

NRNU MEPHI

Dramatic history of chemical elements

Report prepared

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The uneasy history of the recognition of chemical elements in examples from the past and recent for the now-divided fifth group of the periodic system of D. Mendeleev

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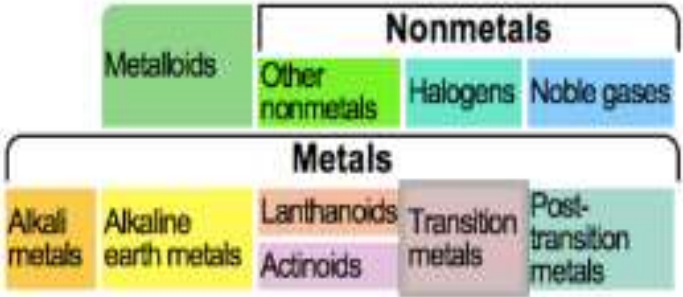


Periodic table of the elements, 2015

1 H Hydrogen 1.008	2 He Helium 4.002602	3 Li Lithium 6.94	4 Be Beryllium 9.012182	5 B Boron 10.81	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.1797	11 Na Sodium 22.989769	12 Mg Magnesium 24.305	13 Al Aluminum 26.981538	14 Si Silicon 28.0855	15 P Phosphorus 30.973762	16 S Sulfur 32.06	17 Cl Chlorine 35.45	18 Ar Argon 39.948	19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.955912	22 Ti Titanium 47.867	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938044	26 Fe Iron 55.845	27 Co Cobalt 58.933195	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.63	33 As Arsenic 74.9216	34 Se Selenium 78.9718	35 Br Bromine 79.904	36 Kr Krypton 83.798	37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.90584	40 Zr Zirconium 91.224	41 Nb Niobium 92.90637	42 Mo Molybdenum 95.94	43 Tc Technetium (98)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.9055	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.414	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760	52 Te Tellurium 127.60	53 I Iodine 126.905	54 Xe Xenon 131.29	55 Cs Cesium 132.905	56 Ba Barium 137.327	57-71 Lanthanoids	72 Hf Hafnium 178.49	73 Ta Tantalum 180.94788	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.222	78 Pt Platinum 195.084	79 Au Gold 196.966569	80 Hg Mercury 200.59	81 Tl Thallium 204.38	82 Pb Lead 207.2	83 Bi Bismuth 208.9804	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)	87 Fr Francium (223)	88 Ra Radium (226)	89-103 Actinoids	104 Rf Rutherfordium (261)	105 Db Dubnium (268)	106 Sg Seaborgium (271)	107 Bh Bohrium (272)	108 Hs Hassium (270)	109 Mt Meitnerium (276)	110 Ds Darmstadtium (281)	111 Rg Roentgenium (280)	112 Cn Copernicium (285)	113 Uut Ununtrium (284)	114 Fl Flerovium (289)	115 Uup Ununpentium (288)	116 Lv Livermorium (293)	117 Uus Ununseptium (294)	118 Uuo Ununoctium (294)
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22
Ti
Titanium
47.867

2
8
10
2

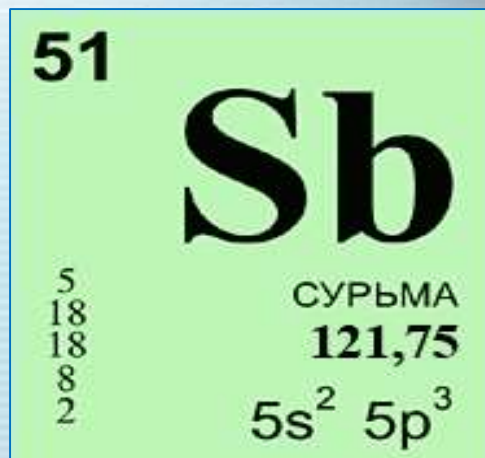


For elements with no stable isotopes, the mass number of the isotope with the longest half-life is in parentheses.

