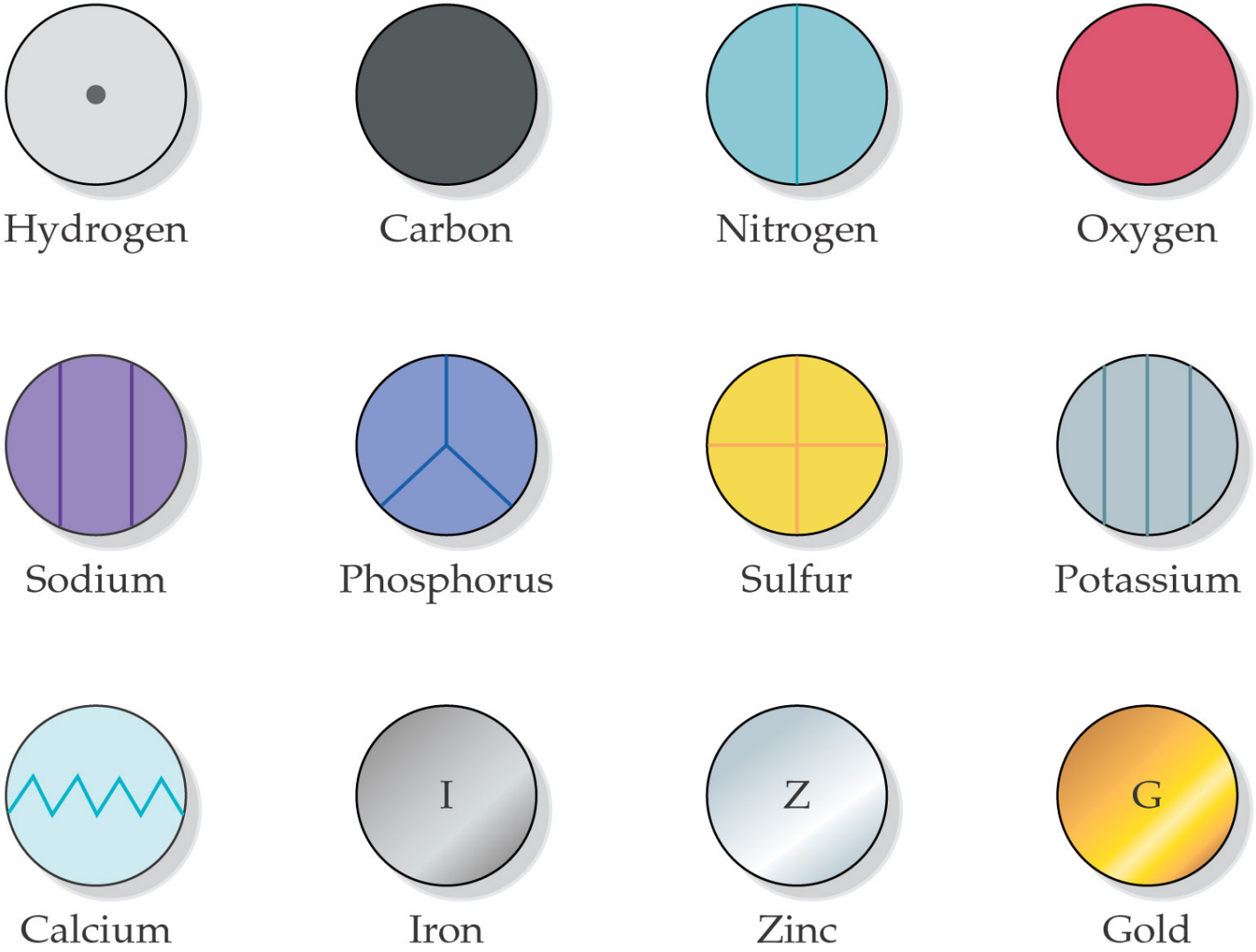
Elements and Compounds

Chapter 3

Dalton's symbols for elements



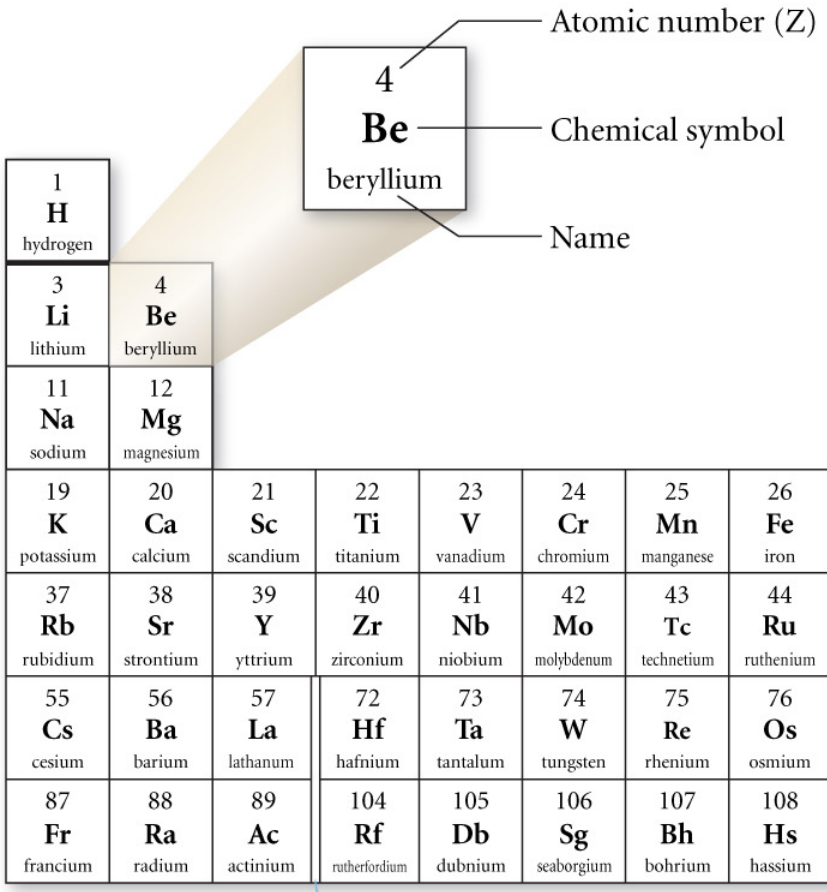
Element Names and Symbols

- Element Ele
- name symbol
- 1 or 2 letters (occasionally 3)
-
- 1st letter is capitalized, 2nd letter is lower case.

