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www.ucb-group.com E-mail: periodic.table@ucb-group.com



Periodic table of the elements

RELATION BETWEEN ELECTRONEGATIVITY DIFFERENCE (Δ) OF THE ATOMS AND AMOUNT OF PARTIAL IONIC CHARACTER (%) OF SINGLE BONDS

Table with columns for Δ and % for various bond types (A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z).

Periodic table elements 1-18 (O), 19-36, 37-54, 55-86, 87-118, including element symbols, atomic numbers, and names.

Main periodic table elements 1-18 (O), 19-36, 37-54, 55-86, 87-118, including element symbols, atomic numbers, and names.

Periodic table elements 13 (IIIa) to 18 (O), including element symbols, atomic numbers, and names.

NOTES

- 1 * Approximate stoichiometry of the oxide.
2 Uncommon oxidation states are put in brackets; some very rare ones have been omitted.
3 ...
4 The absence of coloured strips means that for the corresponding stage of oxidation, the oxide does not exist...

Periodic table elements 57-71, 72-103, 104-118, including element symbols, atomic numbers, and names.

Diagram showing electron configuration for Carbon (1s² 2s² 2p²) and various physical/chemical properties like atomic weight, melting point, etc.

- CRYSTAL STRUCTURE: face-centered cubic, cubic, body-centered cubic, hexagonal, rhombohedral, tetragonal, orthorhombic, monoclinic.
SELECTION OF RADIOACTIVE ISOTOPES: 1st column, 2nd column, 3rd column.

Table of radioactive isotopes with columns for element symbol, isotope, half-life, and decay mode.

