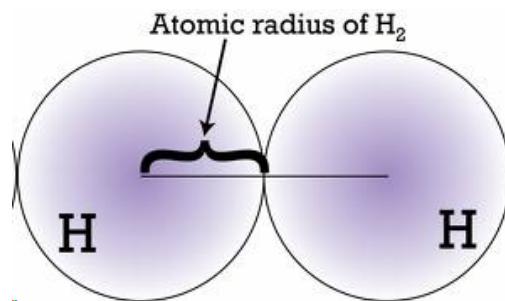


Periodic Trends

- **Atomic Radius** - the distance from the center of the nucleus to the furthest electron in a **neutral atom**.



Periodic Trends

- **Atomic Radius**
generally decreases

generally increases

Periodic Table of the Elements																			
1 H Hydrogen 1.008	2 Be Beryllium 9.012	3 Li Lithium 6.941	4 Mg Magnesium 24.305	5 Na Sodium 22.990	6 Ca Calcium 40.078	7 Sc Scandium 44.966	8 Ti Titanium 47.987	9 Cr Chromium 50.942	10 Mn Manganese 54.938	11 Fe Iron 55.845	12 Co Cobalt 58.933	13 Ni Nickel 58.693	14 Cu Copper 63.546	15 Zn Zinc 65.38	16 Al Aluminum 10.811	17 Si Silicon 12.011	18 Ne Neon 10.003		
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.966	22 Ti Titanium 47.987	23 V Vanadium 50.942	24 Cr Chromium 50.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.691	33 As Arsenic 74.922	34 Se Selenium 78.971	35 Br Bromine 79.904	36 Kr Krypton 84.798		
37 Rb Rubidium 84.498	38 Sr Strontium 87.62	39 Y Yttrium 91.224	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.95	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 106.42	46 Pd Palladium 106.906	47 Ag Silver 107.869	48 Cd Cadmium 112.414	49 In Indium 114.819	50 Tl Thallium 118.711	51 Sb Antimony 121.769	52 Te Tellurium 127.6	53 I Iodine 131.294	54 Xe Xenon 131.294		
55 Cs Cesium 132.905	56 Ba Barium 137.322	57-71 Lanthanides	72 Hf Hafnium 178.49	73 Ta Tantalum 180.945	74 W Tungsten 183.84	75 Re Rhenium 196.207	76 Os Osmium 190.23	77 Ir Iridium 192.217	78 Pt Platinum 195.085	79 Au Gold 196.967	80 Hg Mercury 200.592	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.989	84 Po Polonium 208.982	85 At Astatine 209.887	86 Rn Radium 222.018		
87 Fr Francium 223.029	88 Ra Radium 226.025	89-103 Actinides	104 Rf Rutherfordium 227.029	105 Dy Dubnium 232.029	106 Sg Seaborgium 238.029	107 Bh Bohrium 238.029	108 Hs Hassium 238.029	109 Mt Meitnerium 238.029	110 Ds Darmstadtium 238.029	111 Rg Roentgenium 237.029	112 Cn Copernicium 247.029	113 Uut Ununtrium unknown	114 Fl Florium unknown	115 Uup Ununpentium unknown	116 Lv Livermorium unknown	117 Uus Ununseptium unknown	118 Uuo Ununoctium unknown		
Alkali Metal		Alkaline Earth		Transition Metal		Basic Metal		Semimetal		Nonmetal		Halogen		Noble Gas		Lanthanide		Actinide	

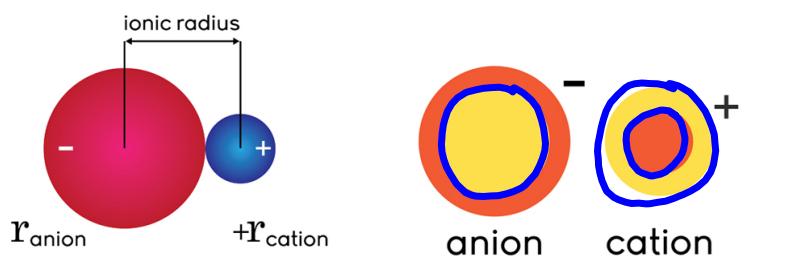
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An **ion** is an atom with a net charge other than zero. An atom that has lost or gained electrons to be happy (**meet octet rule = full valence shell!**)

paws.