Table 3.2 Symbols of the Elements Derived from Early Names*

Present name	Symbol	Former name
Antimony	Sb	Stibium
Copper	Cu	Cuprum
Gold	Au	Aurum
Iron	Fe	Ferrum
Lead	Pb	Plumbum
Mercury	Hg	Hydrargyrum
Potassium	K	Kalium
Silver	Ag	Argentum
Sodium	Na	Natrium
Tin	Sn	Stannum
Tungsten	W	Wolfram

The Periodic Table



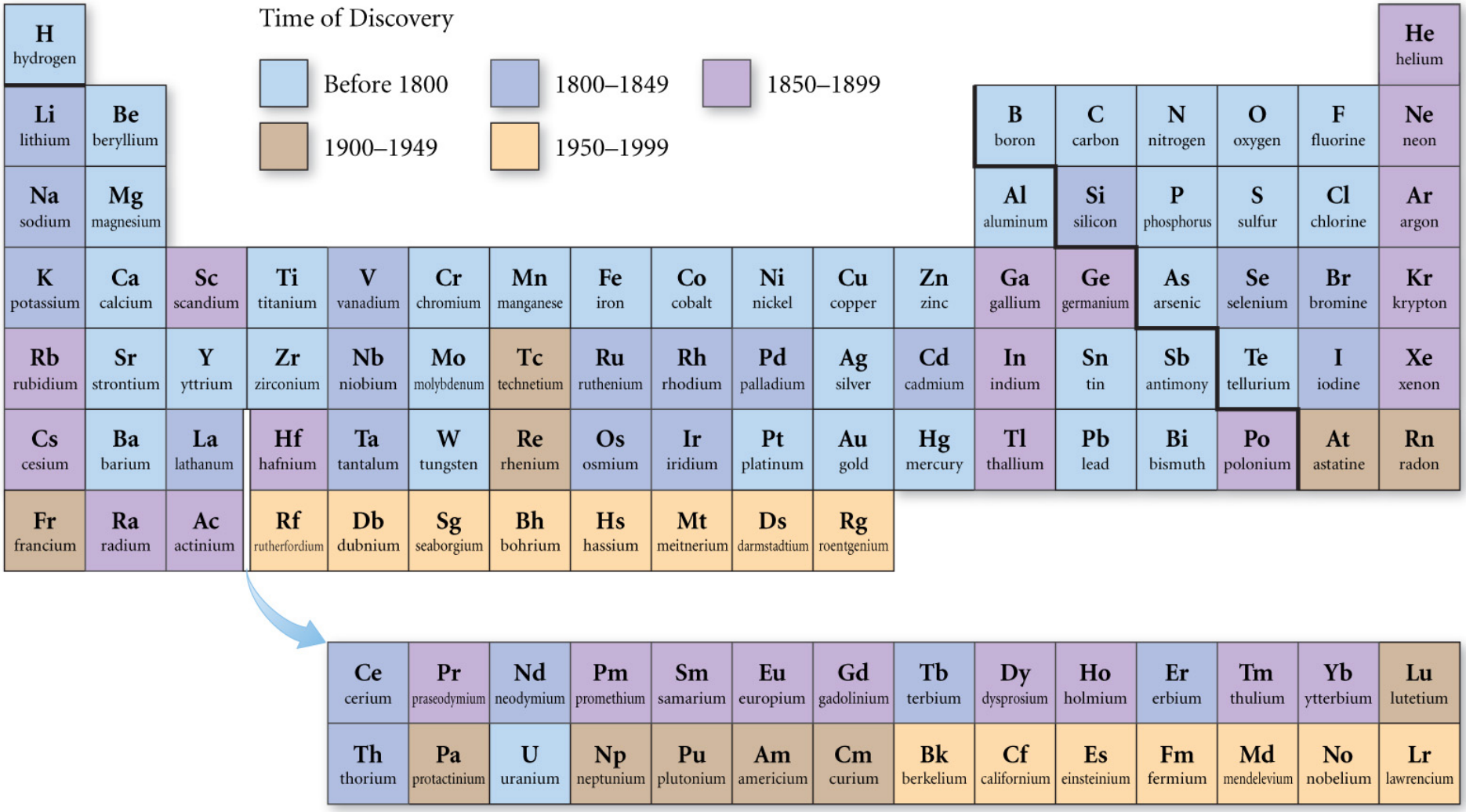
1 H hydrogen																	2 He helium
3 Li lithium	4 Be beryllium											5 B boron	6 C carbon	7 N nitrogen	8 O oxygen	9 F fluorine	10 Ne neon
11 Na sodium	12 Mg magnesium											13 Al aluminum	14 Si silicon	15 P phosphorus	16 S sulfur	17 Cl chlorine	18 Ar argon
19 K potassium	20 Ca calcium	21 Sc scandium	22 Ti titanium	23 V vanadium	24 Cr chromium	25 Mn manganese	26 Fe iron	27 Co cobalt	28 Ni nickel	29 Cu copper	30 Zn zinc	31 Ga gallium	32 Ge germanium	33 As arsenic	34 Se selenium	35 Br bromine	36 Kr krypton
37 Rb rubidium	38 Sr strontium	39 Y yttrium	40 Zr zirconium	41 Nb niobium	42 Mo molybdenum	43 Tc technetium	44 Ru ruthenium	45 Rh rhodium	46 Pd palladium	47 Ag silver	48 Cd cadmium	49 In indium	50 Sn tin	51 Sb antimony	52 Te tellurium	53 I iodine	54 Xe xenon
55 Cs cesium	56 Ba barium	57 La lathanum	72 Hf hafnium	73 Ta tantalum	74 W tungsten	75 Re rhenium	76 Os osmium	77 Ir iridium	78 Pt platinum	79 Au gold	80 Hg mercury	81 Tl thallium	82 Pb lead	83 Bi bismuth	84 Po polonium	85 At astatine	86 Rn radon
87 Fr francium	88 Ra radium	89 Ac actinium	104 Rf rutherfordium	105 Db dubnium	106 Sg seaborgium	107 Bh bohrium	108 Hs hassium	109 Mt meitnerium	110 Ds darmstadtium	111 Rg roentgenium	112 **		114 **		116 **		

