CHEAT SHEETS HERO

Math and Science Fundamentals

A quick reference guide to essential equations and formulas in mathematics and science, covering algebra, calculus, physics, and chemistry. This cheat sheet helps students and professionals alike quickly recall and apply fundamental principles.

Algebra & Calculus

Algebraic Formulas

Quadratic Formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Difference of Squares	$a^2 - b^2 = (a+b)(a-b)$
Perfect Square Trinomial	$a^2 + 2ab + b^2 = (a+b)^2$
Binomial Theorem	$(a+b)^n = \sum_{k=0}^{n} \binom{n}{k} a^{n-k} b^k$
Sum of Cubes	$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$
Difference of Cubes	$a^3 - b^3 = (a-b)(a^2 + ab + b^2)$

Calculus - Differentiation

Power Rule	$\frac{d}{dx}(x^n) = nx^{n-1}$
Product Rule	$\frac{d}{dx}(uv) = u'v + uv'$
Quotient Rule	$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{u'v - uv'}{v^2}$
Chain Rule	$\frac{d}{dx}(f(g(x))) = f'(g(x)) \cdot g'(x)$
Derivative of Sine	$\frac{d}{dx}(sin(x)) = cos(x)$
Derivative of Cosine	$\frac{d}{dx}(cos(x)) = -sin(x)$

Calculus - Integration

Power Rule (Integration)	$\int x^n dx = \frac{x^{n+1}}{n+1} + C$
Integral of Sine	$\int sin(x)dx = -cos(x) + C$
Integral of Cosine	$\int cos(x)dx = sin(x) + C$
Integral of Exponential	$\int e^x dx = e^x + C$
Integral of 1/x	$\int \frac{1}{x}dx = ln|x| + C$
Integration by Parts	$\int u dv = uv - \int v du$

Physics

Mechanics

Kinematic Equation 1	$v = v_0 + at$
Kinematic Equation 2	$\Delta x = v_0 t + \frac{1}{2}at^2$
Kinematic Equation 3	$v^2 = v_0^2 + 2a\Delta x$
Newton's Second Law	$F = ma$
Work	$W = Fd\cos(\theta)$
Potential Energy (Gravity)	$U = mgh$
Kinetic Energy	$K = \frac{1}{2}mv^2$

Thermodynamics

First Law of Thermodynamics	$\Delta U = Q - W$
Ideal Gas Law	$PV = nRT$
Heat Transfer (Conduction)	$Q = kA\frac{\Delta T}{\Delta x}t$
Efficiency of a Heat Engine	$\eta = 1 - \frac{T_c}{T_h}$
Entropy Change	$\Delta S = \frac{Q}{T}$

Electricity & Magnetism

Ohm's Law	$V = IR$
Electric Power	$P = IV$
Coulomb's Law	$F = k\frac{q_1 q_2}{r^2}$
Magnetic Force on a Moving Charge	$F = qvB\sin(\theta)$
Magnetic Field of a Long Straight Wire	$B = \frac{\mu_0 I}{2\pi r}$
Faraday's Law of Induction	$\mathcal{E} = -N\frac{d\Phi}{dt}$

Chemistry

Basic Concepts

Molarity	$M = \frac{\text{moles of solute}}{\text{liters of solution}}$
Molality	$m = \frac{\text{moles of solute}}{\text{kilograms of solvent}}$
Percent Composition	$\% \text{ composition} = \frac{\text{mass of element}}{\text{mass of compound}} \times 100$
Ideal Gas Law	$PV = nRT$
Density	$\rho = \frac{m}{V}$

Thermochemistry

Heat (q)	$q = mc\Delta T$
Enthalpy Change	$\Delta H = \Delta U + P\Delta V$
Hess's Law	$\Delta H_{rxn} = \sum \Delta H_{f(products)} - \sum \Delta H_{f(reactants)}$
Gibbs Free Energy	$\Delta G = \Delta H - T\Delta S$
Relationship between ΔG and K	$\Delta G = -RT \ln K$

Equilibrium

Equilibrium Constant (K)	$K = \frac{[C]^c[D]^d}{[A]^a[B]^b}$ (for $aA + bB \rightleftharpoons cC + dD$)
pH	$pH = -\log[H^+]$
pOH	$pOH = -\log[OH^-]$
Relationship between pH and pOH	$pH + pOH = 14$
Acid Dissociation Constant (Ka)	$K_a = \frac{[H^+][A^-]}{[HA]}$
Base Dissociation Constant (Kb)	$K_b = \frac{[BH^+][OH^-]}{[B]}$

Geometry & Trigonometry

Basic Geometry Formulas

Area of a Circle	$A = \pi r^2$
Circumference of a Circle	$C = 2\pi r$
Area of a Triangle	$A = \frac{1}{2}bh$
Pythagorean Theorem	$a^2 + b^2 = c^2$
Volume of a Sphere	$V = \frac{4}{3}\pi r^3$
Surface Area of a Sphere	$SA = 4\pi r^2$

Trigonometric Identities

Sine Identity	$\sin^2(\theta) + \cos^2(\theta) = 1$
Tangent Identity	$\tan(\theta) = \frac{\sin(\theta)}{\cos(\theta)}$
Cosecant Identity	$\csc(\theta) = \frac{1}{\sin(\theta)}$
Secant Identity	$\sec(\theta) = \frac{1}{\cos(\theta)}$
Cotangent Identity	$\cot(\theta) = \frac{1}{\tan(\theta)}$
Double Angle Formula for Sine	$\sin(2\theta) = 2\sin(\theta)\cos(\theta)$

Laws

Law of Sines	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
Law of Cosines	$c^2 = a^2 + b^2 - 2ab\cos C$

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