SUPPLEMENT No. 3

TO

THE SOVEREIGN BASE AREAS GAZETTE

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SUBSIDIARY LEGISLATION

CONTENTS:

The following SUBSIDIARY LEGISLATION is published in this Supplement which forms part of this Gazette : -

The Weights and Measures Ordinance, 1986 — No.

Regulations under Sections 12 (3), 13 and 69 82

No. 82

THE WEIGHTS AND MEASURES ORDINANCE 1986

(Ordinance 11 of 1986)

REGULATIONS UNDER SECTIONS 12(3), 13 AND 69.

In exercise of the powers conferred upon him under subsection (3) of Section 12 and Sections 13 and 69 of the Weights and Measures Ordinance 1986, the Administrator hereby makes the following Regulations:-

Short title.

1. These Regulations may be cited as the Weights and Measures (Measurement Units) Regulations, 1993.

Interpretation.

2.-(1) In these Regulations, unless the context otherwise requires -

"coefficients" means those parameters without physical dimensions or rates of quantities of the same kind which are necessary for particular measurements or for characterising properties of substances or mixtures of certain substances;

"derived units" means units which are defined by algebraic expressions in the form of products of powers of the base and/or supplementary units of the International System of Units with a numerical factor equal to one (1);

"measurement unit" means a unit of measure, weight or numeration;

Ordinance 11 of 1986

"Ordinance" means the Weights and Measures Ordinance, 1986 and includes any Ordinance amending or substituting the same;

"physical constants" means those constants which express the values of physical invariants in a given system of units;

"prefix" means the prefix used to produce multiples and sub-multiples of units of the International System of Units, as well as the prescribed units;

"special units" means units which, notwithstanding that they do not belong to the International System of Units may be used along with the units of the International System of Units;

"supplementary units" means the units of the International System of Units which have been prescribed as such by the General Conference of Weights and Measures;

"symbol" means a letter or group of letters written or combined according to the manner prescribed in these Regulations, in order to represent appropriately units or a group of units.

(2) Expressions not otherwise defined in these Regulations shall, unless the context otherwise requires, have the meaning assigned to them by the Ordinance.

International System of Units.

3.-(1) The International System of Units (Système International d'Unites) with its international abbreviation "SI" consists of the base, supplementary and derived units.

First Schedule.

(2) (a) The prototype symbols of the SI base units laid down by the Ordinance are specified in paragraph 1 of Part I of the First Schedule.

(b) The special name and symbol of the Kelvin, the temperature unit in the International System of Units used for expressing Celsius temperatures, is specified in paragraph 2 of Part I of the First Schedule. First Schedule.

(3) The supplementary SI units and the prototype symbols and the definitions thereof are specified in Part II of the First Schedule.

(4) SI derived units and the symbols and definitions thereof are specified in Part III of the First Schedule. First Schedule.

(5) The special units prescribed in Part IV of the First Schedule to these Regulations may be used together with SI units under such restrictions as are specified in the said Part. First Schedule.

(6) The decimal multiples and sub-multiples of the base, supplementary or derived SI units, or other prescribed units, shall be expressed, unless otherwise specified, by using the rules laid down in Part V of the First Schedule and the SI prefixes and symbols thereof as they are laid down in paragraph 1 of the said Part. First Schedule.

4.-(1) The separation of the integral part of numbers from the decimal part thereof shall be by a comma only. Writing of figures.

(2) Whenever any number is smaller than the unit, that is it consists of decimal digits only, the zero symbol shall be placed before the decimal point, namely the comma.

(3) In order to facilitate reading, the numbers may be split in groups of three digits beginning with the decimal point, if it exists, and no full-stop or comma shall be placed in the spaces between such groups of digits:

Provided that the separation of numbers in groups shall not be applied where these consist of four digits and represent a year:

Provided further that in the case of numbers representing sums of money, the numbers shall be either continuous, that is without spaces, or a full stop may be used to split them in groups of three digits.

5. The numbers set out in the first column of the Second Schedule shall be expressed in the words specified against them in the second column. Means by which numbers are expressed in letters. Second Schedule.

6. The coefficients relating to - Co-efficients.

(a) the alcoholic content of mixtures of water and alcohol;

(b) the hardness of materials;

(c) the sugar content of sugar solutions;

(d) the relative humidity; and

(e) the pH value of water solutions

as well as the symbols and definitions thereof, are laid down in the Third Schedule. Third Schedule.

7. The constants as well as their corresponding values are laid down in the Fourth Schedule. Constants. Fourth Schedule.

FIRST SCHEDULE

(Regulation 3)

INTERNATIONAL SYSTEM OF UNITS

PART I

1. PROTOTYPE SYMBOLS OF SI BASE UNITS

Quantity	Unit	
	Name	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

2. SPECIAL NAME AND SYMBOL OF THE KELVIN TO EXPRESS CELSIUS TEMPERATURES

Quantity	Unit	
	Name	Symbol
Celsius Temperature	Celsius degree	°C

The Celsius temperature t is defined as the difference $t = T - T_o$ between two thermodynamic temperatures T and T_o where $T_o = 273{,}15$ K by definition.

Space: the temperature difference may be expressed either in kelvin or in Celsius degrees. The unit "Celsius degree" (temperature interval) is equal to the unit of "kelvin".

PART II

SUPPLEMENTARY SI UNITS

1. Unit of plane angle: radian (symbol:rad)

The radian is the plane angle between two radii which cut off on the circumference of a circle equal in length to the radius.

