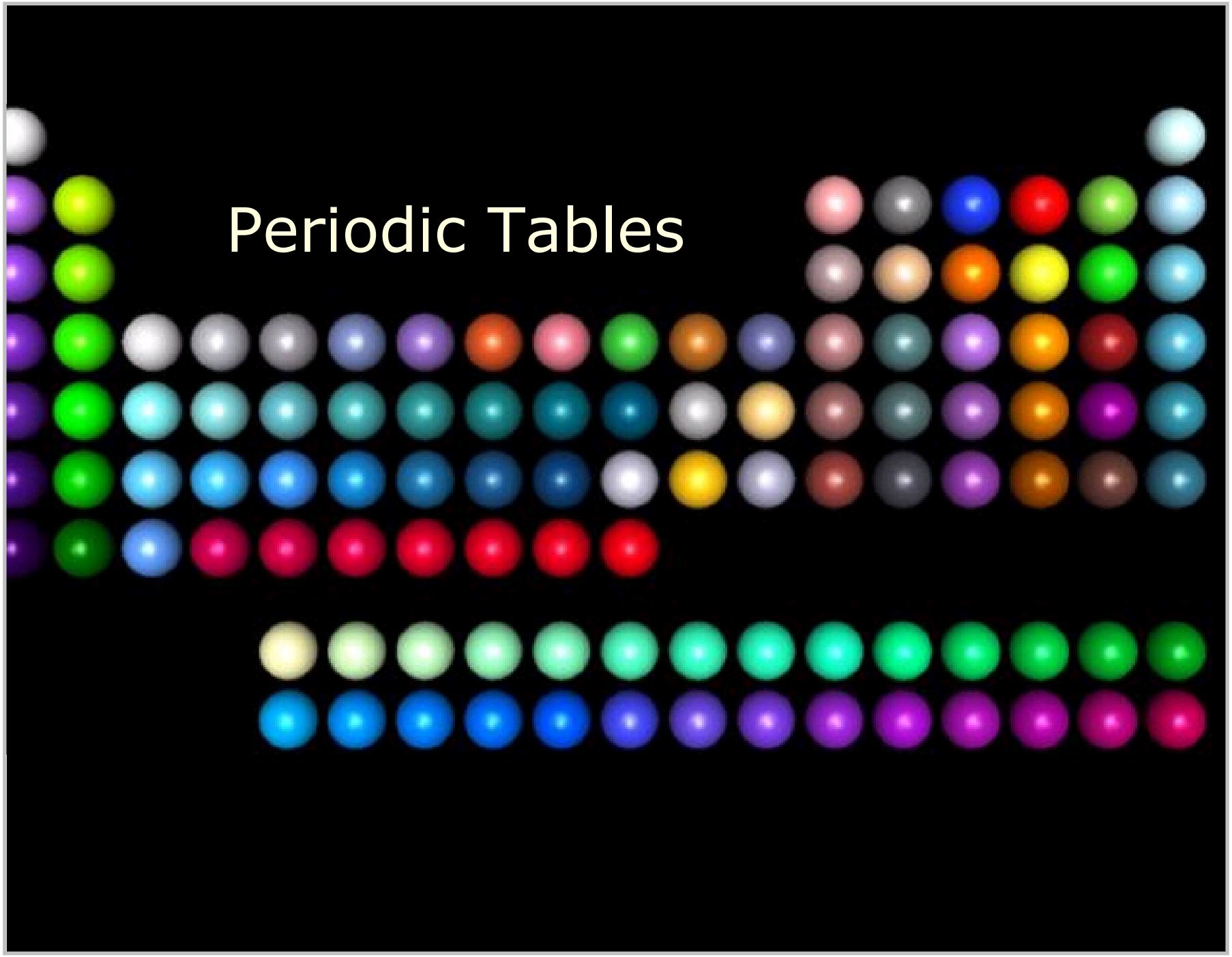
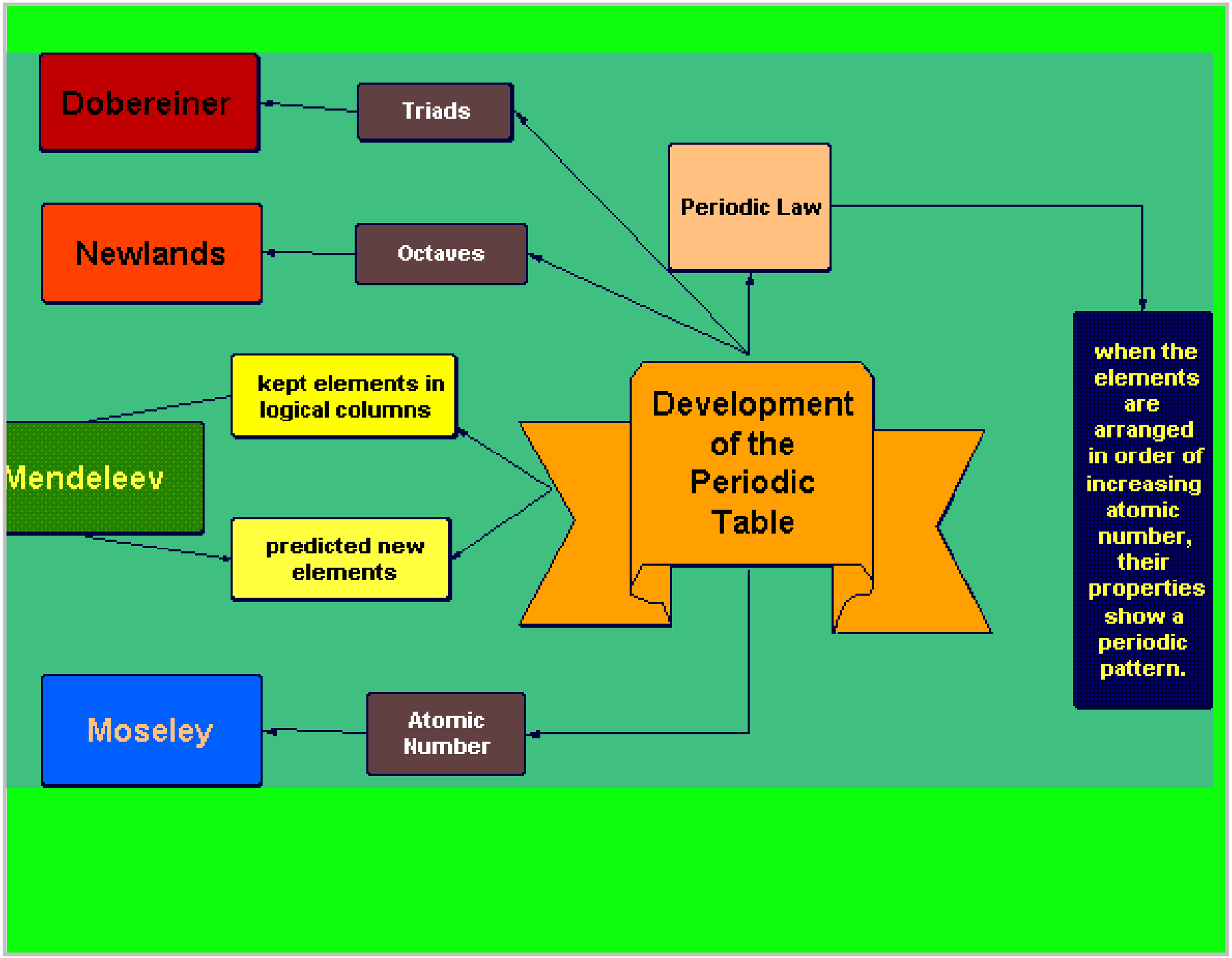
