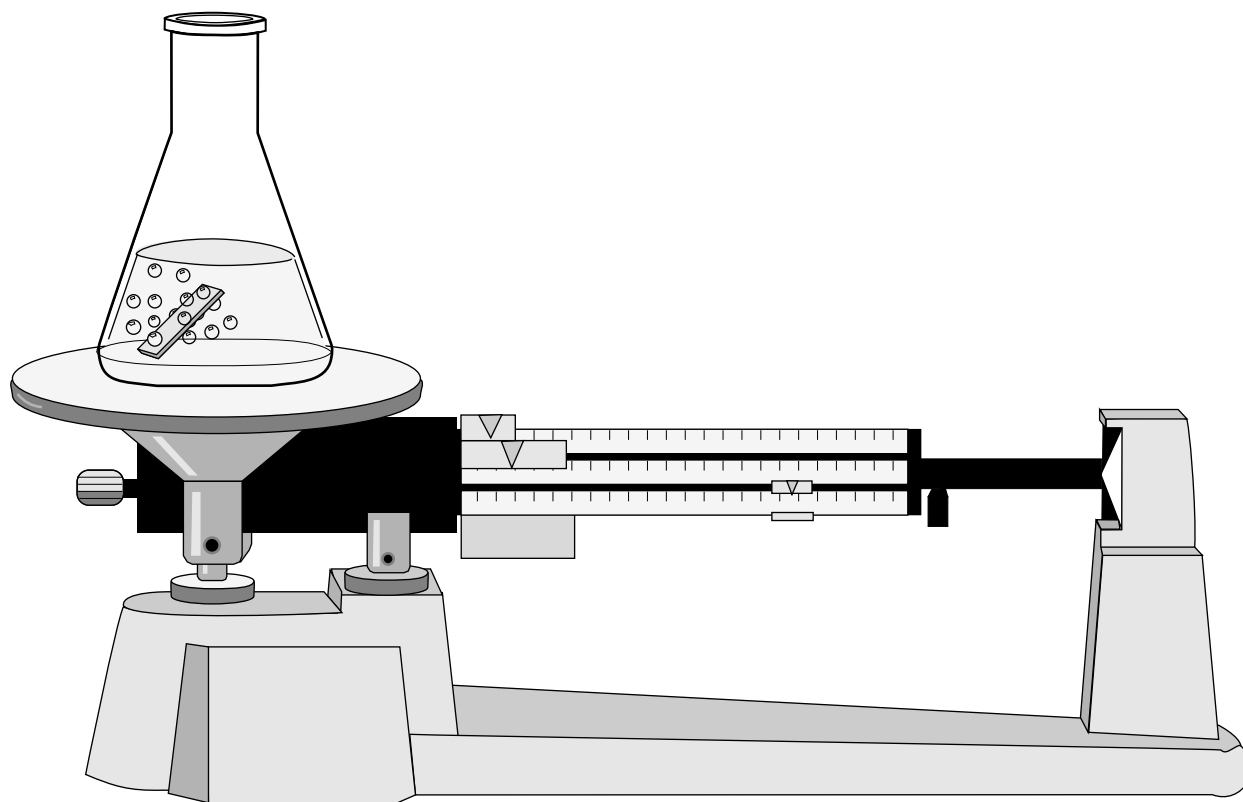


# Data Booklet

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## CHEMISTRY 12

Work done in this booklet  
will not be marked.



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## REFERENCE

D.R. Lide, *CRC Handbook of Chemistry and Physics*, 80<sup>th</sup> edition, CRC Press, Boca Raton, 1999.



