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10 CHEMICAL QUANTITIES

Practice Problems

In your notebook, solve the following problems.

SECTION 10.1 THE MOLE: A MEASUREMENT OF MATTER

1. What is the molar mass of sucrose ($C_{12}H_{22}O_{11}$)?
2. What is the molar mass of each of the following compounds?
   - **a.** phosphorus pentachloride (PCl_5)
   - **b.** uranium hexafluoride (UF_6)
3. Calculate the molar mass of each of the following ionic compounds:
   - **a.** $KMnO_4$
   - **b.** $Ca_3(PO_4)_2$
4. How many moles is 3.52×10^{24} molecules of water?
5. How many atoms of zinc are in 0.60 mol of zinc?
6. What is the mass of 1.00 mol of oxygen (O_2)?

SECTION 10.2 MOLE–MASS AND MOLE–VOLUME RELATIONSHIPS

1. What is the molar mass of each of the following compounds?
   - **a.** $C_6H_{12}O_6$ **b.** $NaHCO_3$ **c.** C_7H_{12} **d.** KNH_4SO_4
2. Calculate the mass in grams of each of the following:
   - **a.** 8.0 mol lead oxide (PbO)
   - **b.** 0.75 mol hydrogen sulfide (H_2S)
   - **c.** 0.00100 mol silicon tetrahydride (SiH_4)
   - **d.** 1.50×10^{-2} mol molecular oxygen (O_2)
   - **e.** 2.30 mol ethylene glycol ($C_2H_6O_2$)
3. How many grams are in 1.73 mol of dinitrogen pentoxide (N_2O_5)?
4. How many grams are in 0.658 mol of calcium phosphate [$Ca_3(PO_4)_2$]?
5. Calculate the number of moles in each of the following:
   - **a.** 0.50 g sodium bromide (NaBr)
   - **b.** 13.5 g magnesium nitrate [$Mg(NO_3)_2$]
   - **c.** 1.02 g magnesium chloride ($MgCl_2$)
   - **d.** 0.00100 g monochloromethane (CH_3Cl)
   - **e.** 1.50×10^{-3} g propylene glycol [$C_3H_6(OH)_2$]
6. 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?
7. 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?

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8. What is the volume at STP of 2.66 mol of methane (CH_4) gas?
9. How many moles is 135 L of ammonia (NH_3) gas at STP?

10.3 PERCENT COMPOSITION AND CHEMICAL FORMULAS

1. A sample of 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?
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.
3. If 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?
4. From the formula for calcium acetate, $Ca(C_2H_3O_2)_2$, calculate the mass of carbon that can be obtained from 65.3 g of the compound.
5. How many grams of aluminum are in 25.0 g of aluminum oxide (Al_2O_3)?
6. How many grams of iron are in 21.6 g of iron(III) oxide (Fe_2O_3)?
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