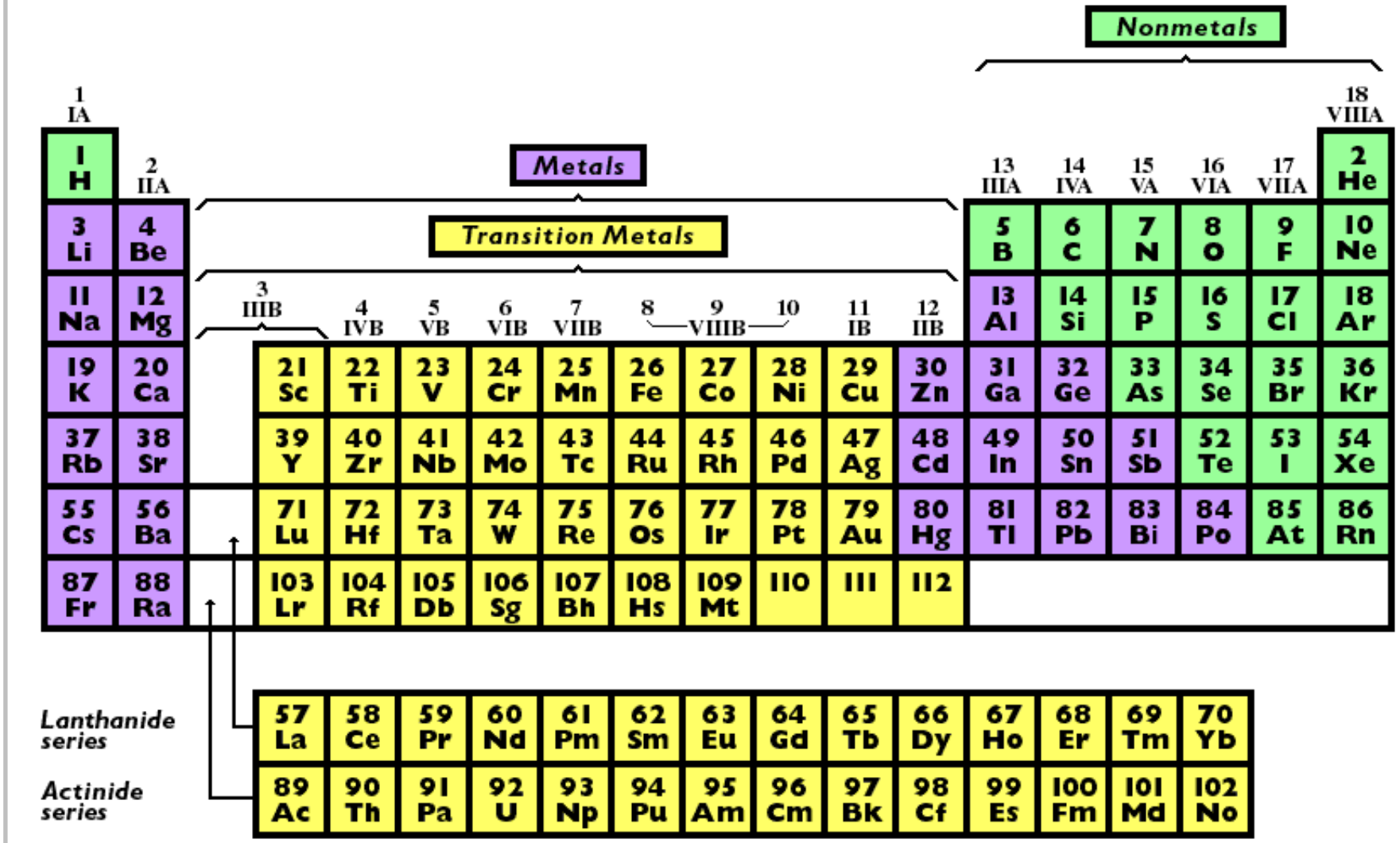
