

Grade 11 Chemistry: formula sheet

The mole, reactions, solutions, gases, water and pH · 26 formulas · metric edition 1

MODULE 1 · THE MOLE

Chemistry 11-1 Moles from Mass ($n = m/M$)

$$n = \frac{m}{M}$$

Converts a measured mass into an amount of substance by dividing by the molar mass.

Chemistry 11-2 Particles from Moles (Avogadro's Number)

$$N = n N_A$$

Converts an amount in moles into an actual particle count using the Avogadro constant $N_A = \dots$

Chemistry 11-3 Percent Composition of an Element

$$\%X = \frac{a M_X}{M_{\text{compound}}} \times 100\%$$

Gives the mass percent an element contributes to a compound from the formula subscript and molar...

MODULE 2 · REACTIONS BY THE NUMBERS

Chemistry 11-4 Percent Yield

$$\% \text{yield} = \frac{m_{\text{actual}}}{m_{\text{theoretical}}} \times 100\%$$

Compares the mass actually isolated from a reaction to the maximum mass stoichiometry predicts.

Chemistry 11-5 Heat of Reaction

$$q = n \Delta H$$

Scales a reaction's molar enthalpy change by the amount reacted to give the total heat released or...

MODULE 3 · SOLUTIONS & DILUTION

Chemistry 11-6 Molarity ($C = n/V$)

$$C = \frac{n}{V}$$

Defines molar concentration as moles of solute per volume of solution.

Chemistry 11-7 Mass Percent of a Solution

$$c = \frac{m_{\text{solute}}}{m_{\text{solution}}} \times 100\%$$

Expresses a solution's concentration as the solute's share of the total solution mass in percent.

Chemistry 11-8 Dilution Equation ($C_1V_1 = C_2V_2$)

$$C_1V_1 = C_2V_2$$

States that concentration times volume is conserved when a solution is diluted, since the moles of...

MODULE 4 · GASES

Chemistry 11-9 Ideal Gas Law

$$PV = nRT$$

Relates pressure, volume, amount, and temperature of a gas.

Chemistry 11-10 Boyle's Law

$$P_1V_1 = P_2V_2$$

At constant temperature, pressure times volume stays constant for a fixed amount of gas.

Chemistry 11-11 Charles's Law

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

At constant pressure, gas volume is directly proportional to absolute temperature.

Chemistry 11-12 Gay-Lussac's Law

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

At constant volume, gas pressure is directly proportional to absolute temperature.

Chemistry 11-13 Combined Gas Law

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

For a fixed amount of gas, pressure times volume over absolute temperature stays constant between...

Chemistry 11-14 Gas Volume at STP

$$V = n V_m$$

Converts between moles of an ideal gas and its volume at STP using the molar volume $V_m = 22.414 \dots$

Chemistry 11-15 Gas Density from Molar Mass

$$\rho = \frac{PM}{RT}$$

Gives an ideal gas's density from its molar mass, pressure, and absolute temperature using $R = \dots$

MODULE 5 · WATER BY THE NUMBERS

Chemistry 11-16 Nutrient ppm from Fertiliser Weight

$$c = \frac{mf}{V}$$

The concentration of a single nutrient element delivered to a reservoir, from the weight of...

Chemistry 11-17 TDS Estimated from Conductivity ($\text{TDS} = k \times \text{EC}$)

$$\text{TDS} = k \times \text{EC}$$

Estimates total dissolved solids in mg/L from a conductivity reading in $\mu\text{S}/\text{cm}$ using an empirical...

Chemistry 11-18 Total Hardness as CaCO_3

$$\text{TH} = 2.497 \text{Ca} + 4.118 \text{Mg}$$

Converts a lab report's calcium and magnesium ion results into a single total hardness expressed as...

Chemistry 11-19 Grains per Gallon $\leftrightarrow$ ppm Hardness

$$H = 17.118 G$$

Converts water hardness between grains per US gallon and mg/L as CaCO_3 using the exact 17.118 mg/L...

Chemistry 11-20 Ion Concentration as CaCO_3 Equivalent

$$C_{\text{CaCO}_3} = C_{\text{ion}} \times \frac{50.04}{\text{EW}}$$

Restates any ion's concentration in the trade's common currency of CaCO_3 by scaling with the ratio...

Chemistry 11-21 Equivalent Weight from Molar Mass and Valence

$$\text{EW} = \frac{M}{z}$$

Gives the gram-equivalent weight of an ion or compound as its molar mass divided by the number of...

Chemistry 11-22 Chlorine Dose, Demand and Residual

$$D = C_{\text{demand}} + C_{\text{res}}$$

The fundamental chlorination balance: the dose applied equals the chlorine consumed by the water's...

Chemistry 11-23 Chemical Feed Rate ($\text{lb}/\text{day} = \text{mg}/\text{L} \times \text{MGD} \times 8.34$)

$$\dot{m} = C Q$$

Converts a target chemical dose and a plant flow into a mass feed rate, the classic pounds-per-day...

MODULE 6 · ACIDS, BASES & PH

Chemistry 11-24 pH from Hydrogen Ion Concentration

$$\text{pH} = -\log_{10} [\text{H}^+]$$

Expresses acidity as the negative base-10 logarithm of the hydrogen ion concentration in mol/L.

Chemistry 11-25 pH and pOH Relation

$$\text{pH} + \text{pOH} = 14$$

Links the acidity and basicity scales of any aqueous solution at 25 °C, where $\text{pK}_w = 14$.

Chemistry 11-26 Titration: Concentration of an Unknown

$$C_a = \frac{n C_b V_b}{V_a}$$

Finds an analyte's concentration from the titre volume, titrant concentration, and the reaction's...