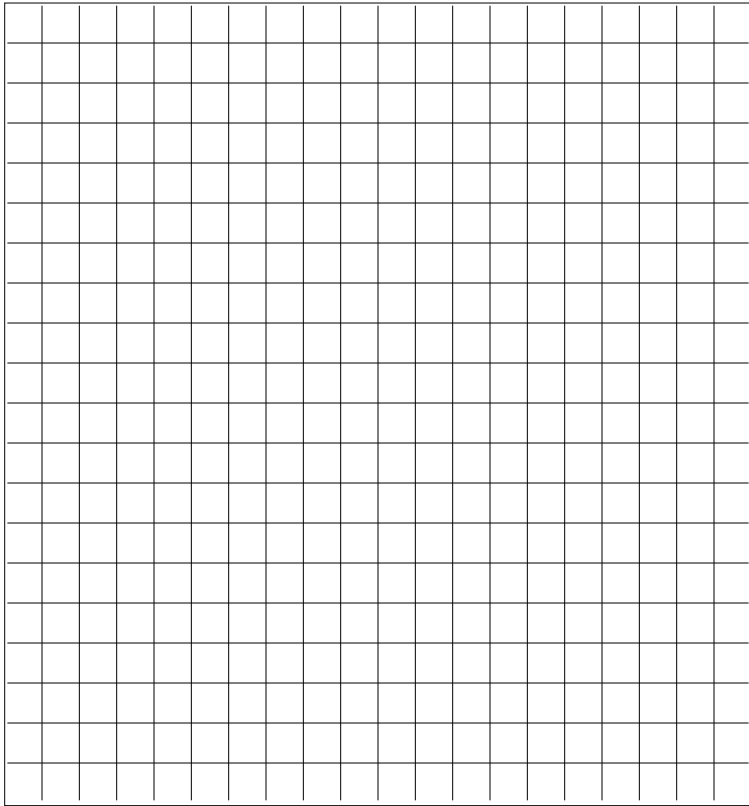


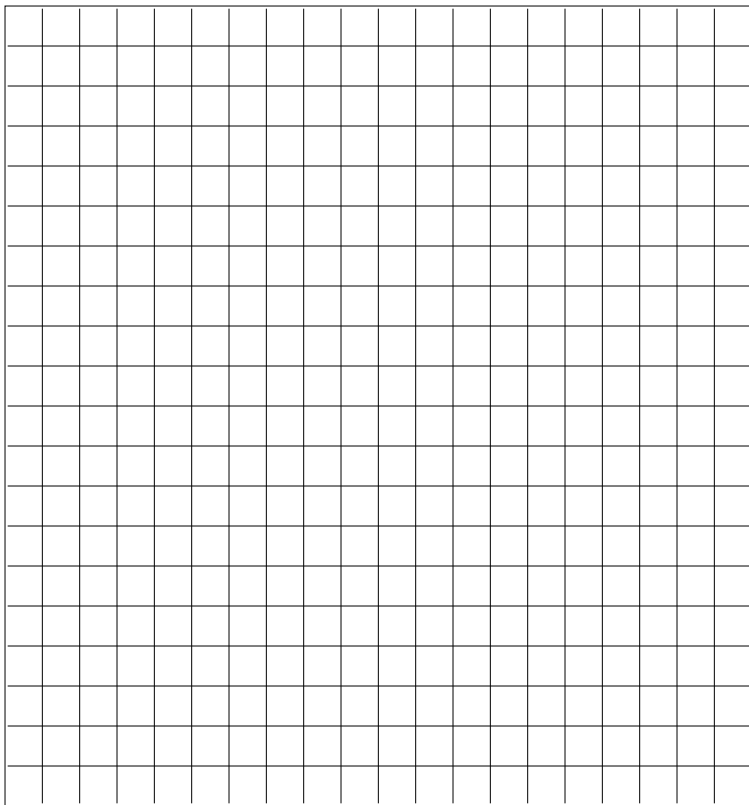
Ionization Energy for Group 2

A large empty grid consisting of 20 columns and 20 rows, intended for plotting data for Group 2 ionization energy.

