Sistema mks y cgs pdf

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de 2015. Un sistema de Unidades es un conjunto de unidades de medida a partir de las cuales se deriva el resto. Existema métrico y el más usado en la actualidad.
Sus unidades básicas son: el metro, el kilogramo, el segundo, el amperio, el kelvin, la candela y el mol. Las demás unidades són: el metro y el kilogramo. Sistema Cegesimal de Unidades (CGS): denominado así porque sus unidades básicas
son el centímetro, el gramo y el segundo. Fue creado como ampliación del sistema métrico para usos científicos. Sistema Matural: en el cual las unidades se escogen de forma que ciertas constantes físicas valgan exactamente la unidades se escogen de forma que ciertas constantes físicas valgan exactamente la unidades se escogen de forma que ciertas constantes físicas valgan exactamente la unidades como ampliación del sistema métrico con unidades creadas para usos técnicos y basadas en
el anterior. Este sistema está en desuso. Sistema Anglosajón de Unidades: es el sistema anglosajón de Unidades: es el sistema anglosajón tradicional. En 1824 fue normalizado en el Reino Unido con el nombre de Sistema Imperial, cuyo uso se mantiene en la vida corriente de este país, También fue normalizado en el Reino Unido, con el nombre de Sistema Imperial, cuyo uso se mantiene en la vida corriente de este país, También fue normalizado en el Reino Unido, con el nombre de Sistema Imperial, cuyo uso se mantiene en la vida corriente de este país, También fue normalizado en el Reino Unido con el nombre de Sistema Imperial, cuyo uso se mantiene en la vida corriente de este país, También fue normalizado en el Reino Unido con el nombre de Sistema Imperial, cuyo uso se mantiene en la vida corriente de este país, También fue normalizado en el Reino Unido con el nombre de Sistema Imperial, cuyo uso se mantiene en la vida corriente de este país, También fue normalizado en el norm
este último solo se utiliza como sistema legal en Estados Unidos y en Liberia. Sistema MKS de Unidades expresa las medidas utilizando como unidades fundamentales metro, kilogramo y segundo (MKS). El sistema MKS de unidades fundamentales metro, kilogramo y segundo (MKS). El sistema MKS de unidades fundamentales metro, kilogramo y segundo (MKS). El sistema MKS de unidades fundamentales metro, kilogramo y segundo (MKS). El sistema MKS de unidades fundamentales metro, kilogramo y segundo (MKS). El sistema MKS de unidades fundamentales metro, kilogramo y segundo (MKS). El sistema MKS de unidades fundamentales metro, kilogramo y segundo (MKS) a fundamentales metro, kilogramo y segundo (MKS). El sistema MKS de unidades fundamentales metro, kilogramo y segundo (MKS) a f
estos sistemas, existen unidades prácticas usadas en diferentes campos y ciencias. Algunas de ellas son: Unidades de medida de energía Véase también Factor de conversión Quantity calculus Número adimensional Magnitud adimensional Magnitud física Conferencia General de
Pesas y Medidas Convención del Metro Datos: Q932268 Multimedia: Systems of units / Q932268 Obtenido de « Modern form of the metric system "SI" redirects here. For other uses, see Si (disambiguation). SI defining constants Symbol Defining Constant Symbol Defining constant Symbol Defining constant Symbol
299792458 m/s h Planck constant 6.62607015×10-34 J·s e elementary charge 1.602176634×10-19 C k Boltzmann constant 1.380649×10-23 J/K NA Avogadro constant 6.02214076×1023 mol-1 Kcd luminous efficacy of 540 THz radiation 683 lm/W SI base units Symbol Name Quantity s second time m metre length kg kilogram mass A ampere
electric current K kelvin thermodynamic temperature mol mole amount of substance cd candela luminous intensity The International System of Units, known by the international abbreviation SI[a] in all languages[1]:125[2]:iii[3] and sometimes pleonastically as the SI system, [b] is the modern form[1]:117[6][7] of the metric system[g] and the world's
most widely used system of measurement.[1]:123[9][10] Established and maintained[11] by the General Conference on Weights and Measures[j] (CGPM[k]), it is the only system of measurement with an official status[m] in nearly every country in the world,[n] employed in science, technology, industry, and everyday commerce. The SI comprises a
coherent[o] system of units of measurement starting with seven base units, which are the second (symbol s, the unit of time), metre (m, length), kilogram (kg, mass), ampere (A, electric current), kelvin (K, thermodynamic temperature), mole (mol, amount of substance), and candela (cd, luminous intensity). The system can accommodate coherent units
for an unlimited number of additional quantities. These are called coherent derived units, which can always be represented as products of powers of the base units.[p] Twenty-two coherent derived units with special names and symbols may
be used in combination to express other coherent units.[r] Since the sizes of coherent units will be convenient for only some applications and not for others, the SI provides twenty additional (non-coherent) SI units for the same quantity; these non-
coherent units are always decimal (i.e. power-of-ten) multiples and sub-multiples and the precision of measurements improves. Since
2019, the magnitudes of all SI units have been defining constants have certain exact numerical values when expressed in terms of their SI units. These defining constants have been defined by declaring that seven defining constants have certain exact numerical values when expressed in terms of their SI units. These defining constants have been defined by declaring that seven defining constants have certain exact numerical values when expressed in terms of their SI units.
Boltzmann constant k, the Avogadro constant NA, and the luminous efficacy Kcd. The nature of the defining constants ranges from fundamental constant Kcd. Prior to 2019, h, e, k, and NA were not defined a priori but were rather very precisely measured quantities. In 2019, their values were fixed
by definition to their best estimates at the time, ensuring continuity with previous definitions of the base units. The current way of definitions of the units are separated conceptually from the definitions. A consequence is that as
science and technologies develop, new and superior realisations may be introduced without the need to redefine the unit. One problem with artefacts is that they can be lost, damaged, or changed; another is that they introduced without the need to redefine the unit. One problem with artefacts is that they can be lost, damaged, or changed; another is that they introduced without the need to redefine the unit.
International Prototype of the Kilogram, a cylinder of platinum-iridium. The original motivation for the development of the SI was the diversity of units that had sprung up within the centimetre-gram-second (CGS) systems (specifically the inconsistency between the systems of electrostatic units and electromagnetic units) and the lack of coordination
between the various disciplines that used them. The General Conference on Weights and Measures (French: Conférence générale des poids et mesures - CGPM), which was established by the Metre Convention of 1875, brought together many international organisations to establish the definitions and standards of a new system and to standardise the
rules for writing and presenting measurements. The system was published in 1960 as a result of an initiative that began in 1948, so it is based on the metre-kilogram-second system of units (MKS) rather than any variant of the CGS. Introduction Countries using the metric (SI), imperial, and US customary systems as of 2019. The International System
of Units, or SI,[1]:123 is a decimal[v] and metric[w] system of units established in 1960 and periodically updated since then. The SI has an official status in most countries are amongst a handful of nations that, to various degrees, also continue to use
their customary systems. Nevertheless, with this nearly universal level of acceptance, the SI "has been used around the world as the preferred system of units, the basic language for science, technology, industry and trade."[1]:123 The only other types of measurement system that still have widespread use across the world are the Imperial and US
customary measurement systems,[z] and they are legally defined in terms of the SI.[aa] There are other, less widespread systems of measurement that are occasionally used in particular regions of the world. In addition, there are many individual non-SI units that don't belong to any comprehensive system of units, but that are nevertheless still
regularly used in particular fields and regions. Both of these categories of unit are also typically defined legally in terms of SI units.[ab] Controlling body The SI was established and is maintained by the General Conference on Weights and Measures (CGPM[k]).[11] In practice, the CGPM follows the recommendations of the Consultative Committee for
Units (CCU), which is the actual body conducting technical deliberations concerning new scientific and the SI. The CCU reports to the EGPM. See below for more details. All the decisions and
recommendations concerning units are collected in a brochure called The International System of Units (SI),[ad] which is published by the International Bureau of Weights and Measures (BIPM[ae]) and periodically updated. Overview of the units SI base units The SI selects seven units to serve as base units, corresponding to seven base physical
quantities.[af][ag] They are the second, with the symbol s, which is the SI unit of the physical quantity of time; the metre, symbol m, the SI unit of length; kilogram (kg, the unit of mass); ampere (A, electric current); kelvin (K, thermodynamic temperature); mole (mol, amount of substance); and candela (cd, luminous intensity).[1] All units in the SI can
be expressed in terms of the base units, and the base units, and the base units, and the base units, and the base units, possibly with a nontrivial
numeric multiplier. When that multiplier is one, the unit is called a coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units (the set of coherent derived units).[ai] Twenty-two coherent derived units).[a
with special names and symbols may be used in combination to express other derived units,[r] which are adopted to facilitate measurement of diverse quantities. Why SI kept the distinction between base and derived units were constructed
as products of powers of the base units. After the redefinition, the SI is defined by fixing the numerical values of seven defining constants. This has the effect that the distinction between the base units and derived units is, in principle, not needed, since all units, base as well as derived, may be constructed directly from the defining constants.
Nevertheless, the distinction is retained because 'it is useful and historically well established', and also because the ISO/IEC 80000 series of standards[ai] specifies base and derived quantities that necessarily have the corresponding SI units.[1]:129 SI metric prefixes
to systematically construct, for the same physical quantity, a set of units that are decimal multiples of each other over a wide range. For example, while the coherent unit of length is the metre,[ak] the SI provides a full range of smaller and larger units of length, any of which may be more convenient for any given application - for example, driving
distances are normally given in kilometres (symbol km) rather than in metres. Here the metric prefixes correspond to integer powers of
1000; the only ones that do not are those for 10, 1/10, 100, and 1/100. In general, given any coherent unit with a separate name and symbol, [am] one forms a new unit by simply adding an appropriate metric prefix signifies a
particular power of ten, the new unit is always a power-of-ten multiple or sub-multiple or sub
grouping formed by a prefix symbol attached to a unit symbol (e.g. 'km', 'cm') constitutes a new inseparable unit symbols to form compound unit symbols. [1]:143 For example, g/cm3 is an SI unit of density, where cm3 is to be interpreted as
(cm)3. Coherent and non-coherent SI units When prefixes are used with the coherent SI units, the resulting units are no longer coherent, because the prefix introduces a numerical factor other than one.[1]:137 The one exception is the kilogram, the only coherent SI unit whose name and symbol, for historical reasons, include a prefix.[an] The
complete set of SI units consists of both the coherent set and the multiples and sub-multiples of coherent units for example, the metre, kilometre, centimetre, anometre, etc. are all SI units of length, though only the metre is a coherent SI unit. A similar statement holds for derived units: for example, kg/m3,
g/dm3, g/cm3, Pg/km3, etc. are all SI units of density, but of these, only kg/m3 is a coherent SI unit. Moreover, the metre is the only coherent SI unit of length. Every physical quantity has exactly one coherent SI unit, although this unit may be expressible in different forms by using some of the special names and symbols.[1]:140 For example, the
coherent SI unit of linear momentum may be written as either kg·m/s or as N·s, and both forms are in use (e.g. compare respectively here[18]:205 and here[19]:135). On the other hand, several different quantities may share same coherent SI unit. For example, the joule per kelvin (symbol J/K) is the coherent SI unit for two distinct quantities: heat
capacity and entropy; another example is the ampere, which is the coherent SI unit for both electric current and magnetomotive force. This is why it is important not to use the unit alone to specify the quantity.[aq] Furthermore, the same coherent SI unit may be a base unit in one context, but a coherent derived unit in another. For example, the
ampere is a base unit when it is a unit of electric current, but a coherent derived unit when it is a unit of magnetomotive force.[1]:140 As perhaps a more familiar example, consider rainfall, defined as volume of rain (measured in m3) that fell per unit area (measured in m2). Since m3/m2 = m, it follows that the coherent derived SI unit of rainfall is
the metre, even though the metre is also the base SI unit of length.[ar] Permitted non-SI units There is a special group of units that are called "non-SI un
that are not powers of ten. Some common examples of such units are the customary units of time, namely the minute (conversion factor of 60 s/min, since 1 min = 60 s), the hour (3600 s), and the day (86400 s); the degree (for measuring plane angles, 1^{\circ} = \pi/180 \text{ rad}); and the electronvolt (a unit of energy, 1 \text{ eV} = 1.602176634 \times 10 - 19 \text{ J}). New units
The SI is intended to be an evolving system; units[as] and prefixes are created and unit definitions are modified through international agreement as the technology of measurement progresses and the precision of measurement as the technology of measurement progresses and the precision of measurement as the technology of measurement progresses and the precision of measureme
which is conceptually separated from any practical realisation of them.[1]:126[at] Namely, the SI units are defined by declaring that seven defining constants is the speed of light in vacuum, c, which in the SI by
definition has the exact value of c = 299792458 m/s. The other six constant; e, the elementary charge; k, the Boltzmann charge;
defining constants ranges from fundamental constants of nature such as c to the purely technical constant Kcd.[1]: 128-9 Prior to 2019, h, e, k, and NA were not defined a priori but were rather very precisely measured quantities. In 2019, their values were fixed by definition to their best estimates at the time, ensuring continuity with previous
definitions of the base units. As far as realisations, what are believed to be the current best practical realisations of units are described in the mises en pratique, [av] which are also published by the BIPM. [22] The abstract nature of the definitions of units is what makes it possible to improve and change the mises en pratique as science and technology.
