

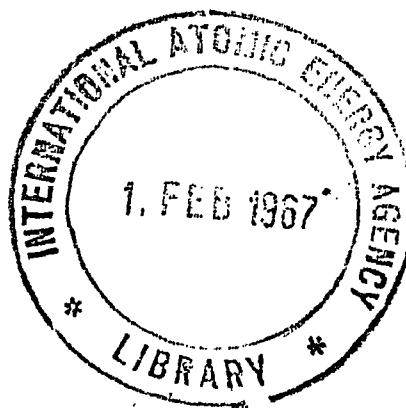


**AUSTRALIAN ATOMIC ENERGY COMMISSION
RESEARCH ESTABLISHMENT
LUCAS HEIGHTS**

CONDENSED TABLES FOR X-RAY FLUORESCENCE ANALYSIS

by

**R.H. BROCKMAN
R.N. WHITEM**



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ABSTRACT

Condensed tables of 2θ angles are provided which are simpler to use for many applications than the comprehensive tables already available.

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LiF (220) crystal

Silicon crystal

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LiF (200) crystal

NaCl crystal

SiO₂ crystal

PE crystal

EDDT crystal

ADP crystal

KAP crystal

1. INTRODUCTION

Several comprehensive tables of two-theta angles are available, for example, Powers (1960), Amsbury et al.(1964). These are invaluable for qualitative analysis of complex materials.

Frequently, the analyst is only concerned with one or a few elements in a known matrix and may wish to check possible interferences and select the most useful analysing crystal. These condensed tables are most suitable for this purpose, being in a more easily manageable form.

In condensing the tables the following steps have been taken:

- (1) Only first order lines were considered, since pulse height analysis virtually eliminates the higher orders.
- (2) The very weak lines were eliminated.
- (3) All lines with excitation energies greater than 50 keV were eliminated.

2. FORM OF THE TABLES

X-ray wavelength data were extracted from Kemp (1963) and two-theta angles calculated by a simple computer programme (Appendix). Card output was used, and where zero values appeared (that is, when $\sin \theta > 1$, or no data were available), these cards were repunched to leave blanks.

Each double page of the tables gives the entire accessible K or L spectrum for a selected crystal.

Each set is headed by the crystal used, and its $2d$ value. In addition, approximate relative intensity values are provided. It will be noted that frequently a value of the weighted mean 2θ value of the $K\alpha_1$ and $K\alpha_2$ lines is given as $K\alpha_{1,2}$. This is very useful when the $K\alpha$ doublet is not resolved.

3. REFERENCES

Amsbury, W.P., Lee, W.W., Rowan, J.H., Walden, G.E. (1964). - Y-1470 - A to I (inclusive).

Kemp, J.W., (1963). - Encyclopaedia of X-Rays and Gamma Rays (Clark, G.L.,
Editor). p.1124. Reinhold, New York.

Powers, M.C. (1960). - X-Ray Fluorescent Spectrometer Conversion Tables.
Philips Electronic Instruments, New York.

APPENDIX 1

FORTRAN IV LISTING OF PROGRAMME

```

C   BRAGG(K)
C   PROGRAMME FOR CONVERSION OF X-RAY WAVELENGTHS TO 2-THETA VALUES
C   PART ONE      K DECK
C   INPUT DATA REQUIRED   1  WAVELENGTH TABLES (DATA)
C                           2  NAME OF CRYSTAL (CRYST)
C                           3  LATTICE SPACING (TWOD)
C   OUTPUT ON CARDS
C   IF DATA NOT IN WAVELENGTH TABLES OR IF LAMBDA/TWOD GT ONE
C                           OUTPUT IS 0.
C                           FEW CARDS AFFECTED ARE BEST REPUNCHED
C   DIMENSION DATA(100,10), DTHETA (100,10), CRYST(3)
C   READ(5,401) ((DATA(M,N),N=1,7),M=3,63)
401  FORMAT(A5,3X6F9.3)
C   DO 413 M=3,63
413  DTHETA(M,1)=DATA(M,1)
411  READ(5,402) CRYST,TWOD
402  FORMAT(3A6,2XF10.0)
C   DO 412 M = 3,63
C   DO 412 N = 2,7
C   IF(DATA(M,N)) 404,404,403
404  DTHETA(M,N) = 0.
C   GO TO 412
403  X = DATA(M,N)/TWOD
C   IF(1.-X)404,405,405
405  DTHETA(M,N)=114.59156*ARSIN(X)
412  CONTINUE
C   WRITE(7,407)
407  FORMAT(20X20HX-RAY 2-THETA TABLES/26X8HK SERIES//)
C   WRITE(7,408) CRYST,TWOD
408  FORMAT(10X3A6,20X4H2D =,F8.4//)
C   WRITE(7,409)
409  FORMAT(61HLINE          KA1,2      KA1      KA2      KB1      KB3
1  KB2/60HINTENSITY      150      100      50      15      15
2  5//)
C   WRITE(7,410)((DTHETA(M,N),N=1,7),M=3,63)
410  FORMAT(A5,3X6F9.2)
C   GO TO 411
C   END

```

```

C   BRAGG(L)
C   PROGRAMME FOR CONVERSION OF X-RAY WAVELENGTHS TO 2-THETA VALUES
C   PART TWO      L DECK
C   INPUT DATA REQUIRED   1  WAVELENGTH TABLES (DATA)
C                           2  NAME OF CRYSTAL (CRYST)
C                           3  LATTICE SPACING (TWOD)
C   OUTPUT ON CARDS
C   IF DATA NOT IN WAVELENGTH TABLES OR IF LAMBDA/TWOD GT ONE
C                           OUTPUT IS 0.
C                           FEW CARDS AFFECTED ARE BEST REPUNCHED
C   DIMENSION DATA(100,10), DTHETA (100,10), CRYST(3)
C   READ(5,401)((DATA(M,N),N=1,9),M=20,95)
401  FORMAT(A5,3X8F9.3)
C   DO 413 M=20,95
413  DTHETA(M,1)=DATA(M,1)
411  READ(5,402) CRYST,TWOD
402  FORMAT(3A6,2XF10.0)
C   DO 412 M=20,95
C   DO 412 N=2,9
C   IF(DATA(M,N)) 404,404,403
404  DTHETA(M,N) = 0.
C   GO TO 412
403  X = DATA(M,N)/TWOD
C   IF(1.-X)404,405,405
405  DTHETA(M,N)=114.59156*ARSIN(X)
412  CONTINUE
C   WRITE(7,407)
407  FORMAT(27X20HX-RAY 2-THETA TABLES/33X8HL SERIES//)
C   WRITE(7,408) CRYST,TWOD
408  FORMAT(10X3A6,20X4H2D =,F8.4//)
C   WRITE(7,409)
409  FORMAT(78HLINE          LA1      LB1      LB2      LY1      LA2
1  LB3      LB4      LL//78HINTENSITY      100      50      20
2  10      10      6      4      3//)
C   WRITE(7,410)((DTHETA(M,N),N=1,9),M=20,95)
410  FORMAT(A5,3X8F9.2)
C   GO TO 411
C   END

```

WAVELENGTH TABLES

X-RAY WAVELENGTH TABLES

LINE		KA1,2	KA1	KA2	KB1	KB3	KB2
INTENSITY		150	100	50	15	15	5
LI	3	230.					
BE	4	113.					
B	5	67.					
C	6	44.					
N	7	31.603					
O	8	23.707					
F	9	18.307					
NE	10	14.615			14.460		
NA	11	11.909			11.574	11.726	
MG	12	9.889			9.559	9.667	
AL	13	8.339	8.338	8.341	7.960	8.059	
SI	14	7.126	7.125	7.127	6.778		
P	15	6.155	6.154	6.157	5.804		
S	16	5.373	5.372	5.375	5.032		
CL	17	4.729	4.728	4.731	4.403		
A	18	4.192	4.191	4.194	3.886		
K	19	3.744	3.742	3.745	3.454		
CA	20	3.360	3.359	3.362	3.089		
SC	21	3.032	3.031	3.034	2.780		
TI	22	2.750	2.749	2.753	2.514		
V	23	2.505	2.503	2.507	2.285		
CR	24	2.291	2.290	2.294	2.085		
MN	25	2.103	2.102	2.105	1.910		
FE	26	1.937	1.936	1.940	1.757		
CO	27	1.791	1.789	1.793	1.621		
NI	28	1.659	1.658	1.661	1.500	1.501	1.489
CU	29	1.542	1.540	1.544	1.392	1.393	1.381
ZN	30	1.437	1.435	1.439	1.296	1.296	1.284
GA	31	1.341	1.340	1.344	1.207	1.208	1.196

GE	32	1.256	1.255	1.258	1.129	1.129	1.117
AS	33	1.177	1.175	1.179	1.057	1.058	1.045
SE	34	1.106	1.105	1.109	0.992	0.993	0.980
BR	35	1.041	1.040	1.044	0.933	0.933	0.921
KR	36	0.981	0.980	0.984	0.879	0.879	0.866
RB	37	0.927	0.926	0.930	0.829	0.830	0.817
SR	38	0.877	0.875	0.880	0.783	0.784	0.771
Y	39	0.831	0.829	0.833	0.740	0.741	0.728
ZR	40	0.788	0.786	0.791	0.701	0.702	0.690
NB	41	0.748	0.747	0.751	0.665	0.666	0.654
MO	42	0.710	0.709	0.713	0.632	0.633	0.621
TC	43	0.676	0.675	0.679	0.601	0.602	0.590
RU	44	0.644	0.643	0.647	0.572	0.573	0.562
RH	45	0.614	0.613	0.617	0.546	0.546	0.535
PD	46	0.587	0.585	0.590	0.521	0.521	0.510
AG	47	0.561	0.559	0.564	0.497	0.498	0.487
CD	48	0.536	0.535	0.539	0.475	0.476	0.465
IN	49	0.514	0.512	0.517	0.455	0.455	0.445
SN	50	0.492	0.491	0.495	0.435	0.436	0.426
SB	51	0.472	0.470	0.475	0.417	0.418	0.408
TE	52	0.453	0.451	0.456	0.400	0.401	0.391
I	53	0.435	0.433	0.438	0.384	0.385	0.376
XE	54	0.418	0.416	0.421	0.369	0.369	0.360
CS	55	0.402	0.401	0.405	0.355	0.355	0.346
BA	56	0.387	0.385	0.390	0.341	0.342	0.333
LA	57	0.373	0.371	0.376	0.328	0.329	0.320
CE	58	0.359	0.357	0.362	0.316	0.317	0.309
PR	59	0.346	0.344	0.349	0.305	0.305	0.297
ND	60	0.334	0.332	0.337	0.294	0.294	0.287
PM	61	0.322	0.321	0.325	0.283	0.284	0.277
SM	62	0.311	0.309	0.314	0.274	0.274	0.267
EU	63	0.301	0.299	0.304	0.264	0.265	0.258

X-RAY WAVELENGTH TABLES

LINE INTENSITY	LA1 100	LB1 50	LB2 20	LY1 10	LA2 10	LB3 6	LB4 4	LL 3
CA 20	36.393	36.022						41.042
SC 21	31.393	31.072						35.671
Ti 22	27.445	27.074						31.423
V 23	24.309	23.898						27.826
CR 24	21.713	21.323				19.429		24.840
MN 25	19.489	19.158				17.575		22.315
FE 26	17.602	17.290				15.742		20.201
CO 27	16.000	15.698				14.269		18.358
NI 28	14.595	14.308				13.167		16.693
CU 29	13.357	13.079				12.115		15.297
ZN 30	12.282	12.009				11.225		14.081
GA 31	11.313	11.045						12.976
GE 32	10.456	10.194						11.944
AS 33	9.671	9.414				8.930		11.069
SE 34	8.990	8.735						10.293
BR 35	8.375	8.126						9.583
KR 36								
RB 37	7.318	7.075			7.325	6.788	6.821	8.363
SR 38	6.863	6.623			6.870	6.367	6.403	7.836
Y 39	6.449	6.211			6.456	5.983	6.018	7.356
ZR 40	6.070	5.836	5.586	5.384	6.077	5.632	5.668	6.918
NB 41	5.725	5.492	5.238	5.036	5.732	5.310	5.346	6.517
MO 42	5.406	5.176	4.923	4.726	5.414	5.013	5.048	6.150
TC 43								
RU 44	4.846	4.620	4.372	4.182	4.854	4.487	4.523	5.503
RH 45	4.597	4.374	4.130	3.944	4.605	4.253	4.289	5.217
PD 46	4.368	4.146	3.909	3.725	4.376	4.034	4.071	4.952
AG 47	4.154	3.935	3.703	3.523	4.162	3.834	3.870	4.707
CD 48	3.956	3.739	3.514	3.336	3.965	3.644	3.681	4.480
IN 49	3.752	3.555	3.339	3.162	3.781	3.470	3.507	4.269
SN 50	3.600	3.385	3.175	3.001	3.609	3.306	3.344	4.071
SB 51	3.439	3.226	3.023	2.852	3.448	3.152	3.190	3.888
TE 52	3.290	3.077	2.882	2.712	3.299	3.009	3.046	3.716
I 53	3.148	2.937	2.751	2.582	3.157	2.874	2.912	3.557
XE 54								
CS 55	2.892	2.683	2.511	2.348	2.902	2.628	2.666	3.267