DISSOCIATION CONSTANTS OF ACIDS IN WATER AT 25°C

Acid	Base	pKa
HI	I ⁻	-11
HBr	Br ⁻	-9
HClO ₄	ClO ₄ ⁻	-8
HCl	Cl ⁻	-7
H ₂ SeO ₄	HSeO ₄ ⁻	-3
H ₂ SO ₄	HSO ₄ ⁻	-3
HMnO ₄	MnO ₄ ⁻	-2.3
H ₃ O ⁺	H ₂ O	-1.74
HNO ₃	NO ₃ ⁻	-1.64
H ₂ CrO ₄	HCrO ₄ ⁻	-1
HClO ₃	ClO ₃ ⁻	-1
CF ₃ COOH	CF ₃ COO ⁻	0.23
CCl ₃ COOH	CCl ₃ COO ⁻	0.7
HO ₃	IO ₃ ⁻	0.8
H ₄ P ₂ O ₇	H ₃ P ₂ O ₇ ⁻	0.85
H ₃ PO ₂	H ₂ PO ₂ ⁻	1.1
H ₂ C ₂ O ₄	HC ₂ O ₄ ⁻	1.2
CHCl ₂ COOH	CHCl ₂ COO ⁻	1.25
H ₂ SO ₃	HSO ₃ ⁻	1.8
H ₃ PO ₃	H ₂ PO ₃ ⁻	1.8
HClO ₂	ClO ₂ ⁻	2
HSO ₄ ⁻	SO ₄ ²⁻	2
H ₃ PO ₄	H ₂ PO ₄ ⁻	2.1
H ₂ AsO ₄	HAsO ₄ ⁻	2.2
CH ₂ ClCOOH	CH ₂ ClCOO ⁻	2.9
H ₂ Te	HTe ⁻	3
[Fe(H ₂ O) ₆] ³⁺	[Fe(H ₂ O) ₅ OH] ²⁺	3.1
HF	F ⁻	3.2
HNO ₂	NO ₂ ⁻	3.4
HCOOH	HCOO ⁻	3.8
HCNO	CNO ⁻	3.9
H ₂ Se	HSe ⁻	4
C ₆ H ₅ COOH	C ₆ H ₅ COO ⁻	4.2
HC ₂ O ₄ ⁻	C ₂ O ₄ ²⁻	4.3
C ₆ H ₅ NH ₃ ⁺	C ₆ H ₅ NH ₂	4.6
NH ₃ ⁺	N ₃ ⁻	4.7
CH ₃ COOH	CH ₃ COO ⁻	4.75
CH ₃ CH ₂ COOH	CH ₃ CH ₂ COO ⁻	4.9
(CH ₂) ₆ N ₄ H ⁺	(CH ₂) ₆ N ₄	5
[Al(H ₂ O) ₆] ³⁺	[Al(H ₂ O) ₅ OH] ²⁺	5
C ₅ H ₅ NH ⁺	C ₅ H ₅ N	5.2
NH ₃ OH ⁺	NH ₂ OH	6
H ₂ PO ₃ ⁻	HPO ₃ ²⁻	6.2
H ₂ CO ₃	HCO ₃ ⁻	6.4
HCrO ₄ ⁻	CrO ₄ ²⁻	6.5
H ₂ P ₂ O ₇ ⁻	HP ₂ O ₇ ²⁻	6.6
H ₂ AsO ₄ ⁻	HAsO ₄ ⁻	7
H ₂ S	HS ⁻	7
H ₂ PO ₄ ⁻	HPO ₄ ²⁻	7.2
HSO ₃ ⁻	SO ₃ ²⁻	7.2
HClO	ClO ⁻	7.3
HBrO	BrO ⁻	8.7
H ₃ BO ₃	H ₂ BO ₃ ⁻	9.2
NH ₄ ⁺	NH ₃	9.2
HCN	CN ⁻	9.3
H ₂ AsO ₃	H ₂ AsO ₃ ⁻	9.6
HP ₂ O ₇ ²⁻	P ₂ O ₇ ³⁻	9.6
H ₂ SiO ₃	HSiO ₃ ⁻	9.9
HIO	IO ⁻	10
C ₆ H ₅ OH	C ₆ H ₅ O ⁻	10
HCO ₃ ⁻	CO ₃ ²⁻	10.4
CH ₃ NH ₃ ⁺	CH ₃ NH ₂	10.7
HAsO ₄ ⁻	AsO ₄ ²⁻	11.5
H ₂ O ₂	HO ₂ ⁻	11.6
HPO ₄ ²⁻	PO ₄ ³⁻	11.9
Ca ²⁺	CaOH ⁺	12.7
HS ⁻	S ²⁻	13
CH ₃ COH	CH ₃ CO ⁻	14.5
CH ₃ OH	CH ₃ O ⁻	15.5
H ₂ O	OH ⁻	15.7
CH ₃ CH ₂ OH	CH ₃ CH ₂ O ⁻	15.9
HO ₂ ⁻	O ₂ ²⁻	25
PH ₃	PH ₂ ⁻	27
OH ⁻	O ²⁻	29
NH ₃	NH ₂ ⁻	35

pH calculations

strong acid : pH = -log C_A
 strong base : pH = 14 + log C_B
 weak acid : pH = 1/2 (pK_A - log C_A)
 weak base : pH = 7 + 1/2 pK_A + 1/2 log C_B
 buffer: pH = pK_A + log (C_B/C_A)

Salts of

strong acid and strong base	pH = 7
weak acid and strong base	pH = 7 + 1/2 pK _A + 1/2 log C _S
strong acid and weak base	pH = 7 - 1/2 pK _B - 1/2 log C _S
weak acid and weak base	pH = 7 + 1/2 pK _A - 1/2 pK _B

ELECTROCHEMICAL SERIES

E₀ = standard reduction potential (volt)
 T = 25°C
 P = 1 atm.

