

X-ray Absorption and Emission Energies of the Elements

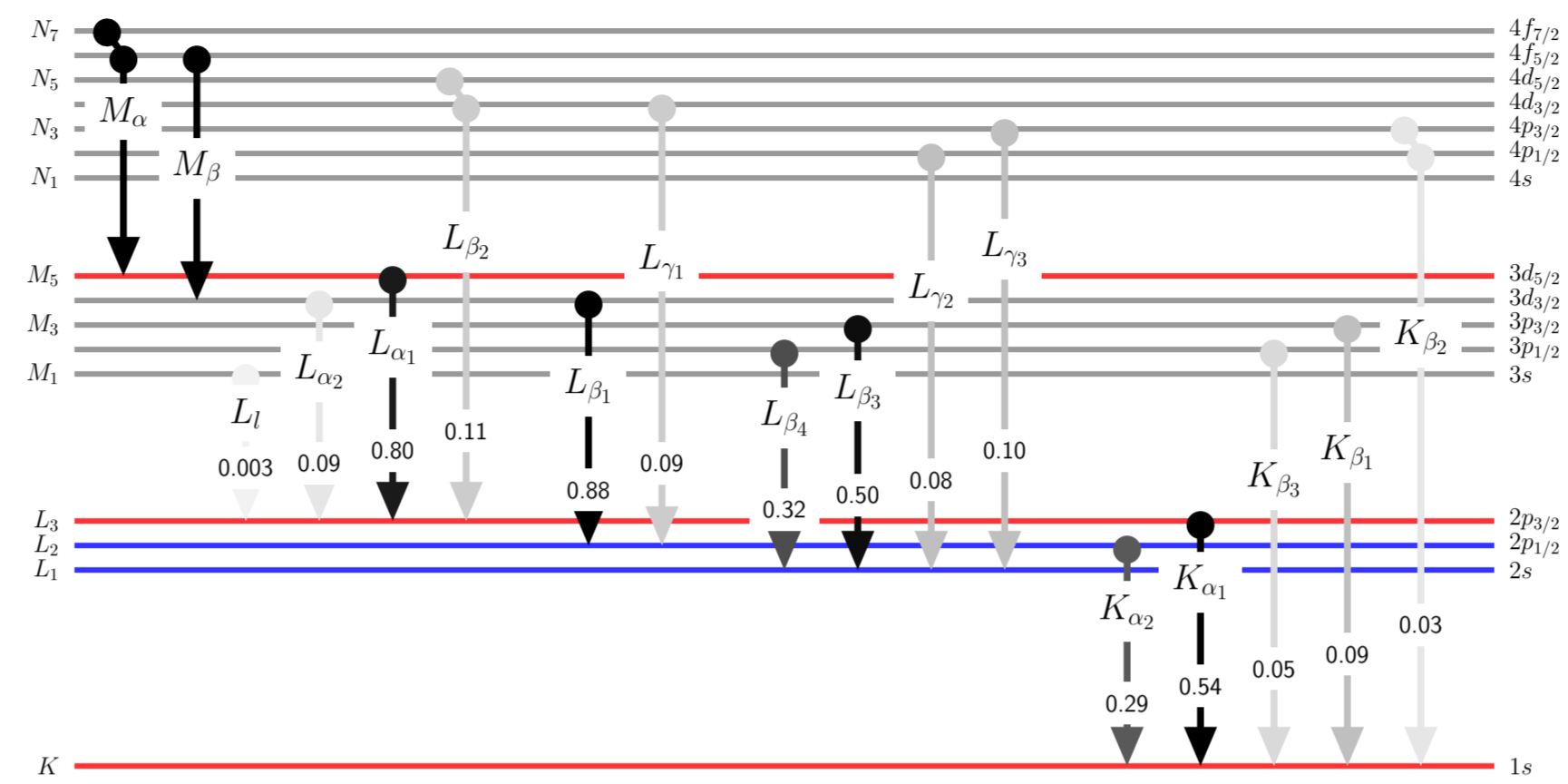
H hydrogen 14 1.0078	1	He helium 25 4.0026	2
Li lithium 55 6.94	3	Be beryllium 112 8 3 3 9.0122	4
Na sodium 1071 64 30 30 22.9898	11	Mg magnesium 1303 1254 89 88 50 49 24.305	12
K potassium 3608 379 297 295 39.0983	19	Ca calcium 4038 438 350 346 40.078	20
Rb rubidium 15200 2065 1864 1804 112 85.4678	37	Sr strontium 16105 2216 2007 1940 134 87.62	38
Cs cesium 35985 5714 5359 5012 727 132.905	55	Ba barium 37441 5989 5624 5247 780 137.327	56
Fr francium 101137 18639 17907 15031 3000 223.0	87	Ra radium 103922 88478 19237 18484 15444 3105 226.0	88
		Ac actinium 106755 90884 19237 18484 15444 3105 227.0	89

