

# X-ray Absorption and Emission Energies of the Elements

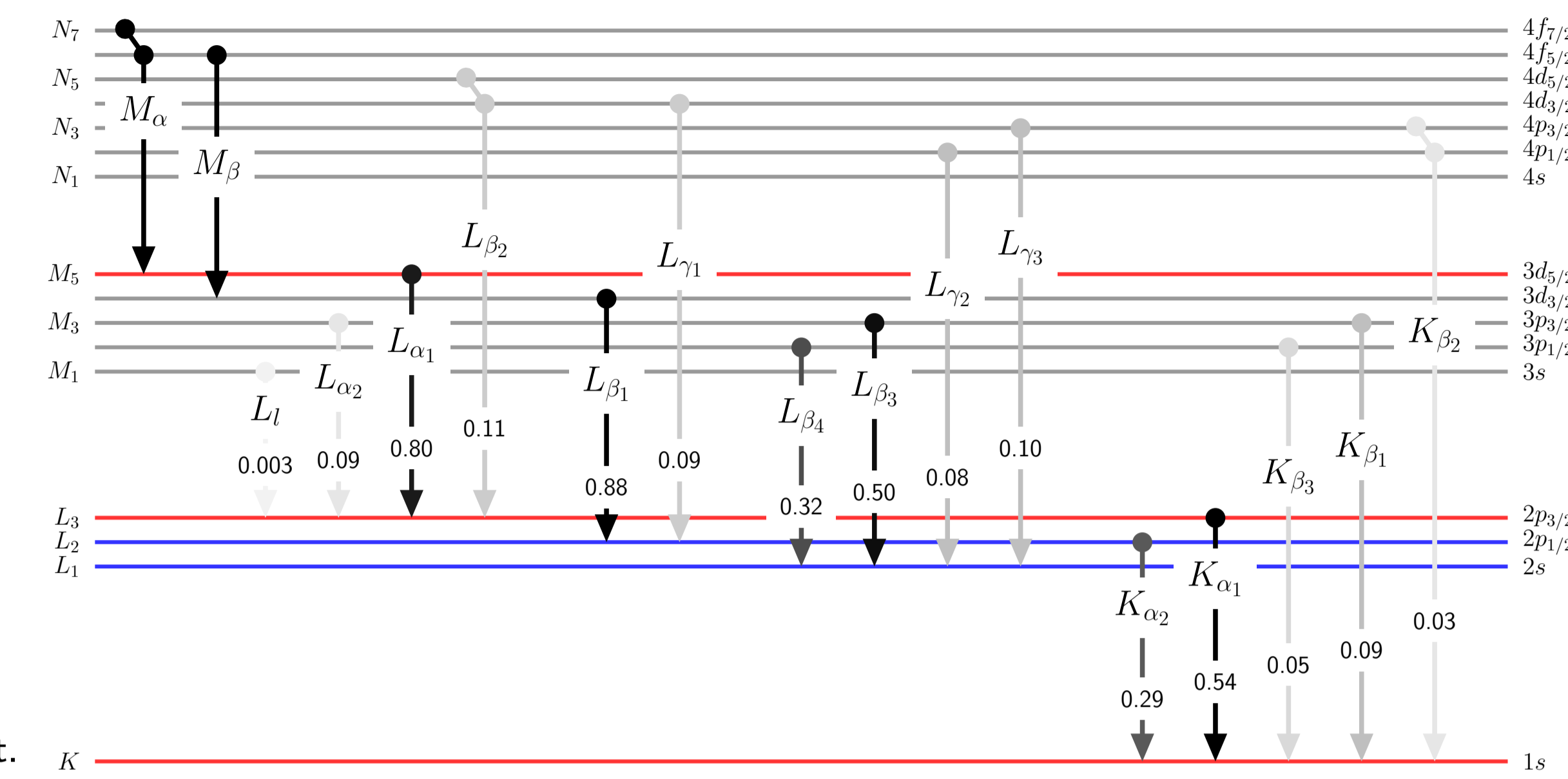
<b>H</b> hydrogen 14 1.0079	<b>Li</b> lithium 55 6.941	<b>Be</b> beryllium 112 108 9.0122	<b>Na</b> sodium 1071 1040 22.9898	<b>K</b> potassium 3608 3314 3590 39.0983	<b>Rb</b> rubidium 15200 13396 14961 85.4678	<b>Cs</b> cesium 35985 30973 34982 132.905	<b>Fr</b> francium 101137 86106 97474 223.02																											
<b>He</b> helium 25 4.0026	<b>B</b> boron 188 183 10.81	<b>C</b> carbon 284 277 12.011	<b>N</b> nitrogen 410 392 14.0067	<b>O</b> oxygen 543 525 15.9994	<b>Al</b> aluminum 1559 1486 1557 26.9815	<b>Si</b> silicon 1839 1740 1837 28.0855	<b>P</b> phosphorus 2146 2010 2140 30.9738	<b>S</b> sulfur 2472 2310 2465 32.06	<b>Cl</b> chlorine 2822 2622 2812 35.453	<b>Ar</b> argon 3206 2958 3190 39.948	<b>Ga</b> gallium 10367 9251 10267 69.72	<b>Ge</b> germanium 11103 9886 10982 72.59	<b>As</b> arsenic 