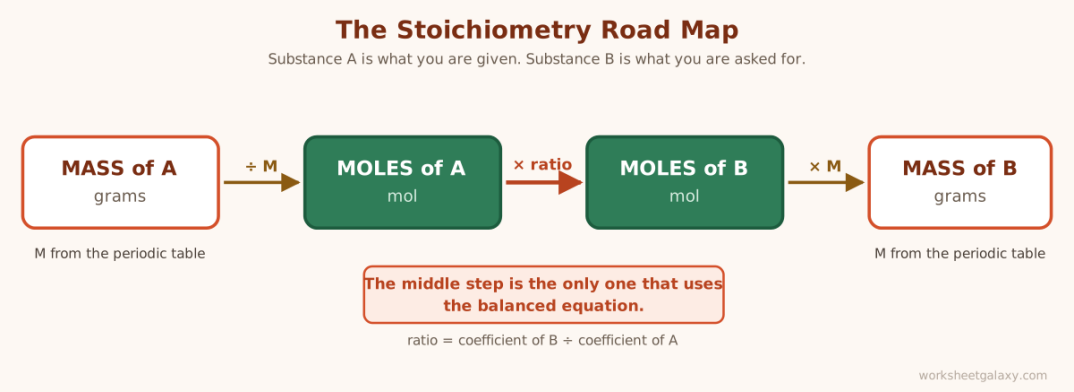
Stoichiometry Worksheet

Grade 11 Chemistry · Mole ratios, mole-to-mole, and mass-to-mass calculations

Name: _____ Date: _____ Score: / 24



Before you start: every equation below is already balanced. Round molar masses to two decimal places and give each final answer to three significant digits with its unit.

Part A · Mole Ratios Read the ratio off the coefficients. No calculator needed.

#	Balanced equation	Ratio asked for	Answer
1	$N_2 + 3H_2 \rightarrow 2NH_3$	$NH_3 : N_2$	
2	$N_2 + 3H_2 \rightarrow 2NH_3$	$H_2 : NH_3$	
3	$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$	$H_2O : CH_4$	
4	$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$	$O_2 : C_3H_8$	
5	$4Fe + 3O_2 \rightarrow 2Fe_2O_3$	$Fe_2O_3 : O_2$	
6	$2KClO_3 \rightarrow 2KCl + 3O_2$	$O_2 : KClO_3$	

Part B · Mole to Mole One step: multiply by the ratio.

1. **$N_2 + 3H_2 \rightarrow 2NH_3$**

   How many moles of NH_3 are produced from 4.00 mol of N_2?

   Answer: _____

2. **$2H_2 + O_2 \rightarrow 2H_2O$**

   How many moles of H_2O are produced from 6.00 mol of H_2?

   Answer: _____

3. **$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$**

How many moles of O_2 are produced from 2.50 mol of CH_4?

Answer: _____

4. **$2Al + 3Cl_2 \rightarrow 2AlCl_3$**

How many moles of $AlCl_3$ are produced from 9.00 mol of Cl_2?

Answer: _____

5. **$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$**

How many moles of CO_2 are produced from 0.800 mol of C_3H_8?

Answer: _____

6. **$2KClO_3 \rightarrow 2KCl + 3O_2$**

How many moles of O_2 are produced from 1.60 mol of $KClO_3$?

Answer: _____

Part C · Mass and Moles Two steps. Watch which side the mass is on.

1. **$CaCO_3 \rightarrow CaO + CO_2$**

How many moles of CO_2 are produced from 50.0 g of $CaCO_3$?

Answer: _____

2. **$N_2 + 3H_2 \rightarrow 2NH_3$**

How many moles of NH_3 are produced from 12.0 g of H_2?

Answer: _____

3. **$Zn + 2HCl \rightarrow ZnCl_2 + H_2$**

How many moles of H_2 are produced from 32.7 g of Zn?

Answer: _____

4. **$2Mg + O_2 \rightarrow 2MgO$**

What mass of MgO is produced from 3.00 mol of Mg?

Answer: _____

5. **$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$**

What mass of CO_2 is produced from 1.50 mol of CH_4?

Answer: _____

Part D · Mass to Mass Three steps, every time. Never jump straight from grams to grams.

1. **$N_2 + 3H_2 \rightarrow 2NH_3$**

What mass of NH_3 is produced from 28.0 g of N_2?

Answer: _____

2. **$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$**

What mass of H_2O is produced from 8.00 g of CH_4?

Answer: _____

3. **$4Fe + 3O_2 \rightarrow 2Fe_2O_3$**

What mass of Fe_2O_3 is produced from 44.7 g of Fe?

Answer: _____

4. **$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$**

What mass of CO_2 is produced from 22.0 g of C_3H_8?

Answer: _____

Part E · Challenge The road map runs in both directions.

