

# **XRAYLIB tables (X-ray fluorescence cross-section)**

**Calculations using XRAYLIB 2.3**

**November 14, 2003**

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## **Abstract**

These tables contain evaluated x-ray fluorescence (XRF) cross-sections for elements from  $Z=5$  to  $Z=90$ . They are calculated using the XRAYLIB library [1]. The tables are created following the formulas 2-6 in [2], for building the x-ray fluorescence cross section. For comparison purposes, additional calculations have been done in order to reproduce the XRF cross section tabulated in [2]. For that, we used the fluorescence yield and fractional radiative rates included in this reference, from which we obtained the cross section values of Krause (or valued very close to them, except for the proximities to the edges, where the photoionisation cross sections could vary).

The main differences for our evaluated data and those of [2] come from the fluorescence yield for the K-lines. Being the cross section proportional to the fluorescence yield, we have also tabulated the value used by XRAYLIB, as well as Krause's one. For the L lines, the main difference arises from the fact that XRAYLIB uses the jump approximation (see [1] for a discussion on this topic) whereas Krause uses the more precise partial cross sections from Scofield [3]. The approximation of using jump values gives satisfactory results for K, L2 and L3 related lines, but XRAYLIB values are very discrepant for L1 lines. A new XRAYLIB version is under development using partial cross sections.

## Element: H , Z= 1

Edge energy, radiation ratio and jump for H (Z= 1)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	-	-	-	0.014
Fluor Yield (xraylib)	-	-	-	-
Fluor Yield (Krause)	-	-	-	-
Jump Factor	-	-	-	1.000

XRF line energies and fractional radiative rate for H (Z= 1)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$	
Line energy [keV]	-	-	-	-	
Radiative rate	-	-	-	-	

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	-	-	-	-	-
Radiative rate	-	-	-	-	-

## Element: He, Z= 2

Edge energy, radiation ratio and jump for He (Z= 2)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	-	-	-	0.025
Fluor Yield (xraylib)	-	-	-	-
Fluor Yield (Krause)	-	-	-	-
Jump Factor	-	-	-	1.000

XRF line energies and fractional radiative rate for He (Z= 2)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	-	-	-	-
Radiative rate	-	-	-	-

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	-	-	-	-	-
Radiative rate	-	-	-	-	-

## Element: Li, Z= 3

Edge energy, radiation ratio and jump for Li (Z= 3)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	-	-	0.005	0.055
Fluor Yield (xraylib)	-	-	-	0.000
Fluor Yield (Krause)	-	-	-	-
Jump Factor	-	-	1.000	1.000

XRF line energies and fractional radiative rate for Li (Z= 3)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	0.054	-	-	-
Radiative rate	-	-	-	-

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	-	-	-	-	-
Radiative rate	-	-	-	-	-

## Element: Be, Z= 4

Edge energy, radiation ratio and jump for Be (Z= 4)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	-	-	0.008	0.112
Fluor Yield (xraylib)	-	-	-	0.000
Fluor Yield (Krause)	-	-	-	-
Jump Factor	1.000	1.000	1.000	23.530

XRF line energies and fractional radiative rate for Be (Z= 4)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	0.108	-	-	-
Radiative rate	-	-	-	-

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	-	-	-	-	-
Radiative rate	-	-	-	-	-

## Element: B , Z= 5

Edge energy, radiation ratio and jump for B (Z= 5)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.005	0.005	0.013	0.188
Fluor Yield (xraylib)	-	-	-	0.001
Fluor Yield (Krause)	-	-	-	0.002
Jump Factor	1.000	1.000	1.000	21.700

XRF line energies and fractional radiative rate for B (Z= 5)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	0.183	-	-	-
Radiative rate	0.667	0.333	-	-

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	-	-	-	-	-
Radiative rate	-	-	-	-	-

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for B (Z= 5)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
1.00	9.81e+00 2.39e+01	1.47e+01 3.59e+01	-	-
1.50	3.00e+00 7.31e+00	4.51e+00 1.10e+01	-	-
2.00	1.27e+00 3.09e+00	1.91e+00 4.64e+00	-	-
3.00	3.69e-01 8.98e-01	5.54e-01 1.35e+00	-	-
4.00	1.51e-01 3.67e-01	2.26e-01 5.50e-01	-	-
5.00	7.46e-02 1.81e-01	1.12e-01 2.72e-01	-	-
6.00	4.17e-02 1.01e-01	6.26e-02 1.52e-01	-	-
8.00	1.65e-02 4.02e-02	2.48e-02 6.03e-02	-	-
10.00	8.02e-03 1.95e-02	1.20e-02 2.92e-02	-	-
15.00	2.12e-03 5.15e-03	3.18e-03 7.73e-03	-	-
20.00	8.19e-04 1.99e-03	1.23e-03 2.98e-03	-	-
30.00	2.12e-04 5.15e-04	3.18e-04 7.73e-04	-	-
40.00	8.10e-05 1.97e-04	1.22e-04 2.95e-04	-	-
50.00	3.83e-05 9.30e-05	5.75e-05 1.40e-04	-	-
60.00	2.08e-05 5.04e-05	3.11e-05 7.56e-05	-	-
80.00	7.90e-06 1.92e-05	1.19e-05 2.88e-05	-	-
100.00	3.75e-06 9.11e-06	5.63e-06 1.37e-05	-	-
150.00	9.78e-07 2.37e-06	1.47e-06 3.56e-06	-	-
200.00	3.83e-07 9.30e-07	5.75e-07 1.39e-06	-	-

## Element: C , Z= 6

Edge energy, radiation ratio and jump for C (Z= 6)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.006	0.006	0.018	0.284
Fluor Yield (xraylib)	-	-	-	0.001
Fluor Yield (Krause)	-	-	-	0.003
Jump Factor	1.000	1.000	1.000	19.020

XRF line energies and fractional radiative rate for C (Z= 6)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	0.277	-	-	-
Radiative rate	0.668	0.332	-	-

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	-	-	-	-	-
Radiative rate	-	-	-	-	-



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for C (Z= 6)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
1.00	3.90e+01 7.86e+01	5.84e+01 1.18e+02	-	-
1.50	1.24e+01 2.49e+01	1.85e+01 3.72e+01	-	-
2.00	5.33e+00 1.07e+01	7.98e+00 1.60e+01	-	-
3.00	1.58e+00 3.18e+00	2.37e+00 4.77e+00	-	-
4.00	6.58e-01 1.32e+00	9.85e-01 1.98e+00	-	-
5.00	3.30e-01 6.62e-01	4.93e-01 9.91e-01	-	-
6.00	1.86e-01 3.74e-01	2.79e-01 5.60e-01	-	-
8.00	7.49e-02 1.50e-01	1.12e-01 2.25e-01	-	-
10.00	3.67e-02 7.36e-02	5.49e-02 1.10e-01	-	-
15.00	9.87e-03 1.98e-02	1.48e-02 2.96e-02	-	-
20.00	3.85e-03 7.71e-03	5.76e-03 1.15e-02	-	-
30.00	1.01e-03 2.02e-03	1.51e-03 3.03e-03	-	-
40.00	3.87e-04 7.77e-04	5.80e-04 1.16e-03	-	-
50.00	1.84e-04 3.69e-04	2.76e-04 5.53e-04	-	-
60.00	1.00e-04 2.01e-04	1.50e-04 3.01e-04	-	-
80.00	3.83e-05 7.69e-05	5.74e-05 1.15e-04	-	-
100.00	1.82e-05 3.65e-05	2.73e-05 5.47e-05	-	-
150.00	4.78e-06 9.58e-06	7.16e-06 1.43e-05	-	-
200.00	1.88e-06 3.77e-06	2.81e-06 5.64e-06	-	-

## Element: N , Z= 7

Edge energy, radiation ratio and jump for N (Z= 7)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.009	0.009	0.024	0.402
Fluor Yield (xraylib)	-	-	-	0.003
Fluor Yield (Krause)	-	-	-	0.005
Jump Factor	1.000	1.000	1.000	17.440

XRF line energies and fractional radiative rate for N (Z= 7)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	0.392	-	-	-
Radiative rate	0.665	0.335	-	-

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	-	-	-	-	-
Radiative rate	-	-	-	-	-

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for N (Z= 7)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
1.00	1.50e+02 2.53e+02	2.25e+02 3.81e+02	-	-
1.50	4.89e+01 8.27e+01	7.35e+01 1.24e+02	-	-
2.00	2.15e+01 3.64e+01	3.24e+01 5.47e+01	-	-
3.00	6.54e+00 1.11e+01	9.84e+00 1.66e+01	-	-
4.00	2.76e+00 4.65e+00	4.14e+00 7.00e+00	-	-
5.00	1.40e+00 2.36e+00	2.10e+00 3.54e+00	-	-
6.00	7.95e-01 1.34e+00	1.20e+00 2.02e+00	-	-
8.00	3.24e-01 5.47e-01	4.87e-01 8.23e-01	-	-
10.00	1.60e-01 2.70e-01	2.41e-01 4.06e-01	-	-
15.00	4.37e-02 7.38e-02	6.58e-02 1.11e-01	-	-
20.00	1.72e-02 2.90e-02	2.59e-02 4.36e-02	-	-
30.00	4.56e-03 7.69e-03	6.86e-03 1.16e-02	-	-
40.00	1.77e-03 2.98e-03	2.66e-03 4.48e-03	-	-
50.00	8.44e-04 1.42e-03	1.27e-03 2.14e-03	-	-
60.00	4.60e-04 7.76e-04	6.92e-04 1.17e-03	-	-
80.00	1.77e-04 2.99e-04	2.66e-04 4.49e-04	-	-
100.00	8.45e-05 1.42e-04	1.27e-04 2.14e-04	-	-
150.00	2.22e-05 3.75e-05	3.34e-05 5.63e-05	-	-
200.00	8.78e-06 1.48e-05	1.32e-05 2.22e-05	-	-

## Element: O , Z= 8

Edge energy, radiation ratio and jump for O (Z= 8)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.007	0.007	0.029	0.532
Fluor Yield (xraylib)	-	-	-	0.006
Fluor Yield (Krause)	-	-	-	0.008
Jump Factor	1.000	1.000	1.000	15.400

XRF line energies and fractional radiative rate for O (Z= 8)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	0.525	-	-	-
Radiative rate	0.666	0.334	-	-

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	-	-	-	-	-
Radiative rate	-	-	-	-	-

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for O (Z= 8)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
1.00	4.40e+02 6.39e+02	6.61e+02 9.59e+02	-	-
1.50	1.48e+02 2.15e+02	2.23e+02 3.24e+02	-	-
2.00	6.66e+01 9.66e+01	9.99e+01 1.45e+02	-	-
3.00	2.07e+01 3.01e+01	3.11e+01 4.52e+01	-	-
4.00	8.86e+00 1.28e+01	1.33e+01 1.93e+01	-	-
5.00	4.53e+00 6.57e+00	6.80e+00 9.86e+00	-	-
6.00	2.60e+00 3.77e+00	3.90e+00 5.66e+00	-	-
8.00	1.07e+00 1.55e+00	1.61e+00 2.33e+00	-	-
10.00	5.34e-01 7.74e-01	8.02e-01 1.16e+00	-	-
15.00	1.48e-01 2.14e-01	2.22e-01 3.22e-01	-	-
20.00	5.88e-02 8.51e-02	8.82e-02 1.28e-01	-	-
30.00	1.57e-02 2.28e-02	2.36e-02 3.42e-02	-	-
40.00	6.13e-03 8.89e-03	9.21e-03 1.33e-02	-	-
50.00	2.94e-03 4.26e-03	4.42e-03 6.40e-03	-	-
60.00	1.61e-03 2.34e-03	2.42e-03 3.51e-03	-	-
80.00	6.23e-04 9.03e-04	9.36e-04 1.36e-03	-	-
100.00	2.98e-04 4.32e-04	4.48e-04 6.49e-04	-	-
150.00	7.89e-05 1.14e-04	1.19e-04 1.72e-04	-	-
200.00	3.12e-05 4.52e-05	4.68e-05 6.78e-05	-	-

## Element: F , Z= 9

Edge energy, radiation ratio and jump for F (Z= 9)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.009	0.009	0.034	0.685
Fluor Yield (xraylib)	-	-	-	0.009
Fluor Yield (Krause)	-	-	-	0.013
Jump Factor	1.000	1.000	1.000	13.840

XRF line energies and fractional radiative rate for F (Z= 9)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	0.677	-	-	-
Radiative rate	0.666	0.334	-	-

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	-	-	-	-	-
Radiative rate	-	-	-	-	-

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for F (Z= 9)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
1.00	1.01e+03 1.45e+03	1.52e+03 2.18e+03	-	-
1.50	3.54e+02 5.10e+02	5.32e+02 7.66e+02	-	-
2.00	1.62e+02 2.33e+02	2.43e+02 3.50e+02	-	-
3.00	5.16e+01 7.43e+01	7.74e+01 1.12e+02	-	-
4.00	2.23e+01 3.22e+01	3.36e+01 4.84e+01	-	-
5.00	1.15e+01 1.66e+01	1.73e+01 2.50e+01	-	-
6.00	6.67e+00 9.61e+00	1.00e+01 1.44e+01	-	-
8.00	2.78e+00 4.00e+00	4.17e+00 6.01e+00	-	-
10.00	1.40e+00 2.01e+00	2.10e+00 3.02e+00	-	-
15.00	3.92e-01 5.64e-01	5.88e-01 8.47e-01	-	-
20.00	1.57e-01 2.26e-01	2.36e-01 3.39e-01	-	-
30.00	4.25e-02 6.12e-02	6.38e-02 9.19e-02	-	-
40.00	1.67e-02 2.40e-02	2.50e-02 3.60e-02	-	-
50.00	8.04e-03 1.16e-02	1.21e-02 1.74e-02	-	-
60.00	4.42e-03 6.36e-03	6.63e-03 9.55e-03	-	-
80.00	1.71e-03 2.47e-03	2.58e-03 3.71e-03	-	-
100.00	8.24e-04 1.19e-03	1.24e-03 1.78e-03	-	-
150.00	2.19e-04 3.15e-04	3.29e-04 4.74e-04	-	-
200.00	8.68e-05 1.25e-04	1.30e-04 1.88e-04	-	-

## Element: Ne, Z= 10

Edge energy, radiation ratio and jump for Ne (Z= 10)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.022	0.022	0.049	0.870
Fluor Yield (xraylib)	-	-	-	0.016
Fluor Yield (Krause)	-	-	-	0.018
Jump Factor	1.000	1.000	1.000	13.610

XRF line energies and fractional radiative rate for Ne (Z= 10)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	0.849	0.849	0.858	0.858
Radiative rate	0.665	0.335	-	-

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	-	-	-	-	-
Radiative rate	-	-	-	-	-



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Ne (Z= 10)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
1.00	2.45e+03 2.78e+03	3.68e+03 4.18e+03	-	-
1.50	8.81e+02 1.01e+03	1.32e+03 1.51e+03	-	-
2.00	4.10e+02 4.69e+02	6.17e+02 7.05e+02	-	-
3.00	1.33e+02 1.53e+02	2.01e+02 2.30e+02	-	-
4.00	5.86e+01 6.72e+01	8.80e+01 1.01e+02	-	-
5.00	3.05e+01 3.50e+01	4.59e+01 5.26e+01	-	-
6.00	1.78e+01 2.04e+01	2.67e+01 3.07e+01	-	-
8.00	7.48e+00 8.59e+00	1.12e+01 1.29e+01	-	-
10.00	3.78e+00 4.34e+00	5.69e+00 6.53e+00	-	-
15.00	1.08e+00 1.23e+00	1.62e+00 1.85e+00	-	-
20.00	4.34e-01 4.98e-01	6.52e-01 7.49e-01	-	-
30.00	1.19e-01 1.36e-01	1.79e-01 2.05e-01	-	-
40.00	4.69e-02 5.38e-02	7.05e-02 8.08e-02	-	-
50.00	2.27e-02 2.60e-02	3.41e-02 3.91e-02	-	-
60.00	1.25e-02 1.44e-02	1.88e-02 2.16e-02	-	-
80.00	4.88e-03 5.60e-03	7.34e-03 8.42e-03	-	-
100.00	2.35e-03 2.70e-03	3.54e-03 4.06e-03	-	-
150.00	6.29e-04 7.22e-04	9.46e-04 1.08e-03	-	-
200.00	2.50e-04 2.87e-04	3.76e-04 4.31e-04	-	-

## Element: Na, Z= 11

Edge energy, radiation ratio and jump for Na (Z= 11)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.031	0.031	0.063	1.072
Fluor Yield (xraylib)	-	-	-	0.021
Fluor Yield (Krause)	-	-	-	0.023
Jump Factor	1.000	1.000	1.000	11.840

XRF line energies and fractional radiative rate for Na (Z= 11)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	1.041	1.041	1.071	1.071
Radiative rate	0.666	0.334	-	-

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	-	-	-	-	0.031
Radiative rate	-	-	-	-	1.000

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Na (Z= 11)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
1.07	-	-	-	-
1.50	1.56e+03 1.74e+03	2.34e+03 2.61e+03	-	-
2.00	7.43e+02 8.31e+02	1.12e+03 1.25e+03	-	-
3.00	2.47e+02 2.77e+02	3.71e+02 4.17e+02	-	-
4.00	1.10e+02 1.24e+02	1.65e+02 1.85e+02	-	-
5.00	5.79e+01 6.50e+01	8.69e+01 9.76e+01	-	-
6.00	3.39e+01 3.82e+01	5.09e+01 5.73e+01	-	-
8.00	1.44e+01 1.62e+01	2.17e+01 2.44e+01	-	-
10.00	7.35e+00 8.26e+00	1.10e+01 1.24e+01	-	-
15.00	2.11e+00 2.37e+00	3.17e+00 3.57e+00	-	-
20.00	8.59e-01 9.66e-01	1.29e+00 1.45e+00	-	-
30.00	2.37e-01 2.67e-01	3.56e-01 4.01e-01	-	-
40.00	9.43e-02 1.06e-01	1.42e-01 1.59e-01	-	-
50.00	4.58e-02 5.15e-02	6.88e-02 7.74e-02	-	-
60.00	2.54e-02 2.85e-02	3.81e-02 4.28e-02	-	-
80.00	9.94e-03 1.12e-02	1.49e-02 1.68e-02	-	-
100.00	4.81e-03 5.40e-03	7.21e-03 8.11e-03	-	-
150.00	1.29e-03 1.45e-03	1.94e-03 2.18e-03	-	-
200.00	5.15e-04 5.79e-04	7.73e-04 8.69e-04	-	-

## Element: Mg, Z= 12

Edge energy, radiation ratio and jump for Mg (Z= 12)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.051	0.051	0.089	1.305
Fluor Yield (xraylib)	0.001	0.001	0.000	0.027
Fluor Yield (Krause)	0.001	0.001	0.000	0.030
Jump Factor	1.000	1.000	1.000	12.020

XRF line energies and fractional radiative rate for Mg (Z= 12)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	1.254	1.253	1.302	1.302
Radiative rate	0.664	0.336	-	-

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	-	-	-	-	0.049
Radiative rate	-	-	-	-	1.000

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Mg (Z= 12)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
1.30	-	-	-	-
1.50	2.66e+03 2.97e+03	4.00e+03 4.47e+03	-	-
2.00	1.28e+03 1.44e+03	1.93e+03 2.17e+03	-	-
3.00	4.36e+02 4.92e+02	6.57e+02 7.41e+02	-	-
4.00	1.97e+02 2.22e+02	2.96e+02 3.34e+02	-	-
5.00	1.04e+02 1.18e+02	1.57e+02 1.78e+02	-	-
6.00	6.16e+01 6.98e+01	9.28e+01 1.05e+02	-	-
8.00	2.64e+01 3.00e+01	3.98e+01 4.51e+01	-	-
10.00	1.36e+01 1.54e+01	2.04e+01 2.31e+01	-	-
15.00	3.94e+00 4.47e+00	5.93e+00 6.72e+00	-	-
20.00	1.62e+00 1.83e+00	2.43e+00 2.75e+00	-	-
30.00	4.51e-01 5.11e-01	6.78e-01 7.68e-01	-	-
40.00	1.80e-01 2.04e-01	2.71e-01 3.07e-01	-	-
50.00	8.79e-02 9.96e-02	1.32e-01 1.50e-01	-	-
60.00	4.88e-02 5.53e-02	7.34e-02 8.32e-02	-	-
80.00	1.92e-02 2.18e-02	2.89e-02 3.27e-02	-	-
100.00	9.32e-03 1.06e-02	1.40e-02 1.59e-02	-	-
150.00	2.51e-03 2.85e-03	3.78e-03 4.29e-03	-	-
200.00	1.01e-03 1.14e-03	1.51e-03 1.71e-03	-	-

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Mg (Z= 12)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.00	-	-	-	-	-
1.30	-	-	-	-	-

## Element: Al, Z= 13

Edge energy, radiation ratio and jump for Al (Z= 13)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.073	0.073	0.118	1.560
Fluor Yield (xraylib)	0.001	0.001	0.000	0.033
Fluor Yield (Krause)	0.001	0.001	0.000	0.039
Jump Factor	1.000	1.000	1.089	10.950

XRF line energies and fractional radiative rate for Al (Z= 13)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	1.487	1.486	1.558	1.558
Radiative rate	0.656	0.330	0.009	0.004

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	-	-	-	-	0.069
Radiative rate	0.066	-	-	-	1.000

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Al (Z= 13)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
1.56	-	-	-	-
2.00	1.99e+03 2.38e+03	3.00e+03 3.58e+03	2.67e+01 3.20e+01	4.01e+01 4.79e+01
3.00	6.93e+02 8.34e+02	1.04e+03 1.25e+03	9.29e+00 1.12e+01	1.39e+01 1.68e+01
4.00	3.17e+02 3.82e+02	4.76e+02 5.74e+02	4.24e+00 5.12e+00	6.37e+00 7.68e+00
5.00	1.69e+02 2.05e+02	2.55e+02 3.08e+02	2.27e+00 2.74e+00	3.41e+00 4.12e+00
6.00	1.01e+02 1.22e+02	1.51e+02 1.83e+02	1.35e+00 1.63e+00	2.03e+00 2.45e+00
8.00	4.36e+01 5.28e+01	6.56e+01 7.94e+01	5.85e-01 7.08e-01	8.78e-01 1.06e+00
10.00	2.25e+01 2.73e+01	3.39e+01 4.10e+01	3.02e-01 3.66e-01	4.53e-01 5.49e-01
15.00	6.62e+00 8.02e+00	9.96e+00 1.21e+01	8.88e-02 1.08e-01	1.33e-01 1.61e-01
20.00	2.73e+00 3.31e+00	4.11e+00 4.97e+00	3.66e-02 4.44e-02	5.50e-02 6.65e-02
30.00	7.69e-01 9.31e-01	1.16e+00 1.40e+00	1.03e-02 1.25e-02	1.55e-02 1.87e-02
40.00	3.09e-01 3.74e-01	4.64e-01 5.62e-01	4.14e-03 5.02e-03	6.21e-03 7.52e-03
50.00	1.51e-01 1.83e-01	2.28e-01 2.76e-01	2.03e-03 2.46e-03	3.04e-03 3.69e-03
60.00	8.43e-02 1.02e-01	1.27e-01 1.53e-01	1.13e-03 1.37e-03	1.70e-03 2.05e-03
80.00	3.33e-02 4.04e-02	5.01e-02 6.07e-02	4.47e-04 5.41e-04	6.71e-04 8.12e-04
100.00	1.62e-02 1.96e-02	2.44e-02 2.95e-02	2.17e-04 2.63e-04	3.26e-04 3.95e-04
150.00	4.40e-03 5.33e-03	6.62e-03 8.01e-03	5.90e-05 7.14e-05	8.85e-05 1.07e-04
200.00	1.76e-03 2.14e-03	2.65e-03 3.21e-03	2.37e-05 2.86e-05	3.55e-05 4.30e-05

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Al (Z= 13)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.00	7.46e-03 4.28e-02	-	-	-	2.08e+00 2.50e+01
1.50	2.52e-03 1.73e-02	-	-	-	7.03e-01 8.36e+00
1.55	2.29e-03 1.60e-02	-	-	-	6.37e-01 7.58e+00

## Element: Si, Z= 14

Edge energy, radiation ratio and jump for Si (Z= 14)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.099	0.100	0.149	1.839
Fluor Yield (xraylib)	0.000	0.000	0.000	0.048
Fluor Yield (Krause)	0.000	0.000	0.000	0.050
Jump Factor	1.000	1.000	1.095	10.370

XRF line energies and fractional radiative rate for Si (Z= 14)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	1.740	1.739	1.836	1.836
Radiative rate	0.646	0.325	0.019	0.010

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	-	-	-	-	0.094
Radiative rate	0.216	-	-	-	1.000



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Si (Z= 14)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
1.84	-	-	-	-
2.00	3.63e+03 3.81e+03	5.45e+03 5.73e+03	1.07e+02 1.12e+02	1.61e+02 1.69e+02
3.00	1.28e+03 1.35e+03	1.92e+03 2.03e+03	3.75e+01 3.98e+01	5.65e+01 5.98e+01
4.00	5.90e+02 6.27e+02	8.87e+02 9.43e+02	1.73e+01 1.84e+01	2.61e+01 2.78e+01
5.00	3.19e+02 3.39e+02	4.79e+02 5.10e+02	9.37e+00 9.98e+00	1.41e+01 1.50e+01
6.00	1.91e+02 2.03e+02	2.87e+02 3.05e+02	5.61e+00 5.97e+00	8.44e+00 8.99e+00
8.00	8.34e+01 8.89e+01	1.25e+02 1.34e+02	2.45e+00 2.62e+00	3.69e+00 3.94e+00
10.00	4.33e+01 4.63e+01	6.51e+01 6.96e+01	1.27e+00 1.36e+00	1.92e+00 2.05e+00
15.00	1.29e+01 1.37e+01	1.94e+01 2.07e+01	3.79e-01 4.04e-01	5.70e-01 6.09e-01
20.00	5.34e+00 5.71e+00	8.04e+00 8.59e+00	1.57e-01 1.68e-01	2.37e-01 2.53e-01
30.00	1.52e+00 1.62e+00	2.28e+00 2.44e+00	4.46e-02 4.77e-02	6.72e-02 7.18e-02
40.00	6.12e-01 6.55e-01	9.21e-01 9.85e-01	1.80e-02 1.93e-02	2.71e-02 2.90e-02
50.00	3.02e-01 3.22e-01	4.53e-01 4.84e-01	8.87e-03 9.48e-03	1.33e-02 1.43e-02
60.00	1.68e-01 1.80e-01	2.53e-01 2.71e-01	4.95e-03 5.29e-03	7.45e-03 7.97e-03
80.00	6.69e-02 7.15e-02	1.01e-01 1.07e-01	1.97e-03 2.10e-03	2.96e-03 3.16e-03
100.00	3.26e-02 3.49e-02	4.91e-02 5.24e-02	9.60e-04 1.03e-03	1.45e-03 1.54e-03
150.00	8.89e-03 9.50e-03	1.34e-02 1.43e-02	2.62e-04 2.79e-04	3.94e-04 4.21e-04
200.00	3.58e-03 3.82e-03	5.38e-03 5.75e-03	1.05e-04 1.12e-04	1.58e-04 1.69e-04

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Si (Z= 14)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.00	4.10e-02 2.00e-01	-	-	-	1.54e+00 1.73e+01
1.50	1.39e-02 8.27e-02	-	-	-	5.23e-01 5.83e+00
1.83	8.09e-03 5.21e-02	-	-	-	3.04e-01 3.37e+00

## Element: P , Z= 15

Edge energy, radiation ratio and jump for P (Z= 15)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.135	0.136	0.189	2.145
Fluor Yield (xraylib)	0.000	0.000	0.000	0.061
Fluor Yield (Krause)	0.000	0.000	0.000	0.063
Jump Factor	6.190	1.000	1.100	9.969

XRF line energies and fractional radiative rate for P (Z= 15)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	2.014	2.013	2.139	2.139
Radiative rate	0.635	0.320	0.030	0.015

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	0.186	-	-	-	0.121
Radiative rate	0.369	-	-	-	1.000

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for P (Z= 15)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
2.15	-	-	-	-
3.00	2.00e+03 2.09e+03	3.01e+03 3.15e+03	9.42e+01 9.87e+01	1.42e+02 1.49e+02
4.00	9.36e+02 9.85e+02	1.41e+03 1.48e+03	4.41e+01 4.64e+01	6.65e+01 7.00e+01
5.00	5.10e+02 5.38e+02	7.68e+02 8.09e+02	2.40e+01 2.53e+01	3.63e+01 3.82e+01
6.00	3.07e+02 3.24e+02	4.62e+02 4.88e+02	1.45e+01 1.53e+01	2.18e+01 2.31e+01
8.00	1.36e+02 1.43e+02	2.04e+02 2.16e+02	6.39e+00 6.76e+00	9.63e+00 1.02e+01
10.00	7.10e+01 7.51e+01	1.07e+02 1.13e+02	3.34e+00 3.54e+00	5.04e+00 5.34e+00
15.00	2.13e+01 2.26e+01	3.20e+01 3.39e+01	1.00e+00 1.06e+00	1.51e+00 1.60e+00
20.00	8.90e+00 9.43e+00	1.34e+01 1.42e+01	4.19e-01 4.44e-01	6.33e-01 6.70e-01
30.00	2.55e+00 2.70e+00	3.83e+00 4.06e+00	1.20e-01 1.27e-01	1.81e-01 1.92e-01
40.00	1.03e+00 1.10e+00	1.56e+00 1.65e+00	4.87e-02 5.17e-02	7.35e-02 7.79e-02
50.00	5.11e-01 5.42e-01	7.69e-01 8.15e-01	2.41e-02 2.55e-02	3.63e-02 3.85e-02
60.00	2.86e-01 3.03e-01	4.30e-01 4.56e-01	1.35e-02 1.43e-02	2.03e-02 2.16e-02
80.00	1.14e-01 1.21e-01	1.72e-01 1.82e-01	5.38e-03 5.70e-03	8.11e-03 8.60e-03
100.00	5.58e-02 5.92e-02	8.40e-02 8.91e-02	2.63e-03 2.79e-03	3.97e-03 4.21e-03
150.00	1.53e-02 1.62e-02	2.30e-02 2.44e-02	7.20e-04 7.64e-04	1.09e-03 1.15e-03
200.00	6.17e-03 6.54e-03	9.28e-03 9.84e-03	2.91e-04 3.08e-04	4.38e-04 4.65e-04

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for P (Z= 15)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.00	1.28e-01 5.36e-01	-	-	-	2.50e+01 1.87e+01
1.50	4.37e-02 2.27e-01	-	-	-	8.53e+00 6.32e+00
2.00	2.01e-02 1.18e-01	-	-	-	3.92e+00 2.88e+00
2.14	1.67e-02 1.01e-01	-	-	-	3.25e+00 2.39e+00

## Element: S , Z= 16

Edge energy, radiation ratio and jump for S (Z= 16)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.164	0.165	0.229	2.472
Fluor Yield (xraylib)	0.000	0.000	0.000	0.070
Fluor Yield (Krause)	0.000	0.000	0.000	0.078
Jump Factor	5.546	1.400	1.104	9.613

XRF line energies and fractional radiative rate for S (Z= 16)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	2.308	2.307	2.464	2.470
Radiative rate	0.623	0.315	0.041	0.021

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	0.225	-	-	-	0.149
Radiative rate	0.475	-	-	-	1.000

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for S (Z= 16)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
2.47	-	-	-	-
3.00	2.78e+03 3.13e+03	4.19e+03 4.72e+03	1.84e+02 2.07e+02	2.76e+02 3.11e+02
4.00	1.32e+03 1.49e+03	1.98e+03 2.24e+03	8.68e+01 9.83e+01	1.30e+02 1.48e+02
5.00	7.23e+02 8.22e+02	1.09e+03 1.24e+03	4.77e+01 5.42e+01	7.17e+01 8.15e+01
6.00	4.38e+02 4.99e+02	6.59e+02 7.51e+02	2.89e+01 3.29e+01	4.34e+01 4.94e+01
8.00	1.95e+02 2.22e+02	2.93e+02 3.35e+02	1.29e+01 1.47e+01	1.93e+01 2.21e+01
10.00	1.03e+02 1.17e+02	1.54e+02 1.76e+02	6.77e+00 7.73e+00	1.02e+01 1.16e+01
15.00	3.11e+01 3.56e+01	4.68e+01 5.36e+01	2.05e+00 2.35e+00	3.09e+00 3.53e+00
20.00	1.31e+01 1.50e+01	1.97e+01 2.26e+01	8.63e-01 9.88e-01	1.30e+00 1.49e+00
30.00	3.78e+00 4.32e+00	5.68e+00 6.51e+00	2.49e-01 2.85e-01	3.74e-01 4.29e-01
40.00	1.54e+00 1.76e+00	2.32e+00 2.66e+00	1.02e-01 1.16e-01	1.53e-01 1.75e-01
50.00	7.64e-01 8.75e-01	1.15e+00 1.32e+00	5.04e-02 5.77e-02	7.58e-02 8.67e-02
60.00	4.29e-01 4.91e-01	6.46e-01 7.40e-01	2.83e-02 3.24e-02	4.25e-02 4.87e-02
80.00	1.72e-01 1.97e-01	2.59e-01 2.96e-01	1.13e-02 1.30e-02	1.70e-02 1.95e-02
100.00	8.43e-02 9.66e-02	1.27e-01 1.45e-01	5.56e-03 6.37e-03	8.36e-03 9.57e-03
150.00	2.32e-02 2.66e-02	3.49e-02 4.00e-02	1.53e-03 1.75e-03	2.30e-03 2.63e-03
200.00	9.38e-03 1.07e-02	1.41e-02 1.62e-02	6.19e-04 7.08e-04	9.31e-04 1.07e-03

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for S (Z= 16)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.00	4.28e-01 1.55e+00	-	-	-	1.98e+01 2.04e+01
1.50	1.47e-01 6.71e-01	-	-	-	6.78e+00 6.90e+00
2.00	6.76e-02 3.55e-01	-	-	-	3.12e+00 3.15e+00
2.47	3.81e-02 2.18e-01	-	-	-	1.76e+00 1.76e+00

## Element: Cl, Z= 17

Edge energy, radiation ratio and jump for Cl (Z= 17)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.200	0.202	0.270	2.822
Fluor Yield (xraylib)	0.000	0.000	0.000	0.089
Fluor Yield (Krause)	0.000	0.000	0.000	0.097
Jump Factor	4.646	1.400	1.108	9.309

XRF line energies and fractional radiative rate for Cl (Z= 17)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	2.622	2.621	2.816	2.816
Radiative rate	0.612	0.309	0.053	0.027

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	0.267	-	-	-	0.183
Radiative rate	0.540	-	-	-	1.000

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Cl (Z= 17)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
2.82	-	-	-	-
3.00	4.21e+03 4.62e+03	6.33e+03 6.95e+03	3.63e+02 3.99e+02	5.46e+02 6.00e+02
4.00	2.01e+03 2.22e+03	3.02e+03 3.34e+03	1.73e+02 1.92e+02	2.61e+02 2.88e+02
5.00	1.11e+03 1.23e+03	1.67e+03 1.86e+03	9.60e+01 1.07e+02	1.44e+02 1.60e+02
6.00	6.78e+02 7.55e+02	1.02e+03 1.14e+03	5.86e+01 6.52e+01	8.81e+01 9.80e+01
8.00	3.05e+02 3.40e+02	4.59e+02 5.12e+02	2.63e+01 2.93e+01	3.95e+01 4.41e+01
10.00	1.61e+02 1.80e+02	2.43e+02 2.71e+02	1.39e+01 1.56e+01	2.09e+01 2.34e+01
15.00	4.94e+01 5.53e+01	7.44e+01 8.33e+01	4.27e+00 4.78e+00	6.42e+00 7.18e+00
20.00	2.09e+01 2.34e+01	3.15e+01 3.53e+01	1.81e+00 2.02e+00	2.72e+00 3.04e+00
30.00	6.08e+00 6.81e+00	9.16e+00 1.03e+01	5.25e-01 5.88e-01	7.90e-01 8.85e-01
40.00	2.49e+00 2.80e+00	3.75e+00 4.21e+00	2.15e-01 2.41e-01	3.24e-01 3.63e-01
50.00	1.24e+00 1.39e+00	1.87e+00 2.09e+00	1.07e-01 1.20e-01	1.61e-01 1.81e-01
60.00	6.99e-01 7.83e-01	1.05e+00 1.18e+00	6.03e-02 6.76e-02	9.07e-02 1.02e-01
80.00	2.81e-01 3.15e-01	4.23e-01 4.74e-01	2.43e-02 2.72e-02	3.65e-02 4.09e-02
100.00	1.38e-01 1.55e-01	2.08e-01 2.33e-01	1.19e-02 1.34e-02	1.80e-02 2.01e-02
150.00	3.82e-02 4.28e-02	5.75e-02 6.45e-02	3.30e-03 3.70e-03	4.96e-03 5.56e-03
200.00	1.55e-02 1.74e-02	2.33e-02 2.62e-02	1.34e-03 1.50e-03	2.01e-03 2.26e-03

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Cl (Z= 17)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.00	1.05e+00 3.33e+00	-	-	-	2.26e+01 2.40e+01
1.50	3.62e-01 1.47e+00	-	-	-	7.80e+00 8.18e+00
2.00	1.67e-01 7.85e-01	-	-	-	3.60e+00 3.74e+00
2.82	6.54e-02 3.57e-01	-	-	-	1.41e+00 1.45e+00

## Element: Ar, Z= 18

Edge energy, radiation ratio and jump for Ar (Z= 18)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.249	0.251	0.326	3.206
Fluor Yield (xraylib)	0.000	0.000	0.000	0.118
Fluor Yield (Krause)	0.000	0.000	0.000	0.118
Jump Factor	4.183	1.400	1.111	9.054

XRF line energies and fractional radiative rate for Ar (Z= 18)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	2.958	2.956	3.190	3.190
Radiative rate	0.599	0.303	0.065	0.033

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	0.311	-	-	-	0.220
Radiative rate	0.579	-	-	-	1.000



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Ar (Z= 18)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
3.21	-	-	-	-
4.00	3.15e+03 3.19e+03	4.74e+03 4.80e+03	3.43e+02 3.47e+02	5.16e+02 5.23e+02
5.00	1.76e+03 1.79e+03	2.64e+03 2.69e+03	1.91e+02 1.95e+02	2.88e+02 2.93e+02
6.00	1.08e+03 1.10e+03	1.62e+03 1.65e+03	1.17e+02 1.20e+02	1.76e+02 1.80e+02
8.00	4.88e+02 4.99e+02	7.34e+02 7.52e+02	5.32e+01 5.44e+01	8.00e+01 8.18e+01
10.00	2.60e+02 2.66e+02	3.91e+02 4.01e+02	2.83e+01 2.91e+01	4.26e+01 4.37e+01
15.00	8.03e+01 8.26e+01	1.21e+02 1.24e+02	8.76e+00 9.00e+00	1.32e+01 1.35e+01
20.00	3.42e+01 3.52e+01	5.15e+01 5.30e+01	3.73e+00 3.84e+00	5.61e+00 5.77e+00
30.00	1.00e+01 1.03e+01	1.51e+01 1.55e+01	1.09e+00 1.12e+00	1.64e+00 1.69e+00
40.00	4.13e+00 4.25e+00	6.22e+00 6.40e+00	4.50e-01 4.64e-01	6.77e-01 6.97e-01
50.00	2.06e+00 2.12e+00	3.11e+00 3.20e+00	2.25e-01 2.32e-01	3.38e-01 3.48e-01
60.00	1.16e+00 1.20e+00	1.75e+00 1.81e+00	1.27e-01 1.31e-01	1.91e-01 1.97e-01
80.00	4.70e-01 4.84e-01	7.08e-01 7.29e-01	5.13e-02 5.28e-02	7.71e-02 7.94e-02
100.00	2.32e-01 2.39e-01	3.49e-01 3.60e-01	2.53e-02 2.60e-02	3.80e-02 3.92e-02
150.00	6.44e-02 6.63e-02	9.69e-02 9.98e-02	7.02e-03 7.23e-03	1.06e-02 1.09e-02
200.00	2.62e-02 2.70e-02	3.94e-02 4.06e-02	2.86e-03 2.94e-03	4.29e-03 4.42e-03