develop without having to change the actual definitions themselves.[ay] In a sense, this way of defining the SI units is no more abstract than the way derived unit, for example, the joule, the unit of energy. Its definition in terms of the base units is kg·m2/s2. Even if
the practical realisations of the metre, kilogram, and second are available, a practical realisation of the joule would require some actual physical procedure for realising the energy in the amount of one joule such that it can be compared to other instances of energy (such
as the energy content of gasoline put into a car or of electricity delivered to a household). The situation with the defining constants and all of the SI units are defined as if we declared that it is the defining constant's units that are now the base units, with all other SI units being derived
units. To make this clearer, first note that each defining constant can be taken as determining the magnitude of that defining constant's unit of measurement;[1]:128 for example, the definition of c defines the unit m/s as 1 m/s = c/299792458 ('the speed of one metre per second is equal to one 299792458th of the speed of light'). In this way, the
defining constants directly define the following seven units: the hertz (Hz), a unit of the physical quantity of frequency; the inverse mole (mol-1), a unit of action; the coulomb (C), a unit of speed; the joule-second (J·s), a unit of speed; the joule-second (J·s), a unit of speed; the joule-second (m/s), a unit of speed; the joule-second (J·s), a unit of speed;
conversion constant between the amount of substance and the number of elementary entities (atoms, molecules, etc.); and the lumen per watt (lm/W), a unit of luminous efficacy (conversion constant between the physical power carried by electromagnetic radiation and the intrinsic ability of that same radiation to produce visual perception of
brightness in humans). Further, one can show, using dimensional analysis, that every coherent SI unit (whether base or derived) can be written as a unique product of powers of the units of the SI defining constants (in complete analogy to the fact that every coherent derived SI unit can be written as a unique product of powers of the base SI units).
For example, the kilogram can be written as kg = (Hz)(J \cdot s)/(m/s)2.[az] Thus, the kilogram is defined in terms of the three defining constants respectively define the units Hz, m/s, and J·s,[ba] while, on the other hand, the kilogram can be written in terms of these three units,
namely, kg = (Hz)(J·s)/(m/s)2.[bb] While the question of how to actually realise the kilogram in practice would, at this point, still be open, that is not really different from the fact that the question of how to actually realise the joule in practice is still in principle open even once one has achieved the practical realisations of the metre, kilogram, and
second. Specifying fundamental constants vs. other methods of definition The current way of definitions formulation in which the result of a decades-long move towards increasingly abstract and idealised formulation in which the result of a decades-long move towards increasingly abstract and idealised formulation in which the result of a decades-long move towards increasingly abstract and idealised formulation in which the result of a decades-long move towards increasingly abstract and idealised formulation in which the result of a decades-long move towards increasingly abstract and idealised formulation in which the result of a decades-long move towards increasingly abstract and idealised formulation in which the result of a decades-long move towards increasingly abstract and idealised formulation in which the result of a decades-long move towards increasingly abstract and idealised formulation in which the result of a decades-long move towards increasingly abstract and idealised formulation in which the result of a decades-long move towards increasingly abstract and idealised formulation in which the result of a decades-long move towards increasingly abstract and idealised formulation in which the result of a decades-long move towards increasingly abstract and idealised formulation in which the result of a decades-long move towards in the result of
science and technologies develop, new and superior realisations may be introduced without the need to redefine the units.[aw] Units can now be realised with 'an accuracy that is ultimately limited only by the quantum structure of nature and our technical abilities but not by the definitions themselves.[ax] Any valid equation of physics relating the
defining constants to a unit can be used to realise the unit, thus creating opportunities for innovation... with increasing accuracy as technology proceeds. [1]:122 In practice, the CIPM Consultative Committees provide so-called "mises en pratique" (practical techniques), [22] which are the descriptions of what are currently believed to be best
experimental realisations of the units. [26] This system lacks the conceptual simplicity of using artefacts (referred to as prototypes) as realisation are one and the same. [bc] However, using artefacts has two major disadvantages that, as soon as it is technologically and
cylinder of platinum-iridium; from 1889 to 2019, the kilogram was by definition equal to the mass of the Planck constant and the Avogadro constant on the other, led to a revision of the definition of the base units, put into effect on 20 May 2019.[33]
This was the biggest change in the SI since it was first formally defined and established in 1960, and it resulted in the definitions of some of the SI units. One made use of a specific physical state of a specific substance (the triple point of water, which was
used in the definition of the kelvin[35]:113-4); others referred to idealised experimental prescriptions[1]:125 (as in the case of the former SI definition (originally enacted in 1979) of the set of definition of the kelvin[35]:113-4); others referred to idealised experimental prescriptions[1]:125 (as in the case of the former SI definition of the kelvin[35]:113-4); others referred to idealised experimental prescriptions[1]:125 (as in the case of the former SI definition of the kelvin[35]:113-4); others referred to idealised experimental prescriptions[1]:125 (as in the case of the former SI definition of the kelvin[35]:113-4); others referred to idealised experimental prescriptions[1]:125 (as in the case of the former SI definition of the kelvin[35]:113-4); others referred to idealised experimental prescriptions[1]:125 (as in the case of the former SI definition of the kelvin[35]:113-4); others referred to idealised experimental prescriptions[1]:125 (as in the case of the former SI definition of the kelvin[35]:113-4); others referred to idealised experimental prescriptions[1]:125 (as in the case of the former SI definition of the kelvin[35]:113-4); others referred to idealised experimental prescriptions[1]:125 (as in the case of the former SI definition of the kelvin[35]:135-4]; others referred to idealised experimental prescriptions[1]:135-4]; others re
constants are found, or if it turns out that other constants can be more precisely measured. [bk] History The original motivation for the development of the SI was the diversity of units that had sprung up within the centimetre–gram–second (CGS) systems (specifically the inconsistency between the systems of electrostatic units and electromagnetic
SI), which now serves as the international standard. Because of this, the standards of the CGS system were gradually replaced with metric standards incorporated from the MKS system, extended with a fourth unit to be taken from the units of
international organisations that were established in 1875 under the terms of the Metre Convention. They are the General Conference on Weights and Measures (CIPM[ac]), and the International Bureau of Weights and Measures (BIPM[ae]). The ultimate authority rests with the
brochure, and advice to the CIPM on matters concerning units of measurement. [40] It is the CCU which considers in detail all new scientific and technological developments related to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the definition of the SI. In practice, when it comes to the single particle particle particle particle particle particle partic
turn, follows the advice of the CCU. The CCU has the following as members:[41][42] national laboratories of the Member States of the CGPM charged with establishing national standards;[bn] relevant intergovernmental organisations and international bodies;[bo] international commissions or committees;[bp] scientific unions;[bq] personal members;
set of base units, derived units, and a set of decimal-based multipliers that are used as prefixed units, [bs] form a coherent system of quantities in such a way that the equations between the numerical values expressed in coherent units have exactly the same form,
including numerical factors, as the corresponding equations between the quantities. For example, 1 N = 1 kg \times 1 m/s2 says that one newton is the force required to accelerate a mass of one kilogram at one metre per second squared, as related through the principle of coherence to the equation relating the corresponding quantities: F = m \times a.
ampere and a volt, because those quantities bear a defined in terms of the SI base units as m/s2. Base units are the building blocks and derived units in the SI, such as acceleration, which is defined in terms of the SI base units are the building blocks.
