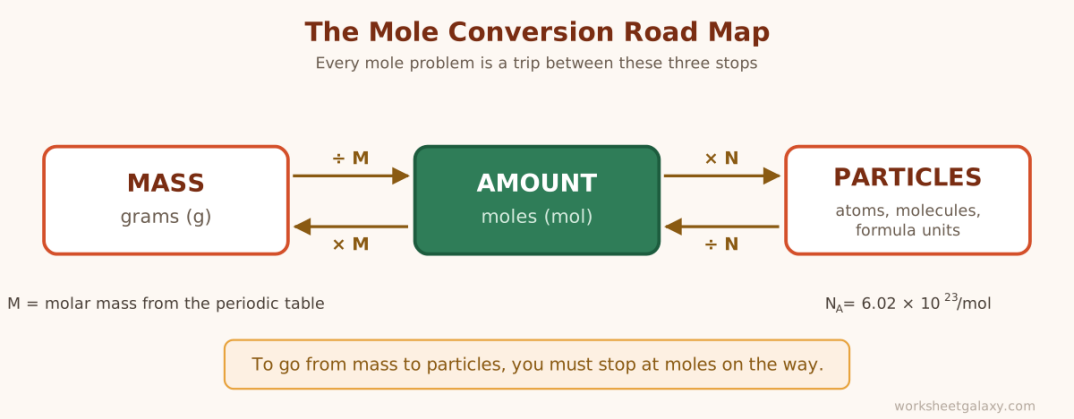
Mole Conversions Worksheet

Grade 11 Chemistry · Molar mass, the Avogadro constant, and two-step conversions

Name: _____ Date: _____ Score: / 24



Before you start: round every molar mass to two decimal places, use $N_A = 6.02 \times 10^{23}$/mol, and give every final answer to three significant digits with its unit.

Part A · Molar Mass Calculate the molar mass of each compound.

#	Compound	Work	Molar mass (g/mol)
1	H_2O		
2	NaCl		
3	CO_2		
4	$Ca(NO_3)_2$		
5	$C_6H_{12}O_6$		
6	$(NH_4)_2SO_4$		

Part B · Mass ↔ Moles Show the formula you use, then solve.

1. How many moles are in 25.0 g of NaCl?

   Answer: _____

2. How many moles are in 88.0 g of CO_2?

   Answer: _____

3. How many moles are in 4.50 g of H_2O?

   Answer: _____

4. What is the mass of 2.50 mol of $CaCO_3$?

Answer: _____

5. What is the mass of 0.750 mol of NH_3?

Answer: _____

6. What is the mass of 3.20 mol of Fe_2O_3?

Answer: _____

Part C · Moles ↔ Particles Name the particle: atoms, molecules, or formula units.

1. How many atoms are in 2.00 mol of He?

Answer: _____

2. How many molecules are in 0.400 mol of CO_2?

Answer: _____

3. How many formula units are in 1.50 mol of NaCl?

Answer: _____

4. How many moles is 3.01×10^{23} molecules of O_2?

Answer: _____

5. How many moles is 9.03×10^{23} formula units of $MgCl_2$?

Answer: _____

Part D · Two-Step Conversions Mass and particles are never one step apart — go through moles.

1. How many molecules are in 18.0 g of H_2O?

Answer: _____

2. How many atoms are in 12.0 g of Ca?

Answer: _____

3. What is the mass of 1.20×10^{24} molecules of CH_4?

Answer: _____

4. What is the mass of 5.00×10^{22} formula units of KBr?

Answer: _____

Part E · Challenge Read carefully — the particle you are asked for may not be the one in the formula.

