

# PERIODIC TABLE OF THE ELEMENTS

## KEY:

**Group Classification Systems**

- black = solid
- red = gas
- blue = liquid
- brown = natural
- radioactive
- outline = synthetic

**Crystal Structure (right side of key)**

- Cubic
- Rhombohedral
- Body-centered Cubic
- Tetragonal
- Face-centered Cubic
- Orthorhombic
- Hexagonal
- Monoclinic

**Frame Color: Thermodynamically stable phase in water**

- Aqueous Ions
- Metal Carbonates
- Metal Hydroxy Carbonates
- Metal Hydroxides
- Metal Oxides
- Metals

**Crystal Structures**

**Frame Color (center of key)**

**Atomic Number**

**Atomic Weight**

**Oxidation States (bold indicates most stable state)**

**Electronic Configuration**

**Electronegativity**

**1st Ionization Potential, eV**

**Name**

**Density, g/cm<sup>3</sup>**

**Melting Point, °C**

**Boiling Point, °C**

**Atomic Radius, Å**

**Ionic Radius, Å**

<b>IA</b> <b>IA</b> <b>H</b> 1 Hydrogen 1.00794 0.0899 -259.34 -252.87 0.46 1.54 2.20 13.598 1s <sup>1</sup>	<b>IIA</b> <b>IIA</b> <b>Li</b> 3 Lithium 6.941 0.534 180.5 1342 1.52 0.76 0.98 5.392 [He] 2s <sup>1</sup>	<b>IIA</b> <b>IIA</b> <b>Be</b> 4 Beryllium 9.012182 1.8477 1287 2471 1.113 0.45 1.57 9.322 [He] 2s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Na</b> 11 Sodium 22.98977 0.97 97.72 883 1.86 1.02 0.93 5.139 [Ne] 3s <sup>1</sup>	<b>IIIB</b> <b>IIIB</b> <b>Mg</b> 12 Magnesium 24.3050 1.74 650 1090 1.60 0.72 1.31 7.646 [Ne] 3s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>K</b> 19 Potassium 39.0983 0.86 63.38 759 2.32 1.38 0.82 4.341 [Ar] 4s <sup>1</sup>	<b>IIIB</b> <b>IIIB</b> <b>Ca</b> 20 Calcium 40.078 1.54 842 1484 1.97 1.00 1.00 6.113 [Ar] 4s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Sc</b> 21 Scandium 44.955910 2.989 1541 2830 1.62 0.745 1.36 6.54 [Ar] 3d <sup>1</sup> 4s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Ti</b> 22 Titanium 47.88 4.5 1668 3287 1.47 0.605 1.54 6.82 [Ar] 3d <sup>2</sup> 4s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>V</b> 23 Vanadium 50.9415 5.96 1910 3407 1.34 0.54 1.63 6.74 [Ar] 3d <sup>3</sup> 4s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Cr</b> 24 Chromium 51.9961 7.20 1907 2671 1.28 0.615 1.66 6.766 [Ar] 3d <sup>5</sup> 4s <sup>1</sup>	<b>IIIB</b> <b>IIIB</b> <b>Mn</b> 25 Manganese 54.93805 7.47 2061 2061 1.27 0.83 1.55 7.435 [Ar] 3d <sup>5</sup> 4s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Fe</b> 26 Iron 55.847 7.86 1538 2861 1.26 0.645 1.83 7.870 [Ar] 3d <sup>6</sup> 4s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Co</b> 27 Cobalt 58.93320 8.92 1495 2927 1.25 0.73 1.91 7.635 [Ar] 3d <sup>7</sup> 4s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Ni</b> 28 Nickel 58.6934 8.90 1455 2913 1.24 0.69 1.91 7.635 [Ar] 3d <sup>8</sup> 4s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Cu</b> 29 Copper 63.546 8.94 1084.62 2562 1.28 0.73 1.90 7.726 [Ar] 3d <sup>10</sup> 4s <sup>1</sup>	<b>IIIB</b> <b>IIIB</b> <b>Zn</b> 30 Zinc 65.39 7.14 419.53 907 1.34 0.74 1.65 9.394 [Ar] 3d <sup>10</sup> 4s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Ga</b> 31 Gallium 69.723 5.999 2.702 660.32 2519 1.431 0.975 1.61 5.986 [Ne] 3p <sup>1</sup>	<b>IIIB</b> <b>IIIB</b> <b>Si</b> 14 Silicon 28.0855 2.33 1414 3265 1.18 0.40 1.90 8.151 [Ne] 3p <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>P</b> 15 Phosphorus 30.973762 1.82 44.15 277 1.08 