BA 56	2.776	2.567	2.404	2.242	2.785	2.516	2.555	3.135
LA 57	2.665	2.458	2.303	2.141	2.674	2.410	2.449	3.006
CE 58	2.561	2.356	2.208	2.048	2.570	2.311	2.349	2.892
PR 59	2.463	2.259	2.119	1.961	2.473	2.216	2.255	2.784
ND 60	2.370	2.166	2.035	1.878	2.382	2.126	2.166	2.675
PM 61	2.283	2.081						
SM 62	2.199	1.998	1.882	1.726	2.210	1.962	2.000	2.482
EU 63	2.120	1.920	1.812	1.657	2.131	1.887	1.926	2.395
GD 64	2.046	1.847	1.746	1.592	2.057	1.815	1.853	2.312
TB 65	1.976	1.777	1.682	1.530	1.986	1.747	1.785	2.234
DY 66	1.909	1.710	1.623	1.473	1.920	1.681	1.720	2.158
HO 67	1.845	1.647	1.567	1.417	1.856	1.619	1.658	2.086
ER 68	1.785	1.587	1.514	1.364	1.796	1.561	1.601	2.019
TU 69	1.726	1.530	1.463	1.316	1.738	1.505	1.544	1.955
YB 70	1.672	1.476	1.416	1.268	1.682	1.452	1.491	1.894
LU 71	1.619	1.424	1.370	1.222	1.630	1.402	1.441	1.836
HF 72	1.569	1.374	1.327	1.179	1.580	1.353	1.392	1.782
TA 73	1.522	1.327	1.285	1.138	1.533	1.307	1.346	1.728
W 74	1.476	1.282	1.245	1.098	1.487	1.263	1.302	1.678
RE 75	1.433	1.238	1.206	1.061	1.444	1.220	1.260	1.630
OS 76	1.391	1.197	1.169	1.025	1.402	1.179	1.218	1.585
IR 77	1.352	1.158	1.135	.991	1.363	1.141	1.179	1.541
PT 78	1.313	1.120	1.102	.958	1.325	1.104	1.142	1.499
AU 79	1.277	1.083	1.070	.927	1.288	1.068	1.106	1.460
HG 80	1.242	1.049	1.040	.897	1.253	1.034	1.072	1.422
TL 81	1.207	1.015	1.010	.868	1.218	1.001	1.039	1.385
PB 82	1.175	.982	.983	.840	1.186	.969	1.007	1.350
BI 83	1.144	.952	.955	.814	1.155	.939	.977	1.317
PO 84	1.114	.921	.929	.786	1.126	.908	.948	1.283
AT 85								
RN 86								
FR 87	1.030	.840	.858	.716				
RA 88	1.005	.814	.836	.694	1.017	.803	.841	1.167
AC 89								
TH 90	.956	.766	.794	.653	.968	.755	.793	1.115
PA 91	.933	.742	.774	.634	.945	.732	.770	1.091
U 92	.911	.720	.755	.615	.923	.710	.748	1.067
NP 93	.890	.698	.735	.597	.901			
PU 94	.868	.678	.719	.579	.880	.669	.707	
AM 95	.849	.658	.701	.562	.860			

WAVELENGTH TABLES (L)

20 TABLES

TOPAZ CRYSTAL

2D= 2.7120

LINE	KA1+2	KA1	KA2	KB1	KB3	KB2
INTENSITY	150	100	50	15	15	5
TI 22				135.94		
V 23	134.94	134.72	135.16	114.82		
CR 24	115.29	115.21	115.53	100.49		
MN 25	101.69	101.62	101.82	89.54		
FE 26	91.16	91.10	91.34	80.76		
CO 27	82.66	82.55	82.77	73.41		
NI 28	75.43	75.38	75.54	67.16	67.21	66.60
CU 29	69.30	69.20	69.41	61.76	61.81	61.22
ZN 30	63.99	63.89	64.09	57.09	57.09	56.52
GA 31	59.27	59.22	59.42	52.85	52.90	52.34
GE 32	55.18	55.13	55.27	49.20	49.20	48.65
AS 33	51.44	51.35	51.54	45.88	45.92	45.33
SE 34	48.14	48.09	48.27	42.91	42.96	42.37
BR 35	45.14	45.10	45.28	40.24	40.24	39.71
KR 36	42.41	42.37	42.55	37.82	37.82	37.24
RB 37	39.97	39.93	40.11	35.60	35.64	35.07
SR 38	37.73	37.65	37.87	33.56	33.61	33.03
Y 39	35.69	35.60	35.78	31.67	31.71	31.14
ZR 40	33.78	33.69	33.92	29.96	30.00	29.48
NB 41	32.02	31.98	32.15	28.39	28.43	27.91
MO 42	30.35	30.31	30.49	26.95	27.00	26.47
TC 43	28.87	28.82	29.00	25.61	25.65	25.13
RU 44	27.47	27.43	27.60	24.35	24.40	23.92
RH 45	26.17	26.13	26.30	23.23	23.23	22.75
PD 46	25.00	24.91	25.13	22.15	22.15	21.68
AG 47	23.88	23.79	24.01	21.12	21.16	20.69
CD 48	22.80	22.75	22.93	20.17	20.22	19.75

IN 49	21.85	21.76	21.98	19.32	19.32	18.89
SN 50	20.90	20.86	21.03	18.46	18.50	18.07
SB 51	20.05	19.96	20.17	17.69	17.73	17.31
TE 52	19.23	19.15	19.36	16.96	17.01	16.58
I 53	18.46	18.37	18.59	16.28	16.32	15.94
XE 54	17.73	17.65	17.86	15.64	15.64	15.26
CS 55	17.05	17.01	17.18	15.04	15.04	14.66
BA 56	16.41	16.32	16.54	14.45	14.49	14.11
LA 57	15.81	15.73	15.94	13.89	13.94	13.55
CE 58	15.21	15.13	15.34	13.38	13.43	13.08
PR 59	14.66	14.57	14.79	12.91	12.91	12.57
ND 60	14.15	14.06	14.28	12.45	12.45	12.15
PM 61	13.64	13.60	13.77	11.98	12.02	11.72
SM 62	13.17	13.08	13.30	11.60	11.60	11.30
EU 63	12.74	12.66	12.87	11.17	11.22	10.92

TOPAZ CRYSTAL

2D = 2.7120

LINE	LA1	LB1	LB2	LY1	LA2	LB3	LB4	LL
INTENSITY	100	50	20	10	10	6	4	3
TE 52				180.00				
I 53				144.38				
XE 54								
CS 55		163.23	135.60	119.94		151.41	158.86	
BA 56		142.36	124.86	111.52		136.17	140.82	
LA 57	158.64	130.01	116.25	104.27	160.79	125.41	129.12	
CE 58	141.58	120.62	109.01	98.08	142.75	116.89	120.03	
PR 59	130.51	112.81	102.77	92.62	131.53	109.59	112.50	
ND 60	121.83	106.01	97.24	87.65	122.88	103.24	106.01	161.05
PM 61	114.66	100.23						
SM 62	108.36	94.91	87.89	79.05	109.15	92.68	95.03	132.47
EU 63	102.83	90.14	83.85	75.32	103.58	88.18	90.50	124.04
GD 64	97.95	85.85	80.15	71.89	98.66	84.02	86.20	116.97
TB 65	93.54	81.88	76.66	68.69	94.16	80.21	82.32	110.92
DY 66	89.48	78.18	73.52	65.80	90.14	76.61	78.72	105.45
HO 67	85.74	74.79	70.59	63.00	86.37	73.31	75.38	100.56
ER 68	82.32	71.63	67.87	60.39	82.94	70.28	72.36	96.23
TU 69	79.05	68.69	65.29	58.06	79.71	67.41	69.41	92.25
YB 70	76.12	65.95	62.95	55.75	76.66	64.74	66.70	88.59
LU 71	73.31	63.35	60.68	53.56	73.89	62.26	64.19	85.22
HF 72	70.70	60.88	58.59	51.54	71.27	59.85	61.76	82.16
TA 73	68.28	58.59	56.57	49.62	68.84	57.62	59.51	79.16
W 74	65.95	56.42	54.65	47.77	66.50	55.51	57.38	76.45
RE 75	63.79	54.32	52.81	46.06	64.34	53.47	55.37	73.89
OS 76	61.72	52.38	51.07	44.41	62.26	51.54	53.37	71.53
IR 77	59.80	50.55	49.48	42.87	60.34	49.76	51.54	69.25
PT 78	57.91	48.78	47.95	41.37	58.49	48.04	49.81	67.11

AU 79	56.18	47.07	46.47	39.97	56.71	46.38	48.14	65.14
HG 80	54.51	45.51	45.10	38.63	55.04	44.82	46.57	63.25
TL 81	52.85	43.96	43.73	37.33	53.37	43.32	45.05	61.42
PB 82	51.35	42.46	42.50	36.09	51.87	41.87	43.59	59.71
BI 83	49.90	41.10	41.24	34.93	50.41	40.51	42.23	58.11
PO 84	48.51	39.71	40.06	33.69	49.06	39.12	40.92	56.47
AT 85								
RN 86								
FR 87	44.64	36.09	36.89	30.62				
RA 88	43.50	34.93	35.91	29.65	44.05	34.45	36.13	50.97
AC 89								
TH 90	41.28	32.81	34.05	27.87	41.82	32.33	34.00	48.55
PA 91	40.24	31.76	33.17	27.04	40.79	31.32	32.99	47.44
U 92	39.26	30.79	32.33	26.21	39.80	30.35	32.02	46.34
NP 93	38.32	29.83	31.45	25.43	38.81			
PU 94	37.33	28.96	30.75	24.65	37.87	28.56	30.22	
AM 95	36.49	28.08	29.96	23.92	36.98			

LIF(220) CRYSTAL

2D = 2.8480

LINE	KA1,2	KA1	KA2	KB1	KB3	KB2
INTENSITY	150	100	50	15	15	5
SC 21				154.91		
TI 22	149.85	149.70	150.32	123.95		
V 23	123.18	123.01	123.35	106.70		
CR 24	107.11	107.04	107.31	94.12		
MN 25	95.19	95.13	95.31	84.23		
FE 26	85.71	85.65	85.87	76.18		
CO 27	77.93	77.83	78.04	69.38		
NI 28	71.26	71.21	71.35	63.56	63.61	63.04
CU 29	65.56	65.47	65.66	58.52	58.56	58.01
ZN 30	60.60	60.51	60.70	54.14	54.14	53.60
GA 31	56.18	56.13	56.32	50.15	50.19	49.66
GE 32	52.34	52.29	52.43	46.71	46.71	46.18
AS 33	48.82	48.73	48.91	43.57	43.61	43.05
SE 34	45.70	45.66	45.83	40.77	40.81	40.25
BR 35	42.88	42.84	43.01	38.25	38.25	37.74
KR 36	40.30	40.25	40.43	35.95	35.95	35.40
RB 37	37.99	37.95	38.12	33.85	33.89	33.34
SR 38	35.87	35.79	36.00	31.92	31.96	31.41
Y 39	33.93	33.85	34.01	30.12	30.16	29.62
ZR 40	32.12	32.04	32.25	28.50	28.54	28.04
NB 41	30.45	30.41	30.58	27.01	27.05	26.55
MO 42	28.87	28.83	29.00	25.64	25.68	25.19
TC 43	27.46	27.42	27.59	24.36	24.41	23.91
RU 44	26.14	26.10	26.26	23.17	23.21	22.76
RH 45	24.90	24.86	25.02	22.11	22.11	21.65
PD 46	23.79	23.71	23.91	21.08	21.08	20.63
AG 47	22.72	22.64	22.84	20.10	20.14	19.69

CD 48	21.70	21.65	21.82	19.20	19.24	18.79
IN 49	20.80	20.71	20.92	18.39	18.39	17.98
SN 50	19.90	19.85	20.02	17.57	17.61	17.21
SB 51	19.08	19.00	19.20	16.84	16.88	16.47
TE 52	18.30	18.22	18.43	16.15	16.19	15.78
I 53	17.57	17.49	17.69	15.50	15.54	15.17
XE 54	16.88	16.80	17.00	14.89	14.89	14.52
CS 55	16.23	16.19	16.35	14.32	14.32	13.96
BA 56	15.62	15.54	15.74	13.75	13.79	13.43
LA 57	15.05	14.97	15.17	13.23	13.27	12.90
CE 58	14.48	14.40	14.60	12.74	12.78	12.46
PR 59	13.96	13.87	14.08	12.30	12.30	11.97
ND 60	13.47	13.39	13.59	11.85	11.85	11.57
PM 61	12.98	12.94	13.11	11.41	11.45	11.16
SM 62	12.54	12.46	12.66	11.04	11.04	10.76
EU 63	12.13	12.05	12.26	10.64	10.68	10.40

