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CROSS SECTIONS FOR K-SHELL IONIZATION BY ELECTRON IMPACT*

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Cross sections for K-shell ionization by electron impact derived from experimental measurements are tabulated according to target atomic number and incident electron energy. Data are presented for elements C through U. © 1990 Academic Press, Inc.

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INTRODUCTION

The behavior and values of the cross section for Kshell ionization by electron impact have been and are the subject of numerous investigations. There is wide interest in this parameter for reasons of both basic knowledge and technological progress. The determination of these cross sections is of basic importance in the attempt to better understand the inelastic electron-atom interaction. Cross sections of this type are used in two common methods of elemental analysis, electron-probe microanalysis (EPMA) and Auger-electron spectroscopy (AES); in addition, these cross sections are needed for elemental analysis by measurement of the K-shell energy-loss spectra of electrons transmitted through samples in electron microscopes.² At present there is a large number of measurements of Kshell ionization cross sections by electron impact over a very wide energy range, from just above the energy threshold to several GeV. It is useful to have available an up-to-date compilation of experimental measurements of this quantity. For this purpose, we have conducted a review of all available cross-section data for K-shell ionization by electron impact. We present here a tabulation of these experimental cross sections.

Experimentally, three techniques have been used to make K-shell ionization cross-section measurements. The creation of K-shell vacancies in atoms or molecules can be detected through the observation of x-ray or Auger electrons which are emitted in the subsequent deexcitation process. A third method of determining K-shell ionization cross sections is measurement of energy-loss spectra of electrons transmitted through thin target films. A detailed review of the methods used, results obtained, and theories developed in studies of inner-shell ionization by electron impact has been given by Powell.¹

In the Table presented here, we have indicated which cross sections have been derived from measurements of x-ray yields, which have been derived from measurements of Auger-electron yields, and which have been derived from transmission electron energy-loss experiments.

The experimentally measured x-ray production cross sections σ_x or Auger-electron production cross sections σ_A are related to ionization cross sections σ_I through the fluorescence yield f (which is the number of x-rays emitted per vacancy produced)

$$\sigma_1 = \sigma_x / f$$
$$= \sigma_A / (1 - f).$$

It seems appropriate that all the tabulated values be associated with one consistent set of fluorescence yields. Therefore, the K-shell ionization cross sections presented here have been reevaluated, where necessary, using the K-shell fluorescence yields given by Tawara et al. 3 (for $Z \le 10$) and Bambynek et al. 4 (for Z > 10). In addition, it seems useful to give these f values along with the element at the beginning of each data block.

The K-shell ionization cross sections tabulated here were obtained from a search of the literature up to May 1989. Data in the present Table are extracted mostly from tabular listings in the original published papers. For papers in which only graphs of K-shell ionization cross sections are presented, the references are indicated in the footnotes of each block, but in general no effort has been made to extract the numerical values from the figures. Exceptions to the latter are made in the cases where the numerical values can be read off with little uncertainty, and in the cases where the authors of the original papers kindly provided the numerical values upon our request. Data not included because of neglect of target-thickness effects or lack of absolute cross section value are:

1.6- to 40-keV electrons on Al target by Butz and Wagner⁵

- 2- to 15-keV electrons on Al, Ti, Ni, Zr, Nb, Mo, Pd, Ta, and Pt targets by Reuter et al.⁶
 - 11.7- to 36-keV electrons on Cu target by Hink⁷
- 13.5- to 49.4-keV electrons on Al, Cu, and Ag targets by Green and Cosslet⁸
- 30- to 180-keV electrons on Ag target by Webster et al.9
- 100- to 400-keV electrons on Ag target by Ito et al. 10 300-keV electrons on C, Cu, Ag, and Au targets by Komma and Nakel 11
 - 500-keV electrons on Ag target by Schule and Nakel¹²

Acknowledgments

A number of people contributed to this compilation of the K-shell ionization cross-section data. In particular, the authors thank Professors W. Mehlhorn and W. Scholz for kindly providing their experimental data in tabular form.

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EXPLANATION OF TABLE

TABLE. Cross Sections for K-Shell Ionization by Electron Impact

The data are arranged first by increasing target atomic number and then by increasing incident electron energy.

Z	Target atomic number
f	K-shell fluorescence yield
ENERGY	Incident electron energy in units of keV
	$3.51\ 1\ \text{means}\ 3.51\times 10^{1}\ \text{keV}$
CROSS SECTION	K-shell ionization cross section and error in units of
	barns derived from experimental data
	4.76 0.44 3 means $(4.76 \pm 0.44) \times 10^3$ barns
TYPE	Type of measurement
Α	Auger-electron yield measurement
X	x-ray yield measurement
El	Transmission electron energy-loss measurement
G	Gas target
Tn	Thin solid target
REF.	Key for locating the reference in the list at the end of
	the Table

TABLE. Cross Sections for K-Shell Ionization by Electron Impact See page 356 for Explanation of Table

ENER	 GY 	CROSS	SECT	ION	TYPE	REF.	ENERG	Y	CROSS	SECTI	LON	TYPE	REF.
*	* Z=6		С	f=	2.69E-3	**	**	z=7		N	f=	4.73E-3	**
2.90	-1	6.91	0.76	4	X,G	Ta73	1.41	0	1.76	0.09	5	A,G	G171
3.00	-1	9.44	1.04	4	X,G	Ta73	1.50	0	1.76	0.19	5	X,G	Ta73
3.50	-1	1.46	0.16	5	X,G	Ta 73	1.51	0	1.76	0.09	5	Α,G	G171
4.00	-1	1.94	0.21	5	X,G	Ta7 3	1.61	0	1.76	0.09	5	A,G	G171
5.00	-1	2.50	0.28	5	X,G	Ta 73	1.71	0	1.75	0.09	5	A,G	G171
6.00	-1	2.93	0.32	5	X,G	Ta73	1.75	0	1.79	0.20	5	X,G	Ta73
7.00	-1	3.03	0.33	5	X,G	Ta 73	1.81	0	1.76	0.09	5	A,G	G171
8.00	-1	3.27	0.36	5	X,G	Ta 73	2.00	0	1.69	0.19	5	X,G	Ta73
9.00	-1	3.26	0.36	5	X,G	Ta73	2.01	0	1.72	0.09	5	A,G	G171
1.00	0	3.28	0.35	5	X,G	Ta73	2.41	0	1.66	0.08	5	A,G	G171
1.25	0	3.26	0.36	5	X,G	Ta73	2.81	0	1.60	0.08	5	A,G	G171
1.50	0	3.21	0.35	5	X,G	Ta73	3.00	0	1.48	0.16	5	X,G	Ta73
1.75	0	3.05	0.34	5	X,G	Ta73	3.22	0	1.53	0.08	5	A,G	G171
2.00	0	2.89 4.53	0.32	5 5	X,G	Ta 73 Hi71	3.62	0	1.47	0.07	5 5	A,G	G171
3.00	0	2.42	0.27	5	X,Tn X,G	Ta73	4.00 4.02	0	1.35 1.39	0.15	5	X,G	Ta73
3.00	0	3.38	0.34	5	X.Tn	Hi71	4.82	0	1.28	0.07	5	A,G A,G	G171 G171
4.00	Ö	2.11	0.23	5	X,G	Ta73	5.63	0	1.20	0.06	5	A,G	G171
4.00	0	2.78	0.19	5	X,Tn	Hi71	6.00	0	1.04	0.11	5	X,G	Ta73
5.00	ő	1.83	0.20	5	X,G	Ta73	6.43	Ö	1.10	0.06	5	λ,G	G171
5.00	ŏ	2.26	0.11	5	X,Tn	Hi71	7.24	Ö	1.03	0.05	5	A,G	G171
6.00	Ō	1.65	0.18	5	X,G	Ta73	8.04	Ŏ	9.69	0.48	4	A,G	G171
7.00	ō	1.77	0.09	5	X, Tn	Hi71	8.50	0	8.75	0.96	4	X,G	Ta73
8.50	Ō	1.33	0.15	5	X,G	Ta73	8.84	Ō	9.11	0.46	4	A,G	G171
1.00	1	1.29	0.06	5	X, Tn	Hi71	9.65	ō	8.58	0.43	4	A,G	G171
1.06	1	1.17	0.13	5	X,G	Ta 73	1.05	1	8.11	0.41	4	A,G	G171
1.26	1	1.02	0.11	5	X,G	Ta73	1.06	1	7.65	0.84	4	X,G	Ta 73
1.47	1	9.18	1.01	4	X,G	Ta7 3	1.26	1	6.60	0.73	4	X,G	Ta7 3
1.50	1	9.07	0.45	4	X,Tn	Hi71	1.47	1	5.75	0.63	4	X,G	Ta7 3
1.68	1	8.55	0.94	4	X,G	Ta 73	1.68	1	5.52	0.61	4	X,G	Ta73
2.00	1	7.21	0.36	4	X,Tn	Hi71	2.50	1	5.30	1.50	4	El, Tn	Is72
2.50	1	5.99	0.30	4	X,Tn	Hi71							
2.50	1	7.50	1.50	4	El,Tn	Is72						079 for	
3.00	1	5.24	0.26	4	X,Tn	Hi71				sectio:	n of	N pA 80	keV
7.50 8.00	1 1	6.00 3.70	0.60	3 4	El,Tn El,Tn	Co72 Eg 75	electr	on 1	mpact				
Graph	is n	esente	d in Re	 ef R		K-shell	* *	Z=8		0	f=	6.45E-3	**
					C by 80					•			
	ron in				_		1.00	0	6.43	0.32	4	A,G	G171
							1.00	0	7.58	0.99	4	X,G	Ta 73
							1.20	0	7.65	0.38	4	A,G	G171
*	* Z=7		N	f≠	4.73E-3	**	1.24	0	8.90	0.89	4	Α,G	P185
							1.40	0	8.53	0.42	4	Α,G	G171
4.50	-1	5.62	0.62	4	X,G	Ta 73	1.60	0	9.05	0.45	4	A,G	G171
5.00	-1	7.57	0.83	4	X,G	Ta73	1.80	0	9.32	0.46	4	A,G	G171
6.00	-1	8.83	0.44	4	λ,G	G171	2.00	0	9.42	0.47	4	A,G	G171
6.00	-1	1.09	0.12	5	X,G	Ta73	2.00	0	9.41	1.22	4	X,G	Ta73
6.50	-1	1.06	0.05	5	A,G	G171	2.08	0	9.40	0.94	4	A,G	P185
7.00	-1 -1	1.36	0.15	5	X,G	Ta73	2.20	0	9.52	0.47	4	A,G	G171
8.00 9.00	-1 -1	1.53	0.17 0.07	5	X,G	Ta73 G171	2.40	0	9.52	0.47	4	A,G	G171
9.00	-1 -1	1.42	0.07	5 5	A,G	Ta73	2.60 2.90	0	9.40 9.28	0.47 0.46	4 4	Α,G	G171
1.00	0	1.56	0.17	5 5	X,G A,G	G171	3.00	0	9.28	0.45	4	A,G A,G	G171 G171
1.00	0	1.72	0.19	5	X,G	Ta73	3.00	0	9.36	1.22	4	Х,G Х,G	Ta73
1.10	Ö	1.65	0.13	5	A,G	G171	3.11	0	9.10	0.91	4	A,G	P185
1.21	ŏ	1.72	0.09	5	λG	G171	3.20	Õ	9.01	0.45	4	A,G	G171
1.25	ō	1.78	0.20	5	X,G	Ta73	3.50	0	8.76	0.48	4	A,G	G171
	-			_	, •			-			_	, -	· - · -

TABLE. Cross Sections for K-Shell Ionization by Electron Impact See page 356 for Explanation of Table

ENER	GY 	CROSS	SECTI	ON	TYPE	REF	ENERG	Y	CROSS	SECT	ION	TYPE	REF.
*	* Z=8		0	f =6	.45E-3	**	* *	Z=1	0	Ne	f=	1.55E-2	**
3.80	0	8.57	0.43	4	A,G	G17.	7.83	0	2.94	0.15	4	A,G	G171
4.00	0	8.96	1.16	4	X,G	Ta7.	8.50	0	3.14	0.35	4	X,G	Ta 73
4.10	0	8.36	0.42	4	A,G	G17:	8.70	0	2.82	0.14	4	A,G	G171
4.40	0	8.13	0.41	4	A,G	G17:	1.00	1	2.61	0.14	4	A,G	G171
4.50	0	8.07	0.40	4	A,G	G17:	1.04	1	2.54	0.13	4	A,G	G171
4.70	0	7.93	0.39	4	A,G	G17:	1.06	1	2.68	0.30	4	X,G	Ta73
5.00	0	7.61	0.38	4	A,G	G171	1.26	1	2.35	0.26	4	X,G	Ta73
5.00	0	7.81	1.02	4	X,G	Ta7:	1.46	1	2.23	0.24	4	X,G	Ta7 3
5.50	0	7.32	0.36	4	A,G	G171							
6.00	0	7.02	0.35	4	A,G	G171	Graph	is v	resente	d in R	ef. H	i81 for	K-shell
6.00	Ō	6.82	0.87	4	X,G	Ta73	-					Ne by 0	
7.00	ō	6.53	0.33	4	A,G	G171			lectron				
8.00	ŏ	6.12	0.30	4	A,G	G171	3.3, 2.			2.111.20.00	~		
8.50	Õ	5.60	0.57	4	X,G	Ta73							
9.00	ŏ	5.72	0.28	4	A,G	G171	**	Z=1	3	Na	f=	2.40E-2	* *
1.00	1	5.39	0.27	4	A,G	G171					-	2.400 2	
1.06	1	4.68	0.61	4	X,G	Ta73	7.00	4	3.50	0.56	3	X,Tn	Ka80
1.10	1	5.09	0.26	4	A,G	G171	2.30	5	3.50	0.56	3	X, Tn	Ka80
1.20	1	4.83	0.24	4		G171	2.50	5	3.50	0.50	,	χ, 111	Naov
1.26					A,G								
	1	4.19	0.54	4	X,G	Ta73			_	W		2 42 5	
1.30	1	4.55	0.23	4	A,G	G171		Z≃1	. 2	Mg	Ι=	2.72E-2	
1.68	1.	3.43	0.45	4	X,G_	Ta73					_		
2.50	1	4.00	1.50	4	El, Tn	Is72	1.00	4	8.74	1.40	2	X,Tn	Mc88
							2.00	4	1.19	0.19	3	X,Tn	Mc88
				_			5.00	4	2.04	0.55	3	X,Tn	Ho79
*	* Z≃10)	Ne	f=1	.55E-2	* *	7.00	4	2.64	0.42	3	X,Tn	Ka80
							2.30	5	2.80	0.45	3	X,Tn	Ka80
9.50	-1	6.00	0.66	3	X,G	Ta 73							
1.00	0	9.16	1.01	3	X,G	Ta 73							
1.25	0	2.07	0.23	4	X,G	Ta73	* 1	z=1	13	Al	f=	3.57E-2	* *
1.26	0	1.56	0.27	4	A,G	P185							
1.31	0	1.98	0.10	4	A,G	G171	2.58	0	1.18	0.13	4	X,Tn	Hi69
1.50	0	2.88	0.32	4	X,G	Ta7 3	3.68	0	1.46	0.16	4	X,Tn	Hi69
1.54	0	2.95	0.50	4	A,G	P185	5.06	0	1.53	0.17	4	X,Tn	Hi69
1.74	0	2.83	0.14	4	A,G	G171	6.54	0	1.46	0.16	4	X,Tn	Hi69
1.75	0	3.35	0.37	4	X,G	Та73	8.79	0	1.34	0.15	4	X,Tn	Hi69
2.00	0	3.74	0.41	4	X,G	Ta 73	1.10	1	1.28	0.14	4	X,Tn	Hi69
2.04	0	4.05	0.45	4	Α,G	P185	1.38	1	1.14	0.13	4	X,Tn	Hi69
2.18	0	3.26	0.16	4	A,G	G171	1.72	1	1.00	0.11	4	X,Tn	Hi69
2.50	0	3.68	0.40	4	X,G	Ta73	2.18	1	8.88	0.98	3	X,Tn	Hi69
2.61	0	3.52	0.18	4	A,G	G171	2.58	1	8.00	0.88	3	X, Tn	Hi69
3.00	0	3.82	0.42	4	X,G	Ta 73	2.97	1	7.28	0.80	3	X,Tn	Hi69
3.05	Ó	3.62	0.18	4	A,G	G171	1.00	4	8.85	1.42	2	X,Tn	Mc88
3.26	ō	3.62	0.18	4	A,G	G171	2.00	4	1.26	0.20	3	X,Tn	Mc88
3.32	ŏ	4.11	0.70	4	A,G	P185	5.00	4	2.18	0.30	3	X,Tn	Но79
3.48	ŏ	3.62	0.18	4	A,G	G171	7.00	4	2.38	0.38	3	X,Tn	Ka80
3.50	Ô	3.94	0.43	4	X,G	Ta73	1.50	5	2.84	1.14	3	X,Tn	Is77
3.70	Ö	3.62	0.18	4	A,G	G171	2.30	5	2.55	0.41	3	X,Tn	Ka80
3.92	Ö	3.60	0.18	4	A,G	G171	2.30			V. M.L	J 		
4.00	o	4.01	0.18	4	X,G	Ta73		ic	nraganta	d in D	of t	2079 for	K-shell
4.08													
	0	3.54	0.60	4	A,G	P185				sect10	nı Oï	Al by 8	o kev
4.13	0	3.57	0.18	4	A,G	G171	electi	con :	impact				
4.35	0	3.55	0.18	4	A,G	G171							
5.04	0	3.25	0.55	4	A,G	P185							
5.22	0	3.41	0.17	4	A,G	G171							
6.00	0	3.50	0.38	4	X,G	Ta73							
6.09	0	3.25	0.16	4	A,G	G171							
6.96	0	3.11	0.16	4	A,G	G171							

