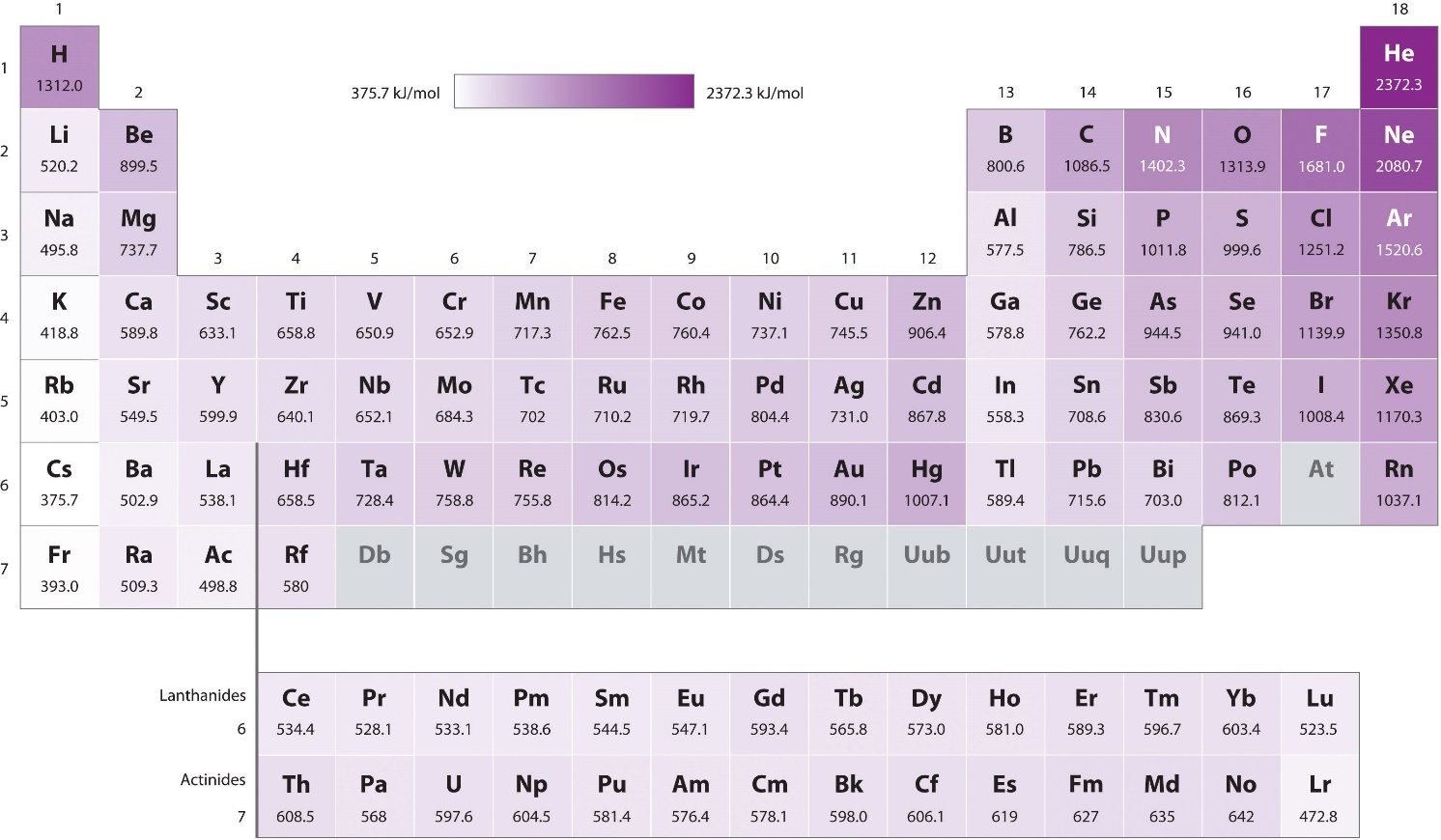
**Ionization Energy Chart of elements Periodic Table**



**These tables list values of** [**molar ionization energies**](https://en.wikipedia.org/wiki/Ionization_energy)**, measured in** [**kJ mol−1**](https://en.wikipedia.org/wiki/Kilojoule_per_mole)**.**

* **This is the energy per mole necessary to remove** [**electrons**](https://en.wikipedia.org/wiki/Electrons) **from gaseous** [**atoms**](https://en.wikipedia.org/wiki/Atoms) **or atomic ions.**
* **The first molar ionization energy applies to the neutral atoms.**
* **The second, third, etc., molar ionization energy applies to the further removal of an electron from a singly, doubly, etc., charged ion**

**1st–10th**

| **number** | **symbol** | **name** | **1st** | **2nd** | **3rd** | **4th** | **5th** | **6th** | **7th** | **8th** | **9th** | **10th** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | H | [hydrogen](https://en.wikipedia.org/wiki/Hydrogen) | 1312.0 |  |  |  |  |  |  |  |  |  |
| 2 | He | [helium](https://en.wikipedia.org/wiki/Helium) | 2372.3 | 5250.5 |  |  |  |  |  |  |  |  |
| 3 | Li | [lithium](https://en.wikipedia.org/wiki/Lithium) | 520.2 | 7298.1 | 11,815.0 |  |  |  |  |  |  |  |
| 4 | Be | [beryllium](https://en.wikipedia.org/wiki/Beryllium) | 899.5 | 1757.1 | 14,848.7 | 21,006.6 |  |  |  |  |  |  |
| 5 | B | [boron](https://en.wikipedia.org/wiki/Boron) | 800.6 | 2427.1 | 3659.7 | 25,025.8 | 32,826.7 |  |  |  |  |  |
| 6 | C | [carbon](https://en.wikipedia.org/wiki/Carbon) | 1086.5 | 2352.6 | 4620.5 | 6222.7 | 37,831 | 47,277.0 |  |  |  |  |
| 7 | N | [nitrogen](https://en.wikipedia.org/wiki/Nitrogen) | 1402.3 | 2856 | 4578.1 | 7475.0 | 9444.9 | 53,266.6 | 64,360 |  |  |  |
| 8 | O | [oxygen](https://en.wikipedia.org/wiki/Oxygen) | 1313.9 | 3388.3 | 5300.5 | 7469.2 | 10,989.5 | 13,326.5 | 71,330 | 84,078.0 |  |  |
| 9 | F | [fluorine](https://en.wikipedia.org/wiki/Fluorine) | 1681.0 | 3374.2 | 6050.4 | 8407.7 | 11,022.7 | 15,164.1 | 17,868 | 92,038.1 | 106,434.3 |  |
| 10 | Ne | [neon](https://en.wikipedia.org/wiki/Neon) | 2080.7 | 3952.3 | 6122 | 9371 | 12,177 | 15,238 | 19,999.0 | 23,069.5 | 115,379.5 | 131,432 |
| 11 | Na | [sodium](https://en.wikipedia.org/wiki/Sodium) | 495.8 | 4562 | 6910.3 | 9543 | 13,354 | 16,613 | 20,117 | 25,496 | 28,932 | 141,362 |
| 12 | Mg | [magnesium](https://en.wikipedia.org/wiki/Magnesium) | 737.7 | 1450.7 | 7732.7 | 10,542.5 | 13,630 | 18,020 | 21,711 | 25,661 | 31,653 | 35,458 |
| 13 | Al | [aluminium](https://en.wikipedia.org/wiki/Aluminium) | 577.5 | 1816.7 | 2744.8 | 11,577 | 14,842 | 18,379 | 23,326 | 27,465 | 31,853 | 38,473 |
