

# The Periodic Table of the Elements

|                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                |                              |                                |                            |                               |                            |  |  |  |  |  |  |  |  |  |  |  |                                     |
|-------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--------------------------------|------------------------------|--------------------------------|----------------------------|-------------------------------|----------------------------|--|--|--|--|--|--|--|--|--|--|--|-------------------------------------|
| Hydrogen<br>1<br>H<br>1.01    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Helium<br>2<br>He<br>4.00      |                              |                                |                            |                               |                            |  |  |  |  |  |  |  |  |  |  |  |                                     |
| Lithium<br>3<br>Li<br>6.94    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Boron<br>5<br>B<br>10.81       | Carbon<br>6<br>C<br>12.01    | Nitrogen<br>7<br>N<br>14.01    | Oxygen<br>8<br>O<br>16.00  | Fluorine<br>9<br>F<br>19.00   | Neon<br>10<br>Ne<br>20.18  |  |  |  |  |  |  |  |  |  |  |  |                                     |
| Sodium<br>11<br>Na<br>22.99   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Aluminum<br>13<br>Al<br>26.98  | Silicon<br>14<br>Si<br>28.09 | Phosphorus<br>15<br>P<br>30.97 | Sulfur<br>16<br>S<br>32.07 | Chlorine<br>17<br>Cl<br>35.45 | Argon<br>18<br>Ar<br>39.95 |  |  |  |  |  |  |  |  |  |  |  |                                     |
| Potassium<br>19<br>K<br>39.10 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Calcium<br>20<br>Ca<br>40.08   |                              |                                |                            |                               |                            |  |  |  |  |  |  |  |  |  |  |  | Krypton<br>36<br>Kr<br>83.80        |
| Rubidium<br>37<br>Rb<br>85.47 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Strontium<br>38<br>Sr<br>87.62 |                              |                                |                            |                               |                            |  |  |  |  |  |  |  |  |  |  |  | Xenon<br>54<br>Xe<br>131.29         |
| Cesium<br>55<br>Cs<br>132.91  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Barium<br>56<br>Ba<br>137.33   |                              |                                |                            |                               |                            |  |  |  |  |  |  |  |  |  |  |  | Radium<br>86<br>Ra<br>(226)         |
| Francium<br>87<br>Fr<br>(223) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Radium<br>88<br>Ra<br>(226)    |                              |                                |                            |                               |                            |  |  |  |  |  |  |  |  |  |  |  | Ununseptium<br>117<br>Uus<br>(2947) |

  

|                                  |                                     |                                |                                  |                                |                                 |                               |                                    |                                   |                                   |                                 |                                    |                                    |                                   |                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------------|-------------------------------------|--------------------------------|----------------------------------|--------------------------------|---------------------------------|-------------------------------|------------------------------------|-----------------------------------|-----------------------------------|---------------------------------|------------------------------------|------------------------------------|-----------------------------------|-------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Scandium<br>21<br>Sc<br>44.96    | Titanium<br>22<br>Ti<br>47.88       | Vanadium<br>23<br>V<br>50.94   | Chromium<br>24<br>Cr<br>52.00    | Manganese<br>25<br>Mn<br>54.94 | Iron<br>26<br>Fe<br>55.85       | Cobalt<br>27<br>Co<br>58.93   | Nickel<br>28<br>Ni<br>58.69        | Copper<br>29<br>Cu<br>63.55       | Zinc<br>30<br>Zn<br>65.39         |                                 |                                    |                                    |                                   |                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Yttrium<br>39<br>Y<br>88.91      | Zirconium<br>40<br>Zr<br>91.22      | Niobium<br>41<br>Nb<br>92.91   | Molybdenum<br>42<br>Mo<br>95.94  | Technetium<br>43<br>Tc<br>(98) | Ruthenium<br>44<br>Ru<br>101.07 | Rhodium<br>45<br>Rh<br>102.91 | Palladium<br>46<br>Pd<br>106.42    | Silver<br>47<br>Ag<br>107.87      | Cadmium<br>48<br>Cd<br>112.41     | Indium<br>49<br>In<br>114.82    | Tin<br>50<br>Sn<br>118.71          | Antimony<br>51<br>Sb<br>121.76     | Tellurium<br>52<br>Te<br>127.60   | Iodine<br>53<br>I<br>126.90         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lutetium<br>71<br>Lu<br>174.97   | Hafnium<br>72<br>Hf<br>178.49       | Tantalum<br>73<br>Ta<br>180.95 | Tungsten<br>74<br>W<br>183.84    | Rhenium<br>75<br>Re<br>186.21  | Osmium<br>76<br>Os<br>190.23    | Iridium<br>77<br>Ir<br>192.22 | Platinum<br>78<br>Pt<br>195.08     | Gold<br>79<br>Au<br>196.97        | Mercury<br>80<br>Hg<br>200.59     | Thallium<br>81<br>Tl<br>204.38  | Lead<br>82<br>Pb<br>207.20         | Bismuth<br>83<br>Bi<br>208.98      | Polonium<br>84<br>Po<br>(209)     | Astatine<br>85<br>At<br>(210)       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lavrentium<br>103<br>Lr<br>(262) | Rutherfordium<br>104<br>Rf<br>(267) | Dubnium<br>105<br>Db<br>(268)  | Seaborgium<br>106<br>Sg<br>(271) | Bohrium<br>107<br>Bh<br>(272)  | Hassium<br>108<br>Hs<br>(270)   | Mitnium<br>109<br>Mt<br>(276) | Darmstadtium<br>110<br>Ds<br>(281) | Roentgenium<br>111<br>Rg<br>(280) | Copernicium<br>112<br>Cn<br>(285) | Ununbium<br>113<br>Uub<br>(284) | Ununquadium<br>114<br>Uuq<br>(289) | Ununpentium<br>115<br>Uup<br>(288) | Ununhexium<br>116<br>Uuh<br>(293) | Ununseptium<br>117<br>Uus<br>(2947) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