0.38 2.19 10.486 [Ne] 3p <sup>3</sup>	<b>IIIB</b> <b>IIIB</b> <b>S</b> 16 Sulfur 32.066 2.07 115.21 444.60 1.06 0.29 2.58 10.360 [Ne] 3p <sup>4</sup>	<b>IIIB</b> <b>IIIB</b> <b>Cl</b> 17 Chlorine 35.4527 3.214 -101.5 -34.04 1.00 1.81 3.16 12.967 [Ne] 3p <sup>5</sup>	<b>IIIB</b> <b>IIIB</b> <b>Ar</b> 18 Argon 39.948 1.784 -189.35 -185.85 0.98 - - 15.759 [Ne] 3p <sup>6</sup>	<b>IIIB</b> <b>IIIB</b> <b>B</b> 5 Boron 10.811 2.31 2075 4000 0.86 0.27 2.04 8.298 [He] 2p <sup>1</sup>	<b>IIIB</b> <b>IIIB</b> <b>C</b> 6 Carbon 12.011 2.25 3550 - 0.77 0.16 2.55 11.260 [He] 2p <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>N</b> 7 Nitrogen 14.00674 1.25046 -210.00 -195.79 0.71 0.16 3.04 14.534 [He] 2p <sup>3</sup>	<b>IIIB</b> <b>IIIB</b> <b>O</b> 8 Oxygen 15.9994 1.429 -218.79 -182.95 0.73 1.38 3.44 13.618 [He] 2p <sup>4</sup>	<b>IIIB</b> <b>IIIB</b> <b>F</b> 9 Fluorine 18.9984032 1.69 -219.62 -188.12 0.717 1.33 3.98 17.422 [He] 2p <sup>5</sup>	<b>IIIB</b> <b>IIIB</b> <b>Ne</b> 10 Neon 20.1797 0.9002 -248.59 -246.08 0.71 - - 21.564 [He] 2p <sup>6</sup>							
<b>IIIB</b> <b>IIIB</b> <b>Rb</b> 37 Rubidium 85.4678 1.532 39.31 688 2.48 1.52 0.82 4.177 [Kr] 5s <sup>1</sup>	<b>IIIB</b> <b>IIIB</b> <b>Sr</b> 38 Strontium 87.62 2.6 777 1382 2.15 1.18 0.95 5.695 [Kr] 5s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Y</b> 39 Yttrium 88.90585 4.469 1526 2836 1.80 0.90 1.22 6.38 [Kr] 4d <sup>1</sup> 5s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Zr</b> 40 Zirconium 91.224 6.49 1855 4409 1.60 0.72 1.33 6.84 [Kr] 4d <sup>2</sup> 5s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Nb</b> 41 Niobium 92.90638 8.57 2477 4744 1.46 0.74 1.6 6.9 [Kr] 4d <sup>3</sup> 5s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Mo</b> 42 Molybdenum 95.94 10.2 2623 4639 1.39 0.59 2.16 7.099 [Kr] 4d <sup>4</sup> 5s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Tc</b> 43 Technetium (97.9072) 115 2334 4150 1.34 0.62 2.2 7.28 [Kr] 4d <sup>5</sup> 5s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Ru</b> 44 Ruthenium 101.07 12.3 3033 4150 1.34 0.62 2.2 7.37 [Kr] 4d <sup>6</sup> 5s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Rh</b> 45 Rhodium 102.90550 12.4 1964 2963 1.37 0.64 2.20 7.46 [Kr] 4d <sup>7</sup> 5s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Pd</b> 46 Palladium 106.42 12.02 1554.9 2963 1.44 0.64 2.20 8.34 [Kr] 4d <sup>8</sup> 5s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Ag</b> 47 Silver 107.8682 10.5 961.78 2162 1.44 1.30 1.93 7.576 [Kr] 4d <sup>10</sup> 5s <sup>1</sup>	<b>IIIB</b> <b>IIIB</b> <b>Cd</b> 48 Cadmium 112.411 8.642 321.07 767 1.489 0.95 1.69 8.993 [Kr] 4d <sup>10</sup> 5s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>In</b> 49 Indium 114.818 7.30 156.60 2072 1.67 0.80 1.78 5.786 [Kr] 4d <sup>10</sup> 5p <sup>1</sup>	<b>IIIB</b> <b>IIIB</b> <b>Sn</b> 50 Tin 118.710 7.28 231.93 2602 1.51 0.69 1.96 7.344 [Kr] 4d <sup>10</sup> 5p <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Sb</b> 51 Antimony 121.757 6.684 630.63 1587 1.45 0.76 2.05 8.641 [Kr] 4d <sup>10</sup> 5p <sup>3</sup>	<b>IIIB</b> <b>IIIB</b> <b>Te</b> 52 Tellurium 127.60 6.25 449.51 988 1.42 0.97 2.1 9.009 [Kr] 4d <sup>10</sup> 5p <sup>4</sup>	<b>IIIB</b> <b>IIIB</b> <b>I</b> 53 Iodine 126.90447 4.93 113.7 184.4 1.33 2.20 2.66 10.451 [Kr] 4d <sup>10</sup> 5p <sup>5</sup>	<b>IIIB</b> <b>IIIB</b> <b>Xe</b> 