- > **Cation:** positively charged ion (lost electrons) = smaller
- > **Anion:** negatively charged ion (gained electrons) = bigger

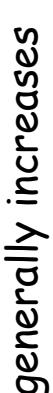


Periodic Trends

- ## • Ionic Radius

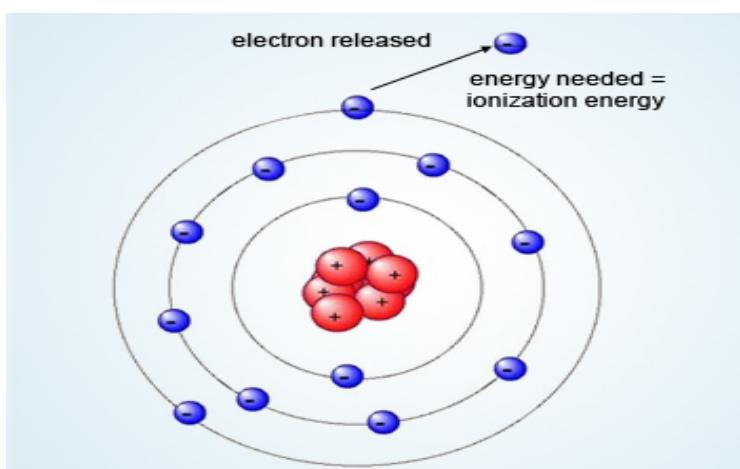
cations decrease

anions decrease





Ionization energy - the energy required to remove an electron from an atom (become a **cation**)



Periodic Trends

- Ionization Energy

generally increases

generally decreases

Periodic Table of the Elements																		18					
																		He Helium 4.003					
1	H Hydrogen 1.008	2																10					
3	Li Lithium 6.941	4	Be Beryllium 8.012															Ne Neon 20.180					
11	Na Sodium 22.990	12	Mg Magnesium 24.305															F Fluorine 19.000					
19	K Potassium 39.09	20	Ca Calcium 40.078	21	Sc Scandium 44.956	22	Ti Titanium 47.867	23	V Vanadium 50.942	24	Cr Chromium 51.996	25	Mn Manganese 54.938	26	Fe Iron 55.845	27	Co Cobalt 58.933	28	Ni Nickel 58.693	13	B Boron 10.811		
37	Rb Rubidium 61.446	38	Sr Strontium 88.905	39	Y Yttrium 88.905	40	Zr Zirconium 91.224	41	Nb Niobium 92.906	42	Mo Molybdenum 95.96	43	Tc Technetium 95.907	44	Ru Ruthenium 101.07	45	Rh Rhodium 102.903	46	Pd Palladium 106.42	47	Ag Silver 107.868	14	C Carbon 12.011
55	Cs Cesium 132.905	56	Ba Barium 137.326	57-71	Hf Hafnium 178.49	72	Ta Tantalum 180.946	73	W Tungsten 183.84	74	Re Rhenium 186.207	75	Os Osmium 190.23	76	Ir Iridium 192.217	77	Pt Platinum 195.085	78	Hg Mercury 196.967	15	N Nitrogen 14.007		
87	Fr Francium 223.029	88	Ra Radium 226.025	89-103	Rf Rutherfordium [261]	104	Db Dubnium [262]	105	Sg Singeenium [263]	106	Bh Bohrium [264]	107	Hs Hassium [265]	108	Mt Meitnerium [268]	109	Ds Darmstadtium [269]	110	Rg Roentgenium [272]	111	Cn Copernicium [277]	31	Ga Gallium 69.723
																	32						
																	As Antimony 72.631						
																	33						
																	Se Selenium 78.971						
																	34						
																	Br Bromine 79.904						
																	35						
																	36						
																	Kr Krypton 84.798						
																	51						
																	52						
																	I Iodine 126.904						
																	54						
																	Xe Xenon 131.124						
																	85						
																	86						
																	Rn Radium 222.018						
																	116						
																	Uuo Uuo Unknown unknown						
																	117						
																	Lu Lutetium 174.967						