58 Ce cerium	59 Pr praseodymium	60 Nd neodymium	61 Pm promethium	62 Sm samarium	63 Eu europium	64 Gd gadolinium	65 Tb terbium	66 Dy dysprosium	67 Ho holmium	68 Er erbium	69 Tm thulium	70 Yb ytterbium	71 Lu lutetium
90 Th thorium	91 Pa protactinium	92 U uranium	93 Np neptunium	94 Pu plutonium	95 Am americium	96 Cm curium	97 Bk berkelium	98 Cf californium	99 Es einsteinium	100 Fm fermium	101 Md mendelevium	102 No nobelium	103 Lr lawrencium

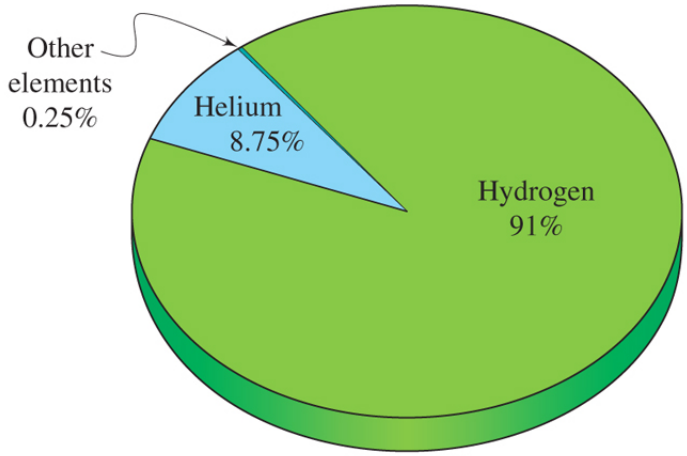
Nomenclature

- Learn the names and symbols of the elements.

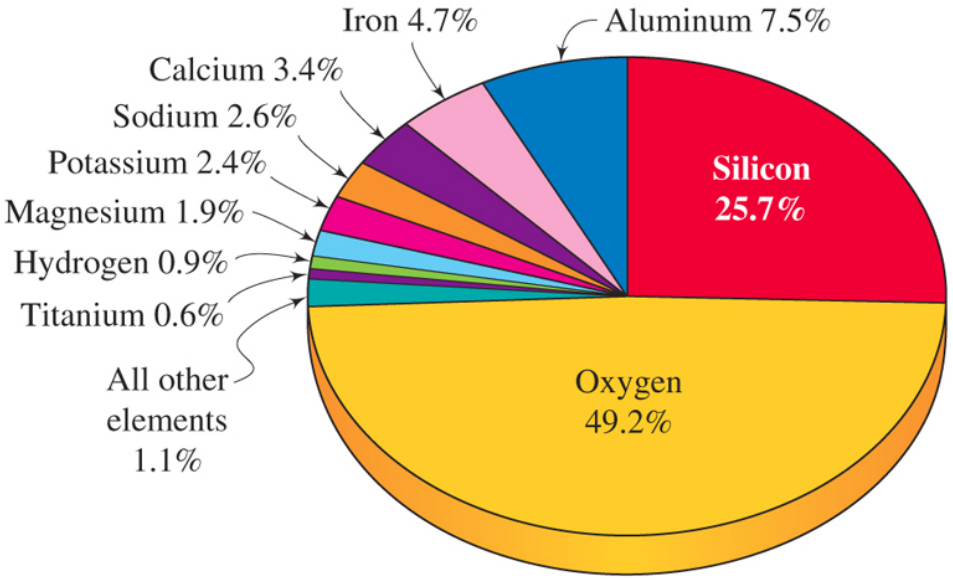
- You must know 1st 36 elements + Rb, Sr, Cs, Ba, Ra, Zr, Ag, Cd, Sn, Sb, Te, I, Xe, Pt, Au, Hg, Pb, Bi, Rn, U



Distribution of the common elements in nature.