Metals and derivatives ●
 Halogen and derivatives ●
 Chalcogens ●
 Others ○

Li ⁺ + e ⁻ ⇌ Li	-3.05
K ⁺ + e ⁻ ⇌ K	-2.93
Rb ⁺ + e ⁻ ⇌ Rb	-2.92
Cs ⁺ + e ⁻ ⇌ Cs	-2.92
Ba ²⁺ + 2e ⁻ ⇌ Ba	-2.91
Sr ²⁺ + 2e ⁻ ⇌ Sr	-2.89
Ca ²⁺ + 2e ⁻ ⇌ Ca	-2.87
Na ⁺ + e ⁻ ⇌ Na	-2.71
Mg ²⁺ + 2e ⁻ ⇌ Mg	-2.37
H ₂ PO ₂ ⁻ + e ⁻ ⇌ P + 2 OH ⁻	-2.05
Be ²⁺ + 2e ⁻ ⇌ Be	-1.85
Al ³⁺ + 3e ⁻ ⇌ Al	-1.66
HPO ₃ ⁻ + 2 H ₂ O + 2e ⁻ ⇌ H ₂ PO ₂ ⁻ + 3 OH ⁻	-1.57
V ³⁺ + 2e ⁻ ⇌ V	-1.18
Mn ²⁺ + 2e ⁻ ⇌ Mn	-1.18
N ₂ + 4 H ₂ O + 4e ⁻ ⇌ N ₂ H ₄ + 4 OH ⁻	-1.16
PO ₄ ³⁻ + 2 H ₂ O + 2e ⁻ ⇌ HPO ₃ ²⁻ + 3 OH ⁻	-1.12
Zn(NH ₃) ₄ ²⁺ + 2e ⁻ ⇌ Zn + 4 NH ₃	-1.03
Se + 2e ⁻ ⇌ Se ²⁻	-0.92
Cr ³⁺ + 2e ⁻ ⇌ Cr	-0.91
SO ₄ ²⁻ + H ₂ O + 2e ⁻ ⇌ SO ₃ ²⁻ + 2 OH ⁻	-0.90
P + 3 H ₂ O + 3e ⁻ ⇌ PH ₃ + 3 OH ⁻	-0.89
2H ₂ O + 2e ⁻ ⇌ H ₂ + 2 OH ⁻	-0.83
Zn ²⁺ + 2e ⁻ ⇌ Zn	-0.76
Cr ³⁺ + 3e ⁻ ⇌ Cr	-0.74
S ₂ O ₃ ²⁻ + 3H ₂ O + 4e ⁻ ⇌ 2 S + 6 OH ⁻	-0.66
SO ₃ ²⁻ + 3H ₂ O + 4e ⁻ ⇌ S + 6 OH ⁻	-0.61
SO ₃ ²⁻ + 3H ₂ O + 6e ⁻ ⇌ S ²⁻ + 6 OH ⁻	-0.58
2 SO ₃ ²⁻ + 3H ₂ O + 4e ⁻ ⇌ S ₂ O ₃ ²⁻ + 6 OH ⁻	-0.56
Ga ³⁺ + 3e ⁻ ⇌ Ga	-0.51
Ni(NH ₃) ₆ ²⁺ + 2e ⁻ ⇌ Ni + 6 NH ₃	-0.51
S + 2e ⁻ ⇌ S ²⁻	-0.51
H ₃ PO ₂ + H ⁺ + e ⁻ ⇌ P + 2 H ₂ O	-0.50
H ₃ PO ₃ + 3 H ⁺ + 3e ⁻ ⇌ P + 3 H ₂ O	-0.50
H ₃ PO ₃ + 2 H ⁺ + 2e ⁻ ⇌ H ₃ PO ₂ + H ₂ O	-0.49
2 CO ₂ + 2 H ⁺ + 2e ⁻ ⇌ (COOH) ₂	-0.47
Fe ²⁺ + 2e ⁻ ⇌ Fe	-0.46
NO ₂ ⁻ + H ₂ O + e ⁻ ⇌ NO + 2 OH ⁻	-0.45
Ag(CN) ₂ ⁻ + e ⁻ ⇌ Ag + 2 CN ⁻	-0.45
Co(NH ₃) ₆ ²⁺ + 2e ⁻ ⇌ Co + 6 NH ₃	-0.43
Cr ³⁺ + e ⁻ ⇌ Cr ²⁺	-0.41
Cd ²⁺ + 2e ⁻ ⇌ Cd	-0.40
H ₃ PO ₄ + 5 H ⁺ + 5e ⁻ ⇌ P + 4 H ₂ O	-0.40
1/2 N ₂ + 3e ⁻ ⇌ NH ₃ + 3 OH ⁻	-0.40
PbSO ₄ + 2e ⁻ ⇌ Pb + SO ₄ ²⁻	-0.36
Co ²⁺ + 2e ⁻ ⇌ Co	-0.28
H ₃ PO ₄ + 2 H ⁺ + 2e ⁻ ⇌ H ₃ PO ₃ + H ₂ O	-0.28
Ni ²⁺ + 2e ⁻ ⇌ Ni	-0.27
V ³⁺ + e ⁻ ⇌ V ²⁺	-0.26
N ₂ + 5 H ⁺ + 4e ⁻ ⇌ N ₂ H ₅ ⁺	-0.23
Sn ²⁺ + 2e ⁻ ⇌ Sn	-0.14
NO ₃ ⁻ + 2 H ₂ O + 3e ⁻ ⇌ NO + 4 OH ⁻	-0.14
(NH ₃) ₄ Fe ²⁺ + 2e ⁻ ⇌ Fe + 4 NH ₃	-0.14
AgCN + e ⁻ ⇌ Ag + CN ⁻	-0.14
Pb ²⁺ + 2e ⁻ ⇌ Pb	-0.13
NO ₂ ⁻ + 6 H ₂ O + 8e ⁻ ⇌ NH ₃ + 9 OH ⁻	-0.12
Fe ³⁺ + 3e ⁻ ⇌ Fe	-0.04
2 H ⁺ + 2e ⁻ ⇌ H ₂	0.0