LIF(220) CRYSTAL

2D = 2.8480

LINE	LA1	LB1	LB2	LY1	LA2	LB3	LB4	LL
INTENSITY	100	50	20	10	10	6	4	3
TE 52								
I 53				144.44				
XE 54			150.01	130.08				
CS 55		140.80	123.69	111.06				
BA 56	154.18	128.67	115.15	103.85	155.85	134.66	138.81	
LA 57	138.70	119.32	107.93	97.49	139.74	124.12	127.56	
CE 58	128.11	111.63	101.66	91.96	128.95	115.60	118.61	
PR 59	119.72	104.97	96.15	87.03	120.53	108.48	111.13	
ND 60	112.64	99.02	91.21	82.51	113.52	102.17	104.71	155.66
PM 61	106.57	93.89				96.57	99.02	139.85
SM 62	101.09	89.10	82.72	74.61	101.79	87.09	89.22	121.26
EU 63	96.21	84.78	79.02	71.16	96.88	82.99	85.10	114.48
GD 64	91.84	80.86	75.62	67.97	92.48	79.18	81.18	108.54
TB 65	87.87	77.21	72.40	64.99	88.43	75.67	77.62	103.33
DY 66	84.18	73.80	69.48	62.29	84.78	72.35	74.30	98.53
HO 67	80.76	70.66	66.76	59.68	81.34	69.29	71.21	94.18
ER 68	77.62	67.73	64.23	57.23	78.19	66.47	68.41	90.29
TU 69	74.61	64.99	61.82	55.04	75.22	63.80	65.66	86.70
YB 70	71.90	62.43	59.63	52.88	72.40	61.31	63.14	83.37
LU 71	69.29	60.00	57.51	50.82	69.83	58.98	60.79	80.28
HF 72	66.86	57.69	55.54	48.91	67.39	56.73	58.52	77.47
TA 73	64.61	55.54	53.64	47.10	65.13	54.63	56.41	74.71
W 74	62.43	53.51	51.84	45.35	62.95	52.65	54.41	72.20
RE 75	60.42	51.53	50.11	43.74	60.93	50.73	52.52	69.83
OS 76	58.47	49.71	48.47	42.19	58.98	48.91	50.64	67.63
IR 77	56.68	47.98	46.97	40.73	57.19	47.24	48.91	65.51
PT 78	54.91	46.31	45.53	39.31	55.45	45.62	47.28	63.52

AU 79	53.28	44.70	44.14	37.99	53.78	44.05	45.70	61.68
HG 80	51.71	43.23	42.84	36.72	52.20	42.58	44.22	59.91
TL 81	50.15	41.76	41.54	35.49	50.64	41.16	42.79	58.20
PB 82	48.73	40.34	40.38	34.31	49.22	39.78	41.41	56.59
BI 83	47.37	39.06	39.18	33.22	47.85	38.50	40.13	55.09
PO 84	46.05	37.74	38.08	32.04	46.58	37.18	38.89	53.55
AT 85								
RN 86								
FR 87	42.40	34.31	35.07	29.12				
RA 88	41.33	33.22	34.14	28.21	41.84	32.75	34.35	48.38
AC 89								
TH 90	39.23	31.20	32.38	26.51	39.74	30.75	32.33	46.10
PA 91	38.25	30.20	31.54	25.73	38.76	29.79	31.37	45.05
U 92	37.31	29.29	30.75	24.94	37.82	28.87	30.45	44.01
NP 93	36.42	28.37	29.91	24.20	36.89			
PU 94	35.49	27.54	29.25	23.46	36.00	27.17	28.75	
AM 95	34.69	26.72	28.50	22.76	35.15			

SILICON CRYSTAL

2D = 3.8310

LINE	KA1.2	KA1	KA2	KB1	KB3	KB2
INTENSITY	150	100	50	15	15	5
K 19	155.53	155.25	155.67	128.74		
CA 20	122.58	122.52	122.70	107.48		
SC 21	104.64	104.59	104.74	93.05		
TI 22	91.75	91.71	91.88	82.03		
V 23	81.67	81.59	81.75	73.23		
CR 24	73.46	73.42	73.57	65.95		
MN 25	66.59	66.55	66.66	59.81		
FE 26	60.74	60.71	60.85	54.60		
CO 27	55.74	55.68	55.81	50.06		
NI 28	51.32	51.29	51.39	46.10		
CU 29	47.47	47.40	47.54	42.61	46.13	45.74
ZN 30	44.06	44.00	44.13	39.55	42.64	42.26
GA 31	40.98	40.95	41.08	36.73	39.55	39.16
GE 32	38.28	38.25	38.34	34.28	36.76	36.38
AS 33	35.78	35.72	35.85	32.03	34.28	33.90
SE 34	33.56	33.53	33.65	30.01	32.06	31.66
BR 35	31.53	31.50	31.63	28.19	30.05	29.64
KR 36	29.67	29.64	29.77	26.53	28.19	27.82
RB 37	28.01	27.98	28.10	24.99	26.53	26.13
SR 38	26.47	26.41	26.56	23.59	25.03	24.63
Y 39	25.06	24.99	25.12	22.27	23.62	23.22
ZR 40	23.74	23.68	23.83	21.09	22.31	21.91
NB 41	22.52	22.49	22.61	19.99	21.12	20.75
MO 42	21.36	21.33	21.45	18.99	20.02	19.66
TC 43	20.33	20.30	20.42	18.05	19.02	18.66
RU 44	19.36	19.32	19.45	17.17	18.08	17.72
RH 45	18.45	18.42	18.54	16.39	17.20	16.87
					16.39	16.06

PD 46	17.63	17.57	17.72	15.63	15.63	15.30
AG 47	16.84	16.78	16.93	14.91	14.94	14.61
CD 48	16.09	16.06	16.18	14.24	14.27	13.94
IN 49	15.42	15.36	15.51	13.64	13.64	13.34
SN 50	14.76	14.73	14.85	13.04	13.07	12.77
SB 51	14.15	14.09	14.24	12.50	12.53	12.23
TE 52	13.58	13.52	13.67	11.99	12.02	11.72
I 53	13.04	12.98	13.13	11.51	11.54	11.26
XE 54	12.53	12.47	12.62	11.05	11.05	10.78
CS 55	12.05	12.02	12.14	10.63	10.63	10.36
BA 56	11.60	11.54	11.69	10.21	10.24	9.97
LA 57	11.17	11.11	11.26	9.82	9.85	9.58
CE 58	10.75	10.69	10.84	9.46	9.49	9.25
PR 59	10.36	10.30	10.45	9.13	9.13	8.89
ND 60	10.00	9.94	10.09	8.80	8.80	8.59
PM 61	9.64	9.61	9.73	8.47	8.50	8.29
SM 62	9.31	9.25	9.40	8.20	8.20	7.99
EU 63	9.01	8.95	9.10	7.90	7.93	7.72

SILICON CRYSTAL

2D = 3.8310

LINE	LA1	LB1	LB2	LY1	LA2	LB3	LB4	LL
INTENSITY	100	50	20	10	10	6	4	3
PD 46				152.98				
AG 47				133.74				
CD 48		154.84	150.29	133.06				
IN 49	156.69	136.24	121.28	121.10				
SN 50	140.00	124.15	111.94	111.25	161.47	144.05	147.83	
SB 51	127.71	114.72	104.20	103.14	140.80	129.85	132.53	
TE 52	118.36	106.87	97.58	96.22	128.32	119.30	121.59	
I 53	110.51	100.11	91.79	90.13	118.89	110.72	112.75	
XE 54				84.75	110.99	103.52	105.33	151.85
CS 55	98.03	88.91	81.91	75.60		97.21	98.95	136.40
BA 56	92.87	84.14	77.73	71.64	98.49	86.63	88.20	117.03
LA 57	88.16	79.82	73.90	67.95	93.26	82.10	83.66	109.83
CE 58	83.90	75.90	70.39	64.63	88.53	77.96	79.47	103.38
PR 59	80.02	72.27	67.16	61.58	84.26	74.20	75.64	98.03
ND 60	76.43	68.86	64.17	58.71	80.41	70.68	72.12	93.22
PM 61	73.16	65.80			76.89	67.41	68.86	88.57
SM 62	70.06	62.87	58.85	53.56				
EU 63	67.20	60.16	56.46	51.26	70.46	61.61	62.94	80.76
GD 64	64.56	57.65	54.23	49.11	67.59	59.02	60.36	77.39
TB 65	62.10	55.27	52.09	47.08	64.95	56.56	57.85	74.24
DY 66	59.78	53.02	50.13	45.22	62.45	54.26	55.54	71.34
HO 67	57.58	50.92	48.29	43.42	60.16	52.05	53.36	68.57
ER 68	55.54	48.94	46.56	41.71	57.96	50.00	51.29	65.98
TU 69	53.56	47.08	44.90	40.18	55.91	48.09	49.40	63.61
YB 70	51.75	45.32	43.38	38.66	53.96	46.26	47.54	61.37
LU 71	50.00	43.64	41.91	37.20	52.09	44.55	45.81	59.26
HF 72	48.35	42.04	40.53	35.85	50.36	42.93	44.19	57.27
					48.71	41.36	42.61	55.44

TA 73	46.82	40.53	39.20	34.56	47.18	39.90	41.14	53.62
W 74	45.32	39.10	37.93	33.31	45.68	38.50	39.74	51.95
RE 75	43.93	37.71	36.70	32.16	44.29	37.14	38.40	50.36
OS 76	42.58	36.41	35.53	31.04	42.93	35.85	37.08	48.88
IR 77	41.33	35.19	34.47	29.98	41.68	34.66	35.85	47.44
PT 78	40.09	34.00	33.44	28.96	40.47	33.50	34.69	46.07
AU 79	38.94	32.84	32.44	28.01	39.29	32.37	33.56	44.80
HG 80	37.83	31.78	31.50	27.08	38.18	31.32	32.50	43.58
TL 81	36.73	30.73	30.57	26.19	37.08	30.29	31.47	42.39
PB 82	35.72	29.70	29.74	25.33	36.07	29.30	30.48	41.27
BI 83	34.75	28.78	28.87	24.54	35.09	28.38	29.55	40.21
PO 84	33.81	27.82	28.07	23.68	34.19	27.42	28.65	39.13
AT 85								
RN 86								
FR 87	31.19	25.33	25.88	21.54				
RA 88	30.42	24.54	25.21	20.87	30.79	24.20	25.36	35.47
AC 89								
TH 90	28.90	23.07	23.92	19.63	29.27	22.73	23.89	33.84
PA 91	28.19	22.34	23.31	19.05	28.56	22.03	23.19	33.09
U 92	27.51	21.67	22.73	18.48	27.88	21.36	22.52	32.34
NP 93	26.87	21.00	22.12	17.93	27.21			
PU 94	26.19	20.39	21.63	17.39	26.56	20.11	21.27	
AM 95	25.61	19.78	21.09	16.87	25.95			

GERMANIUM(220) CRYSTAL

2D = 3.9930

LINE	KA1,2	KA1	KA2	KB1	KB3	KB2
INTENSITY	150	100	50	15	15	5
A 18				153.41		
K 19	139.32	139.15	139.40	119.77		
CA 20	114.59	114.54	114.70	101.36		
SC 21	98.81	98.77	98.90	88.25		
TI 22	87.06	87.02	87.17	78.04		
V 23	77.71	77.64	77.78	69.81		
CR 24	70.02	69.99	70.13	62.96		
MN 25	63.56	63.53	63.63	57.15		
FE 26	58.04	58.01	58.14	52.21		
CO 27	53.30	53.24	53.36	47.90		
NI 28	49.10	49.07	49.16	44.13	44.16	43.79
CU 29	45.43	45.37	45.50	40.80	40.84	40.47
ZN 30	42.19	42.12	42.25	37.88	37.88	37.51
GA 31	39.25	39.22	39.34	35.19	35.22	34.86
GE 32	36.67	36.64	36.73	32.85	32.85	32.49
AS 33	34.29	34.23	34.35	30.70	30.73	30.34
SE 34	32.16	32.13	32.25	28.77	28.80	28.41
BR 35	30.22	30.19	30.31	27.03	27.03	26.67
KR 36	28.44	28.41	28.53	25.43	25.43	25.05
RB 37	26.85	26.82	26.94	23.97	23.99	23.61
SR 38	25.38	25.32	25.46	22.62	22.65	22.27
Y 39	24.02	23.97	24.08	21.36	21.39	21.01
ZR 40	22.76	22.70	22.85	20.22	20.25	19.90
NB 41	21.59	21.56	21.68	19.17	19.20	18.85
MO 42	20.48	20.46	20.57	18.21	18.24	17.89
TC 43	19.49	19.46	19.58	17.31	17.34	16.99
RU 44	18.56	18.53	18.65	16.47	16.50	16.18