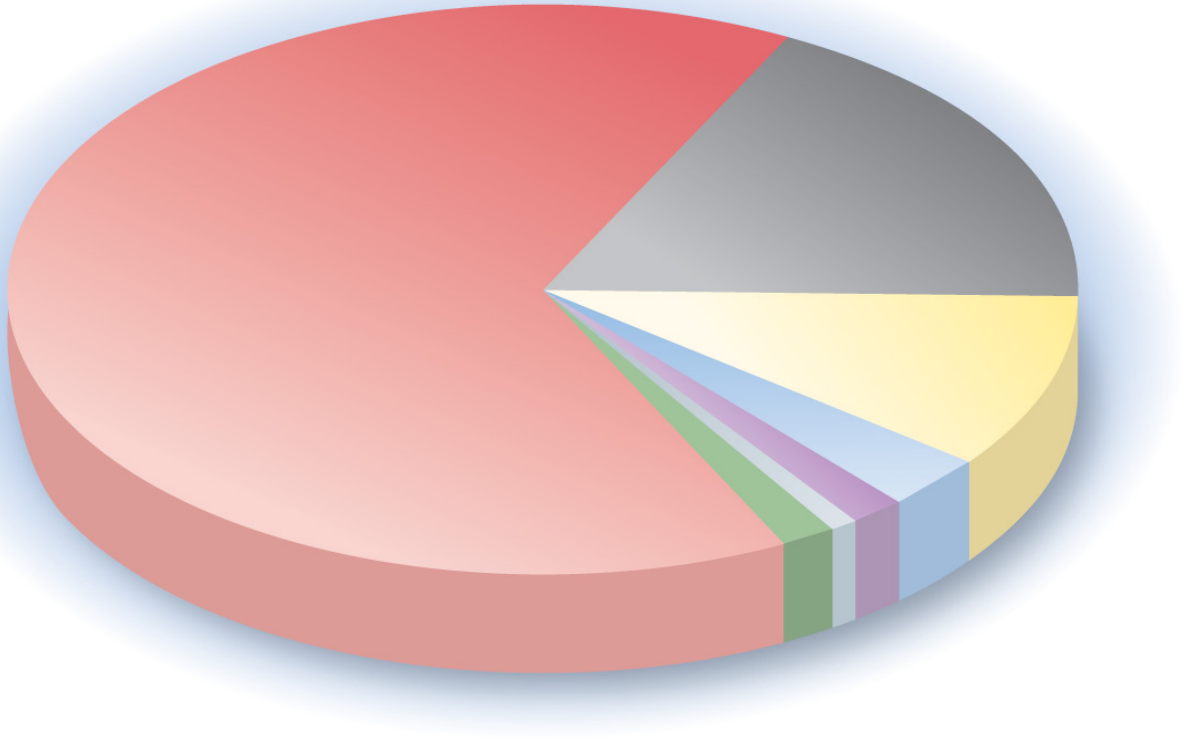


(a) Galaxies



(b) Earth's crust, seawater, and air

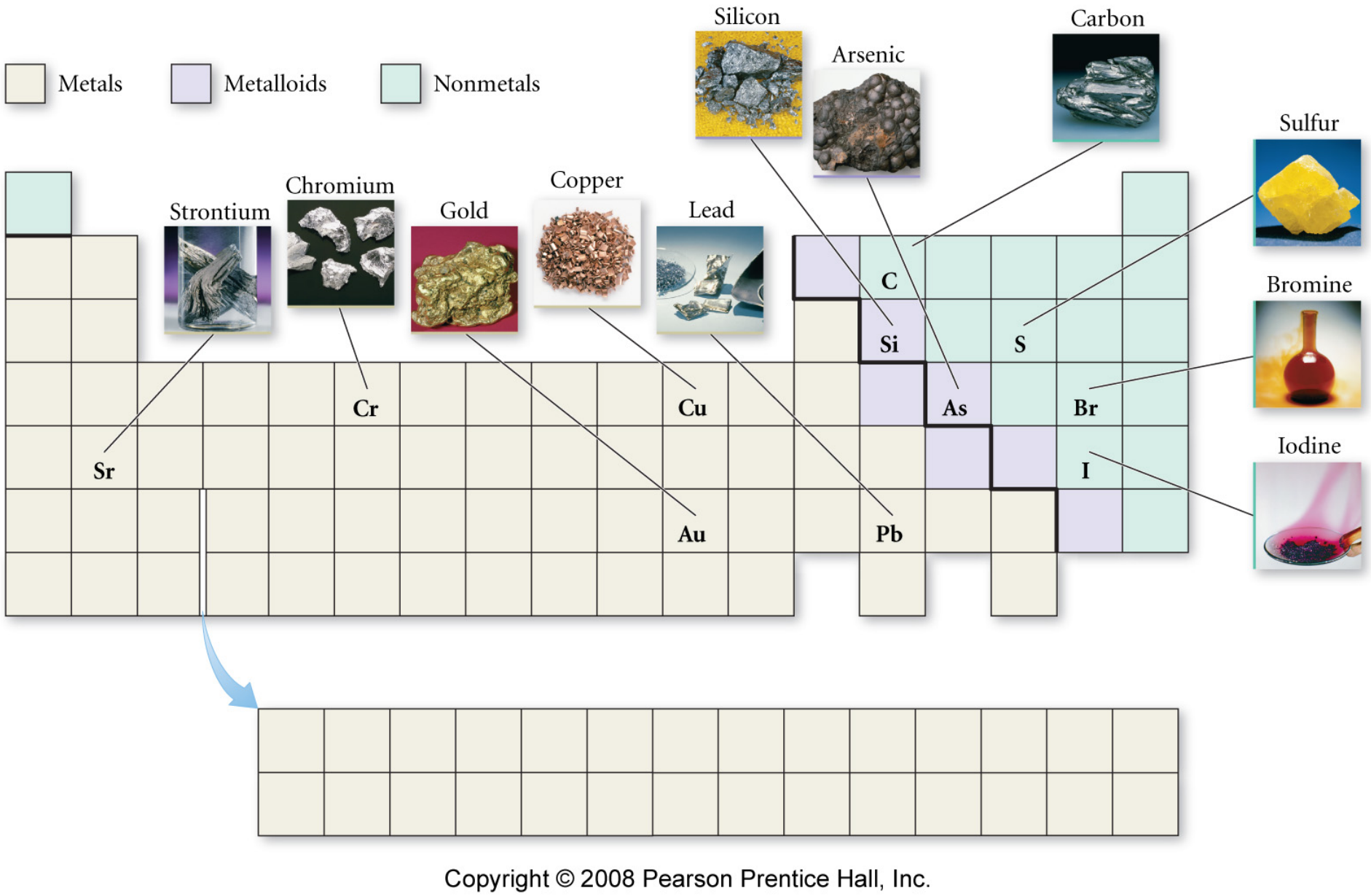
Elemental Composition of Humans (by mass)