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Ar (Z= 18)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.00	2.20e+00 6.13e+00	-	-	-	2.56e+01 2.77e+01
1.50	7.62e-01 2.75e+00	-	-	-	8.86e+00 9.48e+00
2.00	3.52e-01 1.49e+00	-	-	-	4.10e+00 4.35e+00
3.00	1.16e-01 5.94e-01	-	-	-	1.35e+00 1.42e+00
3.20	9.74e-02 5.10e-01	-	-	-	1.13e+00 1.19e+00

## Element: K , Z= 19

Edge energy, radiation ratio and jump for K (Z= 19)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.294	0.296	0.377	3.607
Fluor Yield (xraylib)	0.000	0.000	0.000	0.132
Fluor Yield (Krause)	0.000	0.000	0.000	0.140
Jump Factor	10.980	1.400	1.114	9.163

XRF line energies and fractional radiative rate for K (Z= 19)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	3.314	3.311	3.590	3.590
Radiative rate	0.592	0.299	0.072	0.036

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	0.362	-	-	-	0.260
Radiative rate	0.601	-	-	-	0.950

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for K (Z= 19)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
3.61	-	-	-	-
4.00	4.18e+03 4.45e+03	6.29e+03 6.69e+03	5.06e+02 5.39e+02	7.62e+02 8.11e+02
5.00	2.34e+03 2.50e+03	3.52e+03 3.77e+03	2.84e+02 3.03e+02	4.27e+02 4.57e+02
6.00	1.44e+03 1.55e+03	2.17e+03 2.33e+03	1.75e+02 1.88e+02	2.63e+02 2.83e+02
8.00	6.59e+02 7.11e+02	9.93e+02 1.07e+03	7.99e+01 8.62e+01	1.20e+02 1.30e+02
10.00	3.53e+02 3.82e+02	5.32e+02 5.75e+02	4.28e+01 4.63e+01	6.45e+01 6.97e+01
15.00	1.10e+02 1.20e+02	1.66e+02 1.80e+02	1.34e+01 1.45e+01	2.01e+01 2.18e+01
20.00	4.73e+01 5.13e+01	7.12e+01 7.72e+01	5.73e+00 6.22e+00	8.63e+00 9.36e+00
30.00	1.40e+01 1.52e+01	2.10e+01 2.28e+01	1.69e+00 1.84e+00	2.55e+00 2.77e+00
40.00	5.78e+00 6.28e+00	8.70e+00 9.45e+00	7.00e-01 7.61e-01	1.05e+00 1.15e+00
50.00	2.89e+00 3.15e+00	4.36e+00 4.74e+00	3.51e-01 3.81e-01	5.28e-01 5.74e-01
60.00	1.64e+00 1.78e+00	2.47e+00 2.68e+00	1.99e-01 2.16e-01	2.99e-01 3.25e-01
80.00	6.64e-01 7.22e-01	1.00e-00 1.09e+00	8.05e-02 8.75e-02	1.21e-01 1.32e-01
100.00	3.29e-01 3.57e-01	4.95e-01 5.38e-01	3.98e-02 4.33e-02	5.99e-02 6.52e-02
150.00	9.16e-02 9.95e-02	1.38e-01 1.50e-01	1.11e-02 1.21e-02	1.67e-02 1.82e-02
200.00	3.73e-02 4.06e-02	5.62e-02 6.11e-02	4.53e-03 4.92e-03	6.81e-03 7.41e-03

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for K (Z= 19)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.00	3.89e+00 9.61e+00	-	-	-	4.36e+01 3.99e+01
1.50	1.36e+00 4.39e+00	-	-	-	1.52e+01 1.38e+01
2.00	6.30e-01 2.41e+00	-	-	-	7.06e+00 6.34e+00
3.00	2.09e-01 9.75e-01	-	-	-	2.34e+00 2.08e+00
3.60	1.26e-01 6.35e-01	-	-	-	1.41e+00 1.25e+00

## Element: Ca, Z= 20

Edge energy, radiation ratio and jump for Ca (Z= 20)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.346	0.350	0.438	4.038
Fluor Yield (xraylib)	0.000	0.000	0.000	0.151
Fluor Yield (Krause)	0.000	0.000	0.000	0.163
Jump Factor	5.811	1.400	1.117	8.744

XRF line energies and fractional radiative rate for Ca (Z= 20)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	3.692	3.688	4.013	4.013
Radiative rate	0.587	0.297	0.077	0.039

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	0.416	0.345	-	0.341	0.303
Radiative rate	0.614	-	-	-	0.880

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Ca (Z= 20)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
4.04	-	-	-	-
5.00	3.14e+03 3.42e+03	4.72e+03 5.14e+03	4.13e+02 4.50e+02	6.22e+02 6.77e+02
6.00	1.94e+03 2.12e+03	2.92e+03 3.19e+03	2.56e+02 2.79e+02	3.85e+02 4.20e+02
8.00	8.95e+02 9.84e+02	1.35e+03 1.48e+03	1.18e+02 1.30e+02	1.77e+02 1.95e+02
10.00	4.83e+02 5.32e+02	7.27e+02 8.01e+02	6.36e+01 7.01e+01	9.56e+01 1.05e+02
15.00	1.52e+02 1.68e+02	2.29e+02 2.53e+02	2.00e+01 2.21e+01	3.01e+01 3.33e+01
20.00	6.55e+01 7.25e+01	9.87e+01 1.09e+02	8.63e+00 9.55e+00	1.30e+01 1.44e+01
30.00	1.95e+01 2.16e+01	2.93e+01 3.25e+01	2.57e+00 2.84e+00	3.86e+00 4.28e+00
40.00	8.10e+00 8.99e+00	1.22e+01 1.35e+01	1.07e+00 1.18e+00	1.61e+00 1.78e+00
50.00	4.07e+00 4.52e+00	6.14e+00 6.80e+00	5.37e-01 5.95e-01	8.07e-01 8.95e-01
60.00	2.31e+00 2.56e+00	3.48e+00 3.86e+00	3.05e-01 3.38e-01	4.58e-01 5.08e-01
80.00	9.40e-01 1.04e+00	1.42e+00 1.57e+00	1.24e-01 1.37e-01	1.86e-01 2.07e-01
100.00	4.66e-01 5.17e-01	7.02e-01 7.79e-01	6.14e-02 6.82e-02	9.24e-02 1.03e-01
150.00	1.31e-01 1.45e-01	1.97e-01 2.18e-01	1.72e-02 1.91e-02	2.59e-02 2.87e-02
200.00	5.34e-02 5.92e-02	8.04e-02 8.92e-02	7.03e-03 7.80e-03	1.06e-02 1.17e-02

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Ca (Z= 20)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.00	6.45e+00 1.42e+01	-	-	-	5.58e+01 5.49e+01
1.50	2.27e+00 6.60e+00	-	-	-	1.96e+01 1.91e+01
2.00	1.06e+00 3.66e+00	-	-	-	9.14e+00 8.79e+00
3.00	3.52e-01 1.50e+00	-	-	-	3.04e+00 2.89e+00
4.00	1.59e-01 7.70e-01	-	-	-	1.37e+00 1.29e+00
4.03	1.55e-01 7.55e-01	-	-	-	1.34e+00 1.26e+00

## Element: Sc, Z= 21

Edge energy, radiation ratio and jump for Sc (Z= 21)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.402	0.407	0.500	4.493
Fluor Yield (xraylib)	0.001	0.001	0.000	0.211
Fluor Yield (Krause)	0.001	0.001	0.000	0.188
Jump Factor	5.007	1.400	1.119	8.551

XRF line energies and fractional radiative rate for Sc (Z= 21)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	4.091	4.086	4.460	4.460
Radiative rate	0.586	0.296	0.078	0.040

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	0.471	0.400	-	0.395	0.348
Radiative rate	0.621	0.515	-	0.456	0.400

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Sc (Z= 21)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
4.49	-	-	-	-
5.00	5.13e+03 4.59e+03	7.71e+03 6.91e+03	6.85e+02 6.14e+02	1.03e+03 9.24e+02
6.00	3.19e+03 2.88e+03	4.81e+03 4.33e+03	4.27e+02 3.84e+02	6.43e+02 5.79e+02
8.00	1.48e+03 1.34e+03	2.23e+03 2.02e+03	1.98e+02 1.79e+02	2.98e+02 2.70e+02
10.00	8.03e+02 7.30e+02	1.21e+03 1.10e+03	1.07e+02 9.75e+01	1.62e+02 1.47e+02
15.00	2.56e+02 2.33e+02	3.85e+02 3.51e+02	3.41e+01 3.11e+01	5.14e+01 4.69e+01
20.00	1.11e+02 1.01e+02	1.67e+02 1.52e+02	1.48e+01 1.35e+01	2.23e+01 2.04e+01
30.00	3.32e+01 3.04e+01	4.99e+01 4.57e+01	4.43e+00 4.06e+00	6.67e+00 6.11e+00
40.00	1.39e+01 1.27e+01	2.09e+01 1.91e+01	1.85e+00 1.70e+00	2.79e+00 2.55e+00
50.00	6.99e+00 6.40e+00	1.05e+01 9.64e+00	9.34e-01 8.56e-01	1.41e+00 1.29e+00
60.00	3.98e+00 3.64e+00	5.99e+00 5.48e+00	5.31e-01 4.87e-01	8.00e-01 7.33e-01
80.00	1.62e+00 1.49e+00	2.44e+00 2.24e+00	2.17e-01 1.99e-01	3.26e-01 2.99e-01
100.00	8.07e-01 7.40e-01	1.22e+00 1.11e+00	1.08e-01 9.89e-02	1.62e-01 1.49e-01
150.00	2.27e-01 2.08e-01	3.42e-01 3.13e-01	3.03e-02 2.78e-02	4.57e-02 4.18e-02
200.00	9.30e-02 8.53e-02	1.40e-01 1.28e-01	1.24e-02 1.14e-02	1.87e-02 1.72e-02

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Sc (Z= 21)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.00	1.01e+01 1.99e+01	4.87e+01 5.05e+01	-	8.61e+01 8.72e+01	7.54e+01 7.64e+01
1.50	3.58e+00 9.45e+00	1.73e+01 1.77e+01	-	3.05e+01 3.04e+01	2.67e+01 2.67e+01
2.00	1.67e+00 5.30e+00	8.08e+00 8.22e+00	-	1.43e+01 1.41e+01	1.25e+01 1.23e+01
3.00	5.59e-01 2.21e+00	2.70e+00 2.71e+00	-	4.77e+00 4.63e+00	4.18e+00 4.06e+00
4.00	2.53e-01 1.14e+00	1.22e+00 1.22e+00	-	2.16e+00 2.08e+00	1.89e+00 1.82e+00
4.49	1.84e-01 8.71e-01	8.86e-01 8.82e-01	-	1.57e+00 1.50e+00	1.37e+00 1.32e+00

## Element: Ti, Z= 22

Edge energy, radiation ratio and jump for Ti (Z= 22)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.456	0.461	0.564	4.966
Fluor Yield (xraylib)	0.002	0.001	0.000	0.208
Fluor Yield (Krause)	0.002	0.002	0.000	0.214
Jump Factor	4.592	1.400	1.122	8.366

XRF line energies and fractional radiative rate for Ti (Z= 22)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	4.511	4.505	4.932	4.932
Radiative rate	0.584	0.296	0.079	0.040

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	0.530	0.458	-	0.452	0.395
Radiative rate	0.625	0.708	-	0.629	0.245



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Ti (Z= 22)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
4.97	-	-	-	-
5.00	5.80e+03 5.98e+03	8.75e+03 9.01e+03	7.88e+02 8.12e+02	1.19e+03 1.22e+03
6.00	3.67e+03 3.80e+03	5.53e+03 5.73e+03	4.98e+02 5.16e+02	7.49e+02 7.77e+02
8.00	1.71e+03 1.79e+03	2.58e+03 2.69e+03	2.32e+02 2.43e+02	3.50e+02 3.65e+02
10.00	9.33e+02 9.78e+02	1.41e+03 1.47e+03	1.27e+02 1.33e+02	1.91e+02 2.00e+02
15.00	2.99e+02 3.15e+02	4.51e+02 4.75e+02	4.06e+01 4.28e+01	6.12e+01 6.44e+01
20.00	1.30e+02 1.38e+02	1.97e+02 2.08e+02	1.77e+01 1.87e+01	2.67e+01 2.81e+01
30.00	3.93e+01 4.16e+01	5.93e+01 6.27e+01	5.34e+00 5.65e+00	8.04e+00 8.50e+00
40.00	1.65e+01 1.75e+01	2.49e+01 2.63e+01	2.24e+00 2.37e+00	3.37e+00 3.57e+00
50.00	8.36e+00 8.84e+00	1.26e+01 1.33e+01	1.13e+00 1.20e+00	1.71e+00 1.81e+00
60.00	4.77e+00 5.04e+00	7.18e+00 7.61e+00	6.47e-01 6.85e-01	9.74e-01 1.03e+00
80.00	1.95e+00 2.07e+00	2.94e+00 3.12e+00	2.65e-01 2.81e-01	3.99e-01 4.22e-01
100.00	9.73e-01 1.03e+00	1.47e+00 1.55e+00	1.32e-01 1.40e-01	1.99e-01 2.11e-01
150.00	2.75e-01 2.91e-01	4.14e-01 4.39e-01	3.73e-02 3.95e-02	5.62e-02 5.95e-02
200.00	1.13e-01 1.20e-01	1.70e-01 1.80e-01	1.53e-02 1.62e-02	2.31e-02 2.44e-02

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Ti (Z= 22)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.00	1.49e+01 2.63e+01	7.90e+01 1.48e+02	-	2.47e+02 2.55e+02	9.64e+01 9.94e+01
1.50	5.30e+00 1.28e+01	2.82e+01 5.23e+01	-	8.83e+01 8.96e+01	3.44e+01 3.49e+01
2.00	2.49e+00 7.25e+00	1.32e+01 2.44e+01	-	4.15e+01 4.16e+01	1.61e+01 1.62e+01
3.00	8.35e-01 3.07e+00	4.44e+00 8.08e+00	-	1.39e+01 1.37e+01	5.42e+00 5.34e+00
4.00	3.79e-01 1.60e+00	2.01e+00 3.63e+00	-	6.31e+00 6.16e+00	2.46e+00 2.40e+00
4.96	2.08e-01 9.64e-01	1.11e+00 1.99e+00	-	3.46e+00 3.36e+00	1.35e+00 1.31e+00

## Element: V , Z= 23

Edge energy, radiation ratio and jump for V (Z= 23)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.513	0.521	0.628	5.465
Fluor Yield (xraylib)	0.003	0.001	0.001	0.249
Fluor Yield (Krause)	0.003	0.003	0.001	0.243
Jump Factor	4.073	1.400	1.124	8.242

XRF line energies and fractional radiative rate for V (Z= 23)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	4.952	4.945	5.427	5.427
Radiative rate	0.583	0.296	0.080	0.040

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	0.585	0.519	-	0.511	0.446
Radiative rate	0.628	0.800	-	0.715	0.172

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for V (Z= 23)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
5.47	-	-	-	-
6.00	5.04e+03 4.95e+03	7.60e+03 7.46e+03	6.91e+02 6.77e+02	1.04e+03 1.02e+03
8.00	2.38e+03 2.35e+03	3.59e+03 3.55e+03	3.26e+02 3.22e+02	4.90e+02 4.85e+02
10.00	1.30e+03 1.29e+03	1.96e+03 1.95e+03	1.78e+02 1.77e+02	2.68e+02 2.67e+02
15.00	4.22e+02 4.22e+02	6.37e+02 6.36e+02	5.78e+01 5.78e+01	8.70e+01 8.69e+01
20.00	1.85e+02 1.85e+02	2.79e+02 2.79e+02	2.53e+01 2.54e+01	3.81e+01 3.82e+01
30.00	5.62e+01 5.64e+01	8.48e+01 8.50e+01	7.70e+00 7.72e+00	1.16e+01 1.16e+01
40.00	2.37e+01 2.38e+01	3.58e+01 3.59e+01	3.25e+00 3.26e+00	4.89e+00 4.90e+00
50.00	1.20e+01 1.21e+01	1.81e+01 1.82e+01	1.65e+00 1.65e+00	2.48e+00 2.49e+00
60.00	6.88e+00 6.91e+00	1.04e+01 1.04e+01	9.42e-01 9.46e-01	1.42e+00 1.42e+00
80.00	2.83e+00 2.84e+00	4.26e+00 4.28e+00	3.87e-01 3.89e-01	5.82e-01 5.85e-01
100.00	1.41e+00 1.42e+00	2.13e+00 2.14e+00	1.94e-01 1.95e-01	2.91e-01 2.93e-01
150.00	4.01e-01 4.02e-01	6.04e-01 6.07e-01	5.49e-02 5.51e-02	8.25e-02 8.29e-02
200.00	1.65e-01 1.66e-01	2.49e-01 2.50e-01	2.26e-02 2.27e-02	3.40e-02 3.42e-02

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for V (Z= 23)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.00	2.20e+01 3.53e+01	1.52e+02 3.41e+02	-	5.54e+02 5.90e+02	1.33e+02 1.42e+02
1.50	7.94e+00 1.75e+01	5.48e+01 1.22e+02	-	2.00e+02 2.09e+02	4.81e+01 5.03e+01
2.00	3.74e+00 1.00e+01	2.58e+01 5.71e+01	-	9.42e+01 9.74e+01	2.27e+01 2.34e+01
3.00	1.26e+00 4.31e+00	8.70e+00 1.90e+01	-	3.17e+01 3.22e+01	7.64e+00 7.75e+00
4.00	5.73e-01 2.27e+00	3.96e+00 8.58e+00	-	1.44e+01 1.45e+01	3.47e+00 3.48e+00
5.00	3.09e-01 1.35e+00	2.13e+00 4.59e+00	-	7.77e+00 7.72e+00	1.87e+00 1.86e+00
5.46	2.41e-01 1.10e+00	1.67e+00 3.58e+00	-	6.07e+00 6.01e+00	1.46e+00 1.45e+00

## Element: Cr, Z= 24

Edge energy, radiation ratio and jump for Cr (Z= 24)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.575	0.584	0.695	5.989
Fluor Yield (xraylib)	0.004	0.002	0.001	0.281
Fluor Yield (Krause)	0.004	0.004	0.001	0.275
Jump Factor	5.000	1.400	1.126	8.045

XRF line energies and fractional radiative rate for Cr (Z= 24)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	5.415	5.406	5.947	5.947
Radiative rate	0.585	0.298	0.078	0.040

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	0.654	0.583	-	0.573	0.500
Radiative rate	0.630	0.872	-	0.778	0.120

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Cr (Z= 24)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
5.99	-	-	-	-
6.00	6.39e+03 6.25e+03	9.64e+03 9.44e+03	8.55e+02 8.38e+02	1.29e+03 1.26e+03
8.00	3.10e+03 3.08e+03	4.68e+03 4.64e+03	4.16e+02 4.12e+02	6.27e+02 6.21e+02
10.00	1.71e+03 1.70e+03	2.58e+03 2.57e+03	2.29e+02 2.28e+02	3.45e+02 3.43e+02
15.00	5.58e+02 5.60e+02	8.42e+02 8.44e+02	7.48e+01 7.50e+01	1.13e+02 1.13e+02
20.00	2.46e+02 2.47e+02	3.71e+02 3.73e+02	3.29e+01 3.31e+01	4.97e+01 4.99e+01
30.00	7.52e+01 7.58e+01	1.13e+02 1.14e+02	1.01e+01 1.01e+01	1.52e+01 1.53e+01
40.00	3.18e+01 3.21e+01	4.81e+01 4.85e+01	4.27e+00 4.30e+00	6.43e+00 6.49e+00
50.00	1.62e+01 1.64e+01	2.45e+01 2.47e+01	2.17e+00 2.19e+00	3.28e+00 3.30e+00
60.00	9.29e+00 9.38e+00	1.40e+01 1.42e+01	1.24e+00 1.26e+00	1.88e+00 1.89e+00
80.00	3.83e+00 3.87e+00	5.78e+00 5.84e+00	5.13e-01 5.18e-01	7.74e-01 7.81e-01
100.00	1.92e+00 1.94e+00	2.90e+00 2.93e+00	2.57e-01 2.60e-01	3.88e-01 3.91e-01
150.00	5.46e-01 5.52e-01	8.24e-01 8.33e-01	7.32e-02 7.39e-02	1.10e-01 1.11e-01
200.00	2.26e-01 2.28e-01	3.41e-01 3.44e-01	3.02e-02 3.05e-02	4.56e-02 4.60e-02

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Cr (Z= 24)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.00	3.19e+01 4.62e+01	2.57e+02 6.17e+02	-	1.05e+03 1.06e+03	1.62e+02 1.64e+02
1.50	1.16e+01 2.35e+01	9.35e+01 2.23e+02	-	3.82e+02 3.81e+02	5.89e+01 5.87e+01
2.00	5.49e+00 1.36e+01	4.43e+01 1.05e+02	-	1.81e+02 1.78e+02	2.79e+01 2.74e+01
3.00	1.86e+00 5.94e+00	1.50e+01 3.51e+01	-	6.12e+01 5.91e+01	9.44e+00 9.11e+00
4.00	8.45e-01 3.16e+00	6.82e+00 1.59e+01	-	2.79e+01 2.65e+01	4.30e+00 4.09e+00
5.00	4.56e-01 1.89e+00	3.67e+00 8.51e+00	-	1.50e+01 1.42e+01	2.32e+00 2.18e+00
5.98	2.76e-01 1.24e+00	2.22e+00 5.13e+00	-	9.09e+00 8.51e+00	1.40e+00 1.31e+00

## Element: Mn, Z= 25

Edge energy, radiation ratio and jump for Mn (Z= 25)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.640	0.651	0.769	6.539
Fluor Yield (xraylib)	0.005	0.002	0.001	0.320
Fluor Yield (Krause)	0.005	0.005	0.001	0.308
Jump Factor	3.306	1.400	1.127	7.999

XRF line energies and fractional radiative rate for Mn (Z= 25)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	5.899	5.888	6.491	6.491
Radiative rate	0.582	0.297	0.081	0.041

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	0.721	0.649	-	0.637	0.556
Radiative rate	0.632	0.888	-	0.793	0.105

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Mn (Z= 25)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
6.54	-	-	-	-
8.00	4.04e+03 3.92e+03	6.10e+03 5.92e+03	5.61e+02 5.44e+02	8.45e+02 8.21e+02
10.00	2.23e+03 2.18e+03	3.37e+03 3.29e+03	3.10e+02 3.02e+02	4.67e+02 4.56e+02
15.00	7.35e+02 7.23e+02	1.11e+03 1.09e+03	1.02e+02 1.00e+02	1.54e+02 1.51e+02
20.00	3.26e+02 3.22e+02	4.92e+02 4.86e+02	4.52e+01 4.46e+01	6.82e+01 6.73e+01
30.00	1.00e+02 9.93e+01	1.52e+02 1.50e+02	1.39e+01 1.38e+01	2.10e+01 2.08e+01
40.00	4.27e+01 4.23e+01	6.44e+01 6.38e+01	5.92e+00 5.86e+00	8.93e+00 8.84e+00
50.00	2.18e+01 2.16e+01	3.29e+01 3.26e+01	3.02e+00 3.00e+00	4.56e+00 4.52e+00
60.00	1.25e+01 1.24e+01	1.89e+01 1.87e+01	1.74e+00 1.72e+00	2.62e+00 2.60e+00
80.00	5.18e+00 5.14e+00	7.82e+00 7.76e+00	7.19e-01 7.13e-01	1.08e+00 1.07e+00
100.00	2.60e+00 2.58e+00	3.93e+00 3.90e+00	3.61e-01 3.58e-01	5.44e-01 5.40e-01
150.00	7.43e-01 7.37e-01	1.12e+00 1.11e+00	1.03e-01 1.02e-01	1.55e-01 1.54e-01
200.00	3.08e-01 3.05e-01	4.65e-01 4.61e-01	4.27e-02 4.23e-02	6.44e-02 6.39e-02

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Mn (Z= 25)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.00	4.42e+01 5.84e+01	3.95e+02 9.71e+02	-	1.48e+03 1.69e+03	1.97e+02 2.24e+02
1.50	1.63e+01 3.01e+01	1.46e+02 3.56e+02	-	5.47e+02 6.14e+02	7.24e+01 8.13e+01
2.00	7.75e+00 1.77e+01	6.93e+01 1.68e+02	-	2.60e+02 2.89e+02	3.44e+01 3.82e+01
3.00	2.63e+00 7.84e+00	2.36e+01 5.64e+01	-	8.85e+01 9.65e+01	1.17e+01 1.28e+01
4.00	1.20e+00 4.21e+00	1.08e+01 2.55e+01	-	4.04e+01 4.35e+01	5.35e+00 5.76e+00
5.00	6.50e-01 2.54e+00	5.81e+00 1.37e+01	-	2.18e+01 2.33e+01	2.89e+00 3.08e+00
6.00	3.91e-01 1.66e+00	3.50e+00 8.17e+00	-	1.31e+01 1.39e+01	1.74e+00 1.84e+00
6.53	3.08e-01 1.35e+00	2.75e+00 6.42e+00	-	1.03e+01 1.09e+01	1.37e+00 1.45e+00

## Element: Fe, Z= 26

Edge energy, radiation ratio and jump for Fe (Z= 26)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.708	0.721	0.846	7.112
Fluor Yield (xraylib)	0.006	0.002	0.001	0.336
Fluor Yield (Krause)	0.006	0.006	0.001	0.340
Jump Factor	3.099	1.400	1.129	7.893

XRF line energies and fractional radiative rate for Fe (Z= 26)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	6.404	6.391	7.058	7.058
Radiative rate	0.581	0.297	0.081	0.041

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	0.792	0.718	-	0.705	0.615
Radiative rate	0.632	0.910	-	0.814	0.086



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Fe (Z= 26)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
7.11	-	-	-	-
8.00	4.81e+03 4.89e+03	7.26e+03 7.39e+03	6.70e+02 6.82e+02	1.01e+03 1.03e+03
10.00	2.68e+03 2.74e+03	4.05e+03 4.15e+03	3.73e+02 3.83e+02	5.63e+02 5.77e+02
15.00	8.89e+02 9.18e+02	1.34e+03 1.39e+03	1.24e+02 1.28e+02	1.87e+02 1.93e+02
20.00	3.96e+02 4.11e+02	5.98e+02 6.20e+02	5.52e+01 5.72e+01	8.32e+01 8.63e+01
30.00	1.23e+02 1.28e+02	1.85e+02 1.93e+02	1.71e+01 1.78e+01	2.58e+01 2.68e+01
40.00	5.24e+01 5.46e+01	7.92e+01 8.25e+01	7.31e+00 7.61e+00	1.10e+01 1.15e+01
50.00	2.68e+01 2.80e+01	4.05e+01 4.23e+01	3.74e+00 3.90e+00	5.64e+00 5.88e+00
60.00	1.55e+01 1.61e+01	2.34e+01 2.43e+01	2.15e+00 2.25e+00	3.25e+00 3.39e+00
80.00	6.42e+00 6.69e+00	9.70e+00 1.01e+01	8.95e-01 9.33e-01	1.35e+00 1.41e+00
100.00	3.23e+00 3.37e+00	4.88e+00 5.09e+00	4.51e-01 4.70e-01	6.79e-01 7.08e-01
150.00	9.27e-01 9.67e-01	1.40e+00 1.46e+00	1.29e-01 1.35e-01	1.95e-01 2.03e-01
200.00	3.85e-01 4.01e-01	5.81e-01 6.06e-01	5.36e-02 5.59e-02	8.08e-02 8.43e-02

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Fe (Z= 26)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.00	6.08e+01 7.40e+01	5.29e+02 1.43e+03	-	2.13e+03 2.49e+03	2.24e+02 2.62e+02
1.50	2.27e+01 3.88e+01	1.98e+02 5.33e+02	-	7.97e+02 9.17e+02	8.39e+01 9.66e+01
2.00	1.09e+01 2.31e+01	9.45e+01 2.53e+02	-	3.81e+02 4.33e+02	4.01e+01 4.56e+01
3.00	3.71e+00 1.03e+01	3.23e+01 8.54e+01	-	1.30e+02 1.45e+02	1.37e+01 1.53e+01
4.00	1.70e+00 5.60e+00	1.48e+01 3.88e+01	-	5.96e+01 6.56e+01	6.27e+00 6.91e+00
5.00	9.20e-01 3.40e+00	8.00e+00 2.08e+01	-	3.22e+01 3.51e+01	3.40e+00 3.70e+00
6.00	5.54e-01 2.23e+00	4.82e+00 1.25e+01	-	1.94e+01 2.10e+01	2.04e+00 2.21e+00
7.11	3.45e-01 1.49e+00	3.00e+00 7.71e+00	-	1.21e+01 1.30e+01	1.27e+00 1.37e+00

## Element: Co, Z= 27

Edge energy, radiation ratio and jump for Co (Z= 27)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.779	0.794	0.926	7.709
Fluor Yield (xraylib)	0.008	0.003	0.001	0.368
Fluor Yield (Krause)	0.008	0.008	0.001	0.373
Jump Factor	2.773	1.400	1.130	7.796

XRF line energies and fractional radiative rate for Co (Z= 27)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	6.930	6.916	7.649	7.649
Radiative rate	0.581	0.297	0.081	0.041

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	0.866	0.791	-	0.776	0.678
Radiative rate	0.633	0.925	-	0.828	0.073

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Co (Z= 27)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
7.71	-	-	-	-
8.00	5.89e+03 5.98e+03	8.90e+03 9.04e+03	8.24e+02 8.37e+02	1.24e+03 1.26e+03
10.00	3.33e+03 3.41e+03	5.04e+03 5.16e+03	4.66e+02 4.77e+02	7.00e+02 7.17e+02
15.00	1.11e+03 1.15e+03	1.68e+03 1.74e+03	1.56e+02 1.61e+02	2.34e+02 2.42e+02
20.00	4.99e+02 5.18e+02	7.54e+02 7.83e+02	6.98e+01 7.24e+01	1.05e+02 1.09e+02
30.00	1.56e+02 1.62e+02	2.35e+02 2.45e+02	2.18e+01 2.27e+01	3.27e+01 3.41e+01
40.00	6.67e+01 6.96e+01	1.01e+02 1.05e+02	9.33e+00 9.74e+00	1.40e+01 1.46e+01
50.00	3.43e+01 3.58e+01	5.18e+01 5.41e+01	4.80e+00 5.00e+00	7.20e+00 7.52e+00
60.00	1.98e+01 2.07e+01	2.99e+01 3.12e+01	2.77e+00 2.89e+00	4.16e+00 4.34e+00
80.00	8.24e+00 8.61e+00	1.25e+01 1.30e+01	1.15e+00 1.20e+00	1.73e+00 1.81e+00
100.00	4.16e+00 4.35e+00	6.28e+00 6.57e+00	5.82e-01 6.08e-01	8.74e-01 9.13e-01
150.00	1.20e+00 1.25e+00	1.81e+00 1.89e+00	1.67e-01 1.75e-01	2.52e-01 2.63e-01
200.00	4.98e-01 5.21e-01	7.52e-01 7.87e-01	6.96e-02 7.28e-02	1.05e-01 1.09e-01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Co (Z= 27)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.00	8.39e+01 9.34e+01	7.64e+02 2.02e+03	-	2.86e+03 3.51e+03	2.52e+02 3.08e+02
1.50	3.16e+01 4.98e+01	2.88e+02 7.60e+02	-	1.08e+03 1.30e+03	9.50e+01 1.15e+02
2.00	1.52e+01 3.00e+01	1.39e+02 3.63e+02	-	5.19e+02 6.20e+02	4.57e+01 5.45e+01
3.00	5.22e+00 1.36e+01	4.76e+01 1.23e+02	-	1.78e+02 2.09e+02	1.57e+01 1.84e+01
4.00	2.40e+00 7.45e+00	2.19e+01 5.62e+01	-	8.19e+01 9.45e+01	7.21e+00 8.32e+00
5.00	1.30e+00 4.55e+00	1.18e+01 3.02e+01	-	4.44e+01 5.06e+01	3.91e+00 4.46e+00
6.00	7.84e-01 3.00e+00	7.14e+00 1.81e+01	-	2.68e+01 3.03e+01	2.35e+00 2.66e+00
7.70	3.89e-01 1.66e+00	3.55e+00 8.92e+00	-	1.33e+01 1.49e+01	1.17e+00 1.31e+00

## Element: Ni, Z= 28

Edge energy, radiation ratio and jump for Ni (Z= 28)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.855	0.872	1.008	8.333
Fluor Yield (xraylib)	0.009	0.004	0.001	0.410
Fluor Yield (Krause)	0.009	0.009	0.001	0.406
Jump Factor	2.614	1.400	1.132	7.707

XRF line energies and fractional radiative rate for Ni (Z= 28)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	7.478	7.461	8.265	8.265
Radiative rate	0.580	0.297	0.081	0.041

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	0.941	0.869	-	0.851	0.743
Radiative rate	0.634	0.935	-	0.838	0.063

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Ni (Z= 28)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
8.33	-	-	-	-
10.00	4.18e+03 4.18e+03	6.33e+03 6.32e+03	5.87e+02 5.87e+02	8.87e+02 8.86e+02
15.00	1.41e+03 1.42e+03	2.13e+03 2.15e+03	1.98e+02 1.99e+02	2.98e+02 3.01e+02
20.00	6.35e+02 6.43e+02	9.60e+02 9.73e+02	8.91e+01 9.03e+01	1.35e+02 1.36e+02
30.00	1.99e+02 2.03e+02	3.01e+02 3.07e+02	2.80e+01 2.85e+01	4.22e+01 4.30e+01
40.00	8.58e+01 8.75e+01	1.30e+02 1.32e+02	1.20e+01 1.23e+01	1.82e+01 1.85e+01
50.00	4.42e+01 4.51e+01	6.69e+01 6.82e+01	6.21e+00 6.33e+00	9.37e+00 9.56e+00
60.00	2.56e+01 2.61e+01	3.86e+01 3.95e+01	3.59e+00 3.66e+00	5.42e+00 5.53e+00
80.00	1.07e+01 1.09e+01	1.62e+01 1.65e+01	1.50e+00 1.53e+00	2.26e+00 2.31e+00
100.00	5.40e+00 5.52e+00	8.17e+00 8.35e+00	7.59e-01 7.75e-01	1.15e+00 1.17e+00
150.00	1.56e+00 1.60e+00	2.36e+00 2.41e+00	2.19e-01 2.24e-01	3.31e-01 3.38e-01
200.00	6.51e-01 6.65e-01	9.85e-01 1.01e+00	9.14e-02 9.34e-02	1.38e-01 1.41e-01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Ni (Z= 28)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.00	-	8.97e+02 2.27e+03	-	3.36e+03 4.36e+03	2.53e+02 3.28e+02
1.50	4.26e+01 6.16e+01	3.88e+02 9.78e+02	-	1.48e+03 1.84e+03	1.12e+02 1.38e+02
2.00	2.06e+01 3.77e+01	1.87e+02 4.71e+02	-	7.17e+02 8.78e+02	5.39e+01 6.61e+01
3.00	7.11e+00 1.74e+01	6.47e+01 1.61e+02	-	2.47e+02 2.97e+02	1.86e+01 2.24e+01
4.00	3.27e+00 9.59e+00	2.98e+01 7.35e+01	-	1.14e+02 1.35e+02	8.57e+00 1.01e+01
5.00	1.78e+00 5.90e+00	1.62e+01 3.96e+01	-	6.18e+01 7.23e+01	4.65e+00 5.44e+00
6.00	1.07e+00 3.91e+00	9.76e+00 2.38e+01	-	3.73e+01 4.33e+01	2.81e+00 3.25e+00
8.00	4.80e-01 1.99e+00	4.37e+00 1.05e+01	-	1.67e+01 1.91e+01	1.26e+00 1.43e+00
8.33	4.29e-01 1.81e+00	3.90e+00 9.40e+00	-	1.49e+01 1.70e+01	1.12e+00 1.28e+00

## Element: Cu, Z= 29

Edge energy, radiation ratio and jump for Cu (Z= 29)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	0.931	0.951	1.096	8.979
Fluor Yield (xraylib)	0.011	0.041	0.002	0.442
Fluor Yield (Krause)	0.011	0.010	0.002	0.440
Jump Factor	3.135	1.400	1.133	7.560

XRF line energies and fractional radiative rate for Cu (Z= 29)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	8.048	8.028	8.905	8.905
Radiative rate	0.581	0.298	0.080	0.041

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	1.023	0.950	-	0.930	0.811
Radiative rate	0.632	0.946	-	0.849	0.054

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Cu (Z= 29)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
8.98	-	-	-	-
10.00	5.04e+03 5.05e+03	7.63e+03 7.65e+03	6.96e+02 6.98e+02	1.05e+03 1.05e+03
15.00	1.72e+03 1.74e+03	2.60e+03 2.64e+03	2.37e+02 2.41e+02	3.58e+02 3.64e+02
20.00	7.77e+02 7.92e+02	1.18e+03 1.20e+03	1.07e+02 1.09e+02	1.62e+02 1.65e+02
30.00	2.46e+02 2.52e+02	3.72e+02 3.81e+02	3.39e+01 3.48e+01	5.13e+01 5.25e+01
40.00	1.06e+02 1.09e+02	1.61e+02 1.65e+02	1.47e+01 1.51e+01	2.22e+01 2.28e+01
50.00	5.49e+01 5.64e+01	8.30e+01 8.53e+01	7.58e+00 7.79e+00	1.15e+01 1.18e+01
60.00	3.18e+01 3.27e+01	4.81e+01 4.95e+01	4.39e+00 4.52e+00	6.64e+00 6.82e+00
80.00	1.33e+01 1.37e+01	2.02e+01 2.08e+01	1.84e+00 1.89e+00	2.78e+00 2.86e+00
100.00	6.76e+00 6.96e+00	1.02e+01 1.05e+01	9.34e-01 9.61e-01	1.41e+00 1.45e+00
150.00	1.96e+00 2.02e+00	2.97e+00 3.05e+00	2.71e-01 2.79e-01	4.09e-01 4.21e-01
200.00	8.20e-01 8.44e-01	1.24e+00 1.28e+00	1.13e-01 1.17e-01	1.71e-01 1.76e-01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Cu (Z= 29)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.00	-	1.24e+04 3.14e+03	-	5.15e+03 6.06e+03	3.27e+02 3.84e+02
1.50	5.52e+01 7.42e+01	5.19e+03 1.30e+03	-	2.18e+03 2.49e+03	1.38e+02 1.58e+02
2.00	2.69e+01 4.59e+01	2.53e+03 6.33e+02	-	1.06e+03 1.20e+03	6.73e+01 7.60e+01
3.00	9.32e+00 2.15e+01	8.76e+02 2.18e+02	-	3.68e+02 4.07e+02	2.33e+01 2.58e+01
4.00	4.30e+00 1.19e+01	4.04e+02 9.98e+01	-	1.70e+02 1.85e+02	1.08e+01 1.17e+01
5.00	2.34e+00 7.39e+00	2.20e+02 5.39e+01	-	9.23e+01 9.94e+01	5.86e+00 6.31e+00
6.00	1.42e+00 4.92e+00	1.33e+02 3.24e+01	-	5.58e+01 5.95e+01	3.54e+00 3.77e+00
8.00	6.34e-01 2.53e+00	5.95e+01 1.44e+01	-	2.50e+01 2.62e+01	1.59e+00 1.66e+00
8.97	4.58e-01 1.92e+00	4.31e+01 1.04e+01	-	1.81e+01 1.89e+01	1.15e+00 1.20e+00