Conclusions:

1. Write a generalization about the pattern which you observed.

Ionization Energy for Period 4

A large empty grid consisting of 20 columns and 20 rows, intended for plotting data for Period 4 ionization energy.

2. Write a generalization about the pattern which you observed.

Electronegativity for Group 1

Conclusions:

1. Write a generalization about the pattern which you observed.

Electronegativity for Period 4

2. Write a generalization about the pattern which you observed.

Periodic Trends Data

Z	Name	Symbol	A	N	AtRad(Å)	1stIE(V)	D(g/cc)	ENeg
1	Hydrogen	H	1.008	0	2.08	13.598	0.0899	2.1
2	Helium	He	4.003	2		24.587	0.1785	
3	Lithium	Li	6.941	4	1.55	5.392	0.53	0.98
4	Beryllium	Be	9.012	5	1.12	9.322	1.85	1.57
5	Boron	B	10.611	6	0.98	8.298	2.34	2.04
6	Carbon	C	12.011	6	0.91	11.26	2.26	2.55
7	Nitrogen	N	14.007	7	0.92	14.534	1.125	3.04
8	Oxygen	O	15.999	8	0.65	13.618	1.429	3.44
9	Fluorine	F	18.998	10	0.57	17.422	1.696	3.98
10	Neon	Ne	20.180	10	0.51	21.564	0.9	
11	Sodium	Na	22.990	12	1.9	5.139	0.97	0.93
12	Magnesium	Mg	24.305	12	1.6	7.646	1.74	1.31
13	Aluminum	Al	26.982	14	1.43	5.986	2.7	1.61
14	Silicon	Si	28.085	14	1.32	8.151	2.33	1.9
15	Phosphorus	P	30.974	16	1.28	10.486	1.82	2.19
16	Sulfur	S	32.066	16	1.27	10.36	2.07	2.58
17	Chlorine	Cl	35.453	18	0.97	12.967	3.214	3.16
18	Argon	Ar	39.948	22	0.88	15.759	1.784	
19	Potassium	K	39.098	20	2.35	4.341	0.86	0.82
20	Calcium	Ca	40.078	20	1.97	6.113	1.55	1
21	Scandium	Sc	44.956	24	1.62	6.54	2.99	1.36
22	Titanium	Ti	47.880	26	1.45	6.82	4.54	1.54
23	Vanadium	V	50.941	28	1.34	6.74	6.11	1.63
24	Chromium	Cr	51.996	28	1.3	6.766	7.19	1.66
25	Manganese	Mn	54.938	30	1.35	7.435	7.44	1.55
26	Iron	Fe	55.847	30	1.26	7.87	7.874	1.83
27	Cobalt	Co	58.933	32	1.25	7.86	8.9	1.88
28	Nickel	Ni	58.693	31	1.24	7.635	8.9	1.91
29	Copper	Cu	63.546	35	1.28	7.726	8.96	1.9
30	Zinc	Zn	65.390	35	1.38	9.394	7.13	1.65
31	Gallium	Ga	69.732	39	1.41	5.999	5.91	1.81
32	Germanium	Ge	72.610	41	1.37	7.899	5.32	2.01
33	Arsenic	As	74.922	42	1.39	9.81	5.78	2.18
34	Selenium	Se	78.960	45	1.4	9.752	4.79	2.55
35	Bromine	Br	79.904	45	1.12	11.814	3.12	2.96
36	Krypton	Kr	83.800	48	1.03	13.999	3.75	
37	Rubidium	Rb	85.468	48	2.48	4.177	1.532	0.82
38	Strontium	Sr	87.620	50	2.15	5.695	2.54	0.95
39	Yttrium	Y	88.906	50	1.78	6.38	4.47	1.22
40	Zirconium	Zr	91.224	51	1.6	6.84	6.51	1.33
41	Niobium	Nb	92.906	52	1.46	6.88	8.57	1.6
42	Molybdenum	Mo	95.940	54	1.39	7.099	10.22	2.16
43	Technetium	Tc	98.000	55	1.36	7.28	11.5	1.9
44	Ruthenium	Ru	101.070	57	1.34	7.37	12.37	2.2
45	Rhodium	Rh	102.906	58	1.34	7.46	12.41	2.28
46	Palladium	Pd	106.420	60	1.37	8.34	12	2.2
47	Silver	Ag	107.868	61	1.44	7.576	10.5	1.93
48	Cadmium	Cd	112.410	64	1.71	8.993	8.65	1.69
49	Indium	In	114.820	66	1.66	5.786	7.31	1.78
50	Tin	Sn	118.710	69	1.62	7.344	7.31	1.96
51	Antimony	Sb	121.757	71	1.59	8.641	6.69	2.05
52	Tellurium	Te	127.600	76	1.42	9.009	6.24	2.1
53	Iodine	I	126.904	74	1.32	10.451	4.93	2.66
54	Xenon	Xe	131.290	77			5.9	2.6

