X-Ray Energy Reference

H Hydrogen 1																	He Helium 2
Li Lithium 3	Be Beryllium 4											B Boron 5 0.18	C Carbon 6 0.28	N Nitrogen 7 0.39	O Oxygen 8 0.53	F Fluorine 9 0.68	Ne Neon 10 0.85
Na Sodium 11 1.04 1.07	Mg Magnesium 12 1.25 1.30											Al Aluminum 13 1.49 1.55	Si Silicon 14 1.74 1.83	P Phosphorus 15 2.02 2.14	S Sulfur 16 2.31 2.46	Cl Chlorine 17 2.62 2.82	Ar Argon 18 2.96 3.19
K Potassium 19 3.31 3.59	Ca Calcium 20 3.69 4.01	Sc Scandium 21 4.09 4.46 0.40 0.40	Ti Titanium 22 4.51 4.93 0.45 0.46	V Vanadium 23 4.95 5.43 0.51 0.52	Cr Chromium 24 5.41 5.95 0.57 0.58	Mn Manganese 25 5.90 6.49 0.64 0.65	Fe Iron 26 6.40 7.06 0.70 0.72	Co Cobalt 27 6.93 7.65 0.78 0.79	Ni Nickel 28 7.48 8.26 0.85 0.87	Cu Copper 29 8.05 8.90 0.93 0.95	Zn Zinc 30 8.64 9.57 1.01 1.03	Ga Gallium 31 9.25 10.26 1.10 1.12	Ge Germanium 32 9.89 10.98 1.19 1.21	As Arsenic 33 10.54 11.73 1.28 1.32	Se Selenium 34 11.22 12.50 1.38 1.42	Br Bromine 35 11.92 13.29 1.48 1.53	Kr Krypton 36 12.65 14.11 1.59 1.64
Rb Rubidium 37 13.39 14.96	Sr Strontium 38 14.16 15.83	Y Yttrium 39 14.96 16.74 1.92 2.00	Zr Zirconium 40 15.77 17.67 2.04 2.12	Nb Niobium 41 16.61 18.62 2.17 2.26	Mo Molybdenum 42 17.48 19.61 2.29 2.40	Tc Technetium 43 18.41 20.59 2.42 2.54	Ru Ruthenium 44 19.28 21.66 2.56 2.68	Rh Rhodium 45 20.21 22.72 2.70 2.83	Pd Palladium 46 21.18 23.82 2.84 2.99	Ag Silver 47 22.16 24.94 2.98 3.15	Cd Cadmium 48 23.17 26.09 3.13 3.32	In Indium 49 24.21 27.27 3.29 3.49	Sn Tin 50 25.27 28.48 3.44 3.66	Sb Antimony 51 26.36 29.72 3.61 3.84	Te Tellurium 52 27.47 30.99 3.77 4.03	I Iodine 53 28.61 32.29 3.94 4.22	Xe Xenon 54 29.80 33.64 4.11 4.42
Cs Cesium 55 30.97 34.98 4.29 4.62	Ba Barium 56 32.19 36.38 4.47 4.83		Hf Hafnium 72 55.76 63.21 7.90 9.02	Ta Tantalum 73 57.52 65.21 8.15 9.34	W Tungsten 74 59.31 67.23 8.40 9.67	Re Rhenium 75 61.13 69.30 8.65 10.01	Os Osmium 76 62.99 71.40 8.91 10.35	Ir Iridium 77 64.89 73.55 9.19 10.71	Pt Platinum 78 66.82 75.74 9.44 11.07	Au Gold 79 68.79 77.97 9.71 11.44	Hg Mercury 80 70.82 80.26 9.99 11.82	Tl Thallium 81 72.86 82.56 10.27 12.21	Pb Lead 82 74.96 84.92 10.55 12.61	Bi Bismuth 83 77.10 87.34 10.84 13.02	Po Polonium 84 79.30 89.81 11.13 13.44	At Astatine 85 81.53 92.32 11.42 13.87	Rn Radon 86 83.80 94.88 11.72 14.32
Fr Francium 87 12.03 14.77	Ra Radium 88 88.47 100.1 12.34 15.23																
		57- 71	La Lanthanum 57 33.44 37.80 4.65 5.04	Ce Cerium 58 34.72 39.26 4.84 5.26	Pr Praseodymium 59 36.02 40.75 5.03 5.49	Nd Neodymium 60 37.36 42.27 5.23 5.72	Pm Promethium 61 38.65 43.95 5.43 5.96	Sm Samarium 62 40.12 45.40 5.64 6.21	Eu Europium 63 41.53 47.03 5.85 6.46	Gd Gadolinium 64 42.98 48.72 6.06 6.71	Tb Terbium 65 44.47 50.39 6.28 6.98	Dy Dysprosium 66 45.99 52.17 6.50 7.25	Ho Holmium 67 47.53 53.93 6.72 7.53	Er Erbium 68 49.10 55.69 6.95 7.81	Tm Thulium 69 50.73 57.58 7.18 8.10	Yb Ytterbium 70 52.36 59.35 7.41 8.40	Lu Lutetium 71 54.06 61.28 7.65 8.71
		89-103	Ac Actinium 89 90.89 102.8 12.65 15.71	Th Thorium 90 93.35 105.6 12.97 16.20	Pa Protactinium 91 95.86 108.4 13.29 16.70	U Uranium 92 98.43 111.3 13.61 17.22	Np Neptunium 93 101.1 114.2 13.95 17.74	Pu Plutonium 94 103.7 117.2 14.28 18.28	Am Americium 95 106.5 120.3 14.62 18.83	Cm Curium 96 109.3 123.4 14.96 19.39	Bk Berkelium 97 112.1 126.6 15.31 19.97	Cf Californium 98 115.0 129.8 15.66 20.56	Es Einsteinium 99 118.0 133.1 16.02 21.17	Fm Fermium 100 121.1 136.5 16.38 21.79	Md Mendelevium 101 125.2 141.0 16.74 22.55	No Nobelium 102 127.4 143.5 17.11 23.23	Lr Lawrencium 103 130.6 147.1 17.48 23.93