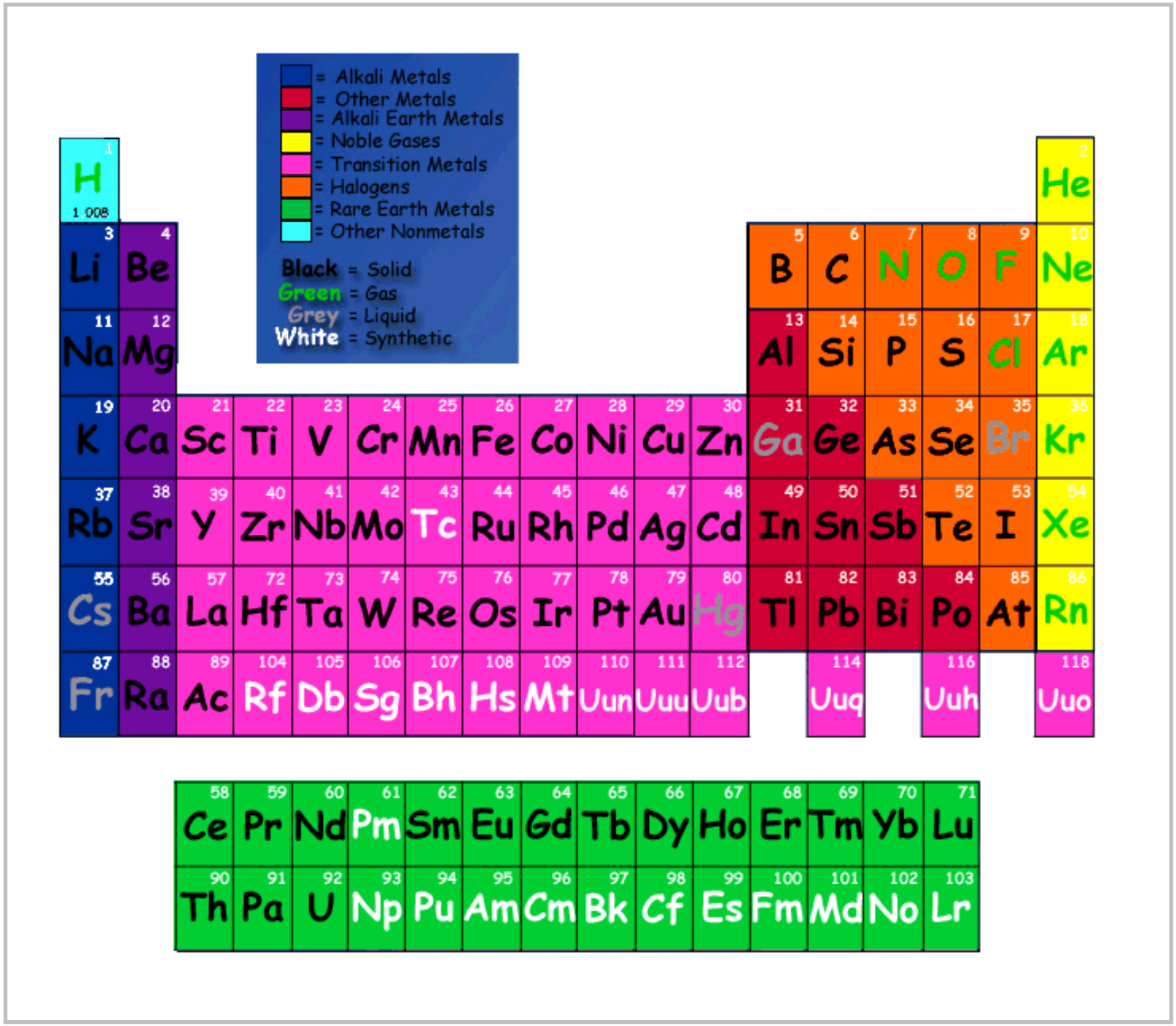
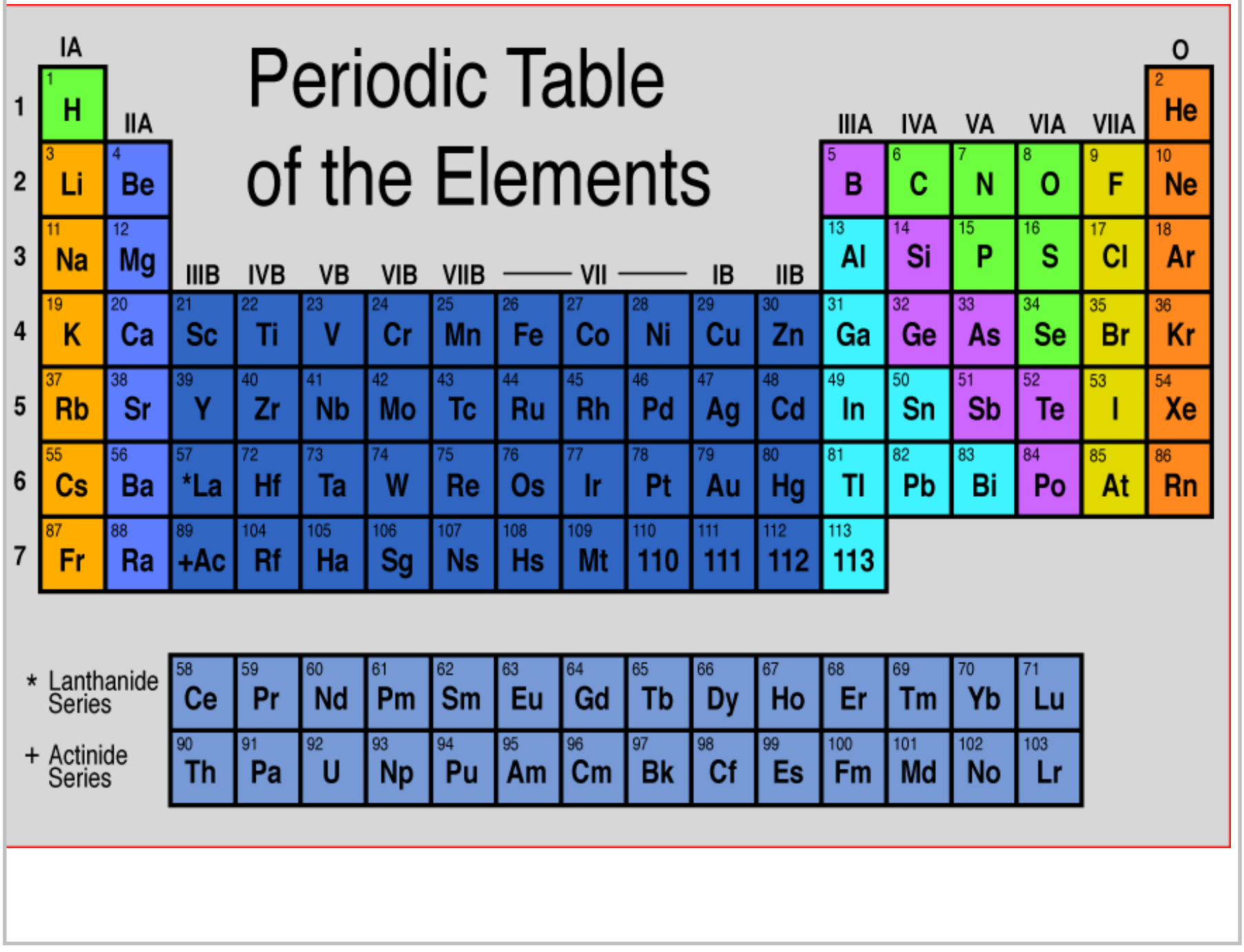