Element Data

Z	Name	Symb	A	N	Ox#	MP(°K)	MP(°C)	BP(°K)	BP(°C)	Lf(KJ/mol)	SpHt(J/g°K)	D(g/cc)	CovRad(Å)	AtRad(Å)	1stIE(V)	ENeg
1	Hydrogen	H	1.008	0	1	13.81	-259.34	20.28	-252.87	0.0585	14.304	0.0899	0.32	2.08	13.598	2.1
2	Helium	He	4.003	2	0	0.95	-272.2	4.218	-268.932	0.021	5.193	0.1785	0.93		24.587	
3	Lithium	Li	6.941	4	1	453.7	180.55	1615	1341.85	3	3.582	0.53	1.23	1.55	5.392	0.98
4	Beryllium	Be	9.012	5	2	1560	1286.85	3243	2969.85	11.71	1.825	1.85	0.9	1.12	9.322	1.57
5	Boron	B	10.611	6	3	2365	2091.85	4275	4001.85	22.6	1.026	2.34	0.82	0.98	8.298	2.04
6	Carbon	C	12.011	6	±4,2	3825	3551.85	5100	4826.85		0.709	2.26	0.77	0.91	11.26	2.55
7	Nitrogen	N	14.007	7	±3,5,4,2	63.15	-210	77.344	-195.806	0.36	1.042	1.125	0.75	0.92	14.534	3.04
8	Oxygen	O	15.999	8	-2	54.8	-218.35	90.188	-182.962	0.222	0.92	1.429	0.73	0.65	13.618	3.44
9	Fluorine	F	18.998	10	-1	53.55	-219.6	85	-188.15	0.26	0.824	1.696	0.72	0.57	17.422	3.98
10	Neon	Ne	20.180	10	0	24.55	-248.6	27.1	-246.05	0.34	1.03	0.9	0.71	0.51	21.564	
11	Sodium	Na	22.990	12	1	371	97.85	1156	882.85	2.601	1.23	0.97	1.54	1.9	5.139	0.93
12	Magnesium	Mg	24.305	12	2	922	648.85	1380	1106.85	8.95	1.02	1.74	1.36	1.6	7.646	1.31
13	Aluminum	Al	26.982	14	3	933.5	660.35	2740	2466.85	10.7	0.9	2.7	1.18	1.43	5.986	1.61
14	Silicon	Si	28.085	14	42	1683	1409.85	2630	2356.85	50.2	0.7	2.33	1.11	1.32	8.151	1.9
15	Phosphorus	P	30.974	16	±3,5,4	317.3	44.15	553	279.85	0.63	0.769	1.82	1.06	1.28	10.486	2.19
16	Sulfur	S	32.066	16	±2,4,6	392.2	119.05	717.82	444.67	1.73	0.71	2.07	1.02	1.27	10.36	2.58
17	Chlorine	Cl	35.453	18	±1,3,5,7	172.17	-100.98	239.18	-33.97	3.21	0.48	3.214	0.99	0.97	12.967	3.16
18	Argon	Ar	39.948	22	0	83.95	-189.2	87.45	-185.7	1.188	0.52	1.784	0.98	0.88	15.759	
