

Introduction to the Mole and Molar Mass

1. What is a mole? The quantity of matter that contains 6.02×10^{23} particles.
2. What is Avogadro's number? 6.02×10^{23}
3. What do 1 mole of mercury and 1 mole of silver have in common?
They both contain 6.02×10^{23} particles (atoms)
4. What do 1 mole of carbon and 1 mole of oxygen have in common?
They both contain 6.02×10^{23} particles (atoms)

5. Complete the table below.

Molecular formula	# moles	# molecules	# atoms
H	1	6.02×10^{23}	$1 \times (6.02 \times 10^{23}) = 6.02 \times 10^{23}$
Cl	1	6.02×10^{23}	$1 \times (6.02 \times 10^{23}) = 6.02 \times 10^{23}$
(HCl)	1	6.02×10^{23}	$2 \times (6.02 \times 10^{23}) = 1.204 \times 10^{24}$
NaOH	1	6.02×10^{23}	$3 \times (6.02 \times 10^{23}) = 1.806 \times 10^{24}$
O ₂	1	6.02×10^{23}	$2 \times (6.02 \times 10^{23}) = 1.204 \times 10^{24}$
CO ₂	1	6.02×10^{23}	$3 \times (6.02 \times 10^{23}) = 1.806 \times 10^{24}$
CaCl ₂	1	6.02×10^{23}	$3 \times (6.02 \times 10^{23}) = 1.806 \times 10^{24}$
Mg(OH) ₂	1	6.02×10^{23}	$5 \times (6.02 \times 10^{23}) = 3.01 \times 10^{24}$

$$2 \times (6.02 \times 10^{23}) = 1.204 \times 10^{24}$$

6. Complete the table below.

Molecular formula	# moles	# molecules	# atoms
K	2	$\frac{1 \text{ mole}}{6.02 \times 10^{23} \text{ molecules}} : \frac{2 \text{ mole}}{\text{x molecules}}$	$2 \times (6.02 \times 10^{23}) \times \underline{1} = 1.204 \times 10^{24}$
KB	2	$2 \times (6.02 \times 10^{23}) = 1.204 \times 10^{24}$	$2 \times (6.02 \times 10^{23}) \times \underline{2} = 2.408 \times 10^{24}$ x 2 atoms: K and B
N ₂ O ₅	2	$2 \times (6.02 \times 10^{23}) = 1.204 \times 10^{24}$	$2 \times (6.02 \times 10^{23}) \times \underline{7} = 8.428 \times 10^{24}$
H ₃ PO ₄	3	$3 \times (6.02 \times 10^{23}) = 1.806 \times 10^{24}$	$3 \times (6.02 \times 10^{23}) \times \underline{8} = 1.44 \times 10^{25}$
Zn(NO ₃) ₂	4	$4 \times (6.02 \times 10^{23}) = 2.408 \times 10^{24}$	$4 \times (6.02 \times 10^{23}) \times \underline{9} = 2.17 \times 10^{25}$

7. How many atoms of nitrogen are there in 1 mole of NO₂?

$$1 \times (6.02 \times 10^{23}) \times 1 = 6.02 \times 10^{23} \text{ atoms}$$

8. How many atoms of hydrogen are there in 1 mole of water? $\rightarrow H_2O$

$$1 \times (6.02 \times 10^{23}) \times 2 = 1.204 \times 10^{24} \text{ atoms}$$

9. How many atoms of oxygen are there in 1 mole of water? $\rightarrow H_2O$

$$1 \times (6.02 \times 10^{23}) \times 1 = 6.02 \times 10^{23} \text{ atoms}$$

10. How many atoms of oxygen are there in 1 mole of N₂O₅?

$$1 \times (6.02 \times 10^{23}) \times 5 = 3.01 \times 10^{24} \text{ atoms}$$

$$\frac{1 \text{ molecule } N_2O_5}{5 \text{ atoms } N_2O_5} : \frac{6.02 \times 10^{23} \text{ molecules } N_2O_5}{x \text{ atoms } N_2O_5}$$

since in each mole there are 6.02×10^{23} molecules

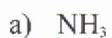
*Ratio long way:

11. What is the molar mass of

- a) Sulfur
- b) Boron
- c) Lead
- d) Phosphorus
- e) Gold

32.07 g/mol
10.81 g/mol
207.20 g/mol
30.97 g/mol
196.97 g/mol

12. Calculate the mass of 1.0 mole of



$$14.01 + 1.01 \times 3 = 17.04 \text{ g}$$



$$16.00 \times 2 = 32.00 \text{ g}$$



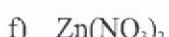
$$32.07 \times 8 = 256.56 \text{ g}$$



$$2(14.01) + 5(16.00) = 108.02 \text{ g}$$



$$24.31 + 32.07 + 4(16.00) = 120.38 \text{ g}$$



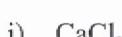
$$65.39 + 2(14.01) + 6(16.00) = 189.41 \text{ g}$$



$$2(14.01) + 8(1.01) + 32.07 + 4(16.00) = 132.17 \text{ g}$$



$$12.01 + 2(16.00) = 44.01 \text{ g}$$



$$40.08 + 2(35.45) = 110.98 \text{ g}$$