# ATOMIC MASSES OF THE ELEMENTS

*Based on mass of C<sup>12</sup> at 12.00.  
Values in parentheses are the mass number of the most stable or best  
known isotopes for elements that do not occur naturally.*

Element	Symbol	Atomic Number	Atomic Mass	Element	Symbol	Atomic Number	Atomic Mass
Actinium	Ac	89	(227)	Mercury	Hg	80	200.6
Aluminum	Al	13	27.0	Molybdenum	Mo	42	95.9
Americium	Am	95	(243)	Neodymium	Nd	60	144.2
Antimony	Sb	51	121.8	Neon	Ne	10	20.2
Argon	Ar	18	39.9	Neptunium	Np	93	(237)
Arsenic	As	33	74.9	Nickel	Ni	28	58.7
Astatine	At	85	(210)	Niobium	Nb	41	92.9
Barium	Ba	56	137.3	Nitrogen	N	7	14.0
Berkelium	Bk	97	(247)	Nobelium	No	102	(259)
Beryllium	Be	4	9.0	Osmium	Os	76	190.2
Bismuth	Bi	83	209.0	Oxygen	O	8	16.0
Boron	B	5	10.8	Palladium	Pd	46	106.4
Bromine	Br	35	79.9	Phosphorus	P	15	31.0
Cadmium	Cd	48	112.4	Platinum	Pt	78	195.1
Calcium	Ca	20	40.1	Plutonium	Pu	94	(244)
Californium	Cf	98	(251)	Polonium	Po	84	(209)
Carbon	C	6	12.0	Potassium	K	19	39.1
Cerium	Ce	58	140.1	Praseodymium	Pr	59	140.9
Cesium	Cs	55	132.9	Promethium	Pm	61	(145)
Chlorine	Cl	17	35.5	Protactinium	Pa	91	231.0
Chromium	Cr	24	52.0	Radium	Ra	88	(226)
Cobalt	Co	27	58.9	Radon	Rn	86	(222)
Copper	Cu	29	63.5	Rhenium	Re	75	186.2
Curium	Cm	96	(247)	Rhodium	Rh	45	102.9
Dubnium	Db	105	(262)	Rubidium	Rb	37	85.5
Dysprosium	Dy	66	162.5	Ruthenium	Ru	44	101.1
Einsteinium	Es	99	(252)	Rutherfordium	Rf	104	(261)
Erbium	Er	68	167.3	Samarium	Sm	62	150.4
Europium	Eu	63	152.0	Scandium	Sc	21	45.0
Fermium	Fm	100	(257)	Selenium	Se	34	79.0
Fluorine	F	9	19.0	Silicon	Si	14	28.1
Francium	Fr	87	(223)	Silver	Ag	47	107.9
Gadolinium	Gd	64	157.3	Sodium	Na	11	23.0
Gallium	Ga	31	69.7	Strontium	Sr	38	87.6
Germanium	Ge	32	72.6	Sulphur	S	16	32.1
Gold	Au	79	197.0	Tantalum	Ta	73	180.9
Hafnium	Hf	72	178.5	Technetium	Tc	43	(98)
Helium	He	2	4.0	Tellurium	Te	52	127.6
Holmium	Ho	67	164.9	Terbium	Tb	65	158.9
Hydrogen	H	1	1.0	Thallium	Tl	81	204.4
Indium	In	49	114.8	Thorium	Th	90	232.0
Iodine	I	53	126.9	Thulium	Tm	69	168.9
Iridium	Ir	77	192.2	Tin	Sn	50	118.7
Iron	Fe	26	55.8	Titanium	Ti	22	47.9
Krypton	Kr	36	83.8	Tungsten	W	74	183.8
Lanthanum	La	57	138.9	Uranium	U	92	238.0
Lawrencium	Lr	103	(262)	Vanadium	V	23	50.9
Lead	Pb	82	207.2	Xenon	Xe	54	131.3
Lithium	Li	3	6.9	Ytterbium	Yb	70	173.0
Lutetium	Lu	71	175.0	Yttrium	Y	39	88.9
Magnesium	Mg	12	24.3	Zinc	Zn	30	65.4
Manganese	Mn	25	54.9	Zirconium	Zr	40	91.2
Mendelevium	Md	101	(258)				