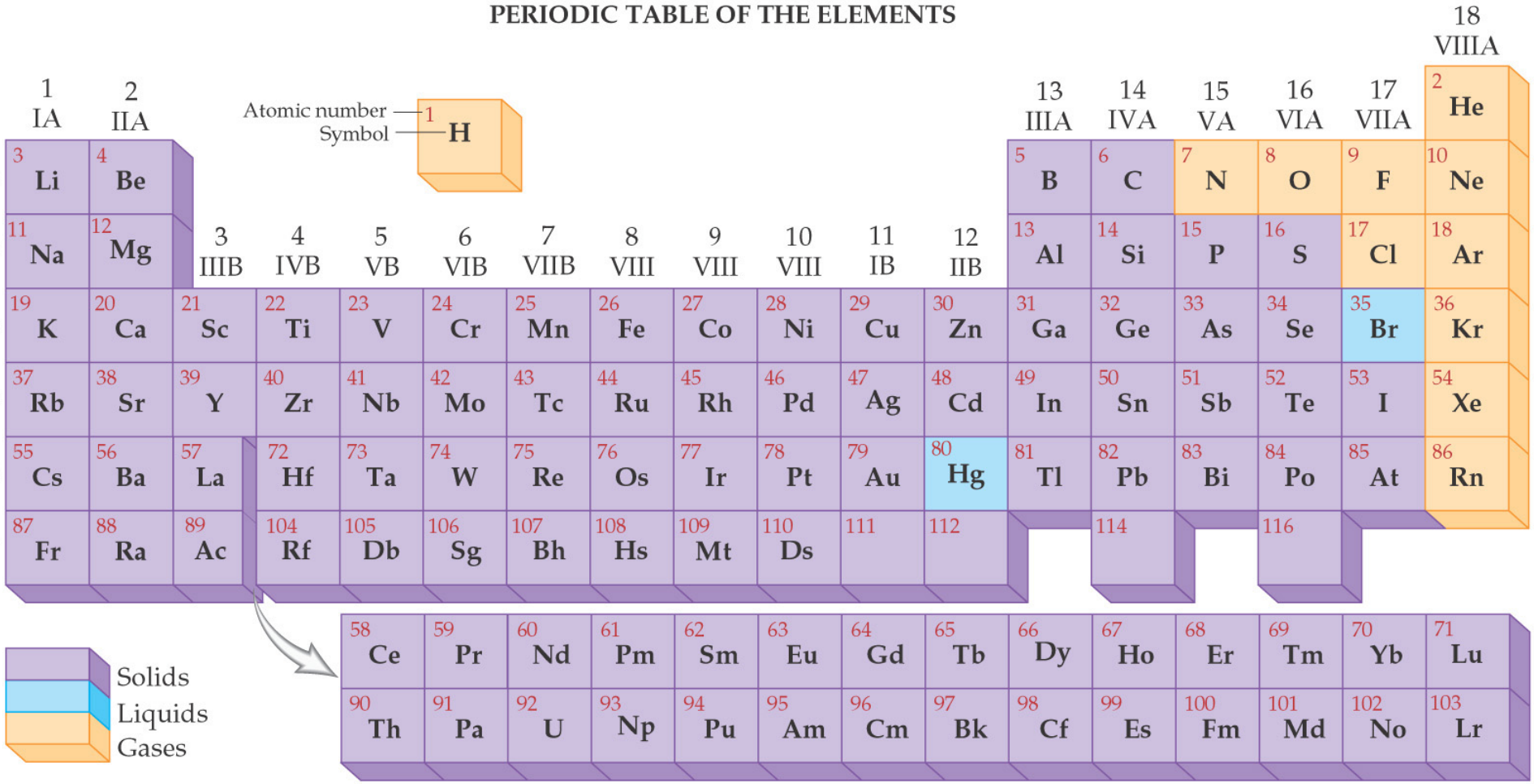
- Oxygen: 65%
- Carbon: 18%
- Hydrogen: 10%
- Nitrogen: 3%
- Calcium: 1.5%
- Phosphorus: 1%
- Other: 1.5%

TABLE 2.2 Approximate Percent Elemental Composition of Humans

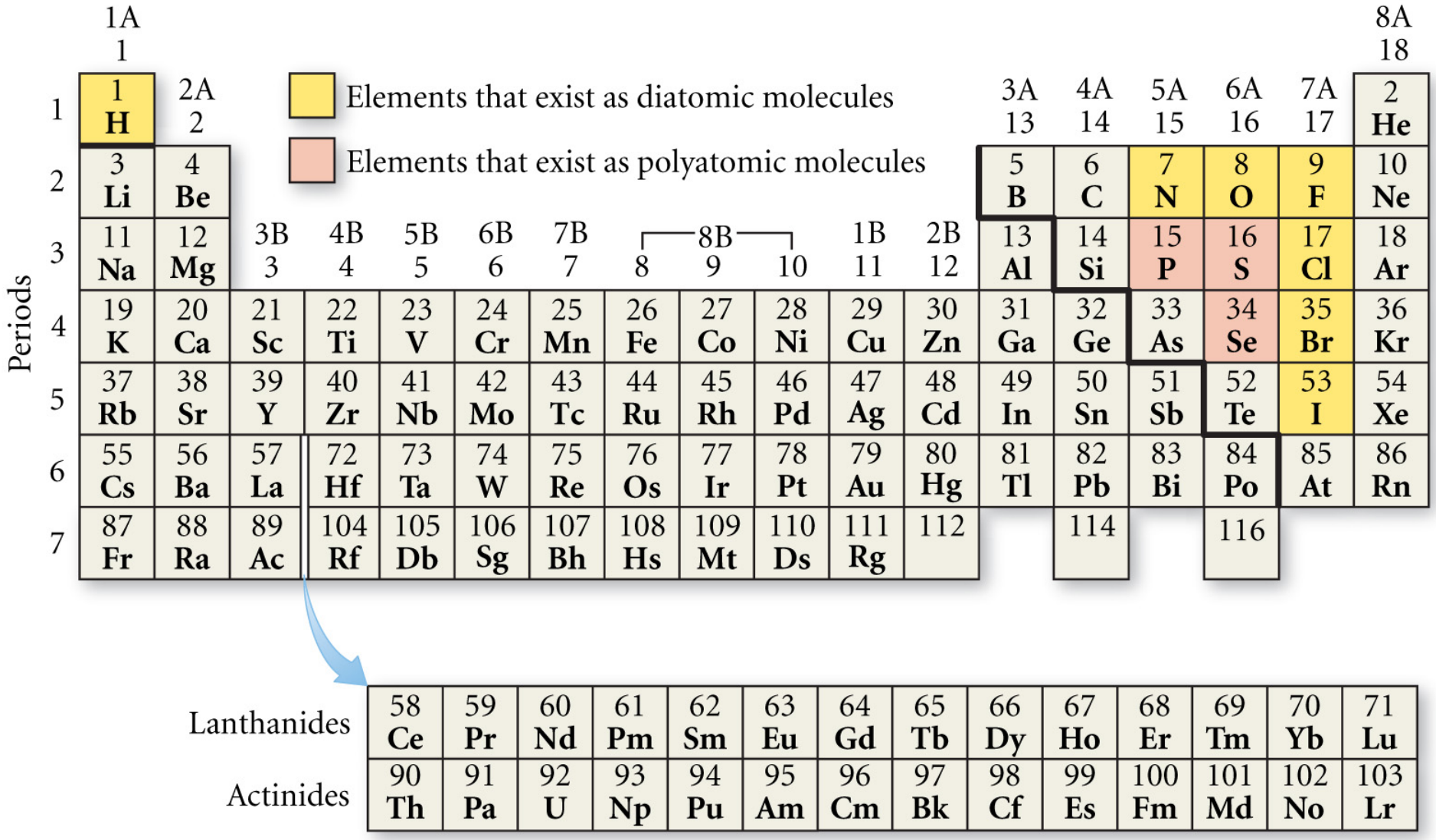
Element	% by Mass	% by Number of Atoms
Oxygen	65	26.4
Carbon	18	9.2
Hydrogen	10	62.4
Nitrogen	3	1.4
Calcium	1.5	0.2
Phosphorus	1	0.3
Other	1.5	0.2