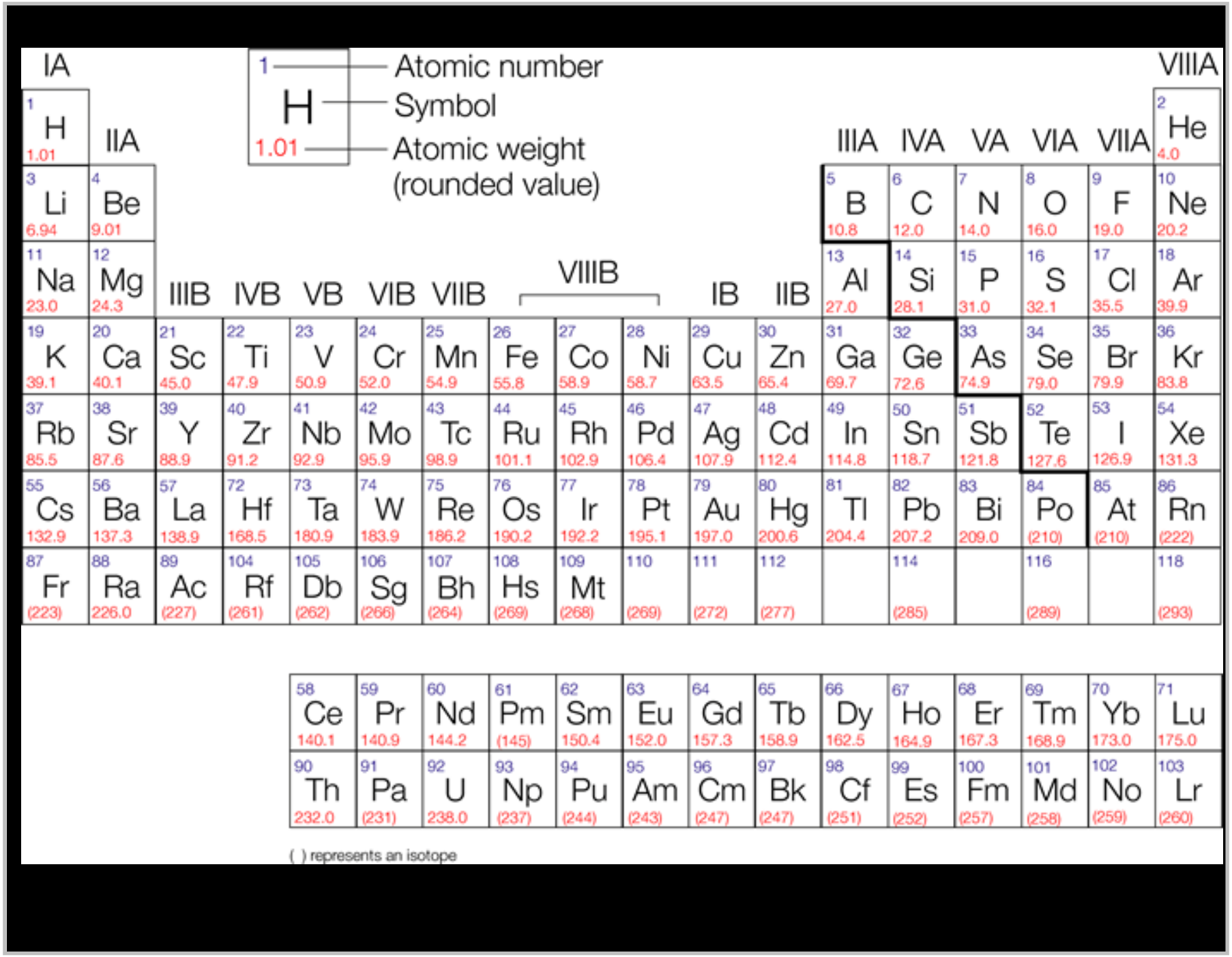