| 14 | Si | [silicon](https://en.wikipedia.org/wiki/Silicon) | 786.5 | 1577.1 | 3231.6 | 4355.5 | 16,091 | 19,805 | 23,780 | 29,287 | 33,878 | 38,726 |
| 15 | P | [phosphorus](https://en.wikipedia.org/wiki/Phosphorus) | 1011.8 | 1907 | 2914.1 | 4963.6 | 6273.9 | 21,267 | 25,431 | 29,872 | 35,905 | 40,950 |
| 16 | S | [sulfur](https://en.wikipedia.org/wiki/Sulfur) | 999.6 | 2252 | 3357 | 4556 | 7004.3 | 8495.8 | 27,107 | 31,719 | 36,621 | 43,177 |
| 17 | Cl | [chlorine](https://en.wikipedia.org/wiki/Chlorine) | 1251.2 | 2298 | 3822 | 5158.6 | 6542 | 9362 | 11,018 | 33,604 | 38,600 | 43,961 |
| 18 | Ar | [argon](https://en.wikipedia.org/wiki/Argon) | 1520.6 | 2665.8 | 3931 | 5771 | 7238 | 8781 | 11,995 | 13,842 | 40,760 | 46,186 |
| 19 | K | [potassium](https://en.wikipedia.org/wiki/Potassium) | 418.8 | 3052 | 4420 | 5877 | 7975 | 9590 | 11,343 | 14,944 | 16,963.7 | 48,610 |
| 20 | Ca | [calcium](https://en.wikipedia.org/wiki/Calcium) | 589.8 | 1145.4 | 4912.4 | 6491 | 8153 | 10,496 | 12,270 | 14,206 | 18,191 | 20,385 |
| 21 | Sc | [scandium](https://en.wikipedia.org/wiki/Scandium) | 633.1 | 1235.0 | 2388.6 | 7090.6 | 8843 | 10,679 | 13,310 | 15,250 | 17,370 | 21,726 |
| 22 | Ti | [titanium](https://en.wikipedia.org/wiki/Titanium) | 658.8 | 1309.8 | 2652.5 | 4174.6 | 9581 | 11,533 | 13,590 | 16,440 | 18,530 | 20,833 |
| 23 | V | [vanadium](https://en.wikipedia.org/wiki/Vanadium) | 650.9 | 1414 | 2830 | 4507 | 6298.7 | 12,363 | 14,530 | 16,730 | 19,860 | 22,240 |
| 24 | Cr | [chromium](https://en.wikipedia.org/wiki/Chromium) | 652.9 | 1590.6 | 2987 | 4743 | 6702 | 8744.9 | 15,455 | 17,820 | 20,190 | 23,580 |
| 25 | Mn | [manganese](https://en.wikipedia.org/wiki/Manganese) | 717.3 | 1509.0 | 3248 | 4940 | 6990 | 9220 | 11,500 | 18,770 | 21,400 | 23,960 |
| 26 | Fe | [iron](https://en.wikipedia.org/wiki/Iron) | 762.5 | 1561.9 | 2957 | 5290 | 7240 | 9560 | 12,060 | 14,580 | 22,540 | 25,290 |
| 27 | Co | [cobalt](https://en.wikipedia.org/wiki/Cobalt) | 760.4 | 1648 | 3232 | 4950 | 7670 | 9840 | 12,440 | 15,230 | 17,959 | 26,570 |
| 28 | Ni | [nickel](https://en.wikipedia.org/wiki/Nickel) | 737.1 | 1753.0 | 3395 | 5300 | 7339 | 10,400 | 12,800 | 15,600 | 18,600 | 21,670 |
| 29 | Cu | [copper](https://en.wikipedia.org/wiki/Copper) | 745.5 | 1957.9 | 3555 | 5536 | 7700 | 9900 | 13,400 | 16,000 | 19,200 | 22,400 |
| 30 | Zn | [zinc](https://en.wikipedia.org/wiki/Zinc) | 906.4 | 1733.3 | 3833 | 5731 | 7970 | 10,400 | 12,900 | 16,800 | 19,600 | 23,000 |
| 31 | Ga | [gallium](https://en.wikipedia.org/wiki/Gallium) | 578.8 | 1979.3 | 2963 | 6180 |  |  |  |  |  |  |
| 32 | Ge | [germanium](https://en.wikipedia.org/wiki/Germanium) | 762 | 1537.5 | 3302.1 | 4411 | 9020 |  |  |  |  |  |