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Periodic Trends

- Reactivity of Metals

generally increases

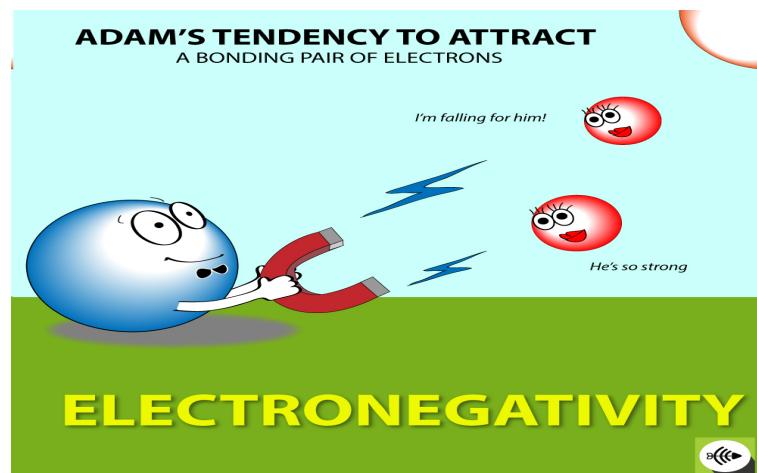
generally increases

Periodic Table of the Elements																				
1 H Hydrogen 1.008																				
3 Li Lithium 6.941	4 Be Boron 9.012	5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180	13 B Boron 10.811	14 C Carbon 12.011	15 N Nitrogen 14.007	16 O Oxygen 15.999	17 F Fluorine 18.998	18 He Helium 4.003							
11 Na Sodium 22.990	12 Mg Magnesium 24.305	13 Al Aluminum 26.982	14 Si Silicon 28.088	15 P Phosphorus 30.974	16 S Sulfur 32.066	17 Cl Chlorine 35.453	18 Ar Argon 39.949													
19 K Potassium 39.09	20 Ca Calcium 40.07	21 Sc Scandium 44.955	22 Ti Titanium 47.867	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.631	33 As Arsenic 74.922	34 Se Selenium 78.971	35 Br Bromine 79.904	36 Kr Krypton 84.798			
37 Rb Rubidium 84.468	38 Sr Strontium 87.62	39 Y Yttrium 88.905	40 Zr Zirconium 91.224	41 Nb Niobium 92.908	42 Mo Molybdenum 95.95	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.908	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.414	49 In Indium 114.818	50 Sn Tin 118.711	51 Sb Antimony 121.762	52 Te Tellurium 127.6	53 I Iodine 126.904	54 Xe Xenon 131.294			
55 Cs Cesium 132.905	56 Ba Barium 137.325	57-71 La Lanthanides 138.905	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.217	78 Pt Platinum 195.085	79 Au Gold 196.967	80 Hg Mercury 200.592	81 Tl Thallium 204.393	82 Pb Lead 207.2	83 Bi Bismuth 209.00	84 Po Polonium 209.887	85 At Astatine 210.002	86 Rn Radon 222.015			
87 Fr Francium 223.023	88-103 Ra Radium 226.025	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [263]	107 Bh Bohrium [264]	108 Hs Hassium [265]	109 Mt Meitnerium [266]	110 Ds Darmstadtium [268]	111 Rg Roentgenium [272]	112 Cn Copernicium [277]	113 Uut Ununtrium unknown	114 Fl Florium [289]	115 Uup Ununpentium unknown	116 Lv Livermorium [298]	117 Uus Ununseptium unknown	118 Uuo Ununoctium unknown				
57 La Lanthanum 138.905	58 Ce Cerium 140.905	59 Pr Praseodymium 141.905	60 Nd Neodymium 144.243	61 Pm Promethium 144.913	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.920	66 Dy Dysprosium 162.503	67 Ho Holmium 164.930	68 Tm Thulium 167.259	69 Yb Ytterbium 168.924	70 Lu Lutetium 173.055	71 Lu Lanthanum 174.967						
89 Ac Actinium 227.028	90 Th Thorium 232.028	91 Pa Protactinium 231.028	92 U Uranium 238.029	93 Np Neptunium 237.045	94 Pu Plutonium 244.064	95 Am Americium 243.061	96 Cm Curium 247.070	97 Bk Berkelium 247.070	98 Cf Californium 251.080	99 Es Einsteinium 254.080	100 Fm Fermium 257.095	101 Md Mendelevium 258.1	102 No Nobelium 259.101	103 Lr Lawrencium 262.0						

