# Thermo Scientific

## X-RAY ENERGY REFERENCE

**Key to Energy Values**

| | |
|---|---|
| $K_\alpha^1$ | $K_\beta^1$ |
| **Ag** | |
| $L_\alpha^1$ | $L_\beta^1$ |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **H 氫** Hydrogen 1 | | | | | | | | | | | | | | | | | **He 氦** Helium 2 |
| **Li 鋰** Lithium 3 | **Be 鈹** Beryllium 4 | | | | | | | | | | | **B 硼** Boron 5 | **C 碳** Carbon 6 | **N 氮** Nitrogen 7 | **O 氧** Oxygen 8 | **F 氟** Fluorine 9 | **Ne 氖** Neon 10 |
| 1.04 1.07 **Na 鈉** Sodium 11 | 1.25 1.30 **Mg 鎂** Magnesium 12 | | | | | | | | | | | 1.49 1.55 **Al 鋁** Aluminum 13 | 1.74 1.83 **Si 矽** Silicon 14 | 2.02 2.14 **P 磷** Phosphorus 15 | 2.31 2.46 **S 硫** Sulfur 16 | 2.62 2.82 **Cl 氯** Chlorine 17 | 2.96 3.19 **Ar 氬** Argon 18 |
| 3.31 3.59 **K 鉀** Potassium 19 | 3.69 4.01 **Ca 鈣** Calcium 20 | 4.09 4.46 **Sc 鈧** Scandium 21 | 4.51 4.93 **Ti 鈦** Titanium 22 | 4.95 5.43 **V 釩** Vanadium 23 | 5.41 5.95 **Cr 鉻** Chromium 24 | 5.90 6.49 **Mn 錳** Manganese 25 | 6.40 7.06 **Fe 鐵** Iron 26 | 6.93 7.65 **Co 鈷** Cobalt 27 | 7.48 8.26 **Ni 鎳** Nickel 28 | 8.05 8.90 **Cu 銅** Copper 29 | 8.64 9.57 **Zn 鋅** Zinc 30 | 9.25 10.26 **Ga 鎵** Gallium 31 | 9.89 10.98 **Ge 鍺** Germanium 32 | 10.54 11.73 **As 砷** Arsenic 33 | 11.22 12.50 **Se 硒** Selenium 34 | 11.92 13.29 **Br 溴** Bromine 35 | 12.65 14.11 **Kr 氪** Krypton 36 |
| | | 0.40 0.40 | 0.45 0.46 | 0.51 0.52 | 0.57 0.58 | 0.64 0.65 | 0.70 0.72 | 0.78 0.79 | 0.85 0.87 | 0.93 0.95 | 1.01 1.03 | 1.10 1.12 | 1.19 1.21 | 1.28 1.32 | 1.38 1.42 | 1.48 1.53 | 1.59 1.64 |
| 13.39 14.96 **Rb 銣** Rubidium 37 | 14.16 15.83 **Sr 鍶** Strontium 38 | 14.96 16.74 **Y 釔** Yttrium 39 | 15.77 17.67 **Zr 鋯** Zirconium 40 | 16.61 18.62 **Nb 鈮** Niobium 41 | 17.48 19.61 **Mo 鉬** Molybdenum 42 | 18.41 20.59 **Tc 鎝** Technetium 43 | 19.28 21.66 **Ru 釕** Ruthenium 44 | 20.21 22.72 **Rh 銠** Rhodium 45 | 21.18 23.82 **Pd 鈀** Palladium 46 | 22.16 24.94 **Ag 銀** Silver 47 | 23.17 26.09 **Cd 鎘** Cadmium 48 | 24.21 27.27 **In 銦** Indium 49 | 25.27 28.48 **Sn 錫** Tin 50 | 26.36 29.72 **Sb 銻** Antimony 51 | 27.47 30.99 **Te 碲** Tellurium 52 | 28.61 32.29 **I 碘** Iodine 53 | 29.80 33.64 **Xe 氙** Xenon 54 |
| | | 1.92 2.00 | 2.04 2.12 | 2.17 2.26 | 2.29 2.40 | 2.42 2.54 | 2.56 2.68 | 2.70 2.83 | 2.84 2.99 | 2.98 3.15 | 3.13 3.32 | 3.29 3.49 | 3.44 3.66 | 3.61 3.84 | 3.77 4.03 | 3.94 4.22 | 4.11 4.42 |
