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Physics Equations & Answers (Quick Study Academic)

Quick Study

ACADEMIC OUTLINE

Quick Study
ACADEMIC

PHYSICS

EQUATIONS & ANSWERS

Essential Tools for Physics Laws, Concepts, Variables and Equations including Sample Problems, Common Pitfalls and Physical Constants

BASICS

A. Units for Physical Quantities

Base Units	Symbol	Unit
Length	L	Meter (m)
Mass	M	Kilogram (kg)
Temperature	T	Kelvin (K)
Time	t	Second (s)
Theory Constant	ϵ	Ampere (A) (C/s)

Derived Units	Symbol	Unit
Acceleration	a	m/s^2
Ang. Accel.	α	rad/s^2
Ang. Momentum	L	$\text{kg m}^2/\text{s}$
Ang. Velocity	ω	rad/s
Angle	θ	radian
Capacitance	C	Farad (F) (C/V)
Charge	Q	Coulomb (C) (A s)
Density	ρ	kg/m^3
Displacement	s	meter (m)
Electric Field	E	V/m
Electric Flux	Φ_E	$\text{N m}^2/\text{C}$
Electromotive Force (EMF)	$\mathcal{E}$	Volt (V)
Energy	E	Joule (J) (kg m ² /s ²)
Entropy	S	J/K
Force	F	Newton (N) (kg m/s ²)
Frequency	f	Hertz (Hz) (s ⁻¹)
Heat	Q	Joule (J)
Magnetic Field	B	Tesla (T) (N/A m)
Magnetic Flux	Φ_B	Weber (Wb) (T m ²)
Momentum	p	kg m/s
Power	P	Watt (W) (J/s)
Pressure	P	Pascal (Pa) (N/m ²)
Resistance	R	Ohm (Ω) (V/A)
Temperature	T	Kelvin (K)
Volume	V	m ³
Wavelength	λ	meter (m)
Work	W	Joule (J) (N m)

B. Fundamental Physical Constants

Base Units	Symbol	Unit
Mass of electron	m_e	9.11×10^{-31} kg
Mass of proton	m_p	1.67×10^{-27} kg
Avogadro Constant	N_A	$6.02 \times 10^{23} \text{ mol}^{-1}$
Elementary charge	e	$1.602 \times 10^{-19} \text{ C}$
Faraday constant	F	$96,485 \text{ C/mol}$
Speed of light	c	$3 \times 10^8 \text{ m/s}$
Molar Gas Constant	R	$8.314 \text{ J/mol}^\circ\text{K}$
Boltzmann Constant	k	$1.38 \times 10^{-23} \text{ J/K}$
Gravitational Constant	G	$6.67 \times 10^{-11} \text{ m}^3/\text{kg s}^2$
Permeability of Space	μ_0	$4\pi \times 10^{-7} \text{ N/A}^2$
Permittivity of Space	ϵ_0	$8.85 \times 10^{-12} \text{ F/m}$

C. Conversion Factors and Approximate Values

Unit	Description
Angle	$1 \text{ radian} = 180^\circ / \pi$
Energy	$1 \text{ erg} = 10^{-7} \text{ J}$
Energy	$1 \text{ eV} = 1.602 \times 10^{-19} \text{ J}$
Force	$1 \text{ dyne} = 10^{-5} \text{ N}$
Pressure	$1 \text{ bar} = 10^5 \text{ Pa}$
Length	$1 \text{ \AA} = 10^{-10} \text{ m}$

MATHEMATICAL CONCEPTS

A. Vector Algebra

- Vector: Directed line segment (arrow) along (x, y, z) components $\hat{i}, \hat{j}, \hat{k}$
- Vector: $\vec{A} = A_x \hat{i} + A_y \hat{j} + A_z \hat{k}$
- Length of $\vec{A} = |\vec{A}| = \sqrt{A_x^2 + A_y^2 + A_z^2}$
- Addition of vectors $\vec{A}$ and $\vec{B}$: add components
- Sample Addition and Length Calculations:

- Subtraction: $\vec{A} - \vec{B} = (A_x - B_x)\hat{i} + (A_y - B_y)\hat{j} + (A_z - B_z)\hat{k}$
- Dot Product: $\vec{A} \cdot \vec{B} = A_x B_x + A_y B_y + A_z B_z$
- Cross Product: $\vec{A} \times \vec{B} = (A_y B_z - A_z B_y)\hat{i} + (A_z B_x - A_x B_z)\hat{j} + (A_x B_y - A_y B_x)\hat{k}$

B. Scalar and Vector Product

- Scalar Product: $\vec{A} \cdot \vec{B} = AB \cos \theta$
- Vector Product: $\vec{A} \times \vec{B} = AB \sin \theta \hat{n}$
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Synopsis

Essential tool for physics laws, concepts, variables and equations, including sample problems, common pitfalls and helpful hints.

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