11867 10543 11726 74.9216	<b>Se</b> selenium 12658 11224 12497 78.96	<b>Br</b> bromine 13474 11924 13292 79.904	<b>Kr</b> krypton 14326 12648 14112 83.8	<b>Cs</b> cesium 35985 30973 34982 132.905	<b>Ba</b> barium 37441 32194 36378 137.33	<b>La</b> lanthanum 38925 33442 37797 138.906	<b>Hf</b> hafnium 65351 55790 63244 178.49	<b>Ta</b> tantalum 67416 57535 65222 180.948	<b>W</b> tungsten 69525 59318 67244 183.85	<b>Re</b> rhenium 71676 61141 69309 186.207	<b>Os</b> osmium 73871 63001 71414 190.2	<b>Ir</b> iridium 76111 64896 73560 192.22	<b>Pt</b> platinum 78395 66831 75750 195.08	<b>Au</b> gold 80725 68806 77982 196.967	<b>Hg</b> mercury 83102 70818 80255 200.59	<b>Tl</b> thallium 85530 72872 82573 204.383	<b>Pb</b> lead 88005 74970 84939 207.2	<b>Bi</b> bismuth 90526 77107 87349 208.98	<b>Po</b> polonium 93105 79291 89803 208.982	<b>At</b> astatine 95730 81516 92304 209.987	<b>Rn</b> radon 98404 83785 94866 222.018