of the system and all the other units are derived from them. SI base units[2]:6[45][46] Unit name Unit symbol Dimension symbo
the caesium-133 atom. metre m L length l {\displaystyle n}, n {\displaystyle n}, r {\displays
constant h exactly to 6.62607015 \times 10 - 34 \text{ J/s} (J = \text{kg·m2·s} - 2), given the definitions of the metre and the second. [33] ampere A I electric current I , i {\displaystyle I,\;i} The flow of exactly 1/1.602176634 \times 10 - 19 times the elementary charge e per second. Equalling approximately 6.2415090744 \times 1018 elementary charges per second. kelvin K \Theta
thermodynamictemperature T {\displaystyle T} The kelvin is defined by setting the fixed numerical value of the Boltzmann constant k to 1.380649×10-23 J·K-1, (J = kg·m2·s-2), given the definition of the kilogram, the metre, and the second. mole mol N amount of substance n {\displaystyle n} The amount of substance of exactly 6.02214076×1023
elementary entities. [n 4] This number is the fixed numerical value of the Avogadro constant, NA, when expressed in the unit mol-1. candela cd J luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 5.4×1014 hertz and that has a radiant intensity in that
direction of 1/683 watt per steradian. Notes ^ Within the context of the SI, the second is the coherent base unit of time, and is used in the definitions of derived units. The name "second" historically arose as being the 2nd-level sexagesimal division (1/602) of some quantity, the hour in this case, which the SI classifies as an "accepted" unit along with
its first-level sexagesimal division the minute. ^ Symbols for length vary greatly with context. Problems involving intuitive three-dimensional quantities often use l {\displaystyle w}, and h {\di
problem so that one axis lies conveniently parallel to the length being measured. Length is then often denoted either by some constant (e.g. a {\displaystyle a}, b {\displaystyle y}, or r {\displaystyle y}, or r {\displaystyle r} for horizontal, vertical, and radial axes,
respectively). ^ Despite the prefix "kilo-", the kilogram is the coherent base unit of mass, and is used in the definitions of derived units. Nonetheless, prefixes for the unit of mass are determined as if the gram were the base unit. ^ When the mole is used, the elementary entities must be specified and may be atoms, molecules, ions, electrons, other
 base quantities of time and length, and thus the SI derived unit is metre per second (symbol m/s). The dimensions of derived units can be expressed in terms of the dimensions of the base units. For example, the SI unit of force is the newton (N), the SI unit of pressure
is the pascal (Pa)—and the pascal can be defined as one newton per square metre (N/m2).[47] SI derived units with special names and symbols[2]:15 Name Symbol Quantity In SI base units In other SI units radian[N 1] rad plane angle m/m 1 steradian[N 1] rad plane angle m/m 1 steradian[N 1] rad plane angle m2/m2 1 hertz Hz frequency s-1 newton N force, weight kg·m·s-2 pascal Pa
pressure, stress kg·m-1·s-2 N/m2 joule J energy, work, heat kg·m2·s-3 I/s coulomb C electric charge s·A volt V electric potential, voltage, emf kg·m2·s-3·A-1 W/A = J/C farad F capacitance kg·m2·s-3·A-2 V/A = J·s/C2 siemens
S electrical conductance kg-1\cdot m-2\cdot s3\cdot A2 \Omega-1 weber Wb magnetic flux kg\cdot m2\cdot s-2\cdot A-1 V·s tesla T magnetic flux density kg\cdot s-2\cdot A-1 Wb/m2 henry H inductance kg\cdot m2\cdot s-2\cdot A-1 Wb/m2 henry
radionuclide (decays per unit time) s-1 gray Gy absorbed dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 J/kg sievert Sv equivalent dose (of ionising radiation) m2·s-2 
mathematical manipulation of length, time, and mass. Examples of coherent derived units in terms of base units[2]:17 Name Symbol Derived quantity Typical symbol square metre m2 area A cubic metre m3 volume V metre per second m/s speed, velocity v metre per second squared m/s2 acceleration a reciprocal metre m-1 wavenumber σ, ν̃
vergence (optics) V, 1/f kilogram per cubic metre kg/m3 density ρ kilogram per square metre kg/m2 current density j ampere per metre kg/m3 concentration c kilogram per cubic metre kg/m3 density γ cubic metre kg/m3 density γ cubic metre kg/m3 density γ kilogram per cubic metre kg/m3 density γ cubic metre kg/m3 density κg/m3 density κg/m3 density κg/m3 density κg/m
mass concentration \rho, \gamma candela per square metre cd/m2 luminance Lv Examples of derived units with special names[2]:18 Name Symbol Quantity In SI base units pascal-second Pa·s dynamic viscosity m-1·kg·s-1 newton-metre N·m moment of force m2·kg·s-2 radian per second rad/s
angular velocity, angular frequency s-1 radian per second squared rad/s2 angular acceleration s-2 watt per square metre W/m2 heat capacity m2·kg·s -2\cdot K-1 joule per kilogram-kelvin J/K entropy, heat capacity, specific entropy m2·s -2\cdot K-1 joule per kilogram J/kg specific energy
m^2 \cdot s - 2 watt per metre-kelvin W/(m \cdot K) thermal conductivity m \cdot kg \cdot s - 3 \cdot K - 1 joule per cubic metre C/m<sup>2</sup> electric flux density, electric displacement
m-2\cdot s\cdot A farad per metre F/m permittivity m-3\cdot kg-1\cdot s4\cdot A2 henry per metre H/m permeability m\cdot kg\cdot s-2\cdot A-2 joule per mole-kelvin J/(mol·K) molar energy m2·kg·s-2·K-1·mol-1 coulomb per kilogram C/kg exposure (x- and \gamma-rays) kg-1·s·A gray per second Gy/s absorbed dose
rate m2 \cdot s-3 watt per steradian W/sr radiant intensity m2 \cdot kg \cdot s-3 watt per square metre-steradian W/(m2 \cdot s-3 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per square metre-steradian W/(m2 \cdot s-3 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity concentration m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity m-3 \cdot s-1 watt per cubic metre kat/m3 catalytic activity m-3 \cdot s-1 watt per 
integer powers of ten, and above a hundred or below a hundredth all are integer powers of a thousand milli-denotes a multiple of a thou
millionth of a metre is a micrometre, not a millimillimetre. Multiples of the kilogram are named as if the gram were the base unit, so a millionth of a kilogram is a millionth of a kilogram is a milligram, not a millionth of a kilogram is a millionth of a kilogram is a millionth of a kilogram are named as if the gram were the base unit, so a millionth of a kilogram is a milligram, not a millionth of a kilogram is a milligram, not a millionth of a kilogram is a milligram, not a millionth of a kilogram is a milligram, not a milligram is a milligram, not a milligram is a milligram, not a milligram is a milligram
the reinterpretation of the "f" as a prefix to "m", with femto being derived from the Danish word femten. Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units accepted for use with SI Main article: Non-SI units acc
their use has not been entirely replaced by their SI alternatives. The CIPM recognised and acknowledged such traditions by compiling a list of non-SI units have a
long history of use. Most societies have used the solar day and its non-decimal subdivisions as a basis of time and, unlike the foot or the pound, these were the same regardless of where they were being measured. The radian, being 1/2π of a revolution, has mathematical advantages but is rarely used for navigation. Further, the units used in navigation
around the world are similar. The tonne, litre, and hectare were adopted by the CGPM in 1879 and have been retained as units that may be used alongside SI units, having been given unique symbols. The catalogued units are given below: Non-SI units accepted for use with SI units Quantity Name Symbol Value in SI units time minute min 1 min = 600 minutes are given below: Non-SI units are given bel
(metric ton) t 1 t = 1 Mg = 103 kg dalton Da 1 Da = 1.660539040(20) \times 10-27 kg energy electronvolt eV 1 eV = 1.602176634 \times 10-19 J logarithmicratio quantities neper Np In using these units it is important that the nature of the quantity be specified and that any reference value used be specified. bel B decibel dB These units are used in
combination with SI units in common units such as the kilowatt-hour (1 kW·h = 3.6 MJ). Common notions of the metric system, as originally defined, represented common quantities or relationships in nature. They still do – the modern precisely defined quantities are refinements of definition and methodology, but the metric system, as originally defined, represented common quantities are refinements of definition and methodology, but the metric system, as originally defined, represented common quantities are refinements of definition and methodology, but the metric system, as originally defined, represented common quantities are refinements of definition and methodology, but the metric system, as originally defined, represented common quantities are refinements of definition and methodology, but the metric system, as originally defined, represented common quantities are refinements of definition and methodology, but the metric system, as originally defined, represented common quantities are refinements of definition and methodology, but the metric system, as originally defined, represented common quantities are refinements of definition and methodology.
still with the same magnitudes. In cases where laboratory precision may not be required or available, or where approximations are good enough, the original definitions may suffice.[bv] A second is 1/86400 of a minute, which is 1/60 of a minute, which is 1/60 of an hour, which is 1/60 of an hour, which is 1/60 of a minute, which is 1/60 of a mi
second is the time it takes a dense object to freely fall 4.9 metres from rest.[bw] The length of the equator is close to 40000000 m (more precisely 40075014.2 m).[51] In fact, the dimensions of our planet were used by the French Academy in the original definition of the metre.[52] The metre is close to the length of a pendulum that has a period of 2
seconds;[bx] most dining tabletops are about 0.75 metres high;[53] a very tall human (basketball forward) is about 2 metres tall.[54] The kilogram is the mass of one gram; a 1-euro coin weighs 7.5 g;[55] a Sacagawea US 1-dollar coin weighs 8.1 g;[56] a UK 50-pence coin
 weighs 8.0 g.[57] A candela is about the luminous intensity of a moderately bright candle, or 1 candle power; a 60 W tungsten-filament incandescent light bulb has a luminous intensity of a moderately bright candle, or 1 candle power; a 60 W tungsten-filament incandescent light bulb has a luminous intensity of a moderately bright candle, or 1 candle power; a 60 W tungsten-filament incandescent light bulb has a luminous intensity of a moderately bright candle, or 1 candle power; a 60 W tungsten-filament incandescent light bulb has a luminous intensity of a moderately bright candle, or 1 candle power; a 60 W tungsten-filament incandescent light bulb has a luminous intensity of a moderately bright candle, or 1 candle power; a 60 W tungsten-filament incandescent light bulb has a luminous intensity of a moderately bright candle, or 1 candle power; a 60 W tungsten-filament incandescent light bulb has a luminous intensity of a moderately bright candle, or 1 candle power; a 60 W tungsten-filament incandescent light bulb has a luminous intensity of a moderately bright candle power; a 60 W tungsten-filament incandescent light bulb has a luminous intensity of a moderately bright candle power; a 60 W tungsten-filament incandescent light bulb has a luminous intensity of a moderately bright candle power; a 60 W tungsten-filament light bulb has a luminous intensity of a moderately bright candle power; a 60 W tungsten-filament light bulb has a luminous intensity of a moderately bright candle power; a 60 W tungsten-filament light bulb has a luminous intensity of a moderately bright candle power; a 60 W tungsten-filament light bulb has a luminous intensity of a moderately bright light bulb has a luminous intensity of a moderately bright light light bulb has a luminous intensity of a moderately bright light light
of a mole of table salt is 58.4 g. Since all gases have the same volume per mole at a given temperature and pressure far from their points of liquefaction and solidification (see Perfect gas), and air is about 1/5 oxygen (molecular mass 32) and 4/5 nitrogen (molecular mass 32) and 4/5 nitrogen (molecular mass 32).
approximation by dividing its molecular mass by 29 (because 4/5 \times 28 + 1/5 \times 32 = 28.8 \approx 29). For example, carbon monoxide (molecular mass 28) has almost the same density as air. A temperature difference of one kelvin is the same density as air.
level; the absolute temperature in kelvins is the temperature in degrees Celsius plus about 273; human body temperature is about 270 (US mains voltage) consumes 0.26 A at this voltage. [bz] Lexicographic
conventions See also: ISO 31-0 § Typographic conventions, and Space (punctuation) § Unit symbols and numbers Unit names According to the SI Brochure,[1]:148 unit names should be treated as common nouns of the context language. This means that they should be treated as common nouns of the context language.
