

NAMES AND SYMBOLS OF COMMON ELEMENTS

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David A. Katz

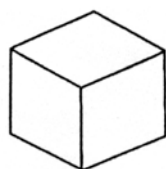
Chemist, Educator, Science Communicator, and Consultant
Department of Chemistry, Pima Community College,
2202 W. Anklam Rd., Tucson, AZ 85745, USA

Part of the language of chemistry are the names and symbols of the chemical elements. There are 91 naturally occurring elements found on Earth. Once you are familiar with the names and symbols of the more common elements, you will be able to learn to write chemical formulas and to do some simple chemical calculations.

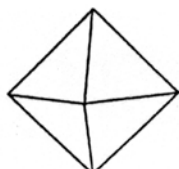
1. A BRIEF HISTORY OF ELEMENT SYMBOLS

The modern symbols used to represent the chemical elements consist of one or two letters from the element's name. Historically, symbols were not always like this.

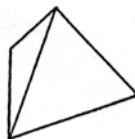
Some of the earliest symbols were those used by the ancient Greeks to represent the four elements earth, air, fire, and water. These were adopted by Plato, using the Pathagorean geometric solids:



Earth
cubic atoms



Air
octahedral atoms



Fire
tetrahedral atoms



Water
icosahedral atoms

As other chemical substances were defined, symbols of the planets were used. Over the centuries, a great many symbols came into use. Although there were many similarities, the secrecy of the alchemists resulted in many variations.

Geoffrey Chaucer, in his Canon Yeoman's Tale from the *Canterbury Tales*, related the symbols as:

*Gold for the sun and silver for the moon,
Iron for Mars and quicksilver in tune
With mercury, lead which prefigures Saturn
And tin for Jupiter. Copper takes the pattern
Of Venus if you please! ...*

A chart of chemical symbols in use about 1780 is shown in Figure 1.

John Dalton, in advocating his atomic theory, recommended symbols composed of circles. Examples of Dalton's symbols for elements and compounds is shown in Figure 2, along with relative weight scale. Scientists of the day, however, viewed Dalton's symbols as cumbersome and with little improvement over the alchemical based symbols of the day.

Finally, in 1813, Jon Jakob Berzelius devised a system using letters of the alphabet. He argued that letters should be used because they could be written more easily than other signs and did not "disfigure" the printed book. The modernized version of Berzelius' system follows under the heading *System for Determining Symbols of the Elements*

CHYMICAL &c. CHARACTERS.

