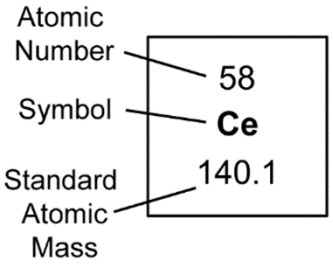
REFERENCE MATERIALS FOR CHEMISTRY



PERIODIC TABLE OF THE ELEMENTS

	1																	18
1	1 **H** 1.0	2											13	14	15	16	17	2 **He** 4.0
2	3 **Li** 6.9	4 **Be** 9.0											5 **B** 10.8	6 **C** 12.0	7 **N** 14.0	8 **O** 16.0	9 **F** 19.0	10 **Ne** 20.2
3	11 **Na** 23.0	12 **Mg** 24.3	3	4	5	6	7	8	9	10	11	12	13 **Al** 27.0	14 **Si** 28.1	15 **P** 31.0	16 **S** 32.1	17 **Cl** 35.5	18 **Ar** 39.9
4	19 **K** 39.1	20 **Ca** 40.1	21 **Sc** 45.0	22 **Ti** 47.9	23 **V** 50.9	24 **Cr** 52.0	25 **Mn** 54.9	26 **Fe** 55.8	27 **Co** 58.9	28 **Ni** 58.7	29 **Cu** 63.5	30 **Zn** 65.4	31 **Ga** 69.7	32 **Ge** 72.6	33 **As** 74.9	34 **Se** 79.0	35 **Br** 79.9	36 **Kr** 83.8
5	37 **Rb** 85.5	38 **Sr** 87.6	39 **Y** 88.9	40 **Zr** 91.2	41 **Nb** 92.9	42 **Mo** 95.9	43 **Tc** (98)	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.4	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.3
6	55 **Cs** 132.9	56 **Ba** 137.3	57–71	72 **Hf** 178.5	73 **Ta** 180.9	74 **W** 183.8	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197.0	80 **Hg** 200.6	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209.0	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
7	87 **Fr** (223)	88 **Ra** (226)	89–103	104 **Rf** (267)	105 **Db** (268)	106 **Sg** (271)	107 **Bh** (272)	108 **Hs** (289)	109 **Mt** (278)	110 **Ds** (281)	111 **Rg** (280)	112 **Cn** (285)	113 **Nh** (284)	114 **Fl** (289)	115 **Mc** (288)	116 **Lv** (292)	117 **Ts** (294)	118 **Og** (294)

Lanthanide Series	57 **La** 138.9	58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** (145)	62 **Sm** 150.4	63 **Eu** 152.0	64 **Gd** 157.3	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.9	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173.0	71 **Lu** 175.0
Actinide Series	89 **Ac** (227)	90 **Th** 232.0	91 **Pa** 231.0	92 **U** 238.0	93 **Np** (237)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (262)

Standard atomic mass values are not listed for elements with no stable isotopes.

Selected Units of Measure

Measure	Unit Name	Symbol
atomic mass	atomic mass unit	u
concentration	parts per million	ppm
concentration	molarity	M
energy, work, quantity of heat	joule	J
length	meter	m
mass	gram	g
pressure	pascal	Pa
quantity of a substance	mole	mol
temperature	kelvin	K
temperature	degree Celsius	°C
volume	liter	L

Prefixes for Metric Units

Factor	Prefix	Symbol
10^{-12}	pico-	p
10^{-9}	nano-	n
10^{-6}	micro-	μ
10^{-3}	milli-	m
10^{-2}	centi-	c
10^{-1}	deci-	d
10^{1}	deca-	D
10^{2}	hecto-	h
10^{3}	kilo-	k

Symbols of Nuclear Chemistry

Name	Symbol
alpha particle	α
beta particle	β^-
gamma radiation	γ
neutron	n
proton	p
positron	β^+

Common Acids

Name	Formula
acetic acid	$HC_2H_3O_2(aq)$
carbonic acid	$H_2CO_3(aq)$
hydrochloric acid	$HCl(aq)$
nitric acid	$HNO_3(aq)$
nitrous acid	$HNO_2(aq)$
phosphoric acid	$H_3PO_4(aq)$
sulfuric acid	$H_2SO_4(aq)$
sulfurous acid	$H_2SO_3(aq)$

Common Bases

Name	Formula
aqueous ammonia	$NH_3(aq)$
calcium hydroxide	$Ca(OH)_2(aq)$
potassium hydroxide	$KOH(aq)$
sodium hydroxide	$NaOH(aq)$

Selected Polyatomic Ions

Name	Formula
acetate	$C_2H_3O_2^-$
ammonium	NH_4^+
carbonate	CO_3^{2-}
chlorite	ClO_2^-
chlorate	ClO_3^-
chromate	CrO_4^{2-}
cyanide	CN^-
dichromate	$Cr_2O_7^{2-}$
hydrogen carbonate	HCO_3^-
hydrogen sulfate	HSO_4^-
hydronium	H_3O^+
hydroxide	OH^-
hypochlorite	ClO^-
mercury (*I*)	Hg_2^{2+}
nitrite	NO_2^-
nitrate	NO_3^-
oxalate	$C_2O_4^{2-}$
perchlorate	ClO_4^-
permanganate	MnO_4^-
phosphate	PO_4^{3-}
sulfite	SO_3^{2-}
sulfate	SO_4^{2-}
thiocyanate	SCN^-
thiosulfate	$S_2O_3^{2-}$

Selected Formulas and Equations

Description	Formula/Equation	Symbols
Combined gas law	$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$	P = pressure V = volume T = temperature
Titration	$M_AV_A = M_BV_B$	M_A = molarity of H^+ V_A = volume of acid M_B = molarity of OH^- V_B = volume of base
Heat	$q = mC\Delta T$	q = heat m = mass C = specific heat capacity ΔT = change in temperature
Temperature	K = °C + 273	

Standard Temperature and Pressure

Standard temperature	273 K
Standard pressure	101.3 kPa

Physical Constants and Properties of Water

Density at 4°C	1.0 g/mL
Heat of fusion	334 J/g
Heat of vaporization	2260 J/g
Specific heat capacity of $H_2O(\ell)$	4.18 J/(g•K)