19	Potassium	K	39.098	20	1	336.8	63.65	1033	759.85	2.33	0.757	0.86	2.03	2.35	4.341	0.82
20	Calcium	Ca	40.078	20	2	1112	838.85	1757	1483.85	8.53	0.647	1.55	1.74	1.97	6.113	1
21	Scandium	Sc	44.956	24	3	1814	1540.85	3109	2835.85	16.11	0.568	2.99	1.44	1.62	6.54	1.36
22	Titanium	Ti	47.880	26	43	1935	1661.85	3560	3286.85	18.6	0.523	4.54	1.32	1.45	6.82	1.54
23	Vanadium	V	50.941	28	5432	2163	1889.85	3650	3376.85	22.8	0.489	6.11	1.22	1.34	6.74	1.63
24	Chromium	Cr	51.996	28	632	2130	1856.85	2945	2671.85	20	0.449	7.19	1.18	1.3	6.766	1.66
25	Manganese	Mn	54.938	30	76423	1518	1244.85	2235	1961.85	14.64	0.48	7.44	1.17	1.35	7.435	1.55
26	Iron	Fe	55.847	30	236	1808	1534.85	3023	2749.85	13.8	0.449	7.874	1.17	1.26	7.87	1.83
27	Cobalt	Co	58.933	32	23	1768	1494.85	3143	2869.85	16.19	0.421	8.9	1.16	1.25	7.86	1.88
28	Nickel	Ni	58.693	31	23	1726	1452.85	3005	2731.85	17.2	0.444	8.9	1.15	1.24	7.635	1.91
29	Copper	Cu	63.546	35	21	1356.6	1083.45	2840	2566.85	13.14	0.385	8.96	1.17	1.28	7.726	1.9
30	Zinc	Zn	65.390	35	2	692.73	419.58	1180	906.85	7.38	0.388	7.13	1.25	1.38	9.394	1.65
31	Gallium	Ga	69.732	39	3	302.92	29.77	2478	2204.85	5.59	0.371	5.91	1.26	1.41	5.999	1.81
32	Germanium	Ge	72.610	41	4	1211.5	938.35	3107	2833.85	31.8	0.32	5.32	1.22	1.37	7.899	2.01
33	Arsenic	As	74.922	42	±3,5	1090	816.85	876	602.85	27.7	0.33	5.78	1.2	1.39	9.81	2.18
34	Selenium	Se	78.960	45	-246	494	220.85	958	684.85	5.54	0.32	4.79	1.16	1.4	9.752	2.55
35	Bromine	Br	79.904	45	±1,5,7	265.95	-7.2	331.85	58.7	5.286	0.226	3.12	1.14	1.12	11.814	2.96
36	Krypton	Kr	83.800	48	2	116	-157.15	120.85	-152.3	1.638	0.248	3.75	1.89	1.03	13.999	
37	Rubidium	Rb	85.468	48	1	312.63	39.48	961	687.85	2.34	0.363	1.532	2.16	2.48	4.177	0.82