2. Unit of solid angle: steradian (symbol:sr)

The steradian is the solid angle, which having its vertex in the centre of a sphere, cuts off an area of the surface of the sphere equal to that of a square with its side of equal length to the radius of the sphere.

PART III

SI DERIVED UNITS

1. Derived units in relation to Space and Time.

(a) Unit of wave number: 1 per metre (symbol : m^{-1}).

1 per metre is the wave number of a monochromatic radiation

whose wave length is equal to 1 metre.

$$(1m^{-1} = \frac{1}{1m})$$

(b) Unit of Surface, Area: 1m: the square metre (symbol:m^2).

The square metre is the area of a square having a side of 1 metre ($1m^2 = 1m.1m$).

(c) Unit of volume: the cubic metre (symbol:m^3)

The cubic metre is the volume of a cube having a side of 1 metre ($1m^3 = 1m.1m.1m$)

(d) Unit of Frequency: the Hertz (symbol Hz).

The herz is the frequency of a periodic phenomenon of which the periodic time is 1 second.

$$(1Hz = 1\ s^{-1} = \frac{1}{1\ s}).$$

(e) Unit of Angular velocity: radian per second (symbol: rad/s or $rad.s^{-1}$).

The radian per second is the angular velocity of a body which, animated by a uniform rotation around a fixed axis, turns 1 radian in 1 second.

$$(1\ rad/s = \frac{1\ rad}{1\ s}).$$

(f) Unit of Angular acceleration: radian per second squared (symbol: rad $/s^2$ or $rad.s^{-2}$).

The radian per second squared is the angular acceleration of a body which is animated by a rotation varying uniformly around a fixed axis, and whose angular velocity varies by 1 radian per second in 1 second.

$$(1\ rad/s^2 = \frac{1\ rad/s}{1\ s}).$$

(g) Unit of speed: metre per second (symbol: m/s or $m.s^{-1}$).

The metre per second is the speed of a body which, animated by a uniform movement, covers 1 metre in 1 second.

$$(1\ m/s = \frac{1\ m}{1\ s}).$$

(h) Unit of Acceleration: metre per second squared (symbol:m/s^2 or $m.s^{-2}$).

The metre per second squared is the acceleration of a body, animated by a uniformly varied movement whose speed varies in 1 second by 1 metre per second.

$$(1\ m/s^2 = \frac{1m/s}{1\ s}).$$

2. Derived Units in relation to Mechanics.

(a) Unit of linear density: kilogram per metre (symbol: kg/m or $kg.m^{-1}$).

The kilogram per metre is the linear density of a homogeneous body of uniform section having a mass of 1 kilogram and a length of 1 metre

$$(1kg/m = \frac{1\ kg}{1\ m}).$$

(b) Surface density unit: kilogram per square metre (symbol: kg/m^2 or $kg.m^{-2}$).

The kilogram per square metre is the surface density of a homogeneous body of uniform thickness having a mass of 1 kilogram and an area of 1 square metre.

$$(1kg/m^2 = \frac{1\ kg}{1\ m^2}).$$

(c) Mass density unit: kilogram per cubic metre (symbol: kg/m^3 or $kg.m^{-3}$).

The kilogram per cubic metre is the density of a homogeneous body having a mass of 1 kilogram and a volume of 1 cubic metre.

$$(1kg/m^3 = \frac{1\ kg}{1\ m^3}).$$

(d) Force unit: newton (symbol:N).

The newton is the force which, when applied to a body having a mass of 1 kilogram, gives it an acceleration of 1 metre per second squared).

$(1\ N = 1\ kg.1\ m/s^2)$.

(e) The unit of movement of force shall be the metre newton.

(symbol: Nm).

The metre newton is the movement of force produced in a body by a force of one newton acting at a perpendicular distance of one metre from the fixed axis around which the body turns.

(f) Pressure, stress unit: pascal (symbol: Pa).

The pascal is the uniform pressure which, when acting on a plane surface of 1 square metre, exercises perpendicularly to that surface a total force of 1 newton.

It is also the uniform stress which, when acting on a plane surface of 1 square metre, exercises on that surface a total force of 1 newton.

$$(1\ Pa = \frac{1\ N}{1\ m^2}).$$

(g) Dynamic viscosity unit: pascal second (symbol: Pa.s).

The pascal second is the dynamic viscosity of a homogeneous fluid in which the uniform linear movement of a plane surface of 1 square metre leads to a retarding force of 1 newton, when there is a difference in velocity of 1 metre per second between two parallel planes separated by a distance of 1 metre.

$$(1\ \text{Pa.s} = \frac{1\ \text{Pa.1m}}{1\ \text{m/s}}).$$

(h) Kinematic viscosity unit: metre squared per second (symbol: m^2/s or $m^2.s^{-1}$).

The metre squared per second is the kinematic viscosity of a fluid whose dynamic viscosity is 1 pascal second and whose density is 1 kilogram per cubic metre.

$$(1\ \text{m}^2/\text{s.} = \frac{1\ \text{Pa.s}}{1\ \text{kg/m}^3}).$$

(i) Unit of surface tension (Coefficient of surface tension): newton per metre (symbol: N/m or $N.m^{-1}$).

The newton per metre is the surface tension produced when a force of 1 newton acts over a length of 1 metre on the surface of a liquid separating that liquid from the material surrounding it.

$$1\ \text{N/m}\ \frac{1\ \text{N}}{1\ \text{m}}).$$

(j) Work, Energy, Quantity or heat unit: joule (symbol: J).

The joule is the work done when the point of application of a force of 1 newton is displaced through a distance of 1 metre in the direction of the force.

