

# 7

## CHEMICAL QUANTITIES

### PRACTICE PROBLEMS

In your notebook, solve the following problems.

#### SECTION 7.1 THE MOLE: A MEASUREMENT OF MATTER

- What is the gram molecular mass of sucrose ( $C_{12}H_{22}O_{11}$ )?  $342.3$
- What is the gram molecular mass of each of the following compounds?  $208.2$ 
  - phosphorus pentachloride ( $PCl_5$ )
  - uranium hexafluoride ( $UF_6$ )  $352$
- Calculate the gram formula mass of each of the following ionic compounds.
  - $KMnO_4$   $158$
  - $Ca_3(PO_4)_2$   $310.2$
- How many moles is  $3.52 \times 10^{24}$  molecules of water?  $5.85 \text{ mol}$
- How many atoms of zinc are in 0.60 mol of zinc?  $3.6 \times 10^{23}$
- What is the mass of 1.00 mol of oxygen ( $O_2$ )?  $32.0$

#### SECTION 7.2 MOLE-MASS AND MOLE-VOLUME RELATIONSHIPS

- What is the molar mass of each of the following compounds?
  - $C_6H_{12}O_6$   $180.2$
  - $NaHCO_3$   $84$
  - $C_7H_{12}$   $96.2$
  - $KNH_4SO_4$   $153.2$
- Calculate the mass in grams of each of the following:
  - 8.0 mol lead oxide ( $PbO$ )  $1.8 \times 10^3$
  - 0.75 mol hydrogen sulfide ( $H_2S$ )  $20 \text{ g}$
  - 0.00100 mol silicon tetrahydride ( $SiH_4$ )  $3.2 \times 10^{-2}$
  - $1.50 \times 10^{-2}$  mol molecular oxygen ( $O_2$ )  $0.480$
  - 2.30 mol ethylene glycol ( $C_2H_6O_2$ )  $1.43 \times 10^2$
- How many grams are there in 1.73 mol of dinitrogen pentoxide ( $N_2O_5$ )?  $1.87 \times 10^2$
- How many grams are there in 0.658 mol of calcium phosphate [ $Ca_3(PO_4)_2$ ] ?  $204.1$
- Calculate the number of moles in each of the following:
  - 0.50 g sodium bromide ( $NaBr$ )  $4.9 \times 10^{-3}$
  - 13.5 g magnesium nitrate [ $Mg(NO_3)_2$ ]  $9.1 \times 10^{-2}$
  - 1.02 g magnesium chloride ( $MgCl_2$ )  $1.08 \times 10^{-2}$
  - 0.00100 g monochloromethane ( $CH_3Cl$ )  $1.98 \times 10^{-5}$
  - $1.50 \times 10^{-3}$  g propylene glycol [ $C_3H_6(OH)_2$ ]  $1.97 \times 10^{-5}$
- A chemist plans to use 435.0 grams of ammonium nitrate ( $NH_4NO_3$ ) in a reaction. How many moles of the compound is this?  $5.43$
- A solution is to be prepared in a laboratory. The solution requires 0.0465 mol of quinine ( $C_{20}H_{24}N_2O_2$ ). What mass, in grams, should the laboratory technician obtain in order to make the solution?  $15.1$
- What is the volume at STP of 2.66 mol of methane ( $CH_4$ ) gas?  $59.6$
- What is the equivalent in moles of 135 L of ammonia ( $NH_3$ ) gas at STP?  $6.03$

### 7.3 PERCENT COMPOSITION AND CHEMICAL FORMULAS

1. A compound analyzed in a chemistry laboratory consists of 5.34 g of carbon, 0.42 g of hydrogen, and 47.08 g of chlorine. What is the percent composition of this compound?   
 $10.1\% \text{ C}$      $7.9\% \text{ H}$      $81.9\% \text{ Cl}$
2. Find the percent composition of a compound containing tin and chlorine if 18.35 g of the compound contains 5.74 g of tin.   
 $31.3\% \text{ Sn}$      $68.7\% \text{ Cl}$
3. 3.907 g of carbon combines completely with 0.874 g of hydrogen to form a compound. What is the percent composition of this compound?   
 $82.1\% \text{ C}$      $17.9\% \text{ H}$
4. From the formula for calcium acetate,  $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$ , calculate the mass of carbon that can be obtained from 65.3 g of the compound.   
 $30.4\% \text{ C} = 19.8 \text{ g}$
5. How many grams of aluminum are there in 25.0 g of aluminum oxide ( $\text{Al}_2\text{O}_3$ )?   
 $13.2 \text{ g}$
6. How many grams of iron are there in 21.6 g of iron(III) oxide ( $\text{Fe}_2\text{O}_3$ )?   
 $15.1 \text{ g}$
7. Determine the empirical formula of each of the following compounds from the percent composition:
  - a. 7.8% carbon and 92.2% chlorine
  - b. 10.0% C, 0.80% H, 89.1% Cl