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Electronegativity - ability of an atom to attract an electron (become an **anion**)



Periodic Trends

- ### • Electronegativity

generally increases

generally decreases

Periodic Table of the Elements																																				
	1																																			
H Hydrogen 1.008																																				
Li Lithium 6.941	2	Be Beryllium 9.012																																		
Na Sodium 22.990	3	Mg Magnesium 24.305	4	Al Aluminum 26.982	5	Si Silicon 28.086	6	P Phosphorus 30.974	7	S Sulfur 32.066	8	O Oxygen 15.999	9	F Fluorine 18.998	10	Ne Neon 20.180	11																			
K Potassium 39.098	19	Ca Calcium 40.078	20	Sc Scandium 44.956	21	Ti Titanium 47.867	22	V Vanadium 50.942	23	Cr Chromium 51.966	24	Mn Manganese 54.938	25	Fe Iron 55.845	26	Co Cobalt 58.933	27	Ni Nickel 58.693	28	Cu Copper 63.546	29	Zn Zinc 65.38	30	Ga Gallium 69.723	31	Ge Germanium 72.631	32									
Rb Rubidium 84.488	37	Y Yttrium 88.906	38	Sr Strontium 87.62	39	Zr Zirconium 91.204	40	Nb Niobium 92.906	41	Mo Molybdenum 95.96	42	Tc Technetium 98.907	43	Ru Ruthenium 101.908	44	Rh Rhodium 102.908	45	Pd Palladium 103.904	46	Au Gold 106.905	47	Cd Cadmium 112.414	48	In Indium 113.811	49	Sn Tin 118.711	50	As Arsenic 74.922	51	Se Selenium 78.971	52	Te Tellurium 121.760	53	I Iodine 126.904	54	Xe Xenon 131.294
Cs Cesium 132.905	55	Ba Barium 137.328	56	Lanthanide 140.912	57-71	Hf Hafnium 178.49	72	Ta Tantalum 180.948	73	W Tungsten 183.847	74	Re Rhenium 186.207	75	Ru Ruthenium 190.23	76	Ir Iridium 192.217	77	Pt Platinum 195.088	78	Au Gold 196.967	79	Hg Mercury 200.992	80	Tl Thallium 204.383	81	Pb Lead 207.2	82	Bi Bismuth 208.983	83	Po Polonium 208.983	84	At Astatine 209.987	85	Rn Radon 222.018		
Fr Francium 223.003	87	Ra Radium 226.025	88	Actinides 226.025	89-103	Ac Actinium 227.028	104	D Dysprosium 161.967	105	Bk Berkelium 162.963	106	B Boron 164.963	107	Hs Hassium 169.969	108	Mt Moscovium 169.969	109	Ds Dubnium 169.969	110	Rg Rutherfordium 169.969	111	Cn Copernicium 170.969	112	Uut Ununtrium 177.969	113	Fl Florium 178.969	114	Uup Ununpentium 178.969	115	Lv Livermorium 178.969	116	Uus Ununhexium 178.969	117	Rn Rutherfordium 178.969		
	57	La Lanthanum 138.905	58	Ce Cerium 140.916	59	Pr Praseodymium 141.905	60	Nd Neodymium 142.943	61	Pm Promethium 143.913	62	Sm Samarium 145.936	63	Eu Europium 151.964	64	Gd Gadolinium 157.928	65	Tb Terbium 158.928	66	Dy Dysprosium 162.903	67	Ho Holmium 164.939	68	Er Erbium 167.259	69	Tm Thulium 168.945	70	Yb Ytterbium 170.947	71	Lu Lutetium 171.967	72	He Helium 0.003				
	89	Ac Actinium 227.028	90	Th Thorium 232.038	91	Pa Protactinium 231.038	92	U Uranium 238.029	93	Np Neptunium 237.048	94	Pu Plutonium 244.064	95	Cm Curium 243.061	96	Bk Berkelium 247.070	97	Cf Californium 251.080	98	Es Einsteinium 254.080	99	Fm Fermium 257.095	100	Md Mendelevium 258.1	101	No Nobelium 259.101	102	Lr Lawrencium 262.003	103	Uuo Ununtrium 262.003						
	104	Alkali Metal	105	Alkaline Earth	106	Transition Metal	107	Basic Metal	108	Semimetal	109	Nometal	110	Halogen	111	Noble Gas	112	Lanthanide	113	Actinide																
	104	Alkali Metal	105	Alkaline Earth	106	Transition Metal	107	Basic Metal	108	Semimetal	109	Nometal	110	Halogen	111	Noble Gas	112	Lanthanide	113	Actinide																