RH 45	17.69	17.66	17.78	15.72	15.72	15.40
PD 46	16.91	16.85	16.99	14.99	14.99	14.68
AG 47	16.15	16.10	16.24	14.30	14.33	14.01
CD 48	15.43	15.40	15.52	13.66	13.69	13.37
IN 49	14.79	14.73	14.88	13.09	13.09	12.80
SN 50	14.16	14.13	14.24	12.51	12.54	12.25
SB 51	13.58	13.52	13.66	11.99	12.02	11.73
TE 52	13.03	12.97	13.11	11.50	11.53	11.24
I 53	12.51	12.45	12.60	11.04	11.07	10.81
XE 54	12.02	11.96	12.10	10.60	10.60	10.35
CS 55	11.56	11.53	11.64	10.20	10.20	9.94
BA 56	11.12	11.07	11.21	9.80	9.83	9.57
LA 57	10.72	10.66	10.81	9.42	9.45	9.19
CE 58	10.32	10.26	10.40	9.08	9.11	8.88
PR 59	9.94	9.88	10.03	8.76	8.76	8.53
ND 60	9.60	9.54	9.68	8.44	8.44	8.24
PM 61	9.25	9.22	9.34	8.13	8.16	7.96
SM 62	8.93	8.88	9.02	7.87	7.87	7.67
EU 63	8.65	8.59	8.73	7.58	7.61	7.41

GERMANIUM(220) CRYSTAL

GERMANIUM(220) CRYSTAL

2D = 3.9930

LINE	LA1	LB1	LB2	LY1	LA2	LB3	LB4	LL
INTENSITY	100	50	20	10	10	6	4	3
RH 45				162.03				
PD 46				137.78				
AG 47			156.45	123.84				
CD 48	164.39	160.44	136.06	113.33				
IN 49	139.98	138.91	123.29	104.72				
SN 50	128.73	125.82	113.48	97.45	166.42	147.55	151.48	
SB 51	118.92	115.93	105.34	91.16	142.49	131.73	134.40	
TE 52	110.96	107.79	98.41	85.56	129.33	120.69	122.87	
I 53	104.07	100.82	92.40	80.58	119.43	111.78	113.75	
XE 54		94.71	87.09		111.42	104.26	106.05	153.66
CS 55					104.49	97.80	99.43	137.07
BA 56	92.82	84.43	77.93	72.03		92.07	93.65	125.95
LA 57	88.09	80.01	74.03	68.32	93.23			
CE 58	83.74	75.99	70.45	64.85	88.45	82.32	83.77	109.81
PR 59	79.79	72.32	67.14	61.71	84.08	78.12	79.56	103.46
ND 60	76.17	68.91	64.10	58.83	80.13	74.25	75.66	97.67
PM 61	72.82	65.70	61.28	56.11	76.54	70.73	72.07	92.82
SM 62	69.74	62.82			73.25	67.42	68.77	88.41
EU 63	66.83	60.05	56.24	51.22		64.34	65.70	84.12
GD 64	64.14	57.48	53.97	49.04	67.21	58.86	60.12	76.86
TB 65	61.65	55.10	51.86	46.99	64.51	56.40	57.68	73.71
DY 66	59.32	52.85	49.83	45.06	62.02	54.07	55.30	70.76
HO 67	57.12	50.71	47.97	43.30	59.65	51.89	53.11	68.04
ER 68	55.04	48.72	46.21	41.57	57.48	49.79	51.03	65.43
TU 69	53.11	46.84	44.56	39.95	55.40	47.84	49.07	62.99
YB 70	51.22	45.06	42.99	38.49	53.46	46.03	47.28	60.75
LU 71	49.51	43.39	41.54	37.03	51.60	44.28	45.50	58.63
	47.84	41.79	40.13	35.64	49.83	42.65	43.85	56.63
					48.19	41.11	42.31	54.75

HF 72	46.27	40.25	38.82	34.35	46.62	39.61	40.80	53.01
TA 73	44.81	38.82	37.55	33.12	45.15	38.21	39.40	51.29
W 74	43.39	37.45	36.33	31.92	43.73	36.88	38.06	49.70
RE 75	42.06	36.12	35.16	30.82	42.40	35.58	36.79	48.19
OS 76	40.77	34.89	34.05	29.75	41.11	34.35	35.52	46.77
IR 77	39.58	33.72	33.03	28.74	39.92	33.21	34.35	45.40
PT 78	38.39	32.58	32.04	27.76	38.76	32.10	33.24	44.10
AU 79	37.30	31.47	31.09	26.85	37.64	31.03	32.16	42.89
HG 80	36.24	30.46	30.19	25.96	36.58	30.02	31.15	41.72
TL 81	35.19	29.45	29.30	25.11	35.52	29.04	30.16	40.59
PB 82	34.23	28.47	28.50	24.29	34.56	28.09	29.21	39.52
BI 83	33.30	27.59	27.67	23.53	33.63	27.20	28.33	38.52
PO 84	32.40	26.67	26.91	22.70	32.76	26.29	27.47	37.48
AT 85								
RN 86								
FR 87	29.90	24.29	24.82	20.66				
RA 88	29.16	23.53	24.17	20.02	29.51	23.20	24.32	33.99
AC 89								
TH 90	27.70	22.12	22.94	18.82	28.06	21.80	22.91	32.43
PA 91	27.03	21.42	22.35	18.27	27.38	21.13	22.24	31.71
U 92	26.38	20.78	21.80	17.72	26.73	20.48	21.59	31.00
NP 93	25.76	20.13	21.21	17.20	26.08			
PU 94	25.11	19.55	20.75	16.67	25.46	19.29	20.40	
AM 95	24.55	18.97	20.22	16.18	24.88			

No

LIF(200) CRYSTAL

2D= 4.0276

LINE	KA1,2	KA1	KA2	KB1	KB3	KB2
INTENSITY	150	100	50	15	15	5
A 18						
K 19						
CA 20	136.74	136.59	136.82	149.52		
SC 21	113.07	113.02	113.18	118.09		
TI 22	97.67	97.62	97.75	100.16		
V 23	86.12	86.08	86.24	87.30		
CR 24	76.92	76.85	76.99	77.25		
MN 25	69.34	69.30	69.44	69.13		
FE 26	62.95	62.92	63.02	62.35		
CO 27	57.49	57.46	57.59	56.62		
NI 28	52.81	52.74	52.87	51.73		
CU 29	48.65	48.62	48.71	47.47		
ZN 30	45.02	44.96	45.08	43.73	43.76	43.39
GA 31	41.81	41.75	41.87	40.44	40.47	40.11
GE 32	38.90	38.87	38.99	37.54	37.54	37.18
AS 33	36.34	36.31	36.40	34.88	34.91	34.55
SE 34	33.98	33.92	34.04	32.56	32.56	32.20
BR 35	31.88	31.85	31.97	30.43	30.46	30.08
KR 36	29.96	29.93	30.05	28.52	28.55	28.17
RB 37	28.19	28.17	28.28	26.79	26.79	26.44
SR 38	26.61	26.58	26.70	25.21	25.21	24.83
Y 39	25.15	25.10	25.24	23.76	23.79	23.41
ZR 40	23.81	23.76	23.87	22.42	22.45	22.07
NB 41	22.57	22.51	22.65	21.17	21.20	20.83
MO 42	21.41	21.38	21.49	20.05	20.08	19.73
TC 43	20.31	20.28	20.39	19.01	19.04	18.69
RU 44	19.32	19.30	19.41	18.06	18.08	17.74
	18.40	18.37	18.49	17.16	17.19	16.85
				16.33	16.36	16.04

RH 45	17.54	17.51	17.62	15.58	15.58	15.27
PD 46	16.76	16.70	16.85	14.86	14.86	14.55
AG 47	16.01	15.96	16.10	14.18	14.21	13.89
CD 48	15.30	15.27	15.38	13.55	13.57	13.26
IN 49	14.66	14.61	14.75	12.97	12.97	12.69
SN 50	14.03	14.00	14.12	12.40	12.43	12.14
SB 51	13.46	13.40	13.55	11.89	11.91	11.63
TE 52	12.92	12.86	13.00	11.40	11.43	11.14
I 53	12.40	12.34	12.49	10.94	10.97	10.71
XE 54	11.91	11.86	12.00	10.51	10.51	10.26
CS 55	11.46	11.43	11.54	10.11	10.11	9.86
BA 56	11.03	10.97	11.11	9.71	9.74	9.49
LA 57	10.63	10.57	10.71	9.34	9.37	9.11
CE 58	10.23	10.17	10.31	9.00	9.03	8.80
PR 59	9.86	9.80	9.94	8.69	8.69	8.46
ND 60	9.51	9.46	9.60	8.37	8.37	8.17
PM 61	9.17	9.14	9.26	8.06	8.09	7.89
SM 62	8.86	8.80	8.94	7.80	7.80	7.60
EU 63	8.57	8.51	8.66	7.52	7.55	7.35

LIF(200) CRYSTAL

2D= 4.0276

LINE	LA1	LB1	LB2	LY1	LA2	LB3	LB4	LL
INTENSITY	100	50	20	10	10	6	4	3
RH 45								
PD 46				156.61				
AG 47			152.12	135.30				
CD 48	158.36	155.38	133.68	122.02				
IN 49	137.36	136.36	121.50	111.85	159.77	144.33	147.84	
SN 50	126.72	123.93	112.00	103.46	139.69	129.58	132.11	
SB 51	117.27	114.38	104.06	96.34	127.29	118.98	121.09	
TE 52	109.54	106.45	97.28	90.16	117.76	110.34	112.25	
I 53	102.82	99.63	91.38	84.65	109.99	103.00	104.75	149.74
XE 54		93.64	86.16	79.74	103.23	96.68	98.27	134.63
CS 55	91.79	83.54	77.14	71.32		91.05	92.61	124.05
BA 56	87.14	79.19	73.29	67.65	92.20	81.46	82.89	
LA 57	82.86	75.22	69.75	64.22	87.49	77.32	78.75	108.42
CE 58	78.97	71.60	66.49	61.13	83.20	73.51	74.90	102.22
PR 59	75.40	68.23	63.49	58.27	79.30	70.03	71.36	96.55
ND 60	72.09	65.07	60.70	55.59	75.76	66.76	68.10	91.79
PM 61	69.06	62.22			72.52	63.72	65.07	87.46
SM 62	66.18	59.48	55.72	50.75				83.24
EU 63	63.52	56.94	53.47	48.59	66.56	58.31	59.55	76.09
GD 64	61.06	54.59	51.38	46.57	63.89	55.88	57.14	72.97
TB 65	58.76	52.36	49.37	44.65	61.42	53.57	54.78	70.06
DY 66	56.59	50.25	47.53	42.90	59.09	51.41	52.62	67.38
HO 67	54.53	48.28	45.79	41.20	56.94	49.34	50.56	64.80
ER 68	52.62	46.41	44.16	39.59	54.88	47.40	48.62	62.39
TU 69	50.75	44.65	42.60	38.14	52.96	45.61	46.84	60.17
YB 70	49.06	43.00	41.17	36.70	51.13	43.88	45.08	58.08
LU 71	47.40	41.41	39.77	35.32	49.37	42.26	43.46	56.10
					47.75	40.74	41.93	54.24

HF 72	45.85	39.89	38.47	34.04	46.19	39.26	40.44	52.52
TA 73	44.41	38.47	37.21	32.82	44.74	37.87	39.05	50.81
W 74	43.00	37.12	36.01	31.64	43.33	36.55	37.72	49.24
RE 75	41.68	35.80	34.85	30.55	42.02	35.26	36.46	47.75
OS 76	40.41	34.58	33.75	29.49	40.74	34.04	35.21	46.35
IR 77	39.23	33.42	32.74	28.49	39.56	32.91	34.04	44.99
PT 78	38.05	32.29	31.76	27.52	38.41	31.82	32.94	43.70
AU 79	36.97	31.20	30.81	26.61	37.30	30.75	31.88	42.51
HG 80	35.92	30.19	29.93	25.74	36.25	29.75	30.87	41.35
TL 81	34.88	29.19	29.05	24.89	35.21	28.78	29.90	40.23
PB 82	33.92	28.22	28.25	24.08	34.25	27.84	28.96	39.17
BI 83	33.00	27.34	27.43	23.32	33.33	26.96	28.08	38.17
PO 84	32.11	26.44	26.67	22.51	32.47	26.06	27.23	37.15
AT 85								
RN 86								
FR 87	29.63	24.08	24.60	20.48				
RA 88	28.90	23.32	23.96	19.84	29.25	23.00	24.11	33.69
AC 89								
TH 90	27.46	21.93	22.74	18.66	27.81	21.61	22.71	32.14
PA 91	26.79	21.23	22.16	18.11	27.14	20.94	22.04	31.43
U 92	26.15	20.60	21.61	17.57	26.50	20.31	21.41	30.72
NP 93	25.53	19.96	21.03	17.05	25.85			
PU 94	24.89	19.38	20.57	16.53	25.24	19.12	20.22	
AM 95	24.34	18.81	20.05	16.04	24.66			

