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<div><div><div>11.01 1+, 1− 2.2 <i>H</i> hydrogen</div></div><div><div>36.94 1.0 <i>Li</i> lithium</div><div>24.31 1.6 <i>Be</i> beryllium</div></div><div><div>22.99 0.9 <i>Na</i> sodium</div><div>24.31 1.3 <i>Mg</i> magnesium</div></div></div> <table><tr><th colspan="6">Table of Common Polyatomic Ions</th></tr><tr><td>acetate (ethanoate)</td><td>CH₃COO[−]</td><td>chromate</td><td>CrO₄^{2−}</td><td>phosphate</td><td>PO₄^{3−}</td></tr><tr><td>ammonium</td><td>NH₄⁺</td><td>dichromate</td><td>Cr₂O₇^{2−}</td><td>hydrogen phosphate</td><td>HPO₄^{2−}</td></tr><tr><td>benzoate</td><td>C₆H₅COO[−]</td><td>cyanide</td><td>CN[−]</td><td>dihydrogen phosphate</td><td>H₂PO₄[−]</td></tr><tr><td>borate</td><td>BO₃^{3−}</td><td>hydroxide</td><td>OH[−]</td><td>silicate</td><td>SiO₃^{2−}</td></tr><tr><td>carbide</td><td>C₂^{2−}</td><td>iodate</td><td>IO₃[−]</td><td>sulphate</td><td>SO₄^{2−}</td></tr><tr><td>carbonate</td><td>CO₃^{2−}</td><td>nitrate</td><td>NO₃[−]</td><td>hydrogen sulphate</td><td>HSO₄[−]</td></tr><tr><td>hydrogen carbonate</td><td>HCO₃[−]</td><td>nitrite</td><td>NO₂[−]</td><td>sulfite</td><td>SO₃^{2−}</td></tr><tr><td>perchlorate</td><td>ClO₄[−]</td><td>oxalate</td><td>O^{2−}CCOO^{2−}</td><td>hydrogen sulfite</td><td>HSO₃[−]</td></tr><tr><td>chlorate</td><td>ClO₃[−]</td><td>hydrogen oxalate</td><td>HO[−]CCOO[−]</td><td>hydrogen sulfide</td><td>HS[−]</td></tr><tr><td>chlorite</td><td>ClO₂[−]</td><td>permanganate</td><td>MnO₄[−]</td><td>thiocyanate</td><td>SCN[−]</td></tr><tr><td>hypochlorite</td><td>OCℓ[−] or ClO[−]</td><td>peroxide</td><td>O₂^{2−}</td><td>thiosulfate</td><td>S₂O₃^{2−}</td></tr><tr><td></td><td></td><td>persulfide</td><td>S₂^{2−}</td><td></td><td></td></tr></table> <div><div><div>Atomic number → 26</div><div>Electronegativity → 1.8</div><div>Symbol → Fe</div><div>Name → iron</div></div><div><div>55.85</div><div>3+, 2+</div></div><div><div>Atomic molar mass (g/mol)</div><div>Most stable ion charges</div></div></div> <div><div><div>SOLID</div><div>LIQUID</div><div>GAS</div></div><div>NOTE: The legend denotes the physical state of the elements at exactly 101.325 kPa and 298.15 K.</div></div>				Table of Common Polyatomic Ions						acetate (ethanoate)	CH ₃ COO [−]	chromate	CrO ₄ ^{2−}	phosphate	PO ₄ ^{3−}	ammonium	NH ₄ ⁺	dichromate	Cr ₂ O ₇ ^{2−}	hydrogen phosphate	HPO ₄ ^{2−}	benzoate	C ₆ H ₅ COO [−]	cyanide	CN [−]	dihydrogen phosphate	H ₂ PO ₄ [−]	borate	BO ₃ ^{3−}	hydroxide	OH [−]	silicate	SiO ₃ ^{2−}	carbide	C ₂ ^{2−}	iodate	IO ₃ [−]	sulphate	SO ₄ ^{2−}	carbonate	CO ₃ ^{2−}	nitrate	NO ₃ [−]	hydrogen sulphate	HSO ₄ [−]	hydrogen carbonate	HCO ₃ [−]	nitrite	NO ₂ [−]	sulfite	SO ₃ ^{2−}	perchlorate	ClO ₄ [−]	oxalate	O ^{2−} CCOO ^{2−}	hydrogen sulfite	HSO ₃ [−]	chlorate	ClO ₃ [−]	hydrogen oxalate	HO [−] CCOO [−]	hydrogen sulfide	HS [−]	chlorite	ClO ₂ [−]	permanganate	MnO ₄ [−]	thiocyanate	SCN [−]	hypochlorite	OCℓ [−] or ClO [−]	peroxide	O ₂ ^{2−}	thiosulfate	S ₂ O ₃ ^{2−}			persulfide	S ₂ ^{2−}			24.00 − <i>He</i> helium	