| 33 | As | [arsenic](https://en.wikipedia.org/wiki/Arsenic) | 947.0 | 1798 | 2735 | 4837 | 6043 | 12,310 |  |  |  |  |
| 34 | Se | [selenium](https://en.wikipedia.org/wiki/Selenium) | 941.0 | 2045 | 2973.7 | 4144 | 6590 | 7880 | 14,990 |  |  |  |
| 35 | Br | [bromine](https://en.wikipedia.org/wiki/Bromine) | 1139.9 | 2103 | 3470 | 4560 | 5760 | 8550 | 9940 | 18,600 |  |  |
| 36 | Kr | [krypton](https://en.wikipedia.org/wiki/Krypton) | 1350.8 | 2350.4 | 3565 | 5070 | 6240 | 7570 | 10,710 | 12,138 | 22,274 | 25,880 |
| 37 | Rb | [rubidium](https://en.wikipedia.org/wiki/Rubidium) | 403.0 | 2633 | 3860 | 5080 | 6850 | 8140 | 9570 | 13,120 | 14,500 | 26,740 |
| 38 | Sr | [strontium](https://en.wikipedia.org/wiki/Strontium) | 549.5 | 1064.2 | 4138 | 5500 | 6910 | 8760 | 10,230 | 11,800 | 15,600 | 17,100 |
| 39 | Y | [yttrium](https://en.wikipedia.org/wiki/Yttrium) | 600 | 1180 | 1980 | 5847 | 7430 | 8970 | 11,190 | 12,450 | 14,110 | 18,400 |
| 40 | Zr | [zirconium](https://en.wikipedia.org/wiki/Zirconium) | 640.1 | 1270 | 2218 | 3313 | 7752 | 9500 |  |  |  |  |
| 41 | Nb | [niobium](https://en.wikipedia.org/wiki/Niobium) | 652.1 | 1380 | 2416 | 3700 | 4877 | 9847 | 12,100 |  |  |  |
| 42 | Mo | [molybdenum](https://en.wikipedia.org/wiki/Molybdenum) | 684.3 | 1560 | 2618 | 4480 | 5257 | 6640.8 | 12,125 | 13,860 | 15,835 | 17,980 |
| 43 | Tc | [technetium](https://en.wikipedia.org/wiki/Technetium) | 702 | 1470 | 2850 |  |  |  |  |  |  |  |
| 44 | Ru | [ruthenium](https://en.wikipedia.org/wiki/Ruthenium) | 710.2 | 1620 | 2747 |  |  |  |  |  |  |  |
| 45 | Rh | [rhodium](https://en.wikipedia.org/wiki/Rhodium) | 719.7 | 1740 | 2997 |  |  |  |  |  |  |  |
| 46 | Pd | [palladium](https://en.wikipedia.org/wiki/Palladium) | 804.4 | 1870 | 3177 |  |  |  |  |  |  |  |
| 47 | Ag | [silver](https://en.wikipedia.org/wiki/Silver) | 731.0 | 2070 | 3361 |  |  |  |  |  |  |  |
| 48 | Cd | [cadmium](https://en.wikipedia.org/wiki/Cadmium) | 867.8 | 1631.4 | 3616 |  |  |  |  |  |  |  |
| 49 | In | [indium](https://en.wikipedia.org/wiki/Indium) | 558.3 | 1820.7 | 2704 | 5210 |  |  |  |  |  |  |
| 50 | Sn | [tin](https://en.wikipedia.org/wiki/Tin) | 708.6 | 1411.8 | 2943.0 | 3930.3 | 7456 |  |  |  |  |  |
| 51 | Sb | [antimony](https://en.wikipedia.org/wiki/Antimony) | 834 | 1594.9 | 2440 | 4260 | 5400 | 10,400 |  |  |  |  |
| 52 | Te | [tellurium](https://en.wikipedia.org/wiki/Tellurium) | 869.3 | 1790 | 2698 | 3610 | 5668 | 6820 | 13,200 |  |  |  |
| 53 | I | [iodine](https://en.wikipedia.org/wiki/Iodine) | 1008.4 | 1845.9 | 3180 |  |  |  |  |  |  |  |
| 54 | Xe | [xenon](https://en.wikipedia.org/wiki/Xenon) | 1170.4 | 2046.4 | 3099.4 |  |  |  |  |  |  |  |
