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Physics Equations & Answers (Quick Study Academic)

Quick Study

PHYSICS

ACADEMIC

PHYSICS

EQUATIONS & ANSWERS

Essential Tool for Physics Laws, Concepts, Variables and Equations including - Sample Problems, Common Pitfalls and Helpful Hints

BASICS

A. Units for Physical Quantities

Base Units	Symbol	Unit
Length	L	Meter (m)
Mass	m, M	Kilogram (kg)
Temperature	T	Kelvin (K)
Time	t	Second (s)
Electric Current	I	Ampere (A, C/s)
Derived Units	Symbol	Unit
Acceleration	a	m/s ²
Ang. Accel.	α	rad/s ²
Ang. Momentum	L	kg m ² /s
Ang. Velocity	ω	rad/s
Angle	θ, φ	radian
Capacitance	C	Farad (F, C/V)
Charge	Q, q	Coulomb (C, A·s)
Density	ρ	kg/m ³
Displacement	s, Δx	meter (m)
Electric Field	E	V/m
Electric Flux	Φ _E	V·m
Electromotive Force (EMF)	ε	Volts (V)
Energy	E, U, Q	Joule (J, kg m ² /s ²)
Entropy	S	J/K
Force	F	Newton (N, kg m/s ²)
Frequency	f, ν	Hertz (Hz, 1/s)
Heat	Q	Joule (J)
Magnetic Field	B	Tesla (T, Wb/m ²)
Magnetic Flux	Φ _B	Weber (Wb, kg m ² /s ² A)
Momentum	p	kg m/s
Power	P	Watt (W, J/s)
Pressure	P	Pascal (Pa, N/m ²)
Resistance	R	Ohm (Ω, V/A)
Torque	τ	N·m
Velocity	v	m/s
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 × 10 ²³ mol ⁻¹
Elementary charge	e	1.60 × 10 ⁻¹⁹ C
Faraday constant	F	96,485 C/mol
Speed of light	c	3.00 × 10 ⁸ m/s
Molar Gas Constant	R	8.314 J mol ⁻¹ K ⁻¹
Boltzmann Constant	k	1.38 × 10 ⁻²³ J/K
Gravitational Constant	G	6.67 × 10 ⁻¹¹ m ³ kg ⁻¹ s ⁻²
Permeability of Space	μ ₀	4π × 10 ⁻⁷ N/A ²
Permittivity of Space	ε ₀	8.85 × 10 ⁻¹² C ² /N·m ²

C. Conversion factors and alternate units

Unit	Description
Angle	1 degree = π/180 rad
Energy	1 eV = 1.60 × 10 ⁻¹⁹ J
Energy	1 Cal = 4.184 J
Force	1 dyne = 10 ⁻⁵ N
Volume	1 L = 1 dm ³
Pressure	1 bar = 10 ⁵ Pa
Length	1 Å = 10 ⁻¹⁰ m

MATHEMATICAL CONCEPTS

1. Vector Algebra

- 1.1 Vector:** Directed line segment having magnitude and direction.
- 1.2 Unit vector:** A vector of unit length (1) in the direction of the vector.
- 1.3 Addition of vectors:** If $\vec{A}$ and $\vec{B}$ are two vectors, their resultant $\vec{R}$ is given by the triangle rule or the parallelogram rule.
- 1.4 Subtraction of vectors:** If $\vec{A}$ and $\vec{B}$ are two vectors, their resultant $\vec{R}$ is given by the triangle rule or the parallelogram rule.
- 1.5 Scalar multiplication:** If $\vec{A}$ is a vector and k is a scalar, then $k\vec{A}$ is a vector of magnitude k times that of $\vec{A}$ in the same direction.
- 1.6 Dot product:** If $\vec{A}$ and $\vec{B}$ are two vectors, their dot product $\vec{A} \cdot \vec{B}$ is a scalar given by $AB \cos \theta$, where θ is the angle between $\vec{A}$ and $\vec{B}$.
- 1.7 Cross product:** If $\vec{A}$ and $\vec{B}$ are two vectors, their cross product $\vec{A} \times \vec{B}$ is a vector of magnitude $AB \sin \theta$ perpendicular to the plane containing $\vec{A}$ and $\vec{B}$.

2. Trigonometry

- 2.1 Right-angled triangle:** A triangle with one angle equal to 90°.
- 2.2 Sine rule:** In any triangle, the ratio of the length of a side to the sine of the opposite angle is constant.
- 2.3 Cosine rule:** In any triangle, the square of the length of a side is equal to the sum of the squares of the other two sides minus twice the product of the other two sides and the cosine of the included angle.
- 2.4 Area of a triangle:** The area of a triangle is given by $\frac{1}{2}ab \sin C$, where a and b are the lengths of two sides and C is the included angle.
- 2.5 Area of a circle:** The area of a circle is given by πr^2 , where r is the radius.
- 2.6 Circumference of a circle:** The circumference of a circle is given by $2\pi r$, where r is the radius.
- 2.7 Volume of a cylinder:** The volume of a cylinder is given by $\pi r^2 h$, where r is the radius and h is the height.
- 2.8 Surface area of a cylinder:** The surface area of a cylinder is given by $2\pi r(h + r)$, where r is the radius and h is the height.

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- 3.1 Vector:** Directed line segment having magnitude and direction.
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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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