Element Data

Z	Name	Symb	A	N	Ox#	MP(°K)	MP(°C)	BP(°K)	BP(°C)	Lf(KJ/mol)	SpHt(J/g°K)	D(g/cc)	CovRad(Å)	AtRad(Å)	1stIE(V)	ENeg
38	Strontium	Sr	87.620	50	2	1042	768.85	1655	1381.85	8.2	0.3	2.54	1.91	2.15	5.695	0.95
39	Yttrium	Y	88.906	50	3	1795	1521.85	3611	3337.85	17.15	0.3	4.47	1.62	1.78	6.38	1.22
40	Zirconium	Zr	91.224	51	4	2128	1854.85	4682	4408.85	21	0.278	6.51	1.45	1.6	6.84	1.33
41	Niobium	Nb	92.906	52	53	2742	2468.85	5015	4741.85	26.9	0.265	8.57	1.34	1.46	6.88	1.6
42	Molybdenum	Mo	95.940	54	65432	2896	2622.85	4912	4638.85	36	0.25	10.22	1.3	1.39	7.099	2.16
43	Technetium	Tc	98.000	55	7	2477	2203.85	4538	4264.85	23	0.24	11.5	1.27	1.36	7.28	1.9
44	Ruthenium	Ru	101.070	57	23468	2610	2336.85	4425	4151.85	25.52	0.238	12.37	1.25	1.34	7.37	2.2
45	Rhodium	Rh	102.906	58	234	2236	1962.85	3970	3696.85	21.76	0.242	12.41	1.25	1.34	7.46	2.28
46	Palladium	Pd	106.420	60	24	1825	1551.85	3240	2966.85	16.74	0.244	12	1.28	1.37	8.34	2.2
47	Silver	Ag	107.868	61	1	1235.08	961.93	2436	2162.85	11.3	0.235	10.5	1.34	1.44	7.576	1.93
48	Cadmium	Cd	112.410	64	2	594.26	321.11	1040	766.85	6.07	0.232	8.65	1.41	1.71	8.993	1.69
49	Indium	In	114.820	66	3	429.78	156.63	2350	2076.85	3.26	0.233	7.31	1.44	1.66	5.786	1.78
50	Tin	Sn	118.710	69	42	505.12	231.97	2876	2602.85	7.2	0.228	7.31	1.41	1.62	7.344	1.96
51	Antimony	Sb	121.757	71	±3,5	903.91	630.76	1860	1586.85	19.83	0.207	6.69	1.4	1.59	8.641	2.05
52	Tellurium	Te	127.600	76	-246	722.72	449.57	1261	987.85	17.49	0.202	6.24	1.36	1.42	9.009	2.1
53	Iodine	I	126.904	74	±1,5,7	38607	38333.85	457.5	184.35	7.76	0.145	4.93	1.33	1.32	10.451	2.66
54	Xenon	Xe	131.290	77	0,2,4,6	161.39	-111.76	165.1	-108.05	2.3	0.158	5.9	1.31	1.24	12.13	2.6
55	Cesium	Cs	132.905	78	1	301.54	28.39	944	670.85	2.092	0.24	1.87	2.35	2.67	3.894	0.79