| 55 | Cs | [caesium](https://en.wikipedia.org/wiki/Caesium) | 375.7 | 2234.3 | 3400 |  |  |  |  |  |  |  |
| 56 | Ba | [barium](https://en.wikipedia.org/wiki/Barium) | 502.9 | 965.2 | 3600 |  |  |  |  |  |  |  |
| 57 | La | [lanthanum](https://en.wikipedia.org/wiki/Lanthanum) | 538.1 | 1067 | 1850.3 | 4819 | 5940 |  |  |  |  |  |
| 58 | Ce | [cerium](https://en.wikipedia.org/wiki/Cerium) | 534.4 | 1050 | 1949 | 3547 | 6325 | 7490 |  |  |  |  |
| 59 | Pr | [praseodymium](https://en.wikipedia.org/wiki/Praseodymium) | 527 | 1020 | 2086 | 3761 | 5551 |  |  |  |  |  |
| 60 | Nd | [neodymium](https://en.wikipedia.org/wiki/Neodymium) | 533.1 | 1040 | 2130 | 3900 |  |  |  |  |  |  |
| 61 | Pm | [promethium](https://en.wikipedia.org/wiki/Promethium) | 540 | 1050 | 2150 | 3970 |  |  |  |  |  |  |
| 62 | Sm | [samarium](https://en.wikipedia.org/wiki/Samarium) | 544.5 | 1070 | 2260 | 3990 |  |  |  |  |  |  |
| 63 | Eu | [europium](https://en.wikipedia.org/wiki/Europium) | 547.1 | 1085 | 2404 | 4120 |  |  |  |  |  |  |
| 64 | Gd | [gadolinium](https://en.wikipedia.org/wiki/Gadolinium) | 593.4 | 1170 | 1990 | 4250 |  |  |  |  |  |  |
| 65 | Tb | [terbium](https://en.wikipedia.org/wiki/Terbium) | 565.8 | 1110 | 2114 | 3839 |  |  |  |  |  |  |
| 66 | Dy | [dysprosium](https://en.wikipedia.org/wiki/Dysprosium) | 573.0 | 1130 | 2200 | 3990 |  |  |  |  |  |  |
| 67 | Ho | [holmium](https://en.wikipedia.org/wiki/Holmium) | 581.0 | 1140 | 2204 | 4100 |  |  |  |  |  |  |
| 68 | Er | [erbium](https://en.wikipedia.org/wiki/Erbium) | 589.3 | 1150 | 2194 | 4120 |  |  |  |  |  |  |
| 69 | Tm | [thulium](https://en.wikipedia.org/wiki/Thulium) | 596.7 | 1160 | 2285 | 4120 |  |  |  |  |  |  |
| 70 | Yb | [ytterbium](https://en.wikipedia.org/wiki/Ytterbium) | 603.4 | 1174.8 | 2417 | 4203 |  |  |  |  |  |  |
| 71 | Lu | [lutetium](https://en.wikipedia.org/wiki/Lutetium) | 523.5 | 1340 | 2022.3 | 4370 | 6445 |  |  |  |  |  |
| 72 | Hf | [hafnium](https://en.wikipedia.org/wiki/Hafnium) | 658.5 | 1440 | 2250 | 3216 |  |  |  |  |  |  |
| 73 | Ta | [tantalum](https://en.wikipedia.org/wiki/Tantalum) | 761 | 1500 |  |  |  |  |  |  |  |  |
| 74 | W | [tungsten](https://en.wikipedia.org/wiki/Tungsten) | 770 | 1700 |  |  |  |  |  |  |  |  |
| 75 | Re | [rhenium](https://en.wikipedia.org/wiki/Rhenium) | 760 | 1260 | 2510 | 3640 |  |  |  |  |  |  |
| 76 | Os | [osmium](https://en.wikipedia.org/wiki/Osmium) | 840 | 1600 |  |  |  |  |  |  |  |  |
| 77 | Ir | [iridium](https://en.wikipedia.org/wiki/Iridium) | 880 | 1600 |  |  |  |  |  |  |  |  |
| 78 | Pt | [platinum](https://en.wikipedia.org/wiki/Platinum) | 870 | 1791 |  |  |  |  |  |  |  |  |