<i>To Abstract</i> $\bar{A}$.	<i>To Dissolve</i> $\approx$	<i>Phlogiston</i> $\uparrow \Delta$.
<i>Acid</i> $\sim + \sim$.	<i>To Distill</i> $d \delta \delta' d' \delta' \delta' \delta'$	<i>Phosphorus</i> Δ .
— <i>Marine</i> $\ominus \oplus \ominus \oplus$.	<i>Dram</i> $\} \angle \dots \delta$.	<i>A Pound</i> $P \text{ lb } p^{\circ} \text{ lb}$.
— <i>Nitrous</i> $\ominus \oplus \ominus \oplus$.	<i>Drachma</i> $\} \angle \dots \delta$.	<i>Precipitate</i> $\sim \sim$.
— <i>Phosphoric</i> Δ .	<i>Drop</i> $G \text{ gt. gut. } \angle$.	<i>Prepate</i> $PP \text{ pp}$.
— <i>Vegetable</i> Φ .	<i>Each</i> $A \bar{a} \bar{a}\bar{a}$.	<i>A Pugil</i> $P p$.
— <i>Nitriolic</i> $\ominus \oplus \ominus \oplus$.	<i>Earth</i> ∇ .	<i>Quick-Lime</i> $CVY \Psi \Phi \text{ T } \nabla$.
— <i>Volatile Sulphureous</i> Φ .	— <i>absorbent</i> ∇ .	<i>Quicksilver</i> Φ .
<i>Ether</i> $\Delta \Delta$.	— <i>of Allum</i> $\Delta \nabla \Phi$.	<i>Quintessence</i> QE .
<i>Air</i> $A' \Delta \Delta$.	— <i>Calcareous</i> $c \nabla - \nabla$.	<i>A Receiver</i> Φ .
— <i>Fixed</i> $\Delta \Delta$.	— <i>Fluor or Fusible</i> ∇ .	<i>Regulus</i> $\Phi \Phi$.
— <i>Mephitic</i> $m \Delta$.	— <i>Sealed</i> ∇ .	— <i>of Antimony Stellated</i> $\Phi \Phi$.
<i>Alcahest, or Alcohol of Wine</i> ∇ .	— <i>Siliceous or Vitrescible</i> ∇ .	— <i>Stellated</i> $\Phi \Phi$.
<i>An Alembic</i> $V \text{ XX XX XX}$.	<i>Essence</i> $Els \Phi$.	<i>Retort</i> $\partial \partial \partial \partial$.
<i>Alkali</i> $\Phi \Phi$.	<i>Fire</i> Δ .	<i>Saffron</i> Φ .
— <i>Caustic Fixed</i> $c \Phi \nabla$.	— <i>Circular</i> Φ .	— <i>of Copper</i> $\Phi \Phi$.
— <i>Volatile</i> $c \Phi \nabla$.	— <i>Reverberating</i> ΔR .	— <i>of Iron</i> Φ .
— <i>Fixed</i> $\Phi \nabla \Phi \nabla \Phi \nabla \Phi \nabla$.	<i>Flows</i> ∇ .	<i>Salt</i> Φ .
— <i>Milder Fixed</i> $m \Phi \nabla$.	<i>Glass</i> $XX \Phi - \Phi$.	— <i>Alkaline</i> $\Phi \Phi$.
— <i>Vol.</i> $\Phi \Phi \Phi \Phi \Phi \Phi$.	<i>Gold</i> Φ .	— <i>Ammoniac</i> $X \text{ I } X \Phi \Phi$.
<i>Amalgam</i> $\bar{a} \bar{a} \bar{a} \Delta$.	— <i>Filings of</i> Φ .	— <i>Common</i> $\Phi \Phi$.
<i>Antimony</i> $\Phi \Phi \Phi$.	— <i>Leaf</i> Φ .	— <i>Gem</i> $\Phi \Phi \Phi$.
— <i>Flowers of</i> Φ .	— <i>Potable</i> OP .	— <i>Sea</i> $\Phi \Phi \Phi$.
<i>Aqua Fortis</i> $F AF \Phi \Phi \Phi$.	<i>A Grain</i> $gr. o.$.	— <i>Sedative</i> SS .
— <i>Regia</i> $AR \Phi \Phi \Phi$.	<i>Gum</i> Φ .	<i>Sund</i> $\Phi \Phi \Phi$.
— <i>Vitae</i> $AV \Phi \Phi \Phi$.	<i>Gypsum</i> ∇ .	<i>A Scruple</i> Φ .