56	Barium	Ba	137.330	81	2	1002	728.85	2078	1804.85	8.01	0.204	3.59	1.98	2.22	5.212	0.89
57	Lanthanum	La	138.905	82	3	1191	917.85	3737	3463.85	11.3	0.19	6.15	1.25	1.38	5.58	1.1
58	Cerium	Ce	140.120	82	34	1071	797.85	3715	3441.85	9.2	0.19	6.77	1.65	1.81	5.47	1.12
59	Praeseodymii	Pr	140.908	82	34	1204	930.85	3785	3511.85	10.04	0.193	6.77	1.65	1.82	5.42	1.13
60	Neodymium	Nd	144.240	84	3	1294	1020.85	3347	3073.85	10.88	0.19	7.01	1.64	1.82	5.49	1.14
61	Promethium	Pm	145.000	84	3	1315	1041.85	3273	2999.85			7.22	1.63		5.55	1.13
62	Samarium	Sm	150.360	88	32	1347	1073.85	2067	1793.85	11.09	0.197	7.52	1.62	1.81	5.63	1.17
63	Europium	Eu	151.965	89	32	1095	821.85	1800	1526.85	10.46	0.182	5.24	1.85	1.99	5.67	1.2
64	Gadolinium	Gd	157.250	93	3	1585	1311.85	3545	3271.85	15.48	0.236	7.9	1.61	1.8	6.15	1.2
65	Terbium	Tb	158.925	94	34	1629	1355.85	3500	3226.85		0.18	8.23	1.59	1.8	5.86	1.1
66	Dysprosium	Dy	162.500	96	3	1685	1411.85	2840	2566.85	11.06	0.173	8.55	1.59	1.8	5.93	1.22
67	Holmium	Ho	164.930	98	3	1747	1473.85	2968	2694.85	17.15	0.165	8.8	1.85	1.79	6.02	1.23
68	Erbium	Er	167.260	99	3	1802	1528.85	3140	2866.85	17.15	0.168	9.07	1.57	1.78	6.101	1.24
69	Thullium	Tm	168.934	100	32	1818	1544.85	2223	1949.85	16.8	0.16	9.32	1.56	1.77	6.184	1.25
70	Ytterbium	Yb	173.040	103	32	1092	818.85	1469	1195.85	7.7	0.155	6.97	1.7	1.94	6.254	1.1
71	Lutetium	Lu	174.967	104	3	1936	1662.85	3668	3394.85	18.6	0.15	9.84	1.56	1.75	5.43	1.27
72	Hafnium	Hf	178.490	106	4	2504	2230.85	4875	4601.85	21.76	0.14	13.31	1.44	1.67	6.65	1.3
73	Tantalum	Ta	180.948	108	5	3293	3019.85	5730	5456.85	36	0.14	16.65	1.34	1.49	7.89	1.5
74	Tungsten	W	183.850	110	65432	3695	3421.85	5825	5551.85	35.4	0.13	19.3	1.3	1.41	7.98	2.36