|                                 |                               |                                    |                                 |                                 |                                |                                |                                  |                                |                                  |                                  |                               |                                   |                                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---------------------------------|-------------------------------|------------------------------------|---------------------------------|---------------------------------|--------------------------------|--------------------------------|----------------------------------|--------------------------------|----------------------------------|----------------------------------|-------------------------------|-----------------------------------|---------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Lanthanum<br>57<br>La<br>138.91 | Cerium<br>58<br>Ce<br>140.12  | Praseodymium<br>59<br>Pr<br>140.91 | Neodymium<br>60<br>Nd<br>144.24 | Promethium<br>61<br>Pm<br>(145) | Samarium<br>62<br>Sm<br>150.36 | Europium<br>63<br>Eu<br>151.97 | Gadolinium<br>64<br>Gd<br>157.25 | Terbium<br>65<br>Tb<br>158.93  | Dysprosium<br>66<br>Dy<br>162.50 | Hoium<br>67<br>Ho<br>164.93      | Erbium<br>68<br>Er<br>167.26  | Thulium<br>69<br>Tm<br>168.93     | Ytterbium<br>70<br>Yb<br>173.04 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Actinium<br>89<br>Ac<br>(227)   | Thorium<br>90<br>Th<br>232.04 | Protactinium<br>91<br>Pa<br>231.04 | Uranium<br>92<br>U<br>238.03    | Neptunium<br>93<br>Np<br>(237)  | Plutonium<br>94<br>Pu<br>(244) | Americium<br>95<br>Am<br>(243) | Curium<br>96<br>Cm<br>(247)      | Berkelium<br>97<br>Bk<br>(247) | Californium<br>98<br>Cf<br>(251) | Einsteinium<br>99<br>Es<br>(252) | Fermium<br>100<br>Fm<br>(257) | Mendelevium<br>101<br>Md<br>(258) | Nobelium<br>102<br>No<br>(259)  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

\*lanthanides

\*\*actinides

# Table of Atomic Masses

Atomic masses are taken from Phys. Rev. D 50 1243 (1994).  
A bracketed value denotes the mass of the longest-lived isotope.

