

Rows → 7 periods
 ↑ ↓ Ion charge (columns ↓ groups / families)

Periodic Table of the Elements

s block p block d block f block

8A 0
 8e⁻ 18

3A 13 4A 14 5A 15 6A 16 7A 17
 2e⁻ 13 4e⁻ 14 5e⁻ 15 6e⁻ 16 7e⁻ 17

Transition Metals

1 H Hydrogen 1.01	2 He Helium 4.00																	3 Li Lithium 6.94	4 Be Beryllium 9.01	5 B Boron 10.81	6 C Carbon 12.01	7 N Nitrogen 14.01	8 O Oxygen 16.00	9 F Fluorine 19.00	10 Ne Neon 20.18	11 Na Sodium 22.99	12 Mg Magnesium 24.31	13 Al Aluminum 26.98	14 Si Silicon 28.09	15 P Phosphorus 30.97	16 S Sulfur 32.07	17 Cl Chlorine 35.45	18 Ar Argon 39.95	19 K Potassium 39.10	20 Ca Calcium 40.08	21 Sc Scandium 44.96	22 Ti Titanium 47.87	23 V Vanadium 50.94	24 Cr Chromium 51.99	25 Mn Manganese 54.94	26 Fe Iron 55.85	27 Co Cobalt 58.93	28 Ni Nickel 58.69	29 Cu Copper 63.55	30 Zn Zinc 65.38	31 Ga Gallium 69.72	32 Ge Germanium 72.63	33 As Arsenic 74.92	34 Se Selenium 78.97	35 Br Bromine 79.90	36 Kr Krypton 83.80	37 Rb Rubidium 85.47	38 Sr Strontium 87.62	39 Y Yttrium 88.91	40 Zr Zirconium 91.22	41 Nb Niobium 92.91	42 Mo Molybdenum 95.95	43 Tc Technetium 98.91	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.91	46 Pd Palladium 106.42	47 Ag Silver 107.87	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.71	51 Sb Antimony 121.76	52 Te Tellurium 127.6	53 I Iodine 126.90	54 Xe Xenon 131.29	55 Cs Cesium 132.91	56 Ba Barium 137.33	57-71 Lanthanides	72 Hf Hafnium 178.49	73 Ta Tantalum 180.95	74 W Tungsten 183.84	75 Re Rhenium 186.21	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.09	79 Au Gold 196.97	80 Hg Mercury 200.59	81 Tl Thallium 204.38	82 Pb Lead 207.2	83 Bi Bismuth 208.98	84 Po Polonium [208.98]	85 At Astatine 209.99	86 Rn Radon 222.02	87 Fr Francium 223.02	88 Ra Radium 226.03	89-103 Actinides	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [278]	110 Ds Darmstadtium [281]	111 Rg Roentgenium [280]	112 Cn Copernicium [285]	113 Nh Nihonium [286]	114 Fl Flerovium [289]	115 Mc Moscovium [289]	116 Lv Livermorium [293]	117 Ts Tennessine [294]	118 Og Oganesson [294]
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57 La Lanthanum 138.91	58 Ce Cerium 140.12	59 Pr Praseodymium 140.91	60 Nd Neodymium 144.24	61 Pm Promethium 144.91	62 Sm Samarium 150.36	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.93	70 Yb Ytterbium 173.06	71 Lu Lutetium 174.97	89 Ac Actinium 227.03	90 Th Thorium 232.04	91 Pa Protactinium 231.04	92 U Uranium 238.03	93 Np Neptunium 237.05	94 Pu Plutonium 244.06	95 Am Americium 243.06	96 Cm Curium 247.07	97 Bk Berkelium 247.07	98 Cf Californium 251.08	99 Es Einsteinium [254]	100 Fm Fermium 257.10	101 Md Mendelevium 258.1	102 No Nobelium 259.10	103 Lr Lawrencium [262]
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metalloids
 non-metals
 metals

Lanthanides & Actinides

7 noble gases

IONS

Positive Ions—Cations

+1

NH_4^+	ammonium
Cu^+	copper(I)
Au^+	gold(I)
Ag^+	silver

+2

Cd^{2+}	cadmium
Cr^{2+}	chromium(II)
Co^{2+}	cobalt(II)
Cu^{2+}	copper(II)
Fe^{2+}	iron(II)
Pb^{2+}	lead(II)
Mn^{2+}	manganese(II)
Hg_2^{2+}	mercury(I)
Hg^{2+}	mercury(II)
Ni^{2+}	nickel(II)
Sn^{2+}	tin(II)
Zn^{2+}	zinc

+3

Al^{3+}	aluminum
Sb^{3+}	antimony(III)
Bi^{3+}	bismuth(III)
Cr^{3+}	chromium(III)
Co^{3+}	cobalt(III)
Ga^{3+}	gallium(III)
Au^{3+}	gold(III)
Fe^{3+}	iron(III)
Mn^{3+}	manganese(III)
Ni^{3+}	nickel(III)

