

## CHAPTER FOUR

### Molar Mass & Avogadro's Number

**4.20** Define the term “mole.” What is the unit for mole in calculations? What does the mole have in common with the pair, the dozen, and the gross? What does Avogadro's number represent?

**4.21** What is the molar mass of an atom? What are the commonly used units for molar mass?

**4.22** Earth's population is about 6.5 billion. Suppose that every person on Earth participates in a process of counting identical particles at the rate of two particles per second. How many years would it take to count  $6.0 \times 10^{23}$  particles? Assume that there are 365 days in a year.

**4.23** The thickness of a piece of paper is 0.0036 in. Suppose a certain book has an Avogadro's number of pages; calculate the thickness of the book in lightyears. (*Hint:* See Problem 1.47 for the definition of light-year.)

**4.24** How many atoms are there in 5.10 moles of sulfur (S)?

**4.25** How many moles of cobalt (Co) atoms are there in  $6.00 \times 10^9$  (6 billion) Co atoms?

**4.26** How many moles of calcium (Ca) atoms are in 77.4 g of Ca?

**4.27** How many grams of gold (Au) are there in 15.3 moles of Au?

**4.28** What is the mass in grams of a single atom of each of the following elements? (a) Hg, (b) Ne.

**4.29** What is the mass in grams of a single atom of each of the following elements? (a) As, (b) Ni.

**4.30** What is the mass in grams of  $1.00 \times 10^{12}$  lead (Pb) atoms?

**4.31** How many atoms are present in 3.14 g of copper (Cu)?

**4.32** Which of the following has more atoms: 1.10 g of hydrogen atoms or 14.7 g of chromium atoms?

**4.33** Which of the following has a greater mass: 2 atoms of lead or  $5.1 \times 10^{-23}$  mole of helium.

**4.34** Analysis of a metal chloride  $XCl_3$  shows that it contains 67.2 percent Cl by mass. Calculate the molar mass of X and identify the element.

**4.35** Myoglobin stores oxygen for metabolic processes in muscle. Chemical analysis shows that it contains 0.34 percent Fe by mass. What is the molar mass of myoglobin? (There is one Fe atom per molecule.)

**4.36** Does 1 g of hydrogen molecules contain as many H atoms as 1 g of hydrogen atoms?