Periodic Tables


Dobereiner
Triads
Newlands
Octaves
Periodic Law
when the elements are arranged in order of increasing atomic number, their properties show a periodic pattern.
kept elements in logical columns
Mendeleev
predicted new elements
Development of the Periodic Table
Moseley
Atomic Number


Nonmetals
Metals
Transition Metals
1 IA
2 IIA
3 IIIB
4 IVB
5 VB
6 VIB
7 VIIB
8
9 VIIIB
10
11 IB
12 IIB
13 IIIA
14 IVA
15 VA
16 VIA
17 VIIA
18 VIIIA
1 H
2 He
3 Li
4 Be
5 B
6 C
7 N
8 O
9 F
10 Ne
11 Na
12 Mg
13 Al
14 Si
15 P
16 S
17 Cl
18 Ar
19 K
20 Ca
21 Sc
22 Ti
23 V
24 Cr
25 Mn
26 Fe
27 Co
28 Ni
29 Cu
30 Zn
31 Ga
32 Ge
33 As
34 Se
35 Br
36 Kr
37 Rb
38 Sr
39 Y
40 Zr
41 Nb
42 Mo
43 Tc
44 Ru
45 Rh
46 Pd
47 Ag
48 Cd
49 In
50 Sn
51 Sb
52 Te
53 I
54 Xe
55 Cs
56 Ba
71 Lu
72 Hf
73 Ta
74 W
75 Re
76 Os
77 Ir
78 Pt
79 Au
80 Hg
81 Tl
82 Pb
83 Bi
84 Po
85 At
86 Rn
87 Fr
88 Ra
103 Lr
104 Rf
105 Db
106 Sg
107 Bh
108 Hs
109 Mt
110
111
112
Lanthanide series
Actinide series
57 La
58 Ce
59 Pr
60 Nd
61 Pm
62 Sm
63 Eu
64 Gd
65 Tb
66 Dy
67 Ho
68 Er
69 Tm
70 Yb
89 Ac
90 Th
91 Pa
92 U
93 Np
94 Pu
95 Am
96 Cm
97 Bk
98 Cf
99 Es
100 Fm
101 Md
102 No