<i>Arsenic</i> $X \Phi \Phi \Phi$.	<i>Half</i> $\Phi \Phi$.	<i>Seal Hermetically</i> SH .
— <i>Regulus of</i> Φ .	<i>Harts Horn</i> CC .	<i>Silver</i> $\Phi \Delta$.
<i>Ash or Ashes</i> $EA \Phi \Phi \Phi$.	<i>Honey</i> $\Phi \Phi$.	— <i>Filings of</i> Φ .
— <i>Pot or Pearl</i> $\Psi \Psi$.	<i>An Hour</i> X .	<i>Spirit</i> $\sim \Phi - \sim$.
<i>Auripigment</i> $\Phi \Phi \Phi \Phi \Phi$.	<i>Iron</i> Φ .	— <i>of Wine</i> $SV \sqrt{\Psi} \nabla$.
<i>Bath</i> B .	— <i>Filings</i> $\Phi \Phi \Phi \Phi$.	— <i>Proof</i> ∇ , or <i>Brandy</i> .
— <i>Sand</i> $AB BA$.	<i>Layer upon Layer</i> SSS .	— <i>Rectified</i> $V \Phi$.
— <i>Vapour</i> VB .	<i>Lead</i> $\Phi \Phi$.	<i>Sublimate</i> $\sim$.
— <i>Water</i> $BM MB$.	<i>Lime</i> $C \Phi$.	<i>Sublime</i> $\sim$.
<i>Bismuth</i> $B W$.	<i>Litharge</i> $\Phi \Phi$.	<i>Sulphur</i> $\Delta \Delta$.
<i>Blood Stone</i> Φ .	<i>Magnesia</i> $M \nabla M$.	— <i>Liver of</i> $\Phi \Phi$.
<i>Bole Armenian</i> $AB \Phi$.	<i>Mercury</i> Φ .	— <i>Mineral called Sulphur-Tram</i> Φ .
<i>Borax</i> $\bar{W} \bar{A} \bar{C} \bar{T} \bar{C} \bar{C} \bar{C}$.	— <i>Precipitated</i> $\Phi \Phi$.	<i>Talc</i> $X X$.
<i>Bottle</i> $\approx$.	— <i>of Saturn</i> $\Phi \Phi$.	<i>Tartar</i> Φ .
<i>Brandy</i> $AV \nabla \Phi \Phi$.	— <i>Sublimed</i> $\Phi \Phi$.	<i>Tin</i> Φ .
<i>Brass</i> $\Phi \Phi$.	<i>Metallic Bodies</i> CM .	<i>Tutty</i> $\Phi \Phi$.
<i>Calamine Stone</i> $LC \Phi$.	— <i>Substances</i> $SM MS$.	<i>Urine</i> $\Phi \Phi$.
<i>To Calcine</i> $\Delta \Phi \Phi$.	<i>Mix</i> m .	<i>Vendigrise</i> Φ .
<i>Camphor</i> $\approx \text{ yr}$.	<i>Modius</i> M .	— <i>Distilled</i> $\Phi \Phi \Phi$.
<i>Caput Mortuum</i> $\Phi \Phi \Phi \Phi$.	<i>A Month</i> $V \Phi$.	<i>Vinegar</i> $\Phi \Phi$.
<i>To Cement</i> $Z \bar{Z}$.	<i>Nickel</i> N .	— <i>Distilled</i> $\Phi \Phi$.
<i>Cerufs</i> $\Phi \Phi \Phi$.	<i>Night</i> $\Phi \Phi$.	<i>Vitriol</i> $\Phi \Phi \Phi \Phi$.
<i>Cinnabar</i> $\Phi \Phi \Phi \Phi$.	<i>Nitre</i> Φ .	<i>Volatile</i> $\Phi \Phi$.
<i>Clay</i> ∇ .	<i>Oil</i> $\Phi \Phi \Phi \Phi \Phi \Phi$.	<i>Water</i> ∇ .
<i>Copper</i> Φ .	— <i>Essential</i> $E \Phi \Delta$.	— <i>Lime</i> ∇ .
<i>Crab</i> Φ .	— <i>Fixed</i> ∇ .	<i>Wax</i> $\Phi \Phi \Phi$.
<i>A Crucible</i> $X \Phi \Phi \Phi \Phi \nabla$.	— <i>Olive</i> Φ .	<i>Wine</i> V .
<i>Cucurbit</i> $\Delta \Delta$.	<i>An Ounce</i> $\angle \dots \Phi$.	— <i>Lees</i> Φ .
<i>Day</i> $\Phi \Phi$.	<i>A Part</i> $p. p.$.	<i>A Year</i> Φ .
<i>Digest</i> $\Phi \Phi \Phi$.	<i>Phlegm</i> $\Phi \Phi$.	<i>Zinc</i> $\Phi \Phi \Phi$.