+4

Sn^{4+}	tin(IV)
Pb^{4+}	lead(IV)

Negative Ions—Anions

-1

CH_3COO^-	acetate (same as below)
$\text{C}_2\text{H}_3\text{O}_2^-$	acetate (same as above)
N_3^-	azide
ClO^-	hypochlorite
ClO_2^-	chlorite
ClO_3^-	chlorate
ClO_4^-	perchlorate
CN^-	cyanide
H_2PO_4^-	dihydrogen phosphate
H^-	hydride
HCO_3^-	hydrogen carbonate or bicarbonate
HSO_4^-	hydrogen sulfate or bisulfate
HSO_3^-	hydrogen sulfite or bisulfite
HS^-	hydrogen sulfide or bisulfide
OH^-	hydroxide
NO_3^-	nitrate
NO_2^-	nitrite
MnO_4^-	permanganate
SCN^-	thiocyanate

-2

CO_3^{2-}	carbonate
CrO_4^{2-}	chromate
$\text{Cr}_2\text{O}_7^{2-}$	dichromate
HPO_4^{2-}	hydrogen phosphate
$\text{C}_2\text{O}_4^{2-}$	oxalate
O_2^{2-}	peroxide
Se^{2-}	selenide
SO_4^{2-}	sulfate
SO_3^{2-}	sulfite

-3

PO_4^{3-}	phosphate
PO_3^{3-}	phosphite

Note: You are expected to know the charges of the common ions by the placement of their respective atoms in the periodic table. For example, the alkali metals are 1+, the alkaline earth metals are 2+, and the halogens are 1-. Recognize that the chlorine oxyanion series is representative of the basic naming scheme and the other halogens form similar ions.

CHEMISTRY REFERENCE SHEET

Metric to Metric Conversions

Smaller than Base	1 m =	1,000,000,000 nm	nano = 10^9 nm
	1 m =	1,000,000 μ m	micro = 10^6 μ m
	1 m =	1,000 mm	milli = 10^3 mm
	1 m =	100 cm	centi = 10^2 cm
Base	*meters can be swapped w/ Liters, sec, or grams		
	1 m =	0.001 km	kilo = 10^{-3} km
	1 m =	0.000001 Mm	Mega = 10^{-6} Mm
Larger than Base	1 m =	0.000000001 Gm	Giga = 10^{-9} Gm

Equivalencies

- 1 calorie = 4.184 Joule
- 1 atmosphere (atm) = 760 mm Hg
- 1 atm = 760 torr
- 1 atm = 101.3 kPa
- 1 atm = 14.68 psi
- 1 mole = 6.022×10^{23} particles
- 1 mole = 22.4 L

Constants

- Freezing/Melting point of $H_2O = 0^\circ C$
- Condensing/Boiling point of $H_2O = 100^\circ C$
- C solid water = $2.03 \frac{J}{g^\circ C}$
- C liquid water = $4.184 \frac{J}{g^\circ C}$
- C water vapor = $1.70 \frac{J}{g^\circ C}$
- $\Delta H_v(\text{water}) = 2260 \frac{J}{g}$
- $\Delta H_f(\text{water}) = 335 \frac{J}{g}$
- $R = 0.08206 \frac{atm \cdot L}{mol \cdot K}$
- $R = 8.31 \frac{kPa \cdot L}{mol \cdot K}$

Equations

- $^\circ F = 1.8(^\circ C) + 32$
- $^\circ C = \frac{(^\circ F - 32)}{1.8}$
- $K = ^\circ C + 273$
- $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$
- $PV = nRT$
- $q_{\text{system}} = -q_{\text{surroundings}}$
- $q = mc\Delta T$
- $q = m\Delta H_f$
- $q = m\Delta H_v$
- $Density = \frac{\text{mass}}{\text{volume}}$
- $M_1 V_1 = M_2 V_2$
- $Molarity = \frac{\text{moles solute}}{\text{liters solution}}$
- $H_{\text{Bond } E} = \sum H_{\text{reactants}} + \sum H_{\text{products}}$
- $\% \text{ yield} = \frac{\text{lab yield}}{\text{known yield}} \times 100$
- $\% \text{ error} = \frac{\text{lab-known}}{\text{known}} \times 100$

Prefixes

Mono = 1	Tri = 3	Penta = 5	Hepta = 7	Nona = 9
Di = 2	Tetra = 4	Hexa = 6	Octa = 8	Deca = 10

