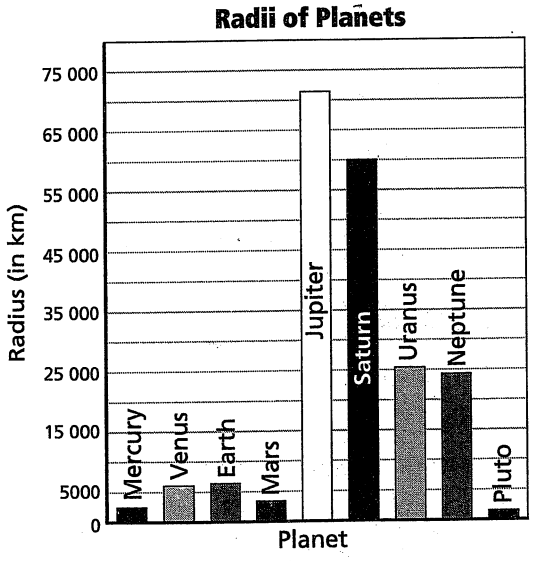
CHAPTER 2 SUPPLEMENTAL PROBLEMS

Data Analysis

1. A sample of aluminum is placed in a 25-mL graduated cylinder containing 10.0 mL of water. The level of water rises to 18.0 mL. Aluminum has a density of 2.7 g/mL. Calculate the mass of the sample.

2. Saturn is about 1 429 000 km from the Sun. How many meters is Saturn from the Sun? Write your answer in scientific notation.

3. Use the graph to answer the questions.



   a. What kind of graph is this?

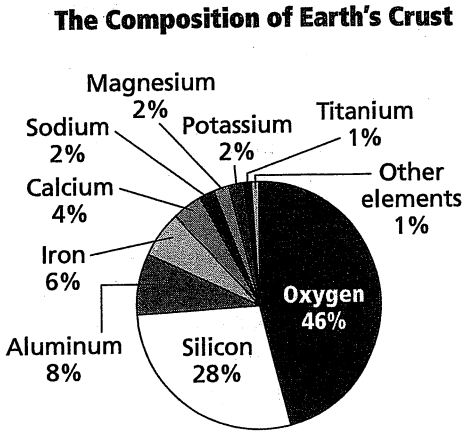
   b. What are the variables?

   c. According to the graph, which has a larger radius, Neptune or Uranus?

   d. According to the graph, what is the radius of Saturn?

   e. Convert the radius of Saturn to meters. Write your answer in scientific notation.

4. Look at the graph below. Then answer the questions.



   a. What kind of graph is this?

   b. According to the graph, which element is most abundant in Earth's crust?

   c. According to the graph, what percent of Earth's crust is made up of titanium? Of calcium?

5. You place a 28.95-g piece of gold in a 10-mL graduated cylinder. The level of the water rises 1.50 mL. What is the density of gold? You know that silver has a density of 10.5 g/cm^3. What mass of silver will raise the level of the water in the graduated cylinder 1.50 mL?

6. Convert 55 miles per hour to kilometers per hour. How many kilometers/second is 55 miles per hour? (1 mile = 1.6 km)

7. Convert the following data to scientific notation.

   a. 166 000 000 000 000 m^2

   b. 8847 m

   c. 484 liters

8. Convert the following as indicated.

a. Aluminum boils at 2467°C. What is aluminum's boiling point in kelvins?

b. Bromine melts at −7.2°C. What is bromine's melting point in kelvins?

c. Chlorine melts at 172 K. What is chlorine's melting point in °C?

d. What is 273 K in °C?

9. American cars use about 600 000 000 gallons of oil per year. How many liters of oil do American cars use per year? Report your answer in scientific notation.
(1 L = 0.908 quart; 1 gallon = 4 quarts)

Solve the following problems. Express your answers in proper scientific notation.

