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Appendices

Tables 1 and 2 are from *Heath's Logarithmic and Trigonometric Tables*, revised by E. J. Oglesby, and are reprinted by permission of D. C. Heath & Company.

Appendix A

TABLES

Table 1. Four-Place Logarithms of Ordinary Numbers

N	0	1	2	3	4	5	6	7	8	9
10	0000	0043	0086	0128	0170	0212	0253	0294	0334	0374
11	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755
12	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106
13	1139	1173	1206	1239	1271	1303	1335	1367	1399	1430
14	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732
15	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014
16	2041	2068	2095	2122	2148	2175	2201	2227	2253	2279
17	2304	2330	2355	2380	2405	2430	2455	2480	2504	2529
18	2553	2577	2601	2625	2648	2672	2695	2718	2742	2765
19	2788	2810	2833	2856	2878	2900	2923	2945	2967	2989
20	3010	3032	3054	3075	3096	3118	3139	3160	3181	3201
21	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404
22	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598
23	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784
24	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962
25	3979	3997	4014	4031	4048	4065	4082	4099	4116	4133
26	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298
27	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456
28	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609
29	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757
30	4771	4786	4800	4814	4829	4843	4857	4871	4886	4900
31	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038
32	5051	5065	5079	5092	5105	5119	5132	5145	5159	5172
33	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302
34	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428
35	5441	5453	5465	5478	5490	5502	5514	5527	5539	5551
36	5563	5575	5587	5599	5611	5623	5635	5647	5658	5670
37	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786
38	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899
39	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010
40	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117
41	6128	6138	6149	6160	6170	6180	6191	6201	6212	6222
42	6232	6243	6253	6263	6274	6284	6294	6304	6314	6325
43	6335	6345	6355	6365	6375	6385	6395	6405	6415	6425
44	6435	6444	6454	6464	6474	6484	6493	6503	6513	6522
45	6532	6542	6551	6561	6571	6580	6590	6599	6609	6618
46	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712
47	6721	6730	6739	6749	6758	6767	6776	6785	6794	6803
48	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893
49	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067
51	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152
52	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235
53	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316
54	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396
N	0	1	2	3	4	5	6	7	8	9

Table 1. Four-Place Logarithms of Ordinary Numbers (Cont.)

N	0	1	2	3	4	5	6	7	8	9
55	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474
56	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551
57	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627
58	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701
59	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774
60	7782	7789	7796	7803	7810	7818	7825	7832	7839	7846
61	7853	7860	7868	7875	7882	7889	7896	7903	7910	7917
62	7924	7931	7938	7945	7952	7959	7966	7973	7980	7987
63	7993	8000	8007	8014	8021	8028	8035	8041	8048	8055
64	8062	8069	8075	8082	8089	8096	8102	8109	8116	8122
65	8129	8136	8142	8149	8156	8162	8169	8176	8182	8189
66	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254
67	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319
68	8325	8331	8338	8344	8351	8357	8363	8370	8376	8382
69	8388	8395	8401	8407	8414	8420	8426	8432	8439	8445
70	8451	8457	8463	8470	8476	8482	8488	8494	8500	8506
71	8513	8519	8525	8531	8537	8543	8549	8555	8561	8567
72	8573	8579	8585	8591	8597	8603	8609	8615	8621	8627
73	8633	8639	8645	8651	8657	8663	8669	8675	8681	8686
74	8692	8698	8704	8710	8716	8722	8727	8733	8739	8745
75	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802
76	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859
77	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915
78	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971
79	8976	8982	8987	8993	8998	9004	9009	9015	9020	9025
80	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079
81	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133
82	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186
83	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238
84	9243	9248	9253	9258	9263	9269	9274	9279	9284	9289
85	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340
86	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390
87	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440
88	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489
89	9494	9499	9504	9509	9513	9518	9523	9528	9533	9538
90	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586
91	9590	9595	9600	9605	9609	9614	9619	9624	9628	9633
92	9638	9643	9647	9652	9657	9661	9666	9671	9675	9680
93	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727
94	9731	9736	9741	9745	9750	9754	9759	9763	9768	9773
95	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818
96	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863
97	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908
98	9912	9917	9921	9926	9930	9934	9939	9943	9948	9952
99	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996
N	0	1	2	3	4	5	6	7	8	9

