

H The elements and their isotopes

Table H.1 lists the explanation and calculation rules for some of the fields in the reference tables per isotope. We cover common isotopes and those mentioned in the book.

Table H.1: Reference explanation/calculation

Field	Explanation/Calculation
Number of deuterons	Determined by the structure (nuclets, endings)
Number of single carbon nucleot protons	Determined by the super-structure: one for each carbon nucleot with 11 protons (= all except the first one, which has 12 protons)
Number of quasi-inner electrons	Determined by the structure: space between nuclets and between branches provides possible spots
Number of additional required proton–electron pairs	Determined by the structure: PEPs required for stability
Number of additional gap proton–electron pairs	Determined by the structure: PEPs not required, but filling a gap (“neutron” gap)
Number of additional other proton–electron pairs	Determined by the structure, all other PEPs, not required and not filling a gap
Total number of protons in the nucleus	Twice the number of deuterons + number of single carbon-nucleot protons + number of additional required proton–electron pairs + number of additional gap proton–electron pairs + number of additional other proton–electron pairs
Number of outer electrons	Number of deuterons + number of single carbon nucleot protons - number of quasi-inner electrons
Number of inner electrons	Number of deuterons + number of additional required proton-electron pairs + number of additional gap proton-electron pairs + number of additional other proton-electron pairs
Element-/Atomic number	Number of deuterons + number of single carbon nucleot protons unable to pull in a quasi-inner electron

Table H.2 lists the deuteron count as well as the single proton count of a nucleot / ending:

Table H.2: Deuteron, single proton, PEP count of nuclets/endings

Nucleot/Ending	Deuteron count	Single proton count	PEP count
First carbon nucleot	6	0	0
Other carbon nucleot	5	1	0
Boron ending	5	0	0
Beryllium ending	4	0	0

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Nuclet/Ending	Deuteron count	Single proton count	PEP count
Lithium nuclet	3	0	0
Five-ending	2	0	1
Four-ending	2	0	0
Two-ending	1	0	0

The fields

- Group,
- Magnetic dipole moment,
- Spin

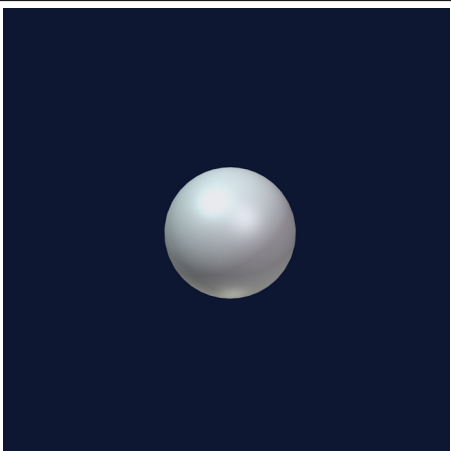
listed in the reference (which was moved to the website) we consider to be legacy information, that needs to be redone in the future.

Information specific to SAM consists of

- SAM lines
- SAM line nucleus BE
- MBS radius (based on proton radius 1)
- MBS Vol./#p

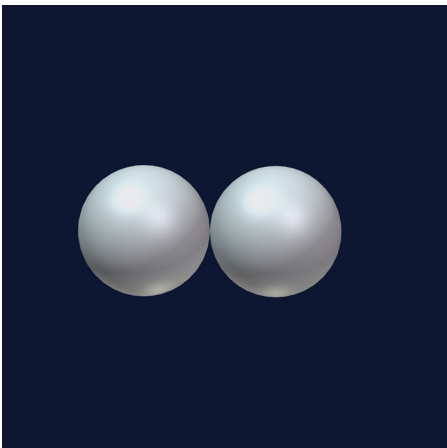
The first row

001 H - Hydrogen 1 (Hydrogen)

Atomic number	1	 Hydrogen-1, is the most primordial isotope of Hydrogen. It is the most abundant element in the universe. The H-1 isotope is in SAM considered not to be the main isotope of hydrogen despite its abundance of 99.8%. The reason for this is that it contains no proton-electron pair (PEP) or “neutron” in the standard model. We regard it therefore as proto-matter, not yet a real element or nucleus.
Total number of protons	1	
Number of deuterons	0	
Number of single protons	1	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	0	
Total number of outer electrons	1	
Group	1	
Isotope abundance	99.9885%	
Element abundance Earth	0.15%	
Half-life	Stable	
Valence / Oxidation state	1	
Magnetic dipole moment	2.792847351 μN	
Spin	1/2	
Electron affinity	0.754195 eV	
MBS radius	1	
MBS Vol./#p	4.18	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	N/A	
SAM line nucleus BE	N/A	