TABLE. Cross Sections for K-Shell Ionization by Electron Impact See page 356 for Explanation of Table

ENERG	Y	CROSS	SECT	ON	TYPE	REF.	ENERG	Y	CROSS	SECTI	ON	TYPE	REF.
**	Z=14	l	Si	f = 4	.70E-2	**	**	Z=18	3	Ar	f=	1.15E-1	**
2.99	0	8.80	0.88	3	A,G	P185	4.00	4	8.68	1.04	2	X,G	Ho79
5.13	0	8.50	0.85	3	A,G	P185	5.00	4	8.66	1.04	2	X,G	Ho79
5.69	0	8.60	0.86	3	A,G	P185	6.00	4	9.20	1.10	2	X,G	Ho79
6.62	0	9.50	0.95	3	A,G	P185							
7.95	0	9.60	0.96	3	A,G	P185							K-shell
5.00	4	1.59	0.23	3	X, Tn	Ho79						Ar by 3.	.21 to
1.50	5	2.25	0.90	3	X,Tn	Is77	4.20 F	ceve.	lectron	impact	5		
**	Z=17		C1	f=9	.42E-2	**	**	z=20)	Ca	f=	1.63E-1	**
7.00	4	1.22	0,20	3	X,Tn	Ka80	2.00	4	6.09	0.79	2	X,G	Ho79
2.30	5	1.30	0.21	3	X,Tn	Ka80	3.50	4	6.52	0.85	2	X,G	Ho79
2.70	5	1.27	0.51	3	X,Tn	Is77	5.00	4	6.95	0.90	2	X,G	Ho79
							6.00	4	7.12	0.93	2	X,G	Ho79
							7.00	4	8.89	3.56	2	X,Tn	Is77
* *	z=18	1	Ar	f=1	.15E-1	* *	1.50	5	9.08	3.63	2	X,Tn	Is77
							2.70	5	1.05	0.42	3	X,Tn	Is77
3.37	0	3.28	0.40	2	X,G	Hi82							
3.59	0	7.80	0.95	2	X,G	Hi82			•	m.:	_	0 100 1	* *
3.64	0	8.20	1.64	2	A,G	P185	* '	z=2:	2	Ti	r=	2.19E-1	* *
3.85	0	1.09	0.13	3 3	X,G	H182	E 01	^	4 00		2	v m-	T.75
3.99 4.00	0	1.35 1.37	0,27 0,18	3	A,G X,G	P185 Ta73	5.91 6. 4 6	0	4.99 6.58		2 2	X,Tn X,Tn	Je75 Je75
4.03	Ö	1.27	0.16	3	X,G	Hi82	7.45	0	9.09		2	X, In X, Tn	Je75
4.19	Ö	1.44	0.15	3	X,G	Qu82	8.44	Ö	1.07		3	X,Tn	Je75
4.32	ŏ	1.49	0.18	3	X,G	Hi82	9.44	0	1.20		3	X,Tn	Je75
4.54	Ö	1.66	0.33	3	λ,G	P185	9.98	Ö	1.26		3	X,Tn	Je75
4.56	ŏ	1.67	0.20	3	X,G	Hi82	1.04	1	1.30		3	X, Tn	Je75
5.00	0	1.90	0.25	3	X,G	Ta73	1.15	1	1.35		3	X, Tn	Je75
5.05	0	2.26	0.45	3	A,G	P185	1.25	1	1.38		3	X.Tn	Je75
5.11	0	1.79	0.18	3	X,G	Qu82	1.34	1	1.40		3	X,Tn	Je75
5.46	0	2.17	0.26	3	X,G	Hi82	1.49	1	1.42		3	X,Tn	Je75
5.97	0	2.76	0.55	3	A,G	P185	1.80	1	1.42		3	X,Tn	Je75
6.00	0	2.38	0.31	3	′X,G	Ta 73	2.30	1	1.36		3	X, Tn	Je75
6.10	0	2.27	0.23	3	X,G	Qu82	2.80	1	1.29		3	X,Tn	Je7 5
6.42	0	2.68	0.33	3	X,G	Hi82	3.30	1	1.22		3	X,Tn	Je75
6.99	0	2.76	0.55	3	A,G	P185	3.80	1	1.15		3	X,Tn	Je75
7.27	0	2.71	0.33	3	X,G	Hi82	4.30	1	1.09		3	X,Tn	Je75
7.68	0	2.67	0.27	3	X,G	Qu82	4.70	1	1.05		3	X,Tn	Je75
8.00	0	3.37	0.67	3	A,G	P185	5.00	1	1.03		3	X,Tn	Je75
8.11 8.20	0	2.92 3.12	0.36 0.32	3 3	X,G	Hi82 Qu82	Cranh		-			1007 for	T chell
8.50	0	2.91	0.38	3	X,G X,G	7a73						Ti by 3	K-shell
8.90	0	3.46	0.69	3	A,G	P185	elect:			Sectio.	II OI	II Dy 3	oo Mev
9.18	0	2.98	0.36	3	X,G	Hi82	erect.	ron 1	mpacc				
9.74	0	2.96	0.59	3	A,G	P185							
1.00	ĭ	2.87	0.35	3	X,G	Hi82	*	* Z=2	3	v	f=	2.50E-1	* *
1.03	1	3.08	0.31	3	X,G	Qu82			_	•	-	2.500	
1.06	1	2.91	0.38	3	X,G	Ta73	2.00	3	3.53	0.35	2	X, Tn	Sc72
1.10	1	2.90	0.35	3	X,G	Hi82		•					
1.20	1	2.87	0.35	3	X,G	Hi82						•	
1.26	1	2.95	0.38	3	X,G	Ta 73							
1.47	1	2.89	0.38	3	X,G	Ta 73							
1.68	1	2.78	0.36	3	X,G	Ta 73							
1.89	1	2.73	0.35	3	X,G	Ta73							
2.00	4	8.09	0.97	2	X,G	но79							
3.00	4	8.35	1.00	2	X,G	Ho79							

TABLE. Cross Sections for K-Shell Ionization by Electron Impact See page 356 for Explanation of Table