Table 2. Four-Place Values of Functions and Radians

DEGREES	RADIANS	Sin	Cos	Tan	Cot	Sec	Csc		
0° 00'	.0000	.0000	1.0000	.0000	—	1.000	—	1.5708	90° 00'
10	029	029	000	029	343.8	000	343.8	679	50
20	058	058	000	058	171.9	000	171.9	650	40
30	.0087	.0087	1.0000	.0087	114.6	1.000	114.6	1.5621	30
40	116	116	.9999	116	85.94	000	85.95	592	20
50	145	145	.999	145	68.75	000	68.76	563	10
1° 00'	.0175	.0175	.9998	.0175	57.29	1.000	57.30	1.5533	89° 00'
10	204	204	.998	204	49.10	000	49.11	504	50
20	233	233	.997	233	42.96	000	42.98	475	40
30	.0262	.0262	.9997	.0262	38.19	1.000	38.20	1.5446	30
40	291	291	.996	291	34.37	000	34.38	417	20
50	320	320	.995	320	31.24	001	31.26	388	10
2° 00'	.0349	.0349	.9994	.0349	28.64	1.001	28.65	1.5359	88° 00'
10	378	378	.993	378	26.43	001	26.45	330	50
20	407	407	.992	407	24.54	001	24.56	301	40
30	.0436	.0436	.9990	.0437	22.90	1.001	22.93	1.5272	30
40	465	465	.989	466	21.47	001	21.49	243	20
50	495	494	.988	495	20.21	001	20.23	213	10
3° 00'	.0524	.0524	.9986	.0524	19.08	1.001	19.11	1.5184	87° 00'
10	553	552	.985	553	18.07	002	18.10	155	50
20	582	581	.983	582	17.17	002	17.20	126	40
30	.0611	.0611	.9981	.0612	16.35	1.002	16.38	1.5097	30
40	640	640	.980	641	15.60	002	15.64	068	20
50	669	669	.978	670	14.92	002	14.96	039	10
4° 00'	.0698	.0698	.9976	.0699	14.30	1.002	14.34	1.5010	86° 00'
10	727	727	.974	729	13.73	003	13.76	981	50
20	756	756	.971	758	13.20	003	13.23	952	40
30	.0785	.0785	.9969	.0787	12.71	1.003	12.75	1.4923	30
40	814	814	.967	816	12.25	003	12.29	893	20
50	844	843	.964	846	11.83	004	11.87	864	10
5° 00'	.0873	.0872	.9962	.0875	11.43	1.004	11.47	1.4835	85° 00'
10	902	901	.959	904	11.06	004	11.10	806	50
20	931	929	.957	934	10.71	004	10.76	777	40
30	.0960	.0958	.9954	.0963	10.39	1.005	10.43	1.4748	30
40	989	987	.951	992	10.08	005	10.13	719	20
50	1018	1016	.948	1022	9.788	005	9.839	690	10
6° 00'	.1047	.1045	.9945	.1051	9.514	1.006	9.567	1.4661	84° 00'
10	076	074	.942	080	9.255	006	9.309	632	50
20	105	103	.939	110	9.010	006	9.065	603	40
30	.1134	.1132	.9936	.1139	8.777	1.006	8.834	1.4573	30
40	164	161	.932	169	8.556	007	8.614	544	20
50	193	190	.929	198	8.345	007	8.405	515	10
7° 00'	.1222	.1219	.9925	.1228	8.144	1.008	8.206	1.4486	83° 00'
10	251	248	.922	257	7.953	008	8.016	457	50
20	280	276	.918	287	7.770	008	7.834	428	40
30	.1309	.1305	.9914	.1317	7.596	1.009	7.661	1.4399	30
40	338	334	.911	346	7.429	009	7.496	370	20
50	367	363	.907	376	7.269	009	7.337	341	10
8° 00'	.1396	.1392	.9903	.1405	7.115	1.010	7.185	1.4312	82° 00'
10	425	421	.899	435	6.968	010	7.040	283	50
20	454	449	.894	465	6.827	011	6.900	254	40
30	.1484	.1478	.9890	.1495	6.691	1.011	6.765	1.4224	30
40	513	507	.886	524	6.561	012	6.636	195	20
50	542	536	.881	554	6.435	012	6.512	166	10
9° 00'	.1571	.1564	.9877	.1584	6.314	1.012	6.392	1.4137	81° 00'
		Cos	Sin	Cot	Tan	Csc	Sec	RADIANS	DEGREES

Table 2. Four-Place Values of Functions and Radians (Cont.)

DEGREES	RADIANS	Sin	Cos	Tan	Cot	Sec	Csc		
9° 00'	.1571	.1564	.9877	.1584	6.314	1.012	6.392	1.4137	81° 00'
10	600	593	872	614	197	013	277	108	50
20	629	622	868	644	084	013	166	079	40
30	.1658	.1650	.9863	.1673	5.976	1.014	6.059	1.4050	30
40	687	679	858	703	871	014	5.955	1.4021	20
50	716	708	853	733	769	015	855	992	10
10° 00'	.1745	.1736	.9848	.1763	5.671	1.015	5.759	1.3963	80° 00'
10	774	765	843	793	576	016	665	934	50
20	804	794	838	823	485	016	575	904	40
30	.1833	.1822	.9833	.1853	5.396	1.017	5.487	1.3875	30
40	862	851	827	883	309	018	403	846	20
50	891	880	822	914	226	018	320	817	10
11° 00'	.1920	.1908	.9816	.1944	5.145	1.019	5.241	1.3788	79° 00'
10	949	937	811	974	066	019	164	759	50
20	978	965	805	.2004	4.989	020	089	730	40
30	.2007	.1994	.9799	.2035	4.915	1.020	5.016	1.3701	30
40	036	.2022	793	065	843	021	4.945	672	20
50	065	051	787	095	773	022	876	643	10
12° 00'	.2094	.2079	.9781	.2126	4.705	1.022	4.810	1.3614	78° 00'
10	123	108	775	156	638	023	745	584	50
20	153	136	769	186	574	024	682	555	40
30	.2182	.2164	.9763	.2217	4.511	1.024	4.620	1.3526	30
40	211	193	757	247	449	025	560	497	20
50	240	221	750	278	390	026	502	468	10
13° 00'	.2269	.2250	.9744	.2309	4.331	1.026	4.445	1.3439	77° 00'
10	298	278	737	339	275	027	390	410	50
20	327	306	730	370	219	028	336	381	40
30	.2356	.2334	.9724	.2401	4.165	1.028	4.284	1.3352	30
40	385	363	717	432	113	029	232	323	20
50	414	391	710	462	061	030	182	294	10
14° 00'	.2443	.2419	.9703	.2493	4.011	1.031	4.134	1.3265	76° 00'
10	473	447	696	524	3.962	031	086	235	50
20	502	476	689	555	914	032	039	206	40
30	.2531	.2504	.9681	.2586	3.867	1.033	3.994	1.3177	30
40	560	532	674	617	821	034	950	148	20
50	589	560	667	648	776	034	906	119	10
15° 00'	.2618	.2588	.9659	.2679	3.732	1.035	3.864	1.3090	75° 00'
10	647	616	652	711	689	036	822	061	50
20	676	644	644	742	647	037	782	032	40
30	.2705	.2672	.9636	.2773	3.606	1.038	3.742	1.3003	30
40	734	700	628	805	566	039	703	974	20
50	763	728	621	836	526	039	665	945	10
16° 00'	.2793	.2756	.9613	.2867	3.487	1.040	3.628	1.2915	74° 00'
10	822	784	605	899	450	041	592	886	50
20	851	812	596	931	412	042	556	857	40
30	.2880	.2840	.9588	.2962	3.376	1.043	3.521	1.2828	30
40	909	868	580	994	340	044	487	799	20
50	938	896	572	.3026	305	045	453	770	10
17° 00'	.2967	.2924	.9563	.3057	3.271	1.046	3.420	1.2741	73° 00'
10	996	952	555	089	237	047	388	712	50
20	.3025	.3007	.9537	.3153	3.172	1.049	3.326	1.2654	40
30	.3054	.3007	.9537	.3153	3.172	1.049	3.326	1.2654	30
40	083	035	528	185	140	049	295	625	20
50	113	062	520	217	108	050	265	595	10
18° 00'	.3142	.3090	.9511	.3249	3.078	1.051	3.236	1.2566	72° 00'
		Cos	Sin	Cot	Tan	Csc	Sec	RADIANS	DEGREES