(1 J = 1 N.1 m).

(k) Unit of power, radiant flux, heat flux: watt (symbol: W).

The watt is the power which produces energy equal to 1 joule per second.

$$(1\ \text{W} = \frac{1\ \text{J}}{1\ \text{s}}).$$

(l) Unit of volume flow: cubic metre per second (symbol: m^3/s or $m^3.s^{-1}$).

The cubic meter per second is the volume flow rate of a uniform flow such that a substance having a volume of 1 cubic metre passes through the cross section of the flow considered in 1 second.

$$(1\ \text{m}^3/\text{s} = \frac{1\ \text{m}^3}{1\ \text{s}}).$$

(m) Unit of Mass flow: kilogram per second (symbol: kg/s or $kg.s^{-1}$).

The kilogram per second is the mass flow rate of a uniform flow such that a substance having a mass of 1 kilogram passes through the cross section considered in 1 second.

$$(1\ kg/s = \frac{1\ kg}{1\ s}).$$

(n) Unit of specific volume: cubic metre per kilogram (symbol: m^3/kg or $m^3.kg^{-1}$).

The cubic metre per kilogram is the specific volume of a homogeneous body, having a volume of 1 cubic metre and a mass of 1 kilogram.

$$(1\ m^3/kg = \frac{1\ m^3}{1\ kg}).$$

3. Derived units relating to heat.

(a) Entropy and heat capacity unit:joule per kelvin (J/K or $J.K^{-1}$).

The joule per kelvin is the increase in the entropy of a system receiving a quantity heat of 1 joule at the constant thermodynamic temperature of 1 kelvin, provided that no irreversible change takes place in the system.

The joule per kelvin is also the heat capacity of a homogeneous body in which the addition of a quantity of heat of 1 joule produces a rise in thermodynamic temperatures of 1 kelvin.

$$(1\ J/K = \frac{1J}{1K}).$$

(b) Specific entropy, specific heat capacity unit: joule per kilogram kelvin (symbol:J/(kg.K) or $J.kg^{-1}.K^{-1}$).

The joule per kilogram kelvin is the specific heat capacity of a homogeneous body having a mass of 1 kilogram in which the addition of a quantity of heat of 1 joule produces a rise in temperature per 1 kelvin.

The joule per kilogram kelvin is also the specific entropy of a system having a homogeneous mass of 1 kilogram which receives a quantity of heat of 1 joule at the constant thermodynamic temperature of 1 kelvin, provided that no irreversible change takes place in the system.

$$(1J/(kg.K) = \frac{1J}{1kg.1K}).$$

(c) Unit of specific energy:joule per kilogram (symbol:J/kg or $J.kg^{-1}$).

The joule per kilogram is the specific energy of a system having a homogeneous mass of 1 kilogram and internal energy of 1 joule .

$$(1J/kg) = \frac{1\ J}{1\ kg}).$$

(d) Unit of thermal conductivity: watt per metre kelvin (symbol: W/(m.K) or $W.m^{-1}.K^{-1}$).

The watt per metre kelvin is the thermal conductivity of a homogeneous body in which a difference of temperature of 1 kelvin between two parallel planes having a surface of 1 square metre and which are 1 metre apart produces between these planes a heat flow rate of 1 watt.

$$(1\ W/(m.K) = \frac{1W/m^2}{1K/1m}).$$

(e) Unit of energy density: joule per cubic metre (symbol:J/m^3 or $J.m^{-3}$).

The joule per cubic metre is the density energy of a system of homogeneous mass having a volume of 1 cubic metre and radiation energy of 1 joule.

$$(1\ J/m^3 = \frac{1\ J}{1m^3}).$$

(f) Unit of heat flux density : watt per square metre (symbol: W/m^2 or $W.m\text{-}^2$).

The watt per square metre is the density of heat flux of a surface having an area of 1 square metre which radiates energy at the rate of 1 joule per second.

$$(1\ W/m^2 = \frac{1\ W}{1\ m^2}).$$

4. Derived units relating to Electricity and Magnetism.

(a) Unit of Quantity of electricity,electric charge: coulomb (symbol:C)

The coulomb is the quantity of electricity carried in 1 second by a current of 1 ampere.

(1C = 1 A.1 s = 1 A.s).

(b) Unit of electric charge density: coulomb per square metre (symbol: C/m^3 or $C.m^{-3}$).

The coulomb per cubic metre is the density of electric charge of a homogeneous mass or system having a volume of 1 cubic metre and a charge of 1 coulomb.

$$(1\ C/m^3 = \frac{1\ C}{1\ m^3}).$$

(c) Unit of electric flux density: coulomb per square metre. (symbol: C/m^2 or $C.m^{-2}$). The coulomb per square metre is the electric flux density when a condenser having plates of infinite length parallel to each other is charged in vacuum with a quantity of electricity equal to 1 coulomb per 1 square metre of area of the plates.

$$1\ C/m^2 = \frac{1\ C}{1\ m^2}).$$

(d) Unit of electric potential, electric tension, electromotive force: volt (symbol: V).

The volt is the difference of electric potential between two points of a conducting wire carrying a constant current of 1 ampere, when the power dissipated between these two points is equal to 1 watt.

$$(1\ V = \frac{1\ W}{1\ A}).$$

(e) Unit of electric field strength: volt per metre (symbol: V/m).

The volt per metre is the strength of the electric field which exercises a force of 1 newton on a body charged with a quantity of electricity of 1 coulomb.

$$1\ V/m = \frac{1\ N}{1\ C}).$$

(f) Unit of electric resistance: ohm (symbol: Ω).