54 Xenon 131.29 5.89 -111.75 -108.04 1.31 0.48 - 12.130 [Kr] 4d <sup>10</sup> 5p <sup>6</sup>	<b>IIIB</b> <b>IIIB</b> <b>Cs</b> 55 Cesium 132.90543 1.879 28.44 671 2.65 1.67 0.79 3.894 [Xe] 6s <sup>1</sup>	<b>IIIB</b> <b>IIIB</b> <b>Ba</b> 56 Barium 137.327 3.594 727 1897 2.173 1.36 0.89 5.212 [Xe] 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>La</b> 57 Lanthanum 138.9055 6.146 920 3455 1.83 1.032 1.10 5.577 [Xe] 5d <sup>1</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Hf</b> 72 Hafnium 178.49 13.31 2233 4603 1.59 0.71 1.3 7.0 [Xe] 4f <sup>14</sup> 5d <sup>2</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Ta</b> 73 Tantalum 180.9479 16.6 3017 5458 1.46 0.64 1.5 7.89 [Xe] 4f <sup>14</sup> 5d <sup>3</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>W</b> 74 Tungsten 183.84 19.35 3422 5555 1.39 0.60 2.36 7.98 [Xe] 4f <sup>14</sup> 5d <sup>4</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Re</b> 75 Rhenium 186.207 20.5 3186 5596 1.37 0.53 1.9 7.88 [Xe] 4f <sup>14</sup> 5d <sup>5</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Os</b> 76 Osmium 190.23 22.61 3033 5012 1.35 0.39 2.2 8.7 [Xe] 4f <sup>14</sup> 5d <sup>6</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Ir</b> 77 Iridium 192.22 22.65 2446 4428 1.35 0.625 2.20 9.1 [Xe] 4f <sup>14</sup> 5d <sup>7</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Pt</b> 78 Platinum 195.08 21.45 1768.4 3825 1.385 0.625 2.28 9.0 [Xe] 4f <sup>14</sup> 5d <sup>9</sup> 6s <sup>1</sup>	<b>IIIB</b> <b>IIIB</b> <b>Au</b> 79 Gold 196.96654 19.31 1064.18 2856 1.44 0.85 2.54 9.225 [Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>1</sup>	<b>IIIB</b> <b>IIIB</b> <b>Hg</b> 80 Mercury 200.59 13.546 -38.83 356.73 1.51 1.02 2.00 10.437 [Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Tl</b> 81 Thallium 204.3833 11.85 304 1473 1.70 1.50 2.04 6.108 [Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup> 6p <sup>1</sup>	<b>IIIB</b> <b>IIIB</b> <b>Pb</b> 82 Lead 207.2 11.34 327.46 1749 1.75 1.19 2.33 7.416 [Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup> 6p <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Bi</b> 83 Bismuth 208.98037 9.78 271.40 1564 1.547 1.03 2.02 7.289 [Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup> 6p <sup>3</sup>	<b>IIIB</b> <b>IIIB</b> <b>Po</b> 84 Polonium (208.9824) 9.196 254 962 1.64 0.94 2.0 8.42 [Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup> 6p <sup>4</sup>	<b>IIIB</b> <b>IIIB</b> <b>At</b> 85 Astatine (209.9871) - 302 337 1.40 2.27 2.2 - [Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup> 6p <sup>5</sup>	<b>IIIB</b> <b>IIIB</b> <b>Rn</b> 86 Radon (222.0176) 9.73 -71 -61.7 1.34 - - 10.748 [Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup> 6p <sup>6</sup>
<b>IIIB</b> <b>IIIB</b> <b>Ce</b> 58 Cerium 140.115 6.773 799 3424 1.818 1.02 1.12 5.466 [Xe] 4f <sup>1</sup> 5d <sup>1</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Pr</b> 59 Praseodymium 140.90765 7.263 931 3510 1.824 0.85 1.13 5.422 [Xe] 4f <sup>3</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Nd</b> 60 Neodymium 144.24 7.00 1016 3066 1.814 0.983 1.14 5.489 [Xe] 4f <sup>4</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Pm</b> 61 Promethium (144.9127) 7.264 1042 3000 1.834 0.97 1.13 5.554 [Xe] 4f <sup>5</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Sm</b> 62 