|             |    |     |            |               |    |     |            |
|-------------|----|-----|------------|---------------|----|-----|------------|
| Actinium    | Ac | 89  | (227.0278) | Mercury       | Hg | 80  | 200.59     |
| Aluminum    | Al | 13  | 26.981539  | Molybdenum    | Mo | 42  | 95.94      |
| Americium   | Am | 95  | (243.0614) | Neodymium     | Nd | 60  | 144.24     |
| Antimony    | Sb | 51  | 121.757    | Neon          | Ne | 10  | 20.1797    |
| Argon       | Ar | 18  | 39.948     | Neptunium     | Np | 93  | (237.0482) |
| Arsenic     | As | 33  | 74.92159   | Nickel        | Ni | 28  | 58.6934    |
| Astatine    | At | 85  | (209.9871) | Neilsbohrium  | Ns | 107 | (262.1231) |
| Barium      | Ba | 56  | 137.327    | Niobium       | Nb | 41  | 92.90628   |
| Berkelium   | Bk | 97  | (247.0703) | Nitrogen      | N  | 7   | 14.00674   |
| Beryllium   | Be | 4   | 9.012182   | Nobelium      | No | 102 | (259.1011) |
| Bismuth     | Bi | 83  | 208.98037  | Osmium        | Os | 76  | 190.23     |
| Boron       | B  | 5   | 10.811     | Oxygen        | O  | 8   | 15.9994    |
| Bromine     | Br | 35  | 79.904     | Palladium     | Pd | 46  | 106.42     |
| Cadmium     | Cd | 48  | 112.411    | Phosphorus    | P  | 15  | 30.973762  |
| Calcium     | Ca | 20  | 40.078     | Platinum      | Pt | 78  | 195.08     |
| Californium | Cf | 98  | (251.0796) | Plutonium     | Pu | 94  | (244.0642) |
| Carbon      | C  | 6   | 12.011     | Polonium      | Po | 84  | (208.9824) |
| Cerium      | Ce | 58  | 140.115    | Potassium     | K  | 19  | 39.0983    |
| Cesium      | Cs | 55  | 132.90543  | Praseodymium  | Pr | 59  | 140.90765  |
| Chlorine    | Cl | 17  | 35.4527    | Promethium    | Pm | 61  | (144.9127) |
| Chromium    | Cr | 24  | 51.9961    | Protactinium  | Pa | 91  | 231.03588  |
| Cobalt      | Co | 27  | 58.93320   | Radium        | Ra | 88  | (226.0254) |
| Copper      | Cu | 29  | 63.546     | Radon         | Rn | 86  | (222.0176) |
| Curium      | Cm | 96  | (247.0703) | Rhenium       | Re | 75  | 186.207    |
| Dysprosium  | Dy | 66  | 162.50     | Rhodium       | Rh | 45  | 102.90550  |
| Einsteinium | Es | 99  | (252.0830) | Rubidium      | Rb | 37  | 85.4678    |
| Erbium      | Er | 68  | 167.26     | Ruthenium     | Ru | 44  | 101.07     |
| Europium    | Eu | 63  | 151.965    | Rutherfordium | Rf | 104 | (261.1089) |
| Fermium     | Fm | 100 | (257.0951) | Samarium      | Sm | 62  | 150.36     |
| Fluorine    | F  | 9   | 18.9984032 | Scandium      | Sc | 21  | 44.955910  |
| Francium    | Fr | 87  | (223.0197) | Seaborgium    | Sg | 106 | (263.1180) |
| Gadolinium  | Gd | 64  | 157.25     | Selenium      | Se | 34  | 78.96      |
| Gallium     | Ga | 31  | 69.723     | Silicon       | Si | 14  | 28.0655    |
| Germanium   | Ge | 32  | 72.61      | Silver        | Ag | 47  | 107.8682   |
| Gold        | Au | 79  | 196.96654  | Sodium        | Na | 11  | 22.989768  |
| Hafnium     | Hf | 72  | 178.49     | Strontium     | Sr | 38  | 87.62      |
| Hahnium     | Ha | 105 | (262.1144) | Sulfur        | S  | 16  | 32.066     |
| Hassium     | Hs | 108 | (265.1306) | Tantalum      | Ta | 73  | 180.9479   |
| Helium      | He | 2   | 4.002602   | Technetium    | Tc | 43  | (97.9072)  |
| Holmium     | Ho | 67  | 164.93032  | Tellurium     | Te | 52  | 127.60     |
| Hydrogen    | H  | 1   | 1.00794    | Terbium       | Tb | 65  | 158.92534  |
| Indium      | In | 49  | 114.818    | Thallium      | Tl | 81  | 204.3833   |
| Iodine      | I  | 53  | 126.90447  | Thorium       | Th | 90  | 232.0381   |
| Iridium     | Ir | 77  | 192.22     | Thulium       | Tm | 69  | 168.93421  |
| Iron        | Fe | 26  | 55.847     | Tin           | Sn | 50  | 118.710    |
| Krypton     | Kr | 36  | 83.80      | Titanium      | Ti | 22  | 47.88      |
| Lanthanum   | La | 57  | 138.9055   | Tungsten      | W  | 74  | 183.84     |
| Lawrencium  | Lr | 103 | (262.1098) | Uranium       | U  | 92  | 238.0289   |
| Lead        | Pb | 82  | 207.2      | Vanadium      | V  | 23  | 50.9415    |
| Lithium     | Li | 3   | 6.941      | Xenon         | Xe | 54  | 131.29     |
| Lutetium    | Lu | 71  | 174.967    | Ytterbium     | Yb | 70  | 173.04     |
| Magnesium   | Mg | 12  | 24.3050    | Yttrium       | Y  | 39  | 88.90585   |
| Manganese   | Mn | 25  | 54.95805   | Zinc          | Zn | 30  | 65.39      |
| Mendelevium | Mt | 109 | (266.1378) | Zirconium     | Zr | 40  | 91.224     |