Table 2. Four-Place Values of Functions and Radians (Cont.)

DEGREES	RADIANS	Sin	Cos	Tan	Cot	Sec	Csc		
18° 00'	.3142	.3090	.9511	.3249	3.078	1.051	3.236	1.2566	72° 00'
10	171	118	502	281	047	052	207	537	50
20	200	145	492	314	018	053	179	508	40
30	.3229	.3173	.9483	.3346	2.989	1.054	3.152	1.2479	30
40	258	201	474	378	960	056	124	450	20
50	287	228	465	411	932	057	098	421	10
19° 00'	.3316	.3256	.9455	.3443	2.904	1.058	3.072	1.2392	71° 00'
10	345	283	446	476	877	059	046	363	50
20	374	311	436	508	850	060	021	334	40
30	.3403	.3338	.9426	.3541	2.824	1.061	2.996	1.2305	30
40	432	365	417	574	798	062	971	275	20
50	462	393	407	607	773	063	947	246	10
20° 00'	.3491	.3420	.9397	.3640	2.747	1.064	2.924	1.2217	70° 00'
10	520	448	387	673	723	065	901	188	50
20	549	475	377	706	699	066	878	159	40
30	.3578	.3502	.9367	.3739	2.675	1.068	2.855	1.2130	30
40	607	529	356	772	651	069	833	101	20
50	636	557	346	805	628	070	812	072	10
21° 00'	.3665	.3584	.9336	.3839	2.605	1.071	2.790	1.2043	69° 00'
10	694	611	325	872	583	072	769	1.2014	50
20	723	638	315	906	560	074	749	985	40
30	.3752	.3665	.9304	.3939	2.539	1.075	2.729	1.1956	30
40	782	692	293	973	517	076	709	926	20
50	811	719	283	1.006	496	077	689	897	10
22° 00'	.3840	.3746	.9272	.4040	2.475	1.079	2.669	1.1868	68° 00'
10	869	773	261	074	455	080	650	839	50
20	898	800	250	108	434	081	632	810	40
30	.3927	.3827	.9239	.4142	2.414	1.082	2.613	1.1781	30
40	956	854	228	176	394	084	595	752	20
50	985	881	216	210	375	085	577	723	10
23° 00'	.4014	.3907	.9205	.4245	2.356	1.086	2.559	1.1694	67° 00'
10	043	934	194	279	337	088	542	665	50
20	072	961	182	314	318	089	525	636	40
30	.4102	.3987	.9171	.4348	2.300	1.090	2.508	1.1606	30
40	131	.4014	159	383	282	092	491	577	20
50	160	041	147	417	264	093	475	548	10
24° 00'	.4189	.4067	.9135	.4452	2.246	1.095	2.459	1.1519	66° 00'
10	218	094	124	487	229	096	443	490	50
20	247	120	112	522	211	097	427	461	40
30	.4276	.4147	.9100	.4557	2.194	1.099	2.411	1.1432	30
40	305	173	088	592	177	100	396	403	20
50	334	200	075	628	161	102	381	374	10
25° 00'	.4363	.4226	.9063	.4663	2.145	1.103	2.366	1.1345	65° 00'
10	392	253	051	699	128	105	352	316	50
20	422	279	038	734	112	106	337	286	40
30	.4451	.4305	.9026	.4770	2.097	1.108	2.323	1.1257	30
40	480	331	013	806	081	109	309	228	20
50	509	358	001	841	066	111	295	199	10
26° 00'	.4538	.4384	.8988	.4877	2.050	1.113	2.281	1.1170	64° 00'
10	567	410	975	913	035	114	268	141	50
20	596	436	962	950	020	116	254	112	40
30	.4625	.4462	.8949	.4986	2.006	1.117	2.241	1.1083	30
40	654	488	936	.5022	1.991	119	228	054	20
50	683	514	923	059	977	121	215	1.1025	10
27° 00'	.4712	.4540	.8910	.5095	1.963	1.122	2.203	1.0996	63° 00'
		Cos	Sin	Cot	Tan	Csc	Sec	RADIANS	DEGREES

Table 2. Four-Place Values of Functions and Radians (Cont.)