The ohm is the electric resistance between two points of a conductor when a constant potential difference of 1 volt, applied to these points, produces in the conductor a current of 1 ampere, the conductor not being the seat of any electromotive force.

$$(1\Omega = \frac{1\ V}{1\ A}).$$

(g) Unit of conductance: siemens (symbol:S).

The siemens is the conductance of a conductor having an electric resistance of 1 ohm.

$$(1\ S = 1\Omega^{-1} = \frac{1}{1\Omega}).$$

(h) Unit of electric capacitance: farad (symbol:F).

The farad is the capacitance of a capacitor between the plates of which there appears a difference of electric potential of 1 volt, when it is charged by a quantity of electricity of 1 coulomb.

$$(1\ F = \frac{1\ C}{1\ V}).$$

(i) Unit of permittivity: farad per metre (symbol: F/m or $F.m^{-1}$).

The farad per metre is the permittivity of the medium which gives a capacitance of 1 farad per square metre of area of two parallel plates separated by a distance of 1 metre.

(j) Unit of inductance: henry (symbol: H).

The henry is the electric inductance of a closed circuit in which an electromotive force of 1 volt is produced when the electric current in the circuit varies uniformly at the rate of 1 ampere per second.

$$(1\ H = \frac{1\ V.1s}{1\ A}).$$

(k) Unit of permeability: henry per metre (symbol: H/m or $H.m^{-1}$).

The henry per metre is the permeability of a material surrounded by a single term of flat sheet conductor including an area of 1 square metre and length 1 metre which gives an inductance of one henry.

(l) Unit of magnetic flux, magnetic induction flux: weber (symbol: Wb).

The weber is the magnetic flux which, linking a circuit of 1 turn, would produce in it an electromotive force of 1 volt, if it were reduced to zero at a uniform rate in 1 second.

(1 Wb = 1 V.1s).

(m) Unit of magnetic induction, magnetic flux density: tesla (symbol: T).

The tesla is the uniform magnetic induction, which, distributed normally over a surface of 1 square metre, produces across the surface a total magnetic flux of 1 weber.

$$(1\ \mathrm{T} = \frac{1\ \mathrm{Wb}}{1\ \mathrm{m}^2}).$$

(n) Unit of Magnetomotive force: ampere (symbol: A).

The ampere is the magnetomotive force along any closed curve which surrounds once only an electric conductor through which an electric current of 1 ampere passes.

(o) Unit of Magnetic field strength: ampere per metre (symbol: A/m or $A.m^{-1}$).

The ampere per metre is the strength of the magnetic field produced in vacuum along the circumference of a circle of 1 metre circumference, by an electric current of 1 ampere maintained in a straight conductor of infinite length, of negligible circular cross section, forming the axis of the circle mentioned.

$$(1\ \mathrm{A/m} = \frac{1\ \mathrm{A}}{1\ \mathrm{m}}).$$

(p) Unit of current density: ampere per square metre (symbol: A/m^2 or $A.m^{-2}$).

The ampere per square metre is the current density in a linear conductor when a current of intensity 1 ampere flows uniformly through a cross section of the conductor equal to 1 square metre perpendicular to the direction of flow of the current.

$$(1\ \mathrm{A/m^2} = \frac{1\ \mathrm{A}}{1\ \mathrm{m}^2}).$$

5. Derived units relating to Physical Chemistry and Molecular Physics.

(a) Unit of concentration (of amount of substance): the mole per cubic metre (symbol: mol/m^3 or $mol.m^{-3}$).

The mole per cubic metre is the concentration of a homogeneous substance having a total volume of 1 cubic metre and containing

1 mole of the given body.

$$(1\ \text{mol/m}^3 = \frac{1\ \text{mol}}{1\ \text{m}^3}).$$

(b) Unit of molar mass: kilograms per mole (symbol: kg/mol or kg.mol^{-1}).

The kilogram per mole is the molar mass of a homogeneous substance whose mass of 1 kilogram has a substance of 1 mole.

$$(1\ \text{kg/mol} = \frac{1\ \text{kg}}{1\ \text{mol}}).$$

(c) Unit of molar energy: joule per mole (symbol: J/mol or J.mol^{-1}).

The joule per mole is the molar energy of 1 mole of substance having the energy of 1 joule.

$$(1\ \text{J/mol} = \frac{1\ \text{J}}{1\ \text{mol}}).$$

(d) Unit of molar entropy, molar heat capacity:joule per mole kelvin (symbol: J/mol.K) or J.mol^{-1}.K^{-1}).

The joule per mole kelvin is the molar entropy of a system of homogeneous mass having a substance equal to one mole receiving a quantity of heat equal to one joule at the constant thermodynamic temperature of one kelvin, provided that no irreversible change takes place in the system.

The joule per mole kelvin is the molar heat capacity of a homogeneous body having an amount of substance equal to one mole, in which a quantity of heat equal to one joule produces an increase of one kelvin in the thermodynamic temperature.

$$(1\ \text{J/(mol.K)} = \frac{1\ \text{J}}{1\ \text{mol}.1\ \text{K}}).$$

6. Derived units relating to Radiation and Light.

(a) Unit of Radiant intensity: watt per steradian (symbol: W/sr or W.sr^{-1}).

The watt per steradian is the radian intensity of a point source sending uniformly a radiant flux of 1 watt in a solid angle of 1 steradian.

$$(1\ \text{W/sr} = \frac{1\ \text{W}}{1\ \text{sr}}).$$

(b) Unit of irradiance: watt per square metre. (symbol: W/m^{-2} or W.m^{-2}).