NACL CRYSTAL

2D= 5.6394

LINE	KA1,2	KA1	KA2	KB1	KB3	KB2
INTENSITY	150	100	50	15	15	5
S 16	144.64	144.57				
CL 17	113.98	113.94	144.77	126.33		
A 18	96.03	96.00	114.05	102.66		
K 19	83.20	83.14	96.09	87.11		
CA 20	73.14	73.12	83.22	75.54		
SG 21	65.05	65.02	73.19	66.43		
TI 22	58.37	58.35	65.10	59.07		
V 23	52.74	52.70	58.44	52.95		
CR 24	47.94	47.92	52.79	47.81		
MN 25	43.79	43.77	48.01	43.40		
FE 26	40.18	40.16	43.83	39.59		
CO 27	37.03	36.99	40.24	36.31		
NI 28	34.22	34.20	37.08	33.41		
CU 29	31.74	31.70	34.26	30.85		
ZN 30	29.53	29.48	31.78	28.58	30.87	30.62
GA 31	27.51	27.49	29.57	26.57	28.60	28.35
GE 32	25.74	25.72	27.58	24.72	26.57	26.32
AS 33	24.09	24.05	25.78	23.10	24.74	24.49
SE 34	22.62	22.60	24.14	21.61	23.10	22.85
BR 35	21.27	21.25	22.68	20.26	21.63	21.36
KR 36	20.04	20.02	21.34	19.05	20.28	20.02
RB 37	18.92	18.90	20.10	17.93	19.05	18.80
SR 38	17.89	17.85	18.98	16.91	17.93	17.67
Y 39	16.95	16.91	17.95	15.96	16.93	16.66
ZR 40	16.06	16.02	16.99	15.08	15.98	15.72
NB 41	15.24	15.22	16.13	14.28	15.10	14.83
MO 42	14.47	14.44	15.31	13.54	14.30	14.06
			14.53	12.87	13.56	13.32
					12.89	12.64

NO

TC 43	13.77	13.75	13.83	12.24	12.26	12.01
RU 44	13.11	13.09	13.18	11.64	11.66	11.44
RH 45	12.50	12.48	12.56	11.11	11.11	10.89
PD 46	11.95	11.91	12.01	10.60	10.60	10.38
AG 47	11.42	11.38	11.48	10.11	10.13	9.91
CD 48	10.91	10.89	10.97	9.66	9.68	9.46
IN 49	10.46	10.42	10.52	9.26	9.26	9.05
SN 50	10.01	9.99	10.07	8.85	8.87	8.66
SB 51	9.60	9.56	9.66	8.48	8.50	8.30
TE 52	9.21	9.17	9.28	8.13	8.16	7.95
I 53	8.85	8.81	8.91	7.81	7.83	7.65
XE 54	8.50	8.46	8.56	7.50	7.50	7.32
CS 55	8.18	8.16	8.24	7.22	7.22	7.04
BA 56	7.87	7.83	7.93	6.93	6.95	6.77
LA 57	7.58	7.54	7.65	6.67	6.69	6.51
CE 58	7.30	7.26	7.36	6.42	6.44	6.28
PR 59	7.04	6.99	7.10	6.20	6.20	6.04
ND 60	6.79	6.75	6.85	5.98	5.98	5.83
PM 61	6.55	6.53	6.61	5.75	5.77	5.63
SM 62	6.32	6.28	6.38	5.57	5.57	5.43
EU 63	6.12	6.08	6.18	5.37	5.39	5.24

NACL CRYSTAL

2D= 5.6394

LINE	LA1	LB1	LB2	LY1	LA2	LB3	LB4	LL
INTENSITY	100	50	20	10	10	6	4	3
ZR 40								
NB 41								
MO 42								
TC 43	146.92	153.74	164.22	145.38				
RU 44		133.22	136.50	126.51				
RH 45			121.61	113.87				
PD 46	118.48	110.02	101.66	95.73	147.49	174.13	142.87	
AG 47	109.21	101.72	94.17	88.75	118.80	140.64	127.05	
CD 48	101.53	94.65	87.76	82.68	109.49	125.48		
IN 49	94.89	88.50	82.09	77.32	101.79	105.43	106.65	154.75
SN 50	89.09	83.06	77.09	72.53	95.13	97.90	99.02	135.37
SB 51	83.41	78.16	72.61	68.21	89.35	91.34	92.42	122.83
TE 52	79.34	73.77	68.53	64.30	84.21	85.67	86.67	113.16
I 53	75.15	69.79	64.83	60.76	79.58	80.51	81.50	105.20
XE 54	71.38	66.13	61.47	57.49	75.38	75.95	76.91	98.40
CS 55	67.86	62.77	58.39	54.50	71.60	71.78	72.74	92.42
BA 56	61.70	56.82	52.88	49.21	68.09	67.96	68.90	87.17
LA 57	58.98	54.15	50.46	46.85		64.49	65.38	82.44
CE 58	56.40	51.68	48.21	44.62	61.94	61.28	62.18	78.21
PR 59	54.02	49.39	46.10	42.59	59.19	55.55	56.43	70.81
ND 60	51.79	47.23	44.14	40.70	56.61	52.99	53.88	67.55
PM 61	49.70	45.17	42.31	38.90	54.22	50.60	51.48	64.42
SM 62	47.76	43.31	38.99	35.64	52.02	48.38	49.23	61.70
EU 63	45.90	41.50	37.48	34.17	49.97	46.28	47.14	59.16
GD 64	44.16	39.81	36.07	32.79	46.14	44.29	45.17	56.63
TB 65	42.55	38.24	34.71	31.48	44.40			
DY 66	41.02	36.73	33.45	30.28	42.79	40.72	41.54	52.22
	39.57	35.30			41.24	39.10	39.94	50.26
					39.81	37.55	38.37	48.41
						36.09	36.91	46.67
						34.68	35.52	45.00

HO 67	38.19	33.96	32.27	29.11	38.43	33.37	34.20	43.42
ER 68	36.91	32.69	31.15	27.99	37.14	32.14	32.99	41.96
TU 69	35.64	31.48	30.07	26.99	35.90	30.96	31.78	40.57
YB 70	34.49	30.35	29.08	25.99	34.71	29.84	30.66	39.25
LU 71	33.37	29.25	28.12	25.03	33.60	28.79	29.61	38.00
HF 72	32.31	28.20	27.22	24.14	32.54	27.76	28.58	36.84
TA 73	31.32	27.22	26.34	23.28	31.55	26.80	27.62	35.69
W 74	30.35	26.28	25.51	22.45	30.58	25.88	26.70	34.62
RE 75	29.44	25.36	24.70	21.69	29.67	24.99	25.82	33.60
OS 76	28.56	24.51	23.93	20.94	28.79	24.14	24.95	32.65
IR 77	27.74	23.70	23.22	20.24	27.97	23.35	24.14	31.72
PT 78	26.93	22.91	22.54	19.56	27.18	22.58	23.37	30.83
AU 79	26.18	22.14	21.87	18.92	26.40	21.83	22.62	30.01
HG 80	25.45	21.44	21.25	18.30	25.68	21.13	21.92	29.21
TL 81	24.72	20.74	20.63	17.71	24.95	20.45	21.23	28.43
PB 82	24.05	20.06	20.08	17.13	24.28	19.79	20.57	27.70
BI 83	23.41	19.44	19.50	16.60	23.64	19.17	19.95	27.01
PO 84	22.79	18.80	18.96	16.02	23.03	18.53	19.36	26.30
AT 85								
RN 86								
FR 87	21.05	17.13	17.50	14.59				
RA 88	20.53	16.60	17.05	14.14	20.78	16.37	17.15	23.89
AC 89								
TH 90	19.52	15.61	16.19	13.30	19.77	15.39	16.17	22.81
PA 91	19.05	15.12	15.78	12.91	19.29	14.92	15.70	22.31
U 92	18.59	14.67	15.39	12.52	18.84	14.47	15.24	21.81
NP 93	18.16	14.22	14.98	12.15	18.39			
PU 94	17.71	13.81	14.65	11.79	17.95	13.63	14.40	
AM 95	17.32	13.40	14.28	11.44	17.54			

SiO2 CRYSTAL

2D= 6.6863

LINE	KA1,2	KA1	KA2	KB1	KB3	KB2
INTENSITY	150	100	50	15	15	5
P 15	134.01	133.97	134.10	120.46		
S 16	106.95	106.92	107.00	97.63		
CL 17	90.03	90.00	90.07	82.37		
A 18	77.65	77.63	77.70	71.07		
K 19	68.10	68.06	68.13	62.21		
CA 20	60.33	60.31	60.37	55.03		
SC 21	53.93	53.91	53.97	49.14		
TI 22	48.57	48.55	48.63	44.17		
V 23	44.00	43.97	44.04	39.97		
CR 24	40.08	40.06	40.13	36.34		
MN 25	36.66	36.65	36.70	33.20		
FE 26	33.68	33.66	33.73	30.47		
CO 27	31.07	31.04	31.11	28.06		
NI 28	28.73	28.71	28.77	25.93	25.95	25.73
CU 29	26.67	26.63	26.70	24.03	24.05	23.84
ZN 30	24.82	24.79	24.86	22.35	22.35	22.14
GA 31	23.14	23.12	23.19	20.80	20.82	20.61
GE 32	21.65	21.64	21.69	19.44	19.44	19.23
AS 33	20.28	20.24	20.31	18.19	18.21	17.98
SE 34	19.04	19.03	19.09	17.06	17.08	16.86
BR 35	17.91	17.90	17.97	16.04	16.04	15.83
KR 36	16.87	16.86	16.93	15.11	15.11	14.88
RB 37	15.94	15.92	15.99	14.24	14.26	14.04
SR 38	15.07	15.04	15.13	13.45	13.47	13.24
Y 39	14.28	14.24	14.31	12.71	12.73	12.50
ZR 40	13.54	13.50	13.59	12.04	12.05	11.85
NB 41	12.85	12.83	12.90	11.42	11.43	11.23

MO 42	12.19	12.17	12.24	10.85	10.86	10.66
TC 43	11.61	11.59	11.66	10.31	10.33	10.12
RU 44	11.05	11.04	11.11	9.82	9.83	9.64
RH 45	10.54	10.52	10.59	9.37	9.37	9.18
PD 46	10.07	10.04	10.12	8.94	8.94	8.75
AG 47	9.63	9.59	9.68	8.53	8.54	8.35
GD 48	9.20	9.18	9.25	8.15	8.16	7.98
IN 49	8.82	8.78	8.87	7.80	7.80	7.63
SN 50	8.44	8.42	8.49	7.46	7.48	7.31
SB 51	8.10	8.06	8.15	7.15	7.17	7.00
TE 52	7.77	7.74	7.82	6.86	6.88	6.70
I 53	7.46	7.43	7.51	6.58	6.60	6.45
XE 54	7.17	7.13	7.22	6.33	6.33	6.17
CS 55	6.89	6.88	6.95	6.09	6.09	5.93
BA 56	6.64	6.60	6.69	5.85	5.86	5.71
LA 57	6.40	6.36	6.45	5.62	5.64	5.49
CE 58	6.16	6.12	6.21	5.42	5.43	5.30
PR 59	5.93	5.90	5.98	5.23	5.23	5.09
ND 60	5.73	5.69	5.78	5.04	5.04	4.92
PM 61	5.52	5.50	5.57	4.85	4.87	4.75
SM 62	5.33	5.30	5.38	4.70	4.70	4.58
EU 63	5.16	5.13	5.21	4.53	4.54	4.42