English, Cyrillic script in Russian, etc.), following the usual grammatical and orthographical rules of the context language. For example, in English and French, even when the unit is named after a person and its symbol begins with a capital letter, the unit name in running text should start with a lowercase letter (e.g., newton, hertz, pascal) and is
capitalized only at the beginning of a sentence and in headings and publication of this rule, the SI Brochure notes[1]:148 that the name of the unit, 'd', is in lowercase, while the modifier 'Celsius' is capitalized because it is
a proper name.[ca][1]:148 The English spelling deka-, meter, and liter, whilst International English uses deca-, meter, and liter. Additionally, the name of the unit whose symbol is t and which is defined according to 1 t = 103 kg
is 'metric ton' US English but 'tonne' in International English.[2]:iii Unit symbols and the values of quantities Symbols of SI units are intended to be unique and universal, independent of the context language.[35]:130–135 The SI Brochure has specific rules for writing them.[35]:130–135 The guideline produced by the National Institute of Standards
written as a number followed by a space (representing a multiplication sign) and a unit symbol; e.g., 2.21 kg, 7.3×102 m2, 22 K. This rule explicitly includes the percent sign (%)[35]:133 Exceptions are the symbol for degrees Celsius (°C).[35]:134 and the symbol for degrees Celsius (°C).[35]:135 Exceptions are the symbol for degrees Celsius (°C).[35]:136 Exceptions are the symbol for degrees Celsius (°C).[35]:137 Exceptions are the symbol for degrees Celsius (°C).[35]:138 Exceptions are the symbol for degree Celsius (°C).[35]:138 Exceptions are the s
placed immediately after the number with no intervening space. Symbols are mathematical entities, not abbreviations, and as such do not have an appended period/full stop (.), unless the rules of grammar demand one for another reason, such as denoting the end of a sentence. A prefix is part of the unit, and its symbol is prepended to a unit symbol
centre dot (·) or a non-breaking space; e.g., N·m or N m. Symbols for derived units formed by division are joined with a solidus is present, parentheses
must be used to avoid ambiguity; e.g., kg/(m \cdot s2), kg/m \cdot s2, and kg/m \cdot s2 are acceptable. In the expression of acceleration due to gravity, a space separates the value and the units, both the 'm' and the 's' are lowercase because neither the metre nor the second are named after people, and
 exponentiation is represented with a superscript '2'. The first letter of symbols for units derived from the name of a person is written in lower case. E.g., the unit of pressure is named after Blaise Pascal, so its symbol is written in lower case. E.g., the unit of pressure is named after Blaise Pascal, so its symbol for tesla, a
measure of magnetic field strength, and "t" the symbol for tonne, a measure of mass. Since 1979, the litre may exceptionally be written using either an uppercase "L" or a lowercase "l", a decision prompted by the similarity of the lowercase "l", a decision prompted by the similarity of the lowercase "l" or a lowercase "l", a decision prompted by the similarity of the lowercase "l" or a lowe
recommends that within the United States "L" be used rather than "l". Symbols do not have a plural form, e.g., 25 kg, not 25 kgs. Uppercase and lowercase prefixes are not interchangeable. E.g., the quantities 1 mW and 1 MW represent two different quantities (milliwatt and megawatt). The symbol for the decimal marker is either a point or comma on
the line. In practice, the decimal point is used in most english-speaking countries and most of Asia, and the comma in most of Latin America and in continental European countries (1,000,000 or 1.000.000) to reduce confusion resulting from the variation
between these forms in different countries. Any line-break inside a number, inside a compound unit, or between number and unit should be avoided. Where this is not possible, line breaks should coincide with thousands separators. Because the value of "billion" and "trillion" varies between languages, the dimensionless terms "ppb" (parts per billion)
and "ppt" (parts per trillion) should be avoided. The SI Brochure does not suggest alternatives. Printing SI symbols The rules covering printing of quantities and units are part of ISO 80000-1:2009.[62] Further rules[cb] are specified in respect of production of text using printing presses, word processors, typewriters, and the like. International System
of Quantities SI Brochure Cover of brochure The International System of Units The CGPM publishes a brochure that defines and presents the SI.[35] Its official version is in French, in line with the Metre Convention.[35]:102 It leaves some scope for local variations, particularly regarding unit names and terms in different languages.[cc][2] The writing
 and maintenance of the CGPM brochure is carried out by one of the committees of the International Committee for Weights and Measures (CIPM). The definitions of the terms "quantity", "unit", "dimension" etc. that are used in the SI Brochure are those given in the International vocabulary of metrology.[63] Main article: International System of
 Ouantities The quantities and equations that provide the context in which the SI units are defined are now referred to as the International System of Quantities (ISQ). The ISQ is based on the quantities underlying each of the seven base units of the SI. Other q
                                                                                                                                                                                                                                                                                                                                                                                                                                                                            uantities, such as area, pressure, and electrical resistance, are derived from these pase
quantities by clear non-contradictory equations. The ISQ defines the quantities that are measured with the SI units.[64] The ISQ is formalised, in part, in the international standard ISO/IEC 80000, which was completed in 2009 with the publication of ISO 80000-1,[65] and has largely been revised in 2019–2020 with the remainder being under review
Realisation of units Main article: Realisation (metrology) Silicon sphere for the Avogadro constant to a relative standard uncertainty of 2×10-8 or less, held by Achim Leistner[66] Metrologists carefully distinguish between the definition of a unit and its realisation. The definition of each base unit of the SI is
drawn up so that it is unique and provides a sound theoretical basis on which the most accurate and reproducible measurements can be made. The realisation of the definition of a quantity of the same kind as the unit. A description of the
mise en pratique[cd] of the base units is given in an electronic appendix to the SI Brochure states that "any method consistent with the laws of physics could be used to realise any SI unit." [35]: 111 Various consultative
committees of the CIPM decided in 2016 that more than one mise en pratique would be developed for determining the value of each unit. [68] These methods include the following: At least three separate experiments be carried out yielding values having a relative standard uncertainty in the determination of the kilogram of no more than 5 \times 10 - 8 and
at least one of these values should be better than 2×10-8. Both the Kibble balance and the Avogadro project should be included in the experiments and any differences between these be reconciled. [69][70] The definition of the kelvin measured with a relative uncertainty of the Boltzmann constant derived from two fundamentally different methods
such as acoustic gas thermometry and dielectric constant gas thermometry be better than one part in 10-6 and that these values be corroborated by other measurements.[71] Evolution of the SI Changes to the SI The International Bureau of Weights and Measures (BIPM) has described SI as "the modern form of metric system".[35]:95 Changing
technology has led to an evolution of the definitions and standards that has followed two principal strands - changes to SI but are still nevertheless used on a worldwide basis. Since 1960 the CGPM has made a number of changes to the SI to meet the needs of specific fields,
notably chemistry and radiometry. These are mostly additions to the list of named derived units, and include the mole (symbol S) for electrical conductance, the becquerel (symbol Bq) for "activity referred to a radionuclide", the gray (symbol Gy) for ionising
radiation, the sievert (symbol Sv) as the unit of dose equivalent radiation, and the katal (symbol kat) for catalytic activity. [35]: 156[72][35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]: 158[35]:
wavelengths of a specific emission of the krypton-86 atom was replaced in 1983 with the distance that light travels in vacuum in exactly specified constant of nature. A few changes to notation conventions have also been made to alleviate lexicographic ambiguities. An analysis under the
aegis of CSIRO, published in 2009 by the Royal Society, has pointed out the opportunities to finish the realisation of that goal, to the point of universal zero-ambiguity machine readability. [73] 2019 redefinitions.
Unlike in the previous definitions, the base units are all derived exclusively from constants of nature. Here, a \rightarrow b {\displaystyle a\rightarrow b} means that a {\displaystyle a\rightarrow b} mea
was the only physical artefact upon which base units (directly the kilogram and indirectly the kilogram, a significant the IPK.[74] During the 2nd and 3rd Periodic Verification of National Prototypes of the Kilogram, a significant
divergence had occurred between the mass of the IPK and all of its official copies stored around the world: the copies had all noticeably increased in mass with respect to the IPK. During extraordinary verifications carried out in 2014 preparatory to redefinition of metric standards, continuing divergence was not confirmed. Nonetheless, the residual
and irreducible instability of a physical IPK undermined the reliability of the entire metric system to precision measurement from small (atomic) to large (astrophysical) scales. A proposal was made that: [75] In addition to the speed of light, four constants of nature – the Planck constant, an elementary charge, the Boltzmann constant, and the
Avogadro constant - be defined to have exact values The International Prototype of the Kilogram be retired The current definitions should change emphasis from explicit unit to explicit constant definitions. The new definitions were adopted at the 26th CGPM on
16 November 2018, and came into effect on 20 May 2019.[76] The change was adopted by the European Union through Directive (EU) 2019/1258.[77] History Stone marking the Austro-Hungarian/Italian border at Pontebba displaying myriametres, a unit of 10 km used in Central Europe in the 19th century (but since deprecated)[78] Main article:
History of the metric system The improvisation of units The units and unit magnitudes of the metric system which became the SI were improvised piecemeal from everyday physical quantities starting in the mid-18th century. Only later were they moulded into an orthogonal coherent decimal system of measurement. The degree centigrade as a unit of
temperature resulted from the scale devised by Swedish astronomer Anders Celsius in 1742. His scale counter-intuitively designated 100 as the freezing point of water and 0 as the freezing point of water and 100 the boiling point. The scale
became known as the centi-grade, or 100 gradations of temperature, scale. The metric system was developed from 1791 onwards by a committee of the French Academy of Sciences, commissioned to create a unified and rational system of measures. [79] The group, which included preeminent French men of science, [80]:89 used the same principles
for relating length, volume, and mass that had been proposed by the English clergyman John Wilkins in 1668[81][82] and the concept of using the Earth's meridian as the basis of the definition of length, originally proposed in 1670 by the French abbot Mouton.[83][84] Carl Friedrich Gauss In March 1791, the Assembly adopted the committee's
proposed principles for the new decimal system of measure including the metre defined to be 1/10,000,000 of the length of the quadrant of Earth's meridian passing through Paris, and authorised a survey to precisely establish the length of the quadrant of Earth's meridian. In July 1792, the committee proposed the names metre, are, litre and grave for the units of length, of the quadrant of Earth's meridian passing through Paris, and authorised a survey to precisely establish the length of the meridian passing through Paris, and authorised a survey to precisely establish the length of the meridian passing through Paris, and authorised a survey to precisely establish the length of the meridian passing through Paris, and authorised a survey to precisely establish the length of the meridian passing through Paris, and authorised a survey to precisely establish the length of the meridian passing through Paris, and authorised a survey to precisely establish the length of the meridian passing through Paris, and authorised a survey to precisely establish the length of the meridian passing through Paris, and authorised a survey to precisely establish the length of the meridian passing through Paris, and authorised a survey to precisely establish the length of the meridian passing through Paris, and authorised a survey to precise the paris, and a
area, capacity, and mass, respectively. The committee also proposed that multiples and submultiples of these units were to be denoted by decimal-based prefixes such as centi for a hundredth and kilo for a thousand.[85]:82 ThomsonMaxwellWilliam Thomson (Lord Kelvin) and James Clerk Maxwell played a prominent role in the development of the
principle of coherence and in the naming of many units of measure. [86][87][88][89][90] Later, during the process of adoption of the metric system, the Latin gramme and kilogramme, replaced the former provincial terms grave. In June 1799, based on the results of the meridian survey, the standard mètre des Archives and
kilogramme des Archives were deposited in the French National Archives. Subsequently, that year, the metric system was adopted by law in France.[91] [92] The French system was short-lived due to its unpopularity. Napoleon ridiculed it, and in 1812, introduced a replacement system, the mesures usualles or "customary measures" which restored
many of the old units, but redefined in terms of the metric system. During the first half of the 19th century there was little consistency in the choice of preferred multiples of the base units: typically the myriametre (10000 metres) was in widespread use in both France and parts of Germany, while the kilogram (1000 grams) rather than the myriagram
was used for mass.[78] In 1832, the German mathematician Carl Friedrich Gauss, assisted by Wilhelm Weber, implicitly defined the second as a base unit when he quoted the Earth's magnetic field had only been described in relative terms. The
technique used by Gauss was to equate the torque induced on a suspended magnet of known mass by the Earth's magnetic field with the torque induced on an equivalent system under gravity. The resultant calculations enabled him to assign dimensions based on mass, length and time to the magnetic field.[ce][93] A candlepower as a unit of
illuminance was originally defined by an 1860 English law as the light produced by a pure spermaceti, a waxy substance found in the heads of sperm whales, was once used to make high-quality candles. At this time the French standard of light was based upon the