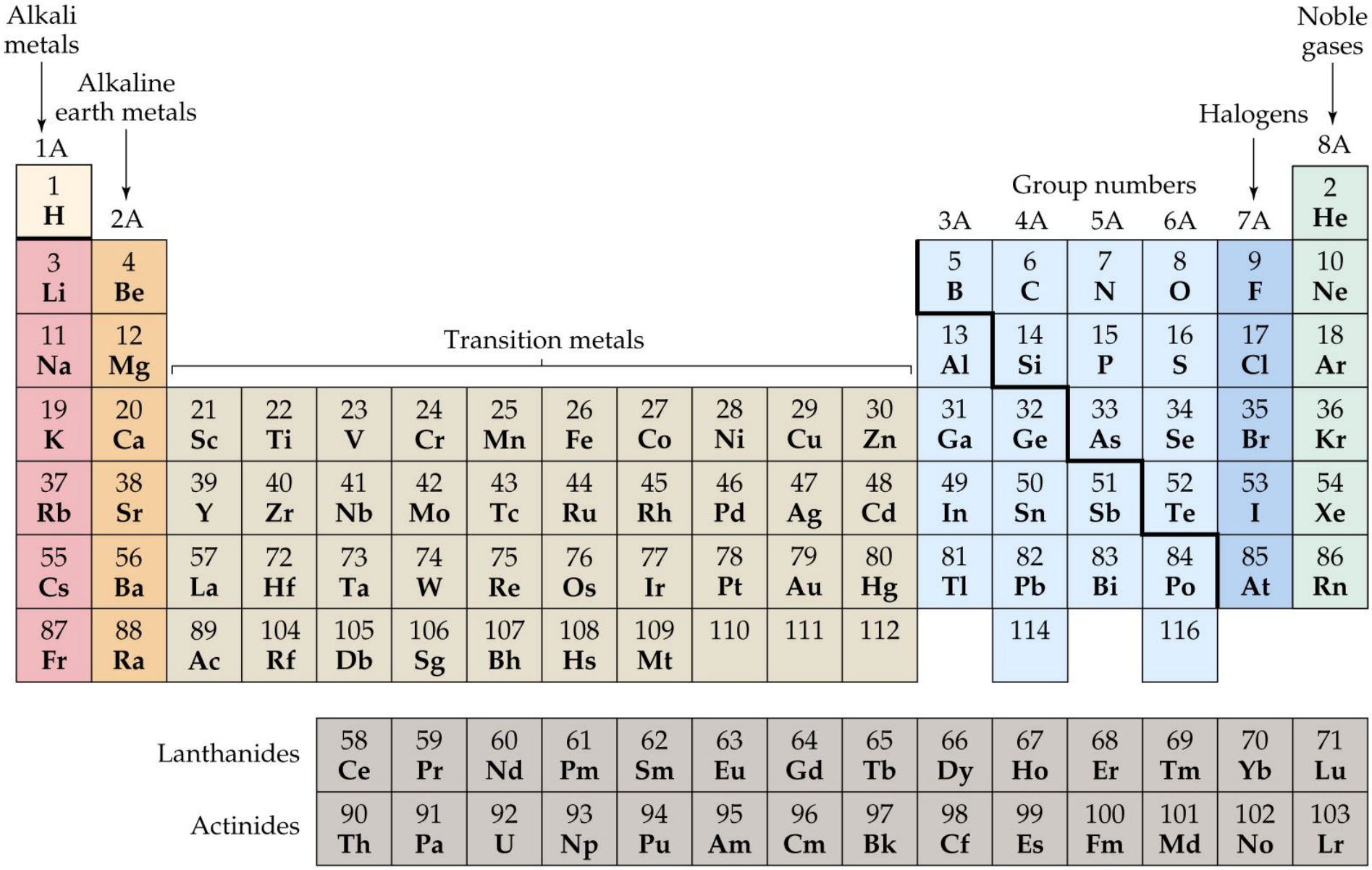


PERIODIC TABLE OF THE ELEMENTS



Molecular Elements




Alkali metals
Alkaline earth metals
Noble gases
Halogens
Group numbers
1A
2A
3A
4A
5A
6A
7A
8A
Transition metals
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 Db
106 Sg
107 Bh
108 Hs
109 Mt
110
111
112
114
116
Lanthanides
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
Actinides
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