## Element: Zn, Z= 30

Edge energy, radiation ratio and jump for Zn (Z= 30)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	1.020	1.043	1.194	9.659
Fluor Yield (xraylib)	0.012	0.009	0.002	0.481
Fluor Yield (Krause)	0.012	0.011	0.002	0.474
Jump Factor	2.455	1.400	1.134	7.543

XRF line energies and fractional radiative rate for Zn (Z= 30)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	8.639	8.616	9.572	9.572
Radiative rate	0.579	0.298	0.082	0.042

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	1.107	1.035	-	1.012	0.884
Radiative rate	0.631	0.951	-	0.852	0.050



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Zn (Z= 30)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
9.66	-	-	-	-
10.00	6.07e+03 5.99e+03	9.19e+03 9.08e+03	8.58e+02 8.47e+02	1.30e+03 1.28e+03
15.00	2.10e+03 2.10e+03	3.18e+03 3.18e+03	2.97e+02 2.97e+02	4.49e+02 4.49e+02
20.00	9.56e+02 9.62e+02	1.45e+03 1.46e+03	1.35e+02 1.36e+02	2.04e+02 2.05e+02
30.00	3.04e+02 3.07e+02	4.60e+02 4.66e+02	4.29e+01 4.34e+01	6.49e+01 6.57e+01
40.00	1.32e+02 1.34e+02	2.00e+02 2.02e+02	1.86e+01 1.89e+01	2.82e+01 2.86e+01
50.00	6.83e+01 6.94e+01	1.03e+02 1.05e+02	9.66e+00 9.80e+00	1.46e+01 1.48e+01
60.00	3.97e+01 4.03e+01	6.01e+01 6.10e+01	5.61e+00 5.70e+00	8.48e+00 8.61e+00
80.00	1.67e+01 1.70e+01	2.53e+01 2.57e+01	2.36e+00 2.40e+00	3.56e+00 3.62e+00
100.00	8.48e+00 8.63e+00	1.28e+01 1.31e+01	1.20e+00 1.22e+00	1.81e+00 1.84e+00
150.00	2.47e+00 2.51e+00	3.74e+00 3.80e+00	3.49e-01 3.55e-01	5.27e-01 5.36e-01
200.00	1.03e+00 1.05e+00	1.57e+00 1.59e+00	1.46e-01 1.49e-01	2.21e-01 2.25e-01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Zn (Z= 30)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.02	-	-	-	-	-
1.04	-	-	-	4.08e+03 5.44e+03	2.39e+02 3.19e+02
1.19	-	1.96e+03 2.79e+03	-	3.53e+03 5.34e+03	2.07e+02 3.13e+02
1.50	7.03e+01 8.80e+01	1.28e+03 1.60e+03	-	2.38e+03 3.05e+03	1.39e+02 1.78e+02
2.00	3.46e+01 5.50e+01	6.30e+02 7.86e+02	-	1.17e+03 1.48e+03	6.85e+01 8.68e+01
3.00	1.21e+01 2.60e+01	2.20e+02 2.72e+02	-	4.08e+02 5.08e+02	2.39e+01 2.97e+01
4.00	5.59e+00 1.46e+01	1.02e+02 1.25e+02	-	1.89e+02 2.32e+02	1.11e+01 1.36e+01
5.00	3.05e+00 9.10e+00	5.55e+01 6.76e+01	-	1.03e+02 1.25e+02	6.03e+00 7.30e+00
6.00	1.84e+00 6.09e+00	3.36e+01 4.06e+01	-	6.24e+01 7.47e+01	3.65e+00 4.37e+00
8.00	8.27e-01 3.15e+00	1.51e+01 1.80e+01	-	2.80e+01 3.30e+01	1.64e+00 1.93e+00
9.65	4.88e-01 2.01e+00	8.89e+00 1.05e+01	-	1.65e+01 1.93e+01	9.66e-01 1.13e+00

## Element: Ga, Z= 31

Edge energy, radiation ratio and jump for Ga (Z= 31)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	1.115	1.142	1.298	10.367
Fluor Yield (xraylib)	0.013	0.012	0.002	0.543
Fluor Yield (Krause)	0.013	0.012	0.002	0.507
Jump Factor	2.959	1.400	1.135	7.468

XRF line energies and fractional radiative rate for Ga (Z= 31)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	9.252	9.225	10.264	10.260
Radiative rate	0.577	0.294	0.083	0.043

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	1.197	1.125	-	1.098	0.957
Radiative rate	0.626	0.954	-	0.854	0.046

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Ga (Z= 31)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
10.37	-	-	-	-
15.00	2.65e+03 2.51e+03	4.00e+03 3.79e+03	3.82e+02 3.62e+02	5.77e+02 5.46e+02
20.00	1.21e+03 1.15e+03	1.83e+03 1.74e+03	1.75e+02 1.66e+02	2.64e+02 2.51e+02
30.00	3.87e+02 3.71e+02	5.85e+02 5.60e+02	5.58e+01 5.35e+01	8.44e+01 8.08e+01
40.00	1.69e+02 1.62e+02	2.55e+02 2.45e+02	2.43e+01 2.34e+01	3.68e+01 3.53e+01
50.00	8.76e+01 8.42e+01	1.32e+02 1.27e+02	1.26e+01 1.21e+01	1.91e+01 1.84e+01
60.00	5.10e+01 4.91e+01	7.70e+01 7.41e+01	7.36e+00 7.08e+00	1.11e+01 1.07e+01
80.00	2.15e+01 2.07e+01	3.25e+01 3.13e+01	3.10e+00 2.99e+00	4.69e+00 4.52e+00
100.00	1.10e+01 1.06e+01	1.66e+01 1.59e+01	1.58e+00 1.52e+00	2.39e+00 2.30e+00
150.00	3.20e+00 3.09e+00	4.83e+00 4.66e+00	4.62e-01 4.45e-01	6.98e-01 6.72e-01
200.00	1.34e+00 1.30e+00	2.03e+00 1.96e+00	1.94e-01 1.87e-01	2.93e-01 2.82e-01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Ga (Z= 31)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.12	-	-	-	-	-
1.14	-	-	-	4.74e+03 5.49e+03	2.57e+02 2.97e+02
1.30	-	2.41e+03 2.72e+03	-	3.94e+03 5.15e+03	2.13e+02 2.79e+02
1.50	9.22e+01 1.07e+02	1.93e+03 1.96e+03	-	3.19e+03 3.70e+03	1.73e+02 2.00e+02
2.00	4.56e+01 6.73e+01	9.53e+02 9.71e+02	-	1.58e+03 1.81e+03	8.53e+01 9.81e+01
3.00	1.60e+01 3.24e+01	3.35e+02 3.39e+02	-	5.54e+02 6.24e+02	3.00e+01 3.38e+01
4.00	7.43e+00 1.83e+01	1.55e+02 1.56e+02	-	2.57e+02 2.85e+02	1.39e+01 1.55e+01
5.00	4.05e+00 1.15e+01	8.48e+01 8.45e+01	-	1.40e+02 1.54e+02	7.60e+00 8.32e+00
6.00	2.46e+00 7.72e+00	5.14e+01 5.09e+01	-	8.51e+01 9.22e+01	4.61e+00 4.99e+00
8.00	1.11e+00 4.02e+00	2.31e+01 2.26e+01	-	3.83e+01 4.08e+01	2.07e+00 2.21e+00
10.00	5.91e-01 2.37e+00	1.24e+01 1.20e+01	-	2.04e+01 2.15e+01	1.11e+00 1.16e+00
10.36	5.34e-01 2.17e+00	1.12e+01 1.08e+01	-	1.85e+01 1.94e+01	1.00e+00 1.05e+00

## Element: Ge, Z= 32

Edge energy, radiation ratio and jump for Ge (Z= 32)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	1.217	1.248	1.414	11.103
Fluor Yield (xraylib)	0.015	0.013	0.002	0.539
Fluor Yield (Krause)	0.015	0.013	0.002	0.535
Jump Factor	3.684	1.400	1.136	7.392

XRF line energies and fractional radiative rate for Ge (Z= 32)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	9.887	9.855	10.982	10.978
Radiative rate	0.574	0.296	0.085	0.043

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	1.294	1.219	-	1.188	1.036
Radiative rate	0.618	0.956	-	0.855	0.044

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Ge (Z= 32)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
11.10	-	-	-	-
15.00	2.91e+03 2.93e+03	4.42e+03 4.44e+03	4.30e+02 4.32e+02	6.50e+02 6.53e+02
20.00	1.34e+03 1.35e+03	2.02e+03 2.05e+03	1.97e+02 1.99e+02	2.98e+02 3.01e+02
30.00	4.31e+02 4.38e+02	6.52e+02 6.64e+02	6.36e+01 6.47e+01	9.60e+01 9.76e+01
40.00	1.88e+02 1.92e+02	2.85e+02 2.91e+02	2.78e+01 2.84e+01	4.20e+01 4.28e+01
50.00	9.81e+01 1.00e+02	1.49e+02 1.52e+02	1.45e+01 1.48e+01	2.19e+01 2.24e+01
60.00	5.72e+01 5.85e+01	8.67e+01 8.87e+01	8.45e+00 8.64e+00	1.28e+01 1.30e+01
80.00	2.42e+01 2.48e+01	3.67e+01 3.76e+01	3.58e+00 3.66e+00	5.40e+00 5.53e+00
100.00	1.24e+01 1.27e+01	1.87e+01 1.92e+01	1.83e+00 1.87e+00	2.76e+00 2.82e+00
150.00	3.63e+00 3.71e+00	5.49e+00 5.63e+00	5.35e-01 5.48e-01	8.08e-01 8.28e-01
200.00	1.53e+00 1.56e+00	2.31e+00 2.37e+00	2.25e-01 2.31e-01	3.40e-01 3.49e-01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Ge (Z= 32)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.22	-	-	-	-	-
1.25	-	-	-	5.59e+03 5.90e+03	2.87e+02 3.03e+02
1.41	-	2.37e+03 2.72e+03	-	4.59e+03 5.56e+03	2.36e+02 2.85e+02
1.50	1.17e+02 1.26e+02	2.33e+03 2.37e+03	-	4.53e+03 4.82e+03	2.33e+02 2.48e+02
2.00	5.80e+01 7.97e+01	1.16e+03 1.17e+03	-	2.24e+03 2.37e+03	1.15e+02 1.22e+02
3.00	2.05e+01 3.90e+01	4.09e+02 4.11e+02	-	7.93e+02 8.21e+02	4.07e+01 4.22e+01
4.00	9.57e+00 2.23e+01	1.90e+02 1.90e+02	-	3.69e+02 3.77e+02	1.90e+01 1.94e+01
5.00	5.23e+00 1.40e+01	1.04e+02 1.03e+02	-	2.02e+02 2.04e+02	1.04e+01 1.05e+01
6.00	3.18e+00 9.48e+00	6.32e+01 6.21e+01	-	1.23e+02 1.22e+02	6.30e+00 6.28e+00
8.00	1.43e+00 4.97e+00	2.85e+01 2.76e+01	-	5.53e+01 5.42e+01	2.84e+00 2.78e+00
10.00	7.66e-01 2.95e+00	1.52e+01 1.46e+01	-	2.96e+01 2.86e+01	1.52e+00 1.47e+00
11.10	5.71e-01 2.29e+00	1.14e+01 1.08e+01	-	2.20e+01 2.12e+01	1.13e+00 1.09e+00

## Element: As, Z= 33

Edge energy, radiation ratio and jump for As (Z= 33)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	1.323	1.359	1.526	11.867
Fluor Yield (xraylib)	0.016	0.014	0.003	0.581
Fluor Yield (Krause)	0.016	0.014	0.003	0.562
Jump Factor	4.156	1.400	1.137	7.314

XRF line energies and fractional radiative rate for As (Z= 33)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	10.543	10.507	11.726	11.720
Radiative rate	0.571	0.294	0.086	0.044

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	1.389	1.317	-	1.282	1.120
Radiative rate	0.607	0.957	-	0.857	0.042

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for As (Z= 33)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
11.87	-	-	-	-
15.00	3.47e+03 3.39e+03	5.26e+03 5.14e+03	5.23e+02 5.11e+02	7.90e+02 7.72e+02
20.00	1.60e+03 1.57e+03	2.42e+03 2.38e+03	2.41e+02 2.37e+02	3.64e+02 3.58e+02
30.00	5.18e+02 5.13e+02	7.85e+02 7.78e+02	7.80e+01 7.73e+01	1.18e+02 1.17e+02
40.00	2.27e+02 2.26e+02	3.45e+02 3.43e+02	3.43e+01 3.41e+01	5.18e+01 5.15e+01
50.00	1.19e+02 1.18e+02	1.80e+02 1.79e+02	1.79e+01 1.78e+01	2.71e+01 2.69e+01
60.00	6.95e+01 6.92e+01	1.05e+02 1.05e+02	1.05e+01 1.04e+01	1.58e+01 1.58e+01
80.00	2.95e+01 2.94e+01	4.47e+01 4.46e+01	4.44e+00 4.43e+00	6.72e+00 6.70e+00
100.00	1.51e+01 1.51e+01	2.29e+01 2.28e+01	2.27e+00 2.27e+00	3.43e+00 3.43e+00
150.00	4.44e+00 4.43e+00	6.73e+00 6.72e+00	6.69e-01 6.68e-01	1.01e+00 1.01e+00
200.00	1.87e+00 1.87e+00	2.84e+00 2.83e+00	2.82e-01 2.82e-01	4.26e-01 4.26e-01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for As (Z= 33)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.32	-	-	-	-	-
1.36	-	-	-	5.75e+03 5.85e+03	2.82e+02 2.87e+02
1.53	-	2.38e+03 2.63e+03	-	4.77e+03 5.34e+03	2.34e+02 2.62e+02
1.50	-	2.49e+03 2.51e+03	-	4.99e+03 5.13e+03	2.45e+02 2.51e+02
2.00	7.48e+01 9.62e+01	1.39e+03 1.40e+03	-	2.79e+03 2.83e+03	1.37e+02 1.39e+02
3.00	2.67e+01 4.76e+01	4.96e+02 4.99e+02	-	9.96e+02 9.93e+02	4.88e+01 4.87e+01
4.00	1.25e+01 2.74e+01	2.32e+02 2.31e+02	-	4.65e+02 4.57e+02	2.28e+01 2.24e+01
5.00	6.84e+00 1.74e+01	1.27e+02 1.26e+02	-	2.55e+02 2.48e+02	1.25e+01 1.21e+01
6.00	4.16e+00 1.18e+01	7.73e+01 7.60e+01	-	1.55e+02 1.49e+02	7.60e+00 7.30e+00
8.00	1.88e+00 6.23e+00	3.49e+01 3.39e+01	-	7.00e+01 6.61e+01	3.43e+00 3.24e+00
10.00	1.01e+00 3.71e+00	1.87e+01 1.80e+01	-	3.75e+01 3.50e+01	1.84e+00 1.71e+00
11.86	6.21e-01 2.47e+00	1.16e+01 1.10e+01	-	2.32e+01 2.14e+01	1.14e+00 1.05e+00

## Element: Se, Z= 34

Edge energy, radiation ratio and jump for Se (Z= 34)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	1.436	1.476	1.654	12.658
Fluor Yield (xraylib)	0.018	0.016	0.003	0.580
Fluor Yield (Krause)	0.018	0.016	0.003	0.589
Jump Factor	4.431	1.400	1.138	7.225

XRF line energies and fractional radiative rate for Se (Z= 34)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	11.223	11.182	12.496	12.490
Radiative rate	0.567	0.293	0.087	0.045

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	1.490	1.419	-	1.379	1.204
Radiative rate	0.596	0.959	-	0.857	0.041



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Se (Z= 34)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
12.66	-	-	-	-
15.00	3.80e+03 3.89e+03	5.76e+03 5.89e+03	5.85e+02 5.99e+02	8.85e+02 9.06e+02
20.00	1.76e+03 1.82e+03	2.67e+03 2.75e+03	2.72e+02 2.80e+02	4.11e+02 4.24e+02
30.00	5.74e+02 5.97e+02	8.71e+02 9.05e+02	8.86e+01 9.20e+01	1.34e+02 1.39e+02
40.00	2.53e+02 2.64e+02	3.84e+02 4.00e+02	3.90e+01 4.07e+01	5.90e+01 6.15e+01
50.00	1.33e+02 1.38e+02	2.01e+02 2.10e+02	2.04e+01 2.13e+01	3.09e+01 3.23e+01
60.00	7.76e+01 8.12e+01	1.18e+02 1.23e+02	1.20e+01 1.25e+01	1.81e+01 1.89e+01
80.00	3.31e+01 3.46e+01	5.01e+01 5.25e+01	5.10e+00 5.34e+00	7.71e+00 8.07e+00
100.00	1.69e+01 1.78e+01	2.57e+01 2.69e+01	2.61e+00 2.74e+00	3.95e+00 4.14e+00
150.00	5.00e+00 5.25e+00	7.58e+00 7.95e+00	7.71e-01 8.09e-01	1.17e+00 1.22e+00
200.00	2.12e+00 2.22e+00	3.21e+00 3.36e+00	3.26e-01 3.42e-01	4.93e-01 5.17e-01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Se (Z= 34)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.44	-	-	-	-	-
1.48	-	-	-	8.72e+03 6.09e+03	4.13e+02 2.88e+02
1.65	-	2.81e+03 2.83e+03	-	5.69e+03 5.67e+03	2.70e+02 2.69e+02
1.50	-	3.06e+03 2.93e+03	-	6.20e+03 6.29e+03	2.94e+02 2.98e+02
2.00	9.39e+01 1.14e+02	1.77e+03 1.78e+03	-	3.57e+03 3.55e+03	1.69e+02 1.68e+02
3.00	3.38e+01 5.67e+01	6.38e+02 6.40e+02	-	1.28e+03 1.25e+03	6.08e+01 5.94e+01
4.00	1.58e+01 3.29e+01	2.99e+02 2.98e+02	-	6.02e+02 5.79e+02	2.85e+01 2.74e+01
5.00	8.69e+00 2.10e+01	1.64e+02 1.63e+02	-	3.31e+02 3.14e+02	1.57e+01 1.49e+01
6.00	5.30e+00 1.43e+01	1.00e+02 9.83e+01	-	2.01e+02 1.89e+02	9.54e+00 8.96e+00
8.00	2.39e+00 7.59e+00	4.52e+01 4.39e+01	-	9.11e+01 8.40e+01	4.31e+00 3.98e+00
10.00	1.28e+00 4.55e+00	2.43e+01 2.33e+01	-	4.89e+01 4.45e+01	2.31e+00 2.11e+00
12.65	6.62e-01 2.60e+00	1.25e+01 1.19e+01	-	2.52e+01 2.26e+01	1.19e+00 1.07e+00

## Element: Br, Z= 35

Edge energy, radiation ratio and jump for Br (Z= 35)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	1.550	1.596	1.782	13.474
Fluor Yield (xraylib)	0.020	0.018	0.004	0.586
Fluor Yield (Krause)	0.020	0.018	0.004	0.618
Jump Factor	4.654	1.400	1.139	7.141

XRF line energies and fractional radiative rate for Br (Z= 35)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	11.924	11.878	13.292	13.285
Radiative rate	0.564	0.292	0.088	0.045

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	1.596	1.526	-	1.480	1.293
Radiative rate	0.582	0.960	-	0.858	0.040

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Br (Z= 35)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
13.47	-	-	-	-
15.00	4.17e+03 4.42e+03	6.33e+03 6.71e+03	6.51e+02 6.90e+02	9.84e+02 1.04e+03
20.00	1.95e+03 2.09e+03	2.96e+03 3.17e+03	3.05e+02 3.26e+02	4.61e+02 4.93e+02
30.00	6.41e+02 6.91e+02	9.72e+02 1.05e+03	1.00e+02 1.08e+02	1.51e+02 1.63e+02
40.00	2.83e+02 3.07e+02	4.29e+02 4.66e+02	4.42e+01 4.79e+01	6.67e+01 7.24e+01
50.00	1.49e+02 1.62e+02	2.26e+02 2.45e+02	2.32e+01 2.52e+01	3.51e+01 3.81e+01
60.00	8.74e+01 9.49e+01	1.33e+02 1.44e+02	1.36e+01 1.48e+01	2.06e+01 2.24e+01
80.00	3.73e+01 4.06e+01	5.67e+01 6.16e+01	5.83e+00 6.34e+00	8.81e+00 9.58e+00
100.00	1.92e+01 2.09e+01	2.91e+01 3.17e+01	2.99e+00 3.26e+00	4.52e+00 4.92e+00
150.00	5.68e+00 6.19e+00	8.63e+00 9.39e+00	8.87e-01 9.66e-01	1.34e+00 1.46e+00
200.00	2.41e+00 2.62e+00	3.65e+00 3.98e+00	3.76e-01 4.09e-01	5.68e-01 6.19e-01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Br (Z= 35)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.55	-	-	-	-	-
1.60	-	-	-	6.41e+03 6.28e+03	2.95e+02 2.89e+02
1.78	-	2.94e+03 2.94e+03	-	5.99e+03 5.83e+03	2.76e+02 2.69e+02
2.00	1.16e+02 1.31e+02	2.22e+03 2.23e+03	-	4.50e+03 4.40e+03	2.07e+02 2.03e+02
3.00	4.16e+01 6.59e+01	8.01e+02 8.02e+02	-	1.62e+03 1.56e+03	7.47e+01 7.19e+01
4.00	1.96e+01 3.85e+01	3.77e+02 3.76e+02	-	7.64e+02 7.24e+02	3.52e+01 3.34e+01
5.00	1.08e+01 2.47e+01	2.08e+02 2.05e+02	-	4.20e+02 3.94e+02	1.94e+01 1.81e+01
6.00	6.58e+00 1.69e+01	1.27e+02 1.24e+02	-	2.56e+02 2.37e+02	1.18e+01 1.09e+01
8.00	2.98e+00 9.04e+00	5.74e+01 5.58e+01	-	1.16e+02 1.06e+02	5.35e+00 4.87e+00
10.00	1.60e+00 5.44e+00	3.08e+01 2.97e+01	-	6.24e+01 5.60e+01	2.87e+00 2.58e+00
13.47	6.93e-01 2.69e+00	1.33e+01 1.26e+01	-	2.70e+01 2.38e+01	1.24e+00 1.10e+00

## Element: Kr, Z= 36

Edge energy, radiation ratio and jump for Kr (Z= 36)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	1.675	1.727	1.921	14.326
Fluor Yield (xraylib)	0.022	0.020	0.004	0.660
Fluor Yield (Krause)	0.022	0.020	0.004	0.643
Jump Factor	4.678	1.400	1.140	7.058

XRF line energies and fractional radiative rate for Kr (Z= 36)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	12.648	12.595	14.113	14.105
Radiative rate	0.562	0.291	0.089	0.045

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	1.707	1.637	-	1.585	1.387
Radiative rate	0.567	0.961	-	0.858	0.039

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Kr (Z= 36)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
14.33	-	-	-	-
15.00	5.11e+03 4.99e+03	7.77e+03 7.58e+03	8.06e+02 7.87e+02	1.22e+03 1.19e+03
20.00	2.42e+03 2.39e+03	3.67e+03 3.62e+03	3.81e+02 3.76e+02	5.75e+02 5.68e+02
30.00	7.96e+02 7.93e+02	1.21e+03 1.20e+03	1.25e+02 1.25e+02	1.90e+02 1.89e+02
40.00	3.54e+02 3.54e+02	5.37e+02 5.37e+02	5.57e+01 5.57e+01	8.42e+01 8.42e+01
50.00	1.86e+02 1.87e+02	2.83e+02 2.83e+02	2.93e+01 2.94e+01	4.43e+01 4.44e+01
60.00	1.10e+02 1.10e+02	1.66e+02 1.67e+02	1.73e+01 1.73e+01	2.61e+01 2.62e+01
80.00	4.69e+01 4.71e+01	7.12e+01 7.16e+01	7.39e+00 7.43e+00	1.12e+01 1.12e+01
100.00	2.41e+01 2.43e+01	3.67e+01 3.69e+01	3.81e+00 3.83e+00	5.75e+00 5.78e+00
150.00	7.18e+00 7.23e+00	1.09e+01 1.10e+01	1.13e+00 1.14e+00	1.71e+00 1.72e+00
200.00	3.05e+00 3.07e+00	4.63e+00 4.66e+00	4.81e-01 4.84e-01	7.26e-01 7.31e-01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Kr (Z= 36)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.67	-	-	-	-	-
1.73	-	-	-	6.61e+03 6.29e+03	2.98e+02 2.84e+02
1.92	-	3.01e+03 2.98e+03	-	6.11e+03 5.91e+03	2.76e+02 2.67e+02
2.00	1.43e+02 1.49e+02	2.73e+03 2.72e+03	-	5.52e+03 5.37e+03	2.49e+02 2.42e+02
3.00	5.16e+01 7.68e+01	9.87e+02 9.83e+02	-	2.00e+03 1.91e+03	9.01e+01 8.63e+01
4.00	2.44e+01 4.54e+01	4.66e+02 4.62e+02	-	9.45e+02 8.93e+02	4.26e+01 4.02e+01
5.00	1.35e+01 2.93e+01	2.57e+02 2.53e+02	-	5.21e+02 4.86e+02	2.35e+01 2.19e+01
6.00	8.22e+00 2.01e+01	1.57e+02 1.53e+02	-	3.18e+02 2.94e+02	1.44e+01 1.33e+01
8.00	3.73e+00 1.08e+01	7.14e+01 6.88e+01	-	1.45e+02 1.31e+02	6.52e+00 5.92e+00
10.00	2.01e+00 6.55e+00	3.84e+01 3.66e+01	-	7.78e+01 6.96e+01	3.51e+00 3.14e+00
14.32	7.32e-01 2.80e+00	1.40e+01 1.31e+01	-	2.83e+01 2.48e+01	1.28e+00 1.12e+00

## Element: Rb, Z= 37

Edge energy, radiation ratio and jump for Rb (Z= 37)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	1.804	1.864	2.065	15.200
Fluor Yield (xraylib)	0.024	0.022	0.005	0.635
Fluor Yield (Krause)	0.024	0.022	0.005	0.667
Jump Factor	3.987	1.400	1.141	6.970

XRF line energies and fractional radiative rate for Rb (Z= 37)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	13.395	13.336	14.961	14.952
Radiative rate	0.559	0.290	0.090	0.046

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	1.827	1.752	-	1.694	1.482
Radiative rate	0.558	0.961	-	0.859	0.038

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Rb (Z= 37)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
15.20	-	-	-	-
20.00	2.54e+03 2.70e+03	3.86e+03 4.10e+03	4.07e+02 4.33e+02	6.15e+02 6.54e+02
30.00	8.42e+02 9.03e+02	1.28e+03 1.37e+03	1.35e+02 1.45e+02	2.04e+02 2.19e+02
40.00	3.75e+02 4.04e+02	5.70e+02 6.14e+02	6.01e+01 6.48e+01	9.09e+01 9.80e+01
50.00	1.98e+02 2.14e+02	3.01e+02 3.25e+02	3.18e+01 3.43e+01	4.80e+01 5.18e+01
60.00	1.17e+02 1.26e+02	1.77e+02 1.92e+02	1.87e+01 2.02e+01	2.83e+01 3.06e+01
80.00	5.01e+01 5.43e+01	7.62e+01 8.26e+01	8.04e+00 8.71e+00	1.22e+01 1.32e+01
100.00	2.59e+01 2.81e+01	3.93e+01 4.26e+01	4.15e+00 4.50e+00	6.27e+00 6.80e+00
150.00	7.72e+00 8.38e+00	1.17e+01 1.27e+01	1.24e+00 1.34e+00	1.87e+00 2.03e+00
200.00	3.29e+00 3.57e+00	4.99e+00 5.42e+00	5.27e-01 5.72e-01	7.96e-01 8.64e-01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Rb (Z= 37)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.80	-	-	-	-	-
1.86	-	-	-	6.26e+03 6.27e+03	2.76e+02 2.76e+02
2.07	-	3.09e+03 3.05e+03	-	5.97e+03 6.01e+03	2.63e+02 2.64e+02
2.00	-	2.92e+03 2.88e+03	-	5.64e+03 5.71e+03	2.48e+02 2.51e+02
3.00	6.35e+01 8.86e+01	1.20e+03 1.20e+03	-	2.33e+03 2.32e+03	1.03e+02 1.02e+02
4.00	3.01e+01 5.29e+01	5.71e+02 5.65e+02	-	1.11e+03 1.09e+03	4.87e+01 4.78e+01
5.00	1.67e+01 3.44e+01	3.16e+02 3.10e+02	-	6.12e+02 5.93e+02	2.69e+01 2.61e+01
6.00	1.02e+01 2.38e+01	1.93e+02 1.89e+02	-	3.75e+02 3.59e+02	1.65e+01 1.58e+01
8.00	4.64e+00 1.29e+01	8.80e+01 8.48e+01	-	1.71e+02 1.61e+02	7.50e+00 7.07e+00
10.00	2.50e+00 7.82e+00	4.74e+01 4.52e+01	-	9.19e+01 8.54e+01	4.04e+00 3.76e+00
15.00	8.00e-01 3.01e+00	1.52e+01 1.41e+01	-	2.94e+01 2.67e+01	1.29e+00 1.17e+00
15.19	7.71e-01 2.92e+00	1.46e+01 1.36e+01	-	2.83e+01 2.57e+01	1.25e+00 1.13e+00

## Element: Sr, Z= 38

Edge energy, radiation ratio and jump for Sr (Z= 38)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	1.940	2.007	2.216	16.105
Fluor Yield (xraylib)	0.026	0.024	0.005	0.690
Fluor Yield (Krause)	0.026	0.024	0.005	0.690
Jump Factor	3.982	1.400	1.141	6.888

XRF line energies and fractional radiative rate for Sr (Z= 38)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	14.165	14.098	15.836	15.825
Radiative rate	0.556	0.289	0.090	0.046

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	1.947	1.872	-	1.807	1.582
Radiative rate	0.549	0.959	-	0.859	0.037



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Sr (Z= 38)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
16.10	-	-	-	-
20.00	3.00e+03 3.03e+03	4.56e+03 4.61e+03	4.89e+02 4.94e+02	7.39e+02 7.46e+02
30.00	1.00e+03 1.02e+03	1.52e+03 1.55e+03	1.63e+02 1.66e+02	2.46e+02 2.51e+02
40.00	4.48e+02 4.59e+02	6.81e+02 6.99e+02	7.29e+01 7.48e+01	1.10e+02 1.13e+02
50.00	2.37e+02 2.44e+02	3.60e+02 3.71e+02	3.86e+01 3.97e+01	5.83e+01 6.00e+01
60.00	1.40e+02 1.44e+02	2.13e+02 2.19e+02	2.28e+01 2.35e+01	3.45e+01 3.55e+01
80.00	6.03e+01 6.22e+01	9.17e+01 9.46e+01	9.82e+00 1.01e+01	1.48e+01 1.53e+01
100.00	3.12e+01 3.22e+01	4.74e+01 4.90e+01	5.08e+00 5.24e+00	7.67e+00 7.92e+00
150.00	9.33e+00 9.65e+00	1.42e+01 1.47e+01	1.52e+00 1.57e+00	2.30e+00 2.37e+00
200.00	3.98e+00 4.12e+00	6.05e+00 6.26e+00	6.48e-01 6.70e-01	9.80e-01 1.01e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Sr (Z= 38)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
1.94	-	-	-	-	-
2.01	-	-	-	6.24e+03 6.20e+03	2.70e+02 2.68e+02
2.22	-	3.10e+03 3.04e+03	-	5.97e+03 5.97e+03	2.58e+02 2.58e+02
2.00	-	-	-	6.29e+03 6.24e+03	2.72e+02 2.70e+02
3.00	7.68e+01 1.02e+02	1.45e+03 1.43e+03	-	2.80e+03 2.77e+03	1.21e+02 1.20e+02
4.00	3.67e+01 6.10e+01	6.90e+02 6.81e+02	-	1.34e+03 1.31e+03	5.77e+01 5.64e+01
5.00	2.03e+01 3.99e+01	3.82e+02 3.75e+02	-	7.40e+02 7.15e+02	3.20e+01 3.09e+01
6.00	1.24e+01 2.77e+01	2.34e+02 2.29e+02	-	4.53e+02 4.34e+02	1.96e+01 1.87e+01
8.00	5.68e+00 1.51e+01	1.07e+02 1.03e+02	-	2.07e+02 1.95e+02	8.94e+00 8.40e+00
10.00	3.06e+00 9.20e+00	5.77e+01 5.50e+01	-	1.12e+02 1.03e+02	4.82e+00 4.47e+00
15.00	9.83e-01 3.58e+00	1.85e+01 1.73e+01	-	3.58e+01 3.24e+01	1.55e+00 1.40e+00
16.10	8.04e-01 3.01e+00	1.51e+01 1.41e+01	-	2.93e+01 2.64e+01	1.27e+00 1.14e+00

## Element: Y , Z= 39

Edge energy, radiation ratio and jump for Y (Z= 39)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	2.080	2.155	2.372	17.038
Fluor Yield (xraylib)	0.028	0.026	0.006	0.668
Fluor Yield (Krause)	0.028	0.026	0.006	0.710
Jump Factor	3.909	1.400	1.142	6.814

XRF line energies and fractional radiative rate for Y (Z= 39)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	14.959	14.883	16.738	16.726
Radiative rate	0.551	0.287	0.091	0.047

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	2.072	1.996	2.158	1.923	1.685
Radiative rate	0.545	0.956	0.007	0.853	0.036

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Y (Z= 39)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
17.04	-	-	-	-
20.00	3.13e+03 3.36e+03	4.76e+03 5.10e+03	5.20e+02 5.57e+02	7.87e+02 8.44e+02
30.00	1.05e+03 1.14e+03	1.60e+03 1.73e+03	1.75e+02 1.89e+02	2.64e+02 2.87e+02
40.00	4.73e+02 5.15e+02	7.19e+02 7.84e+02	7.85e+01 8.56e+01	1.19e+02 1.30e+02
50.00	2.51e+02 2.74e+02	3.82e+02 4.17e+02	4.17e+01 4.56e+01	6.31e+01 6.90e+01
60.00	1.49e+02 1.63e+02	2.26e+02 2.47e+02	2.47e+01 2.70e+01	3.73e+01 4.09e+01
80.00	6.42e+01 7.04e+01	9.76e+01 1.07e+02	1.07e+01 1.17e+01	1.61e+01 1.77e+01
100.00	3.33e+01 3.65e+01	5.06e+01 5.55e+01	5.52e+00 6.06e+00	8.36e+00 9.17e+00
150.00	9.99e+00 1.10e+01	1.52e+01 1.67e+01	1.66e+00 1.82e+00	2.51e+00 2.76e+00
200.00	4.27e+00 4.69e+00	6.49e+00 7.14e+00	7.09e-01 7.79e-01	1.07e+00 1.18e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Y (Z= 39)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
2.08	-	-	-	-	-
2.16	-	-	-	6.14e+03 6.09e+03	2.60e+02 2.58e+02
2.37	-	2.72e+03 3.02e+03	1.91e+01 2.11e+01	5.19e+03 5.92e+03	2.20e+02 2.51e+02
3.00	9.75e+01 1.22e+02	1.71e+03 1.69e+03	1.20e+01 1.18e+01	3.29e+03 3.27e+03	1.40e+02 1.39e+02
4.00	4.66e+01 7.38e+01	8.18e+02 8.04e+02	5.73e+00 5.64e+00	1.57e+03 1.54e+03	6.68e+01 6.55e+01
5.00	2.59e+01 4.85e+01	4.55e+02 4.44e+02	3.19e+00 3.11e+00	8.75e+02 8.48e+02	3.71e+01 3.60e+01
6.00	1.59e+01 3.37e+01	2.79e+02 2.71e+02	1.96e+00 1.90e+00	5.37e+02 5.15e+02	2.28e+01 2.19e+01
8.00	7.28e+00 1.85e+01	1.28e+02 1.22e+02	8.95e-01 8.57e-01	2.46e+02 2.32e+02	1.04e+01 9.83e+00
10.00	3.93e+00 1.14e+01	6.90e+01 6.53e+01	4.83e-01 4.58e-01	1.33e+02 1.24e+02	5.63e+00 5.24e+00
15.00	1.26e+00 4.45e+00	2.22e+01 2.05e+01	1.55e-01 1.44e-01	4.27e+01 3.87e+01	1.81e+00 1.64e+00
17.03	8.82e-01 3.28e+00	1.55e+01 1.42e+01	1.08e-01 9.95e-02	2.98e+01 2.68e+01	1.26e+00 1.14e+00

## Element: Zr, Z= 40

Edge energy, radiation ratio and jump for Zr (Z= 40)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	2.222	2.307	2.532	17.998
Fluor Yield (xraylib)	0.031	0.028	0.007	0.708
Fluor Yield (Krause)	0.031	0.028	0.007	0.730
Jump Factor	3.836	1.400	1.143	6.749

XRF line energies and fractional radiative rate for Zr (Z= 40)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	15.775	15.691	17.667	17.653
Radiative rate	0.551	0.288	0.093	0.047

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	2.201	2.124	2.303	2.042	1.792
Radiative rate	0.541	0.948	0.015	0.847	0.036