## NAMES, FORMULAE, AND CHARGES OF SOME COMMON IONS

\* *Aqueous solutions are readily oxidized by air.*

\*\* *Not stable in aqueous solutions.*

<b>Positive Ions (Cations)</b>			
$\text{Al}^{3+}$	Aluminum	$\text{Pb}^{4+}$	Lead(IV), plumbic
$\text{NH}_4^+$	Ammonium	$\text{Li}^+$	Lithium
$\text{Ba}^{2+}$	Barium	$\text{Mg}^{2+}$	Magnesium
$\text{Ca}^{2+}$	Calcium	$\text{Mn}^{2+}$	Manganese(II), manganous
$\text{Cr}^{2+}$	Chromium(II), chromous	$\text{Mn}^{4+}$	Manganese(IV)
$\text{Cr}^{3+}$	Chromium(III), chromic	$\text{Hg}_2^{2+}$	Mercury(I)*, mercurous
$\text{Cu}^+$	Copper(I)*, cuprous	$\text{Hg}^{2+}$	Mercury(II), mercuric
$\text{Cu}^{2+}$	Copper(II), cupric	$\text{K}^+$	Potassium
$\text{H}^+$	Hydrogen	$\text{Ag}^+$	Silver
$\text{H}_3\text{O}^+$	Hydronium	$\text{Na}^+$	Sodium
$\text{Fe}^{2+}$	Iron(II)*, ferrous	$\text{Sn}^{2+}$	Tin(II)*, stannous
$\text{Fe}^{3+}$	Iron(III), ferric	$\text{Sn}^{4+}$	Tin(IV), stannic
$\text{Pb}^{2+}$	Lead(II), plumbous	$\text{Zn}^{2+}$	Zinc

<b>Negative Ions (Anions)</b>			
$\text{Br}^-$	Bromide	$\text{OH}^-$	Hydroxide
$\text{CO}_3^{2-}$	Carbonate	$\text{ClO}^-$	Hypochlorite
$\text{ClO}_3^-$	Chlorate	$\text{I}^-$	Iodide
$\text{Cl}^-$	Chloride	$\text{HPO}_4^{2-}$	Monohydrogen phosphate
$\text{ClO}_2^-$	Chlorite	$\text{NO}_3^-$	Nitrate
$\text{CrO}_4^{2-}$	Chromate	$\text{NO}_2^-$	Nitrite
$\text{CN}^-$	Cyanide	$\text{C}_2\text{O}_4^{2-}$	Oxalate
$\text{Cr}_2\text{O}_7^{2-}$	Dichromate	$\text{O}^{2-}$	Oxide**
$\text{H}_2\text{PO}_4^-$	Dihydrogen phosphate	$\text{ClO}_4^-$	Perchlorate
$\text{CH}_3\text{COO}^-$	Ethanoate, acetate	$\text{MnO}_4^-$	Permanganate
$\text{F}^-$	Fluoride	$\text{PO}_4^{3-}$	Phosphate
$\text{HCO}_3^-$	Hydrogen carbonate, bicarbonate	$\text{SO}_4^{2-}$	Sulphate
$\text{HC}_2\text{O}_4^-$	Hydrogen oxalate, binoxalate	$\text{S}^{2-}$	Sulphide
$\text{HSO}_4^-$	Hydrogen sulphate, bisulphate	$\text{SO}_3^{2-}$	Sulphite
$\text{HS}^-$	Hydrogen sulphide, bisulphide	$\text{SCN}^-$	Thiocyanate
$\text{HSO}_3^-$	Hydrogen sulphite, bisulphite		

