

Calculations in Analytical Chemistry

The Mole

The mole is the SI unit for amount of substance. It corresponds to the amount of a chemical substance that contains the same number of particles present in 12 grams of C-12 which is equivalent to Avogadro's number, that is, $N_A = 6.022 \times 10^{23}$.

The molar mass is given as the mass of a compound in grams per mole of that substance. It is calculated by adding the molar masses of all the component elements in the compound. Take glucose for example:

Element	Molar mass per element	Number of atoms	Mass
C	12 g/mol	6	72 g/mol
H	1 g/mol	12	12 g/mol
O	16 g/mol	6	96 g/mol
Molar Mass			180 g/mol

Mole and Millimole Calculations

The millimole is simply 1/1000 of a mole. It is sometimes used in calculations because of its convenience.

Example (Skoog, et al., 2014):

1. Find the number of moles and millimoles of benzoic acid (122.1 g/mol) that are contained in 2.00 g of pure acid.

If we use HBz to represent benzoic acid:

$$HBz_{mol} = 2.00 \text{ g}_{HBz} \times \frac{1 \text{ mol}_{HBz}}{122.1 \text{ g}_{HBz}} = 0.0164 \text{ mol}_{HBz}$$

To obtain the number of millimoles, the millimolar mass of benzoic acid will be used:

$$HBz_{mol} = 2.00 \text{ g}_{HBz} \times \frac{1 \text{ mmol}_{HBz}}{0.1221 \text{ g}_{HBz}} = 16.4 \text{ mmol}_{HBz}$$

2. What is the mass in grams of Na^+ (22.99 g/mol) in 25.0 g of Na_2SO_4 (142.0 g/mol)?

$$\begin{aligned} \text{mass}_{\text{Na}^+} &= 25.0 \text{ g}_{\text{Na}_2\text{SO}_4} \times \frac{1 \text{ mol}_{\text{Na}_2\text{SO}_4}}{142.0 \text{ g}_{\text{Na}_2\text{SO}_4}} \times \frac{2 \text{ mol}_{\text{Na}^+}}{1 \text{ mol}_{\text{Na}_2\text{SO}_4}} \times \frac{22.99 \text{ g}_{\text{Na}^+}}{1 \text{ mol}_{\text{Na}^+}} \\ \text{mass}_{\text{Na}^+} &= 8.10 \text{ g}_{\text{Na}^+} \end{aligned}$$

Analytical Chemistry Calculation Questions And Answers

**Gary D. Christian, Purnendu K.
Dasgupta, Kevin A. Schug**



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