illumination from a Carcel oil lamp. The unit was defined as that illumination emanating from a lamp burning pure rapeseed oil at a defined rate. It was accepted that ten standard candles were about equal to one Carcel lamp. Metre Convention A French-inspired initiative for international cooperation in metrology led
to the signing in 1875 of the Metre Convention, also called Treaty of the Metre, by 17 nations.[cf][80]:353-354 Initially the convention was extended to include all physical units, including the ampere and others thereby enabling the CGPM to address
inconsistencies in the way that the metric system had been used.[87][35]:96 A set of 30 prototypes of the kilogram,[cg] in each case made of a 90% platinum-10% iridium alloy, were manufactured by British metallurgy specialty firm[who?] and accepted by the CGPM in 1889. One of each was selected at random to
become the International prototype metre and International prototype kilogram that replaced the mètre des Archives respectively. Each member state was entitled to one of each of the remaining prototypes to serve as the national prototype for that country. [94] The treaty also established a number of international
organisations to oversee the keeping of international standards of measurement. [95][ch] The CGS and MKS system of units Closeup of the National Prototype Metre, serial number 27, allocated to the United States In the 1860s, James Clerk Maxwell, William Thomson (later Lord Kelvin) and others
working under the auspices of the British Association for the Advancement of Science, built on Gauss's work and formalised the concept of a coherent system of units in 1874. The principle of coherence was successfully used to define a number of units of
measure based on the CGS, including the erg for energy, the dyne for force, the barye for pressure, the poise for dynamic viscosity and the stokes for kinematic viscosity and the stokes for dynamic viscosity and the stokes for kinematic viscosity and t
quantities. Beginning in about 1900, physicists who had been using the symbols "μ" (mu) for "micrometre" or "micrometre", and "μ" (gamma) for "micrometre" or "micrometre", and "μ" (gamma) for "micrometre" or "micrometre" 
CGS-based system for electrostatic units, also known as the Gaussian or ESU system, a CGS-based on units defined by the Metre Convention. [97] for electrical distribution systems. Attempts to resolve the electrical units in terms of length, mass, and time using dimensional
analysis was beset with difficulties—the dimensions depended on whether one used the ESU or EMU systems. [90] This anomaly was resolved in 1901 when Giovanni Giorgi published a paper in which he advocated using a fourth base unit alongside the existing three base units. The fourth unit could be chosen to be electric current, voltage, or
electrical resistance.[98] Electric current with named unit 'ampere' was chosen as the base unit, and the other electrical quantities derived from it according to the laws of physics. This became the foundation of the MKS system of units. In the late 19th and early 20th centuries, a number of non-coherent units of measure based on the gram/kilogram,
centimetre/metre, and second, such as the Pferdestärke (metric horsepower) for power,[99][ci] the darcy for permeability[100] and "millimetres of mercury" for barometric and blood pressure were developed or propagated, some of which incorporated standard gravity in their definitions. At the end of the Second World War, a number of different
systems of measurement were in use throughout the world. Some of these systems were metric system and British Imperial system of units In 1948, the 9th CGPM commissioned a study to assess the measurement needs of the
scientific, technical, and educational communities and "to make recommendations for a single practical system of units of measurement, suitable for adoption by all countries adhering to the Metre Convention".[101] This working document was Practical system of units of measurement. Based on this study, the 10th CGPM in 1954 defined an
international system derived from six base units including units of temperature and optical radiation in addition to those for the MKS system mass, length, and time units and Giorgi's current unit, Six base units were recommended; the metre, kilogram, second, ampere, degree Kelvin, and candela. The 9th CGPM also approved the first formal
recommendation for the writing of symbols in the metric system when the basis of the rules as they are now known was laid down. [102] These rules were subsequently extended and now cover unit symbols and names, prefix symbols 
[35]: 104,130 Birth of the SI In 1960, the 11th CGPM synthesised the results of the 12-year study into a set of 16 resolutions. The system was named the International d'Unités. [35]: 110[103] Historical definitions When Maxwell first introduced the concept of a coherent
system, he identified three quantities that could be used as base units: mass, length, and time. Giorgi later identified the need for an electrical base unit, for which the unit of electric current was chosen for SI. Another three base units (for temperature, amount of substance, and luminous intensity) were added later. The early metric systems defined a
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unit of weight as a base unit, while the SI defines an analogous unit of mass. In everyday use, these are mostly interchangeable, but in scientific contexts the difference matters. Mass, strictly the inertial mass, represents a quantity of matter. It relates the acceleration of a body to the applied force via Newton's law,  $F = m \times a$ : force equals mass times acceleration. A force of 1 N (newton) applied to a mass of 1 kg will accelerate it at 1 m/s2. This is true whether the object is floating in space or in a gravity field e.g. at the Earth's surface. Weight is the force exerted on a body by a gravitational field, and hence its weight depends on the strength of the gravitational field. Weight of a 1 kg mass at the Earth's surface is  $m \times g$ ; mass times the acceleration due to gravity, which is 9.81 newtons at the Earth's surface of Mars. Since the acceleration due to gravity is local and varies by location and altitude on the Earth, weight is unsuitable for precision measurements of a property of a body, and this makes a unit

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of weight unsuitable as a base unit. SI base units[2]:6[45][46] Unit name Definition[n 1] second Prior: (1675) 1/86400 of a day of 24 hours of 60 minutes of
corresponding to the transition between the two hyperfine levels of the ground state of the ground state of the meridian through Paris between the North Pole and the Equator.FG Interim (1889): The Prototype of the meridian through Paris between the North Pole and the Equator.FG Interim (1889): The Prototype of the meridian through Paris between the North Pole and the Equator.FG Interim (1889): The Prototype of the meridian through Paris between the North Pole and the Equator.FG Interim (1889): The Prototype of the meridian through Paris between the North Pole and the Equator.FG Interim (1889): The Prototype of the meridian through Paris between the North Pole and the Equator.FG Interim (1889): The Prototype of the meridian through Paris between the North Pole and the Equator.FG Interim (1889): The Prototype of the meridian through Paris between the North Pole and the Equator.FG Interim (1889): The Prototype of the Market Pole and the Equator.FG Interim (1889): The Prototype of the Market Pole and the Equator.FG Interim (1889): The Prototype of the Market Pole and the Equator.FG Interim (1889): The Prototype of the Market Pole and the Equator.FG Interim (1889): The Prototype of the Market Pole and the Equator.FG Interim (1889): The Prototype of the Market Pole and the Equator.FG Interim (1889): The Prototype of the Market Pole and the Equator.FG Interim (1889): The Prototype of the Market Pole and the Pole and the Equator.FG Interim (1889): The Prototype of the Market Pole and the Pole and
length. Interim (1960): 1650763.73 wavelengths in vacuum of the transition between the 2p10 and 5d5 quantum levels of the krypton-86 atom. Current (1983): The grave was defined as being the mass (then called weight) of one
litre of pure water at its freezing point.FG Interim (1889): The mass of a small squat cylinder of $\approx 47$ cubic centimetres of platinum-iridium alloy kept in the International Burueau of Weights and Measures (BIPM), Pavillon de Breteuil, France.[ci] Also, in practice, any of numerous official replicas of it. Current (2019): The kilogram is defined by setting
the Planck constant h exactly to 6.62607015 \times 10 - 34 \text{ J} \cdot \text{s} - 2, given the definitions of the metre and the second. [33] Then the formula would be kg = h/6.62607015 \times 10 - 34 \text{ J} \cdot \text{s} - 2, given the definitions of the metre and the second. [33] Then the formula would be kg = h/6.62607015 \times 10 - 34 \text{ J} \cdot \text{s} - 2, given the definitions of the metre and the second. [33] Then the formula would be kg = h/6.62607015 \times 10 - 34 \text{ J} \cdot \text{s} - 2.
of a circle 1 cm in radius, that creates a field of one oersted at the centre.[104] IEC Interim (1946): The constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross-section, and placed 1 m apart in vacuum, would produce between these conductors a force equal to 2×10-7 newtons per metre
of length. Current (2019): The flow of 1/1.602176634×10-19 times the elementary charge e per second. kelvin Prior (1743): The triple point of water (0.01 °C) defined to be exactly 273.16 K.[n 2] Previous (1967):
1/273.16 of the thermodynamic temperature of the triple point of water. Current (2019): The kelvin is defined by setting the fixed numerical value of the kilogram, the metre, and the second. mole Prior (1900): A stoichiometric quantity which is the equivalent
mass in grams of Avogadro's number of molecules of a substance of a substance of exactly 6.02214076×1023 elementary entities. This number is the fixed numerical
value of the Avogadro constant, NA, when expressed in the unit mol-1 and is called the Avogadro number. candela Prior (1946): The value of the new candle (early name for the candela) is such that the brightness of the full radiator at the temperature of solidification of platinum is 60 new candles per square centimetre. Current (1979): The luminous
intensity, in a given direction, of a source that emits monochromatic radiation of frequency 5.4×1014 hertz and that has a radiant intensity in that direction of 1/683 watt per steradian. Note: both old and new definitions are approximately the luminous intensity of a spermaceti candle burning modestly bright, in the late 19th century called a
 "candlepower" or a "candle". Notes ^ Interim definitions are given here only when there has been a significant difference in the definition. ^ In 1954 the unit of thermodynamic temperature was known as the "degree Kelvin" (symbol "K; "kelvin" spelt with an upper-case "K"). It was renamed the "kelvin" (symbol "K"; "kelvin" spelt with a lower case.
"k") in 1967. The Prior definitions of the various base units in the above table were made by the following authorities: TLB = Tito Livio Burattini, Misura universale, Vilnius, 1675 FG = French Government IEC = International Commission ICAW = Internation
resolutions by either CGPM or the CIPM and are catalogued in the SI Brochure. Metric units that are not recognised by the SI Main article: Metric units Although the term metric system is often used as an informal alternative name for the International System of Units,[105] other metric systems exist, some of which were in widespread use in the
past or are even still used in particular areas. There are also individual metric units such as the sverdrup and the darcy that exist outside of any system of units. Most of the units of the other metric systems are not recognised by the SI.[ck][cn] Here are some examples. The centimetre–gram–second (CGS) system was the dominant metric system in the
 physical sciences and electrical engineering from the 1860s until at least the 1960s, and is still in use in some fields. It includes such SI-unrecognised units as the gal, dyne, erg, barye, etc. in its mechanical sector, as well as the poise and stokes in fluid dynamics. When it comes to the units for quantities in electricity and magnetism, there are several
versions of the CGS system. Two of these are obsolete: the CGS electromagnetic system ('CGS-ESU', with the SI-unrecognised units of statcoulomb, oersted, maxwell, abhenry, gilbert, etc.).[co][cq] A 'blend' of these two systems is still popular and is known
as the Gaussian system (which includes the gauss as a special name for the CGS-EMU unit maxwell per square centimetre).[cr] In engineering (other than electrical engineering), there was formerly a long tradition of using the gravitational metric system, whose SI-unrecognised units include the kilogram-force (kilopond), technical atmosphere,
metric horsepower, etc. The metre-tonne-second (mts) system, used in the Soviet Union from 1933 to 1955, had such SI-unrecognised units are the various legacy and CGS units related to ionising radiation (rutherford, curie, roentgen, rad, rem, etc.), radiometry (langley, jansky)
photometry (phot, nox, stilb, nit, metre-candle,[111]:17 lambert, apostilb, skot, brill, troland, talbot, candlepower, candle), thermodynamics (calorie), and spectroscopy (reciprocal centimetre). Some other SI-unrecognised metric units that don't fit into any of the already mentioned categories include the are, bar, barn, fermi, gradian (gon, grad, or
grade), metric carat, micron, millimetre of mercury, torr, millimetre of mercury, torr, millimetre of mercury, torr, millimetre, or metric prefix with a coherent SI units formed by combining a metric prefix with a coherent SI units formed by combining a metric prefix with a coherent SI units formed by combining a metric prefix with a coherent SI units formed by combining a metric prefix with a coherent SI units formed by combining a metric prefix with a coherent SI units formed by combining a metric prefix with a coherent SI units formed by combining a metric prefix with a coherent SI units formed by combining a metric prefix with a coherent SI units formed by combining a metric prefix with a coherent SI units formed by combining a metric prefix with a coherent SI units formed by combining a metric prefix with a coherent SI units formed by combining a metric prefix with a coherent SI units formed by combining a metric prefix with a coherent SI units formed by combining a metric prefix with a coherent SI units formed by combining a metric prefix with a coherent SI units formed by combining a metric prefix with a coherent SI units formed by combining a metric prefix with a coherent SI units formed by combining a metric prefix with a coherent SI units formed by combining a metric prefix with a coherent size of the coherent size of th
unit. For example, 1 \gamma (unit of magnetic flux density) = 1 nT, 1 Gal = 1 cm·s-2, 1 barye = 1 decipascal, etc. (a related group are the correspondences[co] such as 1 abampere \hat{z} 1 nanohenry, etc.[cs]). Sometimes, it is not even a matter of a metric prefix: the SI-nonrecognised unit may be exactly the same as an SI coherent
unit, except for the fact that the SI does not recognise the special name and symbol. For example, the nit is just an SI-unrecognised name for the SI unit lumen second. Frequently, a non-SI metric unit is related to an SI unit through a power-of-ten factor, but not one
that has a metric prefix, e.g., 1 dyn = 10-5 newton, The angstrom (1 Å = 10-10 m), still used in various fields, etc. (and correspondences[co] like 1 gauss = 10-4 tesla). Finally, there are metric units whose conversion factors to SI units are not powers of ten, e.g., 1 calorie = 4.184 joules and 1 kilogram-force = 9.806650 newtons. Some SI-
unrecognised metric units are still frequently used, e.g., the calorie (in nutrition), the rem (in the US), the jansky (in radio astronomy), the metric horsepower (for engine power, in most of the non-English speaking world), the kilogram-force (for engine power).