Figure 1. A chart of chemical symbols and characters in use about 1780.
(Reproduced from the collection of David A. Katz)

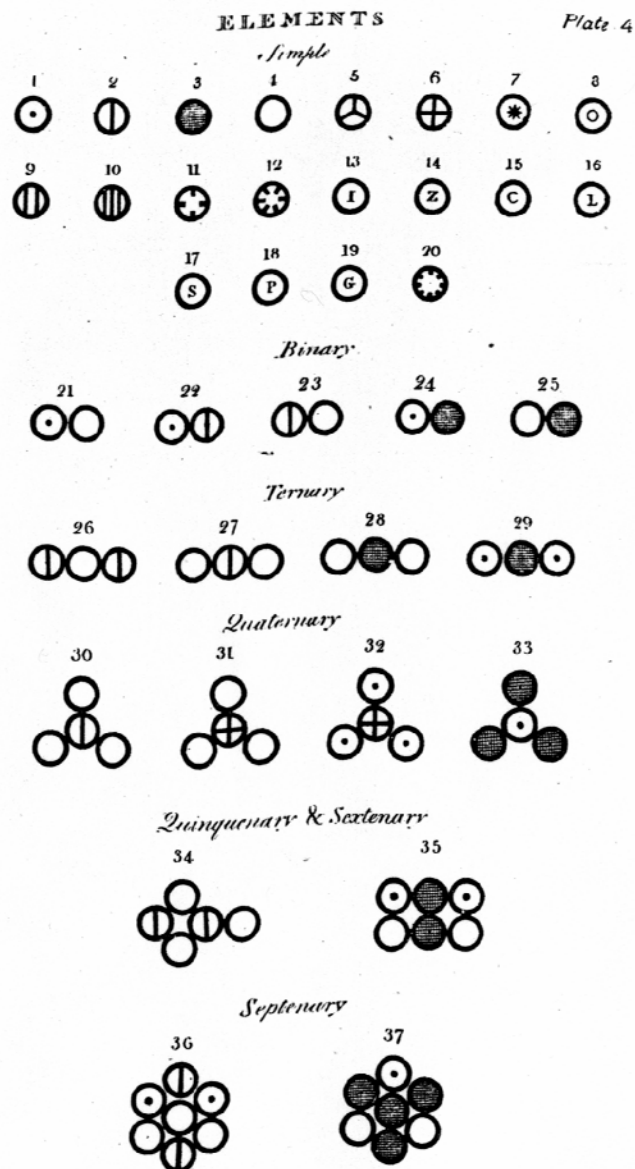


PLATE IV. This plate contains the arbitrary marks or signs chosen to represent the several chemical elements or ultimate particles.

Fig.		Fig.	
1	Hydrog. its rel. weight 1	11	Strontites - - - 46
2	Azote, - - - - - 5	12	Barytes - - - - - 68
3	Carbone or charcoal, - 5	13	Iron - - - - - 38
4	Oxygen, - - - - - 7	14	Zinc - - - - - 56
5	Phosphorus, - - - - 9	15	Copper - - - - - 56
6	Sulphur, - - - - - 13	16	Lead - - - - - 95
7	Magnesia, - - - - - 20	17	Silver - - - - - 100
8	Lime, - - - - - 23	18	Platina - - - - - 100
9	Soda, - - - - - 28	19	Gold - - - - - 140
10	Potash, - - - - - 42	20	Mercury - - - - - 167

21.	An atom of water or steam, composed of 1 of oxygen and 1 of hydrogen, retained in physical contact by a strong affinity, and supposed to be surrounded by a common atmosphere of heat; its relative weight =	8
22.	An atom of ammonia, composed of 1 of azote and 1 of hydrogen - - - - -	6
23.	An atom of nitrous gas, composed of 1 of azote and 1 of oxygen - - - - -	12
24.	An atom of olefiant gas, composed of 1 of carbone and 1 of hydrogen - - - - -	6
25.	An atom of carbonic oxide composed of 1 of carbone and 1 of oxygen - - - - -	12
26.	An atom of nitrous oxide, 2 azote + 1 oxygen -	17
27.	An atom of nitric acid, 1 azote + 2 oxygen -	19
28.	An atom of carbonic acid, 1 carbone + 2 oxygen -	19
29.	An atom of carburetted hydrogen, 1 carbone + 2 hydrogen - - - - -	7
30.	An atom of oxynitric acid, 1 azote + 3 oxygen -	26
31.	An atom of sulphuric acid, 1 sulphur + 3 oxygen -	34
32.	An atom of sulphuretted hydrogen, 1 sulphur + 3 hydrogen - - - - -	16
33.	An atom of alcohol, 3 carbone + 1 hydrogen -	16
34.	An atom of nitrous acid, 1 nitric acid + 1 nitrous gas - - - - -	31
35.	An atom of acetous acid, 2 carbone + 2 water -	26
36.	An atom of nitrate of ammonia, 1 nitric acid + 1 ammonia + 1 water - - - - -	33
37.	An atom of sugar, 1 alcohol + 1 carbonic acid -	35

Figure 2 Dalton's system of symbols from his *New System of Chemical Philosophy*, 1808.

System for Determining Symbols of the Elements

1. The symbols of the most common elements, mainly nonmetals, use the first letter of their English name.

Examples: H, B, C, N, O, F, P, S, I

2. If the name of the element has the same initial letter as another element, then the symbol uses the first and second letters of their English name.

Examples: He, Li, Be, Ne, Al

3. If the first two letters of the element name are the same as another element, then the symbol consists of the first letter and the first consonant of the English name that they do not have in common.