10. a. $5.3 \times 10^{12} + 3.0 \times 10^{11} =$

b. $3.7 \times 10^{6} - 8.0 \times 10^{5} =$

c. $1.85 \times 10^{16} + 9.25 \times 10^{16} =$

d. $2.8 \times 10^{22} + 82 \times 10^{21} =$

e. $3.09 \times 10^{20} - 9.1 \times 10^{19} =$

f. $17 \times 10^{3} + 3 \times 10^{4} + 1.3 \times 10^{4} =$

g. $4.80 \times 10^{15} - 13 \times 10^{13} =$

11. a. $(4.0 \times 10^{5}) \times (3.0 \times 10^{3}) =$

b. $(5.0 \times 10^{12}) \times (8.05 \times 10^{3}) =$

c. $(8.9 \times 10^{5}) \div (3.0 \times 10^{3}) =$

d. $(1.6 \times 10^{12}) \div (8.01 \times 10^{-3}) =$

e. $(9.0 \times 10^{5}) \times (3.0 \times 10^{-3}) =$

f. $(2.4 \times 10^{3}) \div (8.0 \times 10^{-3}) =$

g. $(6.1 \times 10^{-5}) \div (3.01 \times 10^{-2}) =$

12. Mac measured the density of silver three times and obtained the following results:

Trial 1: 10.6 g/cm^3; Trial 2: 10.8 g/cm^3; Trial 3: 9.6 g/cm^3.

Silver has a density of 10.5 g/cm^3

a. Calculate Mac's percent error for each trial.

b. Which trial had the greatest percent error?

13. You calculate that your semester average in history is 97.5. When you get your report card, your average is 96. What was the percent error of your calculation?

14. Determine the number of significant figures in each measurement.

a. 0.000 301 5 m

b. 0.121 012 L

c. 1.056 mL

d. 12.90 s

e. 5000 dogs

f. 5.78910×10^{3} g

15. Round the number 31.257 592 to the requested number of significant figures.

a. 7 significant figures

b. 5 significant figures

c. 3 significant figures

16. Complete the following calculations. Round off the answers to the correct number of significant figures.

a. 2.30 m × 3.65 m × 0.55 m =

b. 103.8 m ÷ 31 s =

c. 26.0 cm × 2.1 cm =

The Structure of the Atom

1. Use the periodic table to complete the following table.

Element	Atomic Number	Protons	Electrons
a. Li			
b.			87
c.	93		
d. Hg			80
e.	81		
f.	75		
g. B			

2. Give the number of protons, electrons, and neutrons in each of the following atoms.

a. $^{108}_{47}Ag$

b. $^{40}_{20}Ca$

c. $^{23}_{11}Na$

3. Name each isotope, and write it in symbolic notation.

a. atomic number 26; mass number 56

b. atomic number 29; mass number 64

c. atomic number 17; mass number 37

4. How many protons, electrons, and neutrons are in each of the following isotopes?

a. uranium-235

b. hydrogen-3

c. silicon-29

5. How many neutrons does europium-151 have? What is the isotope's mass number?

6. How many more neutrons does thorium-230 have than protons? How many electrons does thorium-230 have?

7. Show that the mass number and the number of protons are conserved in the following nuclear equation: $^{234}_{92}U \rightarrow {}^{230}_{90}Th + {}^{4}_{2}He$.

8. Give the mass number of each isotope.

a. Be with 5 neutrons

b. Ga with 39 neutrons

c. Si with 16 neutrons

d. Ti with 26 neutrons

9. Give the atomic number of each isotope.

a. magnesium-25

b. bromine-79

c. antimony-121

10. Neon has two isotopes: neon-10 and neon-12.

a. Which isotope has the greater mass?

b. Which has more neutrons?

c. Which has more protons?

d. Which has more electrons?

11. Use the table below to calculate the atomic mass of element *X*. Then use the periodic table to identify the element. Show all your work.

Isotope	Mass (amu)	Percent Abundance
^{16}X	15.995	99.762
^{17}X	16.999	0.038
^{18}X	17.999	0.20

12. Magnesium has three isotopes. Magnesium-24 has a percent abundance of 78.99%. Magnesium-26 has a percent abundance of 11.01%. What is the percent abundance of magnesium-25? Assume that there are no other magnesium isotopes.

13. Calculate the atomic mass of iridium. Iridium has two isotopes. Iridium-191 has a mass of 191.0 amu and a percent abundance of 37.58%. Iridium-191 has a mass of 193.0 amu and a percent abundance of 62.42%. Show all your work.