Symbol	Z
K edge	K <sub>α1</sub> K <sub>β1</sub>
L <sub>1</sub> edge	L <sub>β3</sub> L <sub>β1</sub> L <sub>β2</sub>
L <sub>2</sub> edge	L <sub>β3</sub> L <sub>β1</sub> L <sub>β2</sub>
L <sub>3</sub> edge	L <sub>α1</sub> L <sub>α2</sub> L <sub>β1</sub> L <sub>β2</sub>
M <sub>5</sub> edge	M <sub>α</sub> M <sub>β</sub>
Mass	oxidation states

Atomic Data and Energies from  
W. T. Elam, B. D. Ravel and J. R. Sieber,  
*Radiation Physics and Chemistry* 63, pp 121-128 (2002)

Common oxidation states from wikipedia.org, after  
N. N. Greenwood and A. Earnshaw,  
*Chemistry of the Elements*, 2nd ed. (1997).

All energies in eV.  
Emission line strengths are approximate, and vary with element.



<b>B</b> boron 188 183 10.81	<b>C</b> carbon 284 277 12.011	<b>N</b> nitrogen 410 392 14.0067	<b>O</b> oxygen 543 525 15.9994	<b>F</b> fluorine 697 677 18.9984	<b>Ne</b> neon 870 849 20.179	<b>Al</b> aluminum 1559 1486 1557 26.9815	<b>Si</b> silicon 1839 1740 1837 28.0855	<b>P</b> phosphorus 2146 2010 2140 30.9738	<b>S</b> sulfur 2472 2310 2465 32.06	<b>Cl</b> chlorine 2822 2622 2812 35.453	<b>Ar</b> argon 3206 2958 3190 39.948	<b>Ga</b> gallium 10367 9251 10267 69.72	<b>Ge</b> germanium 11103 9886 10982 72.59	<b>As</b> arsenic 11867 10543 11726 74.9216	<b>Se</b> selenium 12658 11224 12497 78.96	<b>Br</b> bromine 13474 11924 13292 79.904	<b>Kr</b> krypton 14326 12648 14112 83.8	<b>Cs</b> cesium 35985 30973 34982 132.905	<b>Ba</b> barium 37441 32194 36378 137.33	<b>La</b> lanthanum 38925 33442 37797 138.906	<b>Hf</b> hafnium 65351 55790 63244 178.49	<b>Ta</b> tantalum 67416 57535 65222 180.948	<b>W</b> tungsten 69525 59318 67244 183.85	<b>Re</b> rhenium 71676 61141 69309 186.207	<b>Os</b> osmium 73871 63001 71414 190.2	<b>Ir</b> iridium 76111 64896 73560 192.22	<b>Pt</b> platinum 78395 66831 75750 195.08	<b>Au</b> gold 80725 68806 77982 196.967	<b>Hg</b> mercury 83102 70818 80255 200.59	<b>Tl</b> thallium 85530 72872 82573 204.383	<b>Pb</b> lead 88005 74970 84939 207.2	<b>Bi</b> bismuth 90526 77107 87349 208.98	<b>Po</b> polonium 93105 79291 89803 208.982	<b>At</b> astatine 95730 81516 92304 209.987	<b>Rn</b> radon 98404 83785 94866 222.018
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<https://xrayabsorption.org/xraytable>  
Version 4, 2020-April-19



<b>Ce</b> cerium 40443 34720 39256 140.12	<b>Pr</b> praseodymium 41991 36027 40749 140.908	<b>Nd</b> neodymium 43569 37361 42272 144.24	<b>Pm</b> promethium 45184 38725 43827 144.913	<b>Sm</b> samarium 46834 40118 45414 150.36	<b>Eu</b> europium 48519 41542 47038 151.96	<b>Gd</b> gadolinium 50239 42996 48695 157.25	<b>Tb</b> terbium 51996 44482 50385 158.925	<b>Dy</b> dysprosium 53789 45999 52113 162.5	<b>Ho</b> holmium 55618 47547 53877 164.93	<b>Er</b> erbium 57486 49128 55674 167.26	<b>Tm</b> thulium 59390 50742 57505 168.934	<b>Yb</b> ytterbium 61332 52388 59382 173.04	<b>Lu</b> lutetium 63314 54070 61290 174.967	<b>Th</b> thorium 109651 93351 105605 232.038	<b>Pa</b> protactinium 112601 95868 108427 231.036	<b>U</b> uranium 115606 98440 111303 238.051	<b>Np</b> neptunium 118669 101059 114234 237.048	<b>Pu</b> plutonium 121791 103734 117228 239.052	<b>Am</b> americium 124982 106472 120284 243.061	<b>Cm</b> curium 128241 109271 123403 247.07	<b>Bk</b> berkelium 131556 112121 126580 247.07	<b>Cf</b> californium 134939 115032 129823 251.08	<b>Es</b> einsteinium 139046 117000 132089 252.083	<b>Fm</b> fermium 143071 119000 134089 257.103	<b>Md</b> mendelevium 147096 121000 136089 258.103	<b>No</b> nobelium 151126 125000 140089 259.103	<b>Lr</b> lawrencium 155151 129000 144089 260.103
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Marie Skłodowska Curie