= Alkali Metals
= Other Metals
= Alkali Earth Metals
= Noble Gases
= Transition Metals
= Halogens
= Rare Earth Metals
= Other Nonmetals
Black = Solid
Green = Gas
Grey = Liquid
White = Synthetic
1 H 1.008
2 He
3 Li
4 Be
5 B
6 C
7 N
8 O
9 F
10 Ne
11 Na
12 Mg
13 Al
14 Si
15 P
16 S
17 Cl
18 Ar
19 K
20 Ca
21 Sc
22 Ti
23 V
24 Cr
25 Mn
26 Fe
27 Co
28 Ni
29 Cu
30 Zn
31 Ga
32 Ge
33 As
34 Se
35 Br
36 Kr
37 Rb
38 Sr
39 Y
40 Zr
41 Nb
42 Mo
43 Tc
44 Ru
45 Rh
46 Pd
47 Ag
48 Cd
49 In
50 Sn
51 Sb
52 Te
53 I
54 Xe
55 Cs
56 Ba
57 La
72 Hf
73 Ta
74 W
75 Re
76 Os
77 Ir
78 Pt
79 Au
80 Hg
81 Tl
82 Pb
83 Bi
84 Po
85 At
86 Rn
87 Fr
88 Ra
89 Ac
104 Rf
105 Db
106 Sg
107 Bh
108 Hs
109 Mt
110 Uun
111 Uuu
112 Uub
114 Uuq
116 Uuh
118 Uuo
58 Ce
59 Pr
60 Nd
61 Pm
62 Sm
63 Eu
64 Gd
65 Tb
66 Dy
67 Ho
68 Er
69 Tm
70 Yb
71 Lu
90 Th
91 Pa
92 U
93 Np
94 Pu
95 Am
96 Cm
97 Bk
98 Cf
99 Es
100 Fm
101 Md
102 No
103 Lr


Periodic Table of the Elements
IA
IIA
IIIB
IVB
VB
VIB
VIIB
VII
IB
IIB
IIIA
IVA
VA
VIA
VIIA
O
1 H
2 He
3 Li
4 Be
5 B
6 C
7 N
8 O
9 F
10 Ne
11 Na
12 Mg
13 Al
14 Si
15 P
16 S
17 Cl
18 Ar
19 K
20 Ca
21 Sc
22 Ti
23 V
24 Cr
25 Mn
26 Fe
27 Co
28 Ni
29 Cu
30 Zn
31 Ga
32 Ge
33 As
34 Se
35 Br
36 Kr
37 Rb
38 Sr
39 Y
40 Zr
41 Nb
42 Mo
43 Tc
44 Ru
45 Rh
46 Pd
47 Ag
48 Cd
49 In
50 Sn
51 Sb
52 Te
53 I
54 Xe
55 Cs
56 Ba
57 *La
72 Hf
73 Ta
74 W
75 Re
76 Os
77 Ir
78 Pt
79 Au
80 Hg
81 Tl
82 Pb
83 Bi
84 Po
85 At
86 Rn
87 Fr
88 Ra
89 +Ac
104 Rf
105 Ha
106 Sg
107 Ns
108 Hs
109 Mt
110 110
111 111
112 112
113 113
* Lanthanide Series
58 Ce
59 Pr
60 Nd
61 Pm
62 Sm
63 Eu
64 Gd
65 Tb
66 Dy
67 Ho
68 Er
69 Tm
70 Yb
71 Lu
+ Actinide Series
90 Th
91 Pa
92 U
93 Np
94 Pu
95 Am
96 Cm
97 Bk
98 Cf
99 Es
100 Fm
101 Md
102 No
103 Lr


IA
IIA
IIIB
IVB
VB
VIB
VIIB
VIIIB
IB
IIB
IIIA
IVA
VA
VIA
VIIA
VIIIA
1 H 1.01 — Atomic number
H — Symbol
1.01 — Atomic weight (rounded value)
1 H 1.01
2 He 4.0
3 Li 6.94
4 Be 9.01
5 B 10.8
6 C 12.0
7 N 14.0
8 O 16.0
9 F 19.0
10 Ne 20.2
11 Na 23.0
12 Mg 24.3
13 Al 27.0
14 Si 28.1
15 P 31.0
16 S 32.1
17 Cl 35.5
18 Ar 39.9
19 K 39.1
20 Ca 40.1
21 Sc 45.0
22 Ti 47.9
23 V 50.9
24 Cr 52.0
25 Mn 54.9
26 Fe 55.8
27 Co 58.9
28 Ni 58.7
29 Cu 63.5
30 Zn 65.4
31 Ga 69.7
32 Ge 72.6
33 As 74.9
34 Se 79.0
35 Br 79.9
36 Kr 83.8
37 Rb 85.5
38 Sr 87.6
39 Y 88.9
40 Zr 91.2
41 Nb 92.9
42 Mo 95.9
43 Tc 98.9
44 Ru 101.1
45 Rh 102.9
46 Pd 106.4
47 Ag 107.9
48 Cd 112.4
49 In 114.8
50 Sn 118.7
51 Sb 121.8
52 Te 127.6
53 I 126.9
54 Xe 131.3
55 Cs 132.9
56 Ba 137.3
57 La 138.9
72 Hf 178.5
73 Ta 180.9
74 W 183.9
75 Re 186.2
76 Os 190.2
77 Ir 192.2
78 Pt 195.1
79 Au 197.0
80 Hg 200.6
81 Tl 204.4
82 Pb 207.2
83 Bi 209.0
84 Po (210)
85 At (210)
86 Rn (222)
87 Fr (223)
88 Ra 226.0
89 Ac (227)
104 Rf (261)
105 Db (262)
106 Sg (266)
107 Bh (264)
108 Hs (269)
109 Mt (268)
110 (269)
111 (272)
112 (277)
114 (285)
116 (289)
118 (293)
58 Ce 140.1
59 Pr 140.9
60 Nd 144.2
61 Pm (145)
62 Sm 150.4
63 Eu 152.0
64 Gd 157.3
65 Tb 158.9
66 Dy 162.5
67 Ho 164.9
68 Er 167.3
69 Tm 168.9
70 Yb 173.0
71 Lu 175.0
90 Th 232.0
91 Pa (231)
92 U 238.0
93 Np (237)
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)
103 Lr (260)
( ) represents an isotope