SOLUBILITY PRODUCTS AT 25°C

ANION	OH ⁻	S ²⁻	F ⁻	Cl ⁻	I ⁻	Br ⁻	CO ₃ ²⁻	SO ₄ ²⁻	PO ₄ ³⁻	CrO ₄ ²⁻	CN ⁻	SCN ⁻	CH ₃ COO ⁻	C ₂ O ₄ ²⁻	BrO ₃ ⁻	IO ₃ ⁻
CATION																
Ag ⁺		6.69 x 10 ⁻⁵⁰		1.77 x 10 ⁻¹⁰	8.51 x 10 ⁻¹⁷	5.35 x 10 ⁻¹³	8.45 x 10 ⁻¹²	1.20 x 10 ⁻⁵	8.88 x 10 ⁻¹⁷	1.12 x 10 ⁻¹²	5.97 x 10 ⁻¹⁷	1.03 x 10 ⁻¹²	1.94 x 10 ⁻³	5.40 x 10 ⁻¹²	5.34 x 10 ⁻⁵	3.17 x 10 ⁻⁸
Al ³⁺									9.83 x 10 ⁻²¹							
Ba ²⁺	2.55 x 10 ⁻⁴ (1)		1.84 x 10 ⁻⁷				2.58 x 10 ⁻⁹	1.07 x 10 ⁻¹⁰		1.17 x 10 ⁻¹⁰						4.01 x 10 ⁻⁹
Be ²⁺	3 x 10 ⁻¹⁸															
Bi ³⁺		1.82 x 10 ⁻⁹⁹														
Ca ²⁺	4.68 x 10 ⁻⁶		1.46 x 10 ⁻¹⁰				4.96 x 10 ⁻⁹	7.10 x 10 ⁻⁵	2.07 x 10 ⁻³³					2.34 x 10 ⁻⁹ (3)		6.47 x 10 ⁻⁶
Cd ²⁺	5.27 x 10 ⁻¹⁵	1.40 x 10 ⁻²⁹	6.44 x 10 ⁻³				6.18 x 10 ⁻¹²		2.53 x 10 ⁻³³					1.42 x 10 ⁻⁸ (2)		2.49 x 10 ⁻⁸
Co ²⁺	1.09 x 10 ⁻¹⁵	1.40 x 10 ⁻¹⁹							2.05 x 10 ⁻³⁵							1.21 x 10 ⁻² (4)
Cu ⁺	2.26 x 10 ⁻⁴⁸			1.72 x 10 ⁻⁷	1.27 x 10 ⁻¹²	6.27 x 10 ⁻⁹						1.77 x 10 ⁻¹³				
Cu ²⁺	1.27 x 10 ⁻³⁶									1.39 x 10 ⁻³⁷				4.43 x 10 ⁻¹⁰		6.94 x 10 ⁻⁸ (5)
Fe ²⁺	4.87 x 10 ⁻¹⁷	1.59 x 10 ⁻¹⁹	2.36 x 10 ⁻⁶				3.07 x 10 ⁻¹¹									
Fe ³⁺	2.64 x 10 ⁻³⁹								9.92 x 10 ⁻²⁹ (6)							
Hg ⁺			3.10 x 10 ⁻⁶	1.45 x 10 ⁻¹⁸	5.33 x 10 ⁻²⁹	6.41 x 10 ⁻²³	3.67 x 10 ⁻¹⁷	7.99 x 10 ⁻⁷				3.12 x 10 ⁻²⁰		1.75 x 10 ⁻¹³		
Hg ²⁺	3.13 x 10 ⁻²⁶	6.44 x 10 ⁻⁵³			2.82 x 10 ⁻²⁹											
Li ⁺							8.15 x 10 ⁻⁴									
Mg ²⁺	5.61 x 10 ⁻¹²		7.42 x 10 ⁻¹¹				6.82 x 10 ⁻⁶		9.86 x 10 ⁻²⁵					4.83 x 10 ⁻⁶ (7)		
Mn ²⁺	2.06 x 10 ⁻¹³	4.65 x 10 ⁻¹⁴					2.24 x 10 ⁻¹¹							1.70 x 10 ⁻⁴ (8)		4.37 x 10 ⁻⁷
Ni ²⁺	7.47 x 10 ⁻¹⁶	1.07 x 10 ⁻²¹					1.42 x 10 ⁻⁷		4.73 x 10 ⁻³²							4.71 x 10 ⁻⁵
Pb ²⁺	1.42 x 10 ⁻²⁰	9.04 x 10 ⁻²⁹	7.12 x 10 ⁻⁷	1.17 x 10 ⁻⁵	8.49 x 10 ⁻⁹	7.60 x 10 ⁻⁶	1.46 x 10 ⁻¹³	1.82 x 10 ⁻⁸				2.11 x 10 ⁻⁵		8.51 x 10 ⁻¹⁰		3.68 x 10 ⁻¹³
Sn ²⁺	5.45 x 10 ⁻²⁷	3.25 x 10 ⁻²⁸														
Sr ²⁺			4.33 x 10 ⁻⁹					5.60 x 10 ⁻¹⁰	3.44 x 10 ⁻⁷							1.14 x 10 ⁻⁷
Zn ²⁺	7.71 x 10 ⁻¹⁷	2.93 x 10 ⁻²⁵	3.04 x 10 ⁻²				1.19 x 10 ⁻¹⁰							1.37 x 10 ⁻⁹ (9)		4.29 x 10 ⁻⁶