| 79 | Au | [gold](https://en.wikipedia.org/wiki/Gold) | 890.1 | 1980 |  |  |  |  |  |  |  |  |
| 80 | Hg | [mercury](https://en.wikipedia.org/wiki/Mercury_(element)) | 1007.1 | 1810 | 3300 |  |  |  |  |  |  |  |
| 81 | Tl | [thallium](https://en.wikipedia.org/wiki/Thallium) | 589.4 | 1971 | 2878 |  |  |  |  |  |  |  |
| 82 | Pb | [lead](https://en.wikipedia.org/wiki/Lead) | 715.6 | 1450.5 | 3081.5 | 4083 | 6640 |  |  |  |  |  |
| 83 | Bi | [bismuth](https://en.wikipedia.org/wiki/Bismuth) | 703 | 1610 | 2466 | 4370 | 5400 | 8520 |  |  |  |  |
| 84 | Po | [polonium](https://en.wikipedia.org/wiki/Polonium) | 812.1 |  |  |  |  |  |  |  |  |  |
| 85 | At | [astatine](https://en.wikipedia.org/wiki/Astatine) | 899.003 |  |  |  |  |  |  |  |  |  |
| 86 | Rn | [radon](https://en.wikipedia.org/wiki/Radon) | 1037 |  |  |  |  |  |  |  |  |  |
| 87 | Fr | [francium](https://en.wikipedia.org/wiki/Francium) | 380 |  |  |  |  |  |  |  |  |  |
| 88 | Ra | [radium](https://en.wikipedia.org/wiki/Radium) | 509.3 | 979.0 |  |  |  |  |  |  |  |  |
| 89 | Ac | [actinium](https://en.wikipedia.org/wiki/Actinium) | 499 | 1170 | 1900 | 4700 |  |  |  |  |  |  |
| 90 | Th | [thorium](https://en.wikipedia.org/wiki/Thorium) | 587 | 1110 | 1978 | 2780 |  |  |  |  |  |  |
| 91 | Pa | [protactinium](https://en.wikipedia.org/wiki/Protactinium) | 568 | 1128 | 1814 | 2991 |  |  |  |  |  |  |
| 92 | U | [uranium](https://en.wikipedia.org/wiki/Uranium) | 597.6 | 1420 | 1900 | 3145 |  |  |  |  |  |  |
| 93 | Np | [neptunium](https://en.wikipedia.org/wiki/Neptunium) | 604.5 | 1128 | 1997 | 3242 |  |  |  |  |  |  |
| 94 | Pu | [plutonium](https://en.wikipedia.org/wiki/Plutonium) | 584.7 | 1128 | 2084 | 3338 |  |  |  |  |  |  |
| 95 | Am | [americium](https://en.wikipedia.org/wiki/Americium) | 578 | 1158 | 2132 | 3493 |  |  |  |  |  |  |
| 96 | Cm | [curium](https://en.wikipedia.org/wiki/Curium) | 581 | 1196 | 2026 | 3550 |  |  |  |  |  |  |
| 97 | Bk | [berkelium](https://en.wikipedia.org/wiki/Berkelium) | 601 | 1186 | 2152 | 3434 |  |  |  |  |  |  |
| 98 | Cf | [californium](https://en.wikipedia.org/wiki/Californium) | 608 | 1206 | 2267 | 3599 |  |  |  |  |  |  |
| 99 | Es | [einsteinium](https://en.wikipedia.org/wiki/Einsteinium) | 619 | 1216 | 2334 | 3734 |  |  |  |  |  |  |
| 100 | Fm | [fermium](https://en.wikipedia.org/wiki/Fermium) | 627 | 1225 | 2363 | 3792 |  |  |  |  |  |  |
| 101 | Md | [mendelevium](https://en.wikipedia.org/wiki/Mendelevium) | 635 | 1235 | 2470 | 3840 |  |  |  |  |  |  |
| 102 | No | [nobelium](https://en.wikipedia.org/wiki/Nobelium) | 642 | 1254 | 2643 | 3956 |  |  |  |  |  |  |
