Math and Science Fundamentals

A quick reference guide covering fundamental concepts in mathematics and science, including formulas, definitions, and principles across various disciplines.

Basic Math Formulas

Arithmetic

Area of a Square	$A = s^2$ (where s is the side length)
Area of a Rectangle	$A = l \times w$ (where l is length and w is width)
Area of a Circle	$A = \pi r^2$ (where r is the radius)
Circumference of a Circle	$C = 2\pi r$ (where r is the radius)
Volume of a Cube	$V = s^3$ (where s is the side length)
Volume of a Rectangular Prism	$V = l \times w \times h$ (where l is length, w is width, and h is height)
Simple Interest	$I = P \times r \times t$ (where P is principal, r is rate, and t is time)
Distance	$d = s \times t$ (where s is speed and t is time)

Algebra

Quadratic Formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Slope-Intercept Form	$y = mx + b$ (where m is slope and b is y-intercept)
Point-Slope Form	$y - y_1 = m(x - x_1)$
Exponent Rules	$a^m \times a^n = a^{m+n}$
Exponent Rules	$\frac{a^m}{a^n} = a^{m-n}$
Exponent Rules	$(a^m)^n = a^{m \times n}$

Basic Science Principles

Physics

Newton's Second Law	F = ma (Force = mass × acceleration)
Ohm's Law	V = IR (Voltage = current × resistance)
Kinetic Energy	KE = \frac{1}{2}mv^2 (Kinetic energy = 1/2 × mass × velocity squared)
Potential Energy	PE = mgh (Potential energy = mass × gravity × height)
Wave Speed	v = f \lambda (Wave speed = frequency × wavelength)
Power	P = \frac{W}{t} (Power = work / time)
Work	W = F \times d (Work = force × distance)

Chemistry

Molarity	$Molarity(M) = \frac{\text{moles of solute}}{\text{liters of solution}}$
pH Scale	$pH = -log[H+]$
Ideal Gas Law	$PV = nRT$ (Pressure × Volume = moles × ideal gas constant × temperature)
Avogadro's Number	$6.022 x 10^{23}$ particles/mole
Boyle's Law	$P_1 V_1 = P_2 V_2$
Charles's Law	$\frac{V_1}{T_1} = \frac{V_2}{T_2}$
Gay-Lussac's Law	$\frac{P_1}{T_1} = \frac{P_2}{T_2}$

Key Biological Concepts

Cell Biology

Cell Theory: All living organisms are composed of one or more cells, the cell is the basic unit of structure and organization in organisms, and cells arise from pre-existing cells.
DNA Structure: Double helix composed of nucleotides (Adenine, Thymine, Guanine, Cytosine). A pairs with T, and G pairs with C.
Central Dogma: DNA -> RNA -> Protein (Transcription followed by Translation)
Mitosis: Cell division resulting in two identical daughter cells; used for growth and repair.
Meiosis: Cell division resulting in four genetically different daughter cells; used for sexual reproduction.

Ecology

Food Chain	Linear sequence of organisms through which nutrients and energy pass as one organism eats another.
Food Web	Interconnected network of food chains, showing the complex feeding relationships in an ecosystem.
Trophic Levels	The position an organism occupies in a food chain (e.g., producers, primary consumers, secondary consumers).
Biomes	Large geographic areas characterized by specific climate conditions, animal populations, and plant types.
Ecosystem	A biological community of interacting organisms and their physical environment.
Population	A group of individuals of the same species living and interbreeding within a given area.
Community	An interacting group of various species in a common location.

Important Constants and Units

Physical Constants

Speed of Light (c)	Approximately 3.00 x 10^8 m/s
Gravitational Constant (G)	Approximately 6.674 x 10^{-11} N(m/kg)^2
Avogadro's Number (NA)	6.022 x 10^{23} mol^{-1}
Planck's Constant (h)	6.626 x 10^{-34} J·s
Elementary Charge (e)	1.602 x 10^{-19} C

Common Units

Length	Meter (m)
Mass	Kilogram (kg)
Time	Second (s)
Temperature	Kelvin (K), Celsius (°C), Fahrenheit (°F)
Amount of Substance	Mole (mol)
Electric Current	Ampere (A)

Physical Constants

Common Units