PERIODIC TABLE OF THE ELEMENTS

Table of Radioactive Isotopes

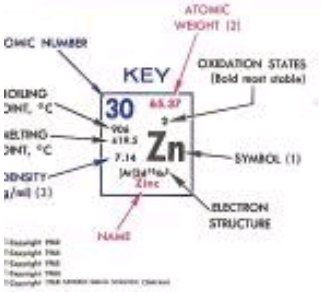
Naturally occurring radioactive isotopes are indicated by a blue mass number. Half lives are in parentheses where s, m, h, d and y stand for seconds, minutes, hours, days and years respectively. The symbols describing the mode of decay and resulting radiation are defined as follows:

α	alpha particle	L	L-electron capture
β⁻	beta particle	SF	spontaneous fission
β⁺	positron	γ	gamma ray
K	K-electron capture	e⁻	internal electron conversion

Ac 227(22y)β⁻,γ
Ag 110(24s)β⁻,γ
111(7.5d)β⁻,γ
Am 241(458y)α,γ,e⁻
242(16.0h)β⁻,K,α,γ
243(8000y)α,γ
As 76(26.7h)β⁻,γ
77(39h)β⁻,γ
At 210(8.3h)K,α,γ
211(7.2h)K,α,γ
Au 198(2.69d)β⁻,γ
Ba 131(12d)K,γ
133(7.2y)K,γ,e⁻
Bi 2(.005d)β⁻,γ
Bk 245(4.94h)K,α,γ
249(314d)β⁻,α,SF
Br 82(36h)β⁻,γ
C 14(5700 y)β⁻
Ca 41(8×10⁵y)K
45(165d)β⁻
47(4.5d)β⁻,γ
Cd 115(43d)β⁻,γ
Ce 141(32d)β⁻,γ
143(33h)β⁻,γ
144(285d)β⁻,γ
Cf 246(35h)α,γ,SF
249(360 y)α,γ,SF
251(800 y)α
Cl 36(3×10⁵y)β⁻
Cm 243(35y)α,γ
245(9300y)α,γ
247(10⁷y)
Co 58(71d)K,β⁺,γ
60(5.27y)β⁻,γ
Cr 51(27d)K,γ
Cs 134(2.0 y)β⁻,γ
135(3×10⁶y)β⁻
137(30y)β⁻,γ
Cu 64(12.8h)K,β⁻,β⁺,γ
Es 253(20d)α,γ,SF
254(1y)α,SF
Eu 154(16y)β⁻,γ
155(1.8y)β⁻,γ
Fe 55(2.6y)K
59(45d)β⁻,γ
Fm 255(20h)α
Fr 223(22m)β⁻,α,γ
Ga 72(14.1h)β⁻,γ
Gd 153(236d)K,α,e⁻
159(18h)β⁻,γ
Ge 71(11d)K
H 3(12.3y)β⁻
Hf 181(45d)β⁻,γ,e⁻
Hg 197(65h)K,γ,e⁻
203(47d)β⁻,γ,e⁻
Ho 166(27.3h)β⁻,γ
I 129(10⁷y)β⁻,γ,e
131(8.05d)β⁻,γ
In 114(50d)γ
Ir 192(74.4d)β⁻,γ
K 40(10⁹y)β⁺,K,γ
42(12.4h)β⁻,γ
La 140(40.2h)β⁻,γ
Lu 176(10¹⁰y)β⁻,K,γ
177(6.8d)β⁻,γ
Md 256(90m)K,SF
Ne 99(67h)β⁻,γ
Na 22(2.6y)β⁺,K,γ
24(15h)β⁻,γ
Nd 147(11.1d)β⁻,γ
Ni 63(125y)β⁻
59(8×10⁴y)L,K
Np 237(2.2×10⁶y)α,γ
239(2.33d)β⁻,γ
Os 191(15d)β⁻,γ,e⁻
P 32(14.2d)β⁻
Pa 231(34000y)α,γ
Pb 210(19.4y)β⁻,γ,e⁻
202(10⁵y)K
Pd 103(17d)K,γ
Pm 147(2.6y)β⁻
Po 210(138.4d)α,γ
209(103 y)α,K,γ
Pr 143(13.6d)β⁻
Pt 197(18h)β⁻,γ
Pu 242(3.8 × 10⁵y)α,SF
241(13y)β⁻,α,γ
239(24300y)α,γ,SF
Ra 226(1620y)α,γ
Rb 86(18.6d)β⁻,γ
Re 188(16.7h)β⁻,γ
186(3.7d)β⁻,γ
Rn 222(3.82d)α
Ru 103(40d)β⁻,γ
97(2.9d)K,γ,e⁻
S 35(88d)β⁻
Sb 122(2.8d)β⁻,K,β⁺,γ
124(60d)β⁻,γ
Sc 46(84d)β⁻,γ
Se 75(120 d)K,γ
Sm 153(47h)β⁻,γ
145(340d)K,γ
Sn 113(119d)K,L,γ,e⁻
Sr 90(28y)β⁻
89(51d)β⁻,γ
85(64d)K,γ
Ta 182(115d)β⁻,γ
Tb 160(73d)β⁻,γ
Tc 99(2×10⁵y)β⁻
97(10⁶y)K
Te 127(9.3h)γ
Th 232(1.4×10¹⁰y)α,γ,SF
228(1.9 y)β⁻
Ti 44(47y)K,γ
Tl 204(3.81y)β⁻,K
Tm 170(134d)β⁻,γ,e⁻
U 238(4.5×10⁹y)α,γ,SF
234(2.5×10⁵y)α,γ,SF
235(7.1×10⁸y)α,γ,SF
233(1.6×10⁵y)α,γ
W 185(75d)β⁻
Y 90(64h)β⁻,e⁻
Yb 175(4.2d)β⁻,γ
169(31d)K,γ,e⁻
Zn 65(245d)K,β⁺,γ
Zr 95(65d)β⁻,γ,e⁻
93(9×10⁵y)β⁻,γ

