

**Data Booklet**  
**Placement test for entry into Grade**  
**11 Chemistry CHEM 181**

<b>Solubility of Some Common Ionic Compounds in Water at 25°C</b>								
<b>Ion</b>	<b>Group1 NH<sub>4</sub><sup>+</sup> H<sub>3</sub>O<sup>+</sup>,H<sup>+</sup></b>	<b>ClO<sub>3</sub><sup>-</sup> NO<sub>3</sub><sup>-</sup> ClO<sub>4</sub><sup>-</sup></b>	<b>CH<sub>3</sub>COO<sup>-</sup></b>	<b>Cl<sup>-</sup> Br<sup>-</sup> I<sup>-</sup></b>	<b>SO<sub>4</sub><sup>2-</sup></b>	<b>S<sup>2-</sup></b>	<b>OH<sup>-</sup></b>	<b>PO<sub>4</sub><sup>3-</sup> SO<sub>3</sub><sup>2-</sup> CO<sub>3</sub><sup>2-</sup></b>
Solubility greater than or equal to 0.1 mol/L (very soluble)	all	all	most	most	most	Group1 Group2 NH <sub>4</sub> <sup>+</sup>	Group1 NH <sub>4</sub> <sup>+</sup> Sr <sup>2+</sup> Ba <sup>2+</sup> Tl <sup>+</sup>	Group1 NH <sub>4</sub> <sup>+</sup>
Solubility less than 0.1 mol/L (slightly soluble)	none	none	Ag <sup>+</sup> Hg <sup>+</sup>	Ag <sup>+</sup> Pb <sup>2+</sup> Hg <sup>+</sup> Cu <sup>+</sup> Tl <sup>+</sup>	Ca <sup>2+</sup> Sr <sup>2+</sup> Ba <sup>2+</sup> Ra <sup>2+</sup> Pb <sup>2+</sup> Ag <sup>+</sup>	most	most	most

1	2	3	4	5	6	7	8	9
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acetate (ethanoate)	CH <sub>3</sub> COO <sup>-</sup>	chromate	CrO <sub>4</sub> <sup>2-</sup>	phosphate	PO <sub>4</sub> <sup>3-</sup>
ammonium	NH <sub>4</sub> <sup>+</sup>	dichromate	Cr <sub>2</sub> O <sub>7</sub> <sup>2-</sup>	hydrogen phosphate	HPO <sub>4</sub> <sup>2-</sup>
benzoate	C <sub>6</sub> H <sub>5</sub> COO <sup>-</sup>	cyanide	CN <sup>-</sup>	dihydrogen phosphate	H <sub>2</sub> PO <sub>4</sub> <sup>-</sup>
borate	BO <sub>3</sub> <sup>3-</sup>	hydroxide	OH <sup>-</sup>	silicate	SiO <sub>3</sub> <sup>2-</sup>
carbide	C <sub>2</sub> <sup>2-</sup>	iodate	IO <sub>3</sub> <sup>-</sup>	sulfate	SO <sub>4</sub> <sup>2-</sup>
carbonate	CO <sub>3</sub> <sup>2-</sup>	nitrate	NO <sub>3</sub> <sup>-</sup>	hydrogen sulfate	HSO <sub>4</sub> <sup>-</sup>
hydrogen carbonate	HCO <sub>3</sub> <sup>-</sup>	nitrite	NO <sub>2</sub> <sup>-</sup>	sulfite	SO <sub>3</sub> <sup>2-</sup>
perchlorate	ClO <sub>4</sub> <sup>-</sup>	oxalate	O <sub>2</sub> C <sub>2</sub> O <sub>2</sub> <sup>2-</sup>	hydrogen sulfite	HSO <sub>3</sub> <sup>-</sup>
chlorate	ClO <sub>3</sub> <sup>-</sup>	hydrogen oxalate	HO <sub>2</sub> C <sub>2</sub> O <sub>2</sub> <sup>-</sup>	hydrogen sulfide	HS <sup>-</sup>
chlorite	ClO <sub>2</sub> <sup>-</sup>	permanganate	MnO <sub>4</sub> <sup>-</sup>	thiocyanate	SCN <sup>-</sup>
hypochlorite	OCl <sup>-</sup> or ClO <sup>-</sup>	peroxide	O <sub>2</sub> <sup>2-</sup>	thiosulfate	S <sub>2</sub> O <sub>3</sub> <sup>2-</sup>
		persulfide	S <sub>2</sub> <sup>2-</sup>		