DEGREES	RADIANS	Sin	Cos	Tan	Cot	Sec	Csc		
27° 00'	.4712	.4540	.8910	.5095	1.963	1.122	2.203	1.0996	63° 00'
10	741	566	897	132	949	124	190	966	50
20	771	592	884	169	935	126	178	937	40
30	.4800	.4617	.8870	.5206	1.921	1.127	2.166	1.0908	30
40	829	643	857	243	907	129	154	879	20
50	858	669	843	280	894	131	142	850	10
28° 00'	.4887	.4695	.8829	.5317	1.881	1.133	2.130	1.0821	62° 00'
10	916	720	816	354	868	-134	118	792	50
20	945	746	802	392	855	136	107	763	40
30	.4974	.4772	.8788	.5430	1.842	1.138	2.096	1.0734	30
40	.5003	797	774	467	829	140	085	705	20
50	032	823	760	505	816	142	074	676	10
29° 00'	.5061	.4848	.8746	.5543	1.804	1.143	2.063	1.0647	61° 00'
10	091	874	732	581	792	145	052	617	50
20	120	899	718	619	780	147	041	588	40
30	.5149	.4924	.8704	.5658	1.767	1.149	2.031	1.0559	30
40	178	950	689	696	756	151	020	530	20
50	207	975	675	735	744	153	010	501	10
30° 00'	.5236	.5000	.8660	.5774	1.732	1.155	2.000	1.0472	60° 00'
10	265	025	646	812	720	157	1.990	443	50
20	294	050	631	851	709	159	980	414	40
30	.5323	.5075	.8616	.5890	1.698	1.161	1.970	1.0385	30
40	352	100	601	930	686	163	961	356	20
50	381	125	587	969	.675	165	951	327	10
31° 00'	.5411	.5150	.8572	.6009	1.664	1.167	1.942	1.0297	59° 00'
10	440	175	557	048	653	-169	932	268	50
20	469	200	542	088	643	171	923	239	40
30	.5498	.5225	.8526	.6128	1.632	1.173	1.914	1.0210	30
40	527	250	511	168	621	175	905	181	20
50	556	275	496	208	611	177	896	152	10
32° 00'	.5585	.5299	.8480	.6249	1.600	1.179	1.887	1.0123	58° 00'
10	614	324	465	289	590	181	878	094	50
20	643	348	450	330	580	184	870	065	40
30	.5672	.5373	.8434	.6371	1.570	1.186	1.861	1.0036	30
40	701	398	418	412	560	188	.853	1.0007	20
50	730	422	403	453	550	190	844	977	10
33° 00'	.5760	.5446	.8387	.6494	1.540	1.192	1.836	.9948	57° 00'
10	789	471	371	536	530	195	828	919	50
20	818	495	355	577	520	197	820	890	40
30	.5847	.5519	.8339	.6619	1.511	1.199	1.812	.9861	30
40	876	544	323	661	501	202	804	832	20
50	905	568	307	703	492	204	796	803	10
34° 00'	.5934	.5592	.8290	.6745	1.483	1.206	1.788	.9774	56° 00'
10	963	616	274	787	473	209	781	745	50
20	992	640	258	830	464	211	773	716	40
30	.6021	.5664	.8241	.6873	1.455	1.213	1.766	.9687	30
40	050	688	225	916	446	216	758	657	20
50	080	712	208	959	437	218	751	628	10
35° 00'	.6109	.5736	.8192	.7002	1.428	1.221	1.743	.9599	55° 00'
10	138	760	175	046	419	223	736	570	50
20	167	783	158	089	411	226	729	541	40
30	.6196	.5807	.8141	.7133	1.402	1.228	1.722	.9512	30
40	225	831	124	177	.393	231	715	483	20
50	254	854	107	221	385	233	708	454	10
36° 00'	.6283	.5878	.8090	.7265	1.376	1.236	1.701	.9425	54° 00'
		Cos	Sin	Cot	Tan	Csc	Sec	RADIANS	DEGREES

Table 2. Four-Place Values of Functions and Radians (Cont.)