SI02 CRYSTAL

2D= 6.6863

LINE	LA1	LB1	LB2	LY1	LA2	LB3	LB4	LL
INTENSITY	100	50	20	10	10	6	4	3
SR 38		164.22				144.44	146.52	
Y 39	149.38	136.53			149.84	126.97	128.33	
ZR 40	130.41	121.58	113.32	107.26	130.70	114.77	115.93	
NB 41	117.79	110.45	103.14	97.73	118.02	105.15	106.17	154.16
MO 42	107.90	101.45	94.83	89.95	108.14	97.14	98.05	133.79
TC 43								
RU 44	92.90	87.41	81.67	77.43	93.10	84.30	85.13	110.78
RH 45	86.87	81.71	76.29	72.29	87.06	79.00	79.80	102.57
PD 46	81.58	76.64	71.55	67.71	81.76	74.22	75.01	95.57
AG 47	76.82	72.10	67.26	63.59	76.99	69.98	70.73	89.49
CD 48	72.55	68.00	63.41	59.86	72.74	66.05	66.81	84.14
IN 49	68.27	64.24	59.92	56.45	68.87	62.53	63.27	79.36
SN 50	65.15	60.83	56.70	53.34	65.33	59.27	60.02	75.01
SB 51	61.91	57.69	53.76	50.50	62.09	56.25	56.99	71.11
TE 52	58.95	54.80	51.07	47.86	59.13	53.49	54.20	67.53
I 53	56.17	52.11	48.59	45.43	56.35	50.91	51.64	64.28
XE 54								
CS 55	51.26	47.31	44.12	41.12	51.45	46.29	47.00	58.50
BA 56	49.06	45.15	42.14	39.18	49.23	44.21	44.93	55.92
LA 57	46.98	43.14	40.29	37.35	47.15	42.25	42.97	53.43
CE 58	45.04	41.26	38.57	35.67	45.21	40.44	41.14	51.26
PR 59	43.23	39.49	36.95	34.11	43.41	38.71	39.42	49.21
ND 60	41.52	37.80	35.44	32.62	41.74	37.08	37.80	47.17
PM 61	39.93	36.27						
SM 62	38.40	34.77	32.70	29.92	38.60	34.13	34.81	43.58
EU 63	36.97	33.38	31.45	28.70	37.17	32.79	33.48	41.98
GD 64	35.64	32.07	30.27	27.55	35.83	31.50	32.18	40.46
TB 65								
DY 66	34.38	30.83	29.14	26.46				
HO 67	33.18	29.64	28.10	25.45	34.56	30.29	30.97	39.04
ER 68	32.04	28.52	27.11	24.47	33.38	29.12	29.81	37.66
TU 69	30.97	27.46	26.17	23.54	32.23	28.03	28.71	36.36
YB 70	29.92	26.46	25.28	22.70	31.16	27.00	27.71	35.15
LU 71	28.96	25.51	24.45	21.86	30.13	26.02	26.70	34.00
HF 72	28.03	24.59	23.65	21.06	29.14	25.08	25.77	32.91
TA 73	27.14	23.72	22.89	20.31	28.22	24.21	24.89	31.88
W 74	26.32	22.89	22.16	19.60	27.34	23.35	24.03	30.91
RE 75	25.51	22.11	21.46	18.90	26.51	22.54	23.23	29.95
OS 76	24.75	21.34	20.78	18.26	25.70	21.78	22.46	29.07
IR 77	24.01	20.63	20.14	17.64	24.94	21.03	21.72	28.22
PT 78	23.33	19.95	19.55	17.05	24.21	20.31	20.99	27.43
AU 79	22.65	19.29	18.97	16.48	23.52	19.65	20.31	26.65
HG 80	22.02	18.64	18.42	15.94	22.86	19.01	19.67	25.91
TL 81	21.41	18.05	17.90	15.42	22.21	18.38	19.04	25.23
PB 82	20.80	17.46	17.38	14.92	21.60	17.79	18.45	24.56
BI 83	20.24	16.89	16.91	14.43	20.99	17.22	17.88	23.91
PO 84	19.70	16.37	16.42	13.99	20.43	16.67	17.32	23.30
AT 85	19.18	15.83	15.97	13.50	19.89	16.15	16.80	22.72
RN 86					19.39	15.61	16.30	22.13
FR 87								
RA 88	17.72	14.43	14.75	12.29				
AC 89	17.29	13.99	14.37	11.92				
TH 90					17.50	13.80	14.45	20.10
PA 91	16.44	13.16	13.64	11.21				
U 92	16.04	12.74	13.29	10.88	16.65	12.97	13.62	19.20
NP 93	15.66	12.36	12.97	10.55	16.25	12.57	13.23	18.78
PU 94	15.30	11.98	12.62	10.25	15.87	12.19	12.85	18.37
AM 95	14.92	11.64	12.35	9.94	15.49			
	14.59	11.30	12.04	9.64	15.13	11.48	12.14	
					14.78			

PE CRYSTAL

2D = 8.7600

LINE	KA1,2	KA1	KA2	KB1	KB3	KB2
INTENSITY	150	100	50	15	15	5
AL 13	144.33	144.29	144.41	130.65	133.85	
SI 14	108.87	108.85	108.90	101.38		
P 15	89.28	89.26	89.31	82.99		
S 16	75.67	75.65	75.70	70.12		
CL 17	65.35	65.33	65.38	60.35		
A 18	57.18	57.17	57.21	52.67		
K 19	50.60	50.58	50.62	46.44		
CA 20	45.11	45.09	45.14	41.30		
SC 21	40.50	40.49	40.53	37.01		
TI 22	36.59	36.58	36.63	33.36		
V 23	33.23	33.21	33.26	30.24		
CR 24	30.32	30.31	30.36	27.54		
MN 25	27.78	27.77	27.81	25.19		
FE 26	25.55	25.54	25.59	23.14		
CO 27	23.59	23.57	23.62	21.33		
NI 28	21.83	21.82	21.86	19.72	19.73	19.57
CU 29	20.28	20.25	20.30	18.29	18.30	18.14
ZN 30	18.88	18.86	18.91	17.02	17.02	16.86
GA 31	17.61	17.60	17.65	15.84	15.85	15.69
GE 32	16.49	16.47	16.51	14.81	14.81	14.65
AS 33	15.44	15.42	15.47	13.86	13.87	13.70
SE 34	14.51	14.49	14.55	13.00	13.02	12.85
BR 35	13.65	13.64	13.69	12.23	12.23	12.07
KR 36	12.86	12.85	12.90	11.52	11.52	11.35
RB 37	12.15	12.14	12.19	10.86	10.87	10.70
SR 38	11.49	11.47	11.53	10.26	10.27	10.10
Y 39	10.89	10.86	10.91	9.69	9.70	9.53

ZR 40						
NB 41	10.32	10.30	10.36			
MO 42	9.80	9.78	9.84	9.18	9.19	9.04
TC 43	9.30	9.28	9.34	8.71	8.72	8.56
RU 44	8.85	8.84	8.89	8.27	8.29	8.13
RH 45	8.43	8.42	8.47	7.87	7.88	7.72
PD 46	8.04	8.03	8.08	7.49	7.50	7.36
AG 47	7.68	7.66	7.72	7.15	7.15	7.00
CD 48	7.34	7.32	7.38	6.82	6.82	6.68
IN 49	7.02	7.00	7.06	6.50	6.52	6.37
SN 50	6.73	6.70	6.77	6.22	6.23	6.09
SB 51	6.44	6.43	6.48	5.95	5.95	5.82
TE 52	6.18	6.15	6.22	5.69	5.71	5.57
I 53	5.93	5.90	5.97	5.46	5.47	5.34
XE 54	5.69	5.67	5.73	5.23	5.25	5.12
CS 55	5.47	5.44	5.51	5.02	5.04	4.92
BA 56	5.26	5.25	5.30	4.83	4.83	4.71
LA 57	5.06	5.04	5.10	4.65	4.65	4.53
CE 58	4.88	4.85	4.92	4.46	4.47	4.36
PR 59	4.70	4.67	4.74	4.29	4.30	4.19
ND 60	4.53	4.50	4.57	4.13	4.15	4.04
PM 61	4.37	4.34	4.41	3.99	3.99	3.89
SM 62	4.21	4.20	4.25	3.85	3.85	3.75
EU 63	4.07	4.04	4.11	3.70	3.72	3.62
	3.94	3.91	3.98	3.58	3.58	3.49
				3.45	3.47	3.38

PE CRYSTAL

2D = 8.7600

LINE	LA1	LB1	LB2	LY1	LA2	LB3	LB4	LL
INTENSITY	100	50	20	10	10	6	4	3
SE 34		171.34						
BR 35	145.90	136.14						
KR 36								
RB 37	113.31	107.73			113.48	101.59	102.27	145.37
SR 38	103.15	98.23			103.30	93.24	93.93	126.89
Y 39	94.82	90.31			94.95	86.16	86.78	114.22
ZR 40	87.72	83.55	79.24	75.85	87.85	80.02	80.64	104.32
NB 41	81.62	77.65	73.45	70.18	81.74	74.63	75.22	96.14
MO 42	76.21	72.44	68.39	65.30	76.35	69.82	70.38	89.18
TC 43								
RU 44	67.17	63.66	59.88	57.03	67.30	61.62	62.17	77.83
RH 45	63.31	59.91	56.26	53.52	63.43	58.09	58.63	73.10
PD 46	59.82	56.50	53.00	50.33	59.94	54.84	55.38	68.85
AG 47	56.61	53.38	50.01	47.43	56.73	51.91	52.44	65.00
CD 48	53.69	50.53	47.30	44.77	53.82	49.16	49.70	61.52
IN 49	50.72	47.89	44.81	42.32	51.14	46.67	47.20	58.33
SN 50	48.53	45.46	42.50	40.07	48.66	44.35	44.88	55.38
SB 51	46.23	43.22	40.37	38.00	46.36	42.18	42.71	52.70
TE 52	44.12	41.13	38.42	36.07	44.25	40.18	40.70	50.20
I 53	42.12	39.18	36.61	34.28	42.25	38.30	38.83	47.91
XE 54								
CS 55	38.55	35.67	33.31	31.09	38.69	34.92	35.44	43.79
BA 56	36.95	34.08	31.86	29.66	37.07	33.38	33.92	41.94
LA 57	35.42	32.59	30.48	28.29	35.55	31.94	32.47	40.14
CE 58	34.00	31.20	29.20	27.04	34.12	30.59	31.11	38.55
PR 59	32.66	29.89	28.00	25.87	32.80	29.31	29.83	37.06
ND 60	31.39	28.63	26.87	24.76	31.56	28.09	28.63	35.56

PM 61	30.21	27.48						
SM 62	29.08	26.37						
EU 63	28.01	25.32	24.81	22.73				
GD 64	27.01	24.34	23.88	21.81	29.23	25.88	26.40	32.92
TB 65	26.07	23.41	22.99	20.94	28.16	24.88	25.40	31.73
DY 66	25.17	22.51	22.14	20.12	27.16	23.92	24.42	30.61
HO 67	24.32	21.67	21.35	19.36	26.21	23.01	23.51	29.55
ER 68	23.51	20.88	20.61	18.62	25.32	22.13	22.65	28.52
TU 69	22.73	20.12	19.90	17.92	24.46	21.30	21.82	27.55
YB 70	22.01	19.40	19.23	17.28	23.66	20.53	21.06	26.65
LU 71	21.30	18.71	18.60	16.65	22.89	19.79	20.30	25.79
HF 72	20.64	18.05	18.00	16.04	22.14	19.08	19.60	24.97
TA 73	20.01	17.43	17.43	15.47	21.45	18.42	18.94	24.20
W 74	19.40	16.83	16.87	14.93	20.78	17.77	18.29	23.47
RE 75	18.83	16.25	16.34	14.40	20.16	17.16	17.68	22.75
OS 76	18.27	15.71	15.83	13.91	19.55	16.58	17.10	22.09
IR 77	17.76	15.19	15.34	13.44	18.98	16.01	16.54	21.45
PT 78	17.24	14.69	14.89	12.99	18.42	15.47	15.98	20.85
AU 79	16.76	14.20	14.45	12.56	17.90	14.97	15.47	20.26
HG 80	16.30	13.76	14.03	12.15	17.40	14.48	14.98	19.71
TL 81	15.84	13.31	13.64	11.75	16.91	14.01	14.51	19.19
PB 82	15.42	12.87	13.24	11.37	16.45	13.56	14.06	18.68
BI 83	15.01	12.48	12.89	11.01	15.98	13.12	13.62	18.19
PO 84	14.61	12.07	12.52	10.66	15.56	12.70	13.20	17.73
AT 85			12.18	10.30	15.15	12.31	12.81	17.29
RN 86					14.77	11.90	12.43	16.84
FR 87	13.50	11.01	11.24	9.38				
RA 88	13.18	10.66	10.95	9.09				
AC 89					13.33	10.52	11.02	15.31
TH 90	12.53	10.03	10.40	8.55				
PA 91	12.23	9.72	10.14	8.30	12.69	9.89	10.39	14.63
U 92	11.94	9.43	9.89	8.05	12.39	9.59	10.09	14.31
NP 93	11.66	9.14	9.63	7.82	12.10	9.30	9.80	13.99
PU 94	11.37	8.88	9.42	7.58	11.81			
AM 95	11.12	8.62	9.18	7.36	11.53	8.76	9.26	