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Zr (Z= 40)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
18.00	-	-	-	-
20.00	3.59e+03 3.72e+03	5.47e+03 5.67e+03	6.04e+02 6.26e+02	9.13e+02 9.46e+02
30.00	1.22e+03 1.28e+03	1.86e+03 1.95e+03	2.05e+02 2.15e+02	3.10e+02 3.26e+02
40.00	5.51e+02 5.81e+02	8.38e+02 8.85e+02	9.25e+01 9.76e+01	1.40e+02 1.48e+02
50.00	2.93e+02 3.10e+02	4.46e+02 4.73e+02	4.92e+01 5.21e+01	7.45e+01 7.89e+01
60.00	1.74e+02 1.84e+02	2.64e+02 2.81e+02	2.92e+01 3.10e+01	4.41e+01 4.68e+01
80.00	7.53e+01 8.01e+01	1.15e+02 1.22e+02	1.26e+01 1.34e+01	1.91e+01 2.03e+01
100.00	3.91e+01 4.16e+01	5.95e+01 6.33e+01	6.56e+00 6.99e+00	9.93e+00 1.06e+01
150.00	1.18e+01 1.26e+01	1.79e+01 1.91e+01	1.98e+00 2.11e+00	2.99e+00 3.19e+00
200.00	5.04e+00 5.38e+00	7.68e+00 8.19e+00	8.47e-01 9.03e-01	1.28e+00 1.37e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Zr (Z= 40)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
2.22	-	-	-	-	-
2.31	-	-	-	6.22e+03 6.17e+03	2.62e+02 2.60e+02
2.53	-	2.70e+03 2.98e+03	4.28e+01 4.71e+01	5.30e+03 6.02e+03	2.23e+02 2.54e+02
3.00	1.23e+02 1.46e+02	2.01e+03 1.98e+03	3.18e+01 3.13e+01	3.97e+03 3.95e+03	1.67e+02 1.66e+02
4.00	5.89e+01 8.85e+01	9.61e+02 9.45e+02	1.52e+01 1.49e+01	1.90e+03 1.87e+03	8.01e+01 7.87e+01
5.00	3.28e+01 5.84e+01	5.36e+02 5.24e+02	8.48e+00 8.29e+00	1.06e+03 1.03e+03	4.46e+01 4.34e+01
6.00	2.02e+01 4.08e+01	3.30e+02 3.20e+02	5.21e+00 5.07e+00	6.52e+02 6.27e+02	2.74e+01 2.64e+01
8.00	9.25e+00 2.26e+01	1.51e+02 1.45e+02	2.39e+00 2.29e+00	2.99e+02 2.83e+02	1.26e+01 1.19e+01
10.00	5.01e+00 1.39e+01	8.17e+01 7.75e+01	1.29e+00 1.23e+00	1.62e+02 1.51e+02	6.81e+00 6.36e+00
15.00	1.61e+00 5.49e+00	2.63e+01 2.44e+01	4.17e-01 3.86e-01	5.21e+01 4.74e+01	2.19e+00 2.00e+00
17.99	9.65e-01 3.55e+00	1.58e+01 1.44e+01	2.49e-01 2.28e-01	3.11e+01 2.81e+01	1.31e+00 1.18e+00

## Element: Nb, Z= 41

Edge energy, radiation ratio and jump for Nb (Z= 41)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	2.371	2.465	2.698	18.986
Fluor Yield (xraylib)	0.034	0.031	0.009	0.733
Fluor Yield (Krause)	0.034	0.031	0.009	0.747
Jump Factor	3.750	1.400	1.143	6.683

XRF line energies and fractional radiative rate for Nb (Z= 41)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	16.615	16.521	18.623	18.607
Radiative rate	0.549	0.287	0.094	0.048

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	2.335	2.257	2.462	2.166	1.902
Radiative rate	0.538	0.936	0.029	0.837	0.035

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Nb (Z= 41)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
18.99	-	-	-	-
20.00	4.02e+03 4.11e+03	6.12e+03 6.26e+03	6.84e+02 6.99e+02	1.03e+03 1.06e+03
30.00	1.37e+03 1.42e+03	2.09e+03 2.17e+03	2.34e+02 2.42e+02	3.54e+02 3.67e+02
40.00	6.22e+02 6.48e+02	9.47e+02 9.88e+02	1.06e+02 1.10e+02	1.60e+02 1.67e+02
50.00	3.32e+02 3.47e+02	5.05e+02 5.29e+02	5.64e+01 5.91e+01	8.54e+01 8.94e+01
60.00	1.97e+02 2.07e+02	3.00e+02 3.15e+02	3.35e+01 3.52e+01	5.07e+01 5.32e+01
80.00	8.56e+01 9.00e+01	1.30e+02 1.37e+02	1.46e+01 1.53e+01	2.21e+01 2.32e+01
100.00	4.45e+01 4.69e+01	6.78e+01 7.14e+01	7.58e+00 7.98e+00	1.15e+01 1.21e+01
150.00	1.35e+01 1.42e+01	2.05e+01 2.16e+01	2.29e+00 2.41e+00	3.47e+00 3.65e+00
200.00	5.78e+00 6.09e+00	8.80e+00 9.28e+00	9.83e-01 1.04e+00	1.49e+00 1.57e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Nb (Z= 41)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
2.37	-	-	-	-	-
2.46	-	-	-	6.22e+03 6.18e+03	2.60e+02 2.58e+02
2.70	-	2.76e+03 2.83e+03	8.49e+01 8.70e+01	5.33e+03 6.20e+03	2.23e+02 2.59e+02
3.00	1.86e+02 2.09e+02	2.23e+03 2.17e+03	6.87e+01 6.69e+01	4.76e+03 4.77e+03	1.99e+02 1.99e+02
4.00	8.92e+01 1.27e+02	1.07e+03 1.02e+03	3.30e+01 3.13e+01	2.29e+03 2.27e+03	9.55e+01 9.49e+01
5.00	4.98e+01 8.44e+01	5.99e+02 5.53e+02	1.84e+01 1.70e+01	1.28e+03 1.26e+03	5.34e+01 5.27e+01
6.00	3.07e+01 5.94e+01	3.69e+02 3.31e+02	1.13e+01 1.02e+01	7.86e+02 7.72e+02	3.29e+01 3.23e+01
8.00	1.41e+01 3.30e+01	1.69e+02 1.45e+02	5.21e+00 4.46e+00	3.61e+02 3.51e+02	1.51e+01 1.47e+01
10.00	7.64e+00 2.04e+01	9.18e+01 7.53e+01	2.82e+00 2.31e+00	1.96e+02 1.89e+02	8.18e+00 7.90e+00
15.00	2.47e+00 8.12e+00	2.96e+01 2.22e+01	9.12e-01 6.83e-01	6.32e+01 6.02e+01	2.64e+00 2.51e+00
18.98	1.27e+00 4.63e+00	1.52e+01 1.08e+01	4.69e-01 3.32e-01	3.25e+01 3.07e+01	1.36e+00 1.28e+00

## Element: Mo, Z= 42

Edge energy, radiation ratio and jump for Mo (Z= 42)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	2.520	2.625	2.865	20.000
Fluor Yield (xraylib)	0.037	0.034	0.010	0.773
Fluor Yield (Krause)	0.037	0.034	0.010	0.765
Jump Factor	3.674	1.400	1.144	6.539

XRF line energies and fractional radiative rate for Mo (Z= 42)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	17.479	17.374	19.608	19.590
Radiative rate	0.547	0.287	0.094	0.049

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	2.473	2.395	2.624	2.293	2.016
Radiative rate	0.534	0.927	0.039	0.829	0.034



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Mo (Z= 42)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
20.00	-	-	-	-
20.00	6.85e+02 4.43e+03	1.04e+03 6.76e+03	1.18e+02 7.66e+02	1.79e+02 1.16e+03
30.00	1.57e+03 1.58e+03	2.39e+03 2.41e+03	2.70e+02 2.73e+02	4.09e+02 4.12e+02
40.00	7.11e+02 7.22e+02	1.08e+03 1.10e+03	1.23e+02 1.25e+02	1.86e+02 1.89e+02
50.00	3.81e+02 3.87e+02	5.80e+02 5.91e+02	6.57e+01 6.69e+01	9.94e+01 1.01e+02
60.00	2.26e+02 2.31e+02	3.45e+02 3.52e+02	3.91e+01 3.99e+01	5.92e+01 6.04e+01
80.00	9.87e+01 1.01e+02	1.50e+02 1.54e+02	1.70e+01 1.74e+01	2.58e+01 2.64e+01
100.00	5.14e+01 5.27e+01	7.84e+01 8.03e+01	8.88e+00 9.09e+00	1.34e+01 1.38e+01
150.00	1.56e+01 1.60e+01	2.38e+01 2.44e+01	2.69e+00 2.76e+00	4.08e+00 4.18e+00
200.00	6.71e+00 6.88e+00	1.02e+01 1.05e+01	1.16e+00 1.19e+00	1.75e+00 1.80e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Mo (Z= 42)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
2.52	-	-	-	-	-
2.63	-	-	-	8.63e+03 6.16e+03	3.57e+02 2.55e+02
2.87	-	2.81e+03 2.86e+03	1.17e+02 1.19e+02	5.35e+03 6.20e+03	2.22e+02 2.57e+02
3.00	2.15e+02 2.25e+02	2.64e+03 2.57e+03	1.10e+02 1.07e+02	5.57e+03 5.59e+03	2.30e+02 2.31e+02
4.00	1.03e+02 1.40e+02	1.27e+03 1.21e+03	5.30e+01 5.04e+01	2.68e+03 2.67e+03	1.11e+02 1.11e+02
5.00	5.79e+01 9.36e+01	7.13e+02 6.61e+02	2.97e+01 2.75e+01	1.50e+03 1.49e+03	6.22e+01 6.16e+01
6.00	3.57e+01 6.61e+01	4.39e+02 3.98e+02	1.83e+01 1.66e+01	9.26e+02 9.12e+02	3.83e+01 3.78e+01
8.00	1.65e+01 3.70e+01	2.02e+02 1.75e+02	8.43e+00 7.29e+00	4.27e+02 4.16e+02	1.77e+01 1.72e+01
10.00	8.93e+00 2.30e+01	1.10e+02 9.11e+01	4.58e+00 3.80e+00	2.32e+02 2.24e+02	9.58e+00 9.28e+00
15.00	2.89e+00 9.21e+00	3.56e+01 2.70e+01	1.48e+00 1.13e+00	7.49e+01 7.15e+01	3.10e+00 2.96e+00
19.99	1.29e+00 4.64e+00	1.58e+01 1.12e+01	6.58e-01 4.67e-01	3.33e+01 3.15e+01	1.38e+00 1.30e+00

## Element: Tc, Z= 43

Edge energy, radiation ratio and jump for Tc (Z= 43)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	2.677	2.793	3.043	21.044
Fluor Yield (xraylib)	0.040	0.037	0.011	0.780
Fluor Yield (Krause)	0.040	0.037	0.011	0.780
Jump Factor	3.594	1.400	1.145	6.561

XRF line energies and fractional radiative rate for Tc (Z= 43)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	18.367	18.251	20.619	20.599
Radiative rate	0.545	0.286	0.095	0.049

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	2.615	2.537	2.791	2.424	2.134
Radiative rate	0.529	0.918	0.049	0.819	0.034

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Tc (Z= 43)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
21.04	-	-	-	-
30.00	1.73e+03 1.74e+03	2.64e+03 2.65e+03	3.03e+02 3.04e+02	4.59e+02 4.60e+02
40.00	7.88e+02 7.97e+02	1.20e+03 1.22e+03	1.38e+02 1.39e+02	2.09e+02 2.11e+02
50.00	4.23e+02 4.29e+02	6.45e+02 6.54e+02	7.40e+01 7.50e+01	1.12e+02 1.14e+02
60.00	2.52e+02 2.56e+02	3.85e+02 3.91e+02	4.41e+01 4.48e+01	6.67e+01 6.79e+01
80.00	1.10e+02 1.12e+02	1.68e+02 1.71e+02	1.93e+01 1.96e+01	2.92e+01 2.97e+01
100.00	5.75e+01 5.87e+01	8.77e+01 8.96e+01	1.01e+01 1.03e+01	1.52e+01 1.56e+01
150.00	1.75e+01 1.79e+01	2.67e+01 2.73e+01	3.06e+00 3.13e+00	4.64e+00 4.74e+00
200.00	7.55e+00 7.72e+00	1.15e+01 1.18e+01	1.32e+00 1.35e+00	2.00e+00 2.04e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Tc (Z= 43)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
2.68	-	-	-	-	-
2.79	-	-	-	8.62e+03 6.11e+03	3.56e+02 2.52e+02
3.04	-	2.87e+03 2.88e+03	1.53e+02 1.54e+02	5.38e+03 6.18e+03	2.22e+02 2.55e+02
3.00	-	2.96e+03 2.83e+03	1.58e+02 1.51e+02	5.57e+03 5.55e+03	2.30e+02 2.29e+02
4.00	1.25e+02 1.59e+02	1.51e+03 1.43e+03	8.06e+01 7.62e+01	3.14e+03 3.10e+03	1.30e+02 1.28e+02
5.00	7.00e+01 1.07e+02	8.49e+02 7.84e+02	4.53e+01 4.18e+01	1.76e+03 1.73e+03	7.28e+01 7.15e+01
6.00	4.33e+01 7.57e+01	5.25e+02 4.74e+02	2.80e+01 2.53e+01	1.09e+03 1.07e+03	4.50e+01 4.40e+01
8.00	2.00e+01 4.26e+01	2.42e+02 2.09e+02	1.29e+01 1.12e+01	5.04e+02 4.88e+02	2.08e+01 2.01e+01
10.00	1.09e+01 2.66e+01	1.32e+02 1.09e+02	7.03e+00 5.83e+00	2.74e+02 2.63e+02	1.13e+01 1.09e+01
15.00	3.53e+00 1.07e+01	4.28e+01 3.26e+01	2.28e+00 1.74e+00	8.89e+01 8.42e+01	3.67e+00 3.47e+00
20.00	1.57e+00 5.44e+00	1.90e+01 1.35e+01	1.01e+00 7.23e-01	3.95e+01 3.71e+01	1.63e+00 1.53e+00
21.04	1.36e+00 4.82e+00	1.65e+01 1.16e+01	8.79e-01 6.18e-01	3.42e+01 3.21e+01	1.41e+00 1.32e+00

## Element: Ru, Z= 44

Edge energy, radiation ratio and jump for Ru (Z= 44)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	2.838	2.967	3.224	22.117
Fluor Yield (xraylib)	0.043	0.040	0.012	0.794
Fluor Yield (Krause)	0.043	0.040	0.012	0.794
Jump Factor	3.518	1.400	1.145	6.503

XRF line energies and fractional radiative rate for Ru (Z= 44)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	19.279	19.150	21.657	21.635
Radiative rate	0.543	0.286	0.096	0.049

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	2.763	2.683	2.965	2.559	2.253
Radiative rate	0.526	0.907	0.060	0.810	0.033

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Ru (Z= 44)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
22.12	-	-	-	-
30.00	1.88e+03 1.91e+03	2.87e+03 2.91e+03	3.33e+02 3.37e+02	5.04e+02 5.10e+02
40.00	8.58e+02 8.76e+02	1.31e+03 1.34e+03	1.52e+02 1.55e+02	2.30e+02 2.35e+02
50.00	4.61e+02 4.73e+02	7.04e+02 7.22e+02	8.16e+01 8.37e+01	1.24e+02 1.27e+02
60.00	2.76e+02 2.83e+02	4.21e+02 4.32e+02	4.88e+01 5.02e+01	7.39e+01 7.59e+01
80.00	1.21e+02 1.25e+02	1.84e+02 1.90e+02	2.14e+01 2.21e+01	3.24e+01 3.34e+01
100.00	6.32e+01 6.53e+01	9.65e+01 9.96e+01	1.12e+01 1.16e+01	1.69e+01 1.75e+01
150.00	1.93e+01 2.00e+01	2.95e+01 3.05e+01	3.42e+00 3.53e+00	5.17e+00 5.35e+00
200.00	8.34e+00 8.63e+00	1.27e+01 1.32e+01	1.48e+00 1.53e+00	2.23e+00 2.31e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Ru (Z= 44)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
2.84	-	-	-	-	-
2.97	-	-	-	6.05e+03 6.03e+03	2.49e+02 2.48e+02
3.22	-	2.84e+03 2.87e+03	1.87e+02 1.89e+02	5.28e+03 6.12e+03	2.17e+02 2.51e+02
3.00	-	3.40e+03 3.34e+03	2.24e+02 2.20e+02	6.33e+03 6.35e+03	2.60e+02 2.61e+02
4.00	1.46e+02 1.81e+02	1.74e+03 1.67e+03	1.14e+02 1.10e+02	3.58e+03 3.59e+03	1.47e+02 1.48e+02
5.00	8.23e+01 1.21e+02	9.77e+02 9.18e+02	6.44e+01 6.05e+01	2.01e+03 2.01e+03	8.28e+01 8.25e+01
6.00	5.10e+01 8.62e+01	6.05e+02 5.57e+02	3.99e+01 3.67e+01	1.25e+03 1.24e+03	5.13e+01 5.09e+01
8.00	2.36e+01 4.88e+01	2.80e+02 2.47e+02	1.84e+01 1.63e+01	5.77e+02 5.67e+02	2.37e+01 2.33e+01
10.00	1.28e+01 3.06e+01	1.53e+02 1.29e+02	1.00e+01 8.51e+00	3.14e+02 3.07e+02	1.29e+01 1.26e+01
15.00	4.18e+00 1.25e+01	4.96e+01 3.87e+01	3.27e+00 2.55e+00	1.02e+02 9.83e+01	4.20e+00 4.04e+00
20.00	1.86e+00 6.34e+00	2.21e+01 1.62e+01	1.45e+00 1.06e+00	4.55e+01 4.34e+01	1.87e+00 1.78e+00
22.11	1.40e+00 4.98e+00	1.66e+01 1.19e+01	1.09e+00 7.82e-01	3.43e+01 3.26e+01	1.41e+00 1.34e+00

## Element: Rh, Z= 45

Edge energy, radiation ratio and jump for Rh (Z= 45)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	3.004	3.146	3.412	23.220
Fluor Yield (xraylib)	0.046	0.043	0.013	0.829
Fluor Yield (Krause)	0.046	0.043	0.013	0.808
Jump Factor	3.444	1.400	1.146	6.444

XRF line energies and fractional radiative rate for Rh (Z= 45)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	20.216	20.074	22.724	22.699
Radiative rate	0.542	0.286	0.097	0.050

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	2.916	2.834	3.144	2.697	2.377
Radiative rate	0.522	0.896	0.071	0.800	0.033

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Rh (Z= 45)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
23.22	-	-	-	-
30.00	2.11e+03 2.09e+03	3.23e+03 3.18e+03	3.77e+02 3.72e+02	5.72e+02 5.64e+02
40.00	9.68e+02 9.62e+02	1.48e+03 1.47e+03	1.73e+02 1.72e+02	2.62e+02 2.60e+02
50.00	5.22e+02 5.21e+02	7.97e+02 7.96e+02	9.32e+01 9.31e+01	1.41e+02 1.41e+02
60.00	3.13e+02 3.13e+02	4.78e+02 4.78e+02	5.58e+01 5.59e+01	8.46e+01 8.47e+01
80.00	1.37e+02 1.38e+02	2.10e+02 2.11e+02	2.45e+01 2.47e+01	3.72e+01 3.73e+01
100.00	7.21e+01 7.25e+01	1.10e+02 1.11e+02	1.29e+01 1.29e+01	1.95e+01 1.96e+01
150.00	2.21e+01 2.23e+01	3.37e+01 3.40e+01	3.94e+00 3.97e+00	5.97e+00 6.02e+00
200.00	9.55e+00 9.63e+00	1.46e+01 1.47e+01	1.71e+00 1.72e+00	2.58e+00 2.60e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Rh (Z= 45)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
3.00	-	-	-	-	-
3.15	-	-	-	8.22e+03 5.93e+03	3.38e+02 2.44e+02
3.41	-	2.83e+03 2.86e+03	2.24e+02 2.25e+02	5.21e+03 6.02e+03	2.14e+02 2.48e+02
4.00	1.72e+02 2.02e+02	2.01e+03 1.93e+03	1.59e+02 1.53e+02	4.09e+03 4.11e+03	1.68e+02 1.69e+02
5.00	9.65e+01 1.35e+02	1.13e+03 1.07e+03	8.91e+01 8.42e+01	2.30e+03 2.30e+03	9.44e+01 9.44e+01
6.00	5.99e+01 9.70e+01	7.01e+02 6.48e+02	5.53e+01 5.11e+01	1.43e+03 1.42e+03	5.86e+01 5.83e+01
8.00	2.78e+01 5.53e+01	3.25e+02 2.89e+02	2.57e+01 2.28e+01	6.61e+02 6.51e+02	2.72e+01 2.68e+01
10.00	1.52e+01 3.48e+01	1.77e+02 1.52e+02	1.40e+01 1.20e+01	3.61e+02 3.52e+02	1.48e+01 1.45e+01
15.00	4.94e+00 1.43e+01	5.78e+01 4.57e+01	4.56e+00 3.61e+00	1.18e+02 1.13e+02	4.84e+00 4.65e+00
20.00	2.21e+00 7.30e+00	2.58e+01 1.91e+01	2.04e+00 1.51e+00	5.25e+01 4.99e+01	2.16e+00 2.05e+00
23.21	1.45e+00 5.10e+00	1.69e+01 1.21e+01	1.33e+00 9.56e-01	3.44e+01 3.25e+01	1.41e+00 1.34e+00

## Element: Pd, Z= 46

Edge energy, radiation ratio and jump for Pd (Z= 46)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	3.173	3.330	3.604	24.350
Fluor Yield (xraylib)	0.049	0.047	0.014	0.846
Fluor Yield (Krause)	0.049	0.047	0.014	0.820
Jump Factor	3.328	1.400	1.146	6.395

XRF line energies and fractional radiative rate for Pd (Z= 46)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	21.177	21.020	23.819	23.791
Radiative rate	0.540	0.286	0.097	0.050

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	3.073	2.990	3.329	2.839	2.503
Radiative rate	0.520	0.885	0.084	0.788	0.033



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Pd (Z= 46)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
24.35	-	-	-	-
30.00	2.31e+03 2.26e+03	3.53e+03 3.46e+03	4.17e+02 4.08e+02	6.32e+02 6.19e+02
40.00	1.06e+03 1.05e+03	1.63e+03 1.61e+03	1.92e+02 1.90e+02	2.91e+02 2.87e+02
50.00	5.75e+02 5.71e+02	8.80e+02 8.73e+02	1.04e+02 1.03e+02	1.57e+02 1.56e+02
60.00	3.45e+02 3.44e+02	5.28e+02 5.25e+02	6.23e+01 6.20e+01	9.44e+01 9.40e+01
80.00	1.52e+02 1.52e+02	2.33e+02 2.32e+02	2.74e+01 2.74e+01	4.16e+01 4.15e+01
100.00	7.99e+01 8.00e+01	1.22e+02 1.22e+02	1.44e+01 1.44e+01	2.18e+01 2.19e+01
150.00	2.46e+01 2.46e+01	3.75e+01 3.76e+01	4.43e+00 4.44e+00	6.71e+00 6.73e+00
200.00	1.07e+01 1.07e+01	1.63e+01 1.63e+01	1.92e+00 1.93e+00	2.91e+00 2.92e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Pd (Z= 46)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
3.17	-	-	-	-	-
3.33	-	-	-	7.91e+03 5.83e+03	3.27e+02 2.41e+02
3.60	-	3.31e+03 2.92e+03	3.16e+02 2.79e+02	5.84e+03 6.01e+03	2.41e+02 2.49e+02
4.00	2.00e+02 2.23e+02	2.35e+03 2.27e+03	2.25e+02 2.17e+02	4.60e+03 4.67e+03	1.90e+02 1.93e+02
5.00	1.13e+02 1.51e+02	1.32e+03 1.25e+03	1.26e+02 1.19e+02	2.59e+03 2.61e+03	1.07e+02 1.08e+02
6.00	7.00e+01 1.09e+02	8.22e+02 7.64e+02	7.85e+01 7.30e+01	1.61e+03 1.61e+03	6.65e+01 6.67e+01
8.00	3.26e+01 6.23e+01	3.82e+02 3.43e+02	3.65e+01 3.27e+01	7.48e+02 7.43e+02	3.09e+01 3.07e+01
10.00	1.78e+01 3.94e+01	2.09e+02 1.81e+02	1.99e+01 1.73e+01	4.08e+02 4.02e+02	1.69e+01 1.67e+01
15.00	5.81e+00 1.63e+01	6.82e+01 5.47e+01	6.52e+00 5.22e+00	1.33e+02 1.30e+02	5.52e+00 5.36e+00
20.00	2.60e+00 8.37e+00	3.05e+01 2.29e+01	2.91e+00 2.19e+00	5.96e+01 5.73e+01	2.47e+00 2.37e+00
24.35	1.49e+00 5.22e+00	1.75e+01 1.26e+01	1.67e+00 1.20e+00	3.42e+01 3.26e+01	1.41e+00 1.35e+00

## Element: Ag, Z= 47

Edge energy, radiation ratio and jump for Ag (Z= 47)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	3.351	3.524	3.806	25.514
Fluor Yield (xraylib)	0.052	0.051	0.016	0.828
Fluor Yield (Krause)	0.052	0.051	0.016	0.831
Jump Factor	3.308	1.400	1.147	6.334

XRF line energies and fractional radiative rate for Ag (Z= 47)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	22.163	21.990	24.942	24.912
Radiative rate	0.539	0.286	0.098	0.051

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	3.234	3.151	3.520	2.984	2.634
Radiative rate	0.516	0.876	0.093	0.781	0.032

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Ag (Z= 47)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
25.51	-	-	-	-
30.00	2.42e+03 2.44e+03	3.70e+03 3.74e+03	4.41e+02 4.46e+02	6.67e+02 6.75e+02
40.00	1.12e+03 1.14e+03	1.71e+03 1.75e+03	2.04e+02 2.09e+02	3.09e+02 3.16e+02
50.00	6.07e+02 6.23e+02	9.30e+02 9.54e+02	1.11e+02 1.14e+02	1.68e+02 1.72e+02
60.00	3.65e+02 3.76e+02	5.59e+02 5.75e+02	6.65e+01 6.85e+01	1.01e+02 1.04e+02
80.00	1.61e+02 1.67e+02	2.47e+02 2.55e+02	2.94e+01 3.04e+01	4.45e+01 4.60e+01
100.00	8.48e+01 8.79e+01	1.30e+02 1.35e+02	1.55e+01 1.60e+01	2.34e+01 2.43e+01
150.00	2.62e+01 2.72e+01	4.00e+01 4.16e+01	4.77e+00 4.95e+00	7.22e+00 7.50e+00
200.00	1.14e+01 1.18e+01	1.74e+01 1.81e+01	2.07e+00 2.15e+00	3.14e+00 3.26e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Ag (Z= 47)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
3.35	-	-	-	-	-
3.52	-	-	-	5.69e+03 5.70e+03	2.35e+02 2.36e+02
3.81	-	2.92e+03 2.93e+03	3.11e+02 3.12e+02	5.04e+03 5.82e+03	2.08e+02 2.41e+02
4.00	2.46e+02 2.58e+02	2.73e+03 2.63e+03	2.90e+02 2.80e+02	5.21e+03 5.28e+03	2.15e+02 2.18e+02
5.00	1.39e+02 1.79e+02	1.54e+03 1.46e+03	1.64e+02 1.56e+02	2.94e+03 2.95e+03	1.22e+02 1.22e+02
6.00	8.64e+01 1.29e+02	9.58e+02 8.96e+02	1.02e+02 9.55e+01	1.83e+03 1.83e+03	7.56e+01 7.56e+01
8.00	4.03e+01 7.42e+01	4.47e+02 4.03e+02	4.76e+01 4.30e+01	8.54e+02 8.45e+02	3.53e+01 3.49e+01
10.00	2.21e+01 4.71e+01	2.45e+02 2.13e+02	2.60e+01 2.27e+01	4.67e+02 4.58e+02	1.93e+01 1.89e+01
15.00	7.23e+00 1.96e+01	8.01e+01 6.49e+01	8.53e+00 6.91e+00	1.53e+02 1.48e+02	6.33e+00 6.11e+00
20.00	3.23e+00 1.01e+01	3.59e+01 2.73e+01	3.82e+00 2.91e+00	6.85e+01 6.53e+01	2.83e+00 2.70e+00
25.51	1.63e+00 5.65e+00	1.80e+01 1.30e+01	1.92e+00 1.38e+00	3.45e+01 3.26e+01	1.42e+00 1.35e+00

## Element: Cd, Z= 48

Edge energy, radiation ratio and jump for Cd (Z= 48)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	3.537	3.727	4.018	26.711
Fluor Yield (xraylib)	0.056	0.056	0.018	0.854
Fluor Yield (Krause)	0.056	0.056	0.018	0.843
Jump Factor	3.254	1.400	1.147	6.275

XRF line energies and fractional radiative rate for Cd (Z= 48)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	23.174	22.984	26.095	26.061
Radiative rate	0.536	0.285	0.099	0.051

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	3.401	3.317	3.717	3.134	2.767
Radiative rate	0.511	0.868	0.101	0.774	0.032

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Cd (Z= 48)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
26.71	-	-	-	-
30.00	2.65e+03 2.63e+03	4.06e+03 4.03e+03	4.88e+02 4.85e+02	7.39e+02 7.34e+02
40.00	1.24e+03 1.24e+03	1.90e+03 1.90e+03	2.28e+02 2.29e+02	3.45e+02 3.47e+02
50.00	6.72e+02 6.79e+02	1.03e+03 1.04e+03	1.24e+02 1.25e+02	1.88e+02 1.89e+02
60.00	4.05e+02 4.10e+02	6.20e+02 6.28e+02	7.46e+01 7.55e+01	1.13e+02 1.14e+02
80.00	1.79e+02 1.82e+02	2.75e+02 2.79e+02	3.31e+01 3.36e+01	5.01e+01 5.09e+01
100.00	9.46e+01 9.64e+01	1.45e+02 1.48e+02	1.74e+01 1.78e+01	2.64e+01 2.69e+01
150.00	2.93e+01 2.99e+01	4.48e+01 4.58e+01	5.39e+00 5.50e+00	8.16e+00 8.33e+00
200.00	1.27e+01 1.30e+01	1.95e+01 1.99e+01	2.35e+00 2.40e+00	3.55e+00 3.63e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Cd (Z= 48)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
3.54	-	-	-	-	-
3.73	-	-	-	5.65e+03 5.66e+03	2.34e+02 2.35e+02
4.02	-	2.98e+03 3.01e+03	3.47e+02 3.50e+02	5.02e+03 5.94e+03	2.08e+02 2.47e+02
4.00	-	3.02e+03 3.05e+03	3.51e+02 3.55e+02	5.08e+03 6.06e+03	2.11e+02 2.51e+02
5.00	1.68e+02 2.08e+02	1.81e+03 1.73e+03	2.11e+02 2.02e+02	3.38e+03 3.41e+03	1.40e+02 1.41e+02
6.00	1.05e+02 1.49e+02	1.13e+03 1.06e+03	1.31e+02 1.24e+02	2.11e+03 2.11e+03	8.73e+01 8.75e+01
8.00	4.90e+01 8.65e+01	5.28e+02 4.80e+02	6.14e+01 5.59e+01	9.84e+02 9.76e+02	4.08e+01 4.05e+01
10.00	2.68e+01 5.52e+01	2.89e+02 2.55e+02	3.37e+01 2.96e+01	5.39e+02 5.31e+02	2.24e+01 2.20e+01
15.00	8.82e+00 2.31e+01	9.51e+01 7.79e+01	1.11e+01 9.06e+00	1.77e+02 1.71e+02	7.35e+00 7.11e+00
20.00	3.95e+00 1.20e+01	4.26e+01 3.29e+01	4.96e+00 3.82e+00	7.95e+01 7.60e+01	3.30e+00 3.15e+00
26.71	1.75e+00 6.03e+00	1.88e+01 1.36e+01	2.19e+00 1.59e+00	3.51e+01 3.32e+01	1.46e+00 1.38e+00

## Element: In, Z= 49

Edge energy, radiation ratio and jump for In (Z= 49)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	3.730	3.938	4.238	27.940
Fluor Yield (xraylib)	0.060	0.061	0.020	0.844
Fluor Yield (Krause)	0.060	0.061	0.020	0.853
Jump Factor	3.150	1.400	1.148	6.229

XRF line energies and fractional radiative rate for In (Z= 49)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	24.210	24.002	27.276	27.237
Radiative rate	0.535	0.285	0.099	0.051

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	3.573	3.487	3.921	3.287	2.904
Radiative rate	0.506	0.861	0.108	0.768	0.032

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for In (Z= 49)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
27.94	-	-	-	-
30.00	2.80e+03 2.84e+03	4.29e+03 4.35e+03	5.20e+02 5.27e+02	7.87e+02 7.98e+02
40.00	1.31e+03 1.35e+03	2.01e+03 2.07e+03	2.44e+02 2.50e+02	3.69e+02 3.79e+02
50.00	7.13e+02 7.36e+02	1.09e+03 1.13e+03	1.33e+02 1.37e+02	2.01e+02 2.07e+02
60.00	4.30e+02 4.46e+02	6.60e+02 6.83e+02	8.00e+01 8.28e+01	1.21e+02 1.25e+02
80.00	1.91e+02 1.99e+02	2.93e+02 3.05e+02	3.56e+01 3.70e+01	5.38e+01 5.60e+01
100.00	1.01e+02 1.05e+02	1.55e+02 1.62e+02	1.88e+01 1.96e+01	2.84e+01 2.96e+01
150.00	3.14e+01 3.28e+01	4.81e+01 5.02e+01	5.83e+00 6.09e+00	8.83e+00 9.22e+00
200.00	1.37e+01 1.43e+01	2.10e+01 2.19e+01	2.54e+00 2.66e+00	3.85e+00 4.03e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for In (Z= 49)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
3.73	-	-	-	-	-
3.94	-	-	-	5.55e+03 5.61e+03	2.31e+02 2.33e+02
4.24	-	3.04e+03 3.03e+03	3.82e+02 3.80e+02	4.97e+03 5.78e+03	2.06e+02 2.40e+02
4.00	-	3.51e+03 3.36e+03	4.40e+02 4.22e+02	5.73e+03 5.86e+03	2.38e+02 2.43e+02
5.00	2.01e+02 2.37e+02	2.12e+03 2.03e+03	2.66e+02 2.55e+02	3.85e+03 3.91e+03	1.60e+02 1.63e+02
6.00	1.25e+02 1.70e+02	1.32e+03 1.24e+03	1.66e+02 1.56e+02	2.40e+03 2.42e+03	9.95e+01 1.01e+02
8.00	5.85e+01 9.93e+01	6.18e+02 5.66e+02	7.77e+01 7.11e+01	1.12e+03 1.12e+03	4.66e+01 4.67e+01
10.00	3.21e+01 6.37e+01	3.39e+02 3.01e+02	4.26e+01 3.78e+01	6.16e+02 6.12e+02	2.56e+01 2.54e+01
15.00	1.06e+01 2.69e+01	1.12e+02 9.25e+01	1.41e+01 1.16e+01	2.03e+02 1.98e+02	8.43e+00 8.23e+00
20.00	4.75e+00 1.40e+01	5.02e+01 3.92e+01	6.31e+00 4.92e+00	9.11e+01 8.79e+01	3.78e+00 3.65e+00
27.93	1.85e+00 6.33e+00	1.96e+01 1.42e+01	2.46e+00 1.78e+00	3.55e+01 3.38e+01	1.48e+00 1.40e+00

## Element: Sn, Z= 50

Edge energy, radiation ratio and jump for Sn (Z= 50)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	3.929	4.156	4.465	29.200
Fluor Yield (xraylib)	0.064	0.065	0.037	0.874
Fluor Yield (Krause)	0.064	0.065	0.037	0.862
Jump Factor	3.006	1.400	1.148	6.161

XRF line energies and fractional radiative rate for Sn (Z= 50)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	25.271	25.044	28.486	28.444
Radiative rate	0.533	0.285	0.100	0.051

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	3.750	3.663	4.131	3.444	3.045
Radiative rate	0.501	0.854	0.115	0.762	0.032



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Sn (Z= 50)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
29.20	-	-	-	-
30.00	3.11e+03 3.08e+03	4.77e+03 4.72e+03	5.83e+02 5.78e+02	8.83e+02 8.74e+02
40.00	1.45e+03 1.45e+03	2.23e+03 2.23e+03	2.72e+02 2.72e+02	4.12e+02 4.12e+02
50.00	7.90e+02 7.95e+02	1.21e+03 1.22e+03	1.48e+02 1.49e+02	2.24e+02 2.26e+02
60.00	4.78e+02 4.83e+02	7.33e+02 7.41e+02	8.97e+01 9.06e+01	1.36e+02 1.37e+02
80.00	2.13e+02 2.16e+02	3.27e+02 3.32e+02	4.00e+01 4.06e+01	6.05e+01 6.14e+01
100.00	1.13e+02 1.15e+02	1.73e+02 1.76e+02	2.12e+01 2.15e+01	3.20e+01 3.26e+01
150.00	3.51e+01 3.58e+01	5.39e+01 5.49e+01	6.59e+00 6.72e+00	9.96e+00 1.02e+01
200.00	1.53e+01 1.57e+01	2.35e+01 2.40e+01	2.88e+00 2.94e+00	4.36e+00 4.45e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Sn (Z= 50)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
3.93	-	-	-	-	-
4.16	-	-	-	7.31e+03 5.55e+03	3.05e+02 2.31e+02
4.46	-	3.02e+03 3.10e+03	4.05e+02 4.15e+02	4.84e+03 5.38e+03	2.02e+02 2.24e+02
4.00	-	-	-	5.99e+03 6.17e+03	2.50e+02 2.57e+02
5.00	3.97e+02 4.45e+02	2.50e+03 2.41e+03	3.35e+02 3.23e+02	3.99e+03 4.09e+03	1.66e+02 1.71e+02
6.00	2.48e+02 3.24e+02	1.56e+03 1.49e+03	2.09e+02 2.00e+02	2.49e+03 2.49e+03	1.04e+02 1.04e+02
8.00	1.16e+02 1.90e+02	7.31e+02 6.90e+02	9.80e+01 9.24e+01	1.17e+03 1.13e+03	4.88e+01 4.71e+01
10.00	6.40e+01 1.22e+02	4.02e+02 3.73e+02	5.39e+01 5.00e+01	6.43e+02 6.00e+02	2.68e+01 2.50e+01
15.00	2.11e+01 5.20e+01	1.33e+02 1.18e+02	1.78e+01 1.58e+01	2.12e+02 1.85e+02	8.86e+00 7.72e+00
20.00	9.50e+00 2.72e+01	5.97e+01 5.13e+01	8.00e+00 6.88e+00	9.54e+01 7.88e+01	3.98e+00 3.29e+00
29.20	3.27e+00 1.11e+01	2.06e+01 1.68e+01	2.76e+00 2.25e+00	3.29e+01 2.53e+01	1.37e+00 1.05e+00

## Element: Sb, Z= 51

Edge energy, radiation ratio and jump for Sb (Z= 51)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	4.132	4.380	4.698	30.491
Fluor Yield (xraylib)	0.069	0.069	0.039	0.872
Fluor Yield (Krause)	0.069	0.069	0.039	0.870
Jump Factor	3.013	1.400	1.148	6.130

XRF line energies and fractional radiative rate for Sb (Z= 51)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	26.359	26.111	29.726	29.679
Radiative rate	0.531	0.284	0.100	0.052

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	3.933	3.844	4.348	3.605	3.189
Radiative rate	0.495	0.849	0.120	0.758	0.032