DEGREES	RADIANS	Sin	Cos	Tan	Cot	Sec	Csc		
36° 00'	.6283	.5878	.8090	.7265	1.376	1.236	1.701	.9425	54° 00'
10	312	901	073	310	368	239	695	396	50
20	341	925	056	355	360	241	688	367	40
30	.6370	.5948	.8039	.7400	1.351	1.244	1.681	.9388	30
40	400	972	021	445	343	247	675	308	20
50	429	995	004	490	335	249	668	279	10
37° 00'	.6458	.6018	.7986	.7536	1.327	1.252	1.662	.9250	53° 00'
10	487	041	969	581	319	255	655	221	50
20	516	065	951	627	311	258	649	192	40
30	.6545	.6088	.7934	.7673	1.303	1.260	1.643	.9163	30
40	574	111	916	720	295	263	636	134	20
50	603	134	898	766	288	266	630	105	10
38° 00'	.6632	.6157	.7880	.7813	1.280	1.269	1.624	.9076	52° 00'
10	661	180	862	860	272	272	618	047	50
20	690	202	844	907	265	275	612	.9018	40
30	.6720	.6225	.7826	.7954	1.257	1.278	1.606	.8988	30
40	749	248	808	.8002	250	281	601	959	20
50	778	271	790	050	242	284	595	930	10
39° 00'	.6807	.6293	.7771	.8098	1.235	1.287	1.589	.8901	51° 00'
10	836	316	753	146	228	290	583	872	50
20	865	338	735	195	220	293	578	843	40
30	.6894	.6361	.7716	.8243	1.213	1.296	1.572	.8814	30
40	923	383	698	292	206	299	567	785	20
50	952	406	679	342	199	302	561	756	10
40° 00'	.6981	.6428	.7660	.8391	1.192	1.305	1.556	.8727	50° 00'
10	.7010	450	642	441	185	309	550	698	50
20	039	472	623	491	178	312	545	668	40
30	.7069	.6494	.7604	.8541	1.171	1.315	1.540	.8639	30
40	098	517	585	591	164	318	535	610	20
50	127	539	566	642	157	322	529	581	10
41° 00'	.7156	.6561	.7547	.8693	1.150	1.325	1.524	.8552	49° 00'
10	185	583	528	744	144	328	519	523	50
20	214	604	509	796	137	332	514	494	40
30	.7243	.6626	.7490	.8847	1.130	1.335	1.509	.8465	30
40	272	648	470	899	124	339	504	436	20
50	301	670	451	952	117	342	499	407	10
42° 00'	.7330	.6691	.7431	.9004	1.111	1.346	1.494	.8378	48° 00'
10	359	713	412	057	104	349	490	348	50
20	389	734	392	110	098	353	485	319	40
30	.7418	.6756	.7373	.9163	1.091	1.356	1.480	.8290	30
40	447	777	353	217	085	360	476	261	20
50	476	799	333	271	079	364	471	232	10
43° 00'	.7505	.6820	.7314	.9325	1.072	1.367	1.466	.8203	47° 00'
10	534	841	294	380	066	371	462	174	50
20	563	862	274	435	060	375	457	145	40
30	.7592	.6884	.7254	.9490	1.054	1.379	1.453	.8116	30
40	621	905	234	545	048	382	448	087	20
50	650	926	214	601	042	386	444	058	10
44° 00'	.7679	.6947	.7193	.9657	1.036	1.390	1.440	.8029	46° 00'
10	709	967	173	713	030	394	435	999	50
20	738	988	153	770	024	398	431	970	40
30	.7767	.7009	.7133	.9827	1.018	1.402	1.427	.7941	30
40	796	030	112	884	012	406	423	912	20
50	825	050	092	942	006	410	418	883	10
45° 00'	.7854	.7071	.7071	1.000	1.000	1.414	1.414	.7854	45° 00'
		Cos	Sin	Cot	Tan	Csc	Sec	RADIANS	DEGREES

Table 3. *Isotopic Masses*

Mass No.	Atomic No.	Element	Atomic Mass
1	0	n	1.008987
1	1	H	1.008145
2	1	H	2.014741
3	1	H	3.016997
3	2	He	3.016977
4	2	He	4.003879
5	2	He	5.0137
5	3	Li	5.0136
6	2	He	6.020833
6	3	Li	6.01697
7	3	Li	7.01822
7	4	Be	7.01916
8	3	Li	8.02502
8	4	Be	8.00785
8	5	B	8.0264
9	4	Be	9.01503
9	5	B	9.01620
10	4	Be	10.01677
10	5	B	10.016110
10	6	C	10.0206
11	5	B	11.012811
11	6	C	11.01495
12	6	C	12.003844
12	7	N	12.0227
13	6	C	13.007505
13	7	N	13.00988
14	6	C	14.00767
14	7	N	14.007550
15	6	C	15.0143
15	7	N	15.004902
15	8	O	15.0078
16	7	N	16.0109
16	8	O	16.000000
17	7	N	17.0139
17	8	O	17.004533
17	9	F	17.007505
18	8	O	18.004883
18	9	F	18.006651
19	8	O	19.0091
19	9	F	19.004444
19	10	Ne	19.007952

Table 3. Isotopic Masses (Cont.)

Mass No.	Atomic No.	Element	Atomic Mass
20	9	F	20.006350
20	10	Ne	19.998772
21	10	Ne	21.000504
21	11	Na	21.004286
22	10	Ne	21.998382
22	11	Na	22.001409
23	10	Ne	23.001768
23	11	Na	22.997055
23	12	Mg	23.001453
24	11	Na	23.998568
24	12	Mg	23.992628
25	12	Mg	24.993745
26	12	Mg	25.990802
27	12	Mg	26.992876
27	13	Al	26.990109
28	13	Al	27.990760
28	14	Si	27.985825
29	14	Si	28.985705
30	14	Si	29.983307
31	14	Si	30.985140
31	15	P	30.983619
32	15	P	31.984016
32	16	S	31.982274
33	15	P	32.982166
33	16	S	32.981941
34	16	S	33.978709
35	17	Cl	34.980064
36	18	A	35.97926
37	17	Cl	36.977675
38	18	A	37.97491
39	19	K	38.97606
40	18	A	39.975148
40	20	Ca	39.97545
41	19	K	40.97490
42	20	Ca	41.97216
43	20	Ca	42.97251
44	20	Ca	43.96924
45	21	Sc	44.97010
46	22	Ti	45.96697
47	22	Ti	46.96668
48	20	Ca	47.96778

Table 3. *Isotopic Masses (Cont.)*

Mass No.	Atomic No.	Element	Atomic Mass
48	22	Ti	47.96317
49	22	Ti	48.96358
50	22	Ti	49.96077
50	24	Cr	49.96210
51	23	V	50.96052
52	24	Cr	51.95707
53	24	Cr	52.95772
54	24	Cr	53.9563
54	26	Fe	53.95704
55	25	Mn	54.95581
56	26	Fe	55.95272
57	26	Fe	56.95359
58	26	Fe	57.9520
58	28	Ni	57.95345
59	27	Co	58.95182
60	27	Co	59.95250
60	28	Ni	59.94901
61	28	Ni	60.94907
62	28	Ni	61.94681
63	29	Cu	62.94926
64	28	Ni	63.94755
64	30	Zn	63.94955
65	29	Cu	64.94835
66	30	Zn	65.94722
67	30	Zn	66.94815
68	30	Zn	67.94686
70	30	Zn	69.94779
70	32	Ge	69.9447
74	32	Ge	73.9426
74	34	Se	73.9439
75	33	As	74.9432
76	32	Ge	75.9433
79	35	Br	78.944
81	35	Br	80.943
82	36	Kr	81.938
84	36	Kr	83.938
85	37	Rb	84.931
86	38	Sr	85.93533
87	37	Rb	86.9295
88	38	Sr	87.93374
94	42	Mo	93.9343

Table 3. Isotopic Masses (Cont.)