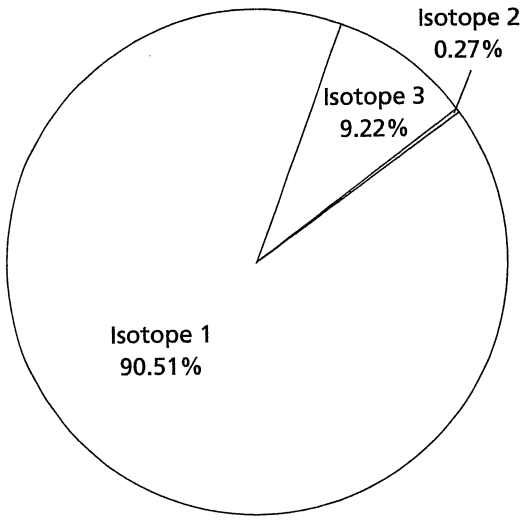
14. An element has three naturally occurring isotopes.

Isotope 1 has a mass of 19.992 amu.

Isotope 2 has a mass of 20.994 amu.

Isotope 3 has a mass of 21.991 amu.

The pie graph shows the relative abundance of each isotope.



a. Calculate the atomic mass of the element.

b. Identify the element, using the periodic table.

15. An element has three naturally occurring isotopes. Information about each isotope is summarized below.

Isotope	Mass (amu)	Percent Abundance
Isotope 1	23.985	78.10
Isotope 2	24.946	10.13
Isotope 3	25.983	11.17

a. Find the atomic mass of this element. Show all your work.

b. Identify the element, using the periodic table.

c. Write each isotope in symbolic notation.

16. The isotope carbon-14 can be used to determine the ages of objects that were once living, such as wood, bones, and fossils. While alive, living things take in all the isotopes of carbon, including carbon-14. Carbon-14 undergoes radioactive decay continuously. After an organism dies, the carbon-14 in its body continues to decay. However, its body no longer takes in new carbon-14. Thus, by measuring how much carbon-14 a once-living object contains and comparing it with the amount of carbon-14 in a currently living thing, you can determine the age of the object.

a. In terms of subatomic structure, how does carbon-14 differ from carbon-12 and carbon-13?

b. How is carbon-14 like carbon-12 and carbon-13?

c. Carbon-14 emits a beta particle as it decays. What atom does carbon-14 decay to?

d. Write an equation to represent the decay of carbon-14.

Electrons in Atoms

1. Orange light has a frequency of $4.8 \times 10^{14}\ s^{-1}$. What is the energy of one quantum of orange light?

2. Which is greater, the energy of one photon of orange light or the energy of one quantum of radiation having a wavelength of 3.36×10^{-9}m?

3. Use the relationships $E = h\nu$ and $c = \lambda\nu$ to write E in terms of h, c, and λ.

4. A radio station emits radiation at a wavelength of 2.90 m. What is the station's frequency in megahertz?

5. Record the frequency of your favorite radio station. What is the wavelength of the radiation emitted from the station?

6. List the sequence in which the following orbitals fill up: 1s, 2s, 3s, 4s, 5s, 6s, 7s, 2p, 3p, 4p, 5p, 6p, 7p, 3d, 4d, 5d, 6d, 4f, 5f.

7. Which element has the ground-state electron configuration $[Kr]5s^24d^{10}5p^4$?

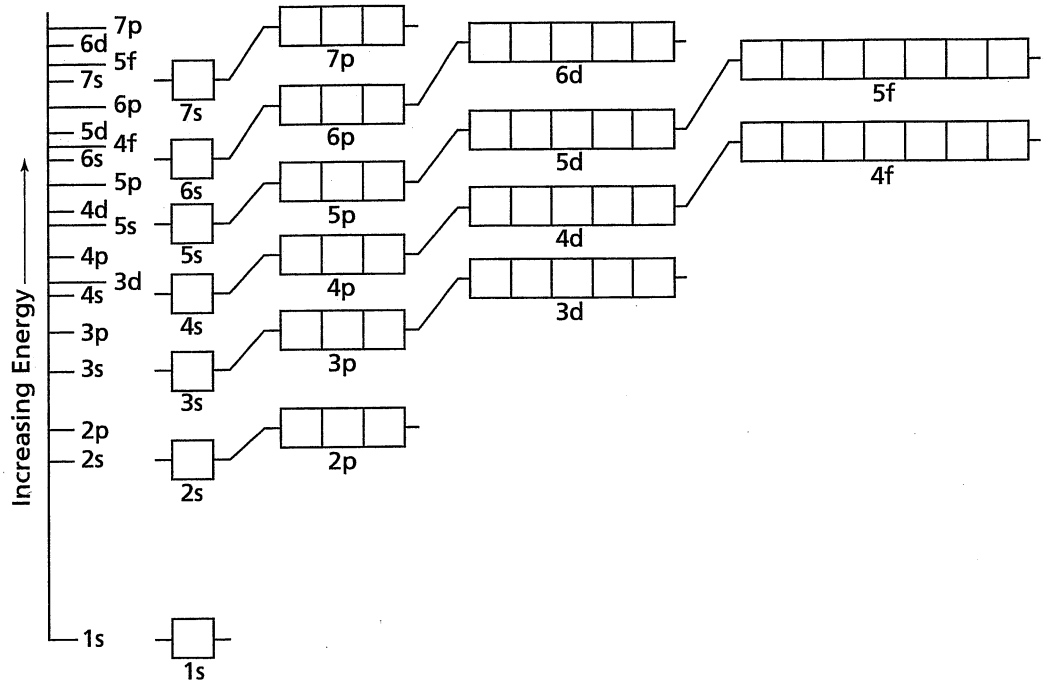
8. Which element has the ground-state electron configuration $[Ar]4s^23d^{10}$?