PE CRYSTAL

EDDT CRYSTAL

2D= 8.8080

LINE	KA1,2	KA1	KA2	KB1	KB3	KB2
INTENSITY	150	100	50	15	15	5
AL 13	142.44	142.40	142.52	129.30	132.40	
SI 14	108.00	107.98	108.03	100.62		
P 15	98.66	88.64	88.70	82.44		
S 16	75.18	75.16	75.21	69.68		
CL 17	64.95	64.93	64.98	59.98		
A 18	56.84	56.83	56.87	52.36		
K 19	50.31	50.28	50.32	46.18		
CA 20	44.85	44.84	44.88	41.06		
SC 21	40.27	40.26	40.30	36.80		
TI 22	36.39	36.37	36.43	33.17		
V 23	33.05	33.02	33.07	30.07		
CR 24	30.15	30.14	30.19	27.39		
MN 25	27.63	27.61	27.65	25.05		
FE 26	25.41	25.39	25.45	23.01		
CO 27	23.46	23.44	23.49	21.21		
NI 28	21.71	21.70	21.74	19.61	19.62	19.47
CU 29	20.17	20.14	20.19	18.19	18.20	18.04
ZN 30	18.78	18.75	18.81	16.92	16.92	16.76
GA 31	17.51	17.50	17.55	15.75	15.77	15.61
GE 32	16.40	16.38	16.42	14.73	14.73	14.57
AS 33	15.36	15.33	15.38	13.78	13.80	13.63
SE 34	14.43	14.41	14.47	12.93	12.95	12.78
BR 35	13.58	13.56	13.61	12.16	12.16	12.00
KR 36	12.79	12.78	12.83	11.45	11.45	11.28
RB 37	12.08	12.07	12.12	10.80	10.81	10.64
SR 38	11.43	11.40	11.47	10.20	10.21	10.04
Y 39	10.83	10.80	10.85	9.64	9.65	9.48

ZR 40	10.27	10.24	10.30			
NB 41	9.74	9.73	9.78	9.13	9.14	8.99
MO 42	9.25	9.23	9.29	8.66	8.67	8.52
TC 43	8.80	8.79	8.84	8.23	8.24	8.09
RU 44	8.39	8.37	8.43	7.83	7.84	7.68
RH 45	7.99	7.98	8.03	7.45	7.46	7.32
PD 46	7.64	7.62	7.68	7.11	7.11	6.96
AG 47	7.30	7.28	7.34	6.78	6.78	6.64
CD 48	6.98	6.96	7.02	6.47	6.48	6.34
IN 49	6.69	6.66	6.73	6.18	6.20	6.05
SN 50	6.40	6.39	6.44	5.92	5.92	5.79
SB 51	6.14	6.12	6.18	5.66	5.67	5.54
TE 52	5.90	5.87	5.94	5.43	5.44	5.31
I 53	5.66	5.64	5.70	5.21	5.22	5.09
XE 54	5.44	5.41	5.48	5.00	5.01	4.89
CS 55	5.23	5.22	5.27	4.80	4.80	4.68
BA 56	5.04	5.01	5.08	4.62	4.62	4.50
LA 57	4.85	4.83	4.89	4.44	4.45	4.33
CE 58	4.67	4.65	4.71	4.27	4.28	4.16
PR 59	4.50	4.48	4.54	4.11	4.13	4.02
ND 60	4.35	4.32	4.39	3.97	3.97	3.86
PM 61	4.19	4.18	4.23	3.83	3.83	3.73
SM 62	4.05	4.02	4.09	3.68	3.70	3.60
EU 63	3.92	3.89	3.96	3.57	3.57	3.47
				3.44	3.45	3.36

EDDT CRYSTAL

EDDT CRYSTAL

2D= 8.8080

LINE	LA1	LB1	LB2	LY1	LA2	LB3	LB4	LL
INTENSITY	100	50	20	10	10	6	4	3
SE 34		165.24						
BR 35	143.92	134.61						
KR 36								
RB 37	112.37	106.88			112.53	100.83	101.50	143.42
SR 38	102.37	97.52			102.52	92.58	93.26	125.66
Y 39	94.14	89.68			94.27	85.57	86.20	113.26
ZR 40	87.13	82.99	78.72	75.36	87.25	79.50	80.11	103.52
NB 41	81.08	77.15	72.98	69.75	81.20	74.15	74.74	95.45
MO 42	75.72	71.98	67.96	64.90	75.86	69.38	69.94	88.57
TC 43								
RU 44	66.76	63.27	59.52	56.69	66.88	61.25	61.80	77.33
RH 45	62.92	59.55	55.92	53.20	63.04	57.74	58.28	72.64
PD 46	59.46	56.16	52.69	50.04	59.58	54.52	55.06	68.42
AG 47	56.28	53.07	49.72	47.15	56.40	51.61	52.13	64.61
CD 48	53.38	50.24	47.03	44.51	53.51	48.88	49.41	61.15
IN 49	50.42	47.61	44.55	42.08	50.84	46.40	46.93	57.98
SN 50	48.25	45.20	42.26	39.84	48.38	44.09	44.62	55.06
SB 51	45.96	42.97	40.15	37.79	46.09	41.94	42.47	52.39
TE 52	43.87	40.89	38.20	35.87	43.99	39.95	40.46	49.91
I 53	41.88	38.96	36.40	34.09	42.01	38.09	38.61	47.64
XE 54								
CS 55	38.34	35.47	33.13	30.92	38.47	34.72	35.24	43.54
BA 56	36.74	33.89	31.68	29.49	36.87	33.20	33.73	41.70
LA 57	35.22	32.41	30.31	28.14	35.35	31.76	32.29	39.91
CE 58	33.81	31.03	29.04	26.89	33.93	30.42	30.93	38.34
PR 59	32.48	29.72	27.84	25.73	32.61	29.14	29.67	36.85
ND 60	31.22	28.47	26.72	24.62	31.38	27.94	28.47	35.36
PM 61								
SM 62	30.04	27.33						
EU 63	28.91	26.22						
GD 64	27.85	25.18	24.67	22.60				
TB 65	26.86	24.21	23.74	21.69	29.06	25.74	26.25	32.73
DY 66	25.93	23.28	22.87	20.83	28.00	24.74	25.26	31.56
HO 67	25.03	22.39	22.02	20.01	27.01	23.78	24.29	30.44
ER 68	24.18	21.55	21.24	19.25	26.06	22.88	23.38	29.39
TU 69	23.38	20.76	20.50	18.52	25.18	22.00	22.52	28.36
YB 70	22.60	20.01	19.80	17.82	24.33	21.18	21.70	27.40
LU 71	21.89	19.29	19.12	17.19	23.53	20.42	20.95	26.50
HF 72	21.18	18.61	18.50	16.55	22.76	19.68	20.19	25.65
TA 73	20.52	17.95	17.90	15.95	22.02	18.98	19.49	24.83
W 74	19.90	17.33	17.33	15.38	21.33	18.32	18.83	24.06
RE 75	19.29	16.74	16.78	14.85	20.67	17.67	18.19	23.34
OS 76	18.73	16.16	16.25	14.32	20.05	17.07	17.58	22.63
IR 77	18.17	15.62	15.74	13.84	19.44	16.49	17.00	21.96
PT 78	17.66	15.11	15.25	13.37	18.87	15.92	16.45	21.33
AU 79	17.15	14.61	14.81	12.92	18.32	15.38	15.90	20.73
HG 80	16.67	14.13	14.37	12.49	17.80	14.89	15.38	20.15
TL 81	16.21	13.68	13.96	12.08	17.30	14.40	14.90	19.60
PB 82	15.75	13.23	13.56	11.69	16.82	13.93	14.43	19.08
BI 83	15.33	12.80	13.17	11.31	16.36	13.48	13.98	18.58
PO 84	14.93	12.41	12.82	10.94	15.90	13.05	13.55	18.09
AT 85	14.53	12.00	12.45	10.61	15.48	12.63	13.13	17.63
RN 86			12.11	10.24	15.07	12.24	12.74	17.20
FR 87					14.69	11.83	12.36	16.75
RA 88	13.43	10.94	11.18					
AC 89	13.10	10.61	10.89	9.33				
TH 90				9.04				
PA 91	12.46	9.98	10.34		13.26	10.46	10.96	15.23
U 92	12.16	9.66	10.08	8.50				
NP 93	11.87	9.38	9.83	8.26	12.62	9.83	10.33	14.55
PU 94	11.60	9.09	9.57	8.01	12.32	9.53	10.03	14.23
AM 95	11.31	8.83	9.36	7.77	12.03	9.25	9.74	13.92
	11.06	8.57	9.13	7.54	11.74			
				7.32	11.47	8.71	9.21	

EDDT CRYSTAL

ADP CRYSTAL

2D = 10.6480

LINE	KA1,2	KA1	KA2	KB1	KB3	KB2
INTENSITY	150	100	50	15	15	5
MG 12	136.47			127.72	130.43	
AL 13	103.10	103.08	103.13	96.76	98.38	
Si 14	84.02	84.00	84.03	79.07		
P 15	70.63	70.61	70.65	66.06		
S 16	60.61	60.60	60.63	56.40		
CL 17	52.73	52.72	52.76	48.85		
A 18	46.37	46.36	46.39	42.81		
K 19	41.17	41.15	41.18	37.86		
CA 20	36.79	36.78	36.81	33.73		
SC 21	33.09	33.08	33.11	30.27		
Ti 22	29.93	29.92	29.97	27.31		
V 23	27.21	27.19	27.24	24.78		
CR 24	24.85	24.84	24.88	22.58		
MN 25	22.78	22.77	22.80	20.67		
FE 26	20.96	20.95	21.00	19.00		
CO 27	19.37	19.34	19.39	17.51		
NI 28	17.93	17.92	17.95	16.20	16.21	16.08
CU 29	16.65	16.63	16.67	15.02	15.03	14.90
ZN 30	15.51	15.49	15.53	13.98	13.98	13.85
GA 31	14.47	14.46	14.50	13.02	13.03	12.90
GE 32	13.55	13.54	13.57	12.17	12.17	12.04
AS 33	12.69	12.67	12.71	11.39	11.40	11.26
SE 34	11.92	11.91	11.96	10.69	10.70	10.56
BR 35	11.22	11.21	11.25	10.05	10.05	9.92
KR 36	10.57	10.56	10.60	9.47	9.47	9.33
RB 37	9.99	9.98	10.02	8.93	8.94	8.80
SR 38	9.45	9.43	9.48	8.43	8.44	8.30

Y 39	8.95	8.93	8.97	7.97	7.98	7.84
ZR 40	8.49	8.47	8.52	7.55	7.56	7.43
NB 41	8.06	8.05	8.09	7.16	7.17	7.04
MO 42	7.65	7.64	7.68	6.81	6.82	6.69
TC 43	7.28	7.27	7.31	6.47	6.48	6.35
RU 44	6.93	6.92	6.97	6.16	6.17	6.05
RH 45	6.61	6.60	6.64	5.88	5.88	5.76
PD 46	6.32	6.30	6.35	5.61	5.61	5.49
AG 47	6.04	6.02	6.07	5.35	5.36	5.24
CD 48	5.77	5.76	5.80	5.11	5.12	5.01
IN 49	5.53	5.51	5.57	4.90	4.90	4.79
SN 50	5.30	5.29	5.33	4.68	4.69	4.59
SB 51	5.08	5.06	5.11	4.49	4.50	4.39
TE 52	4.88	4.86	4.91	4.31	4.32	4.21
I 53	4.68	4.66	4.71	4.13	4.14	4.05
XE 54	4.50	4.48	4.53	3.97	3.97	3.87
CS 55	4.33	4.32	4.36	3.82	3.82	3.72
BA 56	4.17	4.14	4.20	3.67	3.68	3.58
LA 57	4.01	3.99	4.05	3.53	3.54	3.44
CE 58	3.86	3.84	3.90	3.40	3.41	3.33
PR 59	3.72	3.70	3.76	3.28	3.28	3.20
ND 60	3.60	3.57	3.63	3.16	3.16	3.09
PM 61	3.47	3.46	3.50	3.05	3.06	2.98
SM 62	3.35	3.33	3.38	2.95	2.95	2.87
EU 63	3.24	3.22	3.27	2.84	2.85	2.78