| 103 | Lr | [lawrencium](https://en.wikipedia.org/wiki/Lawrencium) | 470 | 1428 | 2228 | 4910 |  |  |  |  |  |  |
| 104 | Rf | [rutherfordium](https://en.wikipedia.org/wiki/Rutherfordium) | 580 | 1390 | 2300 | 3080 |  |  |  |  |  |  |
| 105 | Db | [dubnium](https://en.wikipedia.org/wiki/Dubnium) | 665 | 1547 | 2378 | 3299 | 4305 |  |  |  |  |  |
| 106 | Sg | [seaborgium](https://en.wikipedia.org/wiki/Seaborgium) | 757 | 1733 | 2484 | 3416 | 4562 | 5716 |  |  |  |  |
| 107 | Bh | [bohrium](https://en.wikipedia.org/wiki/Bohrium) | 740 | 1690 | 2570 | 3600 | 4730 | 5990 | 7230 |  |  |  |
| 108 | Hs | [hassium](https://en.wikipedia.org/wiki/Hassium) | 730 | 1760 | 2830 | 3640 | 4940 | 6180 | 7540 | 8860 |  |  |
| 109 | Mt | [meitnerium](https://en.wikipedia.org/wiki/Meitnerium) | 800 | 1820 | 2900 | 3900 | 4900 |  |  |  |  |  |
| 110 | Ds | [darmstadtium](https://en.wikipedia.org/wiki/Darmstadtium) | 960 | 1890 | 3030 | 4000 | 5100 |  |  |  |  |  |
| 111 | Rg | [roentgenium](https://en.wikipedia.org/wiki/Roentgenium) | 1020 | 2070 | 3080 | 4100 | 5300 |  |  |  |  |  |
| 112 | Cn | [copernicium](https://en.wikipedia.org/wiki/Copernicium) | 1155 | 2170 | 3160 | 4200 | 5500 |  |  |  |  |  |
| 113 | Nh | [nihonium](https://en.wikipedia.org/wiki/Nihonium) | 707.2 | 2309 | 3226 | 4382 | 5638 |  |  |  |  |  |
| 114 | Fl | [flerovium](https://en.wikipedia.org/wiki/Flerovium) | 832.2 | 1600 | 3370 | 4400 | 5850 |  |  |  |  |  |
| 115 | Mc | [moscovium](https://en.wikipedia.org/wiki/Moscovium) | 538.3 | 1760 | 2650 | 4680 | 5720 |  |  |  |  |  |
| 116 | Lv | [livermorium](https://en.wikipedia.org/wiki/Livermorium) | 663.9 | 1330 | 2850 | 3810 | 6080 |  |  |  |  |  |
| 117 | Ts | [tennessine](https://en.wikipedia.org/wiki/Tennessine) | 736.9 | 1435.4 | 2161.9 | 4012.9 | 5076.4 |  |  |  |  |  |
| 118 | Og | [oganesson](https://en.wikipedia.org/wiki/Oganesson) | 860.1 | 1560 |  |  |  |  |  |  |  |  |
| 119 | Uue | [ununennium](https://en.wikipedia.org/wiki/Ununennium) | 462.0 | 1700 |  |  |  |  |  |  |  |  |
| 120 | Ubn | [unbinilium](https://en.wikipedia.org/wiki/Unbinilium) | 563.3 | 907 !895–  919 |  |  |  |  |  |  |  |  |
| 121 | Ubu | [unbiunium](https://en.wikipedia.org/wiki/Unbiunium) | 429 |  |  |  |  |  |  |  |  |  |
| 122 | Ubb | [unbibium](https://en.wikipedia.org/wiki/Unbibium) | 540 | 1090 | 1970 | 2620 |  |  |  |  |  |  |

**11th–20th[[edit](https://en.wikipedia.org/w/index.php?title=Molar_ionization_energies_of_the_elements&action=edit&section=2" \o "Edit section: 11th–20th)]**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **number** | **symbol** | **name** | **11th** | **12th** | **13th** | **14th** | **15th** | **16th** | **17th** | **18th** | **19th** | **20th** |
| 11 | Na | [sodium](https://en.wikipedia.org/wiki/Sodium) | 159,076 |  |  |  |  |  |  |  |  |  |