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57 La Lanthanum 138.90	58 Ce Cerium 140.116	59 Pr Praseodymium 140.90765	60 Nd Neodymium 144.242	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.92534	66 Dy Dysprosium 162.500	67 Ho Holmium 164.93032	68 Er Erbium 167.259	69 Tm Thulium 168.93402	70 Yb Ytterbium 173.054	71 Lu Lutetium 174.967
89 Ac Actinium	90 Th Thorium 232.0377	91 Pa Protactinium 231.03688	92 U Uranium 238.02891	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)

Stibium/Antimony/Сурьма



Chemical element No. 51
in normal conditions
is a silver-white metal

Unlike most other metals, it expands when frozen;
it exhibits metallic and non-metallic properties

This element has been known since ancient times.
The Latin name "stibium" comes from the Greek
"stib", and the latter from the ancient Egyptian
"stim", which means "ointment". The Russian word
"surma" is of Turkic origin "surme".
The original meaning of this word in the 10-11th
century is make-up, ointment

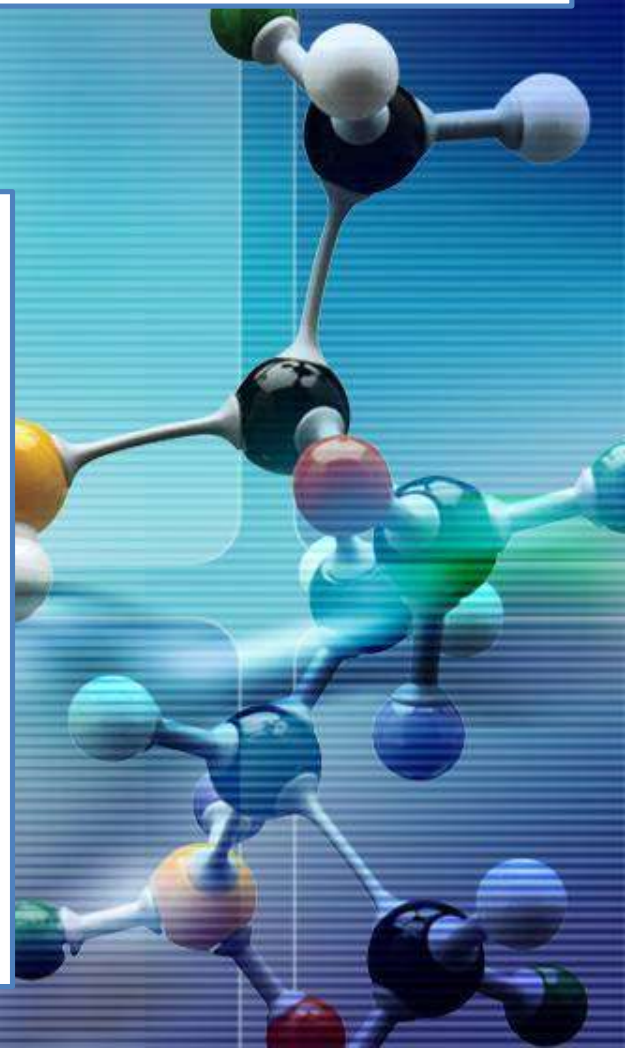


In 1604, the abbot of the monastery, Vasily Valentin, described the properties of a substance, from which pigs quickly gain weight, but the food that was cooked later turned out to be harmful for his monks' wards. This substance turned out to be antimony, but they gave it the Latin name "antimonium" from "anti-monk".

In 1789, A. Lavoisier included antimony in the list of chemical elements called antimoine in French.

English scientists still use the name "antimony". Only a few compounds are named for Latin, for example, stibonic acids.

Nevertheless, IUPAC approved the symbol Sb and the Latin name, allowing for national options



Tantalum

Tantalum is a shiny silver-white metal with a faint bluish tint

73

Ta

2
11
32
18
8
2

ТАНТАЛ
180,948

$4f^{14} 5d^3 6s^2$



Tantalum is a refractory solid metal, but plastic, like gold.

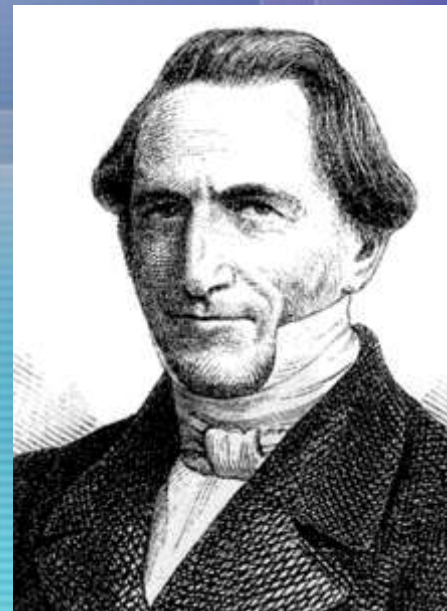
He is extremely resistant to acids, like the mythical Tantalum in relation to water: he was punished by Zeus, and, standing up to his neck in water, could not drink it.



In 1801, an American, C. Hatchet, discovered an element, which he named columbium in honor of H. Columbus.

