

# Appendix C

MAIN-GROUP ELEMENTS			Periodic Table of the Elements													
			<div>Atomic number</div> <div>Electronegativity</div> <div>First ionization energy (kJ/mol)</div> <div>Melting point (K)</div> <div>Boiling point (K)</div>										<div>612.01</div> <div>2.5+4</div> <div>1086-3</div> <div>4768</div> <div>4528</div> <div>Ccarbon</div>		<div>Average atomic mass*</div> <div>Common valence</div> <div>Other valences</div>	
			<div>metals (main group)</div> <div>metals (transition)</div> <div>metals (inner transition)</div> <div>metalloids</div> <div>nonmetals</div>										<div>Gases</div> <div>Liquids</div> <div>Synthetics</div>			
			TRANSITION ELEMENTS													
			3(IIIB)	4(IVB)	5(VB)	6(VIB)	7(VIIB)	8	9(VIIIB)							
1	1(IA)	2(IIA)														
1	<div>11.01</div> <div>2.20</div> <div>131.2</div> <div>13.81</div> <div>30.26</div> <div>Hhydrogen</div>															
2	<div>36.94</div> <div>0.98</div> <div>520</div> <div>435.7</div> <div>1615</div> <div>Liithium</div>	<div>9.01</div> <div>1.57</div> <div>680</div> <div>1980</div> <div>2944</div> <div>Beberyllium</div>														
3	<div>22.99</div> <div>0.93</div> <div>496</div> <div>371</div> <div>1156</div> <div>Naodium</div>	<div>24.31</div> <div>1.31</div> <div>739</div> <div>1023.2</div> <div>1253</div> <div>Mgmagnesium</div>														
4	<div>39.10</div> <div>0.82</div> <div>419</div> <div>336.7</div> <div>1023</div> <div>Kpotassium</div>	<div>40.08</div> <div>1.02</div> <div>590</div> <div>1115</div> <div>1657</div> <div>Calcium</div>	<div>44.96</div> <div>1.36</div> <div>63</div> <div>1841</div> <div>3185</div> <div>Scandium</div>	<div>47.87</div> <div>1.54</div> <div>688</div> <div>1941</div> <div>3680</div> <div>Titanium</div>	<div>50.94</div> <div>1.63</div> <div>736</div> <div>2183</div> <div>3680</div> <div>Vanadium</div>	<div>52.00</div> <div>1.66</div> <div>737</div> <div>2180</div> <div>3680</div> <div>Chromium</div>	<div>54.94</div> <div>1.55</div> <div>717</div> <div>1911</div> <div>3334</div> <div>Mnmanganese</div>	<div>55.85</div> <div>1.83</div> <div>759</div> <div>1811</div> <div>3134</div> <div>Feiron</div>	<div>58.93</div> <div>1.83</div> <div>760</div> <div>1811</div> <div>3134</div> <div>Coobalt</div>							
5	<div>85.47</div> <div>0.82</div> <div>402</div> <div>312.5</div> <div>941.2</div> <div>Rbrubidium</div>	<div>87.62</div> <div>0.95</div> <div>540</div> <div>1030</div> <div>1655</div> <div>Srstrontium</div>	<div>88.91</div> <div>1.22</div> <div>615</div> <div>1765</div> <div>3555</div> <div>Yttrium</div>	<div>91.22</div> <div>1.35</div> <div>680</div> <div>2128</div> <div>3602</div> <div>Zrzirconium</div>	<div>92.91</div> <div>1.5</div> <div>684</div> <div>2128</div> <div>3602</div> <div>Nbniobium</div>	<div>95.94</div> <div>1.71</div> <div>685</div> <div>2868</div> <div>4912</div> <div>Mo molybdenum</div>	<div>(98)</div> <div>210</div> <div>702</div> <div>4330</div> <div>Tctechnetium</div>	<div>101.07</div> <div>2.2</div> <div>720</div> <div>4423</div> <div>Ruruthenium</div>	<div>102.91</div> <div>2.25</div> <div>720</div> <div>4423</div> <div>Rhrhodium</div>							