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Sb (Z= 51)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
30.49	-	-	-	-
40.00	1.54e+03 1.56e+03	2.37e+03 2.39e+03	2.91e+02 2.94e+02	4.42e+02 4.47e+02
50.00	8.43e+02 8.56e+02	1.29e+03 1.32e+03	1.59e+02 1.61e+02	2.42e+02 2.45e+02
60.00	5.11e+02 5.21e+02	7.84e+02 8.01e+02	9.62e+01 9.82e+01	1.46e+02 1.49e+02
80.00	2.28e+02 2.34e+02	3.51e+02 3.59e+02	4.30e+01 4.41e+01	6.54e+01 6.71e+01
100.00	1.21e+02 1.24e+02	1.86e+02 1.91e+02	2.28e+01 2.34e+01	3.47e+01 3.57e+01
150.00	3.78e+01 3.90e+01	5.81e+01 5.98e+01	7.12e+00 7.34e+00	1.08e+01 1.12e+01
200.00	1.66e+01 1.71e+01	2.54e+01 2.62e+01	3.12e+00 3.22e+00	4.74e+00 4.90e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Sb (Z= 51)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
4.13	-	-	-	-	-
4.38	-	-	-	7.38e+03 5.56e+03	3.09e+02 2.33e+02
4.70	-	3.46e+03 3.07e+03	4.92e+02 4.36e+02	5.65e+03 5.41e+03	2.36e+02 2.26e+02
5.00	4.44e+02 4.72e+02	2.82e+03 2.71e+03	4.00e+02 3.84e+02	4.60e+03 4.71e+03	1.92e+02 1.97e+02
6.00	2.79e+02 3.51e+02	1.77e+03 1.70e+03	2.51e+02 2.41e+02	2.89e+03 2.89e+03	1.21e+02 1.21e+02
8.00	1.31e+02 2.06e+02	8.33e+02 7.87e+02	1.18e+02 1.12e+02	1.36e+03 1.31e+03	5.67e+01 5.49e+01
10.00	7.22e+01 1.33e+02	4.59e+02 4.27e+02	6.51e+01 6.06e+01	7.47e+02 7.00e+02	3.13e+01 2.93e+01
15.00	2.39e+01 5.70e+01	1.52e+02 1.36e+02	2.15e+01 1.93e+01	2.47e+02 2.17e+02	1.04e+01 9.08e+00
20.00	1.08e+01 3.00e+01	6.84e+01 5.92e+01	9.70e+00 8.40e+00	1.11e+02 9.29e+01	4.66e+00 3.89e+00
30.00	3.44e+00 1.15e+01	2.19e+01 1.79e+01	3.10e+00 2.55e+00	3.56e+01 2.75e+01	1.49e+00 1.15e+00
30.49	3.29e+00 1.11e+01	2.09e+01 1.71e+01	2.96e+00 2.43e+00	3.40e+01 2.62e+01	1.42e+00 1.10e+00

## Element: Te, Z= 52

Edge energy, radiation ratio and jump for Te (Z= 52)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	4.341	4.612	4.939	31.814
Fluor Yield (xraylib)	0.074	0.074	0.041	0.823
Fluor Yield (Krause)	0.074	0.074	0.041	0.877
Jump Factor	2.978	1.400	1.149	6.085

XRF line energies and fractional radiative rate for Te (Z= 52)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	27.473	27.202	30.996	30.945
Radiative rate	0.528	0.284	0.101	0.052

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	4.120	4.030	4.571	3.769	3.336
Radiative rate	0.490	0.844	0.126	0.753	0.032

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Te (Z= 52)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
31.81	-	-	-	-
40.00	1.55e+03 1.66e+03	2.38e+03 2.56e+03	2.96e+02 3.18e+02	4.47e+02 4.81e+02
50.00	8.48e+02 9.19e+02	1.30e+03 1.41e+03	1.62e+02 1.76e+02	2.45e+02 2.66e+02
60.00	5.15e+02 5.61e+02	7.91e+02 8.62e+02	9.84e+01 1.07e+02	1.49e+02 1.62e+02
80.00	2.31e+02 2.52e+02	3.54e+02 3.88e+02	4.41e+01 4.83e+01	6.67e+01 7.30e+01
100.00	1.23e+02 1.34e+02	1.88e+02 2.07e+02	2.34e+01 2.57e+01	3.54e+01 3.89e+01
150.00	3.84e+01 4.22e+01	5.90e+01 6.49e+01	7.34e+00 8.08e+00	1.11e+01 1.22e+01
200.00	1.68e+01 1.86e+01	2.59e+01 2.85e+01	3.22e+00 3.55e+00	4.87e+00 5.37e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Te (Z= 52)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
4.34	-	-	-	-	-
4.61	-	-	-	5.45e+03 5.55e+03	2.29e+02 2.33e+02
4.94	-	3.49e+03 3.10e+03	5.21e+02 4.62e+02	5.66e+03 5.41e+03	2.38e+02 2.27e+02
5.00	4.94e+02 5.09e+02	3.23e+03 3.08e+03	4.81e+02 4.59e+02	5.20e+03 5.35e+03	2.18e+02 2.25e+02
6.00	3.13e+02 3.78e+02	2.04e+03 1.97e+03	3.05e+02 2.93e+02	3.29e+03 3.32e+03	1.38e+02 1.39e+02
8.00	1.47e+02 2.23e+02	9.60e+02 9.13e+02	1.43e+02 1.36e+02	1.55e+03 1.51e+03	6.50e+01 6.32e+01
10.00	8.13e+01 1.45e+02	5.30e+02 4.98e+02	7.91e+01 7.43e+01	8.55e+02 8.07e+02	3.59e+01 3.39e+01
15.00	2.70e+01 6.23e+01	1.76e+02 1.60e+02	2.63e+01 2.39e+01	2.84e+02 2.51e+02	1.19e+01 1.05e+01
20.00	1.22e+01 3.30e+01	7.94e+01 6.99e+01	1.19e+01 1.04e+01	1.28e+02 1.08e+02	5.38e+00 4.52e+00
30.00	3.90e+00 1.27e+01	2.55e+01 2.13e+01	3.80e+00 3.19e+00	4.10e+01 3.20e+01	1.72e+00 1.34e+00
31.81	3.30e+00 1.11e+01	2.16e+01 1.80e+01	3.22e+00 2.68e+00	3.48e+01 2.69e+01	1.46e+00 1.13e+00

## Element: I , Z= 53

Edge energy, radiation ratio and jump for I (Z= 53)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	4.557	4.852	5.188	33.169
Fluor Yield (xraylib)	0.079	0.079	0.044	0.841
Fluor Yield (Krause)	0.079	0.079	0.044	0.884
Jump Factor	2.950	1.400	1.149	6.039

XRF line energies and fractional radiative rate for I (Z= 53)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	28.612	28.318	32.295	32.240
Radiative rate	0.526	0.283	0.101	0.052

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	4.313	4.221	4.801	3.938	3.485
Radiative rate	0.483	0.839	0.131	0.748	0.032

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for I (Z= 53)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
33.17	-	-	-	-
40.00	1.67e+03 1.77e+03	2.58e+03 2.73e+03	3.21e+02 3.40e+02	4.88e+02 5.17e+02
50.00	9.24e+02 9.87e+02	1.42e+03 1.52e+03	1.77e+02 1.89e+02	2.69e+02 2.87e+02
60.00	5.61e+02 6.02e+02	8.63e+02 9.26e+02	1.08e+02 1.16e+02	1.64e+02 1.76e+02
80.00	2.52e+02 2.72e+02	3.88e+02 4.19e+02	4.84e+01 5.22e+01	7.35e+01 7.93e+01
100.00	1.34e+02 1.45e+02	2.07e+02 2.23e+02	2.58e+01 2.79e+01	3.91e+01 4.23e+01
150.00	4.22e+01 4.58e+01	6.49e+01 7.04e+01	8.09e+00 8.78e+00	1.23e+01 1.33e+01
200.00	1.86e+01 2.02e+01	2.85e+01 3.10e+01	3.56e+00 3.87e+00	5.41e+00 5.87e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for I (Z= 53)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
4.56	-	-	-	-	-
4.85	-	-	-	7.32e+03 5.52e+03	3.09e+02 2.33e+02
5.19	-	3.51e+03 3.11e+03	5.47e+02 4.84e+02	5.65e+03 5.39e+03	2.39e+02 2.27e+02
5.00	-	3.34e+03 3.19e+03	5.21e+02 4.98e+02	5.39e+03 5.54e+03	2.28e+02 2.34e+02
6.00	3.57e+02 4.12e+02	2.33e+03 2.24e+03	3.63e+02 3.49e+02	3.74e+03 3.78e+03	1.58e+02 1.60e+02
8.00	1.68e+02 2.45e+02	1.10e+03 1.05e+03	1.71e+02 1.63e+02	1.76e+03 1.72e+03	7.43e+01 7.26e+01
10.00	9.30e+01 1.60e+02	6.07e+02 5.72e+02	9.46e+01 8.92e+01	9.73e+02 9.23e+02	4.11e+01 3.90e+01
15.00	3.10e+01 6.93e+01	2.02e+02 1.84e+02	3.15e+01 2.88e+01	3.24e+02 2.89e+02	1.37e+01 1.22e+01
20.00	1.40e+01 3.68e+01	9.13e+01 8.09e+01	1.42e+01 1.26e+01	1.46e+02 1.24e+02	6.18e+00 5.24e+00
30.00	4.49e+00 1.43e+01	2.93e+01 2.48e+01	4.57e+00 3.86e+00	4.70e+01 3.70e+01	1.99e+00 1.56e+00
33.16	3.38e+00 1.12e+01	2.21e+01 1.84e+01	3.44e+00 2.87e+00	3.54e+01 2.73e+01	1.50e+00 1.15e+00

## Element: Xe, Z= 54

Edge energy, radiation ratio and jump for Xe (Z= 54)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	4.782	5.104	5.453	34.564
Fluor Yield (xraylib)	0.085	0.083	0.046	0.889
Fluor Yield (Krause)	0.085	0.083	0.046	0.891
Jump Factor	2.920	1.400	1.150	5.988

XRF line energies and fractional radiative rate for Xe (Z= 54)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	29.779	29.458	33.624	33.563
Radiative rate	0.525	0.283	0.102	0.052

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	4.512	4.418	5.037	4.110	3.638
Radiative rate	0.477	0.834	0.135	0.744	0.032



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Xe (Z= 54)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
34.56	-	-	-	-
40.00	1.87e+03 1.89e+03	2.89e+03 2.91e+03	3.64e+02 3.67e+02	5.50e+02 5.54e+02
50.00	1.04e+03 1.06e+03	1.60e+03 1.63e+03	2.02e+02 2.06e+02	3.05e+02 3.10e+02
60.00	6.32e+02 6.46e+02	9.73e+02 9.95e+02	1.23e+02 1.25e+02	1.85e+02 1.89e+02
80.00	2.85e+02 2.93e+02	4.39e+02 4.51e+02	5.54e+01 5.69e+01	8.36e+01 8.59e+01
100.00	1.52e+02 1.57e+02	2.34e+02 2.41e+02	2.95e+01 3.05e+01	4.46e+01 4.60e+01
150.00	4.79e+01 4.96e+01	7.38e+01 7.63e+01	9.31e+00 9.63e+00	1.41e+01 1.45e+01
200.00	2.11e+01 2.19e+01	3.25e+01 3.37e+01	4.10e+00 4.25e+00	6.19e+00 6.41e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Xe (Z= 54)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
4.78	-	-	-	-	-
5.10	-	-	-	5.44e+03 5.57e+03	2.31e+02 2.37e+02
5.45	-	3.00e+03 3.13e+03	4.86e+02 5.08e+02	4.92e+03 5.50e+03	2.09e+02 2.34e+02
5.00	-	-	-	5.75e+03 5.85e+03	2.44e+02 2.48e+02
6.00	3.94e+02 4.33e+02	2.61e+03 2.51e+03	4.23e+02 4.07e+02	4.25e+03 4.33e+03	1.81e+02 1.84e+02
8.00	1.87e+02 2.61e+02	1.24e+03 1.19e+03	2.01e+02 1.92e+02	2.01e+03 1.98e+03	8.55e+01 8.40e+01
10.00	1.04e+02 1.71e+02	6.86e+02 6.50e+02	1.11e+02 1.05e+02	1.12e+03 1.07e+03	4.74e+01 4.52e+01
15.00	3.46e+01 7.50e+01	2.29e+02 2.11e+02	3.71e+01 3.43e+01	3.73e+02 3.34e+02	1.58e+01 1.42e+01
20.00	1.56e+01 4.00e+01	1.04e+02 9.32e+01	1.68e+01 1.51e+01	1.69e+02 1.44e+02	7.16e+00 6.11e+00
30.00	5.03e+00 1.56e+01	3.33e+01 2.87e+01	5.40e+00 4.66e+00	5.43e+01 4.30e+01	2.30e+00 1.83e+00
34.56	3.37e+00 1.11e+01	2.24e+01 1.90e+01	3.62e+00 3.07e+00	3.64e+01 2.81e+01	1.55e+00 1.19e+00

## Element: Cs, Z= 55

Edge energy, radiation ratio and jump for Cs (Z= 55)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	5.012	5.359	5.714	35.985
Fluor Yield (xraylib)	0.091	0.090	0.049	0.898
Fluor Yield (Krause)	0.091	0.090	0.049	0.897
Jump Factor	2.955	1.400	1.150	5.949

XRF line energies and fractional radiative rate for Cs (Z= 55)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	30.973	30.625	34.987	34.920
Radiative rate	0.524	0.283	0.102	0.052

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	4.717	4.620	5.280	4.286	3.795
Radiative rate	0.472	0.831	0.140	0.741	0.032

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Cs (Z= 55)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
35.98	-	-	-	-
40.00	2.00e+03 2.01e+03	3.08e+03 3.09e+03	3.90e+02 3.91e+02	5.91e+02 5.92e+02
50.00	1.12e+03 1.13e+03	1.72e+03 1.74e+03	2.17e+02 2.20e+02	3.29e+02 3.33e+02
60.00	6.79e+02 6.91e+02	1.05e+03 1.06e+03	1.32e+02 1.35e+02	2.00e+02 2.04e+02
80.00	3.07e+02 3.14e+02	4.73e+02 4.85e+02	5.99e+01 6.13e+01	9.07e+01 9.28e+01
100.00	1.64e+02 1.69e+02	2.53e+02 2.60e+02	3.20e+01 3.29e+01	4.85e+01 4.98e+01
150.00	5.19e+01 5.35e+01	8.00e+01 8.24e+01	1.01e+01 1.04e+01	1.53e+01 1.58e+01
200.00	2.29e+01 2.36e+01	3.53e+01 3.64e+01	4.47e+00 4.61e+00	6.77e+00 6.98e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Cs (Z= 55)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
5.01	-	-	-	-	-
5.36	-	-	-	7.52e+03 5.54e+03	3.21e+02 2.36e+02
5.71	-	3.54e+03 3.15e+03	5.94e+02 5.29e+02	5.76e+03 5.44e+03	2.46e+02 2.32e+02
6.00	4.43e+02 4.70e+02	3.01e+03 2.87e+03	5.05e+02 4.82e+02	4.85e+03 4.92e+03	2.07e+02 2.10e+02
8.00	2.11e+02 2.85e+02	1.43e+03 1.37e+03	2.41e+02 2.31e+02	2.31e+03 2.27e+03	9.88e+01 9.67e+01
10.00	1.17e+02 1.87e+02	7.95e+02 7.56e+02	1.34e+02 1.27e+02	1.28e+03 1.22e+03	5.48e+01 5.21e+01
15.00	3.93e+01 8.26e+01	2.66e+02 2.47e+02	4.48e+01 4.15e+01	4.30e+02 3.84e+02	1.84e+01 1.64e+01
20.00	1.78e+01 4.42e+01	1.21e+02 1.09e+02	2.03e+01 1.83e+01	1.95e+02 1.66e+02	8.32e+00 7.08e+00
30.00	5.74e+00 1.74e+01	3.89e+01 3.38e+01	6.54e+00 5.67e+00	6.29e+01 4.97e+01	2.68e+00 2.12e+00
35.98	3.44e+00 1.12e+01	2.33e+01 1.98e+01	3.92e+00 3.33e+00	3.76e+01 2.88e+01	1.61e+00 1.23e+00

## Element: Ba, Z= 56

Edge energy, radiation ratio and jump for Ba (Z= 56)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	5.247	5.624	5.989	37.441
Fluor Yield (xraylib)	0.097	0.096	0.052	0.931
Fluor Yield (Krause)	0.097	0.096	0.052	0.902
Jump Factor	2.896	1.400	1.150	5.901

XRF line energies and fractional radiative rate for Ba (Z= 56)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	32.193	31.817	36.377	36.303
Radiative rate	0.521	0.283	0.102	0.053

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	4.927	4.828	5.531	4.466	3.954
Radiative rate	0.466	0.827	0.144	0.737	0.032

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Ba (Z= 56)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
37.44	-	-	-	-
40.00	2.20e+03 2.14e+03	3.40e+03 3.30e+03	4.31e+02 4.19e+02	6.55e+02 6.36e+02
50.00	1.22e+03 1.20e+03	1.89e+03 1.85e+03	2.40e+02 2.35e+02	3.64e+02 3.57e+02
60.00	7.47e+02 7.37e+02	1.15e+03 1.14e+03	1.46e+02 1.44e+02	2.22e+02 2.19e+02
80.00	3.39e+02 3.36e+02	5.23e+02 5.18e+02	6.63e+01 6.58e+01	1.01e+02 9.99e+01
100.00	1.81e+02 1.81e+02	2.80e+02 2.79e+02	3.55e+01 3.53e+01	5.40e+01 5.37e+01
150.00	5.76e+01 5.75e+01	8.88e+01 8.87e+01	1.13e+01 1.13e+01	1.71e+01 1.71e+01
200.00	2.55e+01 2.55e+01	3.93e+01 3.93e+01	4.98e+00 4.98e+00	7.57e+00 7.57e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Ba (Z= 56)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
5.25	-	-	-	-	-
5.62	-	-	-	5.47e+03 5.51e+03	2.35e+02 2.37e+02
5.99	-	3.09e+03 3.17e+03	5.38e+02 5.51e+02	4.97e+03 5.43e+03	2.14e+02 2.34e+02
6.00	4.95e+02 5.06e+02	3.39e+03 3.23e+03	5.90e+02 5.63e+02	5.42e+03 5.52e+03	2.33e+02 2.37e+02
8.00	2.38e+02 3.10e+02	1.63e+03 1.57e+03	2.84e+02 2.73e+02	2.61e+03 2.57e+03	1.12e+02 1.11e+02
10.00	1.32e+02 2.04e+02	9.06e+02 8.61e+02	1.58e+02 1.50e+02	1.45e+03 1.39e+03	6.23e+01 5.97e+01
15.00	4.44e+01 9.04e+01	3.04e+02 2.83e+02	5.30e+01 4.93e+01	4.86e+02 4.39e+02	2.09e+01 1.89e+01
20.00	2.02e+01 4.87e+01	1.38e+02 1.26e+02	2.41e+01 2.19e+01	2.21e+02 1.90e+02	9.50e+00 8.17e+00
30.00	6.51e+00 1.93e+01	4.46e+01 3.90e+01	7.77e+00 6.78e+00	7.13e+01 5.71e+01	3.07e+00 2.46e+00
37.44	3.49e+00 1.13e+01	2.39e+01 2.04e+01	4.16e+00 3.55e+00	3.82e+01 2.94e+01	1.64e+00 1.26e+00

## Element: La, Z= 57

Edge energy, radiation ratio and jump for La (Z= 57)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	5.483	5.891	6.266	38.925
Fluor Yield (xraylib)	0.104	0.103	0.055	0.913
Fluor Yield (Krause)	0.104	0.103	0.055	0.907
Jump Factor	2.868	1.400	1.151	5.863

XRF line energies and fractional radiative rate for La (Z= 57)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	33.442	33.034	37.801	37.721
Radiative rate	0.520	0.283	0.103	0.053

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	5.143	5.042	5.788	4.651	4.124
Radiative rate	0.461	0.823	0.147	0.732	0.032

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for La (Z= 57)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
38.92	-	-	-	-
40.00	2.28e+03 2.27e+03	3.53e+03 3.51e+03	4.53e+02 4.50e+02	6.84e+02 6.80e+02
50.00	1.27e+03 1.28e+03	1.96e+03 1.97e+03	2.52e+02 2.53e+02	3.81e+02 3.82e+02
60.00	7.79e+02 7.86e+02	1.20e+03 1.21e+03	1.54e+02 1.56e+02	2.33e+02 2.35e+02
80.00	3.54e+02 3.59e+02	5.46e+02 5.55e+02	7.01e+01 7.12e+01	1.06e+02 1.08e+02
100.00	1.90e+02 1.94e+02	2.93e+02 2.99e+02	3.76e+01 3.83e+01	5.68e+01 5.79e+01
150.00	6.04e+01 6.18e+01	9.33e+01 9.55e+01	1.20e+01 1.22e+01	1.81e+01 1.85e+01
200.00	2.68e+01 2.74e+01	4.13e+01 4.24e+01	5.30e+00 5.44e+00	8.02e+00 8.22e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for La (Z= 57)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
5.48	-	-	-	-	-
5.89	-	-	-	5.49e+03 5.53e+03	2.39e+02 2.40e+02
6.27	-	3.62e+03 3.17e+03	6.48e+02 5.68e+02	5.79e+03 5.41e+03	2.51e+02 2.35e+02
6.00	-	3.51e+03 3.33e+03	6.28e+02 5.97e+02	5.61e+03 5.72e+03	2.44e+02 2.48e+02
8.00	2.67e+02 3.36e+02	1.87e+03 1.79e+03	3.34e+02 3.21e+02	2.97e+03 2.95e+03	1.29e+02 1.28e+02
10.00	1.48e+02 2.22e+02	1.03e+03 9.87e+02	1.85e+02 1.77e+02	1.65e+03 1.59e+03	7.15e+01 6.91e+01
15.00	5.00e+01 9.87e+01	3.49e+02 3.26e+02	6.25e+01 5.85e+01	5.55e+02 5.06e+02	2.41e+01 2.20e+01
20.00	2.27e+01 5.34e+01	1.59e+02 1.45e+02	2.84e+01 2.60e+01	2.53e+02 2.20e+02	1.10e+01 9.54e+00
30.00	7.36e+00 2.12e+01	5.14e+01 4.52e+01	9.21e+00 8.09e+00	8.18e+01 6.64e+01	3.55e+00 2.88e+00
38.92	3.53e+00 1.14e+01	2.47e+01 2.11e+01	4.42e+00 3.78e+00	3.93e+01 3.05e+01	1.71e+00 1.32e+00

## Element: Ce, Z= 58

Edge energy, radiation ratio and jump for Ce (Z= 58)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	5.723	6.164	6.549	40.443
Fluor Yield (xraylib)	0.111	0.110	0.058	0.912
Fluor Yield (Krause)	0.111	0.110	0.058	0.912
Jump Factor	2.852	1.400	1.151	5.806

XRF line energies and fractional radiative rate for Ce (Z= 58)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	34.720	34.279	39.258	39.170
Radiative rate	0.519	0.283	0.103	0.053

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	5.365	5.263	6.052	4.840	4.288
Radiative rate	0.460	0.825	0.147	0.734	0.032



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Ce (Z= 58)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
40.44	-	-	-	-
50.00	1.34e+03 1.35e+03	2.07e+03 2.09e+03	2.66e+02 2.68e+02	4.04e+02 4.08e+02
60.00	8.24e+02 8.37e+02	1.27e+03 1.29e+03	1.64e+02 1.66e+02	2.49e+02 2.52e+02
80.00	3.75e+02 3.84e+02	5.80e+02 5.93e+02	7.45e+01 7.62e+01	1.13e+02 1.16e+02
100.00	2.02e+02 2.07e+02	3.12e+02 3.20e+02	4.01e+01 4.11e+01	6.08e+01 6.24e+01
150.00	6.44e+01 6.64e+01	9.96e+01 1.03e+02	1.28e+01 1.32e+01	1.94e+01 2.00e+01
200.00	2.86e+01 2.95e+01	4.42e+01 4.56e+01	5.68e+00 5.86e+00	8.62e+00 8.90e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Ce (Z= 58)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
5.72	-	-	-	-	-
6.16	-	-	-	7.56e+03 5.63e+03	3.30e+02 2.45e+02
6.55	-	3.68e+03 3.29e+03	6.54e+02 5.84e+02	5.87e+03 5.58e+03	2.56e+02 2.43e+02
6.00	-	-	-	5.98e+03 6.03e+03	2.61e+02 2.63e+02
8.00	3.01e+02 3.65e+02	2.13e+03 2.05e+03	3.78e+02 3.64e+02	3.38e+03 3.37e+03	1.47e+02 1.47e+02
10.00	1.67e+02 2.41e+02	1.18e+03 1.13e+03	2.10e+02 2.01e+02	1.88e+03 1.82e+03	8.18e+01 7.93e+01
15.00	5.65e+01 1.08e+02	4.00e+02 3.76e+02	7.10e+01 6.68e+01	6.34e+02 5.81e+02	2.77e+01 2.54e+01
20.00	2.57e+01 5.89e+01	1.82e+02 1.68e+02	3.24e+01 2.98e+01	2.89e+02 2.53e+02	1.26e+01 1.10e+01
30.00	8.35e+00 2.36e+01	5.91e+01 5.24e+01	1.05e+01 9.30e+00	9.38e+01 7.66e+01	4.09e+00 3.34e+00
40.00	3.72e+00 1.19e+01	2.63e+01 2.26e+01	4.67e+00 4.02e+00	4.18e+01 3.25e+01	1.82e+00 1.42e+00
40.44	3.61e+00 1.16e+01	2.55e+01 2.19e+01	4.54e+00 3.89e+00	4.05e+01 3.14e+01	1.77e+00 1.37e+00

## Element: Pr, Z= 59

Edge energy, radiation ratio and jump for Pr (Z= 59)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	5.964	6.440	6.835	41.991
Fluor Yield (xraylib)	0.118	0.117	0.061	0.930
Fluor Yield (Krause)	0.118	0.117	0.061	0.917
Jump Factor	2.815	1.400	1.151	5.763

XRF line energies and fractional radiative rate for Pr (Z= 59)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	36.027	35.551	40.749	40.653
Radiative rate	0.517	0.283	0.104	0.053

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	5.592	5.489	6.322	5.034	4.453
Radiative rate	0.458	0.821	0.147	0.731	0.032

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Pr (Z= 59)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
41.99	-	-	-	-
50.00	1.44e+03 1.43e+03	2.23e+03 2.21e+03	2.89e+02 2.87e+02	4.38e+02 4.34e+02
60.00	8.90e+02 8.90e+02	1.38e+03 1.38e+03	1.79e+02 1.79e+02	2.70e+02 2.70e+02
80.00	4.06e+02 4.09e+02	6.28e+02 6.33e+02	8.16e+01 8.22e+01	1.23e+02 1.24e+02
100.00	2.19e+02 2.21e+02	3.38e+02 3.42e+02	4.40e+01 4.45e+01	6.65e+01 6.72e+01
150.00	7.00e+01 7.11e+01	1.08e+02 1.10e+02	1.41e+01 1.43e+01	2.13e+01 2.16e+01
200.00	3.12e+01 3.17e+01	4.82e+01 4.91e+01	6.26e+00 6.37e+00	9.47e+00 9.63e+00

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Pr (Z= 59)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
5.96	-	-	-	-	-
6.44	-	-	-	7.56e+03 5.64e+03	3.33e+02 2.48e+02
6.83	-	3.22e+03 3.32e+03	5.78e+02 5.95e+02	5.11e+03 5.60e+03	2.25e+02 2.46e+02
6.00	-	-	-	6.63e+03 6.67e+03	2.92e+02 2.94e+02
8.00	3.36e+02 3.91e+02	2.40e+03 2.31e+03	4.31e+02 4.15e+02	3.79e+03 3.81e+03	1.67e+02 1.68e+02
10.00	1.87e+02 2.60e+02	1.34e+03 1.29e+03	2.40e+02 2.31e+02	2.11e+03 2.06e+03	9.29e+01 9.07e+01
15.00	6.34e+01 1.18e+02	4.53e+02 4.28e+02	8.13e+01 7.68e+01	7.15e+02 6.61e+02	3.15e+01 2.91e+01
20.00	2.89e+01 6.44e+01	2.07e+02 1.92e+02	3.71e+01 3.44e+01	3.26e+02 2.88e+02	1.44e+01 1.27e+01
30.00	9.40e+00 2.59e+01	6.73e+01 6.01e+01	1.21e+01 1.08e+01	1.06e+02 8.75e+01	4.67e+00 3.85e+00
40.00	4.19e+00 1.31e+01	3.00e+01 2.60e+01	5.38e+00 4.66e+00	4.73e+01 3.71e+01	2.08e+00 1.64e+00
41.99	3.66e+00 1.17e+01	2.62e+01 2.26e+01	4.69e+00 4.05e+00	4.13e+01 3.21e+01	1.82e+00 1.41e+00

## Element: Nd, Z= 60

Edge energy, radiation ratio and jump for Nd (Z= 60)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	6.208	6.721	7.126	43.569
Fluor Yield (xraylib)	0.125	0.124	0.064	0.917
Fluor Yield (Krause)	0.125	0.124	0.064	0.921
Jump Factor	2.818	1.400	1.152	5.718

XRF line energies and fractional radiative rate for Nd (Z= 60)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	37.361	36.848	42.271	42.166
Radiative rate	0.516	0.283	0.104	0.054

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	5.828	5.721	6.601	5.230	4.632
Radiative rate	0.456	0.821	0.148	0.733	0.032

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Nd (Z= 60)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
43.57	-	-	-	-
50.00	1.50e+03 1.51e+03	2.32e+03 2.34e+03	3.01e+02 3.04e+02	4.57e+02 4.61e+02
60.00	9.27e+02 9.43e+02	1.44e+03 1.46e+03	1.87e+02 1.90e+02	2.84e+02 2.88e+02
80.00	4.25e+02 4.35e+02	6.58e+02 6.74e+02	8.56e+01 8.77e+01	1.30e+02 1.33e+02
100.00	2.29e+02 2.36e+02	3.55e+02 3.65e+02	4.62e+01 4.75e+01	7.01e+01 7.21e+01
150.00	7.36e+01 7.61e+01	1.14e+02 1.18e+02	1.48e+01 1.53e+01	2.25e+01 2.33e+01
200.00	3.28e+01 3.40e+01	5.08e+01 5.26e+01	6.61e+00 6.85e+00	1.00e+01 1.04e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Nd (Z= 60)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
6.21	-	-	-	-	-
6.72	-	-	-	5.61e+03 5.64e+03	2.49e+02 2.50e+02
7.13	-	3.26e+03 3.34e+03	5.89e+02 6.02e+02	5.18e+03 5.62e+03	2.30e+02 2.49e+02
8.00	3.73e+02 4.16e+02	2.70e+03 2.60e+03	4.88e+02 4.69e+02	4.28e+03 4.31e+03	1.90e+02 1.91e+02
10.00	2.08e+02 2.81e+02	1.51e+03 1.45e+03	2.73e+02 2.63e+02	2.39e+03 2.34e+03	1.06e+02 1.04e+02
15.00	7.08e+01 1.28e+02	5.13e+02 4.87e+02	9.27e+01 8.79e+01	8.13e+02 7.54e+02	3.61e+01 3.35e+01
20.00	3.24e+01 7.02e+01	2.35e+02 2.19e+02	4.24e+01 3.95e+01	3.72e+02 3.30e+02	1.65e+01 1.47e+01
30.00	1.05e+01 2.84e+01	7.65e+01 6.88e+01	1.38e+01 1.24e+01	1.21e+02 1.01e+02	5.38e+00 4.47e+00
40.00	4.71e+00 1.44e+01	3.41e+01 2.98e+01	6.17e+00 5.39e+00	5.41e+01 4.29e+01	2.40e+00 1.90e+00
43.56	3.70e+00 1.17e+01	2.68e+01 2.33e+01	4.85e+00 4.20e+00	4.25e+01 3.32e+01	1.89e+00 1.48e+00

## Element: Pm, Z= 61

Edge energy, radiation ratio and jump for Pm (Z= 61)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	6.459	7.013	7.428	45.184
Fluor Yield (xraylib)	0.132	0.132	0.066	0.918
Fluor Yield (Krause)	0.132	0.132	0.066	0.925
Jump Factor	2.801	1.400	1.152	5.674

XRF line energies and fractional radiative rate for Pm (Z= 61)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	38.725	38.172	43.826	43.713
Radiative rate	0.515	0.283	0.105	0.054

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	6.071	5.962	6.892	5.433	4.810
Radiative rate	0.452	0.820	0.149	0.733	0.033

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Pm (Z= 61)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
45.18	-	-	-	-
50.00	1.60e+03 1.59e+03	2.48e+03 2.47e+03	3.26e+02 3.25e+02	4.92e+02 4.90e+02
60.00	9.93e+02 9.97e+02	1.54e+03 1.55e+03	2.02e+02 2.03e+02	3.06e+02 3.07e+02
80.00	4.56e+02 4.62e+02	7.07e+02 7.16e+02	9.29e+01 9.42e+01	1.40e+02 1.42e+02
100.00	2.47e+02 2.51e+02	3.82e+02 3.89e+02	5.03e+01 5.12e+01	7.59e+01 7.72e+01
150.00	7.94e+01 8.12e+01	1.23e+02 1.26e+02	1.62e+01 1.66e+01	2.44e+01 2.50e+01
200.00	3.55e+01 3.64e+01	5.50e+01 5.64e+01	7.24e+00 7.41e+00	1.09e+01 1.12e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Pm (Z= 61)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
6.46	-	-	-	-	-
7.01	-	-	-	5.70e+03 5.65e+03	2.55e+02 2.53e+02
7.43	-	3.36e+03 3.39e+03	6.10e+02 6.16e+02	5.28e+03 5.65e+03	2.36e+02 2.53e+02
8.00	4.10e+02 4.36e+02	3.08e+03 2.91e+03	5.60e+02 5.29e+02	4.84e+03 4.82e+03	2.17e+02 2.16e+02
10.00	2.31e+02 2.98e+02	1.73e+03 1.65e+03	3.15e+02 3.01e+02	2.72e+03 2.64e+03	1.22e+02 1.18e+02
15.00	7.86e+01 1.36e+02	5.90e+02 5.55e+02	1.07e+02 1.01e+02	9.26e+02 8.51e+02	4.15e+01 3.81e+01
20.00	3.60e+01 7.49e+01	2.70e+02 2.50e+02	4.92e+01 4.54e+01	4.25e+02 3.74e+02	1.90e+01 1.67e+01
30.00	1.18e+01 3.05e+01	8.83e+01 7.89e+01	1.61e+01 1.43e+01	1.39e+02 1.14e+02	6.21e+00 5.11e+00
40.00	5.26e+00 1.55e+01	3.95e+01 3.43e+01	7.17e+00 6.24e+00	6.20e+01 4.87e+01	2.77e+00 2.18e+00
45.18	3.73e+00 1.16e+01	2.80e+01 2.40e+01	5.10e+00 4.37e+00	4.40e+01 3.39e+01	1.97e+00 1.52e+00

## Element: Sm, Z= 62

Edge energy, radiation ratio and jump for Sm (Z= 62)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	6.716	7.312	7.737	46.834
Fluor Yield (xraylib)	0.139	0.140	0.071	0.913
Fluor Yield (Krause)	0.139	0.140	0.071	0.929
Jump Factor	2.783	1.400	1.152	5.625

XRF line energies and fractional radiative rate for Sm (Z= 62)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	40.118	39.523	45.413	45.289
Radiative rate	0.514	0.284	0.105	0.054

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	6.316	6.204	7.178	5.636	4.990
Radiative rate	0.450	0.821	0.150	0.730	0.031



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Sm (Z= 62)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
46.83	-	-	-	-
50.00	1.66e+03 1.69e+03	2.57e+03 2.63e+03	3.39e+02 3.46e+02	5.13e+02 5.24e+02
60.00	1.02e+03 1.05e+03	1.59e+03 1.64e+03	2.09e+02 2.15e+02	3.17e+02 3.26e+02
80.00	4.72e+02 4.90e+02	7.33e+02 7.60e+02	9.65e+01 1.00e+02	1.46e+02 1.52e+02
100.00	2.56e+02 2.67e+02	3.97e+02 4.14e+02	5.23e+01 5.45e+01	7.92e+01 8.26e+01
150.00	8.27e+01 8.66e+01	1.28e+02 1.35e+02	1.69e+01 1.77e+01	2.56e+01 2.68e+01
200.00	3.70e+01 3.89e+01	5.75e+01 6.03e+01	7.57e+00 7.94e+00	1.15e+01 1.20e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Sm (Z= 62)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
6.72	-	-	-	-	-
7.31	-	-	-	5.60e+03 5.62e+03	2.38e+02 2.39e+02
7.74	-	3.36e+03 3.44e+03	6.15e+02 6.30e+02	5.19e+03 5.63e+03	2.21e+02 2.39e+02
8.00	4.59e+02 4.84e+02	3.41e+03 3.26e+03	6.25e+02 5.97e+02	5.28e+03 5.35e+03	2.24e+02 2.27e+02
10.00	2.59e+02 3.29e+02	1.93e+03 1.87e+03	3.53e+02 3.43e+02	2.98e+03 2.94e+03	1.27e+02 1.25e+02
15.00	8.84e+01 1.51e+02	6.58e+02 6.31e+02	1.20e+02 1.15e+02	1.02e+03 9.52e+02	4.32e+01 4.04e+01
20.00	4.06e+01 8.35e+01	3.02e+02 2.85e+02	5.53e+01 5.21e+01	4.67e+02 4.19e+02	1.98e+01 1.78e+01
30.00	1.33e+01 3.42e+01	9.90e+01 9.03e+01	1.81e+01 1.65e+01	1.53e+02 1.29e+02	6.49e+00 5.46e+00
40.00	5.95e+00 1.75e+01	4.43e+01 3.94e+01	8.11e+00 7.20e+00	6.85e+01 5.49e+01	2.91e+00 2.33e+00
46.83	3.82e+00 1.20e+01	2.85e+01 2.49e+01	5.21e+00 4.55e+00	4.40e+01 3.43e+01	1.87e+00 1.46e+00

## Element: Eu, Z= 63

Edge energy, radiation ratio and jump for Eu (Z= 63)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	6.977	7.617	8.052	48.519
Fluor Yield (xraylib)	0.147	0.149	0.075	0.939
Fluor Yield (Krause)	0.147	0.149	0.075	0.932
Jump Factor	2.766	1.400	1.152	5.582

XRF line energies and fractional radiative rate for Eu (Z= 63)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	41.543	40.902	47.038	46.904
Radiative rate	0.513	0.284	0.105	0.055

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	6.572	6.456	7.479	5.846	5.177
Radiative rate	0.447	0.820	0.150	0.731	0.033