Periodic Table

1	1 H 1.0001	2											13	14	15	16	17	2 He 4.00	
2	3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 15.99	9 F 18.99	10 Ne 20.18	
3	11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95	
4	19 K 39.1	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 51.99	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80	
5	37 Rb 85.5	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc 98	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.75	52 Te 127.60	53 I 126.91	54 Xe 131.29	
6	55 Cs 132.9	56 Ba 137.33	57-70 *	71 Lu 174.97	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.2	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po 209	85 At 210	86 Rn 222
7	87 Fr 223	88 Ra 226.03	89-102 **	103 Lr 260	104 Rf 261.1	105 Db 262.1	106 Sg 263.1	107 Bh 264.1	108 Hs 265.1	109 Mt [268]	110 Uun [269]	111 Uuu [272]	112 Uub [277]	114 Uuq [289]	116 Uuh [289]			118 Uuo [293]	

*lanthanides

57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm 145	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.92	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04
89 Ac 227.03	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	94 Pu 244	95 Am 243	96 Cm 247	97 Bk 247	98 Cf 251	99 Es 252	100 Fm 257	101 Md 258	102 No 259

**actinides

1	Hydrogen	H	31	Gallium	Ga	61	Promethium	Pm	91	Protactinium	Pa
2	Helium	He	32	Germanium	Ge	62	Samarium	Sm	92	Uranium	U
3	Lithium	Li	33	Arsenic	As	63	Europium	Eu	93	Neptunium	Np
4	Beryllium	Be	34	Selenium	Se	64	Gadolinium	Gd	94	Plutonium	Pu
5	Boron	B	35	Bromine	Br	65	Terbium	Tb	95	Americium	Am
6	Carbon	C	36	Krypton	Kr	66	Dysprosium	Dy	96	Curium	Cm
7	Nitrogen	N	37	Rubidium	Rb	67	Holmium	Ho	97	Berkelium	Bk
8	Oxygen	O	38	Strontium	Sr	68	Erbium	Er	98	Californium	Cf
9	Fluorine	F	39	Yttrium	Y	69	Thulium	Tm	99	Einsteinium	Es
10	Neon	Ne	40	Zirconium	Zr	70	Ytterbium	Yb	100	Fermium	Fm
11	Sodium	Na	41	Niobium	Nb	71	Lutetium	Lu	101	Mendelevium	Md
12	Magnesium	Mg	42	Molybdenum	M	72	Hafnium	Hf	102	Nobelium	No
13	Aluminum	Al	43	Technetium	Tc	73	Tantalum	Ta	103	Lawrencium	Lr
14	Silicon	Si	44	Ruthenium	Ru	74	Tungsten	W	104	Rutherfordium	Rf
15	Phosphorus	P	45	Rhodium	Rh	75	Rhenium	Re	105	Dubnium	Db
16	Sulfur	S	46	Palladium	Pd	76	Osmium	Os	106	Seaborgium	Sg
17	Chlorine	Cl	47	Silver	Ag	77	Iridium	Ir	107	Bohrium	Bh
18	Argon	Ar	48	Cadmium	Cd	78	Platinum	Pt	108	Hassium	Hs
19	Potassium	K	49	Indium	In	79	Gold	Au	109	Meitnerium	Mt
20	Calcium	Ca	50	Tin	Sn	80	Mercury	Hg	110	Ununillium	Uun
21	Scandium	Sc	51	Antimony	Sb	81	Thallium	Tl	111	Ununiumium	Uuu
22	Titanium	Ti	52	Tellurium	Te	82	Lead	Pb	112	Ununbium	Uub
23	Vanadium	V	53	Iodine	I	83	Bismuth	Bi	113	*****	
24	Chromium	Cr	54	Xenon	Xe	84	Polonium	Po	114	Ununquadium	Uuq
25	Manganese	Mn	55	Caesium	Cs	85	Astatine	At	115	*****	
26	Iron	Fe	56	Barium	Ba	86	Radon	Rn	116	Ununhexium	Uuh
27	Cobalt	Co	57	Lanthanum	La	87	Francium	Fr	117	*****	
28	Nickel	Ni	58	Cerium	Ce	88	Radium	Ra	118	Ununoctium	Uuo
29	Copper	Cu	59	Praseodymium	Pr	89	Actinium	Ac	119	*****	
30	Zinc	Zn	60	Neodymium	Nd	90	Thorium	Th	120	*****	

Dmitri Mendeleev-developed first periodic table
Periodic Law - The properties of elements are a periodic function of their atomic numbers.

Moseley-Discovered atomic numbers by bombarding atoms with x-rays.

Atomic Number (Z) -The number of protons in the nucleus
Atomic Mass Number (A) - No. of Protons + No. of Neutrons.
A-Z = No. of Neutrons.

$${}^A_Z X \quad X = \text{Element Symbol}$$

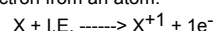
Isotopic Symbol

Atomic Weight-The average weight(mass) of an atom of an element as determined from naturally occurring mixture of the elements

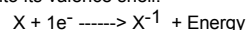
Carbon-12 - The isotope of carbon used as a standard for atomic weights. One atom of carbon-12 has a mass of exactly 12.0000000 amu's.

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Trends of the Periodic Table (based on increasing At. No.)

	Row	Group
Ionization energy	Increases	Decreases
Electronegativity	Increases	Decreases
Metallic Properties	Decreases	Increases
Nonmetallic Prop.	Increases	Decreases
Atomic Radius	Decreases	Increases

Group Names & Characteristics

- Group 1- Alkali Metals -Very Reactive
- Group 2 -Alkaline Earth Metals - Reactive
- Group 17- Halogens - Contains solids, liq. & gases Active
- Group 18- Noble Gases-All monatomic. Unreactive
- Groups 3 to 11-Transition Metals - Incomplete d sublevels, colored compounds, variable ox. nos.

Metals- Left of stairs, Solids except Hg, malleable, ductile, good conductors.