## SOLUBILITY OF COMMON COMPOUNDS IN WATER

*The term soluble here means > 0.1 mol/L at 25°C.*

Negative Ions (Anions)	Positive Ions (Cations)	Solubility of Compounds
All	Alkali ions: Li <sup>+</sup> , Na <sup>+</sup> , K <sup>+</sup> , Rb <sup>+</sup> , Cs <sup>+</sup> , Fr <sup>+</sup>	Soluble
All	Hydrogen ion: H <sup>+</sup>	Soluble
All	Ammonium ion: NH <sub>4</sub> <sup>+</sup>	Soluble
Nitrate, NO <sub>3</sub> <sup>-</sup>	All	Soluble
Chloride, Cl <sup>-</sup> or Bromide, Br <sup>-</sup> or Iodide, I <sup>-</sup>	All others	Soluble
	Ag <sup>+</sup> , Pb <sup>2+</sup> , Cu <sup>+</sup>	Low Solubility
Sulphate, SO <sub>4</sub> <sup>2-</sup>	All others	Soluble
	Ag <sup>+</sup> , Ca <sup>2+</sup> , Sr <sup>2+</sup> , Ba <sup>2+</sup> , Pb <sup>2+</sup>	Low Solubility
Sulphide, S <sup>2-</sup>	Alkali ions, H <sup>+</sup> , NH <sub>4</sub> <sup>+</sup> , Be <sup>2+</sup> , Mg <sup>2+</sup> , Ca <sup>2+</sup> , Sr <sup>2+</sup> , Ba <sup>2+</sup>	Soluble
	All others	Low Solubility
Hydroxide, OH <sup>-</sup>	Alkali ions, H <sup>+</sup> , NH <sub>4</sub> <sup>+</sup> , Sr <sup>2+</sup>	Soluble
	All others	Low Solubility
Phosphate, PO <sub>4</sub> <sup>3-</sup> or Carbonate, CO <sub>3</sub> <sup>2-</sup> or Sulphite, SO <sub>3</sub> <sup>2-</sup>	Alkali ions, H <sup>+</sup> , NH <sub>4</sub> <sup>+</sup>	Soluble
	All others	Low Solubility

## SOLUBILITY PRODUCT CONSTANTS AT 25°C

Name	Formula	$K_{sp}$
Barium carbonate	BaCO <sub>3</sub>	$2.6 \times 10^{-9}$
Barium chromate	BaCrO <sub>4</sub>	$1.2 \times 10^{-10}$
Barium sulphate	BaSO <sub>4</sub>	$1.1 \times 10^{-10}$
Calcium carbonate	CaCO <sub>3</sub>	$5.0 \times 10^{-9}$
Calcium oxalate	CaC <sub>2</sub> O <sub>4</sub>	$2.3 \times 10^{-9}$
Calcium sulphate	CaSO <sub>4</sub>	$7.1 \times 10^{-5}$
Copper(I) iodide	CuI	$1.3 \times 10^{-12}$
Copper(II) iodate	Cu(IO <sub>3</sub> ) <sub>2</sub>	$6.9 \times 10^{-8}$
Copper(II) sulphide	CuS	$6.0 \times 10^{-37}$
Iron(II) hydroxide	Fe(OH) <sub>2</sub>	$4.9 \times 10^{-17}$
Iron(II) sulphide	FeS	$6.0 \times 10^{-19}$
Iron(III) hydroxide	Fe(OH) <sub>3</sub>	$2.6 \times 10^{-39}$
Lead(II) bromide	PbBr <sub>2</sub>	$6.6 \times 10^{-6}$
Lead(II) chloride	PbCl <sub>2</sub>	$1.2 \times 10^{-5}$
Lead(II) iodate	Pb(IO <sub>3</sub> ) <sub>2</sub>	$3.7 \times 10^{-13}$
Lead(II) iodide	PbI <sub>2</sub>	$8.5 \times 10^{-9}$
Lead(II) sulphate	PbSO <sub>4</sub>	$1.8 \times 10^{-8}$
Magnesium carbonate	MgCO <sub>3</sub>	$6.8 \times 10^{-6}$
Magnesium hydroxide	Mg(OH) <sub>2</sub>	$5.6 \times 10^{-12}$
Silver bromate	AgBrO <sub>3</sub>	$5.3 \times 10^{-5}$
Silver bromide	AgBr	$5.4 \times 10^{-13}$
Silver carbonate	Ag <sub>2</sub> CO <sub>3</sub>	$8.5 \times 10^{-12}$
Silver chloride	AgCl	$1.8 \times 10^{-10}$
Silver chromate	Ag <sub>2</sub> CrO <sub>4</sub>	$1.1 \times 10^{-12}$
Silver iodate	AgIO <sub>3</sub>	$3.2 \times 10^{-8}$
Silver iodide	AgI	$8.5 \times 10^{-17}$
Strontium carbonate	SrCO <sub>3</sub>	$5.6 \times 10^{-10}$
Strontium fluoride	SrF <sub>2</sub>	$4.3 \times 10^{-9}$
Strontium sulphate	SrSO <sub>4</sub>	$3.4 \times 10^{-7}$
Zinc sulphide	ZnS	$2.0 \times 10^{-25}$