rocket engine thrust, in China and sometimes in Europe), etc. Others are now rarely used, such as the sthène and the rutherford. See also Non-SI units mentioned in the SI Conversion of units – Comparison of various scales Outline of the metric system – Overview of and topical guide to the metric system List of international common standards
Organisations International Bureau of Weights and Measurement standards end Measurement standards and conventions
Conventional electrical unit Coordinated Universal Time (UTC) – Primary time standard Unities, [1]: 165 which literally means 'International Gunities, [1]: 165 which literally means 'International Système international Système international Système international of the 11th
CGPM (1960), the international abbreviation of the system is: SI.[1]:165 ^ When we say 'SI system', we are basically saying the word 'system international System' twice: 'International System'). This is a type of linguistic redundancy called
pleonasm. Some examples of such pleonastic usage include the list of 'alternate titles' in the Encyclopedia Britannica article on the SI,[3] the last paragraph in an editorial in the journal Nature,[4] and the footnote 1 to Table 5 in the style manual of the International Astronomical Union.[5] ^ In a decimal system, different units for a given kind of
physical quantity are related by factors of 10, so that, within such a system, unit conversions involve the simple process of moving the decimal point to the right or to the left.[8] So instead of relations like 1 mile = 1760 yards, as we have in imperial and US customary measurement systems (which are not decimal), in the SI (which is decimal) we
 instead have 1 kilometre = 1000 metres. Here the kilometre is comparable in size to the mile (1 km \approx 0.6 mi) and the metre to the yard (1 m \approx 1.1 yd). ^ Or one of its decimal multiples or submultiples, like the centimetre. ^
force. ^ A metric system of units is any system of units is any system of weights and measures that is decimal[c] and based on the metre[d] as the unit of force. ^ As of 19 January 2021.[update] ^ a b The latter group includes economic unions such as the Caribbean Community
(CARICOM). ^ This is an international organization with[h] 63 member states and 39 Associate States and Economies of the General Conference (i)[12] It was established in 1875 under the terms of the Metre Convention.[11][13] ^ a b c From French: Conférence générale des poids et mesures. ^ a b It shall be lawful throughout the United States of
America to employ the weights and measures of the metric system; and no contract or dealing, or pleading in any court, shall be deemed invalid or liable to objection because the weights or measures expressed or referred to therein are weights or measures of the metric system. (15 U.S.C. § 204) ^ Here 'official status' means that the SI is recognized
in some way by the laws and regulations of the country. In many countries, this means that using the SI units is mandatory for most commercial and administrative purposes (e.g. in the European Union). On the other hand, when it comes to the US, 'official status' means that federal law specifically allows, but doesn't require, the SI units to be used.[1]
In fact, federal law even states that it is the declared policy of the United States to designate the metric system of measurement as the preferred system of measurement as the preferred system of measurement as the preferred system of measures for United States, Canada, and the United Kingdom, despite
the fact these three countries also continue to use their customary systems to various degrees. ^ Although the precise definition of coherence is complicated, the basic idea is that mathematical relations between the units for quantities should mirror the mathematical relations between the corresponding quantities themselves. For example, the
coherent unit of volume is equal to the volume of a cube whose sides are one unit of length; the coherent unit of pressure exerted by a unit-magnitude force over a surface of unit area; etc. As an example of lack of coherent unit of length.
The principal units of length are inches, feet, yards, and miles; meanwhile, the principal units of fluid volume are based on the (US) gallon, which, at 231 cubic inches, is not a cubic inch, or a cubic mile (note that 231=3×7×11). ^ For example, the SI unit of velocity is the metre per second, m·s-1; of acceleration is the
metre per second squared, m·s-2; etc. These can also be written as m/s and m/s2, respectively. ^ a b For example, the recommended unit for example to kg·m2·s-2, etc. The most recently named derived unit, the katal, was defined in 1999. ^ a b For example, the recommended unit for
the electric field strength is the volt per metre, V/m, where the volt is the derived unit for electric potential difference. The volt per metre is equal to kg·m·s-3·A-1 when expressed in terms of base units. ^ This must be one of 29 coherent derived
units with special names and symbols. ^ For example, the coherent SI unit of length is the metre, about the height of kitchen counter (just over 3 ft). But for driving distances, one would normally use kilometres, where one kilometres; here the metric prefix 'kilo-' (symbol 'k') stands for a factor of 1000. On the other hand, for tailoring
measurements, one would usually use centimetres, where one centimetre is 1/100 of a metre; here the metric prefix 'centi-' (symbol 'c') stands for a factor of 1/100. ^ Non-coherent, customary systems have another tendency, well-illustrated by the US customary system. In that system, some liquid commodities are measured neither in the coherent
units of volume (e.g. cubic inches) nor in gallons, but in barrels. Furthermore, the size of the barrel depends on the commodity: it means 31 US gallons for beer,[14] but 42 gallons for petroleum.[15] So different units may not be
related to each other in any obvious way—even if they have the same name. ^ Meaning that different units for a given quantity, such as length, are related by factors of 10. Therefore, calculations involve the same name. ^ Meaning that different units for a given quantity, such as length, are related by factors of 10. Therefore, calculations involve the same name. ^ Meaning that different units for a given quantity, such as length, are related by factors of 10. Therefore, calculations involve the same name. ^ Meaning that different units for a given quantity, such as length, are related by factors of 10. Therefore, calculations involve the same name. ^ Meaning that different units for a given quantity, such as length, are related by factors of 10. Therefore, calculations involve the same name. ^ Meaning that different units for a given quantity, such as length, are related by factors of 10. Therefore, calculations involve the same name. ^ Meaning that different units for a given quantity, such as length, are related by factors of 10. Therefore, calculations involve the same name. ^ Meaning that different units for a given quantity, such as length, are related by factors of 10. Therefore, calculations involve the same name. ^ Meaning that different units for a given quantity, such as length, are related by factors of 10. Therefore, calculations involve the same name. ^ Meaning that different units for a given quantity of 10. Therefore, and the same name of 10. Therefore, are related by factors of 10. Therefore, are related by fact
synonyms, there are in fact many mutually incompatible metric systems. Moreover, there exist metric units that are not recognised by the SI, below. As of May 2020[update], only for the following countries is it uncertain whether the SI has any official status: Myanmar, Liberia
the Federated States of Micronesia, the Marshall Islands, Palau, and Samoa. ^ In the US, the history of legislation begins with the Metric Act of 1866, which legally protected use of the metric system in commerce. The first section is still part of US law (15 U.S.C. § 204).[1] In 1875, the US became one of the original signatories of the Metric Act of 1866, which legally protected use of the metric system in commerce. The first section is still part of US law (15 U.S.C. § 204).[1] In 1875, the US became one of the original signatories of the Metric Act of 1866, which legally protected use of the metric system in commerce. The first section is still part of US law (15 U.S.C. § 204).[1] In 1875, the US became one of the original signatories of the Metric Act of 1866, which legally protected use of the metric system in commerce. The first section is still part of US law (15 U.S.C. § 204).[1] In 1875, the US became one of the original signatories of the Metric Act of 1866, which legally protected use of the metric system in commerce.
Convention. In 1893, the Mendenhall Order stated that the Office of Weights and Measures ... will in the future regard the International Prototype Metre and Kilogramme as fundamental standards, and the customary units — the yard and the pound — will be derived therefrom in accordance with the Act of July 28, 1866. In 1954, the US adopted the
International Nautical Mile, which is defined as exactly 1852 m, in lieu of the US Nautical Mile, defined as exactly in terms of the metre and the kilogram. In 1968, the Metric Study Act (Pub. L. 90-472, August
9, 1968, 82 Stat. 693) authorised a three-year study of systems of measurement in the US, with particular emphasis on the feasibility of adopting the SI. The Metric Conversion Act of 1975 followed, later amended by the Omnibus Trade and Competitiveness Act of 1988, the Savings in Construction Act of 1996, and the Department of Energy High-End
Computing Revitalization Act of 2004. As a result of all these acts, the US current law (15 U.S.C. § 205b) states that It is therefore the declared policy of the United States trade and commerce; (2) to require that each Federal
agency, by a date certain and to the extent economically feasible by the end of the fiscal year 1992, use the metric system of measurement in its procurements, grants, and other business-related activities, except to the extent that such use is impractical or is likely to cause significant inefficiencies or loss of markets to United States firms, such as
when foreign competitors are producing competitors are products in non-metric units; (3) to seek out ways to increase understanding of the metric system of measurement through educational information and guidance and in Government publications; and (4) to permit the continued use of traditional systems of weights and measures in non-business
activities. ^ There are differences between the US customary system and the United Kingdom's imperial system. For example, the imperial system are differences between the US customary system and the United Kingdom's imperial system. For example, the imperial system are differences between the US customary system and the United Kingdom's imperial system. For example, the imperial system. See e.g. here for the various definitions of the catty, a traditional
Chinese unit of mass, in various places across East and Southeast Asia. Similarly, see this article on the traditional Japanese units of measurement, as well as this one on the traditional Indian units of measurement, as well as this one on the traditional Indian units of measurement. ^ a b from French: Comité international des poids et mesures ^ a b The SI Brochure for short. As of May 2020[update], the latest edition
is the ninth, published in 2019. It is Ref.[1] of this article. ^ a b from French: Bureau international System of Quantities (ISQ).[1]:129 ^ The choice of which and even how many quantities to use as base quantities is not fundamental or even unique – it is a matter of convention.[1]:
126 For example, four base quantities could have been chosen as velocity, angular momentum, electric charge and energy. ^ Here are some examples of coherent derived SI units: the unit of velocity, which is the metre per second, with the symbol m/s2; etc. ^ A
useful property of a coherent system is that when the numerical values of physical quantities are expressed in terms of the units of the system, then the equations between the physical quantities;[16]:6 An example may be useful to
clarify this. Suppose we are given an equation relating some physical quantities, e.g. T = 1/2\{m\}\{v\}2, expressing the kinetic energy T in terms of the mass m and the velocity v. Choose a system of units, and let \{T\}, \{m\}, and \{v\} be the numerical values of T, m, and v when expressed in that system of units. If the system is coherent, then the
numerical values will obey the same equation (including numerical factors) as the physical quantities, i.e. we will have that T = 1/2\{m\}\{v\}2. Therefore, SI units can be converted without numerical factors: 1 J = 1 N·m = 1 C·V = 1 W·s.On the other hand, if the chosen system of units is not coherent, this property may fail. For example, the following is
not a coherent system: one where energy is measured in calories, while mass and velocity are measured in their SI units. After all, in that case, 1/2{m}{v}2 will give a numerical value whose meaning is the kinetic energy when expressed in joules, and that numerical value is different, by a factor of 4.184, from the numerical value when the kinetic
energy is expressed in calories. Thus, in that system, the equation satisfied by the numerical values is instead \{T\} = 1/4.1841/2\{m\}\{v\}2. A Which define the International System of Quantities (ISQ). This correct to say that an SI base unit (like the metre) is a coherent unit for its corresponding physical quantity. Recall that the set of coherent SI
units consists of the base units and the coherent derived units. This usage is consistent with a prefactor of 1. After all, each base unit is obviously so representable—it is equal to itself to the power of 1 and with a prefactor of 1. ^ One kilometre is about
0.62 miles, a length equal to about two and a half laps around a typical athletic track. Walking at a moderate pace for one hour, an adult human will cover about 50 km; from London to New York, 5600 km. In other words, given any base unit or any
coherent derived unit with a special name and symbol. ^ a b For historical reasons, names and symbols for decimal multiples of the unit of mass are formed as if it is the gram which is the base unit, i.e. by attaching prefix names and symbols, respectively, to the unit name "gram" and the unit symbol "g". For example, 10-6 kg is
written as milligram, mg, not as microkilogram, µkg.[1]: 144 ^ This last statement in fact applies to all SI units, not only those with special name and symbols. Consider the example of the SI unit is the newton-metre, N·m. The following are
some examples of non-coherent SI units of torque: N·mm, kN·µm, mN·cm, etc. Note that these non-coherent units are obtained from the original coherent unit by their decimal multiples or submultiples. But then these different powers
of ten combine into one overall power of ten. For example, kN \cdot \mu m = (103 \text{ N}) \cdot (10-6 \text{ m}) = 103-6 \text{ N} \cdot m = 10-3 \text{ N} \cdot m. As the SI Brochure states,[1]:140 this
applies not only to technical texts, but also, for example, to measured in non-coherent SI units such as millimetres in height collected on each square metre during a certain period, equivalent to litres period, equivalent to litres period.
