
תכנית

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מחלקת המחקר והפיתוח

The atomic number and atomic weights of the elements ($^{12}\text{C} = 12$ amu, exactly)

Element	Symbol	Atomic number	Atomic weight*	Element	Symbol	Atomic number	Atomic weight*
Actinium	Ac	89	227.0278	Neodymium	Nd	60	144.24
Aluminium	Al	13	26.98154	Neon	Ne	10	20.179
Americium	Am	95	(243)	Neptunium	Np	93	237.0482
Antimony	Sb	51	121.75	Nickel	Ni	28	58.70
Argon	Ar	18	39.948	Niobium	Nb	41	92.9064
Arsenic	As	33	74.9216	Nitrogen	N	7	14.0067
Astatine	At	85	(210)	Nobelium	No	102	(259)
Barium	Ba	56	137.33	Osmium	Os	76	190.2
Berkelium	Bk	97	(247)	Oxygen	O	8	15.9994
Beryllium	Be	4	9.01218	Palladium	Pd	46	106.4
Bismuth	Bi	83	208.9804	Phosphorous	P	15	30.97376
Boron	B	5	10.81	Platinum	Pt	78	195.09
Bromine	Br	35	79.904	Plutonium	Pu	94	(244)
Cadmium	Cd	48	112.41	Polonium	Po	84	(209)
Calcium	Ca	20	40.08	Potassium	K	19	39.0983
Californium	Cf	98	(251)	Praseodymium	Pr	59	140.9077
Carbon	C	6	12.011	Promethium	Pm	61	(145)
Cerium	Ce	58	140.12	Protactinium	Pa	91	231.0359
Cesium	Cs	55	132.9054	Radium	Ra	88	226.0254
Chlorine	Cl	17	35.453	Radon	Rn	86	(222)
Chromium	Cr	24	51.996	Rhenium	Re	75	186.207
Cobalt	Co	27	58.9332	Rhodium	Rh	45	102.9055
Copper	Cu	29	63.546	Rubidium	Rb	37	85.4678
Curium	Cm	96	(247)	Ruthenium	Ru	44	101.07
Dysprosium	Dy	66	162.50	Rutherfordium	Rf	104	(261)
Einsteinium	Es	99	(254)	Samarium	Sm	62	150.4
Erbium	Er	68	167.26	Scandium	Sc	21	44.9559
Europium	Eu	63	151.96	Selenium	Se	34	78.96
Fermium	Fm	100	(257)	Silicon	Si	14	28.0855
Fluorine	F	9	18.99840	Silver	Ag	47	107.8682
Francium	Fr	87	(223)	Sodium	Na	11	22.98977
Gadolinium	Gd	64	157.25	Strontium	Sr	38	87.62
Gallium	Ga	31	69.72	Sulfur	S	16	32.06
Germanium	Ge	32	72.59	Tantalum	Ta	73	180.9479
Gold	Au	79	196.9665	Technetium	Tc	43	(97)
Hafnium	Hf	72	178.49	Tellurium	Te	52	127.60
Hahnium	Ha	105	(262)	Terbium	Tb	65	158.9254
Helium	He	2	4.00260	Thallium	Tl	81	204.37
Holmium	Ho	67	164.9304	Thorium	Th	90	232.0381
Hydrogen	H	1	1.0079	Thulium	Tm	69	168.9342
Indium	In	49	114.82	Tin	Sn	50	118.69
Iodine	I	53	126.9045	Titanium	Ti	22	47.90
Iridium	Ir	77	192.22	Tungsten	W	74	183.85
Iron	Fe	26	55.847	Uranium	U	92	238.029
Krypton	Kr	36	83.80	Vanadium	V	23	50.9414
Lanthanum	La	57	138.9055	Xenon	Xe	54	131.30
Lawrencium	Lr	103	(260)	Ytterbium	Yb	70	173.04
Lead	Pb	82	207.2	Yttrium	Y	39	88.9059
Lithium	Li	3	6.941	Zinc	Zn	30	65.38
Lutetium	Lu	71	174.97	Zirconium	Zr	40	91.22
Magnesium	Mg	12	24.305	—	—	106	(263)
Manganese	Mn	25	54.9380				
Mendelevium	Md	101	(258)				
Mercury	Hg	80	200.59				
Molybdenum	Mo	42	95.94				

* A value in parentheses is the mass number of the longest-lived isotope of the element.