**RELATIVE STRENGTHS OF BRØNSTED-LOWRY ACIDS AND BASES**  
*in aqueous solution at room temperature.*

Name of Acid	Acid	Base	$K_a$
Perchloric	$\text{HClO}_4$	$\rightarrow \text{H}^+ + \text{ClO}_4^-$	very large
Hydriodic	$\text{HI}$	$\rightarrow \text{H}^+ + \text{I}^-$	very large
Hydrobromic	$\text{HBr}$	$\rightarrow \text{H}^+ + \text{Br}^-$	very large
Hydrochloric	$\text{HCl}$	$\rightarrow \text{H}^+ + \text{Cl}^-$	very large
Nitric	$\text{HNO}_3$	$\rightarrow \text{H}^+ + \text{NO}_3^-$	very large
Sulphuric	$\text{H}_2\text{SO}_4$	$\rightarrow \text{H}^+ + \text{HSO}_4^-$	very large
Hydronium Ion	$\text{H}_3\text{O}^+$	$\rightleftharpoons \text{H}^+ + \text{H}_2\text{O}$	1.0
Iodic	$\text{HIO}_3$	$\rightleftharpoons \text{H}^+ + \text{IO}_3^-$	$1.7 \times 10^{-1}$
Oxalic	$\text{H}_2\text{C}_2\text{O}_4$	$\rightleftharpoons \text{H}^+ + \text{HC}_2\text{O}_4^-$	$5.9 \times 10^{-2}$
Sulphurous ( $\text{SO}_2 + \text{H}_2\text{O}$ )	$\text{H}_2\text{SO}_3$	$\rightleftharpoons \text{H}^+ + \text{HSO}_3^-$	$1.5 \times 10^{-2}$
Hydrogen sulphate ion	$\text{HSO}_4^-$	$\rightleftharpoons \text{H}^+ + \text{SO}_4^{2-}$	$1.2 \times 10^{-2}$
Phosphoric	$\text{H}_3\text{PO}_4$	$\rightleftharpoons \text{H}^+ + \text{H}_2\text{PO}_4^-$	$7.5 \times 10^{-3}$
Hexaaquoiron ion, iron(III) ion	$\text{Fe}(\text{H}_2\text{O})_6^{3+}$	$\rightleftharpoons \text{H}^+ + \text{Fe}(\text{H}_2\text{O})_5(\text{OH})^{2+}$	$6.0 \times 10^{-3}$
Citric	$\text{H}_3\text{C}_6\text{H}_5\text{O}_7$	$\rightleftharpoons \text{H}^+ + \text{H}_2\text{C}_6\text{H}_5\text{O}_7^-$	$7.1 \times 10^{-4}$
Nitrous	$\text{HNO}_2$	$\rightleftharpoons \text{H}^+ + \text{NO}_2^-$	$4.6 \times 10^{-4}$
Hydrofluoric	$\text{HF}$	$\rightleftharpoons \text{H}^+ + \text{F}^-$	$3.5 \times 10^{-4}$
Methanoic, formic	$\text{HCOOH}$	$\rightleftharpoons \text{H}^+ + \text{HCOO}^-$	$1.8 \times 10^{-4}$
Hexaaquochromium ion, chromium(III) ion	$\text{Cr}(\text{H}_2\text{O})_6^{3+}$	$\rightleftharpoons \text{H}^+ + \text{Cr}(\text{H}_2\text{O})_5(\text{OH})^{2+}$	$1.5 \times 10^{-4}$
Benzoic	$\text{C}_6\text{H}_5\text{COOH}$	$\rightleftharpoons \text{H}^+ + \text{C}_6\text{H}_5\text{COO}^-$	$6.5 \times 10^{-5}$