square metre. ^ Even base units; the mole was added as a base SI unit only in 1971.[1]:156 ^ See the next section for why this type of definition is considered advantageous. ^ Their exactly defined values are as follows:[1]:128 \( \Delta \text{Cs}\) \( \) \( \Omega \text{S} \) \( \Omeg
6.62607015 \times 10 - 34 \text{ J} \cdot \text{s} = \{\text{displaystyle e}\} = 1.602176634 \times 10 - 19 \text{ C} \{\text{displaystyle k}\} = 1.380649 \times 10 - 23 \text{ J/K N A } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 1.380649 \times 10 - 23 \text{ J/K N A } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ K cd } \{\text{displaystyle k}\} = 6.02214076 \times 1023 \text{ mol} - 1 \text{ Mol} + 1 \text{ Mol} 
the second, which is still given not in terms of fixed values of fundamental constants but in terms of a particular property of a particular naturally occurring object, the caesium atom. And indeed, it has been clear for some time that relatively soon, by using atoms other than caesium, it will be possible to have definitions of the second that are more
precise than the current one. Taking advantage of these more precise methods will necessitate the change in the definition of the second, probably sometime around the year 2030.[23]:196[24] ^ a b Again, except for the second, probably sometime around the year 2030.[23]:196[24] ^ a b Again, except for the second, probably sometime around the year 2030.[23]:196[24] ^ a b Again, except for the second, probably sometime around the year 2030.[23]:196[24] ^ a b Again, except for the second, probably sometime around the year 2030.[23]:196[24] ^ a b Again, except for the second, probably sometime around the year 2030.[23]:196[24] ^ a b Again, except for the second, probably sometime around the year 2030.[23]:196[24] ^ a b Again, except for the second, probably sometime around the year 2030.[23]:196[24] ^ a b Again, except for the second, probably sometime around the year 2030.[23]:196[24] ^ a b Again, except for the second, probably sometime around the year 2030.[23]:196[24] ^ a b Again, except for the second, probably sometime around the year 2030.[23]:196[24] ^ a b Again, except for the year 2030.[23]:196[24] ^ a b Again, except for the year 2030.[23]:196[24] ^ a b Again, except for the year 2030.[23]:196[24] ^ a b Again, except for the year 2030.[23]:196[24] ^ a b Again, except for the year 2030.[23]:196[24] ^ a b Again, except for the year 2030.[23]:196[24] ^ a b Again, except for the year 2030.[23]:196[24] ^ a b Again, except for the year 2030.[23]:196[24] ^ a b Again, except for the year 2030.[23]:196[24] ^ a b Again, except for the year 2030.[23]:196[24] ^ a b Again, except for the year 2030.[23]:196[24] ^ a b Again, except for the year 2030.[23]:196[24] ^ a b Again, except for the year 2030.[23]:196[24] ^ a b Again, except for the year 2030.[23]:196[24] ^ a b Again, except for the year 2030.[23] ^ a b Again, except for the year 2030.[23] ^ a b Again, except for the year 2030.[23] ^ a b Again, except for the year 2030.[23] ^ a b Again, except for the year 2030.[23] ^ a b Again, except for the year 2030.[23] ^ a 
fundamental constant (whose derived unit includes the second), for example the Rydberg constant. For this to happen, the uncertainty in the measurement of whatever clock transition frequency is being used to define the second at that point. Once that
happens, the definitions will be reversed: the value of the constant will be fixed by definition but which has to be measured. Unfortunately, it is unlikely that this will happen in the
foreseeable future, because presently there are no promising strategies for measuring any additional fundamental constants with the necessary precision. To see this, recall that Hz = s-1 and J = kg \cdot m2 \cdot s-2. Thus, (Hz) (J \cdot s) / (m/s) 2
 = (s-1) [(kg \cdot m2 \cdot s-2) \cdot s] (m \cdot s-1) - 2 = s(-1-2+1+2) \cdot m(2-2) \cdot kg = kg, since all the powers of the units of the defining constants (that is, the only combination of powers of Hz, m/s, J·s, C, J/K, mol-1, and lm/W) that results in the kilogram
 ^ Namely, 1 Hz = \Delta \nu \text{Cs/9}192631770\ 1 m/s = c/299792458, and 1 J·s = h/6.62607015×10-34. The SI Brochure prefers to write the relationship between the kilogram and the defining 1 Hz, 1 m/s, and 1 J·s, like this:[1]:131 1 kg = (299792458)2/(6.62607015×10-34)
(9192631770)h ΔνCs/c2. ^ For example, from 1889 until 1960, the metre was defined as the length of the International Bureau of Weights and Measures, located in the Pavillon de Breteuil in Saint-Cloud, France, near Paris. The final
artefact-based definition of the metre, which stood from 1927 to the redefinition of the metre, at 0°, between the axes of the two central lines marked on the bar of platinum-iridium kept at the Bureau International des Poids et Mesures and declared Prototype of
represent the Airy points of the prototype—the points, separated by 4/7 of the total length of the bar, at which the bending or droop of the bar is minimised.[27] ^ The latter was called the 'quadrant', the length of a meridian from the equator to the North Pole. The originally chosen meridian was the Paris meridian. ^ At the time 'weight' and 'mass'
 were not always carefully distinguished. This volume is 1 cm3 = 1 mL, which is 1 \times 10-6 m3. Thus, the original definition of mass used not the coherent unit of volume (which would be the m3) but a decimal submultiple of it. Indeed, the original idea of the metric system was to define all units using only natural and universally available
measurable quantities. For example, the original definition of the unit of length, the metre, was a definite fraction (one ten-millionth) of the length of a quarter of the Earth's meridian. [bd] Once the metre was defined, one could define the unit of volume as the volume of a cube whose sides are one unit of length. And once the unit of volume was
determined, the unit of mass could be defined as the mass of a unit of volume of some convenient substance at standard conditions. In fact, the original definition of the hundredth part of a metre,[bf] and at the temperature of melting ice. However, it soon became
apparent that these particular 'natural' realisations of the units of length and mass simply could not, at that time, be as precise (and as convenient to access) as the needs of science, technology, and commerce demanded. Therefore, prototypes were adopted instead. Care was taken to manufacture the prototypes so that they would be as close as
possible, given the available science and technology of the day, to the idealised 'natural' realisations. But once the prototypes (see Mètre des Archives and Kilogramme des Archives). Nevertheless, throughout the history of the SI, one keeps seeing
expressions of hope that one day, one would be able to dispense with the prototypes and define all units in terms of standards found in nature. The first such standard was the second. It was never defined using a prototype, being originally defined as 1/86400 of the length of a day (since there are 60 s/min × 24 hr/day = 86400 s/day). As
we mentioned, the vision of defining all units in terms of universally available natural standards was at last fulfilled in 2019, when the sole remaining prototype used by the SI, the one for the kilogram, was finally retired. ^ The following references are useful for identifying the authors of the preceding reference: Ref.,,[29] Ref.,[30] and Ref.[31] ^ a b
As happened with British standards for length and mass in 1834, when they were lost or damaged beyond the point of useability in a great fire known as the burning of Parliament. A commission of eminent scientists was assembled to recommend the steps to be taken for the restoration of the standards, and in its report, it described the destruction
caused by the fire as follows:[28][bh] We shall in the first place describe the state of the House of Commons, as ascertained in our inspection of the House of Commons, as ascertained in our inspection of the Journal Office. The following
list, taken by ourselves from inspection, was compared with a list produced by Mr. Gudge, and stated by him to have been made by Mr. Gudge stated that no other Standards of Length or Weight were in his custody. No. 1. A brass
bar marked "Standard [G. II. crown emblem] Yard, 1758", which on examination was found to have its right hand stud completely melted out, a hole only remaining. The bar was somewhat bent, and discoloured in every part. No. 2. A brass bar with a projecting cock at each end,
forming a bed for the trial of yard-measures; discoloured. No. 3. A brass bar marked "Standard [G. II. crown emblem] Yard, 1760", from which the left hand stud was completely melted out, and which in other respects was in the same condition as No. 1. No. 4. A yard-bed similar to No. 2; discoloured. No. 5. A weight of the form [drawing of a weight]
marked [2 lb. T. 1758], apparently of brass or copper; much discoloured. No. 6. A weight marked in the same manner for 4 lbs., in the same state. No. 7. A weight similar to No. 6, with a hollow space at its base, which appeared at first sight to have been originally filled with some soft metal that had been now melted out, but which on a rough trial
was found to have nearly the same weight as No. 6. No. 8. A similar weight of 8 lbs., similarly marked (with the alteration of 8 lbs.), and in the same state. No. 9. Another exactly like No. 8. A similarly marked. No. 14. A weight with a triangular
ring-handle, marked "S.F. 1759 17 lbs. 8 dwts. Troy", apparently intended to represent the stone of 14 lbs. avoirdupois, allowing 7008 troy grains to each avoirdupois pound. It appears from this list that the bar adopted in the Act 5th Geo. IV., cap. 74, sect. 1, for the legal standard of one yard, (No. 3 of the preceding list), is so far injured, that it is
impossible to ascertain from it, with the most moderate accuracy, the statutable length of one yard. The legal standard of one troy pound is missing. We have therefore to report that it is absolutely necessary that steps be taken for the 2019
redefinition of the SI was the instability of the artefact that served as the definition of the kilogram. Before that, one of the reasons the United States started defining the yard in terms of the metre in 1893 was that[32]:381 [t]he bronze yard No. 11, which was an exact copy of the British imperial yard both in form and material, had shown change
when compared with the imperial yard in 1876 and 1888 which could not reasonably be said to be entirely due to changes in No. 11. Suspicion as to the constancy of the length of the British standard was therefore aroused. In the above, the bronze yard No. 11 is one of two copies of the new British standard was therefore aroused.
after Britain completed the manufacture of new imperial standards to replace those lost in the fire of 1834 (see [bi]). As standards of length, the new yards, especially bronze No. 11, were far superior to the standards of length, the new yards, especially bronze No. 11, were far superior to the standards of length, the new yards, especially bronze No. 11, were far superior to the standards of length, the new yards, especially bronze No. 11, were far superior to the standards of length, the new yards, especially bronze No. 11, were far superior to the standards of length, the new yards, especially bronze No. 11, were far superior to the standards of length, the new yards, especially bronze No. 11, were far superior to the standards of length, the new yards, especially bronze No. 11, were far superior to the standards of length, the new yards, especially bronze No. 11, were far superior to the standards of length, the new yards, especially bronze No. 11, were far superior to the standards of length, the new yards, especially bronze No. 11, were far superior to the standards of length, the new yards, especially bronze No. 11, were far superior to the standards of length, the new yards, especially bronze No. 11, were far superior to the standards of length, the new yards, especially bronze No. 11, were far superior to the standards of length, the new yards of length is not length.