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Eu (Z= 63)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
48.52	-	-	-	-
50.00	1.79e+03 1.78e+03	2.78e+03 2.76e+03	3.67e+02 3.64e+02	5.58e+02 5.54e+02
60.00	1.11e+03 1.11e+03	1.72e+03 1.72e+03	2.27e+02 2.27e+02	3.45e+02 3.46e+02
80.00	5.13e+02 5.18e+02	7.97e+02 8.05e+02	1.05e+02 1.06e+02	1.60e+02 1.61e+02
100.00	2.78e+02 2.83e+02	4.33e+02 4.39e+02	5.70e+01 5.79e+01	8.67e+01 8.81e+01
150.00	9.03e+01 9.22e+01	1.40e+02 1.43e+02	1.85e+01 1.89e+01	2.81e+01 2.87e+01
200.00	4.05e+01 4.14e+01	6.30e+01 6.44e+01	8.30e+00 8.49e+00	1.26e+01 1.29e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Eu (Z= 63)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
6.98	-	-	-	-	-
7.62	-	-	-	7.70e+03 5.65e+03	3.51e+02 2.58e+02
8.05	-	3.42e+03 3.49e+03	6.27e+02 6.41e+02	5.24e+03 5.66e+03	2.39e+02 2.58e+02
8.00	-	3.48e+03 3.33e+03	6.38e+02 6.11e+02	5.33e+03 5.41e+03	2.43e+02 2.47e+02
10.00	2.90e+02 3.55e+02	2.18e+03 2.12e+03	4.01e+02 3.89e+02	3.35e+03 3.32e+03	1.53e+02 1.51e+02
15.00	9.90e+01 1.64e+02	7.45e+02 7.18e+02	1.37e+02 1.32e+02	1.14e+03 1.07e+03	5.21e+01 4.89e+01
20.00	4.55e+01 9.10e+01	3.43e+02 3.25e+02	6.29e+01 5.97e+01	5.25e+02 4.74e+02	2.39e+01 2.16e+01
30.00	1.49e+01 3.75e+01	1.12e+02 1.03e+02	2.06e+01 1.90e+01	1.72e+02 1.46e+02	7.86e+00 6.64e+00
40.00	6.70e+00 1.92e+01	5.04e+01 4.52e+01	9.26e+00 8.29e+00	7.74e+01 6.23e+01	3.53e+00 2.84e+00
48.51	3.89e+00 1.21e+01	2.93e+01 2.58e+01	5.38e+00 4.73e+00	4.50e+01 3.51e+01	2.05e+00 1.60e+00

## Element: Gd, Z= 64

Edge energy, radiation ratio and jump for Gd (Z= 64)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	7.243	7.930	8.376	50.239
Fluor Yield (xraylib)	0.155	0.158	0.079	0.935
Fluor Yield (Krause)	0.155	0.158	0.079	0.935
Jump Factor	2.747	1.400	1.153	5.537

XRF line energies and fractional radiative rate for Gd (Z= 64)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	42.997	42.309	48.697	48.556
Radiative rate	0.511	0.284	0.106	0.054

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	6.831	6.713	7.786	6.057	5.362
Radiative rate	0.443	0.817	0.152	0.728	0.034

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Gd (Z= 64)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
50.24	-	-	-	-
60.00	1.16e+03 1.17e+03	1.80e+03 1.81e+03	2.40e+02 2.42e+02	3.62e+02 3.65e+02
80.00	5.38e+02 5.47e+02	8.37e+02 8.51e+02	1.12e+02 1.13e+02	1.68e+02 1.71e+02
100.00	2.93e+02 2.99e+02	4.55e+02 4.66e+02	6.07e+01 6.20e+01	9.17e+01 9.37e+01
150.00	9.52e+01 9.79e+01	1.48e+02 1.52e+02	1.97e+01 2.03e+01	2.98e+01 3.07e+01
200.00	4.28e+01 4.41e+01	6.66e+01 6.86e+01	8.88e+00 9.15e+00	1.34e+01 1.38e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Gd (Z= 64)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
7.24	-	-	-	-	-
7.93	-	-	-	7.69e+03 5.65e+03	3.55e+02 2.61e+02
8.38	-	3.46e+03 3.49e+03	6.45e+02 6.51e+02	5.25e+03 5.59e+03	2.42e+02 2.58e+02
8.00	-	3.88e+03 3.67e+03	7.23e+02 6.84e+02	5.89e+03 5.99e+03	2.72e+02 2.76e+02
10.00	3.22e+02 3.80e+02	2.45e+03 2.37e+03	4.56e+02 4.43e+02	3.71e+03 3.70e+03	1.71e+02 1.71e+02
15.00	1.10e+02 1.77e+02	8.38e+02 8.09e+02	1.56e+02 1.51e+02	1.27e+03 1.20e+03	5.87e+01 5.54e+01
20.00	5.07e+01 9.87e+01	3.86e+02 3.68e+02	7.19e+01 6.86e+01	5.85e+02 5.30e+02	2.70e+01 2.45e+01
30.00	1.67e+01 4.09e+01	1.27e+02 1.17e+02	2.37e+01 2.19e+01	1.93e+02 1.64e+02	8.89e+00 7.55e+00
40.00	7.49e+00 2.11e+01	5.70e+01 5.14e+01	1.06e+01 9.59e+00	8.65e+01 7.01e+01	3.99e+00 3.23e+00
50.00	4.01e+00 1.24e+01	3.05e+01 2.69e+01	5.69e+00 5.02e+00	4.63e+01 3.61e+01	2.14e+00 1.67e+00
50.23	3.95e+00 1.22e+01	3.01e+01 2.66e+01	5.61e+00 4.95e+00	4.57e+01 3.56e+01	2.11e+00 1.64e+00

## Element: Tb, Z= 65

Edge energy, radiation ratio and jump for Tb (Z= 65)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	7.514	8.252	8.708	51.996
Fluor Yield (xraylib)	0.164	0.167	0.083	0.938
Fluor Yield (Krause)	0.164	0.167	0.083	0.938
Jump Factor	2.732	1.400	1.153	5.492

XRF line energies and fractional radiative rate for Tb (Z= 65)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	44.483	43.745	50.383	50.230
Radiative rate	0.511	0.285	0.106	0.055

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	7.096	6.978	8.102	6.273	5.547
Radiative rate	0.441	0.819	0.152	0.728	0.034

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Tb (Z= 65)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
52.00	-	-	-	-
60.00	1.22e+03 1.22e+03	1.90e+03 1.91e+03	2.53e+02 2.54e+02	3.84e+02 3.86e+02
80.00	5.69e+02 5.78e+02	8.86e+02 9.01e+02	1.18e+02 1.20e+02	1.79e+02 1.82e+02
100.00	3.10e+02 3.17e+02	4.83e+02 4.94e+02	6.44e+01 6.58e+01	9.77e+01 9.98e+01
150.00	1.01e+02 1.04e+02	1.58e+02 1.62e+02	2.10e+01 2.16e+01	3.19e+01 3.28e+01
200.00	4.56e+01 4.70e+01	7.10e+01 7.32e+01	9.46e+00 9.75e+00	1.43e+01 1.48e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Tb (Z= 65)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
7.51	-	-	-	-	-
8.25	-	-	-	5.67e+03 5.68e+03	2.65e+02 2.65e+02
8.71	-	3.50e+03 3.58e+03	6.50e+02 6.65e+02	5.29e+03 5.70e+03	2.47e+02 2.66e+02
8.00	-	-	-	6.17e+03 6.20e+03	2.88e+02 2.89e+02
10.00	3.56e+02 4.05e+02	2.74e+03 2.66e+03	5.07e+02 4.93e+02	4.13e+03 4.13e+03	1.93e+02 1.93e+02
15.00	1.22e+02 1.91e+02	9.41e+02 9.12e+02	1.75e+02 1.69e+02	1.42e+03 1.35e+03	6.64e+01 6.31e+01
20.00	5.65e+01 1.07e+02	4.34e+02 4.17e+02	8.06e+01 7.73e+01	6.56e+02 5.97e+02	3.07e+01 2.79e+01
30.00	1.86e+01 4.47e+01	1.43e+02 1.34e+02	2.66e+01 2.48e+01	2.16e+02 1.85e+02	1.01e+01 8.63e+00
40.00	8.38e+00 2.31e+01	6.44e+01 5.86e+01	1.19e+01 1.09e+01	9.73e+01 7.92e+01	4.54e+00 3.70e+00
50.00	4.49e+00 1.36e+01	3.45e+01 3.07e+01	6.40e+00 5.70e+00	5.21e+01 4.09e+01	2.43e+00 1.91e+00
51.99	4.02e+00 1.24e+01	3.09e+01 2.75e+01	5.73e+00 5.09e+00	4.67e+01 3.64e+01	2.18e+00 1.70e+00

## Element: Dy, Z= 66

Edge energy, radiation ratio and jump for Dy (Z= 66)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	7.790	8.581	9.046	53.789
Fluor Yield (xraylib)	0.174	0.178	0.089	0.975
Fluor Yield (Krause)	0.174	0.178	0.089	0.941
Jump Factor	2.707	1.400	1.153	5.450

XRF line energies and fractional radiative rate for Dy (Z= 66)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	45.999	45.208	52.120	51.958
Radiative rate	0.509	0.285	0.106	0.055

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	7.370	7.248	8.419	6.495	5.743
Radiative rate	0.439	0.822	0.153	0.727	0.034



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Dy (Z= 66)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
53.79	-	-	-	-
60.00	1.33e+03 1.29e+03	2.07e+03 2.00e+03	2.76e+02 2.68e+02	4.20e+02 4.07e+02
80.00	6.22e+02 6.10e+02	9.70e+02 9.51e+02	1.30e+02 1.27e+02	1.97e+02 1.93e+02
100.00	3.40e+02 3.35e+02	5.30e+02 5.22e+02	7.07e+01 6.97e+01	1.08e+02 1.06e+02
150.00	1.11e+02 1.10e+02	1.73e+02 1.72e+02	2.31e+01 2.30e+01	3.52e+01 3.49e+01
200.00	5.01e+01 4.99e+01	7.82e+01 7.78e+01	1.04e+01 1.04e+01	1.59e+01 1.58e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Dy (Z= 66)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
7.79	-	-	-	-	-
8.58	-	-	-	5.71e+03 5.73e+03	2.71e+02 2.72e+02
9.05	-	3.60e+03 3.67e+03	6.69e+02 6.83e+02	5.34e+03 5.74e+03	2.54e+02 2.72e+02
8.00	-	-	-	6.93e+03 7.01e+03	3.29e+02 3.33e+02
10.00	4.01e+02 4.39e+02	3.09e+03 2.99e+03	5.75e+02 5.56e+02	4.59e+03 4.62e+03	2.18e+02 2.19e+02
15.00	1.39e+02 2.11e+02	1.07e+03 1.04e+03	1.99e+02 1.93e+02	1.59e+03 1.52e+03	7.54e+01 7.20e+01
20.00	6.41e+01 1.18e+02	4.94e+02 4.76e+02	9.20e+01 8.87e+01	7.35e+02 6.73e+02	3.49e+01 3.19e+01
30.00	2.12e+01 4.97e+01	1.63e+02 1.53e+02	3.04e+01 2.86e+01	2.43e+02 2.09e+02	1.15e+01 9.90e+00
40.00	9.54e+00 2.58e+01	7.35e+01 6.75e+01	1.37e+01 1.26e+01	1.09e+02 8.96e+01	5.19e+00 4.25e+00
50.00	5.11e+00 1.52e+01	3.94e+01 3.54e+01	7.34e+00 6.60e+00	5.86e+01 4.63e+01	2.78e+00 2.20e+00
53.78	4.17e+00 1.27e+01	3.21e+01 2.87e+01	5.98e+00 5.34e+00	4.78e+01 3.73e+01	2.27e+00 1.77e+00

## Element: Ho, Z= 67

Edge energy, radiation ratio and jump for Ho (Z= 67)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	8.071	8.918	9.394	55.618
Fluor Yield (xraylib)	0.182	0.189	0.094	0.944
Fluor Yield (Krause)	0.182	0.189	0.094	0.944
Jump Factor	2.706	1.400	1.153	5.403

XRF line energies and fractional radiative rate for Ho (Z= 67)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	47.547	46.700	53.877	53.711
Radiative rate	0.508	0.285	0.107	0.055

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	7.652	7.526	8.747	6.720	5.940
Radiative rate	0.436	0.822	0.154	0.726	0.035

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Ho (Z= 67)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
55.62	-	-	-	-
60.00	1.35e+03 1.36e+03	2.11e+03 2.12e+03	2.85e+02 2.86e+02	4.31e+02 4.32e+02
80.00	6.33e+02 6.42e+02	9.88e+02 1.00e+03	1.33e+02 1.35e+02	2.02e+02 2.05e+02
100.00	3.46e+02 3.53e+02	5.40e+02 5.52e+02	7.29e+01 7.44e+01	1.10e+02 1.13e+02
150.00	1.14e+02 1.17e+02	1.77e+02 1.82e+02	2.39e+01 2.46e+01	3.62e+01 3.72e+01
200.00	5.14e+01 5.29e+01	8.02e+01 8.26e+01	1.08e+01 1.11e+01	1.64e+01 1.69e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Ho (Z= 67)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
8.07	-	-	-	-	-
8.92	-	-	-	5.70e+03 5.71e+03	2.74e+02 2.74e+02
9.39	-	4.23e+03 3.74e+03	7.90e+02 6.99e+02	6.18e+03 5.72e+03	2.97e+02 2.75e+02
10.00	4.43e+02 4.72e+02	3.45e+03 3.33e+03	6.45e+02 6.23e+02	5.05e+03 5.09e+03	2.43e+02 2.45e+02
15.00	1.54e+02 2.28e+02	1.20e+03 1.17e+03	2.25e+02 2.19e+02	1.76e+03 1.68e+03	8.45e+01 8.07e+01
20.00	7.15e+01 1.29e+02	5.57e+02 5.39e+02	1.04e+02 1.01e+02	8.15e+02 7.47e+02	3.92e+01 3.59e+01
30.00	2.37e+01 5.43e+01	1.84e+02 1.74e+02	3.45e+01 3.26e+01	2.70e+02 2.32e+02	1.30e+01 1.12e+01
40.00	1.07e+01 2.83e+01	8.32e+01 7.69e+01	1.55e+01 1.44e+01	1.22e+02 1.00e+02	5.85e+00 4.80e+00
50.00	5.73e+00 1.67e+01	4.46e+01 4.05e+01	8.35e+00 7.57e+00	6.53e+01 5.17e+01	3.14e+00 2.49e+00
55.61	4.25e+00 1.29e+01	3.31e+01 2.98e+01	6.19e+00 5.56e+00	4.85e+01 3.77e+01	2.33e+00 1.81e+00

## Element: Er, Z= 68

Edge energy, radiation ratio and jump for Er (Z= 68)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	8.358	9.264	9.751	57.486
Fluor Yield (xraylib)	0.192	0.200	0.100	0.947
Fluor Yield (Krause)	0.192	0.200	0.100	0.947
Jump Factor	2.692	1.400	1.154	5.353

XRF line energies and fractional radiative rate for Er (Z= 68)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	49.127	48.222	55.674	55.480
Radiative rate	0.507	0.286	0.107	0.055

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	7.939	7.810	9.089	6.948	6.139
Radiative rate	0.433	0.821	0.154	0.726	0.035

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Er (Z= 68)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
57.49	-	-	-	-
60.00	1.43e+03 1.43e+03	2.23e+03 2.24e+03	3.01e+02 3.02e+02	4.57e+02 4.58e+02
80.00	6.66e+02 6.75e+02	1.04e+03 1.06e+03	1.41e+02 1.42e+02	2.13e+02 2.16e+02
100.00	3.65e+02 3.72e+02	5.71e+02 5.82e+02	7.70e+01 7.86e+01	1.17e+02 1.19e+02
150.00	1.20e+02 1.24e+02	1.88e+02 1.93e+02	2.54e+01 2.61e+01	3.85e+01 3.96e+01
200.00	5.45e+01 5.61e+01	8.52e+01 8.78e+01	1.15e+01 1.18e+01	1.74e+01 1.80e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Er (Z= 68)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
8.36	-	-	-	-	-
9.26	-	-	-	7.86e+03 5.74e+03	3.79e+02 2.77e+02
9.75	-	4.29e+03 3.79e+03	8.04e+02 7.11e+02	6.23e+03 5.76e+03	3.00e+02 2.77e+02
10.00	4.94e+02 5.15e+02	3.85e+03 3.71e+03	7.21e+02 6.96e+02	5.59e+03 5.65e+03	2.70e+02 2.72e+02
15.00	1.73e+02 2.48e+02	1.34e+03 1.32e+03	2.52e+02 2.48e+02	1.96e+03 1.87e+03	9.43e+01 9.03e+01
20.00	8.02e+01 1.41e+02	6.24e+02 6.08e+02	1.17e+02 1.14e+02	9.08e+02 8.36e+02	4.38e+01 4.03e+01
30.00	2.66e+01 5.96e+01	2.07e+02 1.98e+02	3.89e+01 3.70e+01	3.01e+02 2.61e+02	1.45e+01 1.26e+01
40.00	1.20e+01 3.12e+01	9.36e+01 8.73e+01	1.76e+01 1.64e+01	1.36e+02 1.12e+02	6.56e+00 5.42e+00
50.00	6.46e+00 1.85e+01	5.03e+01 4.60e+01	9.43e+00 8.63e+00	7.32e+01 5.82e+01	3.53e+00 2.80e+00
57.48	4.37e+00 1.32e+01	3.40e+01 3.08e+01	6.39e+00 5.77e+00	4.95e+01 3.86e+01	2.39e+00 1.86e+00

## Element: Tm, Z= 69

Edge energy, radiation ratio and jump for Tm (Z= 69)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	8.648	9.617	10.116	59.390
Fluor Yield (xraylib)	0.201	0.211	0.106	0.983
Fluor Yield (Krause)	0.201	0.211	0.106	0.949
Jump Factor	2.678	1.400	1.154	5.369

XRF line energies and fractional radiative rate for Tm (Z= 69)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	50.741	49.773	57.509	57.303
Radiative rate	0.506	0.286	0.107	0.056

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	8.231	8.102	9.426	7.180	6.342
Radiative rate	0.430	0.820	0.154	0.725	0.035

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Tm (Z= 69)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
59.39	-	-	-	-
60.00	1.53e+03 1.49e+03	2.39e+03 2.33e+03	3.23e+02 3.15e+02	4.92e+02 4.79e+02
80.00	7.19e+02 7.08e+02	1.13e+03 1.11e+03	1.52e+02 1.50e+02	2.31e+02 2.28e+02
100.00	3.95e+02 3.91e+02	6.18e+02 6.13e+02	8.35e+01 8.28e+01	1.27e+02 1.26e+02
150.00	1.31e+02 1.30e+02	2.04e+02 2.04e+02	2.76e+01 2.76e+01	4.20e+01 4.20e+01
200.00	5.93e+01 5.94e+01	9.28e+01 9.29e+01	1.25e+01 1.26e+01	1.91e+01 1.91e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Tm (Z= 69)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
8.65	-	-	-	-	-
9.62	-	-	-	5.66e+03 5.73e+03	2.76e+02 2.79e+02
10.12	-	3.71e+03 3.84e+03	6.99e+02 7.22e+02	5.34e+03 5.73e+03	2.60e+02 2.80e+02
10.00	-	3.83e+03 3.76e+03	7.21e+02 7.07e+02	5.50e+03 5.61e+03	2.69e+02 2.74e+02
15.00	1.90e+02 2.68e+02	1.48e+03 1.48e+03	2.79e+02 2.78e+02	2.13e+03 2.06e+03	1.04e+02 1.01e+02
20.00	8.86e+01 1.53e+02	6.90e+02 6.82e+02	1.30e+02 1.28e+02	9.89e+02 9.22e+02	4.83e+01 4.50e+01
30.00	2.95e+01 6.51e+01	2.30e+02 2.23e+02	4.32e+01 4.19e+01	3.29e+02 2.87e+02	1.61e+01 1.40e+01
40.00	1.33e+01 3.42e+01	1.04e+02 9.86e+01	1.96e+01 1.86e+01	1.49e+02 1.24e+02	7.27e+00 6.05e+00
50.00	7.18e+00 2.03e+01	5.59e+01 5.21e+01	1.05e+01 9.80e+00	8.02e+01 6.42e+01	3.91e+00 3.13e+00
59.38	4.44e+00 1.35e+01	3.45e+01 3.17e+01	6.50e+00 5.97e+00	4.95e+01 3.86e+01	2.42e+00 1.89e+00

## Element: Yb, Z= 70

Edge energy, radiation ratio and jump for Yb (Z= 70)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	8.944	9.978	10.486	61.332
Fluor Yield (xraylib)	0.210	0.222	0.112	0.954
Fluor Yield (Krause)	0.210	0.222	0.112	0.951
Jump Factor	2.665	1.400	1.154	5.270

XRF line energies and fractional radiative rate for Yb (Z= 70)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	52.389	51.355	59.367	59.152
Radiative rate	0.505	0.287	0.108	0.055

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	8.537	8.402	9.780	7.416	6.546
Radiative rate	0.426	0.816	0.154	0.725	0.036



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Yb (Z= 70)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
61.33	-	-	-	-
80.00	7.36e+02 7.42e+02	1.15e+03 1.16e+03	1.57e+02 1.59e+02	2.38e+02 2.40e+02
100.00	4.05e+02 4.11e+02	6.35e+02 6.44e+02	8.66e+01 8.79e+01	1.31e+02 1.33e+02
150.00	1.34e+02 1.38e+02	2.11e+02 2.16e+02	2.87e+01 2.94e+01	4.34e+01 4.44e+01
200.00	6.12e+01 6.28e+01	9.59e+01 9.84e+01	1.31e+01 1.34e+01	1.98e+01 2.03e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Yb (Z= 70)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
8.94	-	-	-	-	-
9.98	-	-	-	8.02e+03 5.71e+03	3.98e+02 2.83e+02
10.49	-	4.36e+03 3.85e+03	8.24e+02 7.28e+02	6.23e+03 5.70e+03	3.09e+02 2.83e+02
10.00	-	4.32e+03 4.31e+03	8.15e+02 8.14e+02	6.16e+03 6.17e+03	3.05e+02 3.06e+02
15.00	2.13e+02 2.89e+02	1.66e+03 1.64e+03	3.13e+02 3.09e+02	2.36e+03 2.28e+03	1.17e+02 1.13e+02
20.00	9.94e+01 1.65e+02	7.72e+02 7.60e+02	1.46e+02 1.44e+02	1.10e+03 1.02e+03	5.45e+01 5.05e+01
30.00	3.32e+01 7.09e+01	2.58e+02 2.49e+02	4.87e+01 4.70e+01	3.67e+02 3.19e+02	1.82e+01 1.58e+01
40.00	1.50e+01 3.74e+01	1.17e+02 1.11e+02	2.21e+01 2.09e+01	1.66e+02 1.38e+02	8.25e+00 6.82e+00
50.00	8.10e+00 2.23e+01	6.29e+01 5.85e+01	1.19e+01 1.10e+01	8.96e+01 7.14e+01	4.44e+00 3.54e+00
60.00	4.87e+00 1.44e+01	3.78e+01 3.46e+01	7.14e+00 6.54e+00	5.39e+01 4.17e+01	2.67e+00 2.06e+00
61.33	4.58e+00 1.37e+01	3.55e+01 3.25e+01	6.71e+00 6.14e+00	5.07e+01 3.90e+01	2.51e+00 1.93e+00

## Element: Lu, Z= 71

Edge energy, radiation ratio and jump for Lu (Z= 71)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	9.244	10.349	10.870	63.314
Fluor Yield (xraylib)	0.220	0.234	0.120	0.951
Fluor Yield (Krause)	0.220	0.234	0.120	0.953
Jump Factor	2.649	1.400	1.154	5.228

XRF line energies and fractional radiative rate for Lu (Z= 71)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	54.070	52.966	61.283	61.048
Radiative rate	0.503	0.287	0.108	0.056

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	8.847	8.709	10.144	7.656	6.753
Radiative rate	0.422	0.818	0.156	0.722	0.036

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Lu (Z= 71)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
63.31	-	-	-	-
80.00	7.66e+02 7.74e+02	1.20e+03 1.22e+03	1.64e+02 1.66e+02	2.49e+02 2.52e+02
100.00	4.23e+02 4.31e+02	6.63e+02 6.76e+02	9.07e+01 9.25e+01	1.37e+02 1.40e+02
150.00	1.41e+02 1.45e+02	2.21e+02 2.27e+02	3.02e+01 3.10e+01	4.57e+01 4.70e+01
200.00	6.42e+01 6.62e+01	1.01e+02 1.04e+02	1.38e+01 1.42e+01	2.09e+01 2.15e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Lu (Z= 71)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
9.24	-	-	-	-	-
10.35	-	-	-	5.68e+03 5.69e+03	2.87e+02 2.88e+02
10.87	-	4.43e+03 3.88e+03	8.46e+02 7.41e+02	6.22e+03 5.63e+03	3.14e+02 2.85e+02
10.00	-	-	-	6.23e+03 6.24e+03	3.15e+02 3.15e+02
15.00	2.39e+02 3.15e+02	1.85e+03 1.84e+03	3.53e+02 3.51e+02	2.59e+03 2.50e+03	1.31e+02 1.26e+02
20.00	1.12e+02 1.81e+02	8.63e+02 8.53e+02	1.65e+02 1.63e+02	1.21e+03 1.12e+03	6.10e+01 5.65e+01
30.00	3.73e+01 7.80e+01	2.89e+02 2.80e+02	5.51e+01 5.36e+01	4.04e+02 3.50e+02	2.04e+01 1.77e+01
40.00	1.69e+01 4.12e+01	1.31e+02 1.25e+02	2.50e+01 2.39e+01	1.83e+02 1.51e+02	9.26e+00 7.65e+00
50.00	9.13e+00 2.46e+01	7.06e+01 6.62e+01	1.35e+01 1.26e+01	9.87e+01 7.85e+01	4.99e+00 3.97e+00
60.00	5.49e+00 1.60e+01	4.25e+01 3.92e+01	8.11e+00 7.50e+00	5.94e+01 4.58e+01	3.00e+00 2.31e+00
63.31	4.73e+00 1.40e+01	3.66e+01 3.36e+01	6.98e+00 6.42e+00	5.11e+01 3.91e+01	2.58e+00 1.97e+00

## Element: Hf, Z= 72

Edge energy, radiation ratio and jump for Hf (Z= 72)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	9.561	10.739	11.271	65.351
Fluor Yield (xraylib)	0.231	0.246	0.128	0.955
Fluor Yield (Krause)	0.231	0.246	0.128	0.955
Jump Factor	2.630	1.400	1.154	5.185

XRF line energies and fractional radiative rate for Hf (Z= 72)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	55.791	54.612	63.234	62.980
Radiative rate	0.502	0.287	0.108	0.056

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	9.164	9.023	10.516	7.899	6.960
Radiative rate	0.417	0.810	0.157	0.720	0.037

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Hf (Z= 72)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
65.35	-	-	-	-
80.00	8.03e+02 8.09e+02	1.26e+03 1.27e+03	1.73e+02 1.74e+02	2.62e+02 2.64e+02
100.00	4.45e+02 4.52e+02	6.99e+02 7.11e+02	9.56e+01 9.72e+01	1.45e+02 1.47e+02
150.00	1.49e+02 1.52e+02	2.34e+02 2.39e+02	3.19e+01 3.27e+01	4.84e+01 4.97e+01
200.00	6.79e+01 6.98e+01	1.07e+02 1.10e+02	1.46e+01 1.50e+01	2.21e+01 2.28e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Hf (Z= 72)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
9.56	-	-	-	-	-
10.74	-	-	-	7.79e+03 5.68e+03	3.96e+02 2.89e+02
11.27	-	3.82e+03 3.87e+03	7.40e+02 7.48e+02	5.38e+03 5.62e+03	2.73e+02 2.85e+02
10.00	-	-	-	6.90e+03 6.95e+03	3.51e+02 3.53e+02
15.00	2.67e+02 3.42e+02	2.02e+03 2.01e+03	3.91e+02 3.89e+02	2.85e+03 2.77e+03	1.45e+02 1.41e+02
20.00	1.25e+02 1.96e+02	9.44e+02 9.33e+02	1.82e+02 1.80e+02	1.33e+03 1.24e+03	6.75e+01 6.29e+01
30.00	4.18e+01 8.53e+01	3.17e+02 3.08e+02	6.12e+01 5.95e+01	4.46e+02 3.89e+02	2.27e+01 1.98e+01
40.00	1.90e+01 4.52e+01	1.44e+02 1.37e+02	2.78e+01 2.66e+01	2.03e+02 1.68e+02	1.03e+01 8.55e+00
50.00	1.03e+01 2.71e+01	7.76e+01 7.28e+01	1.50e+01 1.41e+01	1.09e+02 8.73e+01	5.56e+00 4.44e+00
60.00	6.17e+00 1.76e+01	4.67e+01 4.31e+01	9.04e+00 8.34e+00	6.58e+01 5.10e+01	3.35e+00 2.59e+00
65.35	4.87e+00 1.44e+01	3.68e+01 3.37e+01	7.12e+00 6.52e+00	5.19e+01 3.96e+01	2.64e+00 2.01e+00

## Element: Ta, Z= 73

Edge energy, radiation ratio and jump for Ta (Z= 73)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	9.881	11.136	11.682	67.416
Fluor Yield (xraylib)	0.243	0.258	0.137	0.980
Fluor Yield (Krause)	0.243	0.258	0.137	0.957
Jump Factor	2.613	1.400	1.155	5.143

XRF line energies and fractional radiative rate for Ta (Z= 73)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	57.533	56.278	65.223	64.950
Radiative rate	0.501	0.287	0.108	0.056

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	9.488	9.343	10.895	8.146	7.173
Radiative rate	0.412	0.809	0.158	0.717	0.037

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Ta (Z= 73)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
67.42	-	-	-	-
80.00	8.59e+02 8.44e+02	1.35e+03 1.33e+03	1.85e+02 1.82e+02	2.81e+02 2.77e+02
100.00	4.78e+02 4.74e+02	7.52e+02 7.46e+02	1.03e+02 1.02e+02	1.57e+02 1.55e+02
150.00	1.60e+02 1.60e+02	2.52e+02 2.52e+02	3.45e+01 3.45e+01	5.24e+01 5.25e+01
200.00	7.32e+01 7.35e+01	1.15e+02 1.16e+02	1.58e+01 1.58e+01	2.40e+01 2.41e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Ta (Z= 73)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
9.88	-	-	-	-	-
11.14	-	-	-	7.79e+03 5.67e+03	4.02e+02 2.93e+02
11.68	-	3.84e+03 3.90e+03	7.52e+02 7.63e+02	5.38e+03 5.61e+03	2.78e+02 2.90e+02
10.00	-	-	-	7.55e+03 7.58e+03	3.89e+02 3.91e+02
15.00	2.98e+02 3.71e+02	2.23e+03 2.22e+03	4.37e+02 4.35e+02	3.13e+03 3.05e+03	1.62e+02 1.57e+02
20.00	1.39e+02 2.14e+02	1.04e+03 1.04e+03	2.04e+02 2.02e+02	1.46e+03 1.37e+03	7.55e+01 7.07e+01
30.00	4.68e+01 9.34e+01	3.51e+02 3.43e+02	6.86e+01 6.72e+01	4.92e+02 4.32e+02	2.54e+01 2.23e+01
40.00	2.13e+01 4.97e+01	1.60e+02 1.54e+02	3.12e+01 3.00e+01	2.24e+02 1.87e+02	1.16e+01 9.64e+00
50.00	1.15e+01 2.98e+01	8.63e+01 8.15e+01	1.69e+01 1.60e+01	1.21e+02 9.72e+01	6.25e+00 5.01e+00
60.00	6.94e+00 1.94e+01	5.20e+01 4.84e+01	1.02e+01 9.47e+00	7.30e+01 5.68e+01	3.76e+00 2.93e+00
67.41	5.02e+00 1.47e+01	3.76e+01 3.47e+01	7.35e+00 6.78e+00	5.28e+01 4.03e+01	2.72e+00 2.08e+00

## Element: W , Z= 74

Edge energy, radiation ratio and jump for W (Z= 74)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	10.207	11.544	12.100	69.525
Fluor Yield (xraylib)	0.255	0.270	0.147	0.958
Fluor Yield (Krause)	0.255	0.270	0.147	0.958
Jump Factor	2.613	1.400	1.155	5.099

XRF line energies and fractional radiative rate for W (Z= 74)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	59.319	57.982	67.245	66.952
Radiative rate	0.500	0.288	0.108	0.056

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	9.819	9.673	11.286	8.398	7.388
Radiative rate	0.408	0.805	0.159	0.714	0.037



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for W (Z= 74)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
69.53	-	-	-	-
80.00	8.75e+02 8.79e+02	1.38e+03 1.38e+03	1.89e+02 1.90e+02	2.88e+02 2.89e+02
100.00	4.88e+02 4.95e+02	7.69e+02 7.80e+02	1.05e+02 1.07e+02	1.61e+02 1.63e+02
150.00	1.64e+02 1.68e+02	2.58e+02 2.64e+02	3.54e+01 3.63e+01	5.40e+01 5.52e+01
200.00	7.52e+01 7.73e+01	1.18e+02 1.22e+02	1.63e+01 1.67e+01	2.48e+01 2.54e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for W (Z= 74)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
10.21	-	-	-	-	-
11.54	-	-	-	7.80e+03 5.65e+03	4.08e+02 2.95e+02
12.10	-	3.85e+03 3.89e+03	7.62e+02 7.70e+02	5.40e+03 5.58e+03	2.82e+02 2.92e+02
15.00	3.34e+02 4.03e+02	2.44e+03 2.42e+03	4.83e+02 4.80e+02	3.44e+03 3.36e+03	1.80e+02 1.76e+02
20.00	1.56e+02 2.34e+02	1.14e+03 1.13e+03	2.26e+02 2.24e+02	1.61e+03 1.51e+03	8.42e+01 7.89e+01
30.00	5.26e+01 1.02e+02	3.84e+02 3.77e+02	7.61e+01 7.46e+01	5.43e+02 4.76e+02	2.84e+01 2.49e+01
40.00	2.40e+01 5.48e+01	1.75e+02 1.69e+02	3.47e+01 3.34e+01	2.48e+02 2.07e+02	1.29e+01 1.08e+01
50.00	1.30e+01 3.30e+01	9.49e+01 8.96e+01	1.88e+01 1.77e+01	1.34e+02 1.08e+02	7.00e+00 5.62e+00
60.00	7.83e+00 2.15e+01	5.72e+01 5.32e+01	1.13e+01 1.05e+01	8.08e+01 6.28e+01	4.22e+00 3.28e+00
69.52	5.20e+00 1.51e+01	3.80e+01 3.49e+01	7.52e+00 6.91e+00	5.37e+01 4.08e+01	2.80e+00 2.13e+00

## Element: Re, Z= 75

Edge energy, radiation ratio and jump for Re (Z= 75)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	10.535	11.959	12.527	71.676
Fluor Yield (xraylib)	0.268	0.283	0.144	0.959
Fluor Yield (Krause)	0.268	0.283	0.144	0.959
Jump Factor	2.600	1.400	1.155	5.056

XRF line energies and fractional radiative rate for Re (Z= 75)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	61.141	59.719	69.310	68.995
Radiative rate	0.498	0.287	0.108	0.057

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	10.160	10.010	11.686	8.653	7.604
Radiative rate	0.403	0.802	0.161	0.712	0.038

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Re (Z= 75)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
71.68	-	-	-	-
80.00	9.11e+02 9.14e+02	1.44e+03 1.44e+03	1.98e+02 1.98e+02	3.02e+02 3.03e+02
100.00	5.09e+02 5.16e+02	8.02e+02 8.13e+02	1.10e+02 1.12e+02	1.68e+02 1.71e+02
150.00	1.71e+02 1.75e+02	2.70e+02 2.77e+02	3.72e+01 3.81e+01	5.68e+01 5.81e+01
200.00	7.88e+01 8.10e+01	1.24e+02 1.28e+02	1.71e+01 1.76e+01	2.61e+01 2.68e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Re (Z= 75)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
10.54	-	-	-	-	-
11.96	-	-	-	5.67e+03 5.66e+03	3.00e+02 3.00e+02
12.53	-	3.86e+03 3.89e+03	7.74e+02 7.80e+02	5.41e+03 5.59e+03	2.87e+02 2.96e+02
15.00	3.40e+02 3.97e+02	2.66e+03 2.65e+03	5.33e+02 5.31e+02	3.83e+03 3.77e+03	2.03e+02 1.99e+02
20.00	1.59e+02 2.33e+02	1.25e+03 1.24e+03	2.50e+02 2.49e+02	1.80e+03 1.70e+03	9.52e+01 9.01e+01
30.00	5.39e+01 1.02e+02	4.22e+02 4.15e+02	8.46e+01 8.31e+01	6.07e+02 5.43e+02	3.21e+01 2.87e+01
40.00	2.46e+01 5.50e+01	1.93e+02 1.86e+02	3.87e+01 3.72e+01	2.77e+02 2.38e+02	1.47e+01 1.26e+01
50.00	1.33e+01 3.32e+01	1.04e+02 9.87e+01	2.09e+01 1.98e+01	1.50e+02 1.25e+02	7.96e+00 6.60e+00
60.00	8.05e+00 2.17e+01	6.30e+01 5.86e+01	1.26e+01 1.17e+01	9.07e+01 7.33e+01	4.80e+00 3.88e+00
71.67	4.91e+00 1.42e+01	3.85e+01 3.52e+01	7.71e+00 7.06e+00	5.54e+01 4.37e+01	2.93e+00 2.31e+00

## Element: Os, Z= 76

Edge energy, radiation ratio and jump for Os (Z= 76)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	10.871	12.385	12.968	73.871
Fluor Yield (xraylib)	0.281	0.295	0.130	0.961
Fluor Yield (Krause)	0.281	0.295	0.130	0.961
Jump Factor	2.587	1.400	1.155	5.007

XRF line energies and fractional radiative rate for Os (Z= 76)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	63.001	61.487	71.414	71.078
Radiative rate	0.497	0.288	0.109	0.056

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	10.511	10.355	12.095	8.912	7.822
Radiative rate	0.398	0.798	0.162	0.709	0.038

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Os (Z= 76)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
73.87	-	-	-	-
80.00	9.55e+02 9.58e+02	1.51e+03 1.51e+03	2.09e+02 2.10e+02	3.17e+02 3.18e+02
100.00	5.32e+02 5.38e+02	8.40e+02 8.50e+02	1.17e+02 1.18e+02	1.77e+02 1.79e+02
150.00	1.80e+02 1.84e+02	2.84e+02 2.90e+02	3.95e+01 4.04e+01	5.97e+01 6.11e+01
200.00	8.29e+01 8.51e+01	1.31e+02 1.34e+02	1.82e+01 1.87e+01	2.75e+01 2.83e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Os (Z= 76)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
10.87	-	-	-	-	-
12.39	-	-	-	7.80e+03 5.64e+03	4.19e+02 3.02e+02
12.97	-	4.45e+03 3.89e+03	9.03e+02 7.89e+02	6.25e+03 5.59e+03	3.35e+02 3.00e+02
15.00	3.18e+02 3.59e+02	2.89e+03 2.88e+03	5.87e+02 5.84e+02	4.25e+03 4.20e+03	2.28e+02 2.25e+02
20.00	1.50e+02 2.13e+02	1.36e+03 1.37e+03	2.77e+02 2.77e+02	2.00e+03 1.91e+03	1.07e+02 1.03e+02
30.00	5.07e+01 9.42e+01	4.62e+02 4.57e+02	9.38e+01 9.27e+01	6.78e+02 6.19e+02	3.64e+01 3.32e+01
40.00	2.32e+01 5.07e+01	2.11e+02 2.05e+02	4.29e+01 4.17e+01	3.10e+02 2.74e+02	1.66e+01 1.47e+01
50.00	1.26e+01 3.07e+01	1.15e+02 1.09e+02	2.33e+01 2.22e+01	1.68e+02 1.45e+02	9.02e+00 7.75e+00
60.00	7.61e+00 2.01e+01	6.93e+01 6.50e+01	1.41e+01 1.32e+01	1.02e+02 8.55e+01	5.45e+00 4.59e+00
73.87	4.27e+00 1.23e+01	3.89e+01 3.59e+01	7.90e+00 7.29e+00	5.71e+01 4.71e+01	3.06e+00 2.53e+00