2.00 4 4.50 0.45 2 X.Tn Mo79 3.50 4 5.01 0.50 2 X.Tn Mo79 5.00 4 5.02 0.50 2 X.Tn Mo79 6.00 1.50 0.20 0.60 2 X.Tn Mo79 6.00 1.50 0.20 0.60 2 X.Tn Mo79 6.00 0 0.26 0.60 2 X.Tn Mo79 6.00 0 0.60 0.13 2 X.Tn Mo79 6.00 0 0.60 0.13 2 X.Tn Mo79 6.00 0 0.50 0.50 0.20 X.Tn Mo79 6.00 0 0.50 0.50 0.50 0.50 0.50 0.50 0.5		GY 	CROSS	SECT	ON	TYPE	REF.	ENERG	Y 	CROSS	SECTI	ON	TYPE	REF.
2.00 4 4.50 0.45 2 X.Tn Ho79 3.50 4 5.01 0.50 2 X.Tn Ho79 5.00 4 5.02 0.50 2 X.Tn Ho79 6.00 4 5.02 0.50 2 X.Tn Ho79 6.00 4 5.02 0.50 2 X.Tn Ho79 7.53 1 2.98 2 X.Tn Fore 6.00 4 5.02 0.50 2 X.Tn Ho79 7.53 1 2.98 2 X.Tn Fore 6.00 4 5.02 0.50 2 X.Tn Ho79 7.53 1 2.98 2 X.Tn Fore 6.00 4 5.02 0.50 2 X.Tn Ho79 7.53 1 2.98 2 X.Tn Fore 6.00 4 5.02 0.50 2 X.Tn Ho79 7.53 1 2.98 2 X.Tn Fore 6.00 4 5.02 0.50 2 X.Tn Ho79 7.53 1 2.98 2 X.Tn Fore 6.00 1 1.53 2 2.03 2 X.Tn Fore 6.00 1 1.53 2 2.03 2 X.Tn Fore 6.00 1 1.50 0.50 2 X.Tn Sh80 6.00 4 3.45 0.86 2 X.Tn Ho79 7.40 0 1.49 0.30 2 X.Tn Sh80 7.40 0 1.51 0.51 0.52 2 X.Tn Sh80 7.40 0 1.51 0.52 2 X.Tn Sh80 7.40 0 1.51 0.51 0.52 2 X.Tn Sh80 7.40 0 1.68 0.70 2 X.Tn Sh80 7.40 0 1.67 0.71 2 X.Tn Sh80 7.40 0 1.60 0.70 0.70 1 X.Tn Sh80 7.40 0 1.60 0.70 2 X.Tn Sh80 7.40 0 1.60 0.70 0.70 1 X.Tn Sh80 7.40 0 1.60 0.70 1 X.Tn Sh80 7.40 1 X.Tn Sh80 7.40 0 1 X.Tn Sh80 7.40	*	* Z≈2¢	1	Cr	£=	2.82E+1	**	**	Z=28	3	Ni	f=	4.14E-1	* *
3.50 4 5.01 0.50 2 X.Tn Ho79 5.00 4 5.02 0.50 2 X.Tn Ho79 6.00 4 5.28 0.53 2 X.Tn Fore 6.00 4 5.28 0.53 2 X.Tn Fore 6.00 4 5.28 0.53 2 X.Tn Fore 6.00 4 5.28 0.50 2 X.Tn Fore 6.00 4 5.28 0.50 2 X.Tn Fore 6.00 6 6 6.00 4 3.30 0.26 2 X.Tn Fore 6.00 0 0.68 0.13 2 X.Tn Sh80 6.90 0 0.68 0.13 2 X.Tn Sh80 6.90 0 0.68 0.13 2 X.Tn Sh80 6.90 0 0.50 0.50 2 X.Tn Fore 6.00 0 2.40 0.31 2 X.Tn Sh80 6.00 0 2.40 0.32 2 X.Tn Sh80 6.00 0 2.40 0.31 2 X.Tn Sh80 6.00 0 2.40 0.30 2 X.Tn Sh80 6.00 0 2	2.00	3	2.71	0.27	2	X,Tn	Sc72	4.97	1	4.98		2	X,Tn	Je75
5.00 4 5.02 0.50 2 X.Tn H079	2.00	4	4.50	0.45	2	X,Tn	Ho79	5.56	1	3.37		2	X,Tn	Po47
6.00 4 5.28 0.53 2 X.Th Ho79	3.50	4	5.01	0.50	2	X,Tn	Ho79	7.00	1	3.14	0.20	2	X,Tn	Sm45
Graph is presented in Ref. Wa97 for K-shell 1.53 2 2.23 2 X.Tn Personal Ref. Wa97 for K-shell 1.53 2 2.23 3.37 0.84 2 X.Tn Personal Ref. Wa97 for K-shell 1.83 2 2.06 2 X.Tn Personal Ref. Wa97 for K-shell 1.83 2 2.06 2 X.Tn Personal Ref. Wa97 for K-shell 1.83 2 2.06 2 X.Tn Personal Ref. Wa97 for K-shell 1.83 2 2.06 2 X.Tn Personal Ref. Wa97 for K-shell 2.00 3 2.34 0.86 2 X.Tn Personal Ref. Wa97 for K-shell 2.00 4 2.78 0.22 2 X.Tn Personal Ref. Wa97 for K-shell 2.00 3 2.70 0.32 2 X.Tn Personal Ref. Wa97 for K-shell 2.00 3 2.70 0.32 2 X.Tn Personal Ref. Wa97 for K-shell 2.00 3 2.70 0.32 2 X.Tn Personal Ref. Wa97 for K-shell 2.00 3 2.55 0.25 2 X.Tn Personal Ref. Wa97 for K-shell 2.00 2 2.55 0.25 2 X.Tn Personal Ref. Wa97	5.00	4	5.02	0.50	2	X,Tn	Ho79	7.53	1	2.98		2	X,Tn	Po47
Graph is presented in Ref. Wa87 for K-shell indization cross section of Cr by 300 MeV 1.83 2 2.23 2 X.Tn Pe electron impact 4.90 2 3.37 0.84 2 X.Tn Section of Cr by 300 MeV 1.83 2 2.06 2 X.Tn Section of Cr by 300 MeV 1.83 2 2.06 2 X.Tn Section of Cr by 300 MeV 1.83 2 2.06 3 3.37 0.84 2 X.Tn Section of Cr by 300 MeV 2.00 3 2.34 0.27 2 X.Tn Section of Cr by 300 MeV 2.00 3 2.34 0.27 2 X.Tn Section of Cr by 300 MeV 3.30 0.26 2 X.Tn Section of Cr by 300 3 2.35 3.45 3.25	6.00	4	5.28	0.53	2	X,Tn	Ho79	9.51	1	2.75			X,Tn	Po47
ionization cross section of Cr by 300 MeV electron impact *** Z=25								1.25		2.44			X,Tn	Po47
** Z=25	Graph	is p	resente	d in R	ef. W	a87 for	K-shell					2	•	Po47
** Z=25	ioniz	ation	cross	sectio:	n of	Cr by 30	00 MeV	1.83		2.06			X,Tn	Po47
** Z=25	elect	ron i	mpact									2		Se74
** Z=25														Se74
6.71 0 0 0.26 0.06 2 X.7m Sh80 6.90 0 0.68 0.13 2 X.7m Sh80 6.90 0 0 1.49 0.30 2 X.7m Sh80 7.40 0 0 1.49 0.30 2 X.7m Sh80 8.00 0 2.40 0.31 2 X.7m Sh80 8.00 0 2.40 0.31 2 X.7m Sh80 9.00 1 5.18 0.55 2 X.7m Sh80 1.50 1 6.54 0.70 2 X.7m Sh80 1.50 1 6.54 0.70 2 X.7m Sh80 1.50 1 6.77 0.71 2 X.7m Sh80 2.00 1 6.77 0.71 2 X.7m Sh80 2.00 3 2.70 0.32 2 X.7m Sh80 6.7m Sh80 6.			_		_								-	Sc72
6.71 0 0 0.26 0.06 2 X.7m Sh80 6.00 4 3.67 0.29 2 X.7m Sh80 7.40 0 1.49 0.30 2 X.7m Sh80 9.00 5 4.92 0.39 2 X.7m Ge 8.00 0 2.40 0.31 2 X.7m Sh80 1.50 6 5.96 0.48 2 X.7m Ge 8.00 0 2.40 0.31 2 X.7m Sh80 2.00 6 6.20 0.50 2 X.7m Ge 9.00 0 3.52 0.39 2 X.7m Sh80 2.00 6 6.20 0.50 2 X.7m Ge 9.00 0 3.52 0.39 2 X.7m Sh80 7.00 6 6.20 0.50 2 X.7m Ge 9.00 0 3.52 0.39 2 X.7m Sh80 7.00 6 6.20 0.50 2 X.7m Ge 9.00 0 1 6.77 0.71 2 X.7m Sh80 7.00 1 6.77 0.70 1 X.7m Sh80 7.00 1 6.77 0.70 1 X.7m Sh80 7.00 1 6.70 1 X.7m Sh80 7.00 1 7.00 1 X.7m Sh80 7.00 1 7.0	*	* Z≃2:	5	Mn	f=	3.14E-1	**						-	Но79
6.90 0 0 0.68 0.13 2 X.7m Sh80														Ho79
7.40 0 1.49 0.30 2 X.Tn Sh80 2.00 6 6.20 0.50 2 X.Tn General Shape of Shape														Ho79
8.00 0 2.40 0.31 2 X.Th Sh80														Ge82
9.00 0 3.52 0.39 2 X,Tn Sh80 1.10 1 5.18 0.55 2 X,Tn Sh80 2.00 1 6.54 0.70 2 X,Tn Sh80 2.00 1 6.77 0.71 2 X,Tn Sh80 3 2.70 0.32 2 X,Tn Sc72 Graph is presented in Ref. Da75 for K-sh 5.00 4 4.34 0.39 2 X,Tn Sc72 Graph is presented in Ref. Wa87 for K-shell ionization cross section of Mn by 50 keV electron impact Graph is presented in Ref. Wa87 for K-shell ionization cross section of Mn by 50 keV electron impact Graph is presented in Ref. Wa87 for K-shell ionization cross section of Mn by 50 keV electron impact Graph is presented in Ref. Wa87 for K-shell ionization cross section of Ni by 300 MeV electron impact Graph is presented in Ref. Wa87 for K-shell ionization cross section of Ni by 300 MeV electron impact ## Z=29 Cu														Ge82
1.10								2.00	6	6.20	0.50	2	X,Tn	Ge82
1.50 1 6.54 0.70 2 X,Tn Sh80 2.00 1 6.77 0.71 2 X,Tn Sh80 2.00 3 2.70 0.32 2 X,Tn Sc72 5.00 4 4.34 0.39 2 X,Tn Ho79									 -					
2.00 1 6.77 0.71 2 X.Tn Sh80 2.00 3 2.70 0.32 2 X.Tn Sc72 5.00 4 4.34 0.39 2 X.Tn Ho79									_					
2.00 3 2.70 0.32 2 X,Tn BC72 5.00 4 4.34 0.39 2 X,Tn HO79												n of	Ni by 3 .	0 to 21
Solid 4 34 0.39 2 X.Th Ho79 electron impact Fi67 for K-shell ionization cross section of Mn by 50 keV electron impact Table Tabl														
Graph is presented in Ref. Fi67 for K-shell ionization cross section of Mn by 50 keV electron impact Graph is presented in Ref. Wa87 for K-shell ionization cross section of Mn by 350 MeV electron impact Graph is presented in Ref. Wa87 for K-shell ionization cross section of Mn by 350 MeV electron impact Fig. 1														
Graph is presented in Ref. Fi67 for K-shell ionization cross section of Mn by 50 keV electron impact cross section of Mn by 30 keV electron impact graph is presented in Ref. Wa87 for K-shell ionization cross section of Mn by 350 MeV 9.12 0 1.59 0.36 1 X.Tn Stellectron impact 9.27 0 1.08 0.20 1 X.Tn Stellectron impact 9.27 0 1.08 0.20 1 X.Tn Stellectron impact 1.00 1 8.60 1.70 1 X.Tn Stellectron impact 1.00 1 8.60 0.20 1 X.Tn Stellectron impact 1.00 1 X.Tn Stellectron impact 1.00 1 8.60 0.20 1 X.Tn Stellectron impact 1.00 1 8.60 0.20 1 X.Tn Stellectron impact 1.00 1 8.60 0.20 1	5.00	4	4.34	0.39	2	X, Tn	но79				section	or or	MI DA 30	o mev
	ioniz	ation	cross					9.12	0	1.59	0.36	1	X,Tn	Sh81
** Z=26	erect	ron 1	mpact					0 07	^		^ ^^	-	V	
** Z=26										1.08				Sh80
2.00 3 2.55 0.25 2 X,Tn Sc72 1.20 1 1.86 0.21 2 X,Tn St 1.50 1 2.94 0.36 2 X,Tn St 1.50 1 2.94 0.31 2 X,Tn St 1.50 1 2.94 0.31 2 X,Tn St 2.00 1 4.02 0.40 2 X,Tn St 2.50 1 3.97 0.45 2 X,Tn St 2.50 1 4.15 0.40 2 X,Tn St 2.50 1 4.15 0.40 2 X,Tn St 2.50 1 5.51 0.09 2 X,Tn Dt 4.00 1 5.45 0.05 2 X,Tn Dt 5.00 2 2 3.98 0.05 2 X,Tn Dt 5.00 2 3.98 0.05	*							9.50	0	1.08 3.26	0.60	1	X,Tn	Sh80 Sh80
2.00 3 2.55 0.25 2 X,Tn Sc72 1.20 1 1.86 0.21 2 X,Tn St 1.50 1 2.94 0.36 2 X,Tn St 2.00 1 3.80 0.41 2 X,Tn St 2.00 1 3.80 0.41 2 X,Tn St 2.00 1 4.02 0.40 2 X,Tn St 2.00 1 4.02 0.40 2 X,Tn St 2.00 1 4.02 0.40 2 X,Tn St 2.50 1 4.15 0.40 2 X,Tn St 2.50 1 4.15 0.40 2 X,Tn St 2.50 1 5.51 0.09 2 X,Tn Dt 2.50 1 5.51 0.09 2 X,Tn Dt 4.00 1 5.84 0.07 2 X,Tn Dt 4.00 1 5.24 0.16 2 X,Tn Dt 5.24 0.16 0.18 0 X,T		* 7=2	6	Fo	f=	:3 <i>47</i> F-1	**	9.50 1.00	0 1	1.08 3.26 8.60	0.60 1.70	1 1	X,Tn X,Tn	Sh80 Sh80 Sh81
1.50		* Z=2	6	Fe	f=	3.47E-1	**	9.50 1.00 1.00	0 1 1	1.08 3.26 8.60 6.72	0.60 1.70 1.10	1 1 1	X,Tn X,Tn X,Tn	Sh80 Sh80 Sh81 Sh80
** Z=27	2 00							9.50 1.00 1.00 1.10	0 1 1 1	1.08 3.26 8.60 6.72 1.20	0.60 1.70 1.10 0.18	1 1 1 2	X,Tn X,Tn X,Tn X,Tn	Sh80 Sh80 Sh81 Sh80 Sh80
** Z=27	2.00							9.50 1.00 1.00 1.10 1.20	0 1 1 1	1.08 3.26 8.60 6.72 1.20 1.86	0.60 1.70 1.10 0.18 0.21	1 1 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn	Sh80 Sh80 Sh81 Sh80 Sh80 Sh80
2.00 1 4.02 0.40 2 X,Tn St 2.00 1 3.97 0.45 2 X,Tn St 2.50 1 3.97 0.45 2 X,Tn St 2.50 1 4.15 0.40 2 X,Tn St 2.50 1 5.51 0.09 2 X,Tn St 2.50 1 5.51 0.09 2 X,Tn St 2.50 1 5.51 0.09 2 X,Tn Dt 3.00 1 5.84 0.07 2 X,Tn Dt 4.00 1 5.45 0.05 2 X,Tn Dt 4.00 1 5.05 0.05 2 X,Tn Dt 4.00 1 5.05 0.05 2 X,Tn Dt 5.00 2	2.00							9.50 1.00 1.00 1.10 1.20 1.50	0 1 1 1 1	1.08 3.26 8.60 6.72 1.20 1.86 2.94	0.60 1.70 1.10 0.18 0.21 0.36	1 1 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh80 Sh80 Sh81 Sh80 Sh80 Sh80 Sh81
2.00 3 2.41 0.30 2 X,Tn Sc72 2.50 1 3.97 0.45 2 X,Tn Si 2.50 1 4.15 0.40 2 X,Tn Si 2.50 1 5.51 0.09 2 X,Tn Si 2.50 1 5.51 0.09 2 X,Tn Da 3.00 1 5.84 0.07 2 X,Tn Da 4.00 1 5.45 0.05 2 X,Tn Da 6.00 1 5.24 0.16 2 X,Tn Da 6.00 1 5.24 0.18 2 X,Tn Da 6.00 1 5.24 0.16		3	2.55	0.25	2	X,Tn	Sc72	9.50 1.00 1.00 1.10 1.20 1.50	0 1 1 1 1 1	1.08 3.26 8.60 6.72 1.20 1.86 2.94 2.94	0.60 1.70 1.10 0.18 0.21 0.36 0.31	1 1 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh80 Sh81 Sh80 Sh80 Sh80 Sh80 Sh81 Sh81