Hydrogen oxalate ion	$\text{HC}_2\text{O}_4^-$	$\rightleftharpoons \text{H}^+ + \text{C}_2\text{O}_4^{2-}$	$6.4 \times 10^{-5}$
Ethanoic, acetic	$\text{CH}_3\text{COOH}$	$\rightleftharpoons \text{H}^+ + \text{CH}_3\text{COO}^-$	$1.8 \times 10^{-5}$
Dihydrogen citrate ion	$\text{H}_2\text{C}_6\text{H}_5\text{O}_7^-$	$\rightleftharpoons \text{H}^+ + \text{HC}_6\text{H}_5\text{O}_7^{2-}$	$1.7 \times 10^{-5}$
Hexaaquoaluminum ion, aluminum ion	$\text{Al}(\text{H}_2\text{O})_6^{3+}$	$\rightleftharpoons \text{H}^+ + \text{Al}(\text{H}_2\text{O})_5(\text{OH})^{2+}$	$1.4 \times 10^{-5}$
Carbonic ( $\text{CO}_2 + \text{H}_2\text{O}$ )	$\text{H}_2\text{CO}_3$	$\rightleftharpoons \text{H}^+ + \text{HCO}_3^-$	$4.3 \times 10^{-7}$
Monohydrogen citrate ion	$\text{HC}_6\text{H}_5\text{O}_7^{2-}$	$\rightleftharpoons \text{H}^+ + \text{C}_6\text{H}_5\text{O}_7^{3-}$	$4.1 \times 10^{-7}$
Hydrogen sulphite ion	$\text{HSO}_3^-$	$\rightleftharpoons \text{H}^+ + \text{SO}_3^{2-}$	$1.0 \times 10^{-7}$
Hydrogen sulphide	$\text{H}_2\text{S}$	$\rightleftharpoons \text{H}^+ + \text{HS}^-$	$9.1 \times 10^{-8}$
Dihydrogen phosphate ion	$\text{H}_2\text{PO}_4^-$	$\rightleftharpoons \text{H}^+ + \text{HPO}_4^{2-}$	$6.2 \times 10^{-8}$
Boric	$\text{H}_3\text{BO}_3$	$\rightleftharpoons \text{H}^+ + \text{H}_2\text{BO}_3^-$	$7.3 \times 10^{-10}$
Ammonium ion	$\text{NH}_4^+$	$\rightleftharpoons \text{H}^+ + \text{NH}_3$	$5.6 \times 10^{-10}$
Hydrocyanic	$\text{HCN}$	$\rightleftharpoons \text{H}^+ + \text{CN}^-$	$4.9 \times 10^{-10}$
Phenol	$\text{C}_6\text{H}_5\text{OH}$	$\rightleftharpoons \text{H}^+ + \text{C}_6\text{H}_5\text{O}^-$	$1.3 \times 10^{-10}$
Hydrogen carbonate ion	$\text{HCO}_3^-$	$\rightleftharpoons \text{H}^+ + \text{CO}_3^{2-}$	$5.6 \times 10^{-11}$
Hydrogen peroxide	$\text{H}_2\text{O}_2$	$\rightleftharpoons \text{H}^+ + \text{HO}_2^-$	$2.4 \times 10^{-12}$
Monohydrogen phosphate ion	$\text{HPO}_4^{2-}$	$\rightleftharpoons \text{H}^+ + \text{PO}_4^{3-}$	$2.2 \times 10^{-13}$
Water	$\text{H}_2\text{O}$	$\rightleftharpoons \text{H}^+ + \text{OH}^-$	$1.0 \times 10^{-14}$
Hydroxide ion	$\text{OH}^-$	$\leftarrow \text{H}^+ + \text{O}^{2-}$	very small
Ammonia	$\text{NH}_3$	$\leftarrow \text{H}^+ + \text{NH}_2^-$	very small