				Table of Common Polyatomic Ions																																																																															
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				benzoate	C ₆ H ₅ COO [−]	cyanide	CN [−]	dihydrogen phosphate	H ₂ PO ₄ [−]																																																																										
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				carbide	C ₂ ^{2−}	iodate	IO ₃ [−]	sulphate	SO ₄ ^{2−}																																																																										
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39.10 0.8 <i>K</i> potassium		40.08 1.0 <i>Ca</i> calcium		44.96 1.4 3+ <i>Sc</i> scandium		47.87 1.5 4+, 3+ <i>Ti</i> titanium		50.94 1.6 5+, 4+ <i>V</i> vanadium		52.00 1.7 3+, 2+ <i>Cr</i> chromium		54.94 1.6 2+, 4+ <i>Mn</i> manganese		55.85 1.8 3+, 2+ <i>Fe</i> iron		58.93 1.9 2+, 3+ <i>Co</i> cobalt		58.69 1.9 2+, 3+ <i>Ni</i> nickel		63.55 1.9 2+, 1+ <i>Cu</i> copper		65.41 1.7 2+ <i>Zn</i> zinc		69.72 1.8 3+ <i>Ga</i> gallium		72.64 2.0 4+ <i>Ge</i> germanium		74.92 2.2 <i>As</i> arsenic		78.96 2.6 <i>Se</i> selenium		79.90 3.0 <i>Br</i> bromine		83.80 − <i>Kr</i> krypton																																																	
85.47 0.8 <i>Rb</i> rubidium		87.62 1.0 <i>Sr</i> strontium		88.91 1.2 3+ <i>Y</i> yttrium		91.22 1.3 4+ <i>Zr</i> zirconium		92.91 1.6 5+, 3+ <i>Nb</i> niobium		95.94 2.2 6+ <i>Mo</i> molybdenum		(98) 2.1 7+ <i>Tc</i> technetium		101.07 2.2 3+ <i>Ru</i> ruthenium		102.91 2.3 3+ <i>Rh</i> rhodium		106.42 2.2 2+, 3+ <i>Pd</i> palladium		107.87 1.9 1+ <i>Ag</i> silver		112.41 1.7 2+ <i>Cd</i> cadmium		114.82 1.8 3+ <i>In</i> indium		118.71 2.0 4+, 2+ <i>Sn</i> tin		121.76 2.1 3+, 5+ <i>Sb</i> antimony		127.60 2.1 <i>Te</i> tellurium		126.90 2.7 <i>I</i> iodine		131.29 2.6 − <i>Xe</i> xenon																																																	
132.91 0.8 <i>Cs</i> cesium		137.33 0.9 <i>Ba</i> barium		138.91 1.1 3+ <i>La</i> lanthanum		178.49 1.3 4+ <i>Hf</i> hafnium		180.95 1.5 5+ <i>Ta</i> tantalum		183.84 1.7 6+ <i>W</i> tungsten		186.21 1.9 7+ <i>Re</i> rhenium		190.23 2.2 4+ <i>Os</i> osmium		192.22 2.2 4+ <i>Ir</i> iridium		195.08 2.2 4+, 2+ <i>Pt</i> platinum		196.97 2.4 3+, 1+ <i>Au</i> gold		200.59 1.9 2+, 1+ <i>Hg</i> mercury		204.38 1.8 1+, 3+ <i>Tl</i> thallium		207.2* 1.8 2+, 4+ <i>Pb</i> lead		208.98 1.9 3+, 5+ <i>Bi</i> bismuth		(209) 2.0 2+, 4+ <i>Po</i> polonium		(210) 2.2 <i>At</i> astatine		(222) − <i>Rn</i> radon																																																	
(223) 0.7 <i>Fr</i> francium		(226) 0.9 <i>Ra</i> radium		(227) 1.1 3+ <i>Ac</i> actinium		(261) 4+ <i>Rf</i> rutherfordium		(262) <i>Db</i> dubnium		(266) <i>Sg</i> seaborgium		(264) <i>Bh</i> bohrium		(277) <i>Hs</i> hassium		(268) <i>Mt</i> meitnerium		(271) <i>Ds</i> darmstadtium		(272) <i>Rg</i> roentgenium		(285) <i>Cn</i> copernicium		(284) <i>Nh</i> nihonium		(289) <i>Fl</i> flerovium		(288) <i>Mc</i> moscovium		(293) <i>Lv</i> livermorium		(294) <i>Ts</i> tennessine		(294) <i>Og</i> oganesson																																																	