| 12 | Mg | [magnesium](https://en.wikipedia.org/wiki/Magnesium) | 169,988 | 189,368 |  |  |  |  |  |  |  |  |
| 13 | Al | [aluminium](https://en.wikipedia.org/wiki/Aluminium) | 42,647 | 201,266 | 222,316 |  |  |  |  |  |  |  |
| 14 | Si | [silicon](https://en.wikipedia.org/wiki/Silicon) | 45,962 | 50,502 | 235,196 | 257,923 |  |  |  |  |  |  |
| 15 | P | [phosphorus](https://en.wikipedia.org/wiki/Phosphorus) | 46,261 | 54,110 | 59,024 | 271,791 | 296,195 |  |  |  |  |  |
| 16 | S | [sulfur](https://en.wikipedia.org/wiki/Sulfur) | 48,710 | 54,460 | 62,930 | 68,216 | 311,048 | 337,138 |  |  |  |  |
| 17 | Cl | [chlorine](https://en.wikipedia.org/wiki/Chlorine) | 51,068 | 57,119 | 63,363 | 72,341 | 78,095 | 352,994 | 380,760 |  |  |  |
| 18 | Ar | [argon](https://en.wikipedia.org/wiki/Argon) | 52,002 | 59,653 | 66,199 | 72,918 | 82,473 | 88,576 | 397,605 | 427,066 |  |  |
| 19 | K | [potassium](https://en.wikipedia.org/wiki/Potassium) | 54,490 | 60,730 | 68,950 | 75,900 | 83,080 | 93,400 | 99,710 | 444,880 | 476,063 |  |
| 20 | Ca | [calcium](https://en.wikipedia.org/wiki/Calcium) | 57,110 | 63,410 | 70,110 | 78,890 | 86,310 | 94,000 | 104,900 | 111,711 | 494,850 | 527,762 |
| 21 | Sc | [scandium](https://en.wikipedia.org/wiki/Scandium) | 24,102 | 66,320 | 73,010 | 80,160 | 89,490 | 97,400 | 105,600 | 117,000 | 124,270 | 547,530 |
| 22 | Ti | [titanium](https://en.wikipedia.org/wiki/Titanium) | 25,575 | 28,125 | 76,015 | 83,280 | 90,880 | 100,700 | 109,100 | 117,800 | 129,900 | 137,530 |
| 23 | V | [vanadium](https://en.wikipedia.org/wiki/Vanadium) | 24,670 | 29,730 | 32,446 | 86,450 | 94,170 | 102,300 | 112,700 | 121,600 | 130,700 | 143,400 |
| 24 | Cr | [chromium](https://en.wikipedia.org/wiki/Chromium) | 26,130 | 28,750 | 34,230 | 37,066 | 97,510 | 105,800 | 114,300 | 125,300 | 134,700 | 144,300 |
| 25 | Mn | [manganese](https://en.wikipedia.org/wiki/Manganese) | 27,590 | 30,330 | 33,150 | 38,880 | 41,987 | 109,480 | 118,100 | 127,100 | 138,600 | 148,500 |
| 26 | Fe | [iron](https://en.wikipedia.org/wiki/Iron) | 28,000 | 31,920 | 34,830 | 37,840 | 44,100 | 47,206 | 122,200 | 131,000 | 140,500 | 152,600 |
| 27 | Co | [cobalt](https://en.wikipedia.org/wiki/Cobalt) | 29,400 | 32,400 | 36,600 | 39,700 | 42,800 | 49,396 | 52,737 | 134,810 | 145,170 | 154,700 |
| 28 | Ni | [nickel](https://en.wikipedia.org/wiki/Nickel) | 30,970 | 34,000 | 37,100 | 41,500 | 44,800 | 48,100 | 55,101 | 58,570 | 148,700 | 159,000 |