A year later, the Finnish chemist A. Ekeberg extracted the oxide of the new element from the same minerals and called the element tantalum. However, this discovery was not recognized, and it was only in 1844 that Rose found that columbium is a mixture of two elements. In addition to tantalum, there is another element that is close in properties. This new element was called Rose niobium by the name of the mythical Niobe, the daughter of Tantalus.

Later, there was still a great deal of confusion: first, tantalum was often called columbium, then niobium was suggested to be called columbium. IUPAC did not agree, but this name is still found in the USA.



Dubnium

Dubnium is a chemical element of 5th group of the periodic system. The most stable isotope ²⁶⁸Db, half-life 32 h.

105

Db

ДУБНИЙ

262

2
11
32
32
18
8
2

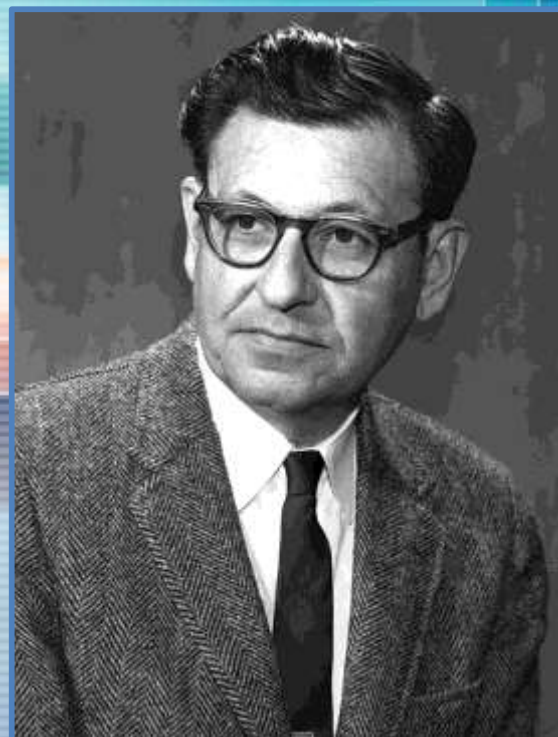
$5f^{14} 6d^3 7s^2$

The metal is most likely in solid state at 298 K. The color is unknown, but probably silvery white or gray.

Dubnium forms a volatile compound with chlorine DbCl_5 . The chemical properties of dubnium are almost unknown.



This element was synthesized by Russian and American scientists independently of each other using bombing technology. This was reported in 1967 by Georgiy Flerov and in 1970 by Albert Giorceau.



Soviet researchers proposed to call the new element Nilsborium (Ns), in honor of Niels Bohr, the Americans - Hanium (Ha), in honor of Otto Han, one of the authors of the discovery of spontaneous uranium fission. Later, in 1994, the IUPAC Commission proposed the name Joliotus (Jl), in honor of Joliot-Curie. The element has long been officially called the Latin numeral Unnilpentium (Unp), that is, simply 105th. The symbols Ns, Ha, Jl could be seen in the tables of elements published in different years. According to the final decision of IUPAC in 1997, this element was named Dubnium in honor of the Russian science city of Dubna.



The cold war left a huge imprint on the chemical nomenclature: as soon as all the stable elements were discovered and the accelerators went into action, it turned out that Soviet and North American scientists were not ready to share the results of their research at the earliest opportunity.

The scandal connected with this mystery is with the name of the elements with serial numbers 104 and 105, which lasted for about 30 years (sometimes ironically referred to as “transfermic wars”): until the late 1990s, in the Russian-language chemistry textbooks the names “Kurchatoviy” and “Nilsboriy”.

81 204,37 Tl ТАЛЛИЙ	82 207,20 Pb СВИНЕЦ	83 208,98 Bi ВИСМУТ	84 [209] Po ПОЛОНИЙ		
Ac [227] АКТИНИЙ	Ku 104 [281] КУРЧАТОВИЙ	Ns 105 [281] НИЛЬСБОРИЙ	Sg 106 [286] СИБОРГИЙ		
* ЛАНТАНОИДЫ					
61 [145] La ЛАВЕНЦИЙ	62 150,40 Sm САМАРИЙ	63 151,96 Eu ЕВРОПИЙ	64 157,25 Gd ГАДОЛИНИЙ	65 158,93 Tb ТЕРБИЙ	Dy 66 162,50 ДИСПРОЗИЙ
** АКТИНОИДЫ					

Conclusions

The uneasy history of the recognition of chemical elements is presented in examples from the past and recent for the now-divided fifth group of the periodic system of D. Mendeleev