References:

Lide, D.R. 2005. *CRC Handbook of Chemistry and Physics*. 86th ed. Boca Raton: CRC Press.

Speight, James G. 2005. *Lange's Handbook of Chemistry*. 6th ed. New York: McGraw–Hill Inc.

IUPAC commission on weights and isotopic abundances. 2002. <http://www.chem.qmw.ac.uk/iupac/AtWt/index.html>.

58 140.12 1.1 Ce cerium	59 140.91 1.1 Pr praseodymium	60 144.24 1.1 Nd neodymium	61 (145) − Pm promethium	62 150.36 1.2 Sm samarium	63 151.96 − Eu europium	64 157.25 1.2 Gd gadolinium	65 158.93 − Tb terbium	66 162.50 1.2 Dy dysprosium	67 164.93 1.2 Ho holmium	68 167.26 1.2 Er erbium	69 168.93 1.3 Tm thulium	70 173.04 − Yb ytterbium	71 174.97 1.0 Lu lutetium
90 232.04 1.3 Th thorium	91 231.04 1.5 Pa protactinium	92 238.03 1.7 U uranium	93 (237) 1.3 Np neptunium	94 (244) 1.3 Pu plutonium	95 (243) − Am americium	96 (247) − Cm curium	97 (247) − Bk berkelium	98 (251) − Cf californium	99 (252) − Es einsteinium	100 (257) − Fm fermium	101 (258) − Md mendelevium	102 (259) − No nobelium	103 (262) − Lr lawrencium

Acid–Base Indicators at 298.15 K				
Indicator	Suggested Abbreviation(s)	pH Range	Colour Change as pH Increases	<i>K</i> _a
methyl violet	HMv _(aq) / Mv [−] _(aq)	0.0 – 1.6	yellow to blue	~2 x 10 ^{−1}
cresol red	H ₂ Cr _(aq) / HCr [−] _(aq)	0.0 – 1.0	red to yellow	~3 x 10 ^{−1}
	HCr [−] _(aq) / Cr ^{2−} _(aq)	7.0 – 8.8	yellow to red	3.5 x 10 ^{−9}
thymol blue	H ₂ Tb _(aq) / HTb [−] _(aq)	1.2 – 2.8	red to yellow	2.2 x 10 ^{−2}
	HTb [−] _(aq) / Tb ^{2−} _(aq)	8.0 – 9.6	yellow to blue	6.3 x 10 ^{−10}
orange IV	HOr _(aq) / Or [−] _(aq)	1.4 – 2.8	red to yellow	~1 x 10 ^{−2}
methyl orange	HMo _(aq) / Mo [−] _(aq)	3.2 – 4.4	red to yellow	3.5 x 10 ^{−4}
bromocresol green	HBg _(aq) / Bg [−] _(aq)	3.8 – 5.4	yellow to blue	1.3 x 10 ^{−5}
methyl red	HMr _(aq) / Mr [−] _(aq)	4.8 – 6.0	red to yellow	1.0 x 10 ^{−5}
chlorophenol red	HCh _(aq) / Ch [−] _(aq)	5.2 – 6.8	yellow to red	5.6 x 10 ^{−7}
bromothymol blue	HBb _(aq) / Bb [−] _(aq)	6.0 – 7.6	yellow to blue	5.0 x 10 ^{−8}
phenol red	HPr _(aq) / Pr [−] _(aq)	6.6 – 8.0	yellow to red	1.0 x 10 ^{−8}
phenolphthalein	HPh _(aq) / Ph [−] _(aq)	8.2 – 10.0	colourless to pink	3.2 x 10 ^{−10}
thymolphthalein	HTh _(aq) / Th [−] _(aq)	9.4 – 10.6	colourless to blue	1.0 x 10 ^{−10}
alizarin yellow R	HAY _(aq) / Ay [−] _(aq)	10.1 – 12.0	yellow to red	6.9 x 10 ^{−12}
indigo carmine	HIc _(aq) / Ic [−] _(aq)	11.4 – 13.0	blue to yellow	~6 x 10 ^{−12}
1,3,5 - trinitrobenzene	HNb _(aq) / Nb [−] _(aq)	12.0 – 14.0	colourless to orange	~1 x 10 ^{−13}