| 29 | Cu | [copper](https://en.wikipedia.org/wiki/Copper) | 25,600 | 35,600 | 38,700 | 42,000 | 46,700 | 50,200 | 53,700 | 61,100 | 64,702 | 163,700 |
| 30 | Zn | [zinc](https://en.wikipedia.org/wiki/Zinc) | 26,400 | 29,990 | 40,490 | 43,800 | 47,300 | 52,300 | 55,900 | 59,700 | 67,300 | 171,200 |
| 36 | Kr | [krypton](https://en.wikipedia.org/wiki/Krypton) | 29,700 | 33,800 | 37,700 | 43,100 | 47,500 | 52,200 | 57,100 | 61,800 | 75,800 | 80,400 |
| 38 | Sr | [strontium](https://en.wikipedia.org/wiki/Strontium) | 31,270 |  |  |  |  |  |  |  |  |  |
| 39 | Y | [yttrium](https://en.wikipedia.org/wiki/Yttrium) | 19,900 | 36,090 |  |  |  |  |  |  |  |  |
| 42 | Mo | [molybdenum](https://en.wikipedia.org/wiki/Molybdenum) | 20,190 | 22,219 | 26,930 | 29,196 | 52,490 | 55,000 | 61,400 | 67,700 | 74,000 | 80,400 |

**21st–30th[**[**edit**](https://en.wikipedia.org/w/index.php?title=Molar_ionization_energies_of_the_elements&action=edit&section=3)**]**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **number** | **symbol** | **name** | **21st** | **22nd** | **23rd** | **24th** | **25th** | **26th** | **27th** | **28th** | **29th** | **30th** |
| 21 | Sc | [scandium](https://en.wikipedia.org/wiki/Scandium) | 582,163 |  |  |  |  |  |  |  |  |  |
| 22 | Ti | [titanium](https://en.wikipedia.org/wiki/Titanium) | 602,930 | 639,294 |  |  |  |  |  |  |  |  |
| 23 | V | [vanadium](https://en.wikipedia.org/wiki/Vanadium) | 151,440 | 661,050 | 699,144 |  |  |  |  |  |  |  |
| 24 | Cr | [chromium](https://en.wikipedia.org/wiki/Chromium) | 157,700 | 166,090 | 721,870 | 761,733 |  |  |  |  |  |  |
| 25 | Mn | [manganese](https://en.wikipedia.org/wiki/Manganese) | 158,600 | 172,500 | 181,380 | 785,450 | 827,067 |  |  |  |  |  |
| 26 | Fe | [iron](https://en.wikipedia.org/wiki/Iron) | 163,000 | 173,600 | 188,100 | 195,200 | 851,800 | 895,161 |  |  |  |  |
| 27 | Co | [cobalt](https://en.wikipedia.org/wiki/Cobalt) | 167,400 | 178,100 | 189,300 | 204,500 | 214,100 | 920,870 | 966,023 |  |  |  |
| 28 | Ni | [nickel](https://en.wikipedia.org/wiki/Nickel) | 169,400 | 182,700 | 194,000 | 205,600 | 221,400 | 231,490 | 992,718 | 1,039,668 |  |  |
| 29 | Cu | [copper](https://en.wikipedia.org/wiki/Copper) | 174,100 | 184,900 | 198,800 | 210,500 | 222,700 | 239,100 | 249,660 | 1,067,358 | 1,116,105 |  |
| 30 | Zn | [zinc](https://en.wikipedia.org/wiki/Zinc) | 179,100 |  |  |  |  |  |  |  |  |  |
| 36 | Kr | [krypton](https://en.wikipedia.org/wiki/Krypton) | 85,300 | 90,400 | 96,300 | 101,400 | 111,100 | 116,290 | 282,500 | 296,200 | 311,400 | 326,200 |
| 42 | Mo | [molybdenum](https://en.wikipedia.org/wiki/Molybdenum) | 87,000 | 93,400 | 98,420 | 104,400 | 121,900 | 127,700 | 133,800 | 139,800 | 148,100 | 154,500 |