## Element: Ir, Z= 77

Edge energy, radiation ratio and jump for Ir (Z= 77)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	11.215	12.824	13.418	76.111
Fluor Yield (xraylib)	0.294	0.308	0.120	0.962
Fluor Yield (Krause)	0.294	0.308	0.120	0.962
Jump Factor	2.580	1.400	1.155	4.963

XRF line energies and fractional radiative rate for Ir (Z= 77)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	64.896	63.287	73.562	73.203
Radiative rate	0.496	0.288	0.109	0.056

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	10.868	10.708	12.513	9.175	8.046
Radiative rate	0.394	0.794	0.163	0.705	0.038

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Ir (Z= 77)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
76.11	-	-	-	-
80.00	9.97e+02 1.00e+03	1.58e+03 1.58e+03	2.19e+02 2.20e+02	3.32e+02 3.33e+02
100.00	5.54e+02 5.60e+02	8.77e+02 8.86e+02	1.22e+02 1.23e+02	1.85e+02 1.87e+02
150.00	1.88e+02 1.92e+02	2.98e+02 3.04e+02	4.14e+01 4.23e+01	6.27e+01 6.41e+01
200.00	8.69e+01 8.93e+01	1.37e+02 1.41e+02	1.91e+01 1.96e+01	2.89e+01 2.97e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Ir (Z= 77)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
11.22	-	-	-	-	-
12.82	-	-	-	7.79e+03 5.60e+03	4.24e+02 3.05e+02
13.42	-	3.84e+03 3.89e+03	7.87e+02 7.99e+02	5.39e+03 5.60e+03	2.94e+02 3.05e+02
15.00	3.04e+02 3.33e+02	3.13e+03 3.10e+03	6.42e+02 6.37e+02	4.69e+03 4.66e+03	2.56e+02 2.54e+02
20.00	1.44e+02 1.99e+02	1.48e+03 1.49e+03	3.04e+02 3.05e+02	2.22e+03 2.14e+03	1.21e+02 1.17e+02
30.00	4.88e+01 8.87e+01	5.03e+02 4.99e+02	1.03e+02 1.02e+02	7.54e+02 7.01e+02	4.11e+01 3.82e+01
40.00	2.24e+01 4.79e+01	2.31e+02 2.25e+02	4.73e+01 4.61e+01	3.46e+02 3.13e+02	1.88e+01 1.70e+01
50.00	1.22e+01 2.91e+01	1.25e+02 1.20e+02	2.57e+01 2.46e+01	1.88e+02 1.66e+02	1.02e+01 9.06e+00
60.00	7.35e+00 1.91e+01	7.57e+01 7.12e+01	1.55e+01 1.46e+01	1.14e+02 9.89e+01	6.19e+00 5.39e+00
76.11	3.81e+00 1.09e+01	3.92e+01 3.61e+01	8.04e+00 7.41e+00	5.88e+01 5.04e+01	3.20e+00 2.74e+00

## Element: Pt, Z= 78

Edge energy, radiation ratio and jump for Pt (Z= 78)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	11.564	13.273	13.880	78.395
Fluor Yield (xraylib)	0.306	0.321	0.114	0.963
Fluor Yield (Krause)	0.306	0.321	0.114	0.963
Jump Factor	2.563	1.400	1.156	4.973

XRF line energies and fractional radiative rate for Pt (Z= 78)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	66.833	65.123	75.749	75.369
Radiative rate	0.495	0.289	0.109	0.056

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	11.231	11.071	12.942	9.442	8.268
Radiative rate	0.388	0.792	0.164	0.702	0.039



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Pt (Z= 78)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
78.39	-	-	-	-
80.00	1.03e+03 1.02e+03	1.63e+03 1.62e+03	2.27e+02 2.26e+02	3.44e+02 3.42e+02
100.00	5.79e+02 5.83e+02	9.17e+02 9.23e+02	1.28e+02 1.28e+02	1.93e+02 1.95e+02
150.00	1.97e+02 2.01e+02	3.13e+02 3.19e+02	4.35e+01 4.43e+01	6.60e+01 6.72e+01
200.00	9.13e+01 9.35e+01	1.45e+02 1.48e+02	2.01e+01 2.06e+01	3.05e+01 3.13e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Pt (Z= 78)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
11.56	-	-	-	-	-
13.27	-	-	-	5.58e+03 5.55e+03	3.09e+02 3.07e+02
13.88	-	4.44e+03 3.89e+03	9.19e+02 8.06e+02	6.19e+03 5.54e+03	3.43e+02 3.07e+02
15.00	2.98e+02 3.18e+02	3.39e+03 3.35e+03	7.02e+02 6.94e+02	5.14e+03 5.12e+03	2.85e+02 2.84e+02
20.00	1.42e+02 1.91e+02	1.61e+03 1.62e+03	3.34e+02 3.36e+02	2.44e+03 2.37e+03	1.35e+02 1.31e+02
30.00	4.83e+01 8.56e+01	5.49e+02 5.45e+02	1.14e+02 1.13e+02	8.33e+02 7.85e+02	4.61e+01 4.34e+01
40.00	2.22e+01 4.64e+01	2.52e+02 2.46e+02	5.22e+01 5.09e+01	3.82e+02 3.52e+02	2.12e+01 1.95e+01
50.00	1.21e+01 2.83e+01	1.37e+02 1.31e+02	2.84e+01 2.72e+01	2.08e+02 1.88e+02	1.15e+01 1.04e+01
60.00	7.30e+00 1.86e+01	8.30e+01 7.80e+01	1.72e+01 1.62e+01	1.26e+02 1.13e+02	6.97e+00 6.24e+00
78.39	3.49e+00 9.91e+00	3.96e+01 3.64e+01	8.20e+00 7.54e+00	6.01e+01 5.31e+01	3.33e+00 2.94e+00

## Element: Au, Z= 79

Edge energy, radiation ratio and jump for Au (Z= 79)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	11.919	13.734	14.353	80.725
Fluor Yield (xraylib)	0.320	0.334	0.107	0.964
Fluor Yield (Krause)	0.320	0.334	0.107	0.964
Jump Factor	2.550	1.400	1.156	4.874

XRF line energies and fractional radiative rate for Au (Z= 79)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	68.804	66.991	77.980	77.575
Radiative rate	0.493	0.290	0.109	0.057

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	11.611	11.442	13.382	9.713	8.494
Radiative rate	0.383	0.789	0.165	0.699	0.039

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Au (Z= 79)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
80.72	-	-	-	-
100.00	6.01e+02 6.05e+02	9.54e+02 9.60e+02	1.33e+02 1.34e+02	2.02e+02 2.03e+02
150.00	2.06e+02 2.10e+02	3.27e+02 3.33e+02	4.55e+01 4.64e+01	6.92e+01 7.05e+01
200.00	9.54e+01 9.78e+01	1.51e+02 1.55e+02	2.11e+01 2.16e+01	3.21e+01 3.29e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Au (Z= 79)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
11.92	-	-	-	-	-
13.73	-	-	-	5.56e+03 5.52e+03	3.11e+02 3.10e+02
14.35	-	3.83e+03 3.88e+03	8.00e+02 8.10e+02	5.34e+03 5.51e+03	2.99e+02 3.09e+02
15.00	2.90e+02 3.04e+02	3.68e+03 3.64e+03	7.69e+02 7.60e+02	5.64e+03 5.62e+03	3.16e+02 3.15e+02
20.00	1.38e+02 1.81e+02	1.76e+03 1.78e+03	3.67e+02 3.71e+02	2.69e+03 2.62e+03	1.51e+02 1.47e+02
30.00	4.72e+01 8.17e+01	6.00e+02 5.98e+02	1.25e+02 1.25e+02	9.18e+02 8.71e+02	5.15e+01 4.88e+01
40.00	2.17e+01 4.44e+01	2.76e+02 2.71e+02	5.76e+01 5.66e+01	4.22e+02 3.93e+02	2.37e+01 2.20e+01
50.00	1.18e+01 2.71e+01	1.50e+02 1.45e+02	3.13e+01 3.02e+01	2.30e+02 2.11e+02	1.29e+01 1.18e+01
60.00	7.16e+00 1.79e+01	9.10e+01 8.63e+01	1.90e+01 1.80e+01	1.39e+02 1.26e+02	7.81e+00 7.09e+00
80.00	3.24e+00 9.07e+00	4.11e+01 3.79e+01	8.58e+00 7.91e+00	6.30e+01 5.62e+01	3.53e+00 3.15e+00
80.72	3.16e+00 8.88e+00	4.01e+01 3.69e+01	8.37e+00 7.71e+00	6.14e+01 5.48e+01	3.44e+00 3.07e+00

## Element: Hg, Z= 80

Edge energy, radiation ratio and jump for Hg (Z= 80)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	12.284	14.209	14.839	83.102
Fluor Yield (xraylib)	0.333	0.347	0.107	0.980
Fluor Yield (Krause)	0.333	0.347	0.107	0.965
Jump Factor	2.534	1.400	1.156	4.828

XRF line energies and fractional radiative rate for Hg (Z= 80)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	70.820	68.895	80.254	79.823
Radiative rate	0.492	0.290	0.109	0.057

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	11.995	11.823	13.830	9.989	8.721
Radiative rate	0.378	0.786	0.165	0.696	0.040

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Hg (Z= 80)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
83.10	-	-	-	-
100.00	6.33e+02 6.28e+02	1.01e+03 9.98e+02	1.40e+02 1.39e+02	2.13e+02 2.12e+02
150.00	2.18e+02 2.19e+02	3.46e+02 3.48e+02	4.83e+01 4.85e+01	7.35e+01 7.38e+01
200.00	1.01e+02 1.02e+02	1.61e+02 1.62e+02	2.24e+01 2.26e+01	3.41e+01 3.45e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Hg (Z= 80)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
12.28	-	-	-	-	-
14.21	-	-	-	5.49e+03 5.46e+03	3.13e+02 3.12e+02
14.84	-	4.41e+03 3.86e+03	9.27e+02 8.13e+02	6.12e+03 5.42e+03	3.49e+02 3.09e+02
15.00	2.99e+02 3.01e+02	3.96e+03 3.96e+03	8.34e+02 8.34e+02	6.13e+03 6.10e+03	3.50e+02 3.48e+02
20.00	1.43e+02 1.83e+02	1.90e+03 1.92e+03	3.99e+02 4.05e+02	2.93e+03 2.87e+03	1.67e+02 1.64e+02
30.00	4.90e+01 8.29e+01	6.49e+02 6.50e+02	1.37e+02 1.37e+02	1.00e+03 9.60e+02	5.73e+01 5.47e+01
40.00	2.26e+01 4.53e+01	2.99e+02 2.95e+02	6.29e+01 6.20e+01	4.62e+02 4.35e+02	2.64e+01 2.48e+01
50.00	1.23e+01 2.77e+01	1.63e+02 1.58e+02	3.43e+01 3.32e+01	2.52e+02 2.34e+02	1.44e+01 1.34e+01
60.00	7.46e+00 1.83e+01	9.88e+01 9.41e+01	2.08e+01 1.98e+01	1.53e+02 1.41e+02	8.72e+00 8.03e+00
80.00	3.38e+00 9.31e+00	4.47e+01 4.13e+01	9.42e+00 8.70e+00	6.92e+01 6.29e+01	3.95e+00 3.59e+00
83.10	3.04e+00 8.50e+00	4.03e+01 3.71e+01	8.48e+00 7.80e+00	6.23e+01 5.66e+01	3.55e+00 3.23e+00

## Element: Tl, Z= 81

Edge energy, radiation ratio and jump for Tl (Z= 81)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	12.658	14.698	15.347	85.530
Fluor Yield (xraylib)	0.347	0.360	0.107	0.966
Fluor Yield (Krause)	0.347	0.360	0.107	0.966
Jump Factor	2.520	1.400	1.156	4.781

XRF line energies and fractional radiative rate for Tl (Z= 81)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	72.872	70.832	82.577	82.118
Radiative rate	0.491	0.290	0.109	0.057

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	12.391	12.213	14.292	10.269	8.953
Radiative rate	0.372	0.783	0.167	0.693	0.040

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Tl (Z= 81)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
85.53	-	-	-	-
100.00	6.47e+02 6.51e+02	1.03e+03 1.04e+03	1.44e+02 1.45e+02	2.19e+02 2.20e+02
150.00	2.24e+02 2.28e+02	3.56e+02 3.63e+02	4.97e+01 5.07e+01	7.58e+01 7.73e+01
200.00	1.04e+02 1.07e+02	1.66e+02 1.70e+02	2.31e+01 2.37e+01	3.52e+01 3.61e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Tl (Z= 81)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
12.66	-	-	-	-	-
14.70	-	-	-	5.44e+03 5.41e+03	3.15e+02 3.13e+02
15.35	-	3.78e+03 3.85e+03	8.04e+02 8.19e+02	5.25e+03 5.39e+03	3.04e+02 3.12e+02
15.00	-	4.00e+03 3.98e+03	8.51e+02 8.47e+02	5.55e+03 5.52e+03	3.21e+02 3.19e+02
20.00	1.48e+02 1.84e+02	2.06e+03 2.09e+03	4.37e+02 4.45e+02	3.19e+03 3.13e+03	1.85e+02 1.81e+02
30.00	5.08e+01 8.38e+01	7.05e+02 7.12e+02	1.50e+02 1.51e+02	1.09e+03 1.05e+03	6.33e+01 6.06e+01
40.00	2.34e+01 4.60e+01	3.26e+02 3.24e+02	6.92e+01 6.88e+01	5.05e+02 4.76e+02	2.92e+01 2.75e+01
50.00	1.28e+01 2.82e+01	1.78e+02 1.74e+02	3.78e+01 3.69e+01	2.76e+02 2.57e+02	1.59e+01 1.49e+01
60.00	7.76e+00 1.87e+01	1.08e+02 1.04e+02	2.29e+01 2.21e+01	1.67e+02 1.55e+02	9.68e+00 8.95e+00
80.00	3.52e+00 9.52e+00	4.89e+01 4.57e+01	1.04e+01 9.71e+00	7.59e+01 6.93e+01	4.39e+00 4.01e+00
85.53	2.93e+00 8.12e+00	4.07e+01 3.78e+01	8.64e+00 8.03e+00	6.31e+01 5.75e+01	3.65e+00 3.33e+00

## Element: Pb, Z= 82

Edge energy, radiation ratio and jump for Pb (Z= 82)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	13.035	15.200	15.861	88.005
Fluor Yield (xraylib)	0.360	0.373	0.112	0.967
Fluor Yield (Krause)	0.360	0.373	0.112	0.967
Jump Factor	2.506	1.400	1.156	4.731

XRF line energies and fractional radiative rate for Pb (Z= 82)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	74.970	72.805	84.939	84.450
Radiative rate	0.489	0.291	0.110	0.056

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	12.793	12.614	14.765	10.552	9.185
Radiative rate	0.366	0.780	0.167	0.691	0.041



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Pb (Z= 82)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
88.00	-	-	-	-
100.00	6.72e+02 6.75e+02	1.07e+03 1.08e+03	1.51e+02 1.52e+02	2.28e+02 2.29e+02
150.00	2.33e+02 2.37e+02	3.71e+02 3.79e+02	5.24e+01 5.34e+01	7.91e+01 8.06e+01
200.00	1.09e+02 1.11e+02	1.73e+02 1.78e+02	2.44e+01 2.50e+01	3.69e+01 3.78e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Pb (Z= 82)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
13.04	-	-	-	-	-
15.20	-	-	-	7.47e+03 5.33e+03	4.39e+02 3.13e+02
15.86	-	3.75e+03 3.82e+03	8.05e+02 8.21e+02	5.19e+03 5.30e+03	3.05e+02 3.11e+02
15.00	-	-	-	5.56e+03 5.52e+03	3.27e+02 3.25e+02
20.00	1.60e+02 1.94e+02	2.21e+03 2.25e+03	4.75e+02 4.84e+02	3.45e+03 3.39e+03	2.03e+02 1.99e+02
30.00	5.50e+01 8.85e+01	7.60e+02 7.70e+02	1.63e+02 1.65e+02	1.19e+03 1.14e+03	6.98e+01 6.69e+01
40.00	2.54e+01 4.88e+01	3.52e+02 3.51e+02	7.55e+01 7.53e+01	5.49e+02 5.19e+02	3.23e+01 3.05e+01
50.00	1.39e+01 3.00e+01	1.92e+02 1.88e+02	4.13e+01 4.04e+01	3.00e+02 2.80e+02	1.76e+01 1.65e+01
60.00	8.44e+00 1.99e+01	1.17e+02 1.13e+02	2.51e+01 2.42e+01	1.82e+02 1.69e+02	1.07e+01 9.93e+00
80.00	3.83e+00 1.02e+01	5.30e+01 4.96e+01	1.14e+01 1.07e+01	8.28e+01 7.58e+01	4.86e+00 4.46e+00
88.00	2.95e+00 8.13e+00	4.08e+01 3.78e+01	8.75e+00 8.12e+00	6.36e+01 5.82e+01	3.74e+00 3.42e+00

## Element: Bi, Z= 83

Edge energy, radiation ratio and jump for Bi (Z= 83)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	13.419	15.711	16.388	90.526
Fluor Yield (xraylib)	0.373	0.387	0.117	0.968
Fluor Yield (Krause)	0.373	0.387	0.117	0.968
Jump Factor	2.492	1.400	1.156	4.682

XRF line energies and fractional radiative rate for Bi (Z= 83)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	77.109	74.816	87.344	86.836
Radiative rate	0.488	0.291	0.110	0.056

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	13.210	13.024	15.248	10.839	9.420
Radiative rate	0.360	0.777	0.169	0.688	0.041

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Bi (Z= 83)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
90.53	-	-	-	-
100.00	6.98e+02 7.01e+02	1.12e+03 1.12e+03	1.58e+02 1.58e+02	2.38e+02 2.39e+02
150.00	2.42e+02 2.47e+02	3.87e+02 3.94e+02	5.46e+01 5.56e+01	8.25e+01 8.41e+01
200.00	1.13e+02 1.16e+02	1.81e+02 1.85e+02	2.56e+01 2.62e+01	3.86e+01 3.96e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Bi (Z= 83)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
13.42	-	-	-	-	-
15.71	-	-	-	7.38e+03 5.26e+03	4.40e+02 3.14e+02
16.39	-	3.73e+03 3.81e+03	8.10e+02 8.27e+02	5.13e+03 5.20e+03	3.05e+02 3.10e+02
15.00	-	-	-	6.00e+03 5.96e+03	3.58e+02 3.55e+02
20.00	1.72e+02 2.02e+02	2.38e+03 2.43e+03	5.17e+02 5.27e+02	3.71e+03 3.64e+03	2.21e+02 2.17e+02
30.00	5.94e+01 9.33e+01	8.21e+02 8.35e+02	1.78e+02 1.81e+02	1.28e+03 1.23e+03	7.62e+01 7.30e+01
40.00	2.75e+01 5.17e+01	3.81e+02 3.81e+02	8.27e+01 8.28e+01	5.93e+02 5.60e+02	3.53e+01 3.34e+01
50.00	1.51e+01 3.19e+01	2.08e+02 2.05e+02	4.52e+01 4.45e+01	3.24e+02 3.03e+02	1.93e+01 1.80e+01
60.00	9.16e+00 2.12e+01	1.27e+02 1.23e+02	2.75e+01 2.66e+01	1.97e+02 1.83e+02	1.18e+01 1.09e+01
80.00	4.17e+00 1.09e+01	5.76e+01 5.41e+01	1.25e+01 1.17e+01	8.98e+01 8.21e+01	5.35e+00 4.89e+00
90.52	2.97e+00 8.12e+00	4.10e+01 3.80e+01	8.91e+00 8.26e+00	6.39e+01 5.83e+01	3.81e+00 3.48e+00

## Element: Po, Z= 84

Edge energy, radiation ratio and jump for Po (Z= 84)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	13.810	16.237	16.928	93.100
Fluor Yield (xraylib)	0.386	0.401	0.122	0.968
Fluor Yield (Krause)	0.386	0.401	0.122	0.968
Jump Factor	2.478	1.400	1.156	4.628

XRF line energies and fractional radiative rate for Po (Z= 84)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	79.293	76.864	89.797	89.247
Radiative rate	0.486	0.292	0.110	0.056

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	13.638	13.447	15.744	11.131	9.664
Radiative rate	0.354	0.774	0.169	0.686	0.041

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Po (Z= 84)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
93.10	-	-	-	-
100.00	7.26e+02 7.29e+02	1.16e+03 1.17e+03	1.64e+02 1.65e+02	2.48e+02 2.49e+02
150.00	2.51e+02 2.56e+02	4.02e+02 4.10e+02	5.68e+01 5.79e+01	8.59e+01 8.75e+01
200.00	1.18e+02 1.21e+02	1.89e+02 1.93e+02	2.67e+01 2.73e+01	4.03e+01 4.13e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Po (Z= 84)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
13.81	-	-	-	-	-
16.24	-	-	-	5.22e+03 5.19e+03	3.16e+02 3.14e+02
16.93	-	3.70e+03 3.79e+03	8.11e+02 8.29e+02	5.06e+03 5.10e+03	3.06e+02 3.09e+02
15.00	-	-	-	6.49e+03 6.47e+03	3.93e+02 3.91e+02
20.00	1.85e+02 2.10e+02	2.57e+03 2.61e+03	5.62e+02 5.72e+02	3.98e+03 3.92e+03	2.41e+02 2.37e+02
30.00	6.40e+01 9.81e+01	8.89e+02 9.09e+02	1.95e+02 1.99e+02	1.38e+03 1.32e+03	8.34e+01 7.99e+01
40.00	2.97e+01 5.45e+01	4.13e+02 4.17e+02	9.04e+01 9.13e+01	6.40e+02 6.04e+02	3.88e+01 3.65e+01
50.00	1.63e+01 3.37e+01	2.26e+02 2.25e+02	4.95e+01 4.92e+01	3.51e+02 3.27e+02	2.12e+01 1.98e+01
60.00	9.91e+00 2.25e+01	1.38e+02 1.35e+02	3.02e+01 2.95e+01	2.14e+02 1.97e+02	1.29e+01 1.20e+01
80.00	4.51e+00 1.16e+01	6.27e+01 5.96e+01	1.37e+01 1.30e+01	9.73e+01 8.89e+01	5.89e+00 5.38e+00
93.10	2.98e+00 8.10e+00	4.14e+01 3.88e+01	9.06e+00 8.49e+00	6.42e+01 5.85e+01	3.89e+00 3.54e+00

## Element: At, Z= 85

Edge energy, radiation ratio and jump for At (Z= 85)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	14.207	16.776	17.482	95.724
Fluor Yield (xraylib)	0.399	0.415	0.128	0.969
Fluor Yield (Krause)	0.399	0.415	0.128	0.969
Jump Factor	2.459	1.400	1.157	4.586

XRF line energies and fractional radiative rate for At (Z= 85)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	81.514	78.944	92.304	91.723
Radiative rate	0.484	0.292	0.110	0.056

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	14.067	13.876	16.252	11.427	9.896
Radiative rate	0.348	0.771	0.171	0.683	0.042

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for At (Z= 85)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
95.72	-	-	-	-
100.00	7.48e+02 7.49e+02	1.20e+03 1.20e+03	1.70e+02 1.70e+02	2.57e+02 2.57e+02
150.00	2.61e+02 2.65e+02	4.18e+02 4.26e+02	5.92e+01 6.03e+01	8.95e+01 9.11e+01
200.00	1.23e+02 1.26e+02	1.97e+02 2.01e+02	2.78e+01 2.85e+01	4.21e+01 4.31e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for At (Z= 85)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
14.21	-	-	-	-	-
16.78	-	-	-	5.14e+03 5.11e+03	3.17e+02 3.15e+02
17.48	-	3.67e+03 3.76e+03	8.13e+02 8.32e+02	4.99e+03 5.02e+03	3.07e+02 3.09e+02
15.00	-	-	-	7.00e+03 7.04e+03	4.32e+02 4.34e+02
20.00	1.99e+02 2.19e+02	2.75e+03 2.79e+03	6.07e+02 6.18e+02	4.27e+03 4.21e+03	2.63e+02 2.60e+02
30.00	6.91e+01 1.04e+02	9.56e+02 9.80e+02	2.11e+02 2.17e+02	1.49e+03 1.43e+03	9.16e+01 8.79e+01
40.00	3.22e+01 5.77e+01	4.45e+02 4.51e+02	9.84e+01 9.98e+01	6.92e+02 6.54e+02	4.26e+01 4.03e+01
50.00	1.76e+01 3.58e+01	2.44e+02 2.43e+02	5.40e+01 5.38e+01	3.79e+02 3.55e+02	2.34e+01 2.19e+01
60.00	1.08e+01 2.39e+01	1.49e+02 1.46e+02	3.29e+01 3.23e+01	2.31e+02 2.15e+02	1.43e+01 1.32e+01
80.00	4.91e+00 1.24e+01	6.79e+01 6.47e+01	1.50e+01 1.43e+01	1.06e+02 9.68e+01	6.51e+00 5.97e+00
95.72	3.00e+00 8.11e+00	4.15e+01 3.89e+01	9.18e+00 8.61e+00	6.46e+01 5.91e+01	3.98e+00 3.64e+00

## Element: Rn, Z= 86

Edge energy, radiation ratio and jump for Rn (Z= 86)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	14.610	17.328	18.048	98.397
Fluor Yield (xraylib)	0.411	0.429	0.134	0.969
Fluor Yield (Krause)	0.411	0.429	0.134	0.969
Jump Factor	2.449	1.400	1.157	4.494

XRF line energies and fractional radiative rate for Rn (Z= 86)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	83.783	81.066	94.867	94.247
Radiative rate	0.483	0.293	0.110	0.056

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	14.512	14.316	16.771	11.727	10.137
Radiative rate	0.341	0.768	0.172	0.680	0.043



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Rn (Z= 86)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
98.40	-	-	-	-
100.00	7.73e+02 7.76e+02	1.24e+03 1.25e+03	1.76e+02 1.77e+02	2.66e+02 2.67e+02
150.00	2.70e+02 2.75e+02	4.33e+02 4.42e+02	6.14e+01 6.26e+01	9.29e+01 9.47e+01
200.00	1.27e+02 1.30e+02	2.04e+02 2.09e+02	2.89e+01 2.97e+01	4.37e+01 4.49e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Rn (Z= 86)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
14.61	-	-	-	-	-
17.33	-	-	-	5.04e+03 5.01e+03	3.16e+02 3.14e+02
18.05	-	3.64e+03 3.73e+03	8.14e+02 8.35e+02	4.91e+03 4.89e+03	3.07e+02 3.06e+02
15.00	-	-	-	7.46e+03 7.47e+03	4.67e+02 4.68e+02
20.00	2.13e+02 2.28e+02	2.95e+03 3.00e+03	6.59e+02 6.70e+02	4.54e+03 4.48e+03	2.84e+02 2.80e+02
30.00	7.44e+01 1.09e+02	1.03e+03 1.06e+03	2.30e+02 2.38e+02	1.59e+03 1.52e+03	9.94e+01 9.53e+01
40.00	3.47e+01 6.09e+01	4.81e+02 4.91e+02	1.07e+02 1.10e+02	7.40e+02 6.97e+02	4.64e+01 4.37e+01
50.00	1.91e+01 3.79e+01	2.64e+02 2.66e+02	5.90e+01 5.95e+01	4.07e+02 3.79e+02	2.55e+01 2.37e+01
60.00	1.16e+01 2.54e+01	1.61e+02 1.60e+02	3.61e+01 3.58e+01	2.48e+02 2.29e+02	1.56e+01 1.43e+01
80.00	5.31e+00 1.31e+01	7.37e+01 7.10e+01	1.65e+01 1.59e+01	1.13e+02 1.03e+02	7.11e+00 6.47e+00
98.39	3.02e+00 8.09e+00	4.18e+01 3.97e+01	9.35e+00 8.87e+00	6.44e+01 5.85e+01	4.04e+00 3.66e+00

## Element: Fr, Z= 87

Edge energy, radiation ratio and jump for Fr (Z= 87)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	15.025	17.899	18.634	101.130
Fluor Yield (xraylib)	0.424	0.443	0.139	0.970
Fluor Yield (Krause)	0.424	0.443	0.139	0.970
Jump Factor	2.443	1.400	1.157	4.481

XRF line energies and fractional radiative rate for Fr (Z= 87)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	86.105	83.232	97.478	96.808
Radiative rate	0.481	0.293	0.110	0.056

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	14.976	14.770	17.303	12.031	10.380
Radiative rate	0.335	0.766	0.173	0.678	0.043

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Fr (Z= 87)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
101.13	-	-	-	-
150.00	2.80e+02 2.85e+02	4.51e+02 4.59e+02	6.40e+01 6.51e+01	9.69e+01 9.85e+01
200.00	1.32e+02 1.35e+02	2.13e+02 2.18e+02	3.02e+01 3.10e+01	4.57e+01 4.68e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Fr (Z= 87)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
15.02	-	-	-	-	-
17.90	-	-	-	4.96e+03 4.93e+03	3.16e+02 3.13e+02
18.63	-	3.60e+03 3.70e+03	8.13e+02 8.35e+02	4.84e+03 4.79e+03	3.08e+02 3.05e+02
20.00	2.26e+02 2.38e+02	3.17e+03 3.22e+03	7.14e+02 7.27e+02	4.86e+03 4.79e+03	3.09e+02 3.05e+02
30.00	7.94e+01 1.14e+02	1.11e+03 1.15e+03	2.51e+02 2.60e+02	1.71e+03 1.63e+03	1.09e+02 1.04e+02
40.00	3.71e+01 6.37e+01	5.19e+02 5.34e+02	1.17e+02 1.21e+02	7.97e+02 7.49e+02	5.07e+01 4.76e+01
50.00	2.04e+01 3.97e+01	2.85e+02 2.90e+02	6.44e+01 6.55e+01	4.38e+02 4.07e+02	2.79e+01 2.59e+01
60.00	1.25e+01 2.66e+01	1.75e+02 1.75e+02	3.94e+01 3.95e+01	2.68e+02 2.47e+02	1.71e+01 1.57e+01
80.00	5.71e+00 1.38e+01	7.99e+01 7.80e+01	1.80e+01 1.76e+01	1.23e+02 1.11e+02	7.80e+00 7.08e+00
100.00	3.10e+00 8.19e+00	4.34e+01 4.14e+01	9.80e+00 9.35e+00	6.67e+01 6.00e+01	4.24e+00 3.82e+00
101.12	3.01e+00 7.98e+00	4.21e+01 4.01e+01	9.50e+00 9.06e+00	6.47e+01 5.82e+01	4.11e+00 3.70e+00

## Element: Ra, Z= 88

Edge energy, radiation ratio and jump for Ra (Z= 88)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	15.444	18.484	19.232	103.915
Fluor Yield (xraylib)	0.437	0.456	0.146	0.970
Fluor Yield (Krause)	0.437	0.456	0.146	0.970
Jump Factor	2.433	1.400	1.157	4.433

XRF line energies and fractional radiative rate for Ra (Z= 88)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	88.476	85.436	100.136	99.434
Radiative rate	0.480	0.294	0.110	0.056

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	15.445	15.236	17.849	12.340	10.622
Radiative rate	0.329	0.763	0.174	0.675	0.044

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Ra (Z= 88)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
103.92	-	-	-	-
150.00	2.90e+02 2.95e+02	4.68e+02 4.76e+02	6.65e+01 6.76e+01	1.01e+02 1.02e+02
200.00	1.37e+02 1.40e+02	2.21e+02 2.26e+02	3.14e+01 3.22e+01	4.76e+01 4.87e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Ra (Z= 88)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
15.44	-	-	-	-	-
18.48	-	-	-	6.86e+03 4.84e+03	4.44e+02 3.13e+02
19.23	-	3.56e+03 3.66e+03	8.10e+02 8.33e+02	4.77e+03 4.67e+03	3.08e+02 3.02e+02
20.00	2.44e+02 2.50e+02	3.37e+03 3.45e+03	7.69e+02 7.87e+02	5.20e+03 5.11e+03	3.37e+02 3.31e+02
30.00	8.57e+01 1.20e+02	1.19e+03 1.24e+03	2.70e+02 2.81e+02	1.83e+03 1.75e+03	1.18e+02 1.13e+02
40.00	4.01e+01 6.73e+01	5.55e+02 5.74e+02	1.27e+02 1.31e+02	8.56e+02 8.03e+02	5.54e+01 5.20e+01
50.00	2.21e+01 4.21e+01	3.06e+02 3.12e+02	6.97e+01 7.12e+01	4.71e+02 4.37e+02	3.05e+01 2.83e+01
60.00	1.35e+01 2.83e+01	1.87e+02 1.89e+02	4.27e+01 4.29e+01	2.89e+02 2.65e+02	1.87e+01 1.71e+01
80.00	6.20e+00 1.47e+01	8.58e+01 8.41e+01	1.95e+01 1.92e+01	1.32e+02 1.20e+02	8.56e+00 7.75e+00
100.00	3.37e+00 8.75e+00	4.67e+01 4.47e+01	1.06e+01 1.02e+01	7.20e+01 6.46e+01	4.66e+00 4.18e+00
103.91	3.04e+00 7.99e+00	4.21e+01 4.02e+01	9.59e+00 9.15e+00	6.49e+01 5.81e+01	4.20e+00 3.76e+00

## Element: Ac, Z= 89

Edge energy, radiation ratio and jump for Ac (Z= 89)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	15.870	19.081	19.846	106.756
Fluor Yield (xraylib)	0.450	0.468	0.153	0.971
Fluor Yield (Krause)	0.450	0.468	0.153	0.971
Jump Factor	2.423	1.400	1.157	4.381

XRF line energies and fractional radiative rate for Ac (Z= 89)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	90.885	87.676	102.847	102.102
Radiative rate	0.479	0.294	0.110	0.056

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	15.932	15.713	18.408	12.652	10.870
Radiative rate	0.322	0.760	0.175	0.672	0.044

XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Ac (Z= 89)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
106.76	-	-	-	-
150.00	3.00e+02 3.05e+02	4.85e+02 4.92e+02	6.90e+01 7.01e+01	1.04e+02 1.06e+02
200.00	1.42e+02 1.46e+02	2.30e+02 2.35e+02	3.27e+01 3.35e+01	4.95e+01 5.07e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Ac (Z= 89)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
15.87	-	-	-	-	-
19.08	-	-	-	4.78e+03 4.74e+03	3.15e+02 3.12e+02
19.85	-	4.02e+03 3.61e+03	9.26e+02 8.30e+02	5.39e+03 4.58e+03	3.55e+02 3.01e+02
20.00	2.61e+02 2.59e+02	3.60e+03 3.72e+03	8.28e+02 8.55e+02	5.55e+03 5.44e+03	3.65e+02 3.57e+02
30.00	9.21e+01 1.25e+02	1.27e+03 1.33e+03	2.92e+02 3.06e+02	1.96e+03 1.87e+03	1.29e+02 1.23e+02
40.00	4.32e+01 7.09e+01	5.95e+02 6.20e+02	1.37e+02 1.43e+02	9.17e+02 8.60e+02	6.03e+01 5.65e+01
50.00	2.38e+01 4.45e+01	3.28e+02 3.38e+02	7.55e+01 7.78e+01	5.06e+02 4.68e+02	3.33e+01 3.08e+01
60.00	1.46e+01 2.99e+01	2.01e+02 2.05e+02	4.63e+01 4.71e+01	3.10e+02 2.84e+02	2.04e+01 1.87e+01
80.00	6.70e+00 1.57e+01	9.23e+01 9.16e+01	2.12e+01 2.11e+01	1.42e+02 1.29e+02	9.36e+00 8.45e+00
100.00	3.65e+00 9.31e+00	5.03e+01 4.88e+01	1.16e+01 1.12e+01	7.76e+01 6.94e+01	5.10e+00 4.57e+00
106.75	3.06e+00 7.98e+00	4.21e+01 4.07e+01	9.69e+00 9.36e+00	6.50e+01 5.81e+01	4.27e+00 3.82e+00

## Element: Th, Z= 90

Edge energy, radiation ratio and jump for Th (Z= 90)

	$L_3$ $2p_{3/2}$	$L_2$ $2p_{1/2}$	$L_1$ $2s_{1/2}$	$K$ $1s_{1/2}$
Edge [keV]	16.300	19.693	20.472	109.650
Fluor Yield (xraylib)	0.463	0.479	0.161	0.971
Fluor Yield (Krause)	0.463	0.479	0.161	0.971
Jump Factor	2.411	1.400	1.157	4.335

XRF line energies and fractional radiative rate for Th (Z= 90)

	$KL_3$ $K\alpha_1$	$KL_2$ $K\alpha_2$	$KM_3$ $K\beta_1$	$KM_2$ $K\beta_3$
Line energy [keV]	93.347	89.957	105.602	104.817
Radiative rate	0.477	0.295	0.110	0.057

	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
Line energy [keV]	16.424	16.202	18.978	12.968	11.118
Radiative rate	0.315	0.757	0.176	0.670	0.045



XRAYLIB [1] and Krause [2] K-shell XRF cross sections (barns/atom)  
for Th (Z= 90)

Energy (keV)	$KL_3$ $K\alpha_1$	$KL_{2,3}$ $K\alpha_{2,1}$	$KM_3$ $K\beta_1$	$KM_{2,3}$ $K\beta_{3,1}$
109.65	-	-	-	-
150.00	3.10e+02 3.15e+02	5.02e+02 5.09e+02	7.15e+01 7.25e+01	1.08e+02 1.10e+02
200.00	1.47e+02 1.51e+02	2.39e+02 2.44e+02	3.40e+01 3.48e+01	5.15e+01 5.27e+01

XRAYLIB [1] and Krause [2] L-shell XRF cross sections (barns/atom)  
for Th (Z= 90)

Energy (keV)	$L_1M_3$ $L\beta_3$	$L_2M_4$ $L\beta_1$	$L_2N_4$ $L\gamma_1$	$L_3M_5$ $L\alpha_1$	$L_3M_1$ $Ll$
16.30	-	-	-	-	-
19.69	-	-	-	4.69e+03 4.65e+03	3.14e+02 3.11e+02
20.47	-	3.96e+03 3.55e+03	9.21e+02 8.25e+02	5.32e+03 4.49e+03	3.56e+02 3.01e+02
20.00	-	3.63e+03 3.72e+03	8.45e+02 8.64e+02	4.88e+03 4.78e+03	3.26e+02 3.20e+02
30.00	9.92e+01 1.31e+02	1.35e+03 1.43e+03	3.14e+02 3.31e+02	2.08e+03 1.99e+03	1.39e+02 1.33e+02
40.00	4.66e+01 7.48e+01	6.35e+02 6.67e+02	1.48e+02 1.55e+02	9.79e+02 9.15e+02	6.55e+01 6.12e+01
50.00	2.57e+01 4.70e+01	3.51e+02 3.65e+02	8.15e+01 8.49e+01	5.41e+02 4.98e+02	3.62e+01 3.33e+01
60.00	1.58e+01 3.17e+01	2.15e+02 2.21e+02	5.00e+01 5.14e+01	3.32e+02 3.02e+02	2.22e+01 2.02e+01
80.00	7.26e+00 1.67e+01	9.89e+01 9.94e+01	2.30e+01 2.31e+01	1.53e+02 1.37e+02	1.02e+01 9.16e+00
100.00	3.96e+00 9.92e+00	5.40e+01 5.31e+01	1.26e+01 1.23e+01	8.33e+01 7.40e+01	5.57e+00 4.95e+00
109.65	3.09e+00 8.00e+00	4.21e+01 4.11e+01	9.78e+00 9.55e+00	6.49e+01 5.75e+01	4.34e+00 3.85e+00