2.50 1 4.15 0.40 2 X,Tn Di ** Z=28 Ni f=4.14E-1 ** 3.00 1 5.84 0.07 2 X,Tn Di ** Z=28 Ni f=4.14E-1 ** 3.00 1 5.84 0.07 2 X,Tn Di 8.91 0 1.05 2 X,Tn Je75 6.00 1 5.24 0.16 2 X,Tn Di 9.83 0 1.93 2 X,Tn Je75 8.00 1 4.79 0.04 2 X,Tn Di 1.23 1 3.51 2 X,Tn Je75 8.10 1 2.69 0.27 2 X,Tn Di 1.47 1 4.46 2 X,Tn Je75 1.00 2 3.98 0.05 2 X,Tn Di 1.48 1 3.16 2 X,Tn Je75 1.00 2 3.98 0.05 2 X,Tn Di 1.48 1 3.16 2 X,Tn Je75 1.35 2 3.66 0.02 2 X,Tn Di 2.47 1 5.28 2 X,Tn Je75 1.35 2 3.66 0.02 2 X,Tn Di 2.48 1 3.89 2 X,Tn Je75 1.52 2 2.19 0.18 2 X,Tn Di 2.48 1 3.89 2 X,Tn Je75 1.52 2 2.19 0.18 2 X,Tn Bi 3.48 1 5.40 2 X,Tn Je75 5.00 2 1.96 0.18 2 X,Tn Bi 3.57 1 3.82 2 X,Tn Je75 5.00 2 1.96 0.18 2 X,Tn Bi 3.97 1 5.26 2 X,Tn Je75 4.00 2 1.91 0.17 2 X,Tn Bi 3.97 1 5.26 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Bi 3.97 1 5.26 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Bi 3.97 1 5.26 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Bi 3.97 1 5.26 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Bi 3.97 1 5.26 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Bi 3.97 1 5.26 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Bi 3.97 1 5.26 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Bi 3.97 1 5.26 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Bi 3.97 1 5.26 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Bi 3.97 1 5.26 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Bi 3.97 1 5.26 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn		3	2.55	0.25	2	X,Tn	Sc72	9.50 1.00 1.00 1.10 1.20 1.50 2.00	0 1 1 1 1 1 1	1.08 3.26 8.60 6.72 1.20 1.86 2.94 2.94 3.80	0.60 1.70 1.10 0.18 0.21 0.36 0.31	1 1 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh80 Sh81 Sh80 Sh80 Sh80 Sh80 Sh81 Sh80 Sh81
** Z=28 Ni f=4.14E-1 ** 3.00 1 5.84 0.07 2 X,Tn Di 8.91 0 1.05 2 X,Tn Je75 6.00 1 5.24 0.16 2 X,Tn Di 9.83 0 1.93 2 X,Tn Je75 8.00 1 4.79 0.04 2 X,Tn Di 1.23 1 3.51 2 X,Tn Je75 8.10 1 2.69 0.27 2 X,Tn Di 1.47 1 4.46 2 X,Tn Je75 1.00 2 3.98 0.05 2 X,Tn Di 1.48 1 3.16 2 X,Tn Je75 1.00 2 3.98 0.05 2 X,Tn Di 1.97 1 5.28 2 X,Tn Je75 1.35 2 3.66 0.02 2 X,Tn Di 2.47 1 5.52 2 X,Tn Je75 1.52 2 2.19 0.18 2 X,Tn Di 2.48 1 3.89 2 X,Tn Je75 1.52 2 2.19 0.18 2 X,Tn Bi 3.48 1 5.40 2 X,Tn Je75 4.00 2 2.03 0.18 2 X,Tn Bi 3.57 1 3.82 2 X,Tn Je75 5.00 2 1.96 0.18 2 X,Tn Bi 3.57 1 3.82 2 X,Tn Je75 4.00 2 1.91 0.17 2 X,Tn Bi 3.97 1 5.26 2 X,Tn Je75 2.00 3 1.98 0.19 2 X,Tn Bi 3.97 1 5.26 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Bi 3.97 1 5.26 2 X,Tn Je75 2.00 3 1.98 0.19 2 X,Tn Bi 3.97 1 5.26 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Bi 3.97 1 5.12 2 X,Tn Je75 4.00 4 2	*	3 * Z=2	2.55 7	0.25 Co	2 f=	X,Tn =3.81E-1	Sc72	9.50 1.00 1.00 1.10 1.20 1.50 2.00 2.00	0 1 1 1 1 1 1 1	1.08 3.26 8.60 6.72 1.20 1.86 2.94 2.94 3.80	0.60 1.70 1.10 0.18 0.21 0.36 0.31 0.41	1 1 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh80 Sh81 Sh80 Sh80 Sh80 Sh80 Sh81 Sh81
8.91 0 1.05 2 X,Tn Je75 6.00 1 5.45 0.05 2 X,Tn De 9.83 0 1.93 2 X,Tn Je75 8.00 1 4.79 0.04 2 X,Tn De 1.23 1 3.51 2 X,Tn Je75 8.10 1 2.69 0.27 2 X,Tn De 1.47 1 4.46 2 X,Tn Je75 1.00 2 3.98 0.05 2 X,Tn De 1.48 1 3.16 2 X,Tn De 1.97 1 5.28 2 X,Tn Je75 1.35 2 3.66 0.02 2 X,Tn De 2.47 1 5.52 2 X,Tn Je75 1.52 2 2.19 0.18 2 X,Tn De 2.48 1 3.89 2 X,Tn De 2.48 1 3.89 2 X,Tn De 3.48 1 5.53 2 X,Tn Je75 4.00 2 2.21 0.20 2 X,Tn Be 3.57 1 3.82 2 X,Tn De 3.57 1 3.82 2 X,Tn De 3.57 1 3.82 2 X,Tn Je75 1.00 2 1.96 0.18 2 X,Tn Be 3.97 1 5.26 2 X,Tn Je75 2.00 3 1.98 0.19 2 X,Tn Be 3.97 1 5.26 2 X,Tn Je75 2.00 3 1.98 0.19 2 X,Tn Be 4.00 4 2.64 0.18 2 X,Tn Be 4.00	*	3 * Z=2	2.55 7	0.25 Co	2 f=	X,Tn =3.81E-1	Sc72	9.50 1.00 1.00 1.10 1.20 1.50 2.00 2.00 2.50	0 1 1 1 1 1 1 1	1.08 3.26 8.60 6.72 1.20 1.86 2.94 2.94 3.80 4.02 3.97	0.60 1.70 1.10 0.18 0.21 0.36 0.31 0.41 0.40	1 1 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	\$h80 \$h80 \$h81 \$h80 \$h80 \$h80 \$h81 \$h80 \$h81
8.91 0 1.05 2 X,Tn Je75 6.00 1 5.24 0.16 2 X,Tn De 9.83 0 1.93 2 X,Tn Je75 8.00 1 4.79 0.04 2 X,Tn De 1.23 1 3.51 2 X,Tn Je75 8.10 1 2.69 0.27 2 X,Tn He 1.47 1 4.46 2 X,Tn Je75 1.00 2 3.98 0.05 2 X,Tn De 1.48 1 3.16 2 X,Tn Po47 1.14 2 2.49 0.25 2 X,Tn He 1.97 1 5.28 2 X,Tn Je75 1.35 2 3.66 0.02 2 X,Tn De 2.47 1 5.52 2 X,Tn Je75 1.52 2 2.19 0.18 2 X,Tn De 2.48 1 3.89 2 X,Tn Po47 3.00 2 2.21 0.20 2 X,Tn Be 2.98 1 5.53 2 X,Tn Je75 4.00 2 2.03 0.18 2 X,Tn Be 3.48 1 5.40 2 X,Tn Je75 5.00 2 1.96 0.18 2 X,Tn Be 3.57 1 3.82 2 X,Tn Po47 6.00 2 1.91 0.17 2 X,Tn Be 3.97 1 5.26 2 X,Tn Je75 2.00 3 1.98 0.19 2 X,Tn Be 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.48 1 4.00 4 2.64 0.18 2 X,Tn Be 4.49 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.48 1 4.00 4 2.64 0.18 2 X,Tn Be 4.49 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Be 4.48 1 4.00 4 2.64 0.18 2 X,Tn Be 4.49 1 5.12 2 X,Tn Be 4.49 1 5.12 2 X,Tn Be 4.40 1 5.12 1 X,Tn Be 4.40 1 5.12 1 X,Tn Be 4.40 1 5.12 1 X,Tn Be 4.40 1 5.40 1 X,	*	3 * Z=2	2.55 7	0.25 Co	2 f=	X,Tn =3.81E-1	Sc72	9.50 1.00 1.00 1.10 1.20 1.50 2.00 2.00 2.50 2.50	0 1 1 1 1 1 1 1 1	1.08 3.26 8.60 6.72 1.20 1.86 2.94 2.94 3.80 4.02 3.97 4.15	0.60 1.70 1.10 0.18 0.21 0.36 0.31 0.41 0.40 0.45 0.40	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	\$h80 \$h80 \$h81 \$h80 \$h80 \$h81 \$h80 \$h81 \$h80 \$h81
9.83 0 1.93 2 X,Tn Je75 8.00 1 4.79 0.04 2 X,Tn Day 1.23 1 3.51 2 X,Tn Je75 8.10 1 2.69 0.27 2 X,Tn He 1.47 1 4.46 2 X,Tn Je75 1.00 2 3.98 0.05 2 X,Tn Day 1.48 1 3.16 2 X,Tn Po47 1.14 2 2.49 0.25 2 X,Tn He 1.97 1 5.28 2 X,Tn Je75 1.35 2 3.66 0.02 2 X,Tn Day 2.47 1 5.52 2 X,Tn Je75 1.52 2 2.19 0.18 2 X,Tn He 2.48 1 3.89 2 X,Tn Po47 3.00 2 2.21 0.20 2 X,Tn Bay 2.98 1 5.53 2 X,Tn Je75 4.00 2 2.03 0.18 2 X,Tn Bay 3.48 1 5.40 2 X,Tn Je75 5.00 2 1.96 0.18 2 X,Tn Bay 3.57 1 3.82 2 X,Tn Po47 6.00 2 1.91 0.17 2 X,Tn Bay 3.97 1 5.26 2 X,Tn Je75 2.00 3 1.98 0.19 2 X,Tn Bay 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn He 3.57 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn Bay 3.97 1 5.26 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn He 3.97 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn	2.00	3 * Z=2 3	2.55 7 2.41	0.25 Co 0.30	2 f= 2	X,Tn =3.81E-1 X,Tn	Sc72 ** Sc72	9.50 1.00 1.00 1.10 1.20 1.50 2.00 2.50 2.50 2.50	0 1 1 1 1 1 1 1 1 1 1	1.08 3.26 8.60 6.72 1.20 1.86 2.94 2.94 3.80 4.02 3.97 4.15 5.51	0.60 1.70 1.10 0.18 0.21 0.36 0.31 0.41 0.45 0.40	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	\$h80 \$h80 \$h81 \$h80 \$h80 \$h81 \$h80 \$h81 \$h80 \$h81 \$h80
1.23 1 3.51 2 X,Tn Je75 8.10 1 2.69 0.27 2 X,Tn Ho 1.47 1 4.46 2 X,Tn Je75 1.00 2 3.98 0.05 2 X,Tn De 1.48 1 3.16 2 X,Tn Po47 1.14 2 2.49 0.25 2 X,Tn Ho 1.97 1 5.28 2 X,Tn Je75 1.35 2 3.66 0.02 2 X,Tn De 2.47 1 5.52 2 X,Tn Je75 1.52 2 2.19 0.18 2 X,Tn Ho 2.48 1 3.89 2 X,Tn Po47 3.00 2 2.21 0.20 2 X,Tn Bo 2.98 1 5.53 2 X,Tn Je75 4.00 2 2.03 0.18 2 X,Tn Bo 3.48 1 5.40 2 X,Tn Je75 5.00 2 1.96	2.00	3 * Z=2 3	2.55 7 2.41	0.25 Co 0.30	2 f= 2	X,Tn =3.81E-1 X,Tn	Sc72 ** Sc72	9.50 1.00 1.00 1.10 1.20 1.50 2.00 2.00 2.50 2.50 2.50 3.00	0 1 1 1 1 1 1 1 1 1 1	1.08 3.26 8.60 6.72 1.20 1.86 2.94 3.94 4.02 3.97 4.15 5.51 5.84	0.60 1.70 1.10 0.18 0.21 0.36 0.31 0.41 0.45 0.45 0.09	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh80 Sh80 Sh81 Sh80 Sh80 Sh81 Sh80 Sh81 Sh80 Sh81
1.47 1 4.46 2 X,Tn Je75 1.00 2 3.98 0.05 2 X,Tn Da 1.48 1 3.16 2 X,Tn Po47 1.14 2 2.49 0.25 2 X,Tn Ht 1.97 1 5.28 2 X,Tn Je75 1.35 2 3.66 0.02 2 X,Tn Da 2.47 1 5.52 2 X,Tn Je75 1.52 2 2.19 0.18 2 X,Tn Ht 2.48 1 3.89 2 X,Tn Po47 3.00 2 2.21 0.20 2 X,Tn Ba 2.98 1 5.53 2 X,Tn Je75 4.00 2 2.03 0.18 2 X,Tn Ba 3.48 1 5.40 2 X,Tn Je75 5.00 2 1.96 0.18 2 X,Tn Ba 3.57 1 3.82 2 X,Tn Je75 2.00 3 1.98	* 2.00 *	3 * Z=2 3 * Z=2	2.55 7 2.41	0.25 Co 0.30	2 f= 2	X,Tn =3.81E-1 X,Tn =4.14E-1	Sc72 ** Sc72	9.50 1.00 1.00 1.10 1.20 1.50 2.00 2.00 2.50 2.50 2.50 3.00 4.00	0 1 1 1 1 1 1 1 1 1 1 1	1.08 3.26 8.60 6.72 1.20 1.86 2.94 3.80 4.02 3.97 4.15 5.51 5.84 5.45	0.60 1.70 1.10 0.18 0.21 0.36 0.31 0.41 0.45 0.45 0.09 0.07	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh80 Sh80 Sh81 Sh80 Sh80 Sh81 Sh80 Sh81 Sh80 Sh81 Sh80 Da72 Da72
1.47 1 4.46 2 X,Tn Je75 1.00 2 3.98 0.05 2 X,Tn De 1.48 1 3.16 2 X,Tn Po47 1.14 2 2.49 0.25 2 X,Tn Ht 1.97 1 5.28 2 X,Tn Je75 1.35 2 3.66 0.02 2 X,Tn De 2.47 1 5.52 2 X,Tn Je75 1.52 2 2.19 0.18 2 X,Tn Ht 2.48 1 3.89 2 X,Tn Po47 3.00 2 2.21 0.20 2 X,Tn Be 2.98 1 5.53 2 X,Tn Je75 4.00 2 2.03 0.18 2 X,Tn Be 3.48 1 5.40 2 X,Tn Je75 5.00 2 1.96 0.18 2 X,Tn Be 3.57 1 3.82 2 X,Tn Je75 2.00 3 1.98	2.00 * 8.91	3 ** Z=2 3 ** Z=2	2.55 7 2.41 8	0.25 Co 0.30	2 f= 2 f= 2	X,Tn =3.81E-1 X,Tn =4.14E-1 X,Tn	Sc72 ** Sc72 ** Je75	9.50 1.00 1.00 1.10 1.20 1.50 2.00 2.50 2.50 2.50 3.00 4.00 6.00	0 1 1 1 1 1 1 1 1 1 1 1 1	1.08 3.26 8.60 6.72 1.20 1.86 2.94 3.80 4.02 3.97 4.15 5.51 5.84 5.45	0.60 1.70 1.10 0.18 0.21 0.36 0.31 0.41 0.45 0.45 0.09 0.07	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh80 Sh80 Sh81 Sh80 Sh80 Sh81 Sh80 Sh81 Sh80 Sh81 Sh80 Da72 Da72
1.97 1 5.28 2 X,Tn Je75 1.35 2 3.66 0.02 2 X,Tn De75 2.47 1 5.52 2 X,Tn Je75 1.52 2 2.19 0.18 2 X,Tn Hu 2.48 1 3.89 2 X,Tn Po47 3.00 2 2.21 0.20 2 X,Tn Be 2.98 1 5.53 2 X,Tn Je75 4.00 2 2.03 0.18 2 X,Tn Be 3.48 1 5.40 2 X,Tn Je75 5.00 2 1.96 0.18 2 X,Tn Be 3.57 1 3.82 2 X,Tn Po47 6.00 2 1.91 0.17 2 X,Tn Be 3.97 1 5.26 2 X,Tn Je75 2.00 3 1.98 0.19 2 X,Tn Hu 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 <td>* 2.00 * 8.91 9.83</td> <td>3 * Z=2 3 * Z=2 0 0</td> <td>2.55 7 2.41 8 1.05 1.93</td> <td>0.25 Co 0.30</td> <td>2 f= 2 f= 2 2</td> <td>X,Tn =3.81E-1 X,Tn =4.14E-1 X,Tn X,Tn</td> <td><pre>sc72 ** sc72 ** Je75 Je75</pre></td> <td>9.50 1.00 1.10 1.20 1.50 2.00 2.50 2.50 2.50 2.50 4.00 6.00 8.00</td> <td>0 1 1 1 1 1 1 1 1 1 1 1 1 1</td> <td>1.08 3.26 8.60 6.72 1.20 1.86 2.94 3.80 4.02 3.97 4.15 5.51 5.54 5.24 4.79</td> <td>0.60 1.70 1.10 0.18 0.21 0.36 0.31 0.41 0.45 0.49 0.09 0.07 0.05 0.16</td> <td>1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2</td> <td>X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn</td> <td>Sh80 Sh80 Sh80 Sh80 Sh80 Sh81 Sh80 Sh81 Sh80 Da72 Da72 Da72</td>	* 2.00 * 8.91 9.83	3 * Z=2 3 * Z=2 0 0	2.55 7 2.41 8 1.05 1.93	0.25 Co 0.30	2 f= 2 f= 2 2	X,Tn =3.81E-1 X,Tn =4.14E-1 X,Tn X,Tn	<pre>sc72 ** sc72 ** Je75 Je75</pre>	9.50 1.00 1.10 1.20 1.50 2.00 2.50 2.50 2.50 2.50 4.00 6.00 8.00	0 1 1 1 1 1 1 1 1 1 1 1 1 1	1.08 3.26 8.60 6.72 1.20 1.86 2.94 3.80 4.02 3.97 4.15 5.51 5.54 5.24 4.79	0.60 1.70 1.10 0.18 0.21 0.36 0.31 0.41 0.45 0.49 0.09 0.07 0.05 0.16	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh80 Sh80 Sh80 Sh80 Sh80 Sh81 Sh80 Sh81 Sh80 Da72 Da72 Da72