Symbol	name	Z
K edge	K _{α1}	K _{β1}
L ₁ edge	L _{β3}	L _{β4}
L ₂ edge	L _{β1}	L _{γ1}
L ₃ edge	L _{α1}	L _{β2}
M ₅ edge	M _α	M _β
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 boron 188 13 5 5 10.81	5	C carbon 284 277 18 7 7 12.011	6	N nitrogen 410 392 37 18 18 14.007	7	O oxygen 543 525 42 18 18 15.999	8	F fluorine 697 677 45 20 20 18.9984	9	Ne neon 870 849 48 22 22 20.1797	10																								
Al aluminum 1559 118 73 72 26.9815	13	Si silicon 1839 1740 150 148 100 99 28.085	14	P phosphorus 2146 2010 2140 189 183 182 30.9738	15	S sulfur 2472 2310 2465 231 224 223 32.06	16	Cl chlorine 2822 2622 2812 270 260 260 35.453	17	Ar argon 3206 2958 3190 326 311 310 39.948	18																								
Ga gallium 10367 9251 10267 11103 9886 10982 1299 1199 1196 1143 1124 1098 1116 1098 19 69.72	31	Ge germanium 11103 9886 10982 11103 9886 10982 1415 1294 1290 1415 1218 1188 1217 1188 29 72.63	32	As arsenic 11867 10543 11726 1527 1386 1381 1359 1317 1188 1324 1282 42 74.9216	33	Se selenium 12658 11224 12497 1652 1491 1486 1474 1419 1188 1434 1379 55 78.971	34	Br bromine 13474 11924 13292 1782 1600 1593 1596 1526 260 1550 1481 69 79.904	35	Kr krypton 14326 12648 14112 1921 1707 1699 1731 1636 1585 1731 1636 94 83.798	36																								
Rb rubidium 15200 2065 1864 1804 112 85.4678	37	Sr strontium 16105 2216 2007 1940 134 87.62	38	Y yttrium 17038 14958 16739 2373 2074 2062 2156 1998 1924 2080 1924 156 88.9058	39	Zr zirconium 17998 15775 17668 2532 2202 2188 2307 2126 2044 2223 2044 179 91.224	40	Nb niobium 18986 16615 18625 2698 2337 2322 2465 2260 2044 2080 2169 202 92.9064	41	Mo molybdenum 20000 17480 19606 2866 2472 2454 2625 2394 2292 2677 2292 254 97.907	42	Tc technetium 21044 18367 20626 3043 2625 2595 2793 2535 2423 2677 2423 254 97.907	43	Ru ruthenium 22117 19279 21656 3224 2762 2741 3224 2683 2558 2838 2697 3002 280 101.07	44	Rh rhodium 23220 20216 22724 3412 2916 2891 3146 2834 3144 3004 2697 3002 307 102.906	45	Pd palladium 24350 21177 23818 3604 3072 3044 3330 2990 3328 3173 2838 3171 335 106.42	46	Ag silver 25514 22163 24941 3806 3233 3202 3524 3150 3520 3351 2983 3347 368 107.868	47	Cd cadmium 26711 23173 26093 4018 3400 3365 3727 3315 3715 3538 3133 3526 405 112.414	48	In indium 27940 24210 27275 4238 3573 3535 3938 3487 3920 3730 3286 3712 444 114.818	49	Sn tin 29200 25271 28485 4465 3750 3708 4156 3663 4131 3929 3604 3904 485 118.71	50	Sb antimony 30491 26359 29725 4698 3932 3885 4380 3842 4347 4132 3604 4099 528 528 538 121.76	51	Te tellurium 31814 27473 30993 4939 4118 4068 4612 4029 4570 4341 3768 4299 573 573 583 127.6	52	I iodine 33169 28612 32294 5188 4313 4257 4852 4221 4801 4557 3938 4506 619 619 631 126.905	53	Xe xenon 34561 29775 33620 5453 4512 4451 5107 4418 5038 4786 4110 4716 676 676 689 131.293	54