## ACID-BASE INDICATORS

Indicator	pH Range in Which Colour Change Occurs	Colour Change as pH Increases
Methyl violet	0.0 – 1.6	yellow to blue
Thymol blue	1.2 – 2.8	red to yellow
Orange IV	1.4 – 2.8	red to yellow
Methyl orange	3.2 – 4.4	red to yellow
Bromcresol green	3.8 – 5.4	yellow to blue
Methyl red	4.8 – 6.0	red to yellow
Chlorophenol red	5.2 – 6.8	yellow to red
Bromthymol blue	6.0 – 7.6	yellow to blue
Phenol red	6.6 – 8.0	yellow to red
Neutral red	6.8 – 8.0	red to amber
Thymol blue	8.0 – 9.6	yellow to blue
Phenolphthalein	8.2 – 10.0	colourless to pink
Thymolphthalein	9.4 – 10.6	colourless to blue
Alizarin yellow	10.1 – 12.0	yellow to red
Indigo carmine	11.4 – 13.0	blue to yellow

# STANDARD REDUCTION POTENTIALS OF HALF-CELLS

*Ionic concentrations are at 1M in water at 25°C.*

	Oxidizing Agents	Reducing Agents	E° (Volts)	
↑ STRONG	$F_2(g) + 2e^-$	$\rightleftharpoons 2F^-$	+2.87	WEAK
	$S_2O_8^{2-} + 2e^-$	$\rightleftharpoons 2SO_4^{2-}$	+2.01	
	$H_2O_2 + 2H^+ + 2e^-$	$\rightleftharpoons 2H_2O$	+1.78	
	$MnO_4^- + 8H^+ + 5e^-$	$\rightleftharpoons Mn^{2+} + 4H_2O$	+1.51	
	$Au^{3+} + 3e^-$	$\rightleftharpoons Au(s)$	+1.50	
	$BrO_3^- + 6H^+ + 5e^-$	$\rightleftharpoons \frac{1}{2}Br_2(l) + 3H_2O$	+1.48	
	$ClO_4^- + 8H^+ + 8e^-$	$\rightleftharpoons Cl^- + 4H_2O$	+1.39	
	$Cl_2(g) + 2e^-$	$\rightleftharpoons 2Cl^-$	+1.36	
	$Cr_2O_7^{2-} + 14H^+ + 6e^-$	$\rightleftharpoons 2Cr^{3+} + 7H_2O$	+1.23	
	$\frac{1}{2}O_2(g) + 2H^+ + 2e^-$	$\rightleftharpoons H_2O$	+1.23	
$MnO_2(s) + 4H^+ + 2e^-$	$\rightleftharpoons Mn^{2+} + 2H_2O$	+1.22		
$IO_3^- + 6H^+ + 5e^-$	$\rightleftharpoons \frac{1}{2}I_2(s) + 3H_2O$	+1.20		
$Br_2(l) + 2e^-$	$\rightleftharpoons 2Br^-$	+1.09		
$AuCl_4^- + 3e^-$	$\rightleftharpoons Au(s) + 4Cl^-$	+1.00		
$NO_3^- + 4H^+ + 3e^-$	$\rightleftharpoons NO(g) + 2H_2O$	+0.96		
$Hg^{2+} + 2e^-$	$\rightleftharpoons Hg(l)$	+0.85		
$\frac{1}{2}O_2(g) + 2H^+(10^{-7}M) + 2e^-$	$\rightleftharpoons H_2O$	+0.82	← Overpotential Effect	
$2NO_3^- + 4H^+ + 2e^-$	$\rightleftharpoons N_2O_4 + 2H_2O$	+0.80		
$Ag^+ + e^-$	$\rightleftharpoons Ag(s)$	+0.80		
