

THE
PHYSICS QUICK
REFERENCE GUIDE

E. Richard Cohen

*Rockwell International Corporation
Thousand Oaks, California*



American Institute of Physics

Woodbury, New York

CONTENTS

Preface	ix
1 PHYSICAL QUANTITIES, SYMBOLS, AND UNITS	1
1.1 Numbers	1
1.2 Physical quantities	2
1.3 Systems of units	6
1.4 Dimensional and “dimensionless” ratios	7
1.5 Symbols and nomenclature	8
2 THE INTERNATIONAL SYSTEM OF UNITS (SI)	17
2.1 Realization of the meter	19
2.2 Derived units	20
2.3 Supplementary derived units	23
2.4 Non-SI systems of units	23
3 RECOMMENDED SYMBOLS FOR PHYSICAL QUANTITIES	37
3.1 Letter symbols	37
3.2 Quantum mechanics	47
3.3 Crystallography	47
4 PRECISE PHYSICAL CONSTANTS	49
4.1 Standards and conversion factors	49
4.2 Unit systems	51
4.3 Physical constants	52
4.4 Fundamental constants	54
5 PHYSICS FORMULARY	63
5.1 Mechanics	63
5.2 Wave propagation	74
5.3 Electricity and magnetism	76
5.4 Hydrogen-like atom (non-relativistic)	93
5.5 Phase shift analysis	95
5.6 Thermodynamics	96

6	ENGINEERING PHYSICS	107
6.1	Engineering elasticity	107
6.2	Friction	112
6.3	Electromagnetic frequency bands	113
6.4	International temperature scale	115
6.5	Heat transfer	117
7	PROPERTIES OF MATTER	123
7.1	Elementary particles	123
7.2	The elements	124
7.3	Densities	131
7.4	Viscosity	132
7.5	Surface tension	135
7.6	Vapor pressure	136
7.7	Compressibility	137
7.8	Materials for nuclear physics	138
8	MATHEMATICAL FORMULAS	141
8.1	Algebraic equations	141
8.2	Factorials	143
8.3	Binomial theorem	143
8.4	Progression and series	144
8.5	Taylor series	145
8.6	Differentiation	146
8.7	Integration	146
8.8	Logarithmic functions	147
8.9	Exponential functions	148
8.10	Trigonometric functions	149
8.11	Inverse trigonometric functions	152
8.12	Hyperbolic functions	153
8.13	Inverse hyperbolic functions	155
8.14	Gamma function	156
8.15	Definite integrals	157
8.16	Delta function	158
8.17	Vector algebra	159
8.18	Orthogonal coordinate systems	163
8.19	General curvilinear spaces	167
8.20	Fourier series and Fourier transforms	169
8.21	Laplace transforms	171
8.22	Bessel functions	173
8.23	Spherical harmonics	176
8.24	Vector addition (Clebsch-Gordan, Wigner) coefficients	179

CONTENTS

vii

9	PROBABILITY AND STATISTICS	183
9.1	Probability distributions	183
9.2	Convolution of distributions; characteristic function	184
9.3	Some common distributions	186
9.4	Statistics, parameter estimation	191
9.5	Bayesian statistics; inverse probability	192
9.6	Parameter estimation; least-squares fitting	193
9.7	Error propagation	198
	SUBJECT INDEX	201