(1) Ba(OH)₂·8H₂O (2) Cd C₂O₄·3H₂O (3) Ca C₂O₄·H₂O (4) Co(IO₃)₂·2H₂O (5) Cu(IO₃)₂·H₂O (6) Fe PO₄·2H₂O (7) Mg C₂O₄·2H₂O (8) Mn C₂O₄·2H₂O (9) Zn C₂O₄·2H₂O

PHYSICAL CONSTANTS

Speed of light	c = 2.997925	10 ⁸ m s ⁻¹
Boltzmann constant	k = 1.38054	10 ⁻²³ J K ⁻¹
Avogadro constant	N _A = 6.02252	10 ²³ mol ⁻¹
Molar volume, ideal gas	V _m = 2.24136	10 ⁻² m ³ mol ⁻¹
Gas constant	R = 8.3143	J mol ⁻¹ K ⁻¹
Faraday constant	F = 9.64870	10 ⁴ C mol ⁻¹
Planck constant	h = 6.6256	10 ⁻³⁴ J s
Stefan-Boltzmann constant	σ = 5.6697	10 ⁻⁸ W m ⁻² K ⁻⁴
Bohr radius	a ₀ = 5.29167	10 ⁻¹¹ m
Gravitational constant	G = 6.6720	10 ⁻¹¹ Nm ² kg ⁻²
Permittivity of vacuum	E ₀ = 8.8542	10 ⁻¹² F m ⁻¹
Permeability of vacuum	N ₀ = 4 π	10 ⁻⁷ H m ⁻¹
Classical electron radius	r _e = 2.817938	10 ⁻¹