Ce cerium 40443 34720 39256 6548 5361 5274 6164 5262 6055 5723 4839 5614 884 140.116	58	Pr praseodymium 41991 36027 40749 6835 5593 5498 6440 5492 6325 5964 5035 5849 929 140.908	59	Nd neodymium 43569 37361 42272 7126 5829 5723 6722 5719 6602 6208 5228 6088 980 144.242	60	Pm promethium 45184 38725 43827 7428 6071 5957 7013 5961 6893 6459 5432 6339 1027 145.0	61	Sm samarium 46834 40118 45414 7737 6317 6196 7312 6201 7183 6716 5633 6587 1083 150.36	62	Eu europium 48519 41542 47038 8052 6571 6438 7617 6458 7484 6977 5850 6844 1128 151.96	63	Gd gadolinium 50239 42996 48695 8376 6832 6688 7930 6708 7787 7243 6053 7100 1190 157.25	64	Tb terbium 51996 44482 50385 8708 7097 6940 8252 6975 8102 7514 6273 7364 1241 158.925	65	Dy dysprosium 53789 45999 52113 9046 7370 7204 8581 7248 8427 8071 6720 7911 1351 162.5	66	Ho holmium 55618 47547 53877 9394 7653 7471 8918 7526 8758 8071 6720 7911 1351 164.93	67	Er erbium 57486 49128 55674 9751 7939 7745 9264 7811 9096 8358 6949 8190 1409 167.259	68	Tm thulium 59390 50742 57505 10116 8231 8026 9617 8102 9442 8648 7180 8472 1468 168.934	69	Yb ytterbium 61332 52388 59382 10486 8536 8313 9978 8402 9787 8944 7416 8753 1528 173.045	70	Lu lutetium 63314 54070 61290 10870 8846 8606 10349 8710 10143 9244 7655 9038 1589 174.967	71								
Th thorium 109651 93351 105605 20472 16426 15642 19693 16202 18981 16300 12968 15588 3332 232.038	90	Pa protactinium 112601 95868 108427 21105 16931 16104 20314 16703 19571 16733 13291 15990 3442 231.036	91	U uranium 115606 98440 111303 21757 17454 16575 20948 17220 20170 17166 13614 16388 3552 238.029	92	Np neptunium 118669 101059 114234 22427 17992 17061 21600 17751 20784 17610 13946 16794 3664 237.048	93	Pu plutonium 121791 103734 117228 23104 18541 17557 22266 18296 21420 18057 14282 17211 3775 239.052	94	Am americium 124982 106472 120284 23808 19110 18069 22952 18856 22072 18510 14620 17630 3890 243.0	95	Cm curium 128241 109271 123403 24526 19688 18589 23651 19427 22735 18970 14961 18054 4009 247.0	96	Bk berkelium 131556 112121 126580 25256 20280 19118 24371 20018 23416 19435 15308 18480 4127 247.0	97	Cf californium 134939 115032 129823 25256 20280 19118 24371 20018 23416 19907 15660 18916 4247 251.0	98	Es einsteinium 139000 115032 129823 25256 20280 19118 24371 20018 23416 19907 15660 18916 4247 251.0	99	Fm fermium 142000 115032 129823 25256 20280 19118 24371 20018 23416 19907 15660 18916 4247 251.0	100	Md mendelevium 145000 115032 129823 25256 20280 19118 24371 20018 23416 19907 15660 18916 4247 251.0	101	No nobelium 148000 115032 129823 25256 20280 19118 24371 20018 23416 19907 15660 18916 4247 251.0	102	Lr lawrencium 151000 115032 129823 25256 20280 19118 24371 20018 23416 19907 15660 18916 4247 251.0	103								



Henry Moseley



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