



SI Units and Prefixes

International System of Units

- Abbreviated SI in all languages
 - Système International d'Unités
- System of units of measurement
 - Current version adopted by 41 nations in 1971
 - Has long history dating back to 1795
- Defines
 - seven base units
 - over thirty derived units
- Unique symbols defined for each of the base units and many of the derived units
- Used heavily in science and engineering

Prefixes

- Used in conjunction with units of measure to denote larger or smaller quantities
- Twenty prefixes are defined
- Only one prefix is used at a time

Base Units of Measure

- Seven base units measure
 - length
 - mass
 - time
 - electric current
 - thermodynamic temperature
 - luminous intensity
 - amount of substance
- Each has a name and symbol
- Example:
 - quantity: length
 - unit: meter
 - symbol: m

Base Units of Measure

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

Derived Units

- Units derived or dependent on one or more of the base units
- Examples:

Quantity	Unit	Symbol
area	square meter	m^2
velocity	meter per second	m/s ($\text{m}\cdot\text{s}^{-1}$)
frequency	Hertz	s^{-1}
force	Newton	N ($\text{kg}\cdot\text{m/s}^2$)

Units Important in Electronics

Quantity	Unit	Symbol	
power	watt	W	(J/s)
electric charge	coulomb	C	(A•s)
potential difference	volt	V	(W/A)
electric resistance	ohm	Ω	(V/A)
capacitance	farad	F	(A•s/V)
inductance	henry	H	(V•s/A)

J is the symbol for joule, which measures work or energy.
It is N•m

Prefixes

- Used to augment units to express larger or smaller quantities
- Prefix is placed in front of the unit of measure
 - 1000 W (watts) can be expressed a 1 kW (kilowatt)
 - 1/100 meter is 1 cm (centimeter)
- Only one prefix can be used at a time
 - 12,000,000,000 W-Not 12 kW, but 12 GW
 - 500,000 m - Not 5 hkm, but 500 km

Defined Prefixes

Factor to multiply unit by	Prefix	Symbol
10^{24}	yotta	Y
10^{21}	zetta	Z
10^{18}	exa	E
10^{15}	peta	P
10^{12}	tera	T
10^9	giga	G
10^6	mega	M
10^3	kilo	k
10^2	hecto	h
10^1	deka	da

Bold indicates the ones you must know

Defined Prefixes (cont.)

Factor to multiply unit by	Prefix	Symbol
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f
10^{-18}	atto	a
10^{-21}	zepto	z
10^{-24}	yocto	y

Bold indicates the ones you must know

Prefix Examples

- Rather than say 24,000 V (volts), we can say 24 kV
 - $24,000 = 24 \times 1000$
 - The prefix for 1000 is kilo (k)
 - $24,000 \text{ V} = 24 \text{ kV}$

- A capacitor is an electronic circuit component that stores charge
 - Ability to store charge is capacitance
 - Unit of measure: farad (F)
 - Typical value: $4 \times 10^{-6} \text{ F}$ or $4 \mu\text{F}$

Test Yourself

- What is the unit of electric current? What is its symbol?
- What is the unit of time and its symbol?
- What do these symbols stand for? Some are units. Some are prefixes.
 - m
 - Ω
 - M
 - T
 - kg
 - μ
 - G

Test Answers

- What is the unit of electric current? What is its symbol? *Ampere, A*
- What is the unit of time and its symbol? *Second, s*
- What do these symbols stand for? Some are units. Some are prefixes.
 - m *milli, prefix for 10^{-3} ; and meter, unit of length*
 - Ω *ohm, unit of electric resistance*
 - M *mega, prefix for 10^6*
 - T *tera, prefix for 10^{12}*
 - kg *kilogram, unit of mass*
 - μ *micro, prefix for 10^{-6}*
 - G *giga, prefix for 10^9*

For More Information

- See the BIPM (Bureau International des Poids et Mesures) website at www.bipm.org/en/si