1.97 1 5.28 2 X,Tn Je75 1.35 2 3.66 0.02 2 X,Tn De75 2.47 1 5.52 2 X,Tn Je75 1.52 2 2.19 0.18 2 X,Tn Hu 2.48 1 3.89 2 X,Tn Po47 3.00 2 2.21 0.20 2 X,Tn Be 2.98 1 5.53 2 X,Tn Je75 4.00 2 2.03 0.18 2 X,Tn Be 3.48 1 5.40 2 X,Tn Je75 5.00 2 1.96 0.18 2 X,Tn Be 3.57 1 3.82 2 X,Tn Po47 6.00 2 1.91 0.17 2 X,Tn Be 3.97 1 5.26 2 X,Tn Je75 2.00 3 1.98 0.19 2 X,Tn Hu 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 <td>2.00 * 8.91 9.83 1.23</td> <td>3 ** Z=2 3 ** Z=2 0 0 1</td> <td>2.55 7 2.41 8 1.05 1.93 3.51</td> <td>0.25 Co 0.30</td> <td>2 f= 2 f= 2 2 2</td> <td>X,Tn =3.81E-1 X,Tn =4.14E-1 X,Tn X,Tn X,Tn X,Tn</td> <td><pre>\$c72 ** \$c72 ** Je75 Je75 Je75</pre></td> <td>9.50 1.00 1.10 1.20 1.50 2.00 2.50 2.50 2.50 3.00 4.00 6.00 8.00</td> <td>0 1 1 1 1 1 1 1 1 1 1 1 1 1 1</td> <td>1.08 3.26 8.60 6.72 1.20 1.86 2.94 3.80 4.02 3.97 4.15 5.51 5.54 5.24 4.79 2.69</td> <td>0.60 1.70 1.10 0.18 0.21 0.36 0.31 0.41 0.40 0.45 0.09 0.07 0.05 0.16 0.04</td> <td>1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2</td> <td>X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn</td> <td>Sh80 Sh80 Sh81 Sh80 Sh81 Sh80 Sh81 Sh80 Sh81 Sh80 Da72 Da72 Da72</td>	2.00 * 8.91 9.83 1.23	3 ** Z=2 3 ** Z=2 0 0 1	2.55 7 2.41 8 1.05 1.93 3.51	0.25 Co 0.30	2 f= 2 f= 2 2 2	X,Tn =3.81E-1 X,Tn =4.14E-1 X,Tn X,Tn X,Tn X,Tn	<pre>\$c72 ** \$c72 ** Je75 Je75 Je75</pre>	9.50 1.00 1.10 1.20 1.50 2.00 2.50 2.50 2.50 3.00 4.00 6.00 8.00	0 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.08 3.26 8.60 6.72 1.20 1.86 2.94 3.80 4.02 3.97 4.15 5.51 5.54 5.24 4.79 2.69	0.60 1.70 1.10 0.18 0.21 0.36 0.31 0.41 0.40 0.45 0.09 0.07 0.05 0.16 0.04	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh80 Sh80 Sh81 Sh80 Sh81 Sh80 Sh81 Sh80 Sh81 Sh80 Da72 Da72 Da72
2.47 1 5.52 2 X,Tn Je75 1.52 2 2.19 0.18 2 X,Tn Ht 2.48 1 3.89 2 X,Tn Po47 3.00 2 2.21 0.20 2 X,Tn Be 2.98 1 5.53 2 X,Tn Je75 4.00 2 2.03 0.18 2 X,Tn Be 3.48 1 5.40 2 X,Tn Je75 5.00 2 1.96 0.18 2 X,Tn Be 3.57 1 3.82 2 X,Tn Po47 6.00 2 1.91 0.17 2 X,Tn Be 3.97 1 5.26 2 X,Tn Je75 2.00 3 1.98 0.19 2 X,Tn H 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn H	* 8.91 9.83 1.23 1.47 1.48	3 ** Z=2 3 ** Z=2 0 0 1 1	2.55 7 2.41 8 1.05 1.93 3.51 4.46 3.16	0.25 Co 0.30	2 f= 2 f= 2 2 2 2 2	X,Tn =3.81E-1 X,Tn =4.14E-1 X,Tn X,Tn X,Tn X,Tn X,Tn	<pre>\$c72 ** \$c72 ** Je75 Je75 Je75 Je75 Je75</pre>	9.50 1.00 1.00 1.10 1.20 1.50 2.00 2.50 2.50 2.50 3.00 4.00 6.00 8.10 1.00	0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.08 3.26 8.60 6.72 1.20 1.86 2.94 3.80 4.02 3.97 4.15 5.51 5.45 5.45 4.79 2.69 3.98	0.60 1.70 1.10 0.18 0.21 0.36 0.31 0.41 0.45 0.40 0.09 0.07 0.05 0.16 0.27 0.05	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh80 Sh80 Sh81 Sh80 Sh81 Sh80 Sh81 Sh80 Da72 Da72 Da72 Da72 Hu72
2.48 1 3.89 2 X,Tn Po47 3.00 2 2.21 0.20 2 X,Tn Be 2.98 1 5.53 2 X,Tn Je75 4.00 2 2.03 0.18 2 X,Tn Be 3.48 1 5.40 2 X,Tn Je75 5.00 2 1.96 0.18 2 X,Tn Be 3.57 1 3.82 2 X,Tn Po47 6.00 2 1.91 0.17 2 X,Tn Be 3.97 1 5.26 2 X,Tn Je75 2.00 3 1.98 0.19 2 X,Tn Se 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn H	* 8.91 9.83 1.23 1.47 1.48 1.97	3 ** Z=2 3 ** Z=2 0 0 1 1	2.55 7 2.41 8 1.05 1.93 3.51 4.46 3.16 5.28	0.25 Co 0.30	2 f= 2 f= 2 2 2 2 2 2 2	X,Tn =3.81E-1 X,Tn =4.14E-1 X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sc72 ** Sc72 ** Je75 Je75 Je75 Je75 Po47	9.50 1.00 1.00 1.10 1.20 1.50 2.00 2.50 2.50 2.50 3.00 4.00 6.00 8.10 1.14 1.35	0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2	1.08 3.26 8.60 6.72 1.20 1.86 2.94 3.97 4.15 5.45 5.45 5.45 5.24 4.79 2.69 8 2.49 3.66	0.60 1.70 1.10 0.18 0.21 0.36 0.31 0.41 0.45 0.40 0.09 0.07 0.05 0.16 0.27 0.05 0.25	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh80 Sh80 Sh80 Sh80 Sh80 Sh81 Sh80 Sh81 Sh80 Da72 Da72 Da72 Da72 Da72 Da72
2.98 1 5.53 2 X,Tn Je75 4.00 2 2.03 0.18 2 X,Tn Be 3.48 1 5.40 2 X,Tn Je75 5.00 2 1.96 0.18 2 X,Tn Be 3.57 1 3.82 2 X,Tn Po47 6.00 2 1.91 0.17 2 X,Tn Be 3.97 1 5.26 2 X,Tn Je75 2.00 3 1.98 0.19 2 X,Tn Se 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn H	* 8.91 9.83 1.23 1.47 1.48 1.97 2.47	3 ** Z=2 3 ** Z=2 0 0 1 1 1	2.55 7 2.41 8 1.05 1.93 3.51 4.46 3.16 5.28	0.25 Co 0.30	2 f= 2 f= 2 2 2 2 2 2 2 2	X,Tn =3.81E-1 X,Tn =4.14E-1 X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sc72 ** Sc72 ** Je75 Je75 Je75 Je75 Je75 Je75 Po47 Je75	9.50 1.00 1.10 1.20 1.50 2.00 2.50 2.50 3.00 4.00 6.00 8.00 8.10 1.35 1.35	0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2	1.08 3.26 8.60 6.72 1.20 1.86 2.94 3.97 4.15 5.51 5.45 5.24 4.79 2.69 2.69 2.49 3.66 2.19	0.60 1.70 1.10 0.18 0.21 0.36 0.31 0.41 0.45 0.40 0.09 0.07 0.05 0.16 0.27 0.05 0.25 0.02	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh80 Sh80 Sh80 Sh80 Sh80 Sh81 Sh80 Sh81 Sh80 Da72 Da72 Da72 Da72 Da72 Hu72 Hu72
3.48 1 5.40 2 X,Tn Je75 5.00 2 1.96 0.18 2 X,Tn B 3.57 1 3.82 2 X,Tn Po47 6.00 2 1.91 0.17 2 X,Tn B 3.97 1 5.26 2 X,Tn Je75 2.00 3 1.98 0.19 2 X,Tn S 4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn H	* 2.00 * 8.91 9.83 1.23 1.47 1.48 1.97 2.47 2.48	3 * Z=2 3 * Z=2 0 0 1 1 1	2.55 7 2.41 8 1.05 1.93 3.51 4.46 5.28 5.52 3.89	0.25 Co 0.30	2 f= 2 f= 2 2 2 2 2 2 2 2 2 2	X,Tn =3.81E-1 X,Tn =4.14E-1 X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sc72 ** Sc72 ** Je75 Je75 Je75 Je75 Je75 Po47 Je75 Po47	9.50 1.00 1.00 1.10 1.20 1.50 2.00 2.50 2.50 2.50 3.00 4.00 6.00 8.10 1.00 1.14 1.35 1.52 3.00	0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2	1.08 3.26 8.60 6.72 1.20 1.86 2.94 3.97 4.15 5.51 5.45 5.24 4.79 2.69 2.69 2.49 3.66 2.19	0.60 1.70 1.10 0.18 0.21 0.36 0.31 0.41 0.45 0.40 0.09 0.07 0.05 0.04 0.27 0.05 0.25 0.02	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh80 Sh80 Sh80 Sh80 Sh80 Sh81 Sh80 Sh81 Sh80 Da72 Da72 Da72 Da72 Da72 Da72
3.57 1 3.82 2 X,Tn Po47 6.00 2 1.91 0.17 2 X,Tn Boundary 1 5.26 2 X,Tn Je75 2.00 3 1.98 0.19 2 X,Tn South 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn House 1 5.12 2 X,	8.91 9.83 1.23 1.47 1.48 1.97 2.48 2.98	3 * Z=2 3 * Z=2 0 0 1 1 1 1	2.55 7 2.41 8 1.05 1.93 3.51 4.46 3.16 5.28 5.52 3.89 5.53	0.25 Co 0.30	2 f= 2 f= 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn =3.81E-1 X,Tn =4.14E-1 X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sc72 ** Sc72 ** Je75 Je75 Je75 Je75 Je75 Po47 Je75 Po47	9.50 1.00 1.10 1.20 1.50 2.00 2.50 2.50 2.50 3.00 4.00 6.00 8.10 1.00 1.14 1.35 1.52 3.00 4.00	0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2	1.08 3.26 8.60 6.72 1.20 1.86 2.94 3.97 4.15 5.51 5.45 5.24 4.79 2.69 2.69 3.66 2.19 2.21	0.60 1.70 1.10 0.18 0.21 0.36 0.31 0.41 0.45 0.09 0.07 0.05 0.16 0.27 0.05 0.25 0.25 0.18	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh80 Sh80 Sh80 Sh80 Sh80 Sh81 Sh80 Sh81 Sh80 Da72 Da72 Da72 Da72 Da72 Da72 Hu72 Da72
4.47 1 5.12 2 X,Tn Je75 4.00 4 2.64 0.18 2 X,Tn H	8.91 9.83 1.23 1.47 1.48 1.97 2.47 2.48 2.98 3.48	3 ** Z=2 3 ** Z=2 0 0 1 1 1 1 1	2.55 7 2.41 8 1.05 1.93 3.51 4.46 3.16 5.28 5.52 3.89 5.53 5.40	0.25 Co 0.30	2 f= 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn =3.81E-1 X,Tn =4.14E-1 X,Tn	** Sc72 ** Je75 Je75 Je75 Je75 Je75 Je75 Je75 Je7	9.50 1.00 1.10 1.20 1.50 2.00 2.50 2.50 2.50 3.00 4.00 6.00 8.10 1.04 1.35 1.52 3.00 4.00 5.00	0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2	1.08 3.26 8.60 6.72 1.20 1.86 2.94 3.97 4.15 5.51 5.84 5.45 5.24 4.79 2.69 3.98 2.49 2.19 2.21 2.03 1.96	0.60 1.70 1.10 0.18 0.21 0.36 0.31 0.41 0.45 0.09 0.07 0.05 0.16 0.27 0.05 0.25 0.25 0.18	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh80 Sh80 Sh80 Sh80 Sh80 Sh81 Sh80 Sh81 Sh80 Da72 Da72 Da72 Da72 Da72 Da72 Da72 Be78 Be78
	8.91 9.83 1.23 1.47 1.48 1.97 2.47 2.48 2.98 3.48 3.57	3 ** Z=2 3 ** Z=2 0 0 1 1 1 1 1 1	2.55 7 2.41 8 1.05 1.93 3.51 4.46 3.16 5.28 5.52 3.89 5.53 5.40 3.82	0.25 Co 0.30	2 f= 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn =3.81E-1 X,Tn =4.14E-1 X,Tn	** Sc72 ** Je75 Je75 Je75 Je75 Je75 Je75 Je75 Je7	9.50 1.00 1.10 1.20 1.50 2.00 2.50 2.50 2.50 3.00 4.00 6.00 8.10 1.04 1.35 1.52 3.00 4.00 6.00	0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2	1.08 3.26 8.60 6.72 1.20 1.86 2.94 3.80 4.02 3.97 4.15 5.51 5.54 5.42 4.79 2.69 8.69 2.19 2.21 2.21 1.96 1.91	0.60 1.70 1.10 0.18 0.21 0.36 0.31 0.41 0.45 0.40 0.09 0.07 0.05 0.16 0.04 0.27 0.05 0.25 0.25 0.18 0.18	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh80 Sh80 Sh80 Sh80 Sh81 Sh80 Sh81 Sh80 Da72 Da72 Da72 Da72 Da72 Da72 Be78 Be78
4.62 1 3.63 2 X,Tn Po47 1.50 5 4.30 0.68 2 X,Tn I	8.91 9.83 1.23 1.47 1.48 1.97 2.47 2.48 2.98 3.57 3.97	3 ** Z=2 3 ** Z=2 0 0 1 1 1 1 1 1	2.55 7 2.41 8 1.05 1.93 3.51 4.46 3.16 5.28 5.52 3.89 5.53 5.40 3.82 5.26	0.25 Co 0.30	2 f= 2 22222222222222222222222222222222	X,Tn =3.81E-1 X,Tn =4.14E-1 X,Tn X,Tn	** Sc72 ** Sc72 ** Je75 Je75 Je75 Je75 Je75 Je75 Je75 Po47 Je75 Je75 Po47 Je75	9.50 1.00 1.10 1.20 1.50 2.00 2.50 2.50 2.50 3.00 4.00 6.00 8.10 1.14 1.35 1.52 3.00 4.00 6.00 2.00	0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2	1.08 3.26 8.60 6.72 1.20 1.86 2.94 3.97 4.02 3.97 4.15 5.42 4.79 2.69 2.21 2.03 1.98	0.60 1.70 1.10 0.18 0.21 0.36 0.31 0.41 0.45 0.09 0.07 0.05 0.16 0.27 0.05 0.25 0.25 0.25 0.18 0.17 0.19	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh80 Sh80 Sh80 Sh80 Sh81 Sh80 Sh81 Sh80 Sh81 Sh80 Da72 Da72 Da72 Da72 Da72 Ea72 Da72 Se78 Be78 Be78 Sc72
	* 2.00 * 8.91 9.83 1.23 1.47 1.48 1.97 2.47 2.48 3.57 3.97 4.47	3 ** Z=2 3 ** Z=2 0 0 1 1 1 1 1 1 1	2.55 7 2.41 8 1.05 1.93 3.51 4.46 3.16 5.28 5.52 3.89 5.53 5.40 3.82 5.26 5.12	0.25 Co 0.30	2 f= 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn =3.81E-1	** Sc72 ** Sc72 ** Je75 Je75 Je75 Je75 Po47 Je75 Je75 Je75 Je75 Je75 Je75 Je75 Je7	9.50 1.00 1.10 1.20 1.50 2.00 2.50 2.50 2.50 3.00 4.00 6.00 8.10 1.14 1.35 1.52 3.00 4.00 5.00 6.00 6.00 6.00 6.00 6.00	0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2	1.08 3.26 8.60 6.72 1.86 2.94 3.97 4.15 5.84 5.54 4.02 3.97 4.15 5.42 4.02 2.98 9.02 3.97 4.15 5.42 4.02 2.03 6.19 2.03 6.19 2.03 6.19 2.03 6.19 2.03 6.19 2.03 6.19 2.03 6.19 2.03 6.19 2.03 6.19 2.03 6.19 2.03 6.19 2.03 6.19 2.03 6.19 2.03 6.19 2.03 6.19 2.03 6.19 6.19 6.19 6.19 6.19 6.19 6.19 6.19	0.60 1.70 1.10 0.18 0.21 0.36 0.31 0.41 0.45 0.09 0.07 0.05 0.16 0.27 0.05 0.25 0.18 0.20 0.18 0.19	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh80 Sh80 Sh80 Sh80 Sh81 Sh80 Sh81 Sh80 Da72 Da72 Da72 Da72 Da72 Da72 Be78 Be78

