

TABLE OF CONTENTS

GENERAL PHYSICS

1.1 Units		
1.1.1 The international system of units (SI)		I
1.1.2 Realization of SI units		4
1.1.3 Relations between SI and other units		7
1.1.4 International specifications for units		12
1.2 Fundamental constants		
1.2.1 Velocity of electromagnetic waves		14
1.2.2 The constant of gravitation		14
1.2.3 Atomic constants		14
1.3 Measurement of mass, pressure and other mechanical quantities		
1.3.1 Mass, volume and density		17
1.3.2 Barometry		21
1.3.3 The measurement of high pressures		23
1.3.4 Hygrometry		27
1.4 Mechanical properties of materials		
1.4.1 Densities		29
1.4.2 Elasticities		31
1.4.3 Viscosities		36
1.4.4 Mean velocity, free path and size of molecules		41
1.4.5 Surface tensions		42
1.5 Temperature and heat		
1.5.1 The International Practical Temperature Scale of 1968 (IPTS-68)		44
1.5.2 Thermoelectric thermometry		47
1.5.3 Optical pyrometry		51
1.5.4 Thermal expansion		52
1.5.5 Specific heat capacities		57
1.5.6 Thermal conductivities		61
1.6 Acoustics		
1.6.1 The velocity and attenuation of sound		71
1.6.2 Physiological and subjective acoustics		77
1.6.3 Preferred frequencies for acoustical measurements		79
1.6.4 Architectural acoustics		80
1.6.5 Musical acoustics		81
1.7 Radiation and optics		
1.7.1 The electromagnetic spectrum		83
1.7.2 Thermal radiation		84
1.7.3 Photometry		86
1.7.4 Colorimetry		88
1.7.5 Wavelength standards		93
1.7.6 Laser radiation		96
1.7.7 Refractive index of gases		99
1.7.8 Refractive index of optical materials		101
1.7.9 Light reflection		109
1.7.10 Optical rotation		111
1.7.11 Electro-optic materials		114

1.8 Electricity and magnetism	
1.8.1 Electrical resistivities	117
1.8.2 Resistance alloys and wire resistances	120
1.8.3 Electrical insulating materials	122
1.8.4 Superconducting properties of materials	124
1.8.5 Dielectric properties of materials	128
1.8.6 Magnetic properties of materials	137
1.9 Astronomy and geophysics	
1.9.1 Astronomical and atomic time systems	149
1.9.2 Astronomical units and constants	153
1.9.3 Physical properties of the Earth	157
1.9.4 Gravity	159
1.9.5 Geomagnetism	160
1.9.6 Cosmic rays	165
1.9.7 The atmosphere	168
1.9.8 Physical properties of sea water	169
1.9.9 The geological time scale	171
1.10 Miscellaneous engineering data	
1.10.1 Screw threads	172
1.10.2 Standard wire sizes	174

CHEMISTRY

2.1 The elements	
2.1.1 The periodic table of the elements with atomic numbers	177
2.1.2 Properties of the elements	178
2.1.3 Abundances of the elements	180
2.1.4 Composition of the Earth's atmosphere	183
2.2 Properties of inorganic compounds	184
2.3 Properties of organic compounds	197
2.4 Vapour pressures and boiling points	
2.4.1 Vapour pressure of water at temperatures between 0 and 360°C	203
2.4.2 Boiling point of water at pressures from 90 to 106.9 kN m ⁻²	203
2.4.3 Vapour pressures of some liquids of low volatility	204
2.4.4 Vapour pressures from 0.2 to 101.325 kN m ⁻²	204
2.4.5 Vapour pressures from 0.2 to 6 MN m ⁻²	213
2.5 Critical constants and second virial coefficients of gases	215
2.6 Properties of solutions	
2.6.1 Solubilities of gases in water	219
2.6.2 Solubilities of solids in water	219
2.6.3 Densities of aqueous solutions	221
2.7 Properties of chemical bonds	
2.7.1 Dipole moments and dipole lengths	224
2.7.2 Bond lengths and dissociation energies of diatomic molecules	225
2.7.3 Bond lengths and angles in polyatomic molecules	225
2.7.4 Bond dissociation energies in polyatomic molecules	226
2.7.5 Atomic radii	226

