Activity 7B: **Mole Calculations (NB \* = difficult)**

**1** For the compound methane, CH4, find the

(a) molar mass

(b) mass of two moles

(c) amount of compound in 64·0 g

(d) mass of 3·00 mol

**2** For the ionic compound calcium carbonate, CaCO3, find the

(a) molar mass

(b) mass of 0·0500 mol

(c) amount of calcium carbonate in 10·0 g of calcium carbonate

(d) amount of calcium ions in 50·0 g of calcium carbonate\*

**3** Calculate the molar mass of CO2

**4** Sulfur dioxide has the molecular formula SO2 and a molar mass of 64·1 g mol−1. Calculate how the amount of SO2 (in moles) present in 6·40 kg of SO2.

**5** The molar mass of sulfur trioxide, SO3, is 80·1 g mol−1. Calculate the number of moles of SO3 in 8·00 kg of sulfur trioxide.

**6** Calculate the amount of carbon present in 88·0 g of propane C3H8.

**7** Calculate the mass of the following substances

(a) 5·50 mol of NO2 *M*(NO2) = 46·0 g mol−1

(b) 0·150 mol of NaHCO3 *M*(NaHCO3) = 84·0 g mol−1

(c) 10·7 mol of C4H10 *M*(C4H10) = 58·0 g mol−1

(d) 1·25 mol of AgCl *M*(AgCl) = 143·5 g mol−1

(e) 0·600 mol of C6H12O6 *M*(C6H12O6) = 180 g mol−1

(f) 25·0 mol of I2 *M*(I2) = 254 g mol−1

(g) 0·50 mol of CCl4

(h) 0·250 mol of CuO

**8** A sample of aluminium oxide, Al2O3, has a mass of 1·02 g. Find the

(a) molar mass of the compound

(b) amount of aluminium oxide in the sample

(c) amount of aluminium ions in the sample

(d) amount of oxide ions in the sample\*

**9** For a sample of ammonium sulfate, (NH4)2SO4, with a mass of 1 320 g, calculate the

(a) molar mass of ammonium sulfate

(b) amount of ammonium sulfate

(c) amount of ammonium ions\*

(d) amount of sulfate ions\*

(e) amount of sulfur atoms\*

(f) amount of nitrogen atoms\*

**10** Calculate the number of moles in each of the following substances

(a) NaCl in 15·2 g *M*(NaCl) = 58·5 g mol−1

(b) CF2Cl2 in 10·9 g *M*(CF2Cl2) = 121 g mol−1

(c) Zn(OH)2 in 25·0 g *M*(Zn(OH)2) = 99·4 g mol−1

(d) Na2CO3 in 21·5 g *M*(Na2CO3) = 106 g mol−1

(e) NH3 in 1·95 g *M*(NH3) = 17·0 g mol−1

(f) CuSO4 in 10·0 g *M*(CuSO4) = 159·7 g mol−1

(g) ZnCO3 in 282 g

(h) (NH4)2CO3 in 34·0 g

Activity 7B: **Mole Calculations Answers**

**1** (a) *M*(CH4) = *M*(C) + 4*M*(H) = 12·0 + 4·0 = 16·0 g mol−1

(b) *m*(CH4) = *n*(CH4)*M*(CH4) = 2 × 16·0 = 32·0 g

(c) *n*(CH4) =  =  = 4·00 mol

(d) *m*(CH4) = *n*(CH4)*M*(CH4) = 3·00 × 16·0 = 48·0 g

**2** (a) *M*(CaCO3) = *M*(Ca) + *M*(C) + 3*M*(O) = 40·1 + 12·0 + 48·0 = 100·1 g mol−1

(b) *m*(CaCO3) = *n*(CaCO3)*M*(CaCO3) = 0·0500 × 100·1 = 5·01 g

(c) *n*(CaCO3) =  =  = 0·0999 mol

(d) *n*(Ca2+) = *n*(CaCO3) =  =  = 0·500 mol

**3** *M*(CO2) = *M*(C) + 2*M*(O) = 12·0 + 32·0 = 44·0 g mol−1

**4** *n*(SO2) =  =  = 99·8 mol

**5** *n*(SO3) =  =  = 99·9 mol

**6** *n*(C3H8) =  =  = 2·00 mol (x 3 = 6 mol)

**7** (a) *m*(NO2) = *n*(NO2)*M*(NO2) = 5·50 × 46·0 = 253 g

(b) *m*(NaHCO3) = *n*(NaHCO3)*M*(NaHCO3) = 0·150 × 84·0 = 12·6 g

(c) *m*(C4H10) = *n*(C4H10)*M*(C4H10) = 10·7 × 58·0 = 620·6 g

(d) *m*(AgCl) = *n*(AgCl)*M*(AgCl) = 1·25 × 143·5 = 179·4 g

(e) *m*(C6H12O6) = *n*(C6H12O6)*M*(C6H12O6) = 0·600 × 180 = 108 g

(f) *m*(I2) = *n*(I2)*M*(I2) = 25·0 × 254 = 6350 g (6·35 kg)

(g) *m*(CCl4) = *n*(CCl4)*M*(CCl4) = 0·500 × (12·0 + 4 × 35·5) = 77·0 g

(h) *m*(CuO) = *n*(CuO)*M*(CuO) = 0·250 × (63·6 + 16·0) = 19·9 g

**8** (a) *M*(Al2O3) = 2*M*(Al) + 3*M*(O)= 54·0 + 48·0 = 102 g mol−1

(b) *n*(Al2O3) =  =  = 0·0100 mol

(c) *n*(Al3+) = 2*n*(Al2O3) = 2 × 0·0100 = 0·0200 mol

(d) *n*(O2−) = 3*n*(Al2O3) = 3 × 0·0100 = 0·0300 mol

**9** (a) *M*((NH4)2SO4) = 2(*M*(N) + 4*M*(H)) + *M*(S) + 4*M*(O) = 2(18·0) + 96·1 = 132·1 g mol−1

(b) *n*((NH4)2SO4) =  =  = 9·99 mol

(c) *n*(NH4+) = 2*n*((NH4)2SO4) = 2 × 9·99 = 20·0 mol

(d) *n*(SO42−) = *n*((NH4)2SO4) = 9·99 mol

(e) *n*(S) = *n*((NH4)2SO4) = 9·99 mol

(f) *n*(N) = 2*n*((NH4)2SO4) = 2 × 9·99 = 20·0 mol

**10** (a) *n*(NaCl) =  =  = 0·260 mol

(b) *n*(CF2Cl2) =  =  = 0·0901 mol

(c) *n*(Zn(OH)2) =  =  = 0·252 mol

(d) *n*(Na2CO3) =  =  = 0·203 mol

(e) *n*(NH3) =  =  = 0·115 mol

(f) *n*(CuSO4) =  =  = 0·0626 mol

(g) *n*(ZnCO3) =  =  = 2·25 mol

(h) *n*((NH4)2CO3) =  =  = 0·354 mol