Samarium 150.36 7.536 1072 3221 1.804 0.97 1.17 5.631 [Xe] 4f <sup>6</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Eu</b> 63 Europium 151.965 8.230 1176 3264 2.084 0.97 1.2 5.666 [Xe] 4f <sup>7</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Gd</b> 64 Gadolinium 157.25 7.901 1314 3264 1.804 0.97 1.2 6.141 [Xe] 4f <sup>7</sup> 5d <sup>1</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Tb</b> 65 Terbium 158.92534 8.551 1359 3221 1.871 0.97 1.22 5.927 [Xe] 4f <sup>9</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Dy</b> 66 Dysprosium 162.50 9.321 1411 2561 1.762 0.89 1.24 6.018 [Xe] 4f <sup>10</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Ho</b> 67 Holmium 164.93032 8.80 1472 2694 1.762 0.88 1.25 6.101 [Xe] 4f <sup>11</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Er</b> 68 Erbium 167.26 9.066 1529 2862 1.759 0.88 1.25 6.101 [Xe] 4f <sup>12</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Tm</b> 69 Thulium 168.93421 9.321 1545 1946 1.759 0.88 1.25 6.18436 [Xe] 4f <sup>13</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Yb</b> 70 Ytterbium 173.04 6.966 824 1194 1.933 0.868 1.1 6.25394 [Xe] 4f <sup>14</sup> 6s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Lu</b> 71 Lutetium 174.967 9.84 1663 3393 1.738 0.861 1.27 5.42589 [Xe] 4f <sup>14</sup> 5d <sup>1</sup> 6s <sup>2</sup>																						
<b>IIIB</b> <b>IIIB</b> <b>Th</b> 90 Thorium 232.0381 11.72 1750 4788 1.79 0.94 1.3 6.08 [Rn] 6d <sup>2</sup> 7s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Pa</b> 91 Protactinium 231.03588 15.37 1572 - 1.63 0.78 1.38 5.89 [Rn] 5f <sup>2</sup> 6d <sup>1</sup> 7s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>U</b> 92 Uranium 238.02889 19.05 4131 - 1.56 0.86 1.38 6.05 [Rn] 5f <sup>3</sup> 6d <sup>1</sup> 7s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Np</b> 93 Neptunium (237.0482) 20.45 4131 - 1.59 0.74 1.36 6.19 [Rn] 5f <sup>4</sup> 6d <sup>1</sup> 7s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Pu</b> 94 Plutonium (244.0642) 19.816 4131 - 1.59 0.86 1.28 5.8 [Rn] 5f <sup>6</sup> 6d <sup>1</sup> 7s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Am</b> 95 Americium (243.0614) 13.67 1176 2607 1.74 0.97 1.3 5.993 [Rn] 5f <sup>7</sup> 7s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Cm</b> 96 Curium (247.0703) 13.51 1345 - 1.70 0.98 1.3 6.02 [Rn] 5f <sup>7</sup> 6d <sup>1</sup> 7s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Bk</b> 97 Berkelium (247.0703) 14.78 1050 - 1.70 0.98 1.3 6.23 [Rn] 5f <sup>9</sup> 7s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Cf</b> 98 Californium (251.0796) 15.1 900 - 1.862 0.95 1.3 6.30 [Rn] 5f <sup>10</sup> 7s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Es</b> 99 Einsteinium (252.083) - 860 - - - - - 6.42 [Rn] 5f <sup>11</sup> 7s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Fm</b> 100 Fermium (257.0951) - 1527 - - - - - 6.50 [Rn] 5f <sup>12</sup> 7s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Md</b> 101 Mendelevium (258.10) - 827 - - - - - 6.58 [Rn] 5f <sup>13</sup> 7s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>No</b> 102 Nobelium (259.1009) - 827 - - - - - 6.65 [Rn] 5f <sup>14</sup> 7s <sup>2</sup>	<b>IIIB</b> <b>IIIB</b> <b>Lr</b> 103 Lawrencium (262.11) - 1627 - - - - - - [Rn] 5f <sup>14</sup> 6d <sup>1</sup> 7s <sup>2</sup>																						