from the nucleus related to its energy?

4. What is meant by the ground state of an atom?

Quantum Mechanical Model

1. What is meant by an *orbital*? What is the general shape of an *s* orbital and a *p* orbital?

2. Does a hydrogen atom have a 3*s* orbital? Explain.

3. For the designation $4d^5$, what is the significance of 4, *d* and 5?

4. Which of the following electron orbital designations is (are) not correct?

   a) 1*p* b) 2*d* c) 3*f* d) 4*s* e) 4*d*

5. How does the number of sublevels change as *n* for the principal energy level increases?

Electron Configurations

1. Which element corresponds to each of the following electron configurations?

   a) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$

   b) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$

   c) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^2$

2. Write the electron configuration for each of the following elements.

   a) Sr b) V c) Kr d) In

3. Which electrons in an atom are the valence electrons? Why are these electrons especially important to the chemical properties of an element?

4. How many 3*d* electrons are found in each of the following elements?

   a) Co b) Ca c) Cd

5. How many valence electrons does each of the following atoms possess?

   a) Al b) Fe c) Pb

6. What is unique about the noble gases in terms of their electron configurations?

7. What sublevel is being filled in the:

   a) Group 3A to Group 8A elements in period 3?

   b) period 5 transition elements?

   c) lanthanides?

Electron Configurations and Chemical Properties

1. How are the electron arrangements for elements in a given A group of the periodic table related? What is the consequence of this?

2. What is meant by the effective nuclear charge (Z_{eff})?

3. Are the 1*s* electrons more strongly attracted to the nucleus in a helium atom or in an argon atom? Explain.

4. Which element, silicon or arsenic, has chemical properties more like that of phosphorus? Explain.

5. Hydrogen and lithium atoms each have a single valence electron. Explain why it takes less energy to remove the valence electron in a lithium atom than it does to remove the valence electron from a hydrogen atom.