Ag — Key to Energy Values

Requires GOLDD technology for metal alloys

Requires GOLDD technology for mining & minerals mode

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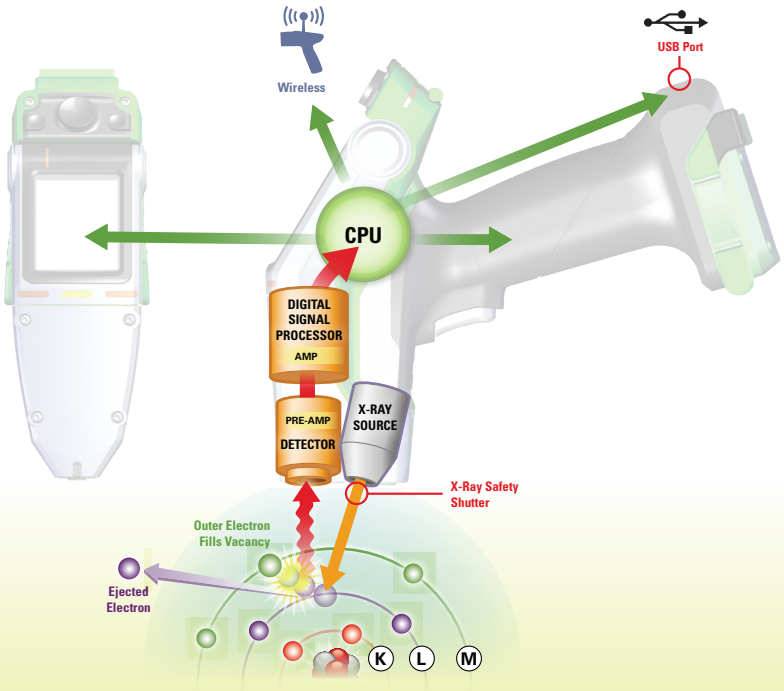
Thermo Scientific™ Niton™ XRF Portable Analyzers

How XRF Analysis Works



1. X-rays are produced by the analyzer and pointed at a sample surface.
2. The energy causes inner-shell electrons to be ejected.
3. Outer-shell electrons fill the vacancies left by the ejected electrons and fluorescent x-rays are emitted.
4. The fluorescent x-rays enter the detector and send electronic pulses to the preamp.
5. The preamp amplifies the signals and sends them to the Digital Signal Processor (DSP).
6. The DSP collects and digitizes the x-ray events and sends the spectral data to the main CPU for processing.
7. The CPU analyzes the spectral data to produce detailed composition analysis.
8. Composition data and other grade or value identification are displayed and stored in memory for later recall or download to an external PC.

For more detailed information on how XRF works, visit
www.thermoscientific.com/portableid

The Right Analyzer for Your Application

Metal and Alloy Analysis

- Instant, positive grade identification
- Superior detection limits for tramp/ trace elements
- Excellent light element performance for sorting Al, Ti, and bronze alloys

Toys and Consumer Goods

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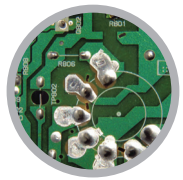
- Rapid results to facilitate timely product shipments
- Thermo Scientific TestAll technology automatically selects the correct analytical mode



RoHS-WEEE Compliance/Halogen-free

- Total Pb, Cd, Hg, Cr, and Br quantified in seconds
- Pass/fail designations provided, with visual identification of out-of-spec elements
- Ideal for high-reliability systems, finished goods, and packaging

Mining Exploration and Geochemical Analysis

- Rapid survey of soil and outcrops to identify potential drill targets
- Direct screening of core and cuttings for rapid decision making on the drill rig
- High sample throughput and increased sample density over traditional lab methods

Environmental Analysis

- Rapid identification of contaminants with analytical range from Mg through U
- Lower detection limits reduce reliance on fixed-site laboratories
- GPS integration for elemental mapping with GIS systems

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