6	<div>132.91</div> <div>0.79</div> <div>57</div> <div>303.7</div> <div>944</div> <div>Cscesium</div>	<div>137.33</div> <div>0.89</div> <div>560</div> <div>1000</div> <div>2170</div> <div>Babarium</div>	<div>138.91</div> <div>1.10</div> <div>538</div> <div>1191</div> <div>3733</div> <div>La lanthanum</div>	<div>178.49</div> <div>1.3</div> <div>542</div> <div>3508</div> <div>4678</div> <div>Hfhafnium</div>	<div>180.95</div> <div>1.5</div> <div>761</div> <div>3280</div> <div>5175</div> <div>Tatantalum</div>	<div>183.84</div> <div>1.7</div> <div>761</div> <div>3280</div> <div>5175</div> <div>Wtungsten</div>	<div>186.21</div> <div>1.9</div> <div>761</div> <div>3450</div> <div>5890</div> <div>Re rhenium</div>	<div>190.23</div> <div>2.2</div> <div>761</div> <div>5365</div> <div>5765</div> <div>Ososmium</div>	<div>192.22</div> <div>2.2</div> <div>761</div> <div>5365</div> <div>5765</div> <div>Iriridium</div>							
7	<div>(223)</div> <div>0.7</div> <div>-375</div> <div>330.2</div> <div>Frfrancium</div>	<div>(226)</div> <div>0.9</div> <div>560</div> <div>900.2</div> <div>Raradium</div>	<div>(227)</div> <div>1.1</div> <div>408</div> <div>1304</div> <div>2631</div> <div>Acactinium</div>	<div>(261)</div> <div>-</div> <div>-</div> <div>-</div> <div>-</div> <div>Rfrutherfordium</div>	<div>(262)</div> <div>-</div> <div>-</div> <div>-</div> <div>-</div> <div>-</div> <div>Dbdubnium</div>	<div>(266)</div> <div>-</div> <div>-</div> <div>-</div> <div>-</div> <div>-</div> <div>Sgseaborgium</div>	<div>(264)</div> <div>-</div> <div>-</div> <div>-</div> <div>-</div> <div>-</div> <div>Bhbohrium</div>	<div>(265)</div> <div>-</div> <div>-</div> <div>-</div> <div>-</div> <div>-</div> <div>Hshassium</div>	<div>(268)</div> <div>-</div> <div>-</div> <div>-</div> <div>-</div> <div>-</div> <div>Mtmeitnerium</div>							
			INNER TRANSITION ELEMENTS													
6	Lanthanoids		<div>140.12</div> <div>1.12</div> <div>527</div> <div>1021</div> <div>3716</div> <div>Cecerium</div>	<div>140.91</div> <div>1.13</div> <div>523</div> <div>1204</div> <div>3362</div> <div>Prpraseodymium</div>	<div>144.24</div> <div>1.14</div> <div>536</div> <div>1204</div> <div>3362</div> <div>Ndneodymium</div>	<div>(145)</div> <div>1.15</div> <div>536</div> <div>1204</div> <div>3362</div> <div>Pmpromethium</div>	<div>150.36</div> <div>1.17</div> <div>542</div> <div>1344</div> <div>3507</div> <div>Sm samarium</div>	<div>151.96</div> <div>1.18</div> <div>547</div> <div>1344</div> <div>3507</div> <div>Eueuropium</div>	<div>157.25</div> <div>1.20</div> <div>547</div> <div>1344</div> <div>3507</div> <div>Gdgadolinium</div>							
7	Actinoids		<div>232.04</div> <div>1.3</div> <div>580</div> <div>2023</div> <div>9001</div> <div>Ththorium</div>	<div>231.04</div> <div>1.5</div> <div>580</div> <div>1840</div> <div>4404</div> <div>Pa protactinium</div>	<div>238.03</div> <div>1.7</div> <div>580</div> <div>1480</div> <div>4404</div> <div>Uuranium</div>	<div>237.05</div> <div>1.5</div> <div>580</div> <div>1480</div> <div>4404</div> <div>Npneptunium</div>	<div>(244)</div> <div>1.3</div> <div>580</div> <div>1480</div> <div>4404</div> <div>Puplutonium</div>	<div>(243)</div> <div>1.3</div> <div>580</div> <div>1480</div> <div>4404</div> <div>Amamericium</div>	<div>(247)</div> <div>1.3</div> <div>580</div> <div>1480</div> <div>4404</div> <div>Cmcurium</div>							