$\frac{1}{2}Hg_2^{2+} + e^-$	$\rightleftharpoons Hg(l)$	+0.80		
$Fe^{3+} + e^-$	$\rightleftharpoons Fe^{2+}$	+0.77		
$O_2(g) + 2H^+ + 2e^-$	$\rightleftharpoons H_2O_2$	+0.70		
$MnO_4^- + 2H_2O + 3e^-$	$\rightleftharpoons MnO_2(s) + 4OH^-$	+0.60		
$I_2(s) + 2e^-$	$\rightleftharpoons 2I^-$	+0.54		
$Cu^+ + e^-$	$\rightleftharpoons Cu(s)$	+0.52		
$H_2SO_3 + 4H^+ + 4e^-$	$\rightleftharpoons S(s) + 3H_2O$	+0.45		
$Cu^{2+} + 2e^-$	$\rightleftharpoons Cu(s)$	+0.34		
$SO_4^{2-} + 4H^+ + 2e^-$	$\rightleftharpoons H_2SO_3 + H_2O$	+0.17		
$Cu^{2+} + e^-$	$\rightleftharpoons Cu^+$	+0.15		
$Sn^{4+} + 2e^-$	$\rightleftharpoons Sn^{2+}$	+0.15		
$S(s) + 2H^+ + 2e^-$	$\rightleftharpoons H_2S(g)$	+0.14		
$2H^+ + 2e^-$	$\rightleftharpoons H_2(g)$	+0.00		
$Pb^{2+} + 2e^-$	$\rightleftharpoons Pb(s)$	-0.13		
$Sn^{2+} + 2e^-$	$\rightleftharpoons Sn(s)$	-0.14		
$Ni^{2+} + 2e^-$	$\rightleftharpoons Ni(s)$	-0.26		
$H_3PO_4 + 2H^+ + 2e^-$	$\rightleftharpoons H_3PO_3 + H_2O$	-0.28		
$Co^{2+} + 2e^-$	$\rightleftharpoons Co(s)$	-0.28		
$Se(s) + 2H^+ + 2e^-$	$\rightleftharpoons H_2Se$	-0.40		
$Cr^{3+} + e^-$	$\rightleftharpoons Cr^{2+}$	-0.41		
$2H_2O + 2e^-$	$\rightleftharpoons H_2 + 2OH^-(10^{-7}M)$	-0.41	← Overpotential Effect	
$Fe^{2+} + 2e^-$	$\rightleftharpoons Fe(s)$	-0.45		
$Ag_2S(s) + 2e^-$	$\rightleftharpoons 2Ag(s) + S^{2-}$	-0.69		
$Cr^{3+} + 3e^-$	$\rightleftharpoons Cr(s)$	-0.74		
$Zn^{2+} + 2e^-$	$\rightleftharpoons Zn(s)$	-0.76		
$Te(s) + 2H^+ + 2e^-$	$\rightleftharpoons H_2Te$	-0.79		
$2H_2O + 2e^-$	$\rightleftharpoons H_2(g) + 2OH^-$	-0.83		
$Mn^{2+} + 2e^-$	$\rightleftharpoons Mn(s)$	-1.19		
$Al^{3+} + 3e^-$	$\rightleftharpoons Al(s)$	-1.66		
$Mg^{2+} + 2e^-$	$\rightleftharpoons Mg(s)$	-2.37		
$Na^+ + e^-$	$\rightleftharpoons Na(s)$	-2.71		
$Ca^{2+} + 2e^-$	$\rightleftharpoons Ca(s)$	-2.87		
$Sr^{2+} + 2e^-$	$\rightleftharpoons Sr(s)$	-2.89		
$Ba^{2+} + 2e^-$	$\rightleftharpoons Ba(s)$	-2.91		
$K^+ + e^-$	$\rightleftharpoons K(s)$	-2.93		
$Rb^+ + e^-$	$\rightleftharpoons Rb(s)$	-2.98		
$Cs^+ + e^-$	$\rightleftharpoons Cs(s)$	-3.03		
$Li^+ + e^-$	$\rightleftharpoons Li(s)$	-3.04		
↑ STRONG				↓ STRONG