Periodic Trends

- ## • Reactivity of non-metals

generally increases

generally increases

Periodic Table of the Elements																											
1																	18										
H Hydrogen 1.008																	He Helium 4.003										
Li Lithium 6.941	Be Boron 9.012	Mg Magnesium 24.305	Ca Calcium 40.078	Sc Samarium 44.956	Ti Titanium 47.887	V Vanadium 50.942	Cr Chromium 51.996	Mn Manganese 54.938	Fe Iron 55.845	Co Cobalt 58.933	Ni Nickel 58.693	Cu Copper 63.546	Zn Zinc 65.38	B Boron 10.811	C Carbon 12.011	N Nitrogen 14.017	O Oxygen 16.999	F Fluorine 19.00									
K Potassium 39.098	Rb Rubidium 87.62	Sr Strontium 88.906	Y Yttrium 89.906	Zr Zirconium 91.224	Nb Niobium 92.906	Mo Molybdenum 95.96	Tc Technetium 98.907	Ru Ruthenium 101.07	Rh Rhodium 102.905	Pd Palladium 104.642	Ag Silver 107.868	Cd Cadmium 112.414	In Indium 113.818	Sb Antimony 121.760	Sn Tin 118.71	Te Tellurium 127.676	I Iodine 126.904	Xe Xenon 131.394									
Cs Cesium 132.905	Ba Barium 137.328	La Lanthanide		Hf Hafnium 178.49	Ta Tantalum 180.945	W Tungsten 183.84	Re Rhenium 185.207	Os Osmium 190.23	Ir Iridium 192.217	Pt Platinum 195.084	Au Gold 196.967	Hg Mercury 200.599	Tl Thallium 204.363	Pb Lead 207.2	Ba Bismuth 208.980	Po Polonium (208.982)	At Astatine 209.987	Rn Radon 222.018									
Fr Francium 223.020	Ra Actinide		Ac Actinium (226.025)		Rf Rutherfordium (261)		Db Darmstadtium (262)		Sg Sg (263)		Bh Bohrium (264)		Hs Hassium (265)		Mt Meitnerium (268)		Ds Darmstadtium (270)										
<table border="1"> <tr> <td>Alkali Metal</td> <td>Alkaline Earth</td> <td>Transition Metal</td> <td>Basic Metal</td> <td>Semimetal</td> <td>Nonmetal</td> <td>Halogen</td> <td>Noble Gas</td> <td>Lanthanide</td> <td>Actinide</td> </tr> </table>																		Alkali Metal	Alkaline Earth	Transition Metal	Basic Metal	Semimetal	Nonmetal	Halogen	Noble Gas	Lanthanide	Actinide
Alkali Metal	Alkaline Earth	Transition Metal	Basic Metal	Semimetal	Nonmetal	Halogen	Noble Gas	Lanthanide	Actinide																		
La Lanthanum 138.905	Ce Cerium 140.116	Pr Praseodymium 141.908	Nd Neodymium 144.243	Sm Promethium 144.913	Eu Europium 151.964	Gd Gadolinium 157.28	Tb Terbium 158.925	Dy Dysprosium 162.500	Ho Holmium 164.930	Er Erbium 167.259	Tm Thulium 168.934	Yb Ytterbium 173.055	Lu Lutetium 174.967														
Ac Actinium 227.026	Th Thorium 232.038	Pa Protactinium 231.038	U Uranium 238.029	Np Neptunium 237.048	Pu Plutonium 244.064	Am Americium 243.061	Cm Curium 247.070	Bk Berkelium 251.080	Cf Californium (254)	Md Mendelevium 257.065	No Nobelium 259.161	Lr Lawrencium (262)															