Mass No.	Atomic No.	Element	Atomic Mass
98	42	Mo	97.93610
102	46	Pd	101.9375
104	46	Pd	103.93655
105	46	Pd	104.9384
106	46	Pd	105.9368
106	48	Cd	105.93984
108	46	Pd	107.93801
108	48	Cd	107.93860
110	46	Pd	109.93965
110	48	Cd	109.93857
111	48	Cd	110.93978
112	48	Cd	111.93885
113	48	Cd	112.94061
113	49	In	112.94045
114	48	Cd	113.93997
115	49	In	114.94040
115	50	Sn	114.94014
116	48	Cd	115.94202
116	50	Sn	115.93927
117	50	Sn	116.94052
118	50	Sn	117.93978
119	50	Sn	118.94122
120	50	Sn	119.94059
120	52	Te	119.94288
122	50	Sn	121.94249
122	52	Te	121.94193
123	52	Te	122.94368
124	50	Sn	123.94490
124	52	Te	123.94278
124	54	Xe	123.94578
125	52	Te	124.94460
126	52	Te	125.94420
126	54	Xe	125.94476
127	53	I	126.94528
128	52	Te	127.94649
128	54	Xe	127.94446
129	54	Xe	153.94601
130	52	Te	129.94853
130	54	Xe	129.94501
131	54	Xe	130.94673
132	54	Xe	131.94615

Table 3. *Isotopic Masses (Cont.)*

Mass No.	Atomic No.	Element	Atomic Mass
134	54	Xe	133.94803
136	54	Xe	135.95046
136	56	Ba	135.9488
137	56	Ba	136.9502
138	56	Ba	137.9498
140	58	Ce	139.9489
141	59	Pr	140.9514
142	58	Ce	141.9537
144	60	Nd	143.9560
150	60	Nd	149.9687
176	72	Hf	175.9923
178	72	Hf	177.9936
180	72	Hf	180.0029
181	73	Ta	181.0031
182	74	W	182.0033
183	74	W	183.0059
184	74	W	184.0052
194	78	Pt	194.0256
196	78	Pt	196.02744
205	82	Pb	205.04559
206	81	Tl	206.04702
206	82	Pb	206.04519
207	81	Tl	207.04934
207	82	Pb	207.04725
208	81	Tl	208.05290
208	82	Pb	208.04754
208	83	Bi	208.04968
209	81	Tl	209.05778
209	82	Pb	209.05398
209	83	Bi	209.05325
209	84	Po	209.05496
210	81	Tl	210.06264
210	82	Pb	210.05622
210	83	Bi	210.05614
210	84	Po	210.05488
211	82	Pb	211.06196
211	83	Bi	211.06047
211	84	Po	211.05927
212	82	Pb	212.06487
212	83	Bi	212.06345
212	84	Po	212.06094

Table 3. *Isotopic Masses (Cont.)*

Mass No.	Atomic No.	Element	Atomic Mass
212	85	At	212.06079
213	83	Bi	213.06824
213	83	Po	213.06696
214	82	Pb	214.07362
214	83	Bi	214.07225
214	84	Po	214.06852
214	85	At	214.06955
215	84	Po	215.07392
215	85	At	215.07313
216	84	Po	216.07617
216	85	At	216.07586
216	86	Em	216.07358
217	85	At	217.07979
217	86	Em	217.07939
218	84	Po	218.08407
218	85	At	218.08369
218	86	Em	218.08017
218	87	Fr	218.08108
219	86	Em	219.08527
219	87	Fr	219.08501
220	86	Em	220.08693
220	87	Fr	220.08706
220	88	Ra	220.08567
221	87	Fr	221.09057
221	88	Ra	221.09060
222	86	Em	222.09397
222	88	Ra	222.09116
222	89	Ac	222.09342
223	87	Fr	223.09697
223	88	Ra	223.09559
223	89	Ac	223.09615
224	88	Ra	224.09703
224	89	Ac	224.09769
224	90	Th	224.09743
225	88	Ra	225.10102
225	89	Ac	225.10081
225	90	Th	225.10170
226	88	Ra	226.10309
226	90	Th	226.10193
226	91	Pa	226.10494
227	88	Ra	227.10723

Table 3. Isotopic Masses (Cont.)

Mass No.	Atomic No.	Element	Atomic Mass
227	89	Ac	227.10666
227	90	Th	227.10642
227	91	Pa	227.10710
228	88	Ra	228.11005
228	89	Ac	228.11005
228	90	Th	228.10685
228	91	Pa	228.10823
228	92	U	228.10863
229	90	Th	229.11021
229	91	Pa	229.11088
229	92	U	229.11258
230	90	Th	230.11206
230	91	Pa	230.11441
230	92	U	230.11222
231	90	Th	231.11628
231	91	Pa	231.11607
231	93	Np	231.11776
232	90	Th	232.11852
232	91	Pa	232.11768
232	92	U	232.11650
232	94	Pu	232.11973
233	90	Th	233.12198
233	91	Pa	233.12027
233	92	U	233.11937
234	90	Th	234.12394
234	91	Pa	234.12281
234	92	U	234.12115
234	94	Pu	234.12269
235	92	U	235.12517
236	94	Pu	236.12667
237	92	U	237.13010
237	93	Np	237.12932
238	92	U	238.13232
238	93	Np	238.13255
238	94	Pu	238.13106
239	92	U	239.13704
239	93	Np	239.13620
239	94	Pu	239.13494
239	95	Am	239.13568
240	96	Cm	240.13744
241	94	Pu	241.13909