\*Average atomic mass data in brackets indicate atomic mass of most stable isotope of the element.  
Data obtained from The CRC Handbook of Chemistry and Physics, 81<sup>st</sup> Edition

# MAIN-GROUP ELEMENTS

MAIN-GROUP ELEMENTS									
									18 (VIII A)
									2 4.00
									3372 51.9 5.02 <b>He</b> helium
13 (IIIA)		14 (IVA)		15 (VA)		16 (VIA)		17 (VIIA)	
5 10.81 7.04 800 2344 4233 <b>B</b> boron		6 12.01 2.55 1.08 4.35 4.08 <b>C</b> carbon		7 14.01 3.04 1.48 69.15 77.36 <b>N</b> nitrogen		8 16.00 3.44 1.24 54.36 56.2 <b>O</b> oxygen		9 19.00 3.98 1.68 53.48 54.88 <b>F</b> fluorine	
13 26.98 1.61 577 932.5 2762 <b>Al</b> aluminum		14 28.09 1.90 780 1807 2358 <b>Si</b> silicon		15 30.97 2.19 1012 317.3 552.7 <b>P</b> phosphorus		16 32.07 2.58 980 382.8 317.8 <b>S</b> sulfur		17 35.45 3.16 1256 177.7 235.1 <b>Cl</b> chlorine	
10		11 (IB)		12 (IIB)		13		14	
28 58.69 1.31 337 1328 3188 <b>Ni</b> nickel		29 63.55 1.90 745 1386 2835 <b>Cu</b> copper		30 65.39 1.55 895 1607 1180 <b>Zn</b> zinc		31 69.72 1.61 876 303.8 2437 <b>Ga</b> gallium		32 72.61 2.31 781 303.8 3108 <b>Ge</b> germanium	
46 106.42 2.20 805 1828 3726 <b>Pd</b> palladium		47 107.87 1.95 728 1329 2435 <b>Ag</b> silver		48 112.41 1.59 885 1643 1040 <b>Cd</b> cadmium		49 114.82 1.76 598 428.8 3343 <b>In</b> indium		50 118.71 1.56 788 505 2875 <b>Sn</b> tin	
78 195.08 2.2 870 2040 4038 <b>Pt</b> platinum		79 196.97 2.4 880 1337 3779 <b>Au</b> gold		80 200.59 1.9 1107 294.3 629.0 <b>Hg</b> mercury		81 204.38 1.8 589 577.3 1746 <b>Tl</b> thallium		82 207.20 1.8 715 800.6 302 <b>Pb</b> lead	
110 (269) - - - - <b>Uun</b> ununilium		111 (272) - - - - <b>Uuu</b> ununium		112 (277) - - - - <b>Uub</b> unubium		114 (285) - - - - <b>Uuq</b> ununquadium		116 (289) - - - - <b>Uuh</b> ununhexium	
83 208.98 1.9 762 944.6 1837 <b>Bi</b> bismuth		84 (209) 2.0 813 527.3 1236 <b>Po</b> polonium		85 (210) 2.2 929 575 - <b>At</b> astatine		86 (222) 2.2 1037 202.2 211.5 <b>Rn</b> radon		118 (293) - - - - <b>Uuo</b> ununoctium	

65 158.93 - 585 1829 2302 <b>Tb</b> terbium	66 162.50 1.22 570 1685 2840 <b>Dy</b> dysprosium	67 164.93 1.25 591 1347 2675 <b>Ho</b> holmium	68 167.26 1.24 589 1802 3141 <b>Er</b> erbium	69 168.93 1.25 587 1816 2322 <b>Tm</b> thulium	70 173.04 1.3 602 1082 1483 <b>Yb</b> ytterbium	71 174.97 1.3 524 1698 3675 <b>Lu</b> lutetium
97 (247) - 801 1322 <b>Bk</b> berkelium	98 (251) - 626 1173 <b>Cf</b> californium	99 (252) - 619 1130 <b>Es</b> einsteinium	100 (257) - 627 1680 <b>Fm</b> fermium	101 (258) - 635 1108 <b>Md</b> mendelevium	102 (259) - 642 1180 <b>No</b> nobelium	103 (262) - - 1830 <b>Lr</b> lawrencium