

7 N nitrogen [14.00, 14.01]	8 O oxygen [15.99, 16.00]	52 Te tellurium 127.6	16 S sulfur [32.05, 32.08]
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Symbols of the Elements, Part III (concluded)*

by *Juris Meija*

During the 20th century the IUPAC symbols for all known chemical elements gradually became the international standard. With the house all in order, the proposed symbols for all newly discovered elements were now scrutinized more than ever, and the nomenclature was set for elements which have not yet been discovered. This is the story of the 20th century.

The Forbidden Symbols

Most aspects of our culture undergo change. Newspapers change their design, corporations change their logos, and countries even change their flags. Symbols of chemical elements are no exception to this rule of life. The inaugural 1903 International Atomic Weights Report, for example, contains quite a few symbols that are no longer in use. There is A for argon, Rd for radium, Yt for yttrium, Gl for glucinum (beryllium), and Cb for columbium (niobium). In addition, other elements have had their symbols changed over the years. By the late 1950s, argon officially become “Ar” and element symbols finally became standardized.

It has been long accepted that the names of elements should be unique and should not recycle some older names that have felt out of vogue long ago.

Symbol	Previous use	Example reference*
A	argon	CIAAW 1902-1955
An	radon-219 (actinon)	CIAAW 1923
Cb	niobium (columbium)	CIAW 1903-1947
Cp	lutetium (cassiopeium)	used for lutetium in the past
Ct	hafnium (celtium)	CR 1947
Gl	beryllium (glucinum)	CIAAW 1903-1925
Ha	hassium (hahnium)	IUPAC 1994
Io	thorium-230 (ionium)	CIAAW 1923
J	iodine	CIAAW 1925, CIAAW 1902
Jl	dubnium (joliotium)	IUPAC 1994
Mv	mendelevium	CR 1955
Nt	radon (niton)	CIAAW 1912-1922
Rd	radium	CIAAW 1903, 1906-1907
Sa	samarium	CIAAW 1906-1922
Tn	radon-220 (thoron)	CIAAW 1923
Tu	tungsten, thulium	CR 1947, CIAAW 1902
X	xenon	CIAAW 1902
Yt	yttrium	CIAAW 1903-1907, 1910-1922

Table 1. Symbols of elements that are no longer used by IUPAC. *CIAAW: International Atomic Weight Tables, CR: Comptes Rendus IUPAC. CIAAW-1902 refers to the 1902 German edition of the first CIAAW table preceding the 1903 Inaugural CIAAW report.

Arguably, the same logic should also apply to symbols of elements.¹ This kind of convention, however, cannot extend too deep into the past because far too many letter combinations were indiscriminately used during the 19th century textbooks. While it is indeed impractical to restrict our choice of new symbols by lingering too deep into the recycle bin of history, it seems fair that any overlap between the International Atomic Weight Tables dating from 1902 and the subsequent IUPAC recommendations is off limits. Table 1 lists the symbols of elements once used in the International Atomic Weight Tables, which are no longer used by IUPAC and therefore are unlikely to enter the periodic table ever again.

Interestingly enough, because all symbols of chemical elements are now formed from the letters in their English names, and because all symbols have to be unique, this may result in a situation when the inability to form a proper symbol does pre-empt the choice of a suitable name of an element. For example, it would be impossible to name a future element after the Estonian capital Tallin (tallinium) because no unique two-letter symbol starting with “T” can be formed. This is because all letter combinations—Ta, Tl, Ti, Tn, Tu, and Tm—are either currently used by IUPAC or have been used in the past as in the case of Tu which was used for thulium by IUPAC in the 1940s, and Tn which was used for an isotope of radon in the roaring twenties. Although this obscure roadblock is not likely to be encountered in naming of some future element, it nevertheless shows the intricate kinship between the symbols and the names of elements.

Brave New Elements

It is in the human nature to seek behind what is known in order to discover new treasure, new worlds, or new chemical elements. The question is, how do we talk about the elements yet to be discovered? What name and symbol shall be given to elements that do not yet exist? Mendeleev had an idea: “So as to avoid introducing new names for the unknown elements into science, I shall designate them by the name of the nearest lower analog of the odd or even elements in the same group, and place in front of this name a Sanskrit numeral (eka, dvi, tri, tschatour, etc.). The unknown elements of the first group will be called eka-caesium (Ec = 75), dvi-caesium (Dc = 220), etc. If niobium, for example, were not known, we would call it eka-vanadium.”²

Although Mendeleev’s nomenclature was good for Sanskrit lovers, and is still used informally, it relies on

Numeral	Prefix	Symbol
0	nil	n
1	un	u
2	b(i)	b
3	tr(i)	t
4	quad	q
5	pen(t)	p
6	hex	h
7	sep(t)	s
8	oc(t)	o
9	en(n)	e

Table 2. IUPAC systematic nomenclature for naming newly discovered or not yet discovered elements. Letters in parenthesis are omitted if they are followed by a repeating letter (eleison rule). For example, the element with atomic number 902, or simply the element 902, is named ennibium, and not ennibium.

the periodic table. If elements are rearranged in the periodic table, their temporary names change thus avoiding unnecessary confusion. A case in point is rhenium which was dubbed tri-manganese by Mendeleev, but now appears only two places below manganese. Also, protactinium used to be eka-tantalum before it was properly placed among the actinides.

In 1979, IUPAC adopted a naming system of all future elements which relies on their atomic numbers.³ In this system, the name of a newly discovered (or undiscovered) element is formed by stringing prefixes of Greek and Latin words of the numerals which form the atomic number of the element (see Table 2). The portmanteau name is always followed by the suffix “-ium”. The symbol of an element is formed by string-

ing together the first letters of the corresponding prefixes. The systematic nomenclature is straightforward. For example, until a proper name will be adopted (if ever), the element with atomic number 2176 is officially called biunsepthexium (symbol Bush), which literally means “the 2176th” in the made-up hybrid list of scientific Latin and Greek.

One would never guess, but chemical nomenclature can indeed be amusing. As the previous example hinted, there is plenty of room for play with the IUPAC nomenclature.⁴ Does the Roman pontiff have his personal chemical element (yes, the element 5859)? Which elementary particle is also a symbol of an element (Photon)? We will end the series on element symbols on this note.

**For Part I see Chem Int Jan-Feb 2014, p. 20-21, and for Part II, see Chem Int Mar-Apr 2014, p. 18-20*

References

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On the Naming and Symbols for Elements 115 and 112

by Eric Scerri

On 27 August 2013 it was announced that scientists from Lund in Sweden had obtained good evidence for the existence of element 115. This event inevitably sets up speculation as to what the element may eventually be named and what its symbol might be. Of course these matters will be adjudicated by the appropriate IUPAC committee and the outcomes will be rapidly disseminated around the world.

In this short communication, I would like to sound a warning about the choice of symbol, in particular, and to mention something that happened over the choice of symbol for element 112, which was named copernicium.

After this element was initially discovered and subsequently approved, the discoverers at the Gesellschaft für Schwerionenforschung (GSI) in Darmstadt, Germany, proposed the symbol Cp. But during the obligatory six-month period of discussion that followed this proposal it was pointed out that Cp had once been used for an element “cassiopeium” which subsequently became known as lutetium. As in the case of any name proposed for an element that is subsequently rejected, any symbol for a rejected element can also never be used again. As a result IUPAC asked the discoverers to choose another symbol, whereupon Cn was proposed and duly ratified.

There is just one further problem. Although nobody seems to have noticed at the time, the symbol Cn had also once been proposed for an element, coronium, whose name and symbol were published in several articles by the English physicist and mathematician