TABLE. Cross Sections for *K*-Shell Ionization by Electron Impact See page 356 for Explanation of Table

	GY	CROSS	SECT	ION	TYPE	REF.	ENERG	Y	CROSS	SECTI	ON	ТҮРЕ	REF.
*	* Z=2	9	Cu	f=	4.45E-1	* *	* *	Z=3	4	Se	f=	5.96E-1	**
1.50	5	3.93	0.05	2	X,Tn	Mi70	5.00	2	1.20	0.11	2	X,Tn	Ki81
3.00	5	4.44	0.05	2	X,Tn	Mi70	5.00	2	1.33	0.12	2	X,Tn	Be78
5.00	5	4.72	0.06	2	X,Tn	Mi70	6.00	2	1.17	0.11	2	X,Tn	Ki81
7.00	5	4.72	0.07	2	X,Tn	Mi70	6.00	2	1.30	0.12	2	X,Tn	Be78
9.00	5	4.74	0.07	2	X,Tn	Mi70	2.00	3	1.12	0.12	2	X,Tn	Sc72
3.00	5	4.61	0.30	2	X,Tn	Ge82	7.00	4	2.69	0.40	2	X,Tn	Is77
1.50 2.00	6 6	5.93 6.29	0.41 0.41	2 2	X,Tn X,Tn	Ge82 Ge82	1.50	5	2.74	0.41	2	X,Tn	Is77
 Graph ioniz	-	resente cross	d in R	ef. F	i67 for Cu by 50	K-shell	-	tion	cross			i67 for Se by 50	
Graph	is p	resente			a87 for Cu by 35		* *	Z=3	5	Br	f≈	6.22E-1	**
	ron i		5600101	ıı OI	ca by 31	o nev	2.00	3	1.12	0.12	2	X,Tn	Sc72
*	* Z=3	0	Zn	f=	4.79E-1	**	* *	Z=3	6	Kr	f=	6.46E-1	**
2.00	3	1.83	0.21	2	X.Tn	Sc72	2.00	4	1.47	0.06	2	X,G	Ho79
1.50	5	3.96	0.59	2	X, Tn	Is77	3.00	4	1.54	0.06	2	X,G	Ho79
							4.00	4	1.60	0.06	2	X,G	Ho79
raph	ie n	resente	d in R	ef W	a87 for	K-shell	5.00	4	1.68	0.07	2	X G	Ho79
ioniz	_	cross			Zn by 35		6.00	4	1.73	0.07	2	X,G	Но79
*	* Z=3	2	Ge	f=	5.40E-1	**	**	z=3	7	Rb	f≠	6.69E-1	**
		_		_			2.00	3	1.02	0.10	2	X, Tn	Sc72
1.12	1	4.76	0.98	0	X.Tn	Sh81							
1 20	1		0.59	1	X.Tn	Sh81							
1.20		3.73											
	1	3.73 1.36	0.14	2	X.Tn	Sh81	* 1	: Z=3	8	Sr	£≃	6.91E-1	* *
1.50					X,Tn X,Tn	Sh81 Sh81	* 1	° Z=3	8	Sr	f≃	6.91E-1	* *
1.50 2.00	1	1.36	0.14	2	X,Tn X,Tn		2.00	· Z=3	8 8.96	Sr 0.91	f = 1	6.91E-1 X,Tn	
1.50 2.00 2.50 2.00	1 1	1.36 2.10	0.14 0.22	2 2 2 2	X,Tn	Sh81		3 5	8.96 2.07		1 2		Sc72
1.50 2.00 2.50 2.00 3.50	1 1 1 4	1.36 2.10 2.37 1.94 2.10	0.14 0.22 0.24 0.16 0.17	2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn	Sh81 Sh81 Ho79 Ho79	2.00 1.50 3.00	3 5 5	8.96 2.07 2.15	0.91 0.04 0.03	1 2 2	X,Tn X,Tn X,Tn	Sc72 Mi70 Mi70
1.50 2.00 2.50 2.00 3.50 5.00	1 1 4 4	1.36 2.10 2.37 1.94 2.10 2.18	0.14 0.22 0.24 0.16 0.17 0.17	2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn	Sh81 Sh81 Ho79 Ho79 Ho79	2.00 1.50 3.00 5.00	3 5 5 5	8.96 2.07 2.15 2.35	0.91 0.04 0.03 0.04	1 2 2 2	X,Tn X,Tn X,Tn X,Tn	Sc72 Mi70 Mi70 Mi70
1.50 2.00 2.50 2.00 3.50 5.00	1 1 1 4	1.36 2.10 2.37 1.94 2.10	0.14 0.22 0.24 0.16 0.17	2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn	Sh81 Sh81 Ho79 Ho79	2.00 1.50 3.00 5.00 7.00	3 5 5 5 5	8.96 2.07 2.15 2.35 2.52	0.91 0.04 0.03 0.04 0.04	1 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn	Sc72 Mi70 Mi70 Mi70 Mi70
1.50 2.00 2.50 2.00 3.50 5.00 6.00	1 1 4 4 4 4 . is p	1.36 2.10 2.37 1.94 2.10 2.18 2.24 	0.14 0.22 0.24 0.16 0.17 0.17 0.18	2 2 2 2 2 2 2 	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh81 Sh81 Ho79 Ho79 Ho79 Ho79	2.00 1.50 3.00 5.00	3 5 5 5	8.96 2.07 2.15 2.35	0.91 0.04 0.03 0.04	1 2 2 2	X,Tn X,Tn X,Tn X,Tn	** Sc72 Mi70 Mi70 Mi70 Mi70
ioniz	1 1 4 4 4 is p	1.36 2.10 2.37 1.94 2.10 2.18 2.24 	0.14 0.22 0.24 0.16 0.17 0.17 0.18	2 2 2 2 2 2 2 	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh81 Sh81 Ho79 Ho79 Ho79 Ho79	2.00 1.50 3.00 5.00 7.00 9.00	3 5 5 5 5	8.96 2.07 2.15 2.35 2.52 2.55	0.91 0.04 0.03 0.04 0.04	1 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn	Sc72 Mi70 Mi70 Mi70 Mi70
1.50 2.00 2.50 2.00 3.50 5.00 6.00 Graph	1 1 4 4 4 is p	1.36 2.10 2.37 1.94 2.10 2.18 2.24 	0.14 0.22 0.24 0.16 0.17 0.17 0.18	2 2 2 2 2 2 2 	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh81 Sh81 Ho79 Ho79 Ho79 Ho79	2.00 1.50 3.00 5.00 7.00 9.00	3 5 5 5 5 5 5	8.96 2.07 2.15 2.35 2.52 2.55	0.91 0.04 0.03 0.04 0.04	1 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sc72 Mi70 Mi70 Mi70 Mi70
1.50 2.00 2.50 2.50 3.50 5.00 6.00 	1 1 4 4 4 is p	1.36 2.10 2.37 1.94 2.10 2.18 2.24 	0.14 0.22 0.24 0.16 0.17 0.17 0.18	2 2 2 2 2 2 2 2 ef. W	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh81 Sh81 Ho79 Ho79 Ho79 K-shell	2.00 1.50 3.00 5.00 7.00 9.00	3 5 5 5 5 5 5	8.96 2.07 2.15 2.35 2.52 2.55	0.91 0.04 0.03 0.04 0.04	1 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sc72 Mi70 Mi70 Mi70 Mi70
1.50 2.00 2.50 2.50 3.50 5.00 6.00 	1 1 4 4 4 is pation	1.36 2.10 2.37 1.94 2.10 2.18 2.24 	0.14 0.22 0.24 0.16 0.17 0.17 0.18	2 2 2 2 2 2 2 ef. W	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn 	Sh81 Sh81 Ho79 Ho79 Ho79 K-shell	2.00 1.50 3.00 5.00 7.00 9.00	3 5 5 5 5 5 5 5 5 2	8.96 2.07 2.15 2.35 2.52 2.55	0.91 0.04 0.03 0.04 0.04 0.04	1 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sc72 Mi70 Mi70 Mi70 Mi70 Mi70
1.50 2.00 2.50 2.50 2.00 3.50 5.00 5.00 Graph ioniz	1 1 4 4 4 is pation	1.36 2.10 2.37 1.94 2.10 2.18 2.24 	0.14 0.22 0.24 0.16 0.17 0.17 0.18	2 2 2 2 2 2 2 ef. W	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn 	Sh81 Sh81 Ho79 Ho79 Ho79 K-shell	2.00 1.50 3.00 5.00 7.00 9.00	3 5 5 5 5 5 5 5 2 2 2 2	8.96 2.07 2.15 2.35 2.52 2.55	0.91 0.04 0.03 0.04 0.04 0.04	1 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sc72 Mi70 Mi70 Mi70 Mi70 Mi70
1.50 2.00 2.50 2.50 2.00 3.50 5.00 5.00 Graph ioniz	1 1 4 4 4 4 	1.36 2.10 2.37 1.94 2.10 2.18 2.24 	0.14 0.22 0.24 0.16 0.17 0.17 0.18 	2 2 2 2 2 2 ef. W	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn Ge by 35	Sh81 Sh81 Ho79 Ho79 Ho79 K-shell	2.00 1.50 3.00 5.00 7.00 9.00	3 5 5 5 5 5 5 5 2 2 4	8.96 2.07 2.15 2.35 2.52 2.55 9	0.91 0.04 0.03 0.04 0.04 0.04 Y 0.18 0.19 0.14	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sc72 Mi70 Mi70 Mi70 Mi70 Mi70 **
1.50 2.00 2.50 2.50 2.00 3.50 5.00 6.00 	1 1 4 4 4 4 	1.36 2.10 2.37 1.94 2.10 2.18 2.24 	0.14 0.22 0.24 0.16 0.17 0.18 ed in R sectio	2 2 2 2 2 2 2 ef. W n of	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn Ge by 35 5.67E-1 X,Tn	Sh81 Sh81 Ho79 Ho79 Ho79 K-shell SO MeV	2.00 1.50 3.00 5.00 7.00 9.00 ***	3 5 5 5 5 5 5 5 5 2 2 4 4	8.96 2.07 2.15 2.35 2.52 2.55 9 0.73 0.76 1.38 1.89	0.91 0.04 0.03 0.04 0.04 0.04 Y 0.18 0.19 0.14 0.28	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sc72 Mi70 Mi70 Mi70 Mi70 Mi70 ** Se74 Se74 Ho79 Is77
1.50 2.00 2.50 2.50 2.00 3.50 6.00 	1 1 4 4 4 4 	1.36 2.10 2.37 1.94 2.10 2.18 2.24 	0.14 0.22 0.24 0.16 0.17 0.17 0.18 	2 2 2 2 2 2 2 ef. W n of	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn Ge by 35	Sh81 Sh81 Ho79 Ho79 Ho79 K-shell SO MeV	2.00 1.50 3.00 5.00 7.00 9.00 *** 4.90 6.70 5.00 7.00 1.50 2.70	3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	8.96 2.07 2.15 2.35 2.52 2.55 9 0.73 0.76 1.38 1.89 1.87 2.05	0.91 0.04 0.03 0.04 0.04 0.04 7 0.18 0.19 0.14 0.28 0.28 0.31	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sc72 Mi70 Mi70 Mi70 Mi70 ** Se74 Se74 Ho79 Is77 Is77
1.50 2.00 2.50 2.50 2.00 3.50 6.00 Graph ioniz elect	1 1 1 4 4 4 4 	1.36 2.10 2.37 1.94 2.10 2.18 2.24 	0.14 0.22 0.24 0.16 0.17 0.18 ed in R sectio	2 2 2 2 2 2 2 2 2 7 ef. W	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn 	Sh81 Sh81 Ho79 Ho79 Ho79 Formal State of the	2.00 1.50 3.00 5.00 7.00 9.00 *** 4.90 6.70 5.00 7.00 1.50 2.70 	3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	8.96 2.07 2.15 2.35 2.52 2.55 9 0.73 0.76 1.38 1.89 1.87 2.05	0.91 0.04 0.03 0.04 0.04 0.04 7 0.18 0.19 0.14 0.28 0.28 0.31	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sc72 Mi70 Mi70 Mi70 Mi70 ** Se74 Ho79 Is77 Is77
1.50 2.00 2.50 2.50 2.00 3.50 6.00 	1 1 1 4 4 4 4 	1.36 2.10 2.37 1.94 2.10 2.18 2.24 	0.14 0.22 0.24 0.16 0.17 0.18 ed in R sectio	2 2 2 2 2 2 ef. W n of f= 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn Ge by 35 5.67E-1 X,Tn	Sh81 Sh81 Ho79 Ho79 Ho79 K-shell SO MeV	2.00 1.50 3.00 5.00 7.00 9.00 4.90 6.70 5.00 7.00 1.50 2.70 	3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	8.96 2.07 2.15 2.35 2.52 2.55 9 0.73 0.76 1.38 1.89 1.87 2.05	0.91 0.04 0.03 0.04 0.04 0.04 7 0.18 0.19 0.14 0.28 0.31	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sc72 Mi70 Mi70 Mi70 Mi70 ** Se74 Ho79 Is77 Is77
1.50 2.00 2.50 2.50 2.00 3.50 6.00 Graph ioniz elect * 2.00	1 1 1 4 4 4 4 	1.36 2.10 2.37 1.94 2.10 2.18 2.24 	0.14 0.22 0.24 0.16 0.17 0.18 d in R sectio	2 2 2 2 2 2 ef. W n of f= 2 f= 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn 387 for Ge by 35 5.67E-1 X,Tn 5.96E-1 X,Tn	Sh81 Sh81 Ho79 Ho79 Ho79 Ho79 K-shell 50 MeV ** Sc72 ** Ki81 Ki81	2.00 1.50 3.00 5.00 7.00 9.00 4.90 6.70 5.00 7.00 1.50 2.70 	3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	8.96 2.07 2.15 2.35 2.52 2.55 9 0.73 0.76 1.38 1.89 1.87 2.05	0.91 0.04 0.03 0.04 0.04 0.04 7 0.18 0.19 0.14 0.28 0.31	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sc72 Mi70 Mi70 Mi70 Mi70 ** Se74 Ho79 Is77 Is77 Is77
2.00 2.50 2.50 2.00 3.50 5.00 5.00 5.00 5.00 4 2.00	1 1 4 4 4 4 	1.36 2.10 2.37 1.94 2.10 2.18 2.24 	0.14 0.22 0.24 0.16 0.17 0.18 	2 2 2 2 2 2 ef. W n of f= 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn 387 for Ge by 35 5.67E-1 X,Tn 5.96E-1 X,Tn	Sh81 Sh81 Ho79 Ho79 Ho79 Ho79 So MeV	2.00 1.50 3.00 5.00 7.00 9.00 4.90 6.70 5.00 7.00 1.50 2.70 	3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	8.96 2.07 2.15 2.35 2.52 2.55 9 0.73 0.76 1.38 1.89 1.87 2.05	0.91 0.04 0.03 0.04 0.04 0.04 7 0.18 0.19 0.14 0.28 0.31	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sc72 Mi70 Mi70 Mi70 Mi70 ** Se74 Se74 Ho79 Is71 Is71
1.50 2.00 2.50 2.50 2.00 3.50 6.00 	1 1 4 4 4 4 	1.36 2.10 2.37 1.94 2.10 2.18 2.24 	0.14 0.22 0.24 0.16 0.17 0.18 	2 2 2 2 2 2 ef. W n of f= 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn 	Sh81 Sh81 Ho79 Ho79 Ho79 Ho79 K-shell 60 MeV ** Sc72 **	2.00 1.50 3.00 5.00 7.00 9.00 4.90 6.70 5.00 7.00 1.50 2.70 Graph ioniz MeV e	3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	8.96 2.07 2.15 2.35 2.52 2.55 9 0.73 0.76 1.38 1.87 2.05 2.05 2.05 2.05 2.05	0.91 0.04 0.03 0.04 0.04 0.04 7 0.18 0.19 0.14 0.28 0.31	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 7 6 6 7	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sc72 Mi70 Mi70 Mi70 Mi70 Mi70 ** Se74 Ho79 Is7 Is7 K-she1
1.50 2.00 2.50 2.50 3.50 5.00 6.00 	1 1 4 4 4 4 	1.36 2.10 2.37 1.94 2.10 2.18 2.24 	0.14 0.22 0.24 0.16 0.17 0.18 	2 2 2 2 2 2 ef. W n of f= 2 2 2 2 2	X,Tn X,Tn X,Tn X,Tn X,Tn 	Sh81 Sh81 Ho79 Ho79 Ho79 Ho79 K-shell 60 MeV ** Sc72 ** Ki81 Ki81 Ki81 Ki81	2.00 1.50 3.00 5.00 7.00 9.00 4.90 6.70 5.00 7.00 1.50 2.70 Graph ioniz MeV e	3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	8.96 2.07 2.15 2.35 2.52 2.55 9 0.73 0.76 1.38 1.87 2.05 2.05 2.05 2.05 2.05	0.91 0.04 0.03 0.04 0.04 0.04 7 0.18 0.19 0.14 0.28 0.31 	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 7 6 6 7	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sc72 Mi70 Mi70 Mi70 Mi70 Mi70 ** Se74 Ho79 Is7 Is7 K-she1