Alkali metals

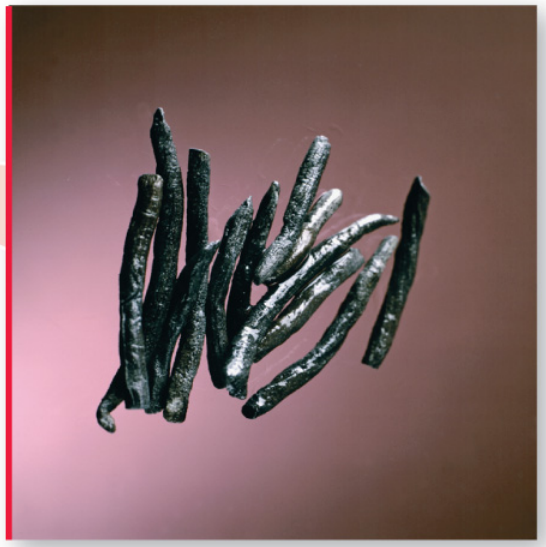
Li

Na

K

Rb

Cs



Alkaline earth metals

Be

Mg

Ca

Sr

Ba

Halogens

F

Cl

Br

I

At

Noble gases

He

Ne

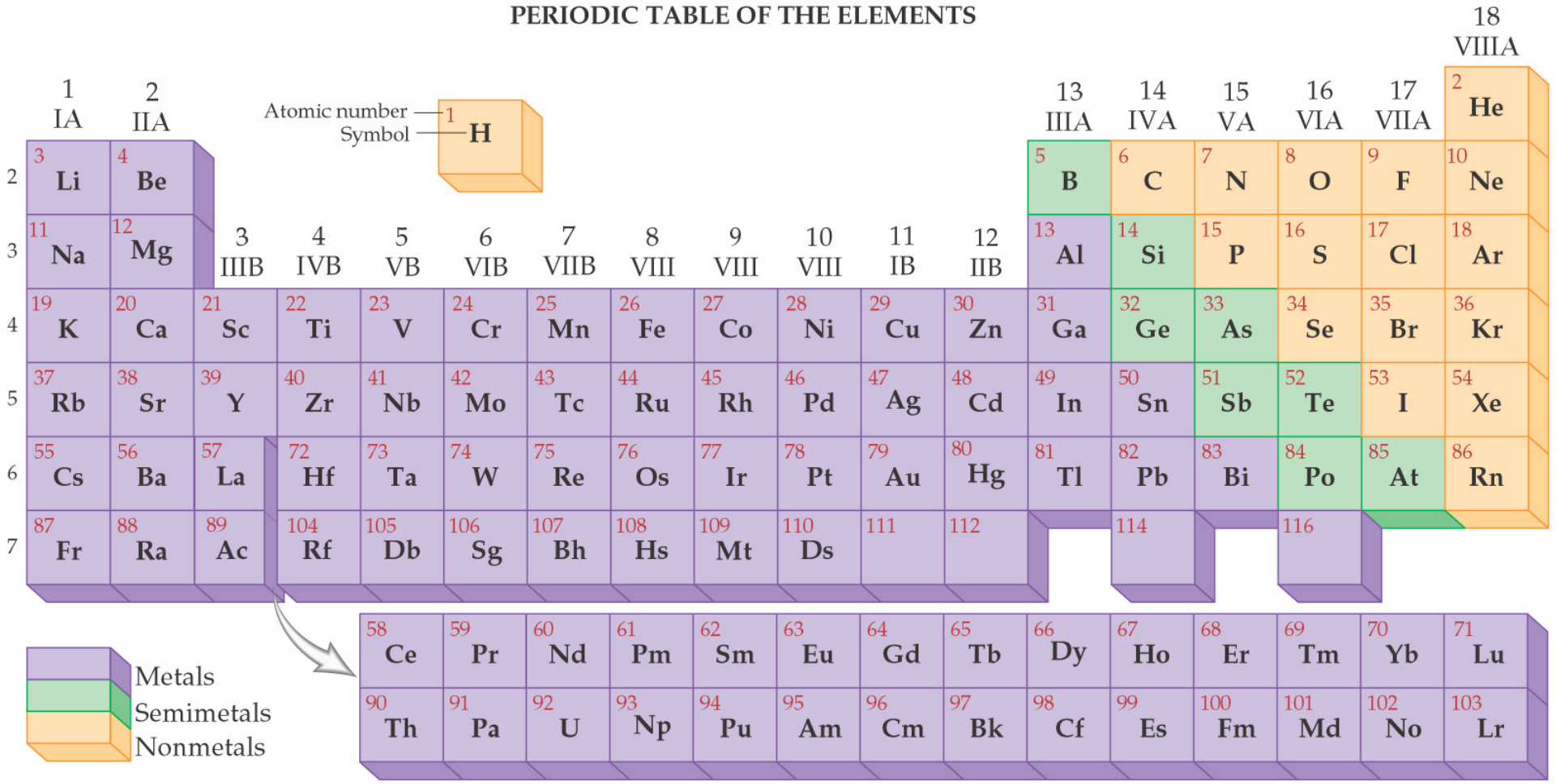
Ar

Kr

Xe

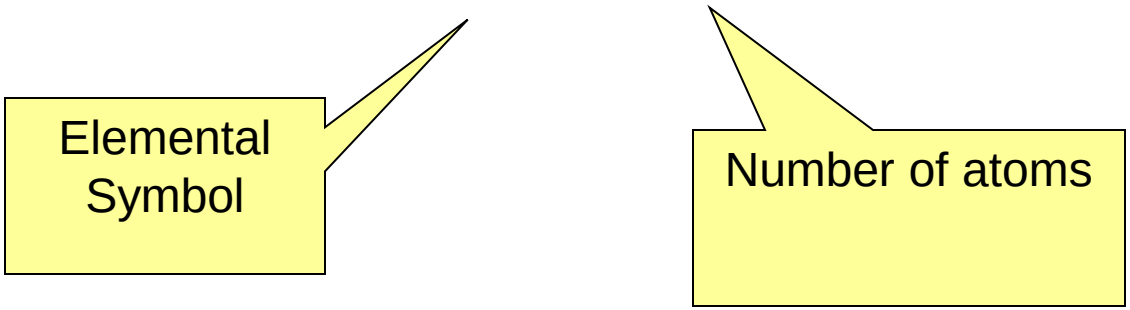
Metallic characters

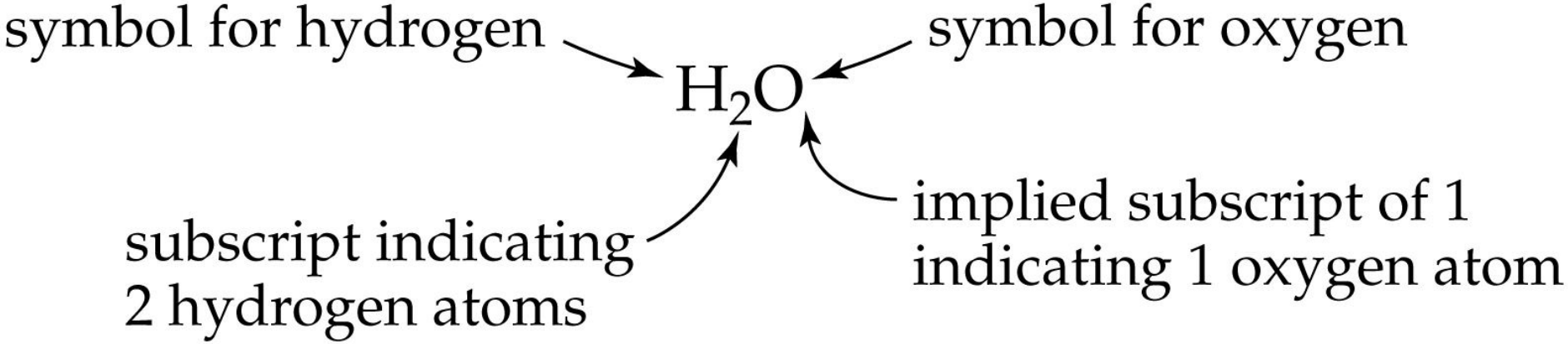
- Metal – shiny, high density, high melting point, great conductor of heat and electricity
- Non-metal – dull, low density, low melting point, not good conductor of heat and electricity
- Semi-metal – metal-like in appearance and has properties that are between that of a metal and a non-metal.

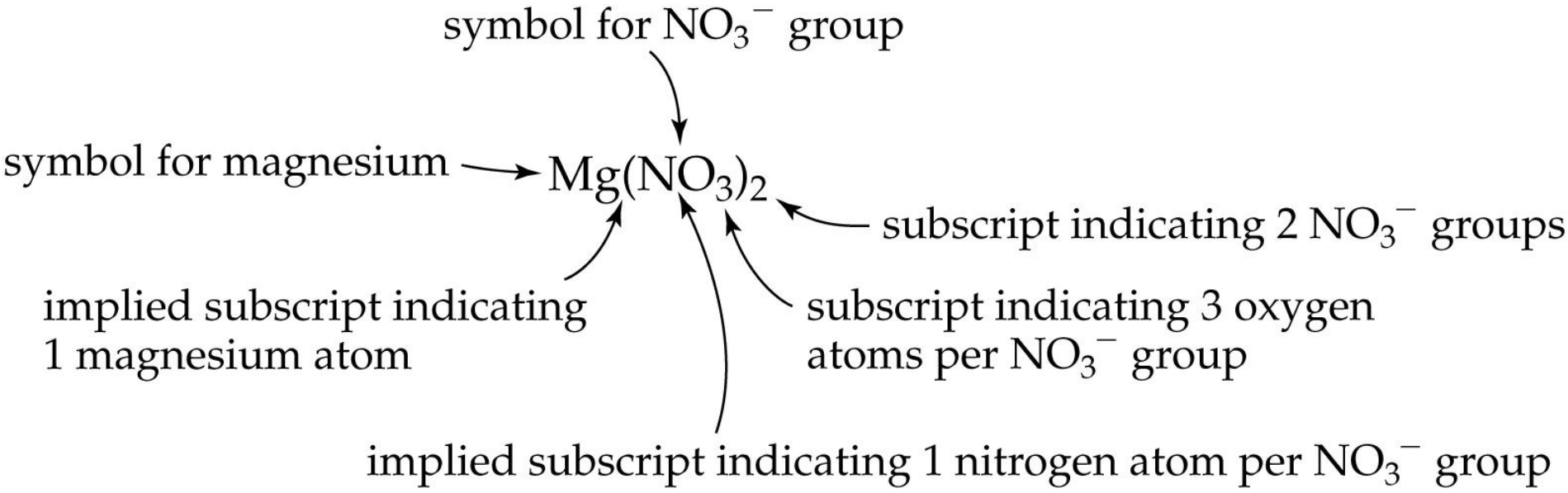


Chemical Formulas

- AxByCz




symbol for hydrogen
symbol for oxygen
H_2O
subscript indicating
2 hydrogen atoms
implied subscript of 1
indicating 1 oxygen atom


symbol for NO_3^- group
symbol for magnesium
$Mg(NO_3)_2$
subscript indicating 2 NO_3^- groups
implied subscript indicating 1 magnesium atom
subscript indicating 3 oxygen atoms per NO_3^- group
implied subscript indicating 1 nitrogen atom per NO_3^- group

Law of Constant Composition

- The **law of constant composition** states that the composition of a substance is always the same, regardless of how the substance was made or where the substance is found.

- For example
  - All water is 11.3% H and 88.8% O

Law of Multiple Proportions

- If the same two elements(A and B) formed two **different** compounds, there is a whole number relationship between the masses of B in the two different compounds for each gram of A in the compound.

  – CO 12 g C 16 g O

Table 5.1 Selected Compounds Showing Elements That Combine to Give More Than One Compound

Compound	Formula	Percent composition
Copper(I) chloride	CuCl	64.2% Cu, 35.8% Cl

Compound	Formula	Percent composition
Copper(I) chloride	$CuCl$	64.2% Cu, 35.8% Cl
Copper(II) chloride	$CuCl_2$	47.3% Cu, 52.7% Cl
Methane	CH_4	74.9% C, 25.1% H
Octane	C_8H_{18}	85.6% C, 14.4% H
Methyl alcohol	CH_4O	37.5% C, 12.6% H, 49.9% O
Ethyl alcohol	C_2H_6O	52.1% C, 13.1% H, 34.7% O
Glucose	$C_6H_{12}O_6$	40.0% C, 6.7% H, 53.3% O