Table 3. *Isotopic Masses (Cont.)*

Mass No.	Atomic No.	Element	Atomic Mass
241	95	Am	241.13919
242	95	Am	242.14215
242	96	Cm	242.14160

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Table 4. Atomic Weights of the Elements

Element	Symbol	Atomic Number	Atomic Weight*
Actinium	Ac	89	227
Aluminum	Al	13	26.98
Americium	Am	95	[243]
Antimony	Sb	51	121.76
Argon	A	18	39.944
Arsenic	As	33	74.91
Astatine	At	85	[210]
Barium	Ba	56	137.36
Berkelium	Bk	97	[249]
Beryllium	Be	4	9.013
Bismuth	Bi	83	209.00
Boron	B	5	10.82
Bromine	Br	35	79.916
Cadmium	Cd	48	112.41
Calcium	Ca	20	40.08
Californium	Cf	98	[249]
Carbon	C	6	12.011
Cerium	Ce	58	140.13
Cesium	Cs	55	132.91
Chlorine	Cl	17	35.457
Chromium	Cr	24	52.01
Cobalt	Co	27	58.94
Copper	Cu	29	63.54
Curium	Cm	96	[245]
Dysprosium	Dy	66	162.51
Erbium	Er	68	167.27
Europium	Eu	63	152.0
Fluorine	F	9	19.00
Francium	Fr	87	[223]
Gadolinium	Gd	64	157.26
Gallium	Ga	31	69.72
Germanium	Ge	32	72.60
Gold	Au	79	197.0
Hafnium	Hf	72	178.50
Helium	He	2	4.003
Holmium	Ho	67	164.94
Hydrogen	H	1	1.0080
Indium	In	49	114.82
Iodine	I	53	126.91
Iridium	Ir	77	192.2
Iron	Fe	26	55.85
Krypton	Kr	36	83.80
Lanthanum	La	57	138.92
Lead	Pb	82	207.21
Lithium	Li	3	6.940
Lutetium	Lu	71	174.99
Magnesium	Mg	12	24.32
Manganese	Mn	25	54.94
Mendelevium	Mv	101	[256]
Mercury	Hg	80	200.61

* A value given in brackets denotes the mass number of the most stable known isotope. From *Journal of the American Chemical Society*, Vol. 78, p. 3235, 1956.

Table 4. Atomic Weights of the Elements (Cont.)

Element	Symbol	Atomic Number	Atomic Weight ^a
Molybdenum	Mo	42	95.95
Neodymium	Nd	60	144.27
Neon	Ne	10	20.183
Neptunium	Np	93	[237]
Nickel	Ni	28	58.71
Niobium (Columbium)	Nb	41	92.91
Nitrogen	N	7	14.008
Osmium	Os	76	190.2
Oxygen	O	8	16
Palladium	Pd	46	106.4
Phosphorus	P	15	30.975
Platinum	Pt	78	195.09
Plutonium	Pu	94	[242]
Polonium	Po	84	210
Potassium	K	19	39.100
Praseodymium	Pr	59	140.92
Promethium	Pm	61	[145]
Protactinium	Pa	91	231
Radium	Ra	88	226.05
Radon	Rn	86	222
Rhenium	Re	75	186.22
Rhodium	Rh	45	102.91
Rubidium	Rb	37	85.48
Ruthenium	Ru	44	101.1
Samarium	Sm	62	150.35
Scandium	Sc	21	44.96
Selenium	Se	34	78.96
Silicon	Si	14	28.09
Silver	Ag	47	107.880
Sodium	Na	11	22.991
Strontium	Sr	38	87.63
Sulfur	S	16	32.066
Tantalum	Ta	73	180.95
Technetium	Tc	43	[99]
Tellurium	Te	52	127.61
Terbium	Tb	65	158.93
Thallium	Tl	81	204.39
Thorium	Th	90	232.05
Thulium	Tm	69	168.94
Tin	Sn	50	118.70
Titanium	Ti	22	47.90
Tungsten	W	74	183.86
Uranium	U	92	238.07
Vanadium	V	23	50.95
Xenon	Xe	54	131.30
Ytterbium	Yb	70	173.04
Yttrium	Y	39	88.92
Zinc	Zn	30	65.38
Zirconium	Zr	40	91.22

^a A value given in brackets denotes the mass number of the most stable known isotope. From *Journal of the American Chemical Society*, Vol. 78, p. 3235, 1956.

Table 5. Distribution of Electrons in the Atoms

X-Ray Notation		K	L		M			N						
Quantum Numbers n, l		1,0	2,0	2,1	3,0	3,1	3,2	4,0	4,1	4,2	4,3			
Element	Atomic Number Z													
H	1	1												
He	2	2												
Li	3	2	1											
Be	4	2	2											
B	5	2	2	1										
C	6	2	2	2										
N	7	2	2	3										
O	8	2	2	4										
F	9	2	2	5										
Ne	10	2	2	6										
Na	11	Neon Configuration 10 electron core			1									
Mg	12				2									
Al	13				2	1								
Si	14				2	2								
P	15				2	3								
S	16				2	4								
Cl	17				2	5								
A	18				2	6								
K	19	Argon Configuration 18 electron core						1						
Ca	20							2						
Sc	21									1	2			
Ti	22									2	2			
V	23									3	2			
Cr	24									5	1			
Mn	25									5	2			
Fe	26									6	2			
Co	27									7	2			
Ni	28									8	2			
Cu	29									10	1			
Zn	30									10	2			
Ga	31									10	2	1		
Ge	32									10	2	2		
As	33									10	2	3		
Se	34									10	2	4		
Br	35									10	2	5		
Kr	36									10	2	6		

Table 5. Distribution of Electrons in the Atoms (Cont.)