Recommended Names and Symbols for Selected Physical Quantities

Name	Symbol	Name	Symbol
Length	l	Quantity of heat	q
Width	w	Internal energy	U
Height	h	Enthalpy	H
Radius	r	Entropy	S
Diameter	d	Gibbs free energy	G
Area	A	Molar heat capacity	
Volume	V	Constant volume	C_V
Time	t	Constant pressure	C_p
speed	u	Specific heat capacity	c
Speed of light in a vacuum	c	Degree of dissociation	α
Gravitational acceleration	g	Equilibrium constant	K
Amplitude of a wave	A	Acid constant	K_a
Frequency	ν	Base constant	K_b
Wavelength	λ	Self-ionization constant for water	K_w
Mass	m	Solubility product	K_{sp}
Density	ρ	Standard equilibrium constant	K^\ominus
Force	F	Standard increase in	
Pressure	P	Gibbs free energy	ΔG^\ominus
Work	W	Standard increase in enthalpy	ΔH^\ominus
Potential energy	E_p	Standard increase in entropy	ΔS^\ominus
Kinetic energy	E_k	Electrical charge	Q
Thermodynamic temperature	T	Electrical current	I
Electrical potential difference (voltage)	ΔV	Osmotic pressure	Π
Electromotive force	E	Mass number	A
Faraday constant	F	Atomic number	Z
Molar mass	M	Neutron number	N
Gas constant	R	Charge of electron	$-e$
Molar volume	V_m	Planck constant	h
Amount of substance A	n_A	Principal quantum number	n
Concentration of substance A	c_A	Half-life	$t_{1/2}$
Mole fraction of substance A	x_A	Avogadro constant	N_A
Mass fraction of substance A	w_A	Number of molecules	N
Partial pressure of substance A	p_A	Molecular dipole moment	μ
Equilibrium concentration of substance A	$[A]$	Rate constant	k
		Activation energy	E^\ddagger

International System of Units (SI)

Base and Important Derived Units

Quantity	Name of unit	Symbol	Definition
Length	meter	m	base unit
Mass	kilogram	kg	base unit
Time	second	s	base unit
Electric current	ampere	A	base unit
Thermodynamic temperature	kelvin	K	base unit
Luminous intensity	candela	cd	base unit
Amount of substance	mole	mol	base unit
Area	square meter	m ²	m ²
Volume	cubic meter	m ³	m ³
Force	newton	N	kg m s ⁻²
Pressure	pascal	Pa	N m ⁻²
Energy	joule	J	kg m ² s ⁻²
Power	watt	W	J s ⁻¹
Electric charge	coulomb	C	AS
Electric potential difference	volt	V	J A ⁻¹ s ⁻¹

SI Prefixes

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

Selected Physical and Chemical Constants

Name	Symbol	Value
Avogadro constant	N_A	$6.022\ 094 \times 10^{23} \text{ mol}^{-1}$
Boltzmann constant	k	$1.380\ 62 \times 10^{-23} \text{ J K}^{-1}$
Electron rest mass	m_e	$9.109\ 56 \times 10^{-31} \text{ kg}$
Electronic charge	$-e$	$-1.602\ 192 \times 10^{-19} \text{ C}$
Faraday constant	F	$9.648\ 67 \times 10^4 \text{ C mol}^{-1}$
Gas constant	R	$8.3143 \text{ J K}^{-1} \text{ mol}^{-1} =$ $8.2056 \times 10^{-2} \text{ l atm K}^{-1} \text{ mol}^{-1} =$ $1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$
Gravitational acceleration (at sea level)	g	$9.806\ 65 \text{ m s}^{-2}$
Neutron rest mass	m_n	$1.674\ 92 \times 10^{-27} \text{ kg}$
Planck's constant	h	$6.626\ 20 \times 10^{-34} \text{ J s}$
Proton rest mass	m_p	$1.672\ 61 \times 10^{-27} \text{ kg}$
Rydberg constant (theoretical)	R_∞	$1.097\ 373\ 1 \times 10^7 \text{ m}^{-1}$
Speed of light in a vacuum	c	$2.997\ 925 \times 10^8 \text{ m s}^{-1}$

Definition of Other Units in Terms of SI Units

Quantity	Definition*	Quantity	Definition*
Length	1 mi = 1.609 km	Pressure	1 dyn cm ⁻² = 0.1 Pa
	1 yd = 0.914 m		1 lb in ⁻² = 6.89 kPa
	1 ft = 0.305 m		1 atm = 101.325 kPa
	39.37 in = 1 m		760 mmHg = 101.325 kPa
	1 in = 2.54 cm		1 bar = 10 ² kPa
	1 angstrom (Å) = 10 ⁻¹⁰ m		760 torr = 101.325 kPa
Mass	1 A ≈ 100 μm	Energy	1 British thermal unit (Btu) ≈ 1055 J
	1 ton (U.S. long) = 1.106 Mg		1 erg = 10 ⁻⁷ J
	1 tonne (metric) = 1 Mg		1 calorie (cal) = 4.184 J
	1 ton (U.S. short) = 0.907 Mg		1 Calorie (nutritional) = 4.184 X 10 ³ J
	2.205 lb (avdp) = 1 kg		1 liter atm = 101.325 J
	1 lb (avdp) = 453.6 g		1 kilowatt hour (kwh) = 3.600 X 10 ⁶ J
Time	1 lb (avdp) = 28.35 g	Volume	1 barrel (U.S. petroleum) (bbl) = 0.159 m ³
	1 year = 3.16 X 10 ⁷ s		1 gal (U.S. liquid) = 3.79 dm ³
	1 day = 8.64 X 10 ⁴ s		1 liter ≈ 1 dm ³
	1 h = 3600 s		1 qt = 0.947 dm ³
	1 min = 60 s		1 pt = 0.474 dm ³
	1 ft ² ≈ 0.093 m ²		1 in ³ = 16.4 cm ³
Area	1 in ² = 6.45 cm ²	1 ml = 1 cm ³	
	1 dyne (dyn) = 10 ⁻⁵ N		
Force	1 horsepower (hp) = 745.7 W		
Power			

The equalities in this column may be used to obtain conversion factors which convert from one type of unit to another.