<b>1</b> 1.01 1+, 1- <b>H</b> hydrogen	<b>3</b> 6.94 1+ <b>Li</b> lithium	<b>4</b> 9.01 2+ <b>Be</b> beryllium	<b>11</b> 22.99 1+ <b>Na</b> sodium	<b>12</b> 24.31 2+ <b>Mg</b> magnesium	<b>19</b> 39.10 1+ <b>K</b> potassium	<b>20</b> 40.08 2+ <b>Ca</b> calcium	<b>21</b> 44.96 3+ <b>Sc</b> scandium	<b>22</b> 47.87 4+, 3+ <b>Ti</b> titanium	<b>23</b> 50.94 5+, 4+ <b>V</b> vanadium	<b>24</b> 52.00 3+, 2+ <b>Cr</b> chromium	<b>25</b> 54.94 2+, 4+ <b>Mn</b> manganese	<b>26</b> 55.85 3+, 2+ <b>Fe</b> iron	<b>27</b> 58.93 2+, 3+ <b>Co</b> cobalt				
<b>37</b> 85.47 1+ <b>Rb</b> rubidium	<b>38</b> 87.62 2+ <b>Sr</b> strontium	<b>39</b> 88.91 3+ <b>Y</b> yttrium	<b>40</b> 91.22 4+ <b>Zr</b> zirconium	<b>41</b> 92.91 5+, 3+ <b>Nb</b> niobium	<b>42</b> 95.94 6+ <b>Mo</b> molybdenum	<b>43</b> (98) 7+ <b>Tc</b> technetium	<b>44</b> 101.07 3+ <b>Ru</b> ruthenium	<b>45</b> 102.91 3+ <b>Rh</b> rhodium	<b>55</b> 132.91 1+ <b>Cs</b> cesium	<b>56</b> 137.33 2+ <b>Ba</b> barium	<b>57</b> 138.91 3+ <b>La</b> lanthanum	<b>72</b> 178.49 4+ <b>Hf</b> hafnium	<b>73</b> 180.95 5+ <b>Ta</b> tantalum	<b>74</b> 183.84 6+ <b>W</b> tungsten	<b>75</b> 186.21 7+ <b>Re</b> rhenium	<b>76</b> 190.23 4+ <b>Os</b> osmium	<b>77</b> 192.22 4+ <b>Ir</b> iridium
<b>87</b> (223) 1+ <b>Fr</b> francium	<b>88</b> (226) 2+ <b>Ra</b> radium	<b>89</b> (227) 3+ <b>Ac</b> actinium	<b>104</b> (261) 4+ <b>Rf</b> rutherfordium	<b>105</b> (262) <b>Db</b> dubnium	<b>106</b> (266) <b>Sg</b> seaborgium	<b>107</b> (264) <b>Bh</b> bohrium	<b>108</b> (277) <b>Hs</b> hassium	<b>109</b> (268) <b>Mt</b> meitnerium									

—lanthanide and actinide series begin

#### References

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

Speight, James G. 2005. *Lange's Handbook of Chemistry*. 16<sup>th</sup> ed. New York: McGraw-Hill, Inc.

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

<b>58</b> 140.12 3+ <b>Ce</b> cerium	<b>59</b> 140.91 3+ <b>Pr</b> praseodymium	<b>60</b> 144.24 3+ <b>Nd</b> neodymium	<b>61</b> (145) 3+ <b>Pm</b> promethium	<b>62</b> 150.36 3+, 2+ <b>Sm</b> samarium
<b>90</b> 232.04 4+ <b>Th</b> thorium	<b>91</b> 231.04 5+, 4+ <b>Pa</b> protactinium	<b>92</b> 238.03 6+, 4+ <b>U</b> uranium	<b>93</b> (237) 5+ <b>Np</b> neptunium	<b>94</b> (244) 4+, 6+ <b>Pu</b> plutonium

10	11	12	13	14	15	16	17	18
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Legend for Elements

<span style="background-color: #ffffcc; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> Metallic solids	<span style="background-color: #add8e6; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> Gases
<span style="background-color: #c8e6c9; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> Non-metallic solids	<span style="background-color: #ffb6c1; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> Liquids

Note: The legend denotes the physical state of the elements at exactly 101.325 kPa and 298.15 K.

**Key**

Atomic number → 26    55.85  
 Electronegativity → 1.8  
 Symbol → Fe  
 Name → iron

Atomic molar mass (g/mol)\*  
 Most stable ion charges

\* Based on <sup>12</sup>C  
 ( ) Indicates mass of the most stable isotope

										2    4.00 — He helium	
		5    10.81 2.0 B boron	6    12.01 2.6 C carbon	7    14.01 3.0 N nitrogen	8    16.00 3.4 O oxygen	9    19.00 4.0 F fluorine	10    20.18 — Ne neon				
		13    26.98 1.6 Al aluminium	14    28.09 1.9 Si silicon	15    30.97 2.2 P phosphorus	16    32.07 2.6 S sulfur	17    35.45 3.2 Cl chlorine	18    39.95 — Ar argon				
28    58.69 1.9 Ni nickel	29    63.55 1.9 Cu copper	30    65.41 1.7 Zn zinc	31    69.72 1.8 Ga gallium	32    72.64 2.0 Ge germanium	33    74.92 2.2 As arsenic	34    78.96 2.6 Se selenium	35    79.90 3.0 Br bromine	36    83.80 — Kr krypton			
46    106.42 2.2 Pd palladium	47    107.87 1.9 Ag silver	48    112.41 1.7 Cd cadmium	49    114.82 1.8 In indium	50    118.71 2.0 Sn tin	51    121.76 2.1 Sb antimony	52    127.60 2.1 Te tellurium	53    126.90 2.7 I iodine	54    131.29 2.6 Xe xenon			
78    195.08 2.2 Pt platinum	79    196.97 2.4 Au gold	80    200.59 1.9 Hg mercury	81    204.38 1.8 Tl thallium	82    207.2* 1.8 Pb lead	83    208.98 1.9 Bi bismuth	84    (209) 2.0 Po polonium	85    (210) 2.2 At astatine	86    (222) — Rn radon			
110 (271) Ds darmstadtium	111 (272) Rg roentgenium										* The isotopic mix of naturally occurring lead is more variable than other elements, preventing precision to greater than tenths of a gram per mole.
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			
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			