International System of Units

The **International System of Units** (abbreviated **SI** from the French *Le **S**ystème **I**nternational d'Unités*) is the modern form of the metric system and is generally a system devised around the convenience of the number 10.
The headquarters of The International System of Units is located in Sevres, France.

In Slovakia, this role is assumed by the Slovak Institute of Metrology in Bratislava.

SI base units

There are seven base units:

Name	Symbol	Quantity
metre	**m**	length
kilogram	**kg**	mass
second	**s**	time
ampere	**A**	electric current
kelvin	**K**	thermodynamic temperature
mole	**mol**	amount of substance
candela	**cd**	luminous intensity

Ampere

The **ampere** (symbol: **A**) is the basic SI unit of electrical current (*I*). It is named after the French scientist who discovered electromagnetism André Marie Ampère.

SI definition:

The ampere is a constant current which will produce a force of 2×10^{-7} newtons per meter of length between two straight, parallel conductors of infinite length and negligible circular cross-section placed one metre apart in a vacuum.

SI derived units

Derived units are created by combining several basic units. Due to the length and complexity of their names, some of them are assigned a new name: coulomb, kilogram per cubic metre, kilogram per square metre, metre per second, newton, ohm, pascal, volt, watt,…

Other SI units

Some units do not belong to the SI system, but are accepted due to their widespread use: hour, minute, degree of Celsius, liter,...

Prefix

Prefixes are used to express the multiples or parts of basic and derived units.

abb.	name	origin	value		name
T	tera	gr. *τέρας, téras* = tetrákis = four times	10^{12}	1 000 000 000 000	trillion
G	giga	gr. *γίγας, gígas* = great	10^{9}	1 000 000 000	milliard*
M	mega	gr. *μέγας, mégas* = big	10^{6}	1 000 000	million
k	kilo	gr. *χίλιοι, chílioi* = thousand	10^{3}	1 000	thousand
h	hekto	gr. *εκατόν, hekatón* = hundred	10^{2}	100	hundred
da	deka	gr. *δέκα, déka* = ten	10^{1}	10	ten
–	**----**		10^{0}	1	one
d	deci	lat. *decimus* = tenth	10^{-1}	0,1	tenth
c	centi	lat. *centesimus* = hundredth	10^{-2}	0,01	hundredth
m	mili	lat. *millesimus* = thousandth	10^{-3}	0,001	thousandth
μ	mikro	gr. *μικρός, mikrós* = small	10^{-6}	0,000 001	millionth
n	nano	gr. *νάνος, nános* = trpaslík	10^{-9}	0,000 000 001	milliardth
p	piko	tal. *piccolo* = small	10^{-12}	0,000 000 000 001	billionth

*) American equivalent of the Slovak unit called “milliard” is a billion.

For example: 1 kV = 10^{3} V = 1 000 V; 1 pF = 10^{-12} F = 0,000 000 000 001 F

Volt

The **volt** (symbol: **V**) is the SI derived unit of electric potential difference (*U*) or electromotive force (*E*). It is named in honor of the Lombardy physicist Alessandro Volta.

The volt is defined as the potential difference across a conductor when a current of one ampere dissipates one watt of power.

$$U = \frac{P}{I}\ \text{[V; W, A]}$$

Ohm

The **ohm** (symbol: Ω) is the SI unit of electrical impedance (*Z*) or, in the direct current case, electrical resistance (*R*), named after Georg Ohm.

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

$$R = \frac{U}{I} \text{ or } Z = \frac{U}{I} \text{ [Ω; V, A]}$$

Siemens

The **siemens** (symbol: S) is the SI derived unit of electric conductance. It is equal to inverse of ohm. It is named after the German inventor and industrialist Ernest Werner von Siemens. In English, the term *siemens* is used both for the singular and plural. The 14th General Conference on Weights and Measures approved the addition of the siemens as an SI derived unit in 1971.

The **siemens** is equivalent to the previously used ***mho*** unit, which was derived from spelling *ohm* backwards and written with an upside-down capital Greek letter Omega: [℧].