+1
1ve +2
2ve

1	H	Hydrogen	1.008
3	Li	Lithium	6.941
4	Be	Beryllium	9.012
11	Na	Sodium	22.990
12	Mg	Magnesium	24.305
19	K	Potassium	39.098
20	Ca	Calcium	40.078
37	Rb	Rubidium	84.468
38	Sr	Strontrium	87.62
55	Cs	Cesium	132.905
87	Fr	Francium	223.020
56	Ba	Barium	137.328
57	La	Lanthanum	138.905
58	Ce	Cerium	140.116
59	Pr	Praseodymium	140.908
60	Nd	Ndymium	144.243
61	Pm	Promethium	144.913
62	Sm	Samarium	150.36
63	Eu	Europium	151.964
64	Gd	Gadolinium	158.925
65	Tb	Terbium	158.920
66	Dy	Dysprosium	162.500
67	Ho	Holmium	164.930
68	Tm	Thulium	168.924
69	Er	Erbium	167.239
70	Yb	Ytterbium	173.055
71	Lu	Lutetium	174.967
89	Ac	Actinium	227.028
90	Th	Thorium	232.039
91	Pa	Protactinium	231.036
92	U	Uranium	238.029
93	Np	Neptunium	237.048
94	Pu	Plutonium	244.064
95	Am	Americium	243.061
96	Cm	Curium	247.070
97	Bk	Berkelium	247.070
98	Cf	Californium	251.080
99	Es	Einsteinium	257.065
100	Fm	Fermium	258.1
101	Md	Mendelevium	259.101
102	No	Nobelium	259.101
103	Lr	Lawrencium	[262]

Periodic Table of the Elements

+3
3ve
+5
5ve
+2
2ve
-1
1ve

part.

group

5	B	Boron	10.811
6	C	Carbon	12.011
7	N	Nitrogen	14.007
8	O	Oxygen	15.999
9	F	Fluorine	18.998
10	Ne	Neon	20.180
13	Al	Aluminum	26.982
14	Si	Silicon	28.086
15	P	Phosphorus	30.974
16	S	Sulfur	32.066
17	Cl	Chlorine	35.453
18	Ar	Argon	39.949
19	K	Kalium	39.098
20	Ca	Calcium	40.078
21	Sc	Sandium	44.906
22	Ti	Titanium	47.987
23	V	Vandium	50.942
24	Cr	Chromium	51.996
25	Mn	Manganese	54.938
26	Fe	Iron	55.845
27	Co	Cobalt	58.933
28	Ni	Nickel	58.693
29	Cu	Copper	63.546
30	Zn	Zinc	65.38
31	Ga	Gallium	69.723
32	As	Antimony	74.922
33	Ge	Germanium	72.631
34	Se	Selenium	78.971
35	Br	Bromine	79.904
36	Kr	Krypton	84.798
37	Rb	Rubidium	84.468
38	Sr	Strontrium	87.62
39	Y	Yttrium	88.906
40	Zr	Zirconium	91.224
41	Nb	Nobium	92.906
42	Mo	Molybdenum	95.95
43	Tc	Technetium	98.007
44	Ru	Ruthenium	101.07
45	Rh	Rhodium	102.906
46	Pd	Palladium	106.42
47	Ag	Silver	107.868
48	Cd	Cadmium	112.414
49	In	Indium	114.818
50	Sn	Tin	118.711
51	Sb	Antimony	121.760
52	Te	Tefturium	127.6
53	I	Iodine	126.904
54	Xe	Xenon	131.294
81	Tl	Thallium	204.383
82	Pb	Lead	206.562
83	Bi	Bismuth	208.980
84	Po	Polonium	[208.982]
85	At	Astatine	209.987
86	Rn	Radon	222.018
87	Fr	Francium	223.020
88	Ra	Radium	226.025
89-103	Actnides		
104	Rf	Rutherfordium	[261]
105	Db	Dubnium	[262]
106	Sg	Seaborgium	[263]
107	Bh	Bohrium	[264]
108	Hs	Hassium	[265]
109	Mt	Methemerium	[266]
110	Ds	Demessium	[267]
111	Rg	Roentgenium	[277]
112	Cn	Curium	[278]
113	Uut	Ununtrium	[289]
114	Fl	Flerovium	[289]
115	Up	Ununpentium	[289]
116	Lv	Livermorium	[288]
117	Uus	Ununseptium	[289]
118	Uuo	Ununoctium	[289]

Alkali Metal Alkaline Earth Transition Metal Basic Metal Semimetal Nonmetal Halogen Noble Gas Lanthanide Actinide

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