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INTERNATIONAL SYSTEM OF UNITS

The Système International d'Unités (SI) was adopted by the eleventh General Conference on Weights and Measures and endorsed by the International Organization for Standardization in 1960. The system is an extension and refinement of the traditional metric system and is superior to any other in being completely coherent, rational and comprehensive. In the system there is one, and only one, unit for each physical quantity and the product or quotient of any two SI units yields the unit of the resulting quantity; no numerical factors are involved.

The seven base and two supplementary units on which the SI is based are listed in Table 1.

Table 1. Base and supplementary SI units

Quantity	Name of unit	Unit symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol
Plane angle	radian	rad
Solid angle	steradian	sr

The base units are defined as follows:

Metre: The metre is the length equal to 1 650 763·73 (exactly) wavelengths in a vacuum of the radiation corresponding to the transition between the energy levels $2p_{10}$ and $5d_5$ of the pure nuclide ^{86}Kr.

Kilogram: The kilogram is the mass of the International Prototype Kilogram which is in the custody of the Bureau International des Poids et Mesures at Sèvres, France.

Second: The second is the duration of 9 192 631 770 periods of the radiation corresponding to the transition between the two hyperfine levels ($F = 4$, $M_F = 0$ and $F = 3$, $M_F = 0$) of the ground state of the atom of pure ^{133}Cs.

Ampere: The ampere is that constant current which, if maintained in two parallel rectilinear conductors, of infinite length and of negligible circular cross-section, at a distance apart of 1 metre in a vacuum, would produce a force between the conductors equal to 2×10^{-7} newton per metre of length.

Kelvin: The kelvin is completely defined by the decision of the 1954 Conférence Générale to assign the value 273·16 kelvin (exactly) to the thermodynamic temperature at the triple point of water. It is 1/273·16 of the thermodynamic temperature of the triple point of water.

Candela: The candela is the luminous intensity, in a given direction, of a source emitting monochromatic radiation of frequency 540×10^{12} Hz and the radiant intensity of which in that direction is 1/683 watt per steradian.

Mole: The mole is the amount of substance of a system which contains as many elementary units as there are carbon atoms in 0·012 kg (exactly) of the pure nuclide ^{12}C. The elementary unit must be specified and may be an atom, a molecule, an ion, an electron, a photon, etc., or a specified group of such entities.

All the other necessary units can be derived from these base units. Tables 2 and 3 list some of the derived units.

Table 2. Derived SI units with special names

Physical quantity	Name of unit	Symbol for unit	Definition of unit
Energy	joule	J	$kg\,m^2\,s^{-2}$
Force	newton	N	$kg\,m\,s^{-2} = J\,m^{-1}$
Pressure	pascal	Pa	$kg\,m^{-1}\,s^{-2} = N\,m^{-2}$
Power	watt	W	$kg\,m^2\,s^{-3} = J\,s^{-1}$
Electric charge	coulomb	C	A s
Electric potential difference	volt	V	$kg\,m^2\,s^{-3}\,A^{-1} = J\,A^{-1}\,s^{-1}$
Electric resistance	ohm	Ω	$kg\,m^2\,s^{-3}\,A^{-2} = V\,A^{-1}$
Electric conductance	siemens	S	$kg^{-1}\,m^{-2}\,s^3\,A^2 = \Omega^{-1}$
Electric capacitance	farad	F	$A^2\,s^4\,kg^{-1}\,m^{-2} = A\,s\,V^{-1}$
Magnetic flux	weber	Wb	$kg\,m^2\,s^{-2}\,A^{-1} = V\,s$
Inductance	henry	H	$kg\,m^2\,s^{-2}\,A^{-2} = V\,s\,A^{-1}$
Magnetic flux density	tesla	T	$kg\,s^{-2}\,A^{-1} = V\,s\,m^{-2}$
Luminous flux	lumen	lm	cd sr
Illumination	lux	lx	$cd\,sr\,m^{-2}$
Frequency	hertz	Hz	s^{-1}
Activity (radioactive)	becquerel	Bq	s^{-1}
Absorbed dose (radiation)	gray	Gy	$J\,kg^{-1}$
Equivalent dose	sievert	Sv	$J\,kg^{-1}$

Table 3. Other derived SI units

Physical quantity	SI unit	Symbol
Area	square metre	m^2
Volume	cubic metre	m^3
Density	kilogram per cubic metre	$kg\,m^{-3}$
Velocity	metre per second	$m\,s^{-1}$
Angular velocity	radian per second	$rad\,s^{-1}$
Acceleration	metre per second squared	$m\,s^{-2}$
Kinematic viscosity	square metre per second	$m^2\,s^{-1}$
Dynamic viscosity	pascal second	Pa s
Electric field strength	volt per metre	$V\,m^{-1}$
Magnetic field strength	ampere per metre	$A\,m^{-1}$
Luminance	candela per square metre	$cd\,m^{-2}$
Heat capacity	joule per kelvin	$J\,K^{-1}$
Thermal conductivity	watt per metre kelvin	$W\,m^{-1}\,K^{-1}$
Surface tension	newton per metre	$N\,m^{-1}$
Thermal coefficient of expansion	reciprocal kelvin	K^{-1}

Some of the SI units are of inconvenient size, but the prefixes listed in Table 4 may be used to indicate fractions or multiples of the base or derived units.