Solubility Table

	(aq) soluble product										-- product not possible * H ₂ O or HOH (l)			
	(s) insoluble product													
	C ₂ H ₃ O ₂ ⁻	Br ⁻	I ⁻	Cl ⁻	OH ⁻	NO ₃ ⁻	HCO ₃ ⁻	CO ₃ ²⁻	C ₂ O ₄ ²⁻	O ₂ ²⁻	CrO ₄ ²⁻	SO ₄ ²⁻	S ²⁻	PO ₄ ³⁻
Group 1 & NH ₄ ⁺	(aq)	(aq)	(aq)	(aq)	(aq)	(aq)	(aq)	(aq)	(aq)	(aq)	(aq)	(aq)	(aq)	(aq)
Al ³⁺	(aq)	(aq)	(aq)	(aq)	(s)	(aq)	(aq)	--	--	(s)	--	(aq)	--	(s)
Ba ²⁺	(aq)	(aq)	(aq)	(aq)	(aq)	(aq)	(aq)	(s)	(s)	(aq)	(s)	(s)	--	(s)
Bi ³⁺	(s)	--	(s)	--	(s)	--	--	(s)	(s)	(s)	--	--	(s)	(aq)
Ca ²⁺	(aq)	(aq)	(aq)	(aq)	(aq)	(aq)	(aq)	(s)	(s)	(s)	(aq)	(aq)	--	(s)
Co ²⁺ Ni ²⁺ & Cu ²⁺	(aq)	(aq)	(aq)	(aq)	(s)	(aq)	(aq)	(s)	(s)	(s)	(s)	(aq)	(s)	(s)
Fe ²⁺	(aq)	(aq)	(aq)	(aq)	(s)	(aq)	(aq)	(s)	(s)	(s)	--	(aq)	(s)	(s)
Fe ³⁺	(s)	(aq)	--	(aq)	(s)	(aq)	(aq)	--	(aq)	(s)	--	(aq)	(s)	(s)
Pb ²⁺	(aq)	(s)	(s)	(s)	(s)	(aq)	(aq)	(s)	(s)	(s)	(s)	(s)	--	(s)
Mg ²⁺	(aq)	(aq)	(aq)	(aq)	(s)	(aq)	(aq)	(s)	(s)	(s)	(aq)	(aq)	--	(s)
Hg ²⁺	(aq)	(s)	(s)	(aq)	(s)	(aq)	(aq)	(s)	(s)	(s)	(aq)	--	(s)	(s)
Ag ⁺	(aq)	(s)	(s)	(s)	(s)	(aq)	(aq)	(s)	(s)	(s)	(s)	(s)	(s)	(s)
Zn ²⁺	(aq)	(aq)	(aq)	(aq)	(s)	(aq)	(aq)	(s)	(s)	(s)	(s)	(aq)	(s)	(s)

Activity Series

Metals	Non-Metals
Lithium	Fluorine
Potassium	Chlorine
Barium	Bromine
Calcium	Iodine
Sodium	
Magnesium	
Aluminium	
Manganese	
Zinc	
Chromium	
Iron	
Cobalt	
Nickel	
Tin	
Lead	
Hydrogen	
Copper	
Silver	
Mercury	
Platinum	
Gold	

Table of Bond Enthalpies (kJ/mol) at 25°C

Bond	Enthalpy (kJ/mol)	Bond	Enthalpy (kJ/mol)	Bond	Enthalpy (kJ/mol)
H-H	435	C-N	301	P≡P	490
H-F	569	C-O	352	Br-Br	193
H-Cl	431	C=O	532	Cl-Cl	243
H-Br	364	C-Br	234	H-Se	276
H-I	297	C-Cl	331	H-Te	243
H-C	414	C-F	440	S=S	427
H-N	460	N≡N	950	C-S	260
H-O	465	N-N	297	H-Si	393
H-S	377	O=O	498	H-P	318
C-C	368	O-O	213	C-Si	289
C=C	724	F-F	159	I-I	151
C≡C	963	Si-Si	339	N=O	590

Standard Enthalpies of Formation ΔH_f°

Comp.	ΔH_f° (kJ/mol)	Comp.	ΔH_f° (kJ/mol)
BaCl ₂	-858.6	MnO	-384.9
BaSO ₄	-1473.2	MnO ₂	-519.7
CH ₄	-74.8	NH ₃	-46.2
C ₂ H ₆	-83.7	NH ₄ Cl	-315.4
CaCl ₂	-877.3	NO	+90.4
CaCO ₃	-1206.9	NO ₂	+33.9
Ca(OH) ₂	-1002.8	N ₂ O ₄	+9.16
CO	-110.5	NaCl	-411.0
CO ₂	-393.5	NaF	-569.0
HCl	-92.3	NaNO ₃	-446.2
H ₂ O (g)	-241.8	NaOH	-426.7
H ₂ O (l)	-285.8	SnCl ₄	-545.2
H ₂ S	-20.1	SnO	-286.2
H ₂ SO ₄	-811.3	SnO ₂	-580.7
K ₂ CO ₃	-1150.0	SO ₂	-296.1
MgCl ₂	-641.8	SO ₃	-395.2
Mg(OH) ₂	-926.8	ZnO	-348.0
MgSO ₄	-1278.2	ZnS	-202.9