9. Write electron-dot structures for the following atoms.
   a. $[Ne]3s^23p^3$
   b. $[Ar]4s^23d^3$
   c. potassium

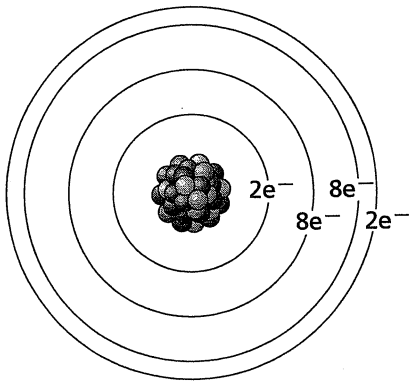
10. Complete the following table.

Element	Symbol	Orbitals					Electron Configuration
		1s	2s	$2p_x$	$2p_y$	$2p_z$	
a. Nitrogen							$1s^22s^22p^3$
b.	F	↑↓	↑↓	↑↓	↑↓	↑	
c. Carbon							
d.							$1s^22s^1$

11. Complete the orbital diagram for arsenic.



12. Use the figure below to answer the following questions.



a. How many valence electrons does an atom of this element have?

b. What is the atom's electron-dot structure?

c. If enough energy was added to remove an electron, from which energy level would the electron be removed? Explain your answer.

13. What is the ground-state electron configuration of each of the following atoms? Use noble-gas notation.

a. selenium

b. krypton

c. chlorine

14. What is the highest energy level (n) that is occupied in the following elements?

a. He

b. Ca

c. Sn

15. Write the electron configuration for each element described below and identify the element.

a. an element that contains 8 electrons

b. an element that contains 14 electrons

CHAPTER 6 SUPPLEMENTAL PROBLEMS

The Periodic Table and Periodic Law

For questions 1–5, do not use the periodic table.

1. Write the electron configurations for the elements in periods 2–4 of group 2A.

2. Determine the group, period, and block of the elements with the following electron configurations.
   a. $[He]2s^2 2p^4$
   b. $[Xe]6s^1$
   c. $[Ar]4s^2 3d^{10} 4p^2$

3. Categorize each of the elements in problem 2 as a representative element or a transition element.

4. Write the electron configuration of the element fitting each of the following descriptions. Use noble-gas notations.
   a. Group 8A element in the third period
   b. Group 4A element in the fourth period
   c. Halogen in the second period
   d. Group 1A element in the fourth period

5. What are the noble-gas notations of all the elements with the following valence electron configurations?
   a. s^2
   b. $s^2 p^1$

For questions 6–9, do not use Figure 6-12, 6-15, or 6-20.

6. Rank the following atoms in order of decreasing radii.
   a. Al, Na, P, S
   b. Al, Ga, In
   c. As, Ge, Ga
   d. Br, Ca, Cl, K

7. Rank the following ions in order of decreasing radii.
   a. Br^-, Cl^-, F^-
   b. Be^{2+}, Ca^{2+}, Mg^{2+}
   c. Ca^{2+}, Ga^{3+}, K^+

8. Rank the following particles in order of decreasing radii.
   a. I, I^-
   b. K, K^+
   c. Al, Al^{3+}

9. Rank the following atoms in order of decreasing electronegativity.
   a. Na, Li, K
   b. K, Sc, Ca
   c. As, Sn, S