Table 4. Prefixes for SI units

Fraction	Prefix	Symbol	Multiple	Prefix	Symbol
10^{-1}	deci	d	10	deca	da
10^{-2}	centi	c	10^{2}	hecto	h
10^{-3}	milli	m	10^{3}	kilo	k
10^{-6}	micro	μ	10^{6}	mega	M
10^{-9}	nano	n	10^{9}	giga	G
10^{-12}	pico	p	10^{12}	tera	T
10^{-15}	femto	f	10^{15}	peta	P
10^{-18}	atto	a	10^{18}	exa	E

Also, there are a number of familiar units which differ from the corresponding SI units only by powers of ten. They are not part of SI but will probably continue in use for some time. The list of such units in Table 5 is not exhaustive.

Table 5. Named units which are decimal fractions or multiples of SI units

Physical quantity	Name	Symbol	Definition
Length	ångström	Å	10^{-10} m
Length	micron	μm	10^{-6} m
Area	hectare	ha	10^{4} m^{2}
Volume	litre	l	10^{-3} m^{3}
Mass	tonne	t	10^{3} kg
Force	dyne	dyn	10^{-5} N
Pressure	bar	bar	10^{5} Pa
Energy	erg	erg	10^{-7} J
Kinematic viscosity	stokes	St	10^{-4} m^{2} s^{-1}
Dynamic viscosity	poise	P	10^{-1} Pa s
Magnetic flux	maxwell	Mx	10^{-8} Wb
Magnetic flux density (magnetic induction)	gauss	G	10^{-4} T
Absorbed dose (radiation)	rad	rad	10^{-2} Gy

Table 6 lists a number of other units which are not part of SI and defines them exactly in terms of the base SI units. *Their use is to be discouraged.*

Table 6. Some common units defined exactly in terms of SI units

Physical quantity	Name	Symbol	Definition
Length	inch	in	$2{\cdot}54\times10^{-2}$ m
Area	acre	ac	$4\,046{\cdot}856\,422\,4$ m^2
Mass	pound (avoirdupois)	lb	$0{\cdot}453\,592\,37$ kg
Force	kilogram-force	kgf	$9{\cdot}806\,65$ N
Pressure	atmosphere	atm	101 325 Pa
Pressure	torr	Torr	(101 325/760) Pa
Pressure	conventional millimetre of mercury	mmHg	$13{\cdot}595\,1\times980{\cdot}665\times10^{-1}$ Pa
Energy	kilowatt-hour	kW h	$3{\cdot}6\times10^{6}$ J
Energy	thermochemical calorie	cal (thermochem.)	$4{\cdot}184$ J
Energy	international table calorie	cal_{IT}	$34{\cdot}186\,8$ J
Activity	curie	Ci	$3{\cdot}7\times10^{10}$ Bq

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EDITORIAL

The warning 'publish or perish' applies equally well to a scientific journal as to a research scientist. Consequently, both the journal and the scientist are faced with the temptation to compromise standards under the pressure to publish. In spite of the difficulties that the *Australian Journal of Physics* has experienced in recent years, there has been a steadfast determination to maintain the Journal's established position as an international medium for the publication of pure and applied physics.

During 1982, 124 papers were submitted to the Journal, an encouraging increase on the 87 papers submitted in 1981. The rejection rate in 1982 was 33%, a figure much lower than in previous years and one that indicates an improvement in the overall quality of papers submitted. Referees in the United States, Canada, the United Kingdom, West Germany, Italy, Denmark, Japan and New Zealand were used for about one-third of the papers submitted. It is with pleasure that we thank all those who acted as referees and advisers during the year.

Over the past year the average publication time for papers has been 7 months. The average time taken for the acceptance of papers is at present slightly under 3 months, with slightly more than 4 months for production. Every effort will be made in the future to shorten the publication time of papers, while at the same time maintaining the Journal's high standards of quality. Authors can assist in keeping publication times to a minimum by adhering to the instructions in the Notice to Authors when preparing their manuscripts. Similarly, referees are reminded to return manuscripts to the Editorial Office immediately, preferably with the names of alternative referees, if they are unable to furnish their report within the allotted time.

By recognizing the need to adapt the Journal to cater for the changing needs of the physics community a number of new features will be introduced in 1983, designed to both broaden the outlook and increase the standing of the Journal. In addition to the usual research papers and short communications, several *review articles* will be published each year. While it is intended that these reviews will be primarily directed at developments in physics which have taken place largely in Australia, this is not to be seen as a limitation on their nature or scope. Review articles will normally be invited, but authors interested in publishing a review in the Journal are welcome to contact and discuss the matter with an appropriate member of the Advisory Committee.

Another new feature in 1983 will be the addition of *Corresponding Members* to the Advisory Committee of the Journal. The Corresponding Members are to be distinguished overseas physicists who will serve as influential spokesmen for the Journal, as well as recommend suitable referees and adjudicate in the case of controversial papers in fields of physics not already covered by other members of the Advisory Committee.

Towards the end of 1983 the Journal proposes to publish a *special issue*, consisting of a group of papers by colleagues of the late Stuart Butler. In addition, the Journal will continue to publish papers given by keynote speakers at major physics conferences held in Australia. Conference organizers interested in publishing conference papers are encouraged to contact the Editor or the Chairman of the Advisory Committee at the earliest possible opportunity.

T. F. Smith
(*Chairman*)

R. P. Robertson
(*Editor*)