X-Ray Notation		K L M			N			O			P			Q						
Quantum Numbers <i>n, l</i>		1	2	3	4,0	4,1	4,2	4,3	5,0	5,1	5,2	6,0	6,1	6,2	7,0	7,1				
Element	Atomic Number <i>Z</i>																			
Rb	37	Krypton Configuration 36 electron core							1											
Sr	38											2								
Y	39									1		2								
Zr	40									2		2								
Nb	41									4		1								
Mo	42									5		1								
Ma	43									6		1								
Ru	44									7		1								
Rh	45									8		1								
Pd	46									10										
Ag	47	Palladium Configuration 46 electron core							1											
Cd	48											2								
In	49											2	1							
Sn	50											2	2							
Sb	51											2	3							
Te	52											2	4							
I	53											2	5							
Xe	54											2	6							
Cs	55	Xenon Configuration										1								
Ba	56	54 electron core										2								
La	57	Shells 1,0 to 4,2 contain 46 electrons							2	6	1	2								
Ce	58									1	2	6	1	2						
Pr	59									2	2	6	1	2						
Nd	60									3	2	6	1	2						
Pm	61									4	2	6	1	2						
Sm	62									5	2	6	1	2						
Eu	63									6	2	6	1	2						
Gd	64									7	2	6	1	2						
Tb	65									8	2	6	1	2						
Dy	66									9	2	6	1	2						
Ho	67									10	2	6	1	2						
Er	68									11	2	6	1	2						
Tm	69									13	2	6	0	2						
Yb	70									14	2	6	0	2						
Lu	71				14	2	6	1	2											

Table 5. Distribution of Electrons in the Atoms (Cont.)

X-Ray Notation		K	L	M	N	O			P			Q					
Quantum Numbers <i>n, l</i>		1	2	3	4	5,0	5,1	5,2	5,3	6,0	6,1	6,2	7,0	7,1			
Element	Atomic Number <i>Z</i>																
Hf	72	Shells 1,0 to 5,1 contain 68 electrons					2			2							
Ta	73						3					2					
W	74						4					2					
Re	75						5					2					
Os	76						6					2					
Ir	77						7					2					
Pt	78						9					1					
Au	79						10					1					
Hg	80						10					2					
Tl	81						10					2	1				
Pb	82						10					2	2				
Bi	83						10					2	3				
Po	84						10					2	4				
At	85						10					2	5				
Rn	86						10					2	6				
Fr	87					Radon Configuration											1
Ra	88	86 electron core											2				
Ac	89								2	6	1		2				
Th	90						1	2	2	6	1		2				
Pa	91						2	2	2	6	1		2				
U	92						3	2	2	6	1		2				
Np	93						4	2	2	6	1		2				
Pu	94						5	2	2	6	1		2				
Am	95						6	2	2	6	1		2				
Cm	96						7	2	2	6	1		2				
Bk	97						8	2	2	6	1		2				
Cf	98						9	2	2	6	1		2				
E	99						10	2	2	6	1		2				
Fm	100						11	2	2	6	1		2				
Mv	101						12	2	2	6	1		2				

Table 6. Periodic Table of the Elements

	I	II	III	IV	V	VI	VII	VIII
1	1 H 1.0080							2 He 4.003
2	3 Li 6.940	4 Be 9.013	5 B 10.82	6 C 12.011	7 N 14.008	8 O 16	9 F 19.00	10 Ne 20.183
3	11 Na 22.991	12 Mg 24.32	13 Al 26.98	14 Si 28.09	15 P 30.975	16 S 32.066	17 Cl 35.457	18 Ar 39.944
4	19 K 39.100	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.95	24 Cr 52.01	25 Mn 54.94	26 Fe 27 Co 28 Ni 55.85 58.94 58.71
	29 Cu 63.54	30 Zn 65.38	31 Ga 69.72	32 Ge 72.60	33 As 74.91	34 Se 78.96	35 Br 79.916	36 Kr 83.80
5	37 Rb 85.48	38 Sr 87.63	39 Y 88.92	40 Zr 91.22	41 Nb 92.91	42 Mo 95.95	43 Tc [99]	44 Ru 45 Rh 46 Pd 101.1 102.91 106.4
	47 Ag 107.880	48 Cd 112.41	49 In 114.82	50 Sn 118.70	51 Sb 121.76	52 Te 127.61	53 I 126.91	54 Xe 131.30
6	55 Cs 132.91	56 Ba 137.36	57-71 Rare Earths*	72 Hf 178.50	73 Ta 180.95	74 W 183.86	75 Re 186.22	76 Os 77 Ir 78 Pt 190.2 192.2 195.09
	79 Au 197.0	80 Hg 200.61	81 Tl 204.39	82 Pb 207.21	83 Bi 209.00	84 Po 210	85 At [210]	86 Rn 222
7	87 Fr [223]	88 Ra 226.05	89-102 Actinide† Series					

*Rare Earth or Lanthanide Series.

57 La 138.92	58 Ce 140.13	59 Pr 140.92	60 Nd 144.27	61 Pm [145]
62 Sm 150.35	63 Eu 152.0	64 Gd 157.26	65 Tb 158.93	66 Dy 162.51
67 Ho 164.94	68 Er 167.27	69 Tm 168.94	70 Yb 173.04	71 Lu 174.99

† Actinide Series.

89 Ac 227	90 Th 232.05	91 Pa 231	92 U 238.07
93 Np [237]	94 Pu [242]	95 Am [243]	96 Cm [245]
97 Bk [249]	98 Cf [249]	99 E (Einsteinium)	100 Fm (Fermium)
101 Mv [256]	102 (Nobelium)		