2.7.6	Ionic radii	227
2.7.7	Crystal structures	229
2.8	Nuclear magnetic resonance and Mössbauer effect	
2.8.1	Nuclear moments and magnetic resonance	234
2.8.2	NMR chemical shifts in diamagnetic molecules	237
2.8.3	Nuclear spin relaxation time	243
2.8.4	The Mössbauer effect	243
2.9	Electrochemistry	
2.9.1	Standard solutions for calibrating conductivity vessels	247
2.9.2	Conductivities	247
2.9.3	Standard half-cell EMFs at 25°C	248
2.9.4	Ionization constant of water	249
2.9.5	pH values	250
2.9.6	Half-wave potentials of metals	252
2.9.7	Osmotic coefficients	254
2.9.8	Activity coefficients	255
2.9.9	Acidity constants	256
2.9.10	Stability constants and solubility products	257
2.10	Chemical thermodynamics	
2.10.1	Molar heat capacities, heats of fusion and vaporization of the elements	259
2.10.2	Molar heat capacities of some solids at various temperatures	264
2.10.3	Molar heat capacities of gases at constant pressure at various temperatures	265
2.10.4	Cryoscopic and ebullioscopic constants, heats of fusion and vaporization for some common solvents	266
2.10.5	Standard free energies, heats of formation, entropies and molar heat capacities	268
2.10.6	CODATA key values for thermodynamics, 1977.	283
2.11	Miscellaneous data	
2.11.1	Properties of polymers	287
2.11.2	Some characteristics of common glasses	291
2.11.3	Cooling agents	292
2.11.4	Mohs's scale of mineral hardness	292
2.11.5	Calorific values of solid, liquid and gaseous fuels.	292

ATOMIC AND NUCLEAR PHYSICS

3.1	Free electrons and ions in gases	
3.1.1	Ionic mobility	297
3.1.2	Electron mobility	298
3.1.3	Ionic recombination	298
3.1.4	Ionic diffusion	299
3.1.5	Electron diffusion	300
3.1.6	Electron collisions	300
3.2	Work function	302
3.3	Electrons in atoms	
3.3.1	Arrangement of electrons in atoms	304
3.3.2	Ionization potentials	307
3.3.3	Auger spectroscopy	308
3.3.4	X-ray photoemission spectroscopy.	310

3.4 X-rays		
3.4.1	X-ray absorption edges, characteristic X-ray lines and fluorescence yields	317
3.4.2	Attenuation of photons	325
3.5 Absorption of particles and dosimetry		
3.5.1	Range and stopping power of ions in various materials	327
3.5.2	Inelastic mean free path of electrons in solids.	334
3.5.3	Range of electrons and beta rays	335
3.5.4	Radiation units and quantities.	335
3.6 Radioactive elements		
3.6.1	Table of nuclides	340
3.6.2	The Radioactive Series and their precursors	416
3.6.3	Radioactive sources	422
3.7 Nuclear fission and neutron interactions		
3.7.1	Fission fundamentals	424
3.7.2	Neutron cross-sections	427
3.7.3	Attenuation of fast neutrons: neutron moderation and diffusion	438
3.7.4	Nuclear fusion data	440
3.8 Nuclei and particles		
3.8.1	Size of atomic nuclei	448
3.8.2	Subatomic particles	448

MATHEMATICAL FUNCTIONS

4.1 Functions	455
4.2 Statistical methods for the treatment of experimental data	456
<i>Index</i>	463

NOTE ON THE USE OF PAGE HEADINGS

The user of this book will find that the Index is the key to what it contains. Headings in heavy type on each page are intended to assist him in finding his way in the tables, within the sections listed briefly above, and without continual reference to the Index. When parts of more than one table are to be found on a single page, the heading refers in general to the first table which *starts* on that page.