1. $N_2 + 3H_2 \rightarrow 2NH_3$

   What mass of H_2 is needed to produce 68.0 g of NH_3?

   Answer: _____

2. $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

   What mass of water is produced when 1.00 mol of O_2 reacts completely?

   Answer: _____

3. $2KClO_3 \rightarrow 2KCl + 3O_2$

   A student says that 1 mol of $KClO_3$ produces 3 mol of O_2, because the coefficient of O_2 is 3. Explain the error, then find how many moles of O_2 come from 4.00 mol of $KClO_3$.

   Answer: _____

Answer Key · Stoichiometry

Full worked solutions — Grade 11 Chemistry

Part A · Mole Ratios

1. $NH_3 : N_2$ → **2 : 1**
2. $H_2 : NH_3$ → **3 : 2**
3. $H_2O : CH_4$ → **2 : 1**
4. $O_2 : C_3H_8$ → **5 : 1**
5. $Fe_2O_3 : O_2$ → **2 : 3**
6. $O_2 : KClO_3$ → **3 : 2**

Part B · Mole to Mole

1. ratio $NH_3 : N_2$ = 2 : 1; n = 4.00 mol × 2/1
   8.00 mol
2. ratio $H_2O : H_2$ = 2 : 2; n = 6.00 mol × 2/2
   6.00 mol
3. ratio $O_2 : CH_4$ = 2 : 1; n = 2.50 mol × 2/1
   5.00 mol
4. ratio $AlCl_3 : Cl_2$ = 2 : 3; n = 9.00 mol × 2/3
   6.00 mol
5. ratio $CO_2 : C_3H_8$ = 3 : 1; n = 0.800 mol × 3/1
   2.40 mol
6. ratio $O_2 : KClO_3$ = 3 : 2; n = 1.60 mol × 3/2
   2.40 mol

Part C · Mass and Moles

1. 1. $n(CaCO_3)$ = 50.0 g ÷ 100.09 g/mol = 0.500 mol
   2. $n(CO_2)$ = 0.500 mol × 1/1
   0.500 mol
2. 1. $n(H_2)$ = 12.0 g ÷ 2.02 g/mol = 5.94 mol
   2. $n(NH_3)$ = 5.94 mol × 2/3
   3.96 mol
3. 1. n(Zn) = 32.7 g ÷ 65.38 g/mol = 0.500 mol
   2. $n(H_2)$ = 0.500 mol × 1/1
   0.500 mol
4. 1. n(MgO) = 3.00 mol × 2/2 = 3.00 mol
   2. m = 3.00 mol × 40.31 g/mol
   121 g
5. 1. $n(CO_2)$ = 1.50 mol × 1/1 = 1.50 mol
   2. m = 1.50 mol × 44.01 g/mol
   66.0 g

Part D · Mass to Mass

1. 1. $n(N_2) = 28.0\ g \div 28.02\ g/mol = 0.999\ mol$
   2. $n(NH_3) = 0.999\ mol \times 2/1 = 2.00\ mol$
   3. $m = 2.00\ mol \times 17.04\ g/mol$

   34.1 g
2. 1. $n(CH_4) = 8.00\ g \div 16.05\ g/mol = 0.498\ mol$
   2. $n(H_2O) = 0.498\ mol \times 2/1 = 0.996\ mol$
   3. $m = 0.996\ mol \times 18.02\ g/mol$

   17.9 g
3. 1. $n(Fe) = 44.7\ g \div 55.85\ g/mol = 0.800\ mol$
   2. $n(Fe_2O_3) = 0.800\ mol \times 2/4 = 0.400\ mol$
   3. $m = 0.400\ mol \times 159.70\ g/mol$

   63.9 g
4. 1. $n(C_3H_8) = 22.0\ g \div 44.11\ g/mol = 0.499\ mol$
   2. $n(CO_2) = 0.499\ mol \times 3/1 = 1.50\ mol$
   3. $m = 1.50\ mol \times 44.01\ g/mol$

   66.0 g

Part E · Challenge

1. • $n(NH_3) = 68.0\ g \div 17.04\ g/mol = 3.99\ mol$
   • $n(H_2) = 3.99\ mol \times 3/2 = 5.99\ mol$
   • $m = 5.99\ mol \times 2.02\ g/mol$

   12.1 g
2. • ratio $H_2O : O_2 = 4 : 5$
   • $n(H_2O) = 1.00\ mol \times 4/5 = 0.800\ mol$
   • $m = 0.800\ mol \times 18.02\ g/mol$

   14.4 g
3. • the 3 in front of O_2 is not a ratio on its own — it only has meaning next to the 2 in front of $KClO_3$
   • the correct ratio is $O_2 : KClO_3 = 3 : 2$, so 1 mol of $KClO_3$ gives 1.50 mol of O_2, not 3 mol
   • $n(O_2) = 4.00\ mol \times 3/2$

   6.00 mol