The watt per square metre is the irradiance produced by a radiant flux of 1 watt distributed uniformly over an element having a surface of 1 square metre and containing the point source.

$$(1\ \text{W/m}^2 = \frac{1\ \text{W}}{1\ \text{m}^2}).$$

(c) Unit of radiance: watt per square metre steradian (symbol: $W/(m^2.sr)$ or $W.m^{-2}.sr^{-1}$).

The watt per square metre steradian is the radiance of a source radiating one watt per steradian per square metre of projected area.

$$(1\ W/(m^2.sr) = \frac{1\ W}{1m^2.1sr}).$$

(d) Unit of luminance: candela per square metre (symbol: cd/m^2 or $cd.m^{-2}$).

The candela per square metre is the luminance perpendicular to the plane surface of 1 square metre of a source of which the luminous intensity perpendicular to that surface is 1 candela.

$$(1cd/m^2 = \frac{1\ cd}{1\ m^2}).$$

(e) Unit of luminous flux: lumen (symbol: lm).

The lumen is the luminous flux emitted in the unit solid angle (steradian) by a uniform point source having a luminous intensity of 1 candela.

(1 lm = 1 cd.1 sr)

(f) Unit of illuminance: lux (symbol: lx).

The lux is the illuminance of a surface receiving a luminous flux of 1 lumen uniformly distributed over 1 square metre of the surface.

$$(1\ lx = \frac{1\ lm}{1\ m^2}).$$

7. Derived units relating to ionizing radiations.

(a) Unit of activity (of a radioactive source) becquerel (symbol: Bq).

The becquerel is the activity of a radioactive source in which one nuclear transformation or transition recurs per second.

$$(1\ Bq = \frac{1}{1\ s}).$$

(b) Unit of absorbed dose: (gray) (symbol: Gy).

The gray is the dose absorbed in an element of matter of 1 kilogram mass to which the energy of 1 joule is imparted by ionizing radiations whose energy fluence (energy flux density) is constant.

$$(1\ Gy = \frac{1\ J}{1kg}).$$

(c) Unit of dose equivalent: (sievert) (symbol: Sv).

The sievert is the dose equivalent which is produced by carrying energy of 1 joule into a body having a mass of 1 kilogram by ionizing radiation of a uniform intensity.

$$(1\ Sv = \frac{1\ J}{1\ kg}).$$

(d) Unit of exposure dose: coulomb per kilogram (symbol: C/kg or $C.kg^{-1}$).

The coulomb per kilogram is the exposure of a photonic ionizing radiation which can produce in a quantity of air of 1 kilogram mass, positive or negative ions carrying a total electric charge of 1 coulomb, the energy fluence being uniform in the quantity of air considered.

$$(1\ C/kg = \frac{1\ C}{1\ kg}).$$

PART IV
SPECIAL UNITS

1.Plane angle units:

(a) Revolution (turn) = 2π rad.

(b) Degree (symbo l: °)= $\frac{\pi}{180}$ rad.

(c) Minute (symbol:') = $(\frac{1}{60})^\circ = \frac{\pi}{10\ 800}$ rad.

(d) Second (symbol :") $=(\frac{1}{60})' = \frac{\pi}{648\ 000}$ rad.

2. Vergence of optical systems unit: diopter = $1m^{-1}$.

3. Unit of length: Nautical mile (international) = 1 852m.
The use of this unit is authorised only in marine and aerial navigation.

4. Unit of area of farmland and estates:

(a) are (symbol: a)= 100 $m^2=10^2\ m^2$

(b) decare (symbol: daa)= 1 000 $m^2=10^3\ m^2$

(c) hectare (symbol: ha)= 10 000 $m^2 = 10^4\ m^2$.

5. Unit of volume: Litre: (symbol: l or L) = 1 $dm^3 = 10^{-3}m^3$, and the multiples and submultiples of the litre formed in accordance with Part V of the Schedule hereto.

6. Units of time:

(a) minute (symbol: min) = 60 s.

(b) hour (symbol: h) = 60 min = 3600 s.

(c) day (symbol: d) = 24 h = 86 400 s

(d) week, month and year of the Gregorian calendar.

7. Unit of speed:

$$\text{Knot} = 1 \text{ nautical mile per hour} = \frac{1\,852}{3\,600}\text{m/s.}$$

The use of this unit is authorised only in marine and aerial navigation.

8. Units of mass:

(a) tonne (symbol: t) = 1 Mg = 10^3 kg, and the multiples of the tonne formed in accordance with Part V of the Schedule hereto.

(b) unit of atomic mass: (symbol : u). The atomic mass unit is equal to the fraction of 1/12 of the mass of an atom of the nuclide ^{12}C.

Approximative value: 1 u = 1,660 57 x 10^{-27}kg.

Its use is authorised only in Chemistry and Physics.

(c) metric carat (symbol: ct). 1 ct = 0,000 2 kg = 2 x 10^{-4} kg. Its use is authorised only for measuring the mass of precious stones.

9. Unit of linear density of fibres and textiles:
tex (symbol: tex) = 1 g/km = 10^{-6} kg/m,
and the multiples and submultiples of the tex formed in accordance with Part V of the Schedule hereto.

10. Unit of Pressure of fluids:
Bar (symbol: bar) = 100 000 Pa = 10^5Pa,
and the multiples and submultiples of the bar formed in accordance with Part V of the Schedule hereto.