TABLE. Cross Sections for K-Shell Ionization by Electron Impact See page 356 for Explanation of Table

	GY 	CROSS	SECT	ON 	TYPE	REF.	ENERGY	. -	CROSS	SECTI	ON	TYPE	REF.
*	* Z=4	0	Zr	f≂	7.30E-1	**	**	Z= 4 7		Ag	f =	8.30E-1	**
5.30	2	1.15	0.08	2	X,Tn	Ha64	2.00	2	5.61	0.67	1	X, Tn	Ki81
8.20	2	1.25	0.09	2	X,Tn	Ha64	2.00	2	5.10	0.48	1	X,Tn	Re66
.13	3	1.15	0.09	2	X,Tn	Ha64	2.50	2	5.10	0.48	1	X,Tn	Re66
. 44	3	0.99	0.10	2	X,Tn	Ha64	3.00	2	5.41	0.65	1	X,Tn	Ki8
							3.00	2	4.72	0.48	1	X,Tn	Re6
							3.00	2	5.99	0.54	1	X,Tn	Ri7
*	* Z=4.	2	Mo	f≖	7.64E-1	* *	3.00	2	5.59	0.56	1	X,Tn	Sc7
							4.00	2	5.21	0.62	1	X,Tn	Ki8:
9.00	4	1.48	0.22	2	X,Tn	Is77	4.00	2	5.78	0.52	1	X,Tn	Ri7
L.50	5	1.41	0.02	2	X,Tn	Mi70	4.00	2	5.30	0.53	1	X,Tn	Sc7(
3.00	5	1.51	0.02	2	X, Tn	Mi70	4.90	2	3.68	0.90	1	X,Tn	Se7
5.00	5	1.63	0.02	2	X.Tn	Mi70	5.00	2	5.21	0.62	1	X,Tn	Ki8:
7.00	5	1.66	0.03	2	X, Tn	Mi70	5.00	2	5.61	0.51	1	X,Tn	Ri7
9.00	5	1.74	0.02	2	X.Tn	Mi70	5.00	2	5.02	0.50	1	X,Tn	Sc7
							6.00	2	5.21	0.62	1	X,Tn	Ki8
							6.00	2	5.46	0.50	1	X, Tn	Ri7
*	* Z=4	6	Pd	f≃	8.19E-1	**	6.00	2	5.21	0.52	1	X,Tn	Sc7
							6.70	2	3.97	1.00	1	X,Tn	Se7
3.00	2	6.73	0.60	1	X,Tn	Ri77	1.00	3	4.53	0.48	ī	X, Tn	Re6
1.00	2	6.45	0.60	1	X.Tn	Ri77	2.00	3	5.66	0.51	1	X,Tn	Sc7
5.00	2	6.45	0.60	1	X Tn	Ri77	2.00	4	7.70	0.50	ī	X,Tn	Но7
5.00	2	6.43	0.60	ī	X, Tn	Ri77	3.50	4	8.60	0.50	ī	X,Tn	Ho7
2.50	3	7.10	0.71	1	X.Tn	Be70	5.00	4	8.70	0.50	1	X,Tn	Ho7
7.10	3	7.80	0.78	1	X, Tn	Be70	6.00	4	9.50	0.60	1	X,Tn	Но7
9.00	4	1.16	0.17	2	X.Tn	Is77	9.00	5	1.47	0.11	2	X, Tn	Ge8
2.50	5	1.23	0.18	2	X.Tn	Is77	1.50	6	1.44	0.11	2	X, Tn	Ge 8
	J	1.23	0.10	-	27, 111	13,,	2.00	6	1.55	0.11	2	X, Tn	Ge8
*	* Z=4	7	Аg	f≃	8.30E-1	**	Graph i	is p	resente	 d in Re	 ef. F	i67 for	K-she
							ionizat	tion	cross	section	n of	Ag by 5	keV
2.60	1	1.90	0.30	0	X,Tn	Sh81	electro	on in	npact				
2.70	1	6.21	0.90	0	nT,X	Sh81	Graph :	is pi	resente	d in Re	ef. H	a66 for	K-she
2.80	1	9.11	1.10	0	X.Tn	Sh81	ionizat	tion			n of	Ag by 1	00 to
	1 1		1.10 0.16	0 1	X,Tn X,Tn	Sh81 Sh81				section	n of		00 to
2.90		9.11					400 ke	/ ele	cross ectron	section impact			
2.90 3.00	1	9.11 1.25	0.16	1	X.Tn	Sh81	400 ke Graph	V ele is p	cross ectron resente	section impact d in Re	ef. D	Ag by 1	K-she
2.90 3.00 3.00	1 1	9.11 1.25 1.64	0.16 0.19	1 1	X.Tn X.Ta	Sh81 Sh81	400 ke Graph i ioniza	/ ele is pr tion	cross ectron resente	section impact d in Re section	ef. D	Ag by 1 a75 for	K-she
2.90 3.00 3.00 3.05	1 1 1	9.11 1.25 1.64 2.57	0.16 0.19 0.06	1 1 1	X,Tn X,Tn X,Tn	Sh81 Sh81 Da72	400 ket Graph i ionizat 30 MeV	Velois printing the printing th	cross ectron resente cross etron i	section impact d in Re section mpact	ef. D n of	Ag by 1 a75 for Ag by 3	K~she .0 to
2.90 3.00 3.00 3.05 3.85	1 1 1 1	9.11 1.25 1.64 2.57 1.47 2.86 4.99	0.16 0.19 0.06 0.13	1 1 1	X,Tn X,Tn X,Tn X,Tn	Sh81 Sh81 Da72 Cl35	400 ket Graph i ionizat 30 MeV Graph i	Velois protion electrical velocities of the contraction of the contrac	cross ectron resente cross etron i resente	section impact d in Re section mpact d in Re	ef. D n of ef. W	Ag by 1 a75 for	K-she .0 to K-she
2.90 3.00 3.00 3.05 3.85 4.00 5.00	1 1 1 1	9.11 1.25 1.64 2.57 1.47 2.86 4.99 6.32	0.16 0.19 0.06 0.13 0.26	1 1 1 1	X,Tn X,Tn X,Tn X,Tn X,Tn	Sh81 Sh81 Da72 Cl35 Cl35	400 ket Graph i ioniza 30 MeV Graph i ioniza	Velois protion electrical electri	cross ectron resente cross etron i resente	section impact d in Re section mpact d in Re section	ef. D n of ef. W	Ag by 1 a75 for Ag by 3 a87 for	K-she .0 to K-she
2.90 3.00 3.00 3.05 3.85 4.00 5.00	1 1 1 1 1	9.11 1.25 1.64 2.57 1.47 2.86 4.99	0.16 0.19 0.06 0.13 0.26 0.09	1 1 1 1 1	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh81 Sh81 Da72 Cl35 Cl35 Da72	400 ket Graph i ioniza 30 MeV Graph i ioniza	Velois protion electrical electri	cross ectron resente cross etron i resente cross	section impact d in Re section mpact d in Re section	ef. D n of ef. W	Ag by 1 a75 for Ag by 3 a87 for	K-she .0 to K-she
2.90 3.00 3.05 3.05 3.85 4.00 5.00	1 1 1 1 1 1	9.11 1.25 1.64 2.57 1.47 2.86 4.99 6.32	0.16 0.19 0.06 0.13 0.26 0.09 0.10	1 1 1 1 1 1	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh81 Sh81 Da72 Cl35 Cl35 Da72 Da72	400 ket Graph i ioniza 30 MeV Graph i ioniza	Velois protion electrical electri	cross ectron resente cross etron i resente cross	section impact d in Re section mpact d in Re section	ef. D n of ef. W	Ag by 1 a75 for Ag by 3 a87 for	K-she .0 to K-she
2.90 3.00 3.05 3.85 4.00 5.00 5.10	1 1 1 1 1 1 1	9.11 1.25 1.64 2.57 1.47 2.86 4.99 6.32 3.73 6.80	0.16 0.19 0.06 0.13 0.26 0.09 0.10 0.34	1 1 1 1 1 1 1	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh81 Sh81 Da72 Cl35 Cl35 Da72 Da72 Cl35 Da72	400 ke Graph i ioniza 30 MeV Graph i ioniza 380 MeV	Velenis protection electrical protection velocities vel	cross ectron resente cross etron i resente cross ectron	section impact d in Re section mpact d in Re section	ef. D n of ef. W n of	Ag by 1 a75 for Ag by 3 a87 for Ag by 3	K-she .0 to K-she 00 to
2.90 3.00 3.00 3.05 3.85 4.00 5.00 5.00	1 1 1 1 1 1 1 1	9.11 1.25 1.64 2.57 1.47 2.86 4.99 6.32 3.73 6.80	0.16 0.19 0.06 0.13 0.26 0.09 0.10 0.34 0.11	1 1 1 1 1 1 1	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh81 Sh81 Da72 Cl35 Cl35 Da72 Da72 Cl35	400 ke Graph i ioniza 30 MeV Graph i ioniza 380 MeV	Velois protion electrical electri	cross ectron resente cross etron i resente cross ectron	section impact d in Re section mpact d in Re section impact	ef. D n of ef. W n of	Ag by 1 a75 for Ag by 3 a87 for	K-she .0 to K-she 00 to
2.90 3.00 3.05 3.85 4.00 5.00 5.00 6.00 6.38	1 1 1 1 1 1 1 1 1	9.11 1.25 1.64 2.57 1.47 2.86 4.99 6.32 3.73 6.80 5.51	0.16 0.19 0.06 0.13 0.26 0.09 0.10 0.34 0.11	1 1 1 1 1 1 1 1	X, Tn X, Tn	Sh81 Sh81 Da72 Cl35 Cl35 Da72 Da72 Cl35 Da72 Ki81	400 ke Graph i ioniza 30 MeV Graph i ioniza 380 MeV	Velenis protection electrical protection velocities vel	cross ectron resente cross etron i resente cross ectron	section impact d in Re section mpact d in Re section impact	ef. D n of ef. W n of	Ag by 1 a75 for Ag by 3 a87 for Ag by 3	K-she .0 to K-she 00 to
2.90 3.00 3.00 3.05 3.85 4.00 5.00 5.10 6.00 6.38 7.65	1 1 1 1 1 1 1 1 1 1	9.11 1.25 1.64 2.57 1.47 2.86 4.99 6.32 3.73 6.80 5.51 4.08	0.16 0.19 0.06 0.13 0.26 0.09 0.10 0.34 0.11 0.66 0.36	1 1 1 1 1 1 1 1 1 1	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh81 Sh81 Da72 Cl35 Cl35 Da72 Da72 Cl35 Da72 Ki81 Cl35 Cl35	400 ket Graph i ionizad 30 MeV Graph i ionizad 380 Met	Velois prition election velo	cross ectron resente cross etron i resente cross ectron	section impact d in Re section mpact d in Re section impact	ef. D n of ef. W n of	Ag by 1 a75 for Ag by 3 a87 for Ag by 3	K-she .0 to K-she 00 to
2.90 3.00 3.00 3.05 3.85 4.00 5.00 5.00 6.00 6.38 7.65 8.00	1 1 1 1 1 1 1 1 1 1	9.11 1.25 1.64 2.57 1.47 2.86 4.99 6.32 3.73 6.80 5.51 4.08 4.25	0.16 0.19 0.06 0.13 0.26 0.09 0.10 0.34 0.11 0.66 0.36 0.38	1 1 1 1 1 1 1 1 1 1 1	X, Tn X, Tn	Sh81 Sh81 Da72 Cl35 Cl35 Da72 Da72 Cl35 Da72 Ki81 Cl35	400 ket Graph i ionizad 30 MeV Graph i ionizad 380 Met	Velois prition election velo	cross ectron resente cross etron i resente cross ectron	section impact d in Re section mpact d in Re section impact	ef. Don of ef. Won of f=	Ag by 1 a75 for Ag by 3 a87 for Ag by 3 a87 for Ag by 3 a8.40E-1 X.Tn	K-she .0 to K-she 00 to
2.90 3.00 3.00 3.05 3.85 4.00 5.00 6.00 6.38 7.65 8.00 8.93	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	9.11 1.25 1.64 2.57 1.47 2.86 4.99 6.32 3.73 6.80 5.51 4.08 4.25 6.79	0.16 0.19 0.06 0.13 0.26 0.09 0.10 0.34 0.11 0.66 0.36 0.38	1 1 1 1 1 1 1 1 1 1 1 1	X, Tn X, Tn	Sh81 Sh81 Da72 Cl35 Cl35 Da72 Da72 Cl35 Da72 Ki81 Cl35 Cl35	400 ket Graph i ioniza 30 MeV Graph i ioniza 380 Met	Velois prition election velo	cross ectron resente cross etron i resente cross ectron	section impact d in Re section mpact d in Re section impact	ef. Don of ef. Won of f=	Ag by 1 a75 for Ag by 3 a87 for Ag by 3	K-she .0 to K-she 00 to **
2.90 3.00 3.00 3.05 3.85 4.00 5.00 6.00 6.38 7.65 8.00 8.93	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	9.11 1.25 1.64 2.57 1.47 2.86 4.99 6.32 3.73 6.80 5.51 4.08 4.25 6.79 4.34	0.16 0.19 0.06 0.13 0.26 0.09 0.10 0.34 0.11 0.66 0.36 0.38 0.07	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	X, Tn X, Tn	Sh81 Sh81 Da72 Cl35 Cl35 Da72 Da72 Cl35 Da72 Ki81 Cl35 Cl35 Da72 Cl35	400 ket Graph i ioniza 30 MeV Graph i ioniza 380 Met	Veleis prition election velo	cross ectron resente cross etron i resente cross ectron	section impact d in Re section mpact d in Re section impact Cd 0.41	ef. Don of ef. Won of f=	Ag by 1 a75 for Ag by 3 a87 for Ag by 3 a87 for Ag by 3 a8.40E-1 X.Tn	K-she .0 to K-she 00 to **
2.90 3.00 3.00 3.05 3.85 4.00 5.00 5.00 6.00 6.38 7.65 8.00 8.93	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	9.11 1.25 1.64 2.57 1.47 2.86 4.99 6.32 3.73 6.80 5.51 4.25 6.79 4.34 6.79	0.16 0.19 0.06 0.13 0.26 0.09 0.10 0.34 0.11 0.66 0.36 0.38 0.07 0.39	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	X, Tn X, Tn	Sh81 Sh81 Da72 Cl35 Cl35 Da72 Da72 Cl35 Da72 Ki81 Cl35 Cl35 Da72 Cl35	400 ket Graph i ioniza 30 MeV Graph i ioniza 380 Met	V election election v election v election v election v election z=4	cross ectron resente cross etron i resente cross ectron	section impact d in Re section mpact d in Re section impact Cd 0.41	ef. Don of ef. We fef. We fef. We fef. We fef. We feet feft feft feft feft feft feft f	Ag by 1 a75 for Ag by 3 a87 for Ag by 3 a87 for Ag by 3 a8.40E-1 X.Tn	K-she .0 to K-she 00 to ** Sc7
2.90 3.00 3.00 3.05 3.85 4.00 5.00 6.00 6.00 6.38 7.65 8.00 8.93 1.00 1.00	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	9.11 1.25 1.64 2.57 1.47 2.86 4.99 6.32 3.73 6.80 5.51 4.25 6.79 4.34 6.79 5.91	0.16 0.19 0.06 0.13 0.26 0.09 0.10 0.34 0.11 0.66 0.36 0.38 0.07 0.39 0.06	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	X, Tn X, Tn	Sh81 Sh81 Da72 Cl35 Cl35 Da72 Da72 Cl35 Da72 Ki81 Cl35 Cl35 Da72 Cl35 Cl35 Cl35 Cl35 Cl35 Cl35 Cl35 Cl35	400 ket Graph i ionizat 30 MeV Graph i ionizat 380 Met ** 2.00	V election election v election v election v election v electron v	cross ectron resente cross ctron i resente cross ectron	section impact d in Re section mpact d in Re section impact Cd 0.41 In 0.52	ef. Don of ef. Won of f=	Ag by 1 a75 for Ag by 3 a87 for Ag by 3 a87 for Ag by 3 a8.40E-1 X.Tn a8.50E-1 X.Tn	K-she .0 to K-she 00 to ** Sc7 **
2.90 3.00 3.00 3.05 3.85 4.00 5.10 6.00 6.38 7.65 8.93 1.00 1.00	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2	9.11 1.25 1.64 2.57 1.47 2.86 4.99 6.32 3.73 6.80 5.51 4.08 4.25 6.79 4.34 6.79 5.91 5.69	0.16 0.19 0.06 0.13 0.26 0.09 0.10 0.34 0.11 0.66 0.36 0.38 0.07 0.39 0.06 0.71	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh81 Sh81 Da72 Cl35 Cl35 Da72 Da72 Cl35 Da72 Ki81 Cl35 Cl35 Da72 Cl35 Da72 Cl35 Da72 Cl35 Cl35 Cl35 Cl35	400 ket Graph i ionizat 30 MeV Graph : ionizat 380 Met ** 2.00	Velois prition election Velo	cross ectron resente cross etron i resente cross ectron 8 4.57	section impact d in Re section mpact d in Re section impact Cd 0.41 In 0.52 0.50	ef. Donof ef. Won of f= 1 f= 1	Ag by 1 a75 for Ag by 3 a87 for Ag by 3 a87 for Ag by 3 a8.40E-1 X.Tn X.Tn X,Tn	K-she .0 to K-she 00 to ** Sc7 **
2.90 3.00 3.00 3.05 3.85 4.00 5.10 6.00 6.38 7.65 8.00 8.93 1.00 1.00	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2	9.11 1.25 1.64 2.57 1.47 2.86 4.99 6.32 3.73 6.80 5.51 4.08 4.25 6.79 4.34 6.79 5.69 4.25	0.16 0.19 0.06 0.13 0.26 0.09 0.10 0.34 0.11 0.66 0.36 0.37 0.39 0.07 0.58 0.38	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh81 Sh81 Da72 Cl35 Cl35 Da72 Da72 Cl35 Da72 Ki81 Cl35 Cl35 Da72 Cl35 Da72 Cl35 Da72 Cl35 Da72 Cl35 Da72 Cl35 Da72 Cl35	400 ket Graph i ionizat 30 MeV Graph : ionizat 380 Met ** 2.00	Velois prition election velo	cross ectron resente cross ectron i resente cross ectron 8 4.57	section impact d in Re section mpact d in Re section impact Cd 0.41 In 0.52 0.50 0.51	ef. D n of ef. W n of f= 1 f=	Ag by 1 a75 for Ag by 3 a87 for Ag by 3 a87 for Ag by 3 a8.40E-1 X.Tn X.Tn X.Tn X.Tn	K-she .0 to K-she 00 to ** Sc7 **
2.90 3.00 3.00 3.05 3.85 4.00 5.10 6.00 6.38 7.65 8.00 8.93 1.00 1.00 1.02	1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2	9.11 1.25 1.64 2.57 1.47 2.86 4.99 6.89 6.80 5.51 4.08 4.25 6.79 4.34 6.79 5.91 5.91	0.16 0.19 0.06 0.13 0.26 0.09 0.10 0.34 0.11 0.66 0.36 0.38 0.07 0.39 0.06 0.71 0.58 0.38	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	X, Tn	Sh81 Sh81 Da72 Cl35 Cl35 Da72 Da72 Cl35 Da72 Ki81 Cl35 Cl35 Da72 Cl35 Da72 Cl35 Da72 Cl35 Cl35 Cl35 Cl35	400 ket Graph i ionizat 30 MeV Graph i ionizat 380 Met ** 2.00	V election election v	cross ectron resente cross ectron i resente cross ectron 8 4.57 9 5.72 5.63 5.66	section impact d in Re section mpact d in Re section impact Cd 0.41 In 0.52 0.50 0.51 0.51	ef. Don of ef. We for of f	Ag by 1 a75 for Ag by 3 a87 for Ag by 3 a87 for Ag by 3 a8.40E-1 X.Tn X.Tn X.Tn X.Tn X.Tn	K-she .0 to K-she 00 to ** Sc7 **
2.90 3.00 3.00 3.05 3.85 4.00 5.10 6.00 6.38 7.65 8.00 1.00 1.00 1.02 1.14	1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2	9.11 1.25 1.64 2.57 1.47 2.86 4.99 6.79 4.34 6.79 5.61 5.62 4.94 6.79 4.94 6.77 4.16	0.16 0.19 0.06 0.13 0.26 0.09 0.10 0.34 0.11 0.66 0.38 0.07 0.39 0.71 0.58 0.45 0.07	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh81 Sh81 Da72 Cl35 Cl35 Da72 Da72 Cl35 Da72 Ki81 Cl35 Da72 Cl35 Da72 Cl35 Da72 Cl35 Da72 Cl35 Da72 Cl35 Da72 Cl35	400 ket Graph i ionizat 30 MeV Graph : ionizat 380 Met ** 2.00	V election election V	cross ectron resente cross ectron i resente cross ectron 8 4.57 9 5.72 5.63 5.66 4.33	section impact d in Re section mpact d in Re section impact Cd 0.41 In 0.52 0.50 0.51 0.51 0.39	ef. Don of ef. We not f=	Ag by 1 a75 for Ag by 3 a87 for Ag by 3 a87 for Ag by 3 a8.40E-1 X.Tn X.Tn X.Tn X.Tn X.Tn	K-she .0 to K-she 00 to ** Sc7 ** Ri7 Ri7 Ri7 Sc7
2.90 3.00 3.00 3.05 3.85 4.00 5.10 6.00 6.38 7.65 8.00 1.00 1.00 1.00 1.20	1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2	9.11 1.25 1.64 2.57 1.47 2.86 4.99 6.32 36.80 5.51 4.08 4.25 4.34 6.79 4.34 6.79 4.25 4.25 4.25 4.25	0.16 0.19 0.06 0.13 0.26 0.09 0.10 0.34 0.36 0.38 0.07 0.39 0.06 0.71 0.58 0.45 0.07 0.37	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	X, Tn X, Tn	Sh81 Sh81 Da72 Cl35 Cl35 Da72 Da72 Cl35 Da72 Ki81 Cl35 Da72 Cl35	400 ket Graph i ionizat 30 MeV Graph : ionizat 380 Met ** 2.00 ** 3.00 4.00 5.00 6.00 2.00 1.50	Veleis prition election Veleval 3 Z=4 2 2 2 2 3 5	cross ectron resente cross ctron i resente cross ectron 8 4.57 9 5.72 5.63 5.66 4.33 1.28	section impact d in Re section mpact d in Re section impact Cd 0.41 In 0.52 0.50 0.51 0.51 0.39 0.19	ef. Don of ef. We not f=	Ag by 1 a75 for Ag by 3 a87 for Ag by 3 a87 for Ag by 3 a8.40E-1 X.Tn X.Tn X.Tn X.Tn X,Tn X,Tn	K-she .0 to K-she 00 to ** Sc7 ** Ri7 Ri7 Ri7 Sc7 Is7
2.80 2.90 3.00 3.00 3.05 5.10 6.00 6.38 7.65 8.90 1.00 1.02 1.14 1.20 1.28 1.40 1.53	1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2	9.11 1.25 1.64 2.57 1.47 2.86 4.99 6.79 4.34 6.79 5.61 5.62 4.94 6.79 4.94 6.77 4.16	0.16 0.19 0.06 0.13 0.26 0.09 0.10 0.34 0.11 0.66 0.38 0.07 0.39 0.71 0.58 0.45 0.07	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn	Sh81 Sh81 Da72 Cl35 Cl35 Da72 Da72 Cl35 Da72 Ki81 Cl35 Da72 Cl35 Da72 Cl35 Da72 Cl35 Da72 Cl35 Da72 Cl35 Da72 Cl35	400 ket Graph i ionizat 30 MeV Graph : ionizat 380 Met ** 2.00	V election election V	cross ectron resente cross ectron i resente cross ectron 8 4.57 9 5.72 5.63 5.66 4.33	section impact d in Re section mpact d in Re section impact Cd 0.41 In 0.52 0.50 0.51 0.51 0.39	ef. Don of ef. We not f=	Ag by 1 a75 for Ag by 3 a87 for Ag by 3 a87 for Ag by 3 a8.40E-1 X.Tn X.Tn X.Tn X.Tn X.Tn	K-she .0 to K-she 00 to **