1. How many **hydrogen atoms** are in 36.0 g of water, H_2O?

Answer: _____

2. A sample of ammonium sulfate, $(NH_4)_2SO_4$, contains 1.20×10^{23} nitrogen atoms. What is the mass of the sample?

Answer: _____

3. Which contains more atoms: 8.00 g of helium or 8.00 g of neon? Show your reasoning.

Answer: _____

Answer Key · Mole Conversions

Full worked solutions — Grade 11 Chemistry

Part A · Molar Mass

1. H_2O → 2(1.01) + 16.00
   18.02 g/mol
2. NaCl → 22.99 + 35.45
   58.44 g/mol
3. CO_2 → 12.01 + 2(16.00)
   44.01 g/mol
4. $Ca(NO_3)_2$ → 40.08 + 2(14.01) + 6(16.00)
   164.10 g/mol
5. $C_6H_{12}O_6$ → 6(12.01) + 12(1.01) + 6(16.00)
   180.18 g/mol
6. $(NH_4)_2SO_4$ → 2(14.01) + 8(1.01) + 32.07 + 4(16.00)
   132.17 g/mol

Part B · Mass ↔ Moles

1. M(NaCl) = 58.44 g/mol; n = m ÷ M = 25.0 g ÷ 58.44 g/mol
   0.428 mol
2. M(CO_2) = 44.01 g/mol; n = m ÷ M = 88.0 g ÷ 44.01 g/mol
   2.00 mol
3. M(H_2O) = 18.02 g/mol; n = m ÷ M = 4.50 g ÷ 18.02 g/mol
   0.250 mol
4. M($CaCO_3$) = 100.09 g/mol; m = n × M = 2.50 mol × 100.09 g/mol
   250 g
5. M(NH_3) = 17.04 g/mol; m = n × M = 0.750 mol × 17.04 g/mol
   12.8 g
6. M(Fe_2O_3) = 159.70 g/mol; m = n × M = 3.20 mol × 159.70 g/mol
   511 g

Part C · Moles ↔ Particles

1. $N = n \times N_A = 2.00 \text{ mol} \times 6.02 \times 10^{23}/\text{mol}$
   1.20×10^{24} atoms
2. $N = n \times N_A = 0.400 \text{ mol} \times 6.02 \times 10^{23}/\text{mol}$
   2.41×10^{23} molecules
3. $N = n \times N_A = 1.50 \text{ mol} \times 6.02 \times 10^{23}/\text{mol}$
   9.03×10^{23} formula units
4. $n = N \div N_A = 3.01 \times 10^{23} \div 6.02 \times 10^{23}/\text{mol}$
   0.500 mol
5. $n = N \div N_A = 9.03 \times 10^{23} \div 6.02 \times 10^{23}/\text{mol}$
   1.50 mol

Part D · Two-Step Conversions

1. 1. n = 18.0 g ÷ 18.02 g/mol = 0.999 mol
   2. N = 0.999 mol × 6.02 × 10^{23}/mol
   6.01 × 10^{23} molecules

2. 1. n = 12.0 g ÷ 40.08 g/mol = 0.299 mol
   2. N = 0.299 mol × 6.02 × 10^{23}/mol
   1.80 × 10^{23} atoms

3. 1. n = 1.20 × 10^{24} ÷ 6.02 × 10^{23}/mol = 1.99 mol
   2. m = 1.99 mol × 16.05 g/mol
   31.9 g

4. 1. n = 5.00 × 10^{22} ÷ 6.02 × 10^{23}/mol = 0.0831 mol
   2. m = 0.0831 mol × 119.00 g/mol
   9.89 g

Part E · Challenge

1. • M(H_2O) = 18.02 g/mol
   • n(H_2O) = 36.0 g ÷ 18.02 g/mol = 2.00 mol
   • each molecule holds 2 H, so n(H) = 2 × 2.00 mol = 4.00 mol
   • N(H) = 4.00 mol × 6.02 × 10^{23}/mol
   2.41 × 10^{24} hydrogen atoms

2. • each formula unit of $(NH_4)_2SO_4$ holds 2 N atoms
   • formula units = 1.20 × 10^{23} ÷ 2 = 6.00 × 10^{22}
   • n = 6.00 × 10^{22} ÷ 6.02 × 10^{23}/mol = 0.0997 mol
   • M($(NH_4)_2SO_4$) = 132.17 g/mol
   • m = 0.0997 mol × 132.17 g/mol
   13.2 g

3. • He: n = 8.00 g ÷ 4.00 g/mol = 2.00 mol → 1.20 × 10^{24} atoms
   • Ne: n = 8.00 g ÷ 20.18 g/mol = 0.396 mol → 2.38 × 10^{23} atoms
   • The lighter element has the smaller molar mass, so the same mass contains more moles — and therefore more atoms.
   He — 1.20 × 10^{24} atoms