11. Units of Work, Energy, Quantity of heat:

(a) watt hour (symbol: Wh) = 3,6 x 10^3J, and the multiples and submultiples of the watt hour formed in accordance with Part V of the Schedule hereto.

(b) electron volt (symbol: eV), and the multiples and submultiples of the electron volt formed in accordance with Part V of the Schedule hereto.

The electron volt is equal to the kinetic energy acquired by an electron in passing through a potential difference of 1 volt in vacuum.
Approximative value: 1 eV = 1,602 19 x 10^{-19} J.

The use of this unit is authorised only in specialised fields of scientific research.

12. Power units:

(a) Voltampere (symbol: VA) = 1 W, and the multiples and submultiples of the voltampere formed in accordance with Part V of the Schedule hereto.

The use of this unit is authorised only for the measurement of the apparent power of alternating electric current.

(b) Var (symbol: var) = 1 W, and the multiples and submultiples of the var formed in accordance with Part V of the Schedule hereto.

The use of this unit is authorised only for the measurement of wattless electric power.

PART V
SI PREFIXES AND RULES OF USE OF SI PREFIXES

1. SI Prefixes

(a) Multiples

NUMERICAL FACTOR by which the unit is multiplied	**PREFIX** which is placed before the name of the unit	**SYMBOL** which is placed before the symbol of the unit
1 000 000 000 000 000 000 = 10^{18}	exa	E
1 000 000 000 000 000 = 10^{15}	peta	P
1 000 000 000 000 = 10^{12}	tera	T
1 000 000 000 = 10^{9}	giga	G
1 000 000 = 10^{6}	mega	M
1 000 = 10^{3}	kilo	k
100 = 10^{2}	hecto	h
10 = 10^{1}	deca	da

(b) Submultiples

NUMERICAL FACTOR by which the unit is multiplied	**PREFIX** which is placed before the name of the unit	**SYMBOL** which is placed before the symbol of the unit
0,1=10^{-1}	deci	d
0,01=10^{-2}	centi	c
0,001=10^{-3}	milli	m
0,000 001=10^{-6}	micro	μ
0,000 000 001=10^{-9}	nano	n
0,000 000 000 001=10^{-12}	pico	p
0,000 000 000 000 001=10^{-15}	femto	f
0,000 000 000 000 000 001=10^{-18}	atto	a

2. Combination of symbol prefix with unit symbol.

(1) The prefix symbol shall be placed before the unit symbol without intermediate space or full stop and such combination shall form the symbol of the multiple and submultiple of the unit.

(2) The combination referred to in sub-paragraph (1) shall be deemed

to form a new symbol of the unit which can be raised to a positive or negative power and which can be combined with other unit symbols to form the symbols for compound units.

(3) To designate the decimal multiples and submultiples of a derived unit which is expressed in the form of a fraction, a prefix can be attached to the units which appear either in the numerator or in the denominator or in both of these terms.

3. Avoidance of errors.

For the avoidance of errors in the calculations -

(a) every physical quantity shall be expressed in SI units; and

(b) the prefixes of units shall be replaced by powers of 10.

4. Exponents.

Whenever the symbol of a multiple or submultiple of a unit carries an exponent, such exponent shall be deemed to refer not only to the part of the symbol which determines the unit but to the total of the symbol; for example,

$$1\ \mathrm{cm}^2 = (\mathrm{cm})^2 = 10^{-4}\ \mathrm{m}^2 \text{ and } 1\ \mathrm{cm}^{-1} = (\mathrm{cm})^{-1} = 10^2\ \mathrm{m}^{-1}.$$

5. Compound units.

(1) Compound units can be formed by the combination of the units prescribed in these Regulations.

(2) To designate multiples and submultiples of a compound unit only one prefix shall be used and compound prefixes that is prefixes which are formed by the juxtaposition of more than one of the prescribed prefixes shall not be used; for example nm and not mμm shall be written.

6. Use of prefixes with the unit of mass.

The names and symbols of decimal multiples and submultiples of the unit of mass shall be designated by the addition of prefixes to the word "gram" and the symbols thereof in the symbol "g"; for example milligram (mg), microgram (g), megagram (Mg).

7. Writing of unit symbols.

(1) The symbols of units shall -

(a) remain unchanged in the plural;

(b) not be followed by a full stop, other than at the end of the sentence; and

(c) be placed after the complete numerical value in the expression of a quantity leaving a space between the numerical value and the unit.

(2) The symbol of units, other than the symbol of ohm, which is the capital Greek letter Ω, shall be written in small latin letters unless they originate from principal names in which case their initial letter shall be written in a capital latin letter.

8. Multiplication of units.

Whenever a compound unit is formed by the multiplication of two or more units, the multiplication shall be indicated by a full stop as a sign of the multiplication:

Provided that such full stop may be omitted where no confusion with another unit symbol is possible; for example the newton measure may be expressed N.m or Nm but not mN which symbolises the millinewton.

9. Division of units.

(1) Whenever a compound unit is formed by dividing one unit by another, the division shall be indicated by either an oblique (/) or a horizontal line (-) or negative powers for example the metre per second may be expressed as m/s, $\frac{m}{s}$ or $m.s^{-1}$.

(2) In no case shall there be included on the same line more than one oblique, unless brackets are used to avoid confusion and in complicated cases negative powers or brackets shall be used; for example the metre per second to the square may be expressed as m/s^2, (m/s)/s or $m.s^{-2}$, but not as m/s/s, and the volt per metre, a unit of intensity of an electric field, expressed in base SI units, may be expressed as $m.kg/(s^3.A)$ or $m.kg.s^{-3}.A^{-1}$, but not as $m.kg/s^3/A$.