| 30.97 34.98 **Cs 銫** Caesium 55 | 32.19 36.38 **Ba 鋇** Barium 56 | | 55.76 63.21 **Hf 鉿** Hafnium 72 | 57.52 65.21 **Ta 鉭** Tantalum 73 | 59.31 67.23 **W 鎢** Tungsten 74 | 61.13 69.30 **Re 錸** Rhenium 75 | 62.99 71.40 **Os 鋨** Osmium 76 | 64.89 73.55 **Ir 銥** Iridium 77 | 66.82 75.74 **Pt 鉑** Platinum 78 | 68.79 77.97 **Au 金** Gold 79 | 70.82 80.26 **Hg 汞** Mercury 80 | 72.86 82.56 **Tl 鉈** Thallium 81 | 74.96 84.92 **Pb 鉛** Lead 82 | 77.10 87.34 **Bi 鉍** Bismuth 83 | 79.30 89.81 **Po 釙** Polonium 84 | 81.53 92.32 **At 砹** Astatine 85 | 83.80 94.88 **Rn 氡** Radon 86 |
| | | | 7.90 9.02 | 8.15 9.34 | 8.40 9.67 | 8.65 10.01 | 8.91 10.35 | 9.19 10.71 | 9.44 11.07 | 9.71 11.44 | 9.99 11.82 | 10.27 12.21 | 10.55 12.61 | 10.84 13.02 | 11.13 13.44 | 11.42 13.87 | 11.72 14.32 |
| 86.11 97.47 **Fr 鈁** Francium 87 | 88.47 100.1 **Ra 鐳** Radium 88 | | | | | | | | | | | | | | | | |
| 12.03 14.77 | 12.34 15.23 | | | | | | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 33.44 37.80 **La 鑭** Lanthanum 57 | 34.72 39.26 **Ce 鈰** Cerium 58 | 36.02 40.75 **Pr 鐠** Praseodymium 59 | 37.36 42.27 **Nd 釹** Neodymium 60 | 38.65 43.95 **Pm 鉕** Promethium 61 | 40.12 45.40 **Sm 釤** Samarium 62 | 41.53 47.03 **Eu 銪** Europium 63 | 42.98 48.72 **Gd 釓** Gadolinium 64 | 44.47 50.39 **Tb 鋱** Terbium 65 | 45.99 52.17 **Dy 鏑** Dysprosium 66 | 47.53 53.93 **Ho 鈥** Holmium 67 | 49.10 55.69 **Er 鉺** Erbium 68 | 50.73 57.58 **Tm 銩** Thulium 69 | 52.36 59.35 **Yb 鐿** Ytterbium 70 | 54.06 61.28 **Lu 鑥** Lutetium 71 |
| 4.65 5.04 | 4.84 5.26 | 5.03 5.49 | 5.23 5.72 | 5.43 5.96 | 5.64 6.21 | 5.85 6.46 | 6.06 6.71 | 6.28 6.98 | 6.50 7.25 | 6.72 7.53 | 6.95 7.81 | 7.18 8.10 | 7.41 8.40 | 7.65 8.71 |
| 90.89 102.8 **Ac 錒** Actinium 89 | 93.35 105.6 **Th 釷** Thorium 90 | 95.86 108.4 **Pa 鏷** Protactinium 91 | 98.43 111.3 **U 鈾** Uranium 92 | 101.1 114.2 **Np 鎿** Neptunium 93 | 103.7 117.2 **Pu 鈽** Plutonium 94 | 106.5 120.3 **Am 鋂** Americium 95 | 109.3 123.4 **Cm 鋦** Curium 96 | 112.1 126.6 **Bk 錇** Berkelium 97 | 115.0 129.8 **Cf 鉲** Californium 98 | 118.0 133.1 **Es 鑀** Einsteinium 99 | 121.1 136.5 **Fm 鐨** Fermium 100 | 125.2 141.0 **Md 鍆** Mendelevium 101 | 127.4 143.5 **No 鍩** Nobelium 102 | 130.6 147.1 **Lr 鐒** Lawrencium 103 |
| 12.65 15.71 | 12.97 16.20 | 13.29 16.70 | 13.61 17.22 | 13.95 17.74 | 14.28 18.28 | 14.62 18.83 | 14.96 19.39 | 15.31 19.97 | 15.66 20.56 | 16.02 21.17 | 16.38 21.79 | 16.74 22.55 | 17.11 23.23 | 17.48 23.93 |

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