Measures (a predecessor of NIST) as the standards of the United States. They were twice taken to England and recompared with the imperial yard, in 1876 and in 1888, and, as mentioned above, measurable discrepancies were found.[32]:381 In 1890, as a signatory of the Metre Convention, the US received two copies of the International Prototype
Metre, the construction of which represented the most advanced ideas of standards of the time. Therefore it seemed that US measures would have greater stability and higher accuracy by accepting the international metre as fundamental standard, which was formalised in 1893 by the Mendenhall Order.[32]:379-81 ^ As mentioned above, it is all but
certain that the defining constant \Delta \nu Cs {\displaystyle \Delta u _{\text{Cs}}} will have to be replaced relatively soon, as it is becoming increasingly clear that atoms other than caesium can provide more precise time standards. However, it is not excluded that some of the other defining constants would eventually have to be replaced as well. For
example, the elementary charge e corresponds to a coupling strength of the electromagnetic force via the fine-structure constant α {\displaystyle \alpha } can vary over time. The presently known experimental limits of the maximum possible variation of α {\displaystyle \alpha } are so low that 'any
effect on foreseeable practical measurements can be excluded, [1]:128 even if one of these theories turns out to be correct. Nevertheless, if the fine-structure constant turns out to slightly vary over time, science and technology may in the future advance to a point where such changes become measurable. At that point, one might consider replacing
for the purposes of defining the SI, the elementary charge with some other quantity, the choice of which will be informed by what we learn about the time variation of α {\displaystyle \alpha } . ^ The official term is "States Parties to the Metre Convention"; the term "Member States" is its synonym and used for easy reference.[12] As of
13 January 2020, [update][12] there are 63 Member States and 39 Associate States and Economies of the General Conference. [i] ^ Among the tasks of these Consultative Committees are the detailed consideration of advances in physics that directly influence metrology, the preparation of Recommendations for discussion at the CIPM, the
 identification, planning and execution of key comparisons of national measurement standards, and the provision of advice to the CIPM on the scientific work in the laboratories of the BIPM.[39] ^ As of April 2020, these include those from Spain (CEM), Russia (FATRiM), Switzerland (METAS), Italy (INRiM), South Korea (KRISS), France (LNE), China
(NIM), US (NIST), Japan (AIST/NIM]), UK (NPL), Canada (NRC), and Germany (PTB). As of April 2020, these include International Commission (ISO), and International Organization of Legal Metrology (OIML). As of April 2020, these include International Commission on
 Illumination (CIE), CODATA Task Group on Fundamental Constants, International Commission on Radiation Units and Measurements (ICRU), and International Astronomical Union (IAU), International Union of Pure and Applied Chemistry
(IUPAC), and International Union of Pure and Applied Physics (IUPAP). ^ These are individuals with a long-term involvement in matters related to units, having actively contributed to publications on units, and having a global view and understanding of science as well as knowledge on the development and functioning of the International System of
Units.[43] As of April 2020, these include[42][44] Prof. Marc Himbert and Dr. Terry Quinn. ^{\circ} For historical reasons, the kilogram rather than the gram is treated as the coherent unit, making an exception to this characterisation. ^{\circ} Ohm's law: 1 \Omega = 1 V/A from the relationship E = I × R, where E is electromotive force or voltage (unit: volt), I is current than the gram is treated as the coherent unit, making an exception to this characterisation.
(unit: ampere), and R is resistance (unit: ohm). The 22nd CGPM meeting Draft Resolution includes a proposal to add new unit prefixes ronna (R) for powers of 27, ronto (r) for -30.[49][50] While the second is readily determined from the Earth's rotation period, the metre, originally defined in terms of the
Earth's size and shape, is less amenable; however, the fact that the Earth's circumference is very close to 40000 km may be a useful mnemonic. ^{\circ} This is evident from the formula t = 2\pi \sqrt{L} (g. ^{\circ} A 60 watt light bulb has about 800 lumens[58] which is radiated
equally in all directions (i.e. 4\pi steradians), thus is equal to Iv = 800 lm/4\pi sr \approx 64 cd. ^{\circ} This is evident from the formula P = I V. ^{\circ} The unit is named after Anders Celsius. ^{\circ} a b Except where specifically noted, these rules are common to both the SI Brochure and the NIST brochure.
and Technology (NIST) has produced a version of the CGPM document (NIST SP 330) which clarifies usage for English-language publications that use American English ^ This term is a translation of the official [French] text of the SI Brochure. ^ The strength of the Earth's magnetic field was designated 1 G (gauss) at the surface (= 1
cm-1/2·g1/2·s-1). ^ Argentina, Austria-Hungary, Belgium, Brazil, Denmark, France, German Empire, Italy, Peru, Portugal, Russia, Spain, Sweden and Norway, Switzerland, Ottoman Empire, United States, and Venezuela. ^ The text "Des comparaisons périodiques des étalons nationaux avec les prototypes internationaux" (English: the periodical Comparaisons périodiques des étalons nationaux avec les prototypes internationaux avec les prototyp
comparisons of national standards with the international prototypes) in article 6.3 of the Metre Convention distinguishes between the words "standard" (OED: "The legal magnitude of a unit of measure or weight") and "prototype" (OED: "an original on which something is modelled"). ^ These included: General Conference on Weights and Measures
(Conférence générale des poids et mesures or CIPM) International Bureau of Weights and Measures (Comité international des poids et mesures or BIPM) – an international metrology centre at Sèvres in France that has custody of the
International prototype kilogram, provides metrology services for the CGPM and CIPM. ^ Pferd is German for "horse" and Stärke is German for "strength" or "power". The Pferdestärke is the power needed to raise 75 kg against gravity at the rate of one metre per second. (1 PS = 0.985 HP). ^ It is known as the International Prototype of the
Kilogram. ^ Meaning, they are neither part of the SI nor one of the non-SI units accepted for use with that system. ^ All major systems of units in which force rather than mass is a base unit are of a type known as gravitational system (also known as technical or engineering system). In the most
prominent metric example of such a system, the unit of force is taken to be the kilogram under standard kilogram under standar
therefore has a value of 1 hyl = 9.80665 kg, so that it is not a decimal multiple of the gram. ^ Having said that, some unit of length or as a decimal multiple or submultiple of the base unit in all of them. The metre is recognised by all metric systems. The second is a base unit in all of them. The metre is recognised by all metric systems. The second is a base unit in all of them. The metre is recognised by all metric systems.
hand, not every metric system recognises the gram as a unit (either the base unit, the unit of mass is then a derived unit, defined as the mass that, when acted upon by a net unit of mass as a base unit. The unit of mass is then a derived unit, defined as the mass that, when acted upon by a net unit of mass as a base unit.
force, is accelerated at the unit rate (i.e. at a rate of 1 base unit of length[cl] per second squared).[cm] ab c Interconversion between different systems of units is usually straightforward; however, the units for electricity and magnetism are an exception, and a surprising amount of care is required. The problem is that, in general, the physical
quantities that go by the same name and play the same role in the CGS-ESU, CGS-EMU, and SI—e.g. 'electric charge', 'electric field strength', etc.—do not merely have different units in the three systems; technically speaking, they are actually different units in the three systems; technically speaking, they are actually different units in the three systems; technically speaking, they are actually different units in the three systems; technically speaking, they are actually different units in the three systems; technically speaking, they are actually different units in the three systems; technically speaking, they are actually different units in the three systems; technically speaking, they are actually different units in the three systems; technically speaking, they are actually different units in the three systems; technically speaking, they are actually different units in the three systems; technically speaking, they are actually different units in the three systems; technically speaking, they are actually different units in the three systems; the system of the three systems are actually different units in the three systems; the system of the three systems are actually different units in the three systems; the system of the three systems are actually different units are actually different units.
systems can be identified as the quantity two instances of which enter in the numerator of Coulomb's law (as that law is written in each system). This identification produces three different physical quantities: the 'CGS-ESU charge', and the 'SI charge', and the 'SI charge', and the 'SI charge', and the 'SI charge'.
terms of the base dimensions: mass1/2 × length3/2 × time-1 for the CGS-ESU charge, mass1/2 × length1/2 for the CGS-EMU charge, and current is independent of those of mass, length, and time). On the other hand, these three quantities are clearly quantifying the same underlying
physical phenomenon. Thus, we say not that 'one abcoulomb corresponds to ten coulomb', [106]:423 written as 1 abC = 10 C.[107]:35 By that we mean, 'if the CGS-EMU electric charge is measured to have the magnitude of 1 abC, then the SI electric charge will have the magnitude of 10 C'.[107]:
35[108]: 57-58 ^ Neither EMU nor ESU units had sizes that were convenient for practical work of electrical engineers. It was therefore decided to establish a 'practical' system of units, where each unit is an appropriate decimal multiple or submultiple of the corresponding EMU unit, so that the resulting units have convenient sizes and form a
coherent system. These practical units were given names derived from the names of eminent scientists, and many of these units—both the names and the magnitudes—were later incorporated into the SI: the volt, the ampere, the ohm, etc. ^ For several decades, the ESU and EMU units did not have special names; one would just say, for example, the
ESU unit of resistance. In 1903, A. E. Kennelly suggested that the names of the ESU units be analogously obtained by using the 'abotat-', which was later
shortened to 'stat-' (giving the 'statohm', 
be derived from the corresponding names of practical units. Kennelly's naming system was widely used in the US, but, apparently, not in Europe.[110] ^ a b The CGS-Gaussian units are a blend of the CGS-ESU and CGS-EMU, taking units related to magnetism from the latter and all the rest from the former. In addition, the system introduces the
gauss as a special name for the CGS-EMU unit maxwell per square centimetre. ^ Authors often abuse notation slightly and write these with an 'equals' sign ('='). References ^ a b c d e f g h i j k l m n o p q r s t u v w x y z aa ab ac ad ae af ag ah ai aj ak International Bureau of Weights and Measures (20 May
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