Avogadro Constant	$\frac{6.02 \times 10^{23} \text{ particles}}{\text{mol}}$	Universal Gas Constant	$8.3145 \frac{\text{kPa} \bullet \text{L}}{\text{K} \bullet \text{mol}}$
STP	273.15 K and 101.325 kPa	Molar Volume at STP	22.4 L/mol
SATP	298.15 K and 100 kPa	Molar Volume at SATP	24.8 L/mol
Combined Gas Law	$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$	Ideal Gas Law	$PV = nRT$

Solubility of Some Common Ionic Compounds in Water at 298.15 K								
Ion	Group 1 ions							
	H ⁺ NH ₄ ⁺ NO ₃ [−] ClO ₃ [−] ClO ₄ [−] CH ₃ COO [−]	F [−]	Cl [−] Br [−] I [−]	SO ₄ ^{2−}	CO ₃ ^{2−} PO ₄ ^{3−} SO ₃ ^{2−}	IO ₃ [−] O [−] OC [−] COO ^{2−}	S ^{2−}	OH [−]
Solubility greater than or equal to 0.1 mol/L (very soluble)	most	most	most	most	Group 1 ions NH ₄ ⁺	Group 1 ions NH ₄ ⁺ Co(IO ₃) ₂ Fe ² (O [−] OC [−] COO) ₃	Group 1 ions NH ₄ ⁺ Mg ²⁺ Ca ²⁺	Group 1 ions NH ₄ ⁺
Solubility less than 0.1 mol/L (slightly soluble)	RbClO ₄ CsClO ₄ AgCH ₃ COO Hg ₂ (CH ₃ COO) ₂	Li ⁺ Mg ²⁺ Ca ²⁺ Sr ²⁺ Ba ²⁺ Fe ²⁺ Hg ²⁺ Pb ²⁺	Cu ⁺ Ag ⁺ Hg ₂ ²⁺ Pb ²⁺ Tl ⁺	Ca ²⁺ Sr ²⁺ Ba ²⁺ Ag ⁺ Hg ₂ ²⁺ Pb ²⁺ Ra ²⁺	most	most	most	most

SELECTED ION COLORS

Ion	Solution color (1.0 mol/L)	Solution Color (0.010 mol/L)	Ion	Flame colour
Groups 1, 2, 17	colorless	colorless	Li ⁺	bright red
Cr ²⁺	dark blue	pale blue	Na ⁺	bright yellow
Cr ³⁺	blue–green	green	K ⁺	violet
Co ²⁺	red	pink	Rb ⁺	violet
Cu ⁺	blue–green	pale blue–green	Cs ⁺	violet
Cu ²⁺	blue	pale blue		
Fe ²⁺	pale green	colorless	Ca ²⁺	yellow–red
Fe ³⁺	yellow–brown	pale yellow	Sr ²⁺	bright red
Mn ²⁺	pale pink	colorless	Ba ²⁺	yellow–green
Ni ²⁺	blue–green	pale green		
CrO ₄ ^{2−}	yellow	pale yellow	Cu ²⁺	blue–green
Cr ₂ O ₇ ^{2−}	orange	pale orange	Pb ²⁺	light blue–grey
MnO ₄ [−]	deep purple	purple–pink	Zn ²⁺	whitish–green

Selected SI Prefixes		
Prefix	Exponential Symbol	Value
tera	T	10 ¹²
giga	G	10 ⁹
mega	M	10 ⁶
kilo	k	10 ³
milli	m	10 ^{−3}
micro	μ	10 ^{−6}
nano	n	10 ^{−9}
pico	p	10 ^{−12}