TABLE. Cross Sections for *K*-Shell Ionization by Electron Impact See page 356 for Explanation of Table

ENERG	Y	CROSS	SECT	CON	TYPE	REF.	ENERG		CROSS	SECTI	ON	TYPE	REF.
* *	z=49	ı	In	f=	8.50E~1	**	* *	Z=52		Te	f = 8	.75E-1	**
7.00	5	1.25	0.02	2	X, Tn	Mi70	2.00	3	3.79	0.34	1	X,Tn	Sc72
9.00	5	1.30	0.02	2	X,Tn	Mi70	Graph	is pr	esente	d in Re	ef. Wa	87 for	K-shell
* *	z=50	1	Sn	f≈	8.59E-1	**	ioniza	tion	cross	section	of 1	e by 30	0 to
	<i>D</i> 30			4			300 110			2			
2.00	2 2	4.60 5.80	0.49 0.30	1 1	X,Tn X,Tn	Re66 Ha64	* *	Z=54	L	Xe	f=8	8.89E-1	**
3.00	2	5.10	0.46	1	X,Tn	Ri77		2-51	•	no.	- `	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
4.00	2	4.89	0.44	ī	X.Tn	Ri77	2.00	4	5.00	0.50	1	X,G	но79
5.00	2	4.88	0.44	1	X Tn	Ri77	3.00	4	5.50	0.50	1	X,G	Н079
5.30	2		0.30	1	X.Tn	Ha64	4.00	4	5.70	0.50	1	X,G	но79
6.00	2	3.91	0.39	1	X.Tn	Re66	5.00	4	5.80	0.50	1	X,G	но79
6.00	2	4.85	0.44	1	X Tn	Ri77	6.00	4	6.00	0.50	1	X,G	но79
8.00	2	3.81	0.39	1	X.Tn	Re66							
8.20	2		0.40	1	X.Tn	Ha64							
1.00	3	3.81	0.39	1	X.Tn	Re66	* *	z=56	5	Вa	f=9	9.01E-1	* *
1.13	3	7.20	0.40	1	X.Tn	Ha64							
1.20	3		0.39	1	X.Tn	Re66	2.00	3	3.01	0.27	1	X,Tn	Sc72
1.40	3	4.11	0.39	1	X.Tn	Re66	7.00	4	7.64	1.15	1	X,Tn	Is77
1.44	3		0.40	1	X.Tn	Ha64	9.00	4	6.86	1.03	1	X,Tn	Is77
1.70	3		0.39	1	X, In	Re66	1.50	5	7.76	1.16	1	X,Tn	Is77
2.00	3		0.39	1	X, Tn	Re66	2.70	5	8.95	1.34	1	X,Tn	Is77
2.00	3	4.30	0.39	1	X,Tn	Sc72							
2.00	4	7.10	0.50	1	X.Tn	Ho79							
5.00	4	8.30	0.60	1	X.Tn	Ho79	**	* Z=5	7	La	f=	9.06E-1	* *
1.50	5	1.11	0.17	2	X,Tn	Is77							~ 70
							2.00	3	1.90	0.17	1	X,Tn	Sc72
					i67 for								
			section	n of	Sn by 50	кеу	.i.		n	C	£_	9.11E-1	
electr		•				w -1 . 1 2	*	* Z=5	8	Ce	I=	9.11E-1	
					o64 for		2.00	1	2 24	0 21	1	V m-	Sc72
				n or	Sn by 50	to 500	2.00	3	2.34	0.21	1	X, Tn	3014
		on impa		_ .	- 6 6 6	er =1, . 3.1			,				
					a66 for			* Z=5	۵	Pr	f -	9.15E-1	* *
		ectron			Sn by 10	10 10	•	~ 2-5	,	LI	<i>L</i> –	J. 1 JL 1	
					a87 for	V-choll	2.00	3	2.38	0.21	1	X,Tn	Sc72
					Sn by 30		2.00	J	2.50	0.21	*	11, 111	50.5
		ectron		11 01	Sir by 30	70 00							
300 110	C.A. C.T.	ect on	Impact				*	* Z=6	0	Nd	f =	9.20E-1	**
*:	* Z=5:	1.	Sb	f=	8.67E-1	**	2.00	3	2.14	0.19	1	X,Tn	Sc72
6.00	1	3.40	0.41	1	X,Tn	Ki81							
1.00	2	4.01	0.48	1	X,Tn	Ki81	*	* Z=6	2	Sm	f=	9.28E-1	* *
2.00	2	4.11	0.49	1	X,Tn	Ki81							
3.00	2	3.81	0.46	1	X,Tn	Ki81	2.00	3	2.19			X,Tn	Sc72
4.00	2	3.71	0.44	1	X,Tn	Ki81	9.00	4	5.36	0.80	1	X,Tn	Is77
5.00	2	3.71	0.44	1	X,Tn	Ki81							
6.00	2	3.81	0.46	1	X,Tn	Ki81				_	_	0 215 1	
2.00	3	4.11	0.37	1	X,Tn	Sc72	*	* Z=6	3	Eu	£≃	9.31E-1	* *
							2.00	3	2.11	0.19	1	X,Tn	Sc72

TABLE. Cross Sections for K-Shell Ionization by Electron Impact See page 356 for Explanation of Table

ENERG'	Y 	CROSS	SECT	ION	TYPE	REF.	ENERG	Y	CROSS	SECTI	ON	TYPE
**	Z=64		Gđ	f=9	0.34E-1	**	* *	2=7	9	Au	f=	9.6 4E -1
.00	3	2.09	0.19	1	X,Tn	Sc72	9.00	1	2.46	0.30	0	X,Tn
				-			1.00	2	4.43	0.10	0	X, Tn
							1.20	2	5.91	0.10	0	X, Tn
* *	2=67		НО	f=9	.43E-1	**	1.40	2	6.50	0.10	ō	X, Tn
							2.00	2	8.57	0.10	0	X, Tn
00	4	3.40	0.30	1	X,Tn	Ho79	4.90	2	1.06	0.26	1	X.Tn
00	4	4.20	0.40	1	X,Tn	Но79	6.00	2	0.99	0.10	1	X.Tn
00	4	3.79	0.57	1	X.Tn	Is77	6.70	2	1.47	0.36	1	X, Tn
							8.00	2	0.99	0.10	1	X,Tn
							1.00	3	0.99	0.10	1	X,Tn
* *	Z = 68	}	Er	f=9	9.45E-1	**	1.20	3	0.99	0.10	1	X.Tn
							1.40	3	0.99	0.10	1	X,Tn
.00	3	1.70	0.15	1	X,Tn	Sc72	1.70	3	1.08	0.10	1	X.Tn
							2.00	3	1.08	0.10	1	X.Tn
							2.00	3	1.21	0.11	1	X,Tn
* *	Z=69)	Tm	f=9	9.48E-1	**	2.50	3	1.10	0.11	1	X.Tn
							7.10	3	1.40	0.14	1	X.Tn
00	5	4.74	0.09	1	X.Tn	Mi7 0	2.00	4	2.26	0.10	1	X.Tn
.00	5	4.63	0.06	1	X.Tn	Mi70	3.50	4	2.42	0.10	1	X,Tn
00	5	4.74	0.06	1	X.Tn	Mi70	5.00	4	2.50	0.10	1	X, Tn
.00	5	4.94	0.06	1	X.Tn	Mi70	6.00	4	2.66	0.10	1	X.Tn
							9.00	4	2.85	0.29	1	X,Tn
							3.00	5	3.03	0.04	1	X.Tn
* *	Z=70)	Yb	f=9	9.50E-1	* *	5.00	5	3.16	0.05	1	X,Tn
							7.00	5	3.35	0.05	1	X, Tn
.90	2	1.32	0.33	1	X.Tn	Se74	9.00	5	3.43	0.05	1	X,Tn
.70	2	1.66	0.41	1	X,Tn	Se74						
.00	3	1.54	0.14	1	X,Tn	Sc72	ioniza	ation		section		1064 for Au by 1
	Z=73		Ta	f=9	9.56E~1	**	Graph	is p	resente	d in R		la66 for Au by 2
.90	2	1.13	0.28	1	X,Tn	Se74	550 ke	∍V el	ectron	impact		
.70	2	1.50	0.30	1	X,Tn	Se74						a75 for
.00	5	3.83	0.05	1	X,Tn	Mi70					n of	Au by 3
.00	5	4.36	0.16	1	X,Tn	Mi70	MeV e	lectr	on impa	ct		
	Z=74	l	W	f=	9.57E~1	* *	*:	* Z=8	32	Pb	f=	9.68E-1
**			0.16	1	X,Tn	Ha64	2.40	2	1 71	0.20	1	y m
		1 96	0.10	1	X,In X,Tn	на64 На64	2.40 4.90	2	1.71	0.20	1	X,Tn
40	2	1.96	0.25		A . I II		4.90 5.30	2	6.50	3.20	0	X,Tn
40 30	2 2	2.38	0.25			H=64	3.11	2	1.87	0.20	_	X.Tn
40 30 20	2 2 2	2.38 3.45	0.35	1	X,Tn	Ha64			0 70	4 00		ზ m−
40 30 20 13	2 2 2 2	2.38 3.45 3.40	0.35 0.35	1 1	X,Tn X,Tn	Ha64	6.70	2		4.80	0	X,Tn
.40 .30 .20	2 2 2	2.38 3.45	0.35	1	X,Tn		6.70 8.20	2 2	2.55	0.35	1	X.Tn
.40 .30 .20 .13	2 2 2 2 2	2.38 3.45 3.40 2.49	0.35 0.35 0.38	1 1 1	X,Tn X,Tn X,Tn	Ha64 Ha64	6.70 8.20 1.13	2 2 3	2.55 2.60	0.35 0.35	1 1	X.Tn X.Tn
.40 .30 .20 .13 .44	2 2 2 2 2 is pr	2.38 3.45 3.40 2.49	0.35 0.35 0.38 d in R	1 1 1 ef. H	X,Tn X,Tn X,Tn 	Ha64 Ha64 K-shell	6.70 8.20 1.13 1.44	2 2 3 3	2.55 2.60 2.48	0.35 0.35 0.50	1 1 1	X,Tn X,Tn X,Tn
.40 .30 .20 .13 .44 	2 2 2 2 2 	2.38 3.45 3.40 2.49 	0.35 0.35 0.38 d in R sectio	1 1 1 ef. H	X,Tn X,Tn X,Tn 	Ha64 Ha64	6.70 8.20 1.13 1.44 2.00	2 2 3 3 3	2.55 2.60 2.48 1.03	0.35 0.35 0.50 0.09	1 1 1	X,Tn X,Tn X,Tn X,Tn
.40 .30 .20 .13 .44 	2 2 2 2 2 	2.38 3.45 3.40 2.49	0.35 0.35 0.38 d in R sectio	1 1 1 ef. H	X,Tn X,Tn X,Tn 	Ha64 Ha64 K-shell	6.70 8.20 1.13 1.44 2.00 5.00	2 2 3 3 4	2.55 2.60 2.48 1.03 2.40	0.35 0.35 0.50 0.09 0.20	1 1 1 1	X,Tn X,Tn X,Tn X,Tn X,Tn
.40 .30 .20 .13 .44 	2 2 2 2 2 	2.38 3.45 3.40 2.49 	0.35 0.35 0.38 d in R sectio	1 1 1 ef. H	X,Tn X,Tn X,Tn 	Ha64 Ha64 K-shell	6.70 8.20 1.13 1.44 2.00	2 2 3 3 3	2.55 2.60 2.48 1.03	0.35 0.35 0.50 0.09	1 1 1	X,Tn X,Tn X,Tn X,Tn
.40 .30 .20 .13 .44 raph oniza eV el	2 2 2 2 2 	2.38 3.45 3.40 2.49 	0.35 0.35 0.38 d in R sectio	1 1 1 ef. Hann of t	X,Tn X,Tn X,Tn a66 for by 20	Ha64 Ha64 K-shell O to 550	6.70 8.20 1.13 1.44 2.00 5.00 9.00	2 3 3 3 4 4	2.55 2.60 2.48 1.03 2.40 2.26	0.35 0.35 0.50 0.09 0.20 0.23	1 1 1 1 1	X,Tn X,Tn X,Tn X,Tn X,Tn X,Tn
.40 .30 .20 .13 .44 raph oniza	2 2 2 2 2 is prition	2.38 3.45 3.40 2.49 	0.35 0.35 0.38 d in R sectio	1 1 1 ef. Hann of t	X,Tn X,Tn X,Tn 	Ha64 Ha64 K-shell O to 550	6.70 8.20 1.13 1.44 2.00 5.00 9.00 Graph	2 3 3 4 4 is p	2.55 2.60 2.48 1.03 2.40 2.26	0.35 0.35 0.50 0.09 0.20 0.23	1 1 1 1 1 1 ef. H	X,Tn X,Tn X,Tn X,Tn X,Tn

TABLE. Cross Sections for K-Shell Ionization by Electron Impact See page 356 for Explanation of Table

ENERG	Y	CROSS	SECT	ON	TYPE	REF.
**	Z=83		Bi	f=	9.70 E -1	* *
2.00	3	9.87	0.89	0	X, Tn	Sc72
3.50	4	2.10	0.10	1	X,Tn	Ho79
5.00	4	2.10	0.10	1	X,Tn	Ho79
6.00	4	2.21	0.10	1	X,Tn	Ho79
9.00	4	2.14	0.21	1	X,Tn	Is77
3.00	5	2.98	0.05	1	X,Tn	Mi70
5.00	5	3.22	0.05	1	X,Tn	Mi70
**	Z=92		U	f=9	.76E-1	k #
9.00	4	1.80	0.18	1	X, Tn	Is77

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