Watt

The **watt** (symbol: **W**) is the SI derived unit of power, equal to one joule of energy per second. 1 W = 1 J/s = 1 Nm/s

In electrical terms, if one volt of potential difference is applied to a resistive load, and a current of one ampere flows, then one watt of power is dissipated. More simply stated: watts is equal to amps times volts. $P=U.I$ [W; V,A]

The **watt** is named after James Watt for his contributions to the development of the steam engine.

The power in a d-c circuit is equal to the product of volts and amperes, but in an a-c circuit this is true only when the load is resistive and has no reactance.

In the a-c circuit, we recognize three types of powers: true power *P*, reactive power *Q* and apparent power *S*.

The relation between the aforementioned powers is: $S^2 = P^2 + Q^2$

Apparent power: $S=U.I$ [VA; V,A]; **True power**: $P=S.\cos\varphi = U.I.\cos\varphi$ [W; V,A];

Reactive power: $Q=S.\sin\varphi = U.I.\sin\varphi$ [VAr; V,A]

The ratio of the true power to the apparent power in an a-c circuit is called the **power factor** (cos φ):

$\cos\varphi = \frac{P}{S}$. Its value can be between 0 and 1.

Hertz

The hertz (**Hz**) is a derived SI unit of frequency (*f*). It is named after German physics, professor Heinrich Rudolf Hertz, a scientist in the area of electromagnetic waves.

This unit defines the number of periodic phenomena per second. One Hz simply means "one time per second" (*1/s*, s^{-1}); 100 Hz means "a hundred times per second", etc. Sometimes cycles per second instead of the term Hertz is used. One hertz simply means "one cycle per second".

Farad

The **farad** (symbol: F) is the SI unit of capacitance. It is named after the British physicist Michael Faraday. The farad is defined as the amount of capacitance for which a potential difference of one volt results in a static charge of one coulomb. It has the base SI representation of $\frac{s^4.A^2}{m^2.kg}$. Since an ampere is the rate of electrical flow (current) of one coulomb per second, an alternate definition is that a farad is the amount of capacitance that requires one second for one ampere flow of charge (Q) to change the voltage by one volt: $C = \frac{Q}{U} = \frac{I.t}{U}$.

Farad is relatively big unit; many electronic circuits require capacitors of much smaller values such as pico Farad or micro Farad.

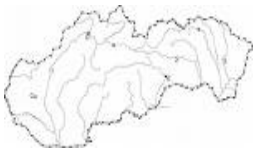
Henry

The **henry** (symbol: H) is the SI unit of inductance. It is named after Joseph Henry (1797-1878), American scientist who discovered electromagnetic induction independently of and at about the same time as Michael Faraday (1791-1867) in England.

If the rate of change of current in a circuit is one ampere per second and the resulting electromotive force is one volt, then the inductance of the circuit is one henry.

Other units

Celsius – Fahrenheit – Kelvin



°C °F

Hi! How are you? What's the weather like there?

Hello. I'm fine, thank you. It is 30 degrees outside.

20 68

Ohh! That is very cold. What are you doing right now?

I am sitting by the pool in a swimsuit and I'm sweating.

You must be kidding! When we have 30 degrees here, we wear winter jackets.

If it is 30 degrees Fahrenheit in Seattle, what is the equivalent temperature in degrees Celsius? How many Kelvins is that?

$^oC = (^oF - 32)\frac{5}{9}$ $^oF = {}^oC\frac{9}{5} + 32$ $K = {}^oC + 273{,}16$

Units used in some other countries:

Length:

inch	1 in = 25,4 mm
foot	1 ft = 12 in
yard	1 yd = 3 ft
mile	1 mile = 1609,3 m

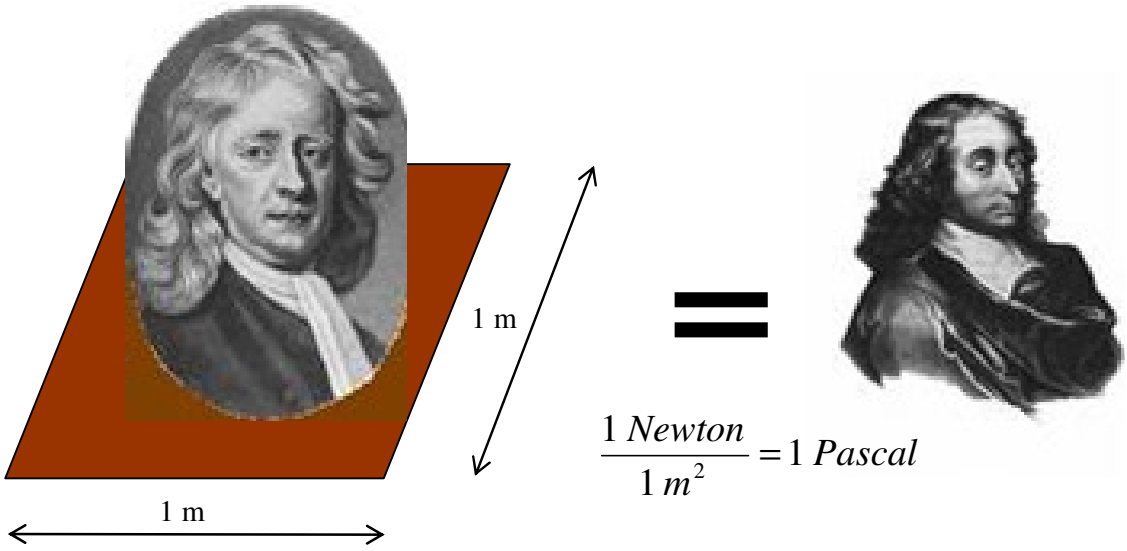
Mass:

pound	1 lb = 16 oz = 453,6 g
ounce	1 oz = 28,35 g
ton (UK)	1 ton = 1016,1 kg
ton (US)	1 ton = 907,2 kg

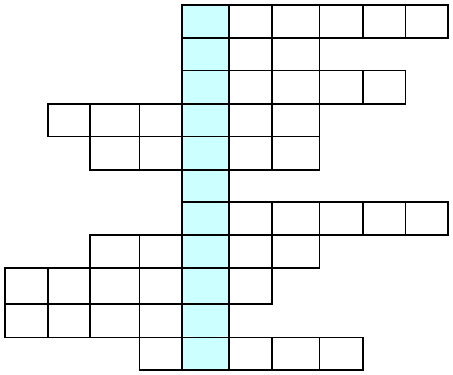
Volume:

gallon (UK)	1 gal = 4,55 l
gallon (US)	1 gal = 3,78 l
pint (UK)	1 pt = 5,68 dl
barrel (US)	1 bbl = 159 l
fluid ounce (UK)	1 fl oz = 28,4 ml
fluid ounce (US)	1 fl oz = 29,6 ml

Joke



The greatest scientific award:



The unit of force
Inverse unit for siemens
Name of the founder of logical algebra.
Basic unit for electric current.
Name of a physicist after which the unit voltage is named.

The unit of pressure.
Maria Sklodovska's name after her wedding.
Basic unit for thermodynamic temperature.
The unit of frequency.
The unit of magnetic field.

VOCABULARY

length – dĺžka
mass – hmotnosť
electric current – elektrický prúd
luminous intensity – svietivosť
amount of substance – látkové množstvo
basic unit – základná jednotka
derived unit – odvodená jednotka
voltage – napätie (elektrické)
power – výkon, sila
true power – činný výkon
reactive power – jalový výkon
apparent power – zdanlivý výkon
conductor – vodič (elektrický)
contribution – príspevok
load – záťaž (elektrická)
inductance – indukčnosť
development – vývoj, vývin, rozvoj
steam engine – parný stroj/motor
charge – náboj (elektrický)
pressure – tlak (mechanický)
tension – napätie (mechanické)
power factor – účinník