GROUP IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIII			IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
1 1.00797 H Hydrogen																	2 4.0026 He Helium
3 6.939 Li Lithium	4 9.0122 Be Beryllium											5 10.811 B Boron	6 12.01115 C Carbon	7 14.0067 N Nitrogen	8 15.9994 O Oxygen	9 18.9984 F Fluorine	10 20.183 Ne Neon
11 22.9898 Na Sodium	12 24.312 Mg Magnesium											13 26.9815 Al Aluminum	14 28.086 Si Silicon	15 30.9738 P Phosphorus	16 32.064 S Sulfur	17 35.453 Cl Chlorine	18 39.948 Ar Argon
19 39.102 K Potassium	20 40.08 Ca Calcium	21 44.956 Sc Scandium	22 47.90 Ti Titanium	23 50.942 V Vanadium	24 51.996 Cr Chromium	25 54.938 Mn Manganese	26 55.847 Fe Iron	27 58.933 Co Cobalt	28 58.71 Ni Nickel	29 63.54 Cu Copper	30 65.37 Zn Zinc	31 69.72 Ga Gallium	32 72.59 Ge Germanium	33 74.922 As Arsenic	34 78.96 Se Selenium	35 79.909 Br Bromine	36 83.80 Kr Krypton
37 85.47 Rb Rubidium	38 87.62 Sr Strontium	39 88.905 Y Yttrium	40 91.22 Zr Zirconium	41 92.906 Nb Niobium	42 95.94 Mo Molybdenum	43 (98) Tc Technetium	44 101.07 Ru Ruthenium	45 102.905 Rh Rhodium	46 106.4 Pd Palladium	47 107.870 Ag Silver	48 112.40 Cd Cadmium	49 114.82 In Indium	50 118.69 Sn Tin	51 121.75 Sb Antimony	52 127.60 Te Tellurium	53 126.904 I Iodine	54 131.30 Xe Xenon
55 132.905 Cs Cesium	56 137.34 Ba Barium	57 138.91 ★ La Lanthanum	72 178.49 Hf Hafnium	73 180.948 Ta Tantalum	74 183.85 W Wolfram	75 186.2 Re Rhenium	76 190.2 Os Osmium	77 192.2 Ir Iridium	78 195.09 Pt Platinum	79 196.967 Au Gold	80 200.59 Hg Mercury	81 204.37 Tl Thallium	82 207.19 Pb Lead	83 208.980 Bi Bismuth	84 (210) Po Polonium	85 (210) At Astatine	86 (222) Rn Radon
87 (223) Fr Francium	88 (226) Ra Radium	89 (227) ★★ Ac Actinium	104														

★	58 140.12 Ce	59 140.907 Pr	60 144.24 Nd	61 (147) Pm	62 150.35 Sm	63 151.96 Eu	64 157.25 Gd	65 158.924 Tb	66 162.50 Dy	67 164.930 Ho	68 167.26 Er	69 168.934 Tm	70 173.04 Yb	71 174.97 Lu
	Cerium	Praseodymium	Neodymium	Promethium	Samarium	Europium	Gadolinium	Terbium	Dysprosium	Holmium	Erbium	Thulium	Ytterbium	Lutetium
★★	90 232.038 Th	91 (231) Pa	92 238.03 U	93 (237) Np	94 (242) Pu	95 (243) Am	96 (247) Cm	97 (247) Bk	98 (249) Cf	99 (254) Es	100 (253) Fm	101 (256) Md	102 (254) No	103 (257) Lw
	Thorium	Protactinium	Uranium	Neptunium	Plutonium	Americium	Curium	Berkelium	Californium	Einsteinium	Fermium	Mendelevium	Nobelium	Lawrencium



NOTES:
(1) Black — solid.
Red — gas.
Blue — liquid.
Outline — synthetically prepared.
(2) Based upon carbon – 12. ( ) indicates most stable or best known isotope.
(3) Values for gaseous elements are for liquids at the boiling point.

SIDE 1