ADP CRYSTAL

2D = 10.6480

LINE	LA1	LB1	LB2	LY1	LA2	LB3	LB4	LL
INTENSITY	100	50	20	10	10	6	4	3
GE 32	158.21	146.42						
AS 33	130.53	124.28						
SE 34	115.19	110.24				114.00		
BR 35	103.73	99.49						150.33
KR 36								128.31
RB 37	86.83	83.28						
SR 38	80.26	76.92			86.93	79.21	79.67	103.52
Y 39	74.55	71.37			80.36	73.45	73.93	94.77
ZR 40	69.51	66.47	63.28	60.75	74.65	68.37	68.83	87.39
NB 41	65.05	62.10	58.93	56.45	69.60	63.87	64.32	81.04
MO 42	61.02	58.17	55.08	52.70	65.14	59.83	60.27	75.47
TC 43					61.12	56.17	56.60	70.56
RU 44	54.14	51.43	48.48	46.25	54.24	49.85	50.27	62.24
RH 45	51.15	48.51	45.64	43.48	51.25	47.08	47.51	58.67
PD 46	48.44	45.83	43.08	40.95	48.53	44.52	44.96	55.43
AG 47	45.92	43.38	40.70	38.64	46.02	42.21	42.62	52.47
CD 48	43.62	41.11	38.54	36.52	43.72	40.02	40.45	49.76
IN 49	41.26	39.01	36.55	34.55	41.60	38.04	38.46	47.27
SN 50	39.52	37.07	34.70	32.74	39.62	36.18	36.61	44.96
SB 51	37.69	35.27	32.99	31.07	37.79	34.44	34.87	42.83
TE 52	36.00	33.59	31.41	29.51	36.10	32.83	33.24	40.85
I 53	34.39	32.02	29.95	28.07	34.49	31.32	31.74	39.03
XE 54								
CS 55	31.52	29.19	27.28	25.48	31.63	28.58	29.00	35.74
BA 56	30.22	27.90	26.10	24.31	30.32	27.34	27.77	34.25
LA 57	28.99	26.69	24.98	23.20	29.09	26.16	26.59	32.80
CE 58	27.83	25.57	23.94	22.18	27.93	25.07	25.49	31.52

PR 59	26.75	24.50	22.96	21.23	26.86	24.02	24.45	30.31
ND 60	25.72	23.47	22.04	20.32	25.85	23.03	23.47	29.10
PM 61	24.76	22.54						
SM 62	23.84	21.63	20.36	18.66	23.96	21.24	21.65	26.96
EU 63	22.97	20.78	19.60	17.91	23.09	20.42	20.84	26.00
GD 64	22.16	19.98	18.88	17.20	22.28	19.63	20.04	25.08
TB 65	21.39	19.21	18.18	16.52	21.50	18.89	19.30	24.22
DY 66	20.66	18.48	17.53	15.90	20.78	18.17	18.59	23.39
HO 67	19.96	17.80	16.93	15.29	20.08	17.49	17.92	22.60
ER 68	19.30	17.14	16.35	14.72	19.42	16.86	17.30	21.86
TU 69	18.66	16.52	15.79	14.20	18.79	16.25	16.67	21.16
YB 70	18.07	15.94	15.28	13.68	18.18	15.67	16.10	20.49
LU 71	17.49	15.37	14.78	13.18	17.61	15.13	15.56	19.86
HF 72	16.95	14.83	14.32	12.71	17.07	14.60	15.02	19.27
TA 73	16.44	14.32	13.86	12.27	16.56	14.10	14.52	18.68
W 74	15.94	13.83	13.43	11.84	16.06	13.62	14.05	18.13
RE 75	15.47	13.35	13.01	11.44	15.59	13.16	13.59	17.61
OS 76	15.01	12.91	12.61	11.05	15.13	12.71	13.14	17.12
IR 77	14.59	12.49	12.24	10.68	14.71	12.30	12.71	16.64
PT 78	14.17	12.08	11.88	10.32	14.30	11.90	12.31	16.19
AU 79	13.78	11.68	11.53	9.99	13.90	11.51	11.92	15.76
HG 80	13.40	11.31	11.21	9.66	13.52	11.15	11.56	15.35
TL 81	13.02	10.94	10.89	9.35	13.14	10.79	11.20	14.95
PB 82	12.67	10.58	10.59	9.05	12.79	10.44	10.85	14.57
BI 83	12.34	10.26	10.29	8.77	12.45	10.12	10.53	14.21
PO 84	12.01	9.92	10.01	8.47	12.14	9.78	10.22	13.84
AT 85								
RN 86								
FR 87	11.10	9.05	9.24	7.71				
RA 88	10.83	8.77	9.01	7.47	10.96	8.65	9.06	12.58
AC 89								
TH 90	10.30	8.25	8.55	7.03	10.43	8.13	8.54	12.02
PA 91	10.05	7.99	8.34	6.83	10.18	7.88	8.29	11.76
U 92	9.82	7.75	8.13	6.62	9.95	7.65	8.06	11.50
NP 93	9.59	7.52	7.92	6.43	9.71			
PU 94	9.35	7.30	7.74	6.23	9.48	7.20	7.61	
AM 95	9.15	7.09	7.55	6.05	9.27			

ADP CRYSTAL

KAP CRYSTAL

2D = 26.6328

LINE	KA1,2	KA1	KA2	KB1	KB3	KB2
INTENSITY	150	100	50	15	15	5
O 8	125.78					
F 9	86.85					
NE 10	66.56			65.77		
NA 11	53.12			51.52	52.24	
MG 12	43.59			42.07	42.57	
AL 13	36.49	36.49	36.50	34.78	35.23	
SI 14	31.04	31.03	31.04	29.49		
P 15	26.72	26.72	26.73	25.17		
S 16	23.28	23.27	23.29	21.78		
CL 17	20.46	20.45	20.46	19.03		
A 18	18.11	18.11	18.12	16.78		
K 19	16.16	16.15	16.17	14.90		
CA 20	14.50	14.49	14.50	13.32		
SC 21	13.07	13.07	13.08	11.98		
TI 22	11.85	11.85	11.87	10.83		
V 23	10.79	10.79	10.80	9.84		
CR 24	9.87	9.87	9.88	8.98		
MN 25	9.06	9.05	9.07	8.23		
FE 26	8.34	8.34	8.35	7.57		
CO 27	7.71	7.70	7.72	6.98		
NI 28	7.14	7.14	7.15	6.46	6.46	6.41
CU 29	6.64	6.63	6.65	5.99	6.00	5.94
ZN 30	6.19	6.18	6.19	5.58	5.58	5.53
GA 31	5.77	5.77	5.79	5.20	5.20	5.15
GE 32	5.41	5.40	5.41	4.86	4.86	4.81
AS 33	5.07	5.06	5.07	4.55	4.55	4.50
SE 34	4.76	4.76	4.77	4.27	4.27	4.22

BR 35	4.48	4.48	4.49	4.02	4.02	3.96
KR 36	4.22	4.22	4.23	3.78	3.78	3.73
RB 37	3.99	3.99	4.00	3.57	3.57	3.52
SR 38	3.77	3.77	3.79	3.37	3.37	3.32
Y 39	3.58	3.57	3.58	3.18	3.19	3.13
ZR 40	3.39	3.38	3.40	3.02	3.02	2.97
NB 41	3.22	3.21	3.23	2.86	2.87	2.81
MO 42	3.06	3.05	3.07	2.72	2.72	2.67
TC 43	2.91	2.90	2.92	2.59	2.59	2.54
RU 44	2.77	2.77	2.78	2.46	2.47	2.42
RH 45	2.64	2.64	2.65	2.35	2.35	2.30
PD 46	2.53	2.52	2.54	2.24	2.24	2.19
AG 47	2.41	2.41	2.43	2.14	2.14	2.10
CD 48	2.31	2.30	2.32	2.04	2.05	2.00
IN 49	2.21	2.20	2.22	1.96	1.96	1.91
SN 50	2.12	2.11	2.13	1.87	1.88	1.83
SB 51	2.03	2.02	2.04	1.79	1.80	1.76
TE 52	1.95	1.94	1.96	1.72	1.73	1.68
I 53	1.87	1.86	1.88	1.65	1.66	1.62
XE 54	1.80	1.79	1.81	1.59	1.59	1.55
CS 55	1.73	1.73	1.74	1.53	1.53	1.49
BA 56	1.67	1.66	1.68	1.47	1.47	1.43
LA 57	1.60	1.60	1.62	1.41	1.42	1.38
CE 58	1.54	1.54	1.56	1.36	1.36	1.33
PR 59	1.49	1.48	1.50	1.31	1.31	1.28
ND 60	1.44	1.43	1.45	1.27	1.27	1.23
PM 61	1.39	1.38	1.40	1.22	1.22	1.19
SM 62	1.34	1.33	1.35	1.18	1.18	1.15
EU 63	1.30	1.29	1.31	1.14	1.14	1.11

KAP CRYSTAL

KAP CRYSTAL

2D = 26.6328

LINE	LA1	LB1	LB2	LY1	LA2	LB3	LB4	LL
INTENSITY	100	50	20	10	10	6	4	3
V 23	131.78	127.61						
CR 24	109.23	106.38						
MN 25	94.07	92.00				93.69		137.71
FE 26	82.74	80.96				82.58		113.83
CO 27	73.85	72.23				72.47		98.66
NI 28	66.46	64.99				64.79		87.15
CU 29	60.20	58.82				59.26		77.63
ZN 30	54.92	53.60				54.12		70.11
GA 31	50.27	49.00				49.86		63.84
GE 32	46.23	45.01						58.32
AS 33	42.58	41.40						53.29
SE 34	39.46	38.29				39.18		49.12
BR 35	36.66	35.53						45.47
KR 36								42.18
RB 37	31.90	30.81						
SR 38	29.87	28.80			31.93	29.53	29.68	36.60
Y 39	28.03	26.97			29.90	27.66	27.82	34.22
ZR 40	26.35	25.32	24.21	23.33	28.06	25.96	26.12	32.07
NB 41	24.83	23.80	22.69	21.80	26.38	24.42	24.58	30.11
MO 42	23.42	22.41	21.30	20.44	24.86	23.00	23.16	28.33
TC 43					23.46	21.70	21.85	26.70
RU 44	20.97	19.98	18.90	18.07				
RH 45	19.88	18.91	17.84	17.03	21.00	19.40	19.56	23.85
PD 46	18.88	17.91	16.88	16.08	19.91	18.38	18.53	22.59
AG 47	17.95	16.99	15.98	15.20	18.91	17.42	17.59	21.43
CD 48	17.08	16.14	15.16	14.39	17.98	16.55	16.71	20.36
IN 49	16.20	15.34	14.40	13.64	17.12	15.73	15.89	19.37
					16.32	14.97	15.13	18.45
SN 50	15.54	14.60	13.69	12.94	15.58	14.26	14.43	17.59
SB 51	14.84	13.91	13.03	12.29	14.88	13.59	13.76	16.79
TE 52	14.19	13.27	12.42	11.69	14.23	12.97	13.13	16.04
I 53	13.58	12.66	11.86	11.13	13.62	12.39	12.55	15.35
XE 54								
CS 55	12.47	11.56	10.82	10.12	12.51	11.33	11.49	14.09
BA 56	11.97	11.06	10.36	9.66	12.00	10.84	11.01	13.52
LA 57	11.49	10.59	9.92	9.22	11.52	10.38	10.55	12.96
CE 58	11.04	10.15	9.51	8.82	11.08	9.96	10.12	12.47
PR 59	10.61	9.73	9.13	8.45	10.66	9.55	9.71	12.00
ND 60	10.21	9.33	8.76	8.09	10.26	9.16	9.33	11.53
PM 61	9.84	8.96						
SM 62	9.47	8.60	8.10	7.43	9.52	8.45	8.61	10.69
EU 63	9.13	8.27	7.80	7.13	9.18	8.13	8.29	10.32
GD 64	8.81	7.95	7.52	6.85	8.86	7.82	7.98	9.96
TB 65	8.51	7.65	7.24	6.59	8.55	7.52	7.69	9.62
DY 66	8.22	7.36	6.99	6.34	8.27	7.24	7.41	9.30
HO 67	7.94	7.09	6.75	6.10	7.99	6.97	7.14	8.98
ER 68	7.69	6.83	6.52	5.87	7.73	6.72	6.89	8.70
TU 69	7.43	6.59	6.30	5.66	7.48	6.48	6.65	8.42
YB 70	7.20	6.35	6.10	5.46	7.24	6.25	6.42	8.16
LU 71	6.97	6.13	5.90	5.26	7.02	6.04	6.20	7.91
HF 72	6.75	5.91	5.71	5.07	6.80	5.82	5.99	7.67
TA 73	6.55	5.71	5.53	4.90	6.60	5.63	5.79	7.44
W 74	6.35	5.52	5.36	4.73	6.40	5.44	5.60	7.22
RE 75	6.17	5.33	5.19	4.57	6.22	5.25	5.42	7.02
OS 76	5.99	5.15	5.03	4.41	6.04	5.07	5.24	6.82
IR 77	5.82	4.98	4.88	4.26	5.87	4.91	5.07	6.63
PT 78	5.65	4.82	4.74	4.12	5.70	4.75	4.92	6.45
AU 79	5.50	4.66	4.61	3.99	5.54	4.60	4.76	6.29
HG 80	5.35	4.51	4.48	3.86	5.39	4.45	4.61	6.12
TL 81	5.20	4.37	4.35	3.74	5.24	4.31	4.47	5.96
PB 82	5.06	4.23	4.23	3.61	5.10	4.17	4.33	5.81