Examples:

magnesium has the symbol Mg
(first letter and first consonant)

manganese has the symbol Mn

chlorine has the symbol Cl
(first letter and first consonant NOT in common)

chromium has the symbol Cr

4. Some symbols are based on the old name or Latin name of the element. There are eleven elements:

Na	natrium	Sb	stibium
K	kalium	W	wolfram
Fe	ferrum	Au	aurum
Cu	cuprum	Hg	hvdargyrum
Ag	argentum	Pb	plumbum
Sn	stannum		

5. New elements, or those with disputed claims for discovery/ synthesis are named using three letters based on the Latin for their atomic numbers:

First letter:	U from Uni or Un = 1
Second letter:	n from nil = 0
Third letter:	From latin numerical prefix:
	q for quad = 4
	p for pent = 5
	b for hex = 6
	s for sept = 7
	o for oct = 8
	e for ennea = 9

2. MODERN CHEMICAL SYMBOLS

Listed below are the atomic numbers, names, and symbols of the most common elements. The atomic number is used to determine the place of the element in the periodic table, it also has other meaning as you will find out later in the course.

Become familiar with the names and symbols of these elements.

Atomic Number	Name	Symbol	Atomic Number	Name	Symbol
1	hydrogen	H	28	nickel	Ni
2	helium	He	29	copper	Cu
3	lithium	Li	30	zinc	Zn
4	beryllium	Be	33	arsenic	As
5	boron	B	35	bromine	Br
6	carbon	C	36	krypton	Kr
7	nitrogen	N	37	rubidium	Rb
8	oxygen	O	38	strontium	Sr
9	fluorine	F	47	silver	Ag
10	neon	Ne	48	cadmium	Cd
11	sodium	Na	50	tin	Sn
12	magnesium	Mg	51	antimony	Sb
13	aluminum	Al	53	iodine	I
14	silicon	Si	54	xenon	Xe
15	phosphorus	P	55	cesium	Cs
16	sulfur	S	56	barium	Ba
17	chlorine	Cl	74	tungsten	W
18	argon	Ar	78	platinum	Pt
19	potassium	K	79	gold	Au
20	calcium	Ca	80	mercury	Hg
21	scandium	Sc	82	lead	Pb
22	titanium	Ti	83	bismuth	Bi
23	vanadium	V	86	radon	Rn
24	chromium	Cr	87	francium	Fr
25	manganese	Mn	88	radium	Ra
26	iron	Fe	92	uranium	U
27	cobalt	Co			

THE PERIODIC TABLE OF THE ELEMENTS

																	18 Noble Gas	
1 IA 1 H 1.008																	2 He 4.003	
3 Li 6.941	4 Be 9.012											13 IIIA B 10.81	14 IVA C 12.01	15 VA N 14.01	16 VIA O 16.00	17 VIIA F 19.00	18 Ne 20.18	
11 Na 22.99	12 Mg 24.30	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8 —	9 VIII B	10 —	11 IB	12 IIB	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95	
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	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	
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	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 183.8	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 (209)	85 At (210)	86 Rn (222)	
87 Fr (223)	88 Ra (226)	89 Ac† (227)	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (269)	109 Mt (268)	110 Ds (271)	111 Rg (272)	112 Uub (277)	113 Uut (284)	114 Uuq (289)	115 Uup (288)	116 Uuh (292)	117 Uus	118 Uuo	

*Lanthanide Series

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 157.2	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 231.0	92 U 238.0	93 Np 237.0	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 (262)

†Actinide Series

All atomic weights are scaled to the relative mass of $^{12}\text{C} = 12$ exactly.

Atomic weights in parentheses are those of the most stable or best known isotope.

Atomic weights from N. N. Greenwood and H. S. Feiser, on behalf of the Committee on Teaching of Chemistry of the International Union of Pure and Applied Chemistry (IUPAC) in consultation with the IUPAC Commission on Atomic Weights and Isotopic Abundances with updated values from IUPAC 1999.

Transfermium names: Element 104, Rutherfordium, Rf; Element 105, Dubnium, Db; Element 106, Seaborgium, Sg; Element 107, Bohrium, Bh; Element 108, Hassium, Hs; Element 109, Meitnerium, Mt. As adopted by IUPAC, August, 1997. Reference: *Chemical and Engineering News*, 75, (no. 36), Sept. 8, 1997, 10. Element 110, Darmstadtium, Ds, proposed by IUPAC-IUPAP. Element 111, Roentgenium, Rg, (provisional, May 2004). Recently reported elements are unnamed and use Latin numerical names. Existence of elements 117 and 118 are not known.