Nonmetals- Right of stairs, Tend to be molecular, covalent bonding, gases or soft liquids, some are diatomic (HOFBrINCl)

Metalloids-have both metallic and nonmetallic properties, Si, Ge, As, and Sb are used extensively in the electronics industry to make semiconductors.

Periodic Table

- Alkali Metals
- Alkaline Earth Metals
- Transition Metals
- Other Metals
- Nonmetals
- Noble Gases

1	1 H 1.0001	2											13	14	15	16	17	18 2 He 4.00	
2	3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 15.99	9 F 18.99	10 Ne 20.18	
3	11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95	
4	19 K 39.1	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 51.99	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80	
5	37 Rb 85.5	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc 98	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.75	52 Te 127.60	53 I 126.91	54 Xe 131.29	
6	55 Cs 132.9	56 Ba 137.33	57-70 * Lu 174.97	71 Hf 178.49	72 Ta 180.95	73 W 183.85	74 Re 186.21	75 Os 190.2	76 Ir 192.22	77 Pt 195.08	78 Au 196.97	79 Hg 200.59	80 Tl 204.38	81 Pb 207.2	82 Bi 208.98	83 Po 209	84 At 210	85 Rn 222	
7	87 Fr 223	88 Ra 226.03	89-102 **	103 Lr 260	104 Rf 261.1	105 Db 262.1	106 Sg 263.1	107 Bh 264.1	108 Hs 265.1	109 Mt [268]	110 Uun [269]	111 Uuu [272]	112 Uub [277]	113 Uuc [285]	114 Uuq [289]	115 Uur [291]	116 Uuh [293]	117 Uus [294]	118 Uuo [293]

*lanthanides	57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm 145	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.92	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04
**actinides	89 Ac 227.03	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	94 Pu 244	95 Am 243	96 Cm 247	97 Bk 247	98 Cf 251	99 Es 252	100 Fm 257	101 Md 258	102 No 259

1	Hydrogen	H	31	Gallium	Ga	61	Promethium	Pm	91	Protactinium	Pa
2	Helium	He	32	Germanium	Ge	62	Samarium	Sm	92	Uranium	U
3	Lithium	Li	33	Arsenic	As	63	Europium	Eu	93	Neptunium	Np
4	Beryllium	Be	34	Selenium	Se	64	Gadolinium	Gd	94	Plutonium	Pu
5	Boron	B	35	Bromine	Br	65	Terbium	Tb	95	Americium	Am
6	Carbon	C	36	Krypton	Kr	66	Dysprosium	Dy	96	Curium	Cm
7	Nitrogen	N	37	Rubidium	Rb	67	Holmium	Ho	97	Berkelium	Bk
8	Oxygen	O	38	Strontium	Sr	68	Erbium	Er	98	Californium	Cf
9	Fluorine	F	39	Yttrium	Y	69	Thulium	Tm	99	Einsteinium	Es
10	Neon	Ne	40	Zirconium	Zr	70	Ytterbium	Yb	100	Fermium	Fm
11	Sodium	Na	41	Niobium	Nb	71	Lutetium	Lu	101	Mendelevium	Md
12	Magnesium	Mg	42	Molybdenum	Mo	72	Hafnium	Hf	102	Nobelium	No
13	Aluminum	Al	43	Technetium	Tc	73	Tantalum	Ta	103	Lawrencium	Lr
14	Silicon	Si	44	Ruthenium	Ru	74	Tungsten	W	104	Rutherfordium	Rf
15	Phosphorus	P	45	Rhodium	Rh	75	Rhenium	Re	105	Dubnium	Db
16	Sulfur	S	46	Palladium	Pd	76	Osmium	Os	106	Seaborgium	Sg
17	Chlorine	Cl	47	Silver	Ag	77	Iridium	Ir	107	Bohrium	Bh
18	Argon	Ar	48	Cadmium	Cd	78	Platinum	Pt	108	Hassium	Hs
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