10. Expression of measurement results.

The appropriate integers and the decimal multiples and submultiples by which a unit is expressed shall be selected in such a manner that the numerical value of the unit shall be between 0,1 and 1 000; for example $1{,}2X10^4$ N may be written as 12 kN, 0,003 94 m may be written as 3,94 mm, 1 401 Pa may be written as 1,401 kPa and $3{,}1 \text{ X } 10^{-8}$ may be written as 31 ns.

SECOND SCHEDULE

(Regulation 5)

MANNER IN WHICH CERTAIN NUMBERS SHALL BE EXPRESSED IN WORDS.

First Column	Second Column
1 000 or 10^3	One thousand
10 000 or 10^4	Ten thousand
100 000 or 10^5	One hundred thousand
1 000 000 or 10^6	One million
10 000 000 or 10^7	Ten millions
100 000 000 or 10^8	One hundred millions
1 000 000 000 or 10^9	One thousand millions
10 000 000 000 or 10^{10}	Ten thousand millions
100 000 000 000 or 10^{11}	One hundred thousand millions
1 000 000 000 000 or 10^{12}	One billion
10 000 000 000 000 or 10^{13}	Ten billions
100 000 000 000 000 or 10^{14}	One hundred billions
1 000 000 000 000 000 or 10^{15}	One thousand billions
10 000 000 000 000 000 or 10^{16}	Ten thousand billions
100 000 000 000 000 000 or 10^{17}	One hundred thousand billions
1 000 000 000 000 000 000 or 10^{18}	One trillion

Provided that in order to express the powers of 10, from 10^{12} and above, the formula 10^{6N} = (n) - one million may be used, where n represents the arithmetic adverbs of the numbers N=2,3 4 and so on (for example 10^{12} = one billion, 10^{18} = one trillion, 10^{24} = quadrillion, 10^{30} = centillion etc.)

THIRD SCHEDULE

(Regulation 6)

CO-EFFICIENTS

1. Alcoholic strengths.

(a) Alcoholic strength by volume (symbol: % vol.)
The alcoholic strength by volume of a mixture of water and alcohol is the ratio of the volume of alcohol, measured at 20°C, contained in the mixture to the total volume of the mixture, measured at the same temperature.

(b) Alcoholic strength by mass (symbol: % mass).
The alcoholic strength by mass of a mixture of water and alcohol is the ratio of the mass of alcohol contained in the mixture to the total mass of the mixture.

(c) For the purpose of the inter-relation between these two strengths and between the density of aqueous solution of alcohol, the International Recommendation No. 22 on Alcoholometry together with the International Alcoholometric Tables shall be used.

2. Hardness of materials.

(a) Brinell hardness number.
The Brinell hardness number is a number related to the size of the permanent impression made by a ball indenter of specified size, pressed into the surface of the material under a specified load. The surface area of the impression is determined from the average measured diameter of the rim of the impression and from the ball diameter.

(b) Vickers hardness number.

The Vickers hardness number is a number obtained by dividing the load in kilograms applied to a square-based pyramidal diamond indenter having included face angles of 136° by the surface area of the impression calculated from the measured diagonal impression.

(c) Rockwell hardness number.
The Rockwell hardness number is a number derived from the net increase in depth of impression as the load on an indenter is increased from a fixed minimum load to a high load and then returned to the minimum load.

3. Sugar strengths.

For the purpose of determining the sugar strength in sucrose solutions one of the following co-efficients may be used:-

(a) Degree Brix.
Degree Brix is the percentage of sucrose present by mass in a pure sugar solution at a temperature of 20°C.

(b) International Sugar Degree (symbol:°S).
The point 100°S on the International Sugar Scale corresponds to an optical rotation $(40,765 \pm 0,001)^\circ$ sustained by the polarised light of the green line of mercury isotope - 198 (wave-length = 546,227 1 nm in vacuum) on traversing the length of 200,000 mm of a solution of sugar in pure water, kept at a temperature of 20,00°C and containing 26,016 0 g, of pure sucrose when

weighed in vacuum to make 100,000 cm^3 of solution ("normal" sugar solution).

The point 100°S on the International Sugar Scale also corresponds to an optical rotation (34,616± 0,001)° sustained by the polarised light of the yellow line of sodium (wavelength = 589,440 0 nm in vacuum) on traversing the length of 200,000 mm of a solution of sugar in pure water, kept at a temperature of 20,00°C and containing 26,016 0 g, of pure sucrose when weighed in vacuum to make 100,000 cm^3 of solution ("normal" sugar solution).

Note:- A mass of 26,016 0 g of sucrose corresponds to 26,000 g when this sucrose is weighed in air with a density of 8 000 kg/m^3 in air at a standard pressure of 101,325 kPa, at a temperature of 20°C and a relative humidity of 50%, the density of this air therefore being 1,2 kg/m^3.

4. Relative humidity (symbol: RH)

The relative humidity is the ratio of the actual vapour pressure of water vapours present in the air at the temperature of measurement to the saturation vapour pressure over a plane liquid water surface at the same temperature.

5. pH value of a water solution.

pH value is the negative logarithm to the base 10 of the inverse of the hydrogen ion concentration in a dilute ionic solution, that is, pH = $-\lambda o\gamma_{10}$ (H^+) where (H^+) is the concentration of hydrogen ions in moles per litre (for example, a solution of hydrochloric acid with a concentration of 0,14 mol/L has a pH value= $-\lambda o\gamma_{10}$ (0,14)=0,853 87).