Figure 1: XRF CS for  $KL_3$  ( $K\alpha_1$ ) line

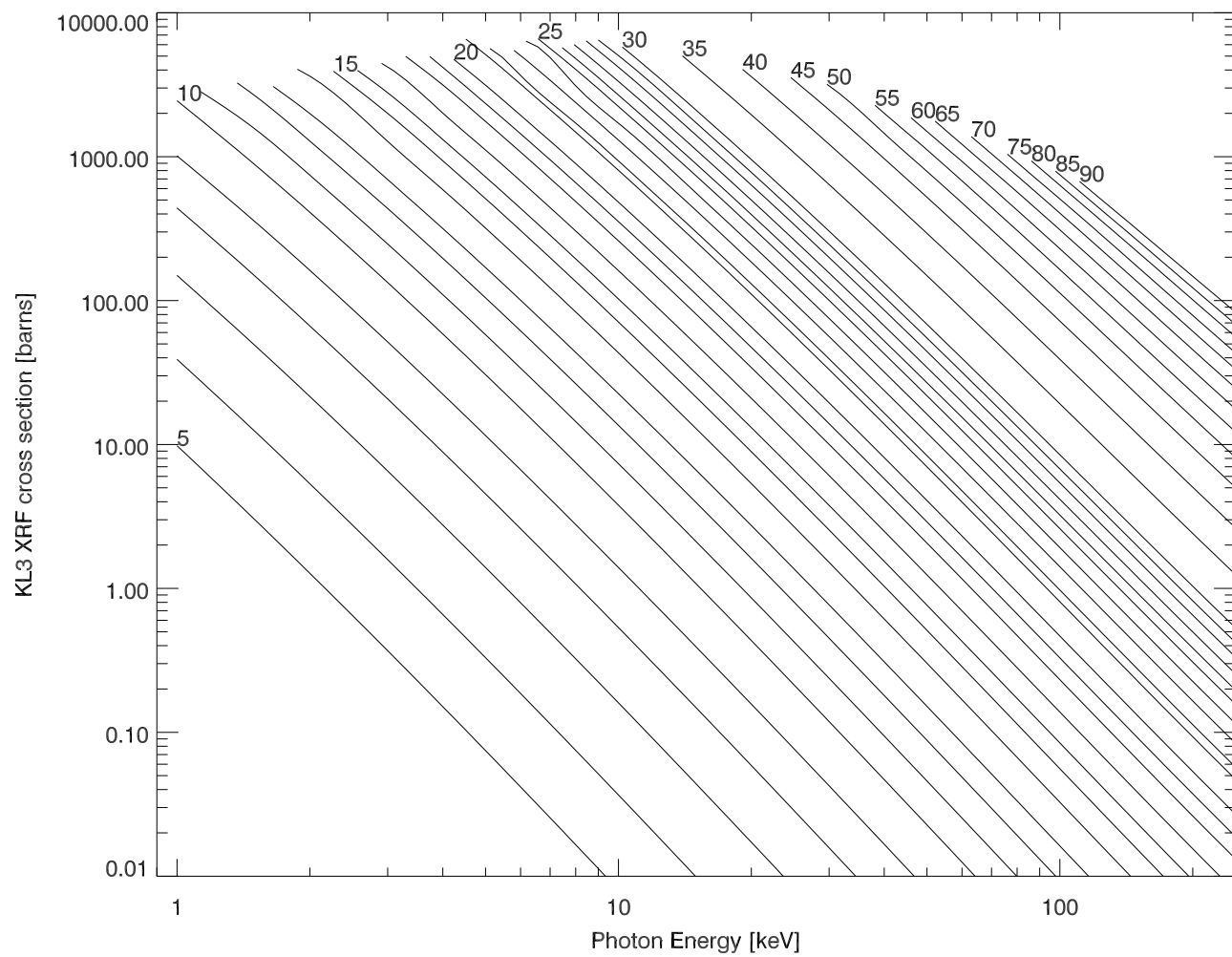


Figure 2: XRF CS for  $KL_2$  ( $K\alpha_2$ ) line

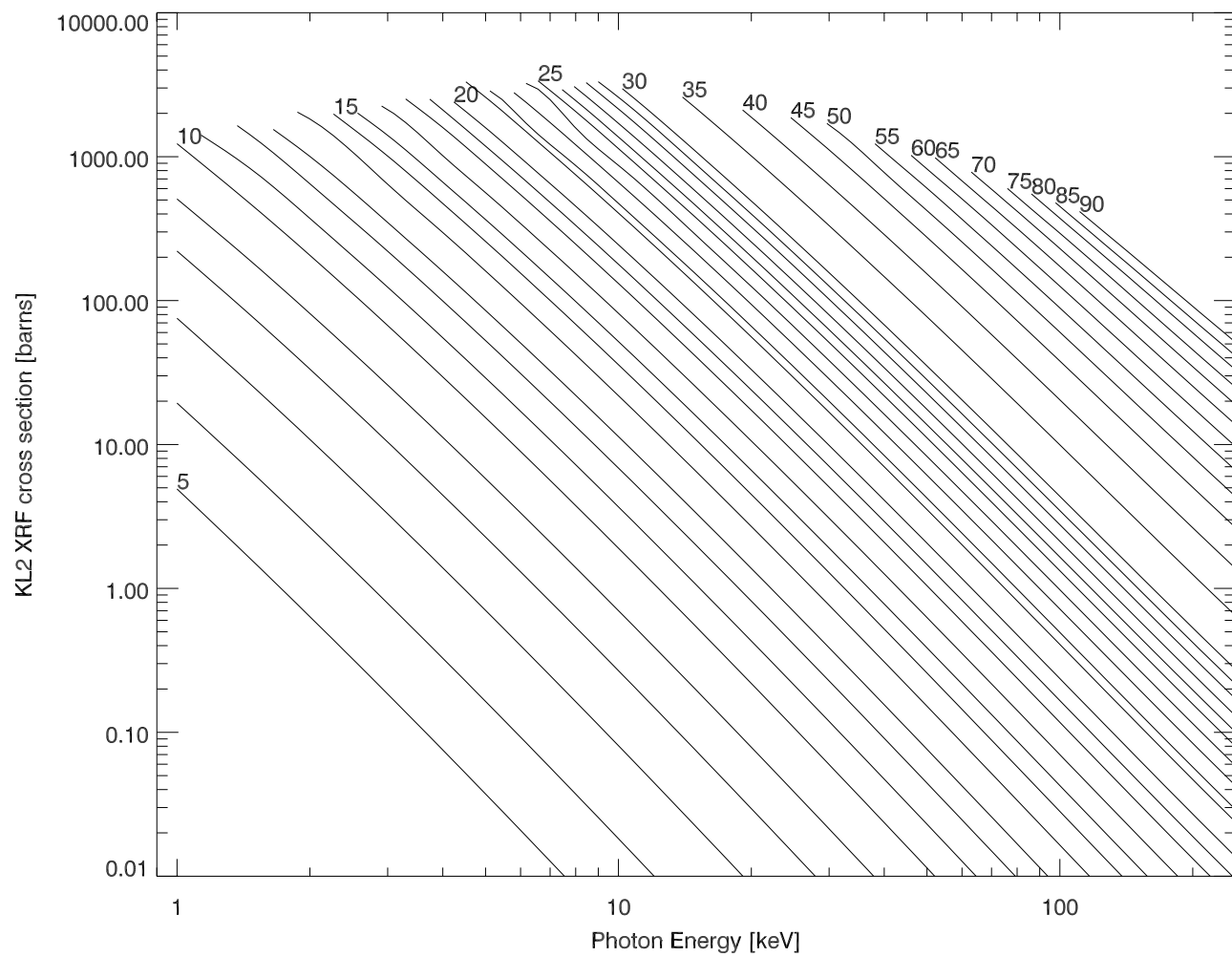


Figure 3: XRF CS for  $K M_3$  ( $K\beta_1$ ) line

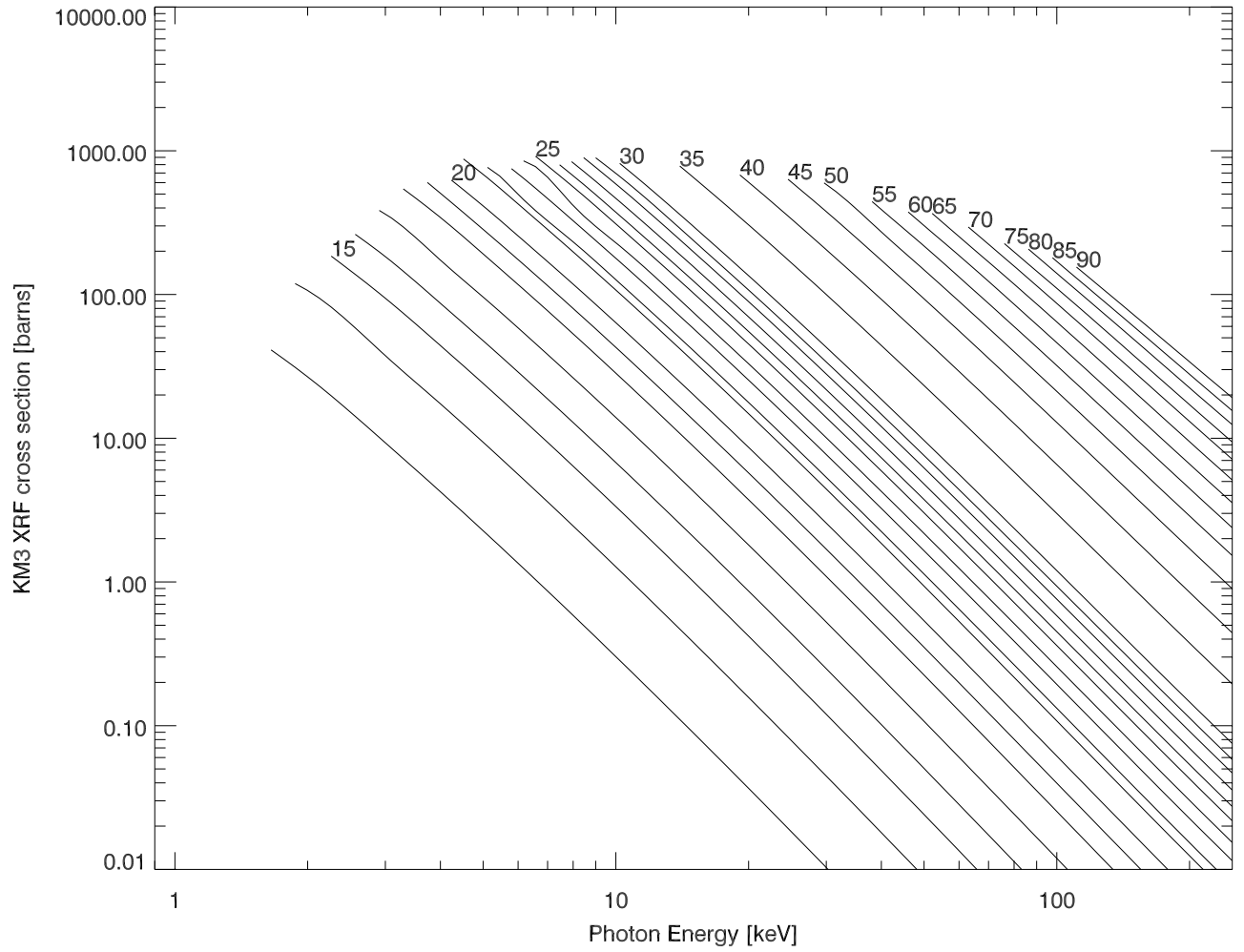


Figure 4: XRF CS for  $K M_2$  ( $K\beta_3$ ) line

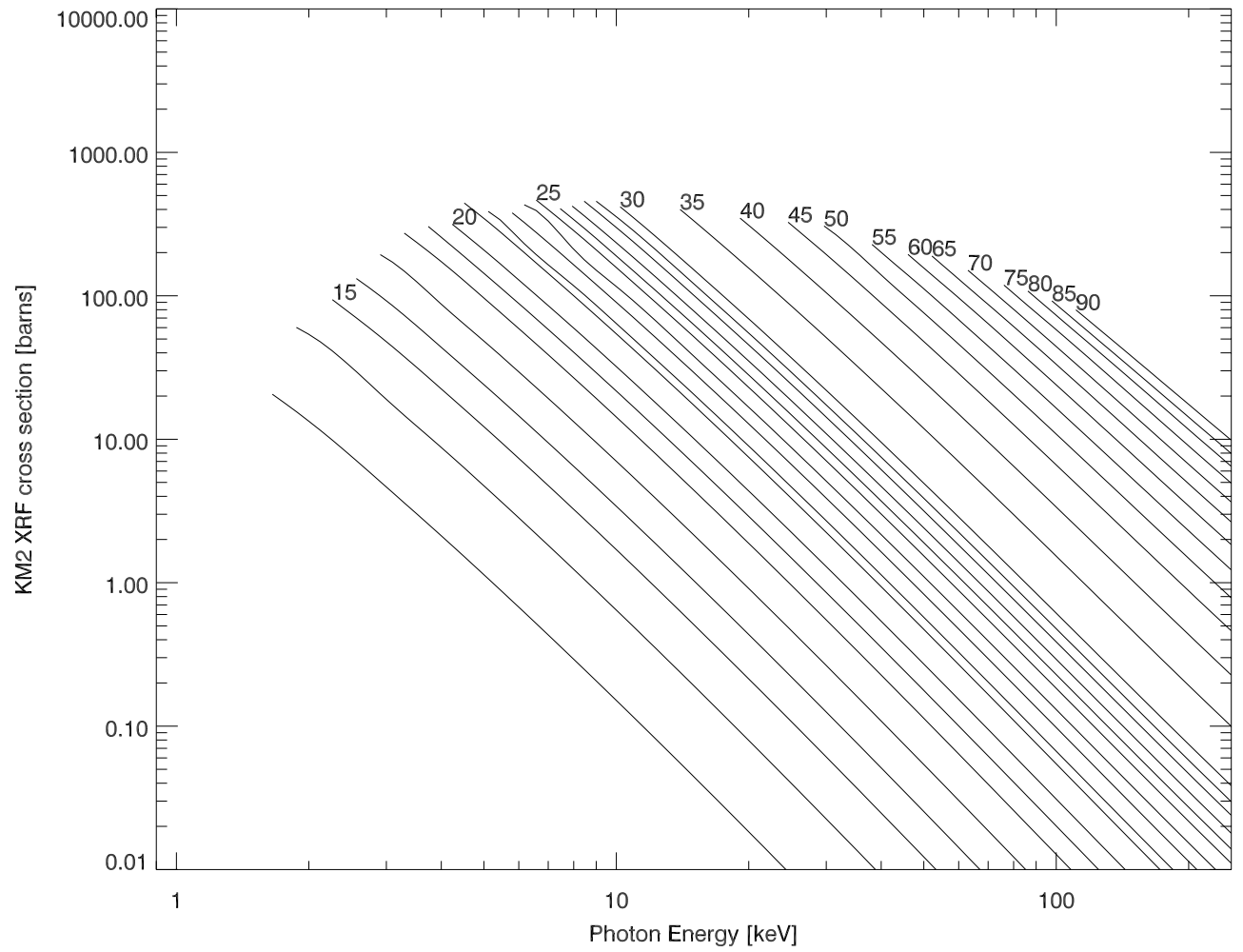


Figure 5: XRF CS for  $L_1M_3$  ( $L\beta_3$ ) line

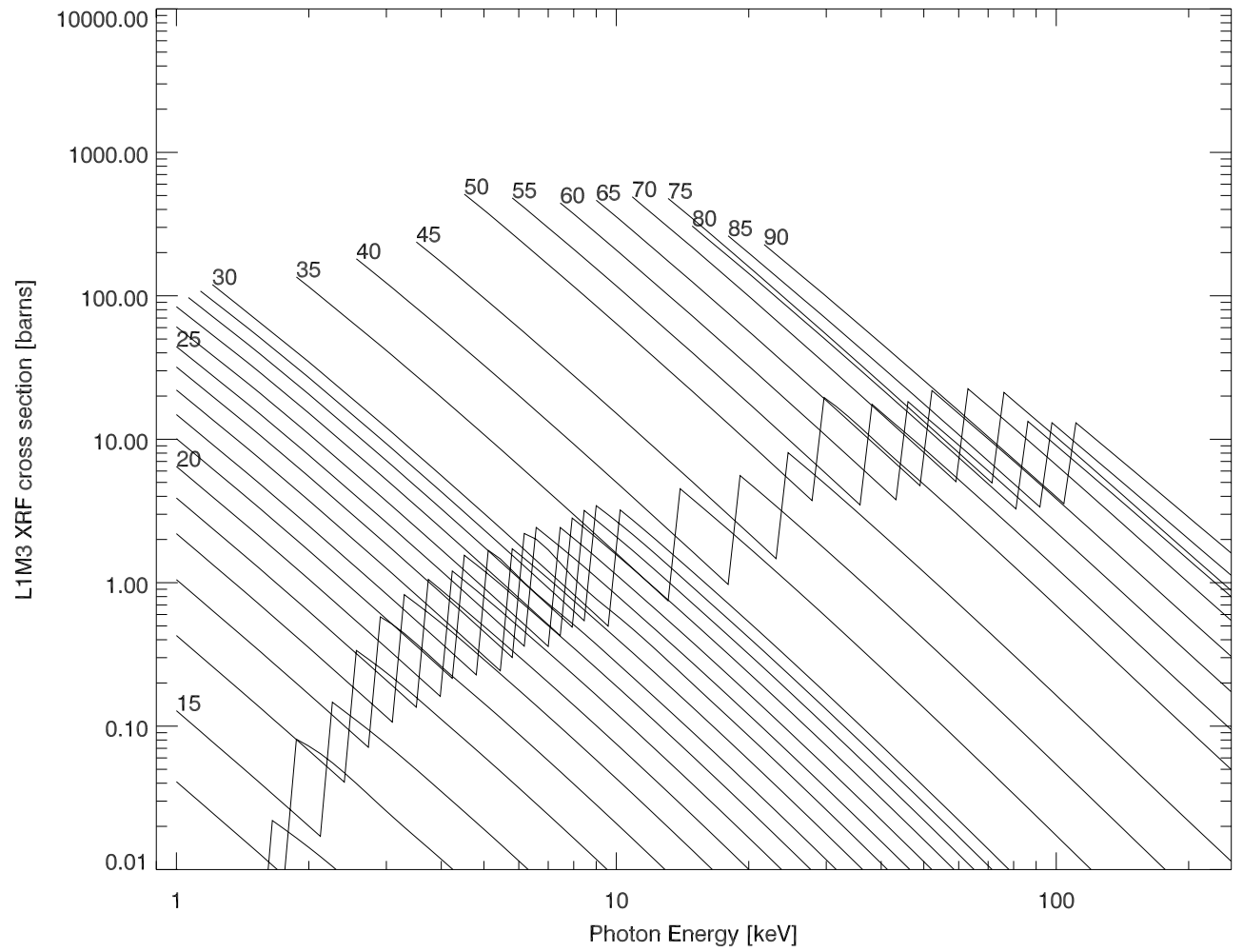


Figure 6: XRF CS for  $L_2M_4$  ( $L\beta_1$ ) line

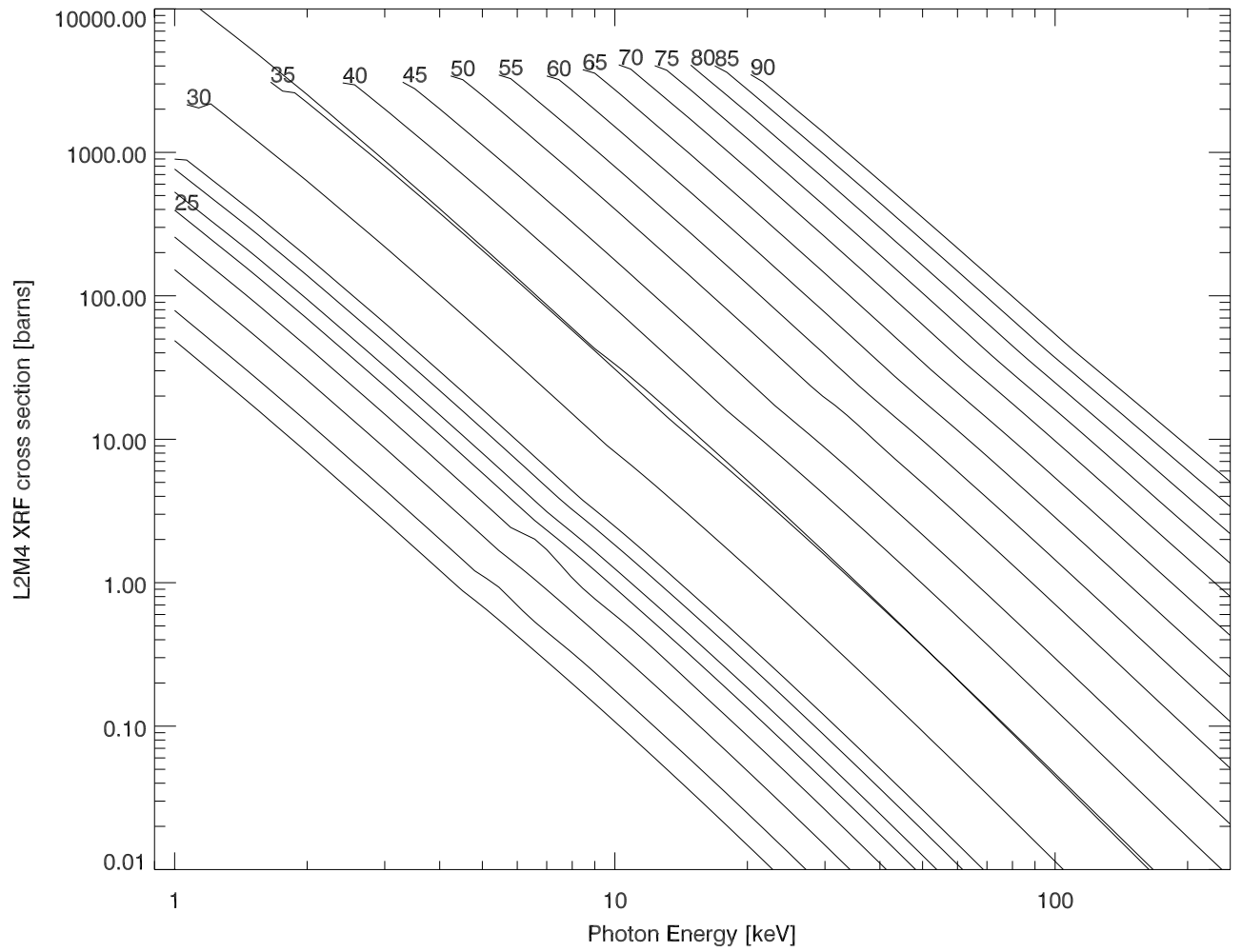


Figure 7: XRF CS for  $L_2N_4$  ( $L\gamma_1$ ) line

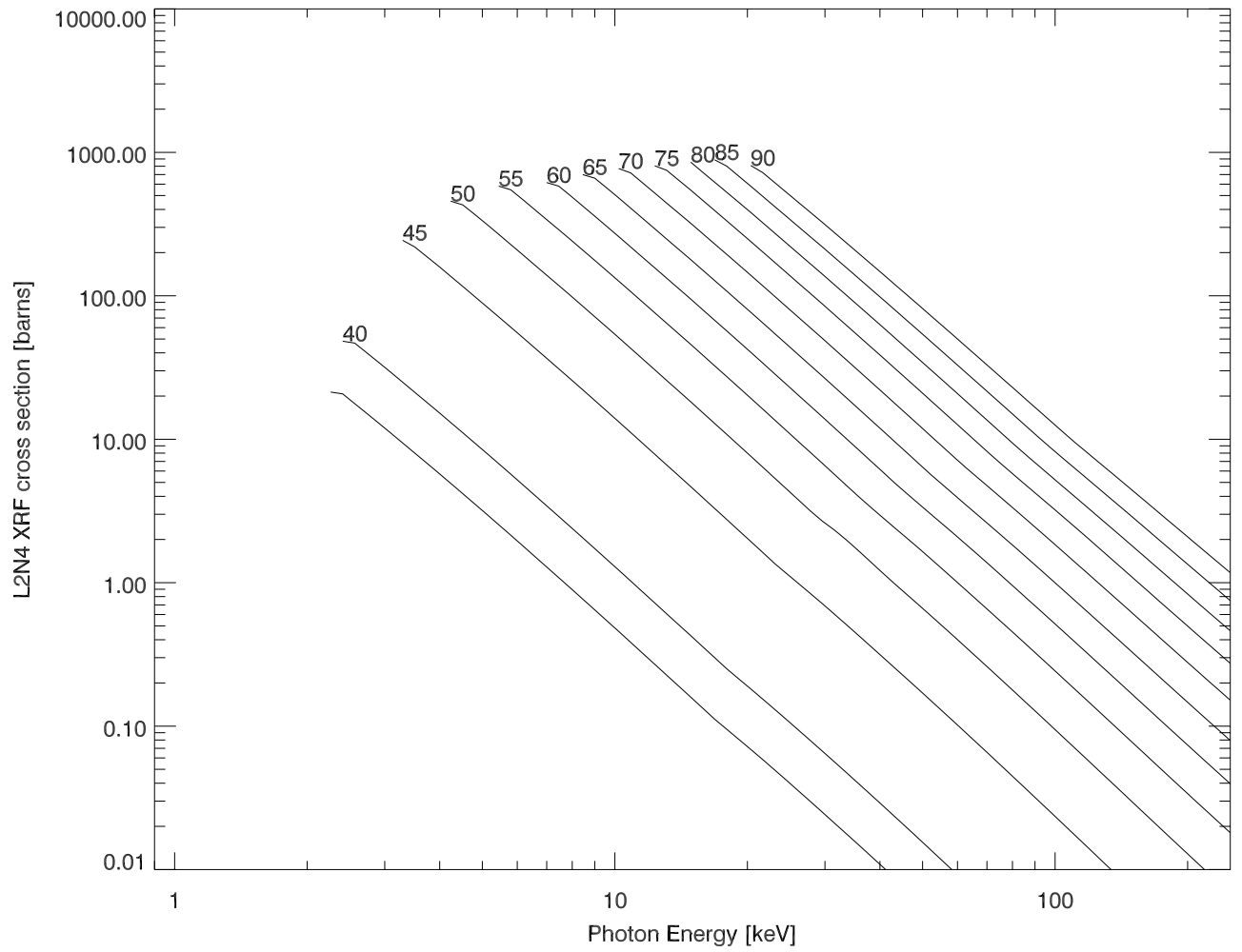




Figure 8: XRF CS for  $L_3M_5$  ( $L\alpha_1$ ) line

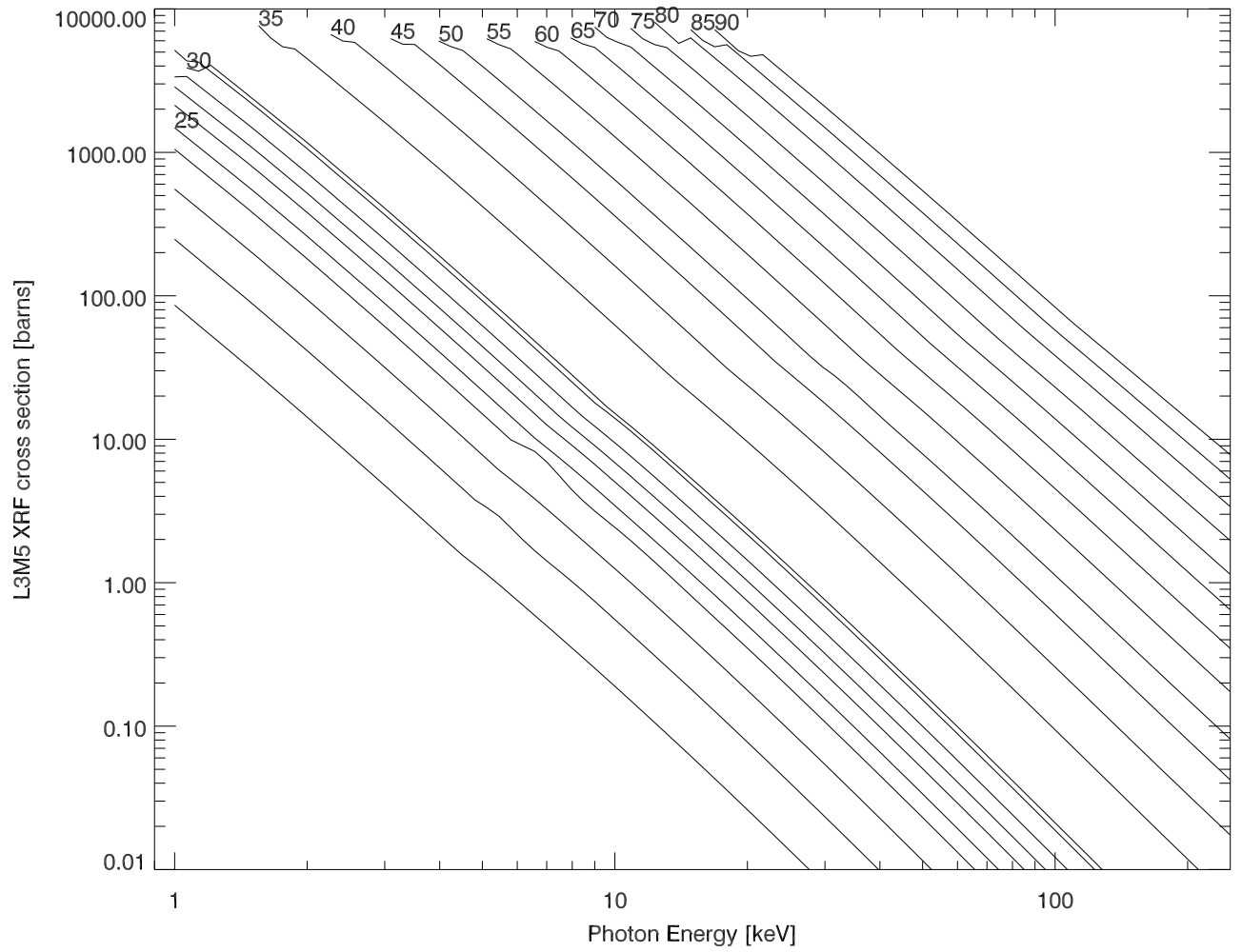


Figure 9: XRF CS for  $L_3M_1$  ( $Ll$ ) line

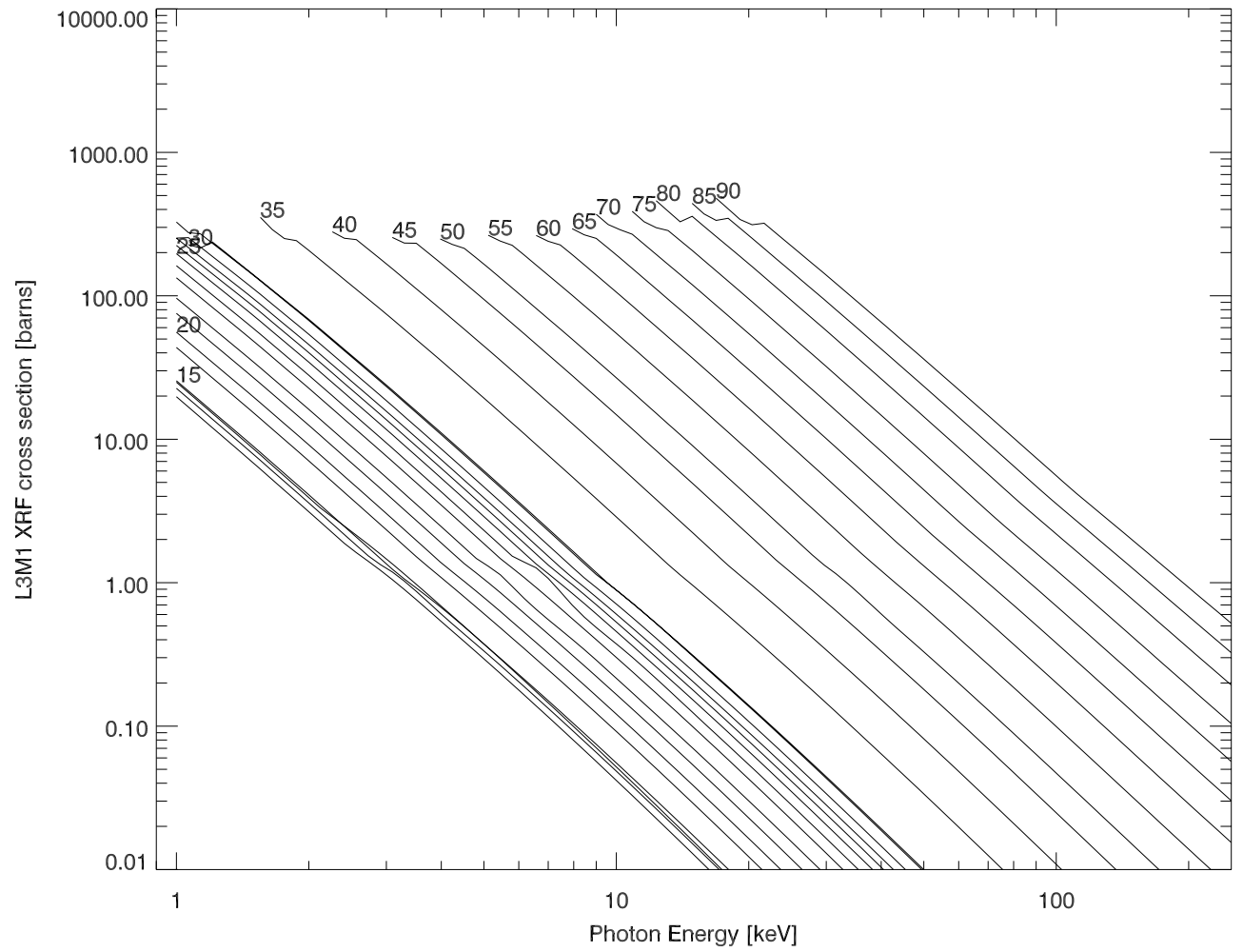
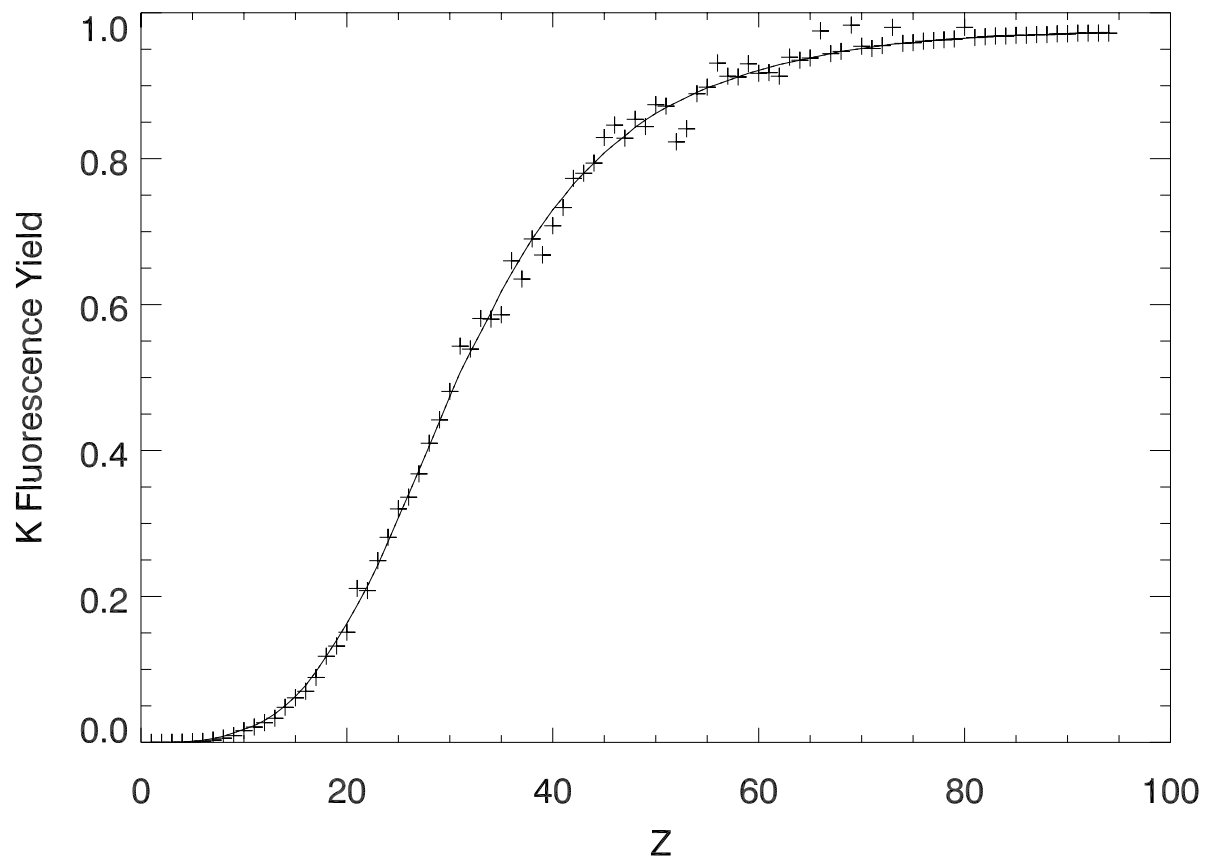


Figure 10: K-shell fluorescence yield from Hubbell used in xraylib (+) and Krause [2] values (continuous line)



## References

- [1] A. Brunetti, M. Sanchez del Rio, B. Golosio, A. Simionovici and A. Somogyi, “A library for X-ray matter interactions cross sections for X-ray fluorescence applications”, *To be published in Spectrochimica Acta B* <http://ftp.esrf.fr/pub/scisoft/xraylib/>
- [2] M.O. Krause, C.W. Nestor, C.J. Sparks and E. Ricci, “X-Ray Fluorescence Cross Sections for K and L X Rays of the elements”, *Oak Ridge Report ORNL-5399*, 1978.
- [3] J.H. Scofield, “Theoretical Photoionization Cross Sections from 1 to 1500 keV”, *Lawrence Livermore Laboratory Report UCRL-51326*, pp. 340-345, 1998. [ftp://www-phys.llnl.gov/pub/rayleigh/RTAB/others/Scofield\\_1973](ftp://www-phys.llnl.gov/pub/rayleigh/RTAB/others/Scofield_1973)