FOURTH SCHEDULE

(Regulation 7)

FUNDAMENTAL PHYSICAL CONSTANTS

Quantity	Symbol	Numerical Value	Uncertainty (part per million)
Speed of light in vacuum	c	2,997 924 58(1,2) X10^8 $m.s^{-1}$	0,004
Permeability of vacuum	π	$4\mu_o$X10^{-7} $H.m^{-1}$ =12,566 370 614 4 X10^{-7} $H.m^{-1}$	
Permittivity of vacuum	$\varepsilon_o=1/\mu_o c^2$	8,854 187 818 (71) X10^{-12} $F.m^{-2}$	0,008
Fine-structure constant	a	7,297 350 6(60) X10^{-3}	0,82
	1/a	137,036 04(11)	0,82
Elementary electrical charge	e	1,602 189 2(46) X10^{-19}C	2,9
Planck constant	h	6,626 176(36) X10^{-34} J.s	5,4

Quantity	Symbol	Numerical Value	Uncer-tainty (part per million)
Avogadro constant	N_A	6,022 045(31) $X10^{23}mol^{-1}$	5,1
Electron rest mass	m_e	9,109 534(47) $X10^{-31}kg$	5,1
Proton rest mass	m_p	1,672 648 5(86) $X10^{-27}kg$	5,1
Ratio of proton mass to electron mass	m_p/m_e	1 836,151 52(70)	0,38
Newton rest mass	m_n	1,674 954 3(86) $X10^{-27}kg$	5,1
Electron charge to mass ratio	e/m_e	1,758 804 7(49) $X10^{11}$ $C.kg^{-1}$	2,8
Josephson frequency voltage ratio	2e/h	4,835 939(13) $X10^{14}Hz.V^{-1}$	2,6
Faraday constant	$F=N_Ae$	9,648 456(27) $X10^4C.mol^{-1}$	2,8
Rydberg constant	R_∞	1,097 373 177(83) $X10^7$ m^{-1}	0,075
Bohr radius	$a_o=a/4\pi R_\infty$	5,291 770 6(44) $X10^{-11}m$	0,82
Classical electron radius	$r_e=\mu_o e^2/4\pi m_e$	2,817 938 0(70) $X10^{-15}m$	2,5
Bohr Magneton	$\mu_B=eh/4\pi m_e$	9,274 078(36) $X10^{-24}J.T^{-1}$	3,9
Electron magnetic movement	μ_e	9,284 832(36) $X10^{-24}J.T^{-1}$	3,9
Gyromagnetic ratio of protons in water	γ_p	2,675 130 1(75) $X10^8 s^{-1}.T^{-1}$	2,8
Gyromagnetic ratio of protons(corrected)	γ_p	2,675 198 7(75) $X10^8 s^{-1}.T^{-1}$	2,8
Magnetic flux quantum	$\Phi_o=h/2e$	2,067 850 6(54) $X10^{-1}Wb$	2,6
Proton magnetic moment	μ_p	1,410 617 1(55) $X10^{-26}J.T^{-1}$	3,9
Ratio of electron and proton magnetic moments	μ_e/μ_p	658,210 688 0(66)	0,010
Nuclear magneton	$\mu_N=eh/4\pi m_p$	5,050 824(20) $X10^{-27}J.T^{-1}$	3,9
Muon rest mass	m_μ	1,883 566(11) $X10^{-28}kg$	5,6

Quantity	Symbol	Numerical Value	Uncertainty (part per million)
Muon magnetic moment	μ_μ	4,490 474(18) $X10^{-26}J.T^{-1}$	3,9
Ratio of muon and proton magnetic moments	μ_μ/μ_p	3,183 340 2(72)	2,3
Ratio of muon mass to electron mass	m_μ/m_e	206,768 65(47)	2,3
Compton wave length of the electron	$\lambda_C=h/m_eC$ $=a^2/2R_\infty$	2,426 308 9(40) $X10^{-12}m$	1,6
Compton wave length of the proton	$\lambda_{C,p}=$ h/m_pC	1,321 409 9(22) $X10^{-15}m$	1,7
Compton wave length of the neutron	$\lambda_{C,n}=$ h/m_nC	1,319 590 9(22) $X10^{-15}m$	1,7
Molar volume of ideal gas at s.t.p.	V_m	22,413 83(70) $X10^3m^3.mol^{-1}$	31
Molar gas constant	$R=V_mP_o/T_o$	8,314 41(26) $J.mol^{-1}.K^{-1}$	31
(T_o=273,15K, P_o=101,325kPa			
Boltzmann constant	$k=R/N_A$	1,380 662(44) $X10^{-23}J.K^{-1}$	32
Stefan-Boltzman constant	σ	5,670 32(71) $X10^{-8}W.m^{-2}.K^{-4}$	125
First radiation constant	$c_1=2\pi hc^2$	3,741 832(20) $X10^{-16}W.m^2$	5,4
Second radiation constant	$c_2=hc/k$	1,438 786(45) $X10^{-2}m.K$	31
Gravitational constant	G	6,672 0(41) $X10^{-11}m^3.s^{-2}$.kg-1	615
Standard acceleration of gravity	g	9,806 65 m/s^2	
Atmospheric pressure	Po	1,013 $25X10^5Pa$	

Dated this 9th day of November, 1993.

By the Administrator's Command,
G.L. JONES,
Chief Officer,
Sovereign Base Areas.

(105/14)

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