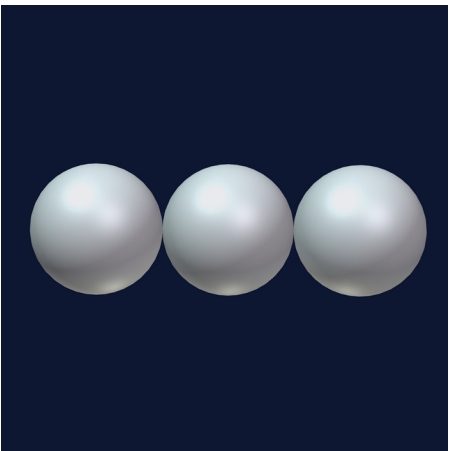
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001 H - Hydrogen 2 (Deuterium)

Atomic number	1	 Deuterium is with 0.2% low in abundance, yet the normal isotope of hydrogen. It is the most basic representation of the nucleus since this is what all other nuclei are in essence made up off. Each successive element grow in the general rule by adding one deuteron (this is the 'stripped from outer electrons' version of deuterium).
Total number of protons	2	
Number of deuterons	1	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	1	
Total number of outer electrons	1	
Group	1	
Isotope abundance	0.0115%	
Element abundance Earth	0.15%	
Half-life	Stable	
Valence / Oxidation state	1	
Magnetic dipole moment	0.8574382 μN	
Spin	1	
Electron affinity	0.75459 eV	
MBS radius	2	
MBS Vol./#p	16.76	
Average nucleon BE	1.112 MeV	
Nucleus BE	2.225 MeV	
SAM lines	1	
SAM line nucleus BE	2.225 MeV	

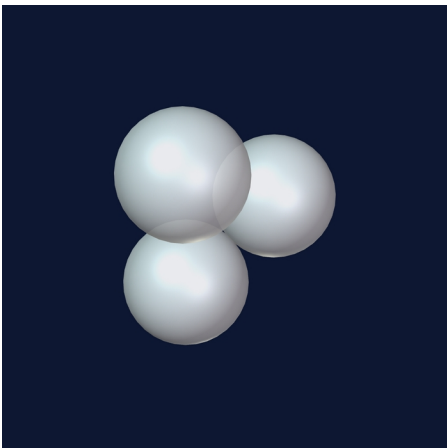
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001 H - Hydrogen 3 (Tritium)

Atomic number	1	 A normal isotope of hydrogen in the sense that it is made up of the base element (Deuterium) plus an extra PEP. It can also be understood as two deuterons bound together by a shared center proton which expresses its relative stability.
Total number of protons	3	
Number of deuterons	1	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	1	
Number of quasi inner electrons	0	
Total number of inner electrons	2	
Total number of outer electrons	1	
Group	1	
Isotope abundance	Trace	
Element abundance Earth	0.15%	
Half-life	12.32 y	
Valence / Oxidation state	1	
Magnetic dipole moment	2.9789625 μN	
Spin	1/2	
Electron affinity	N/A	
MBS radius	3	
MBS Vol./#p	37.7	
Average nucleon BE	2.827 MeV	
Nucleus BE	8.482 MeV	
SAM lines	4 (2*2)	
SAM line nucleus BE	8.9 MeV	

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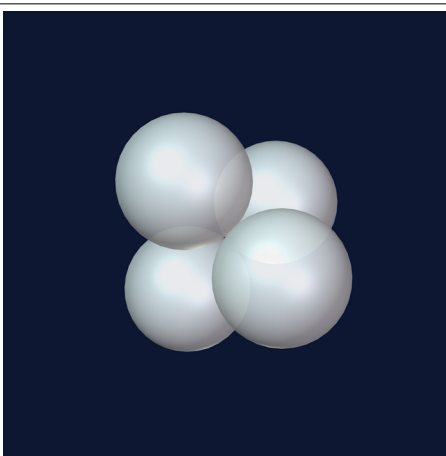
002 He - Helium 3

Atomic number	2	 Helium 3 is again an odd isotope as it is created by the removal of a proton-electron pair from the nucleus of helium-4 or the adding of a proton first before the PEP. It is the decay product of H-3.
Total number of protons	3	
Number of deuterons	1	
Number of single protons	1	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	1	
Total number of outer electrons	2	
Group	18	
Isotope abundance	0.000134%	
Element abundance Earth	$5.5 \times 10^{-7}\%$	
Half-life	Stable	
Valence / Oxidation state	0	
Magnetic dipole moment	$-2.1276253 \mu\text{N}$	
Spin	1/2	
Electron affinity	N/A	
MBS radius	2.15	
MBS Vol./#p	13.88	
Average nucleon BE	2.573 MeV	
Nucleus BE	7.718 MeV	
SAM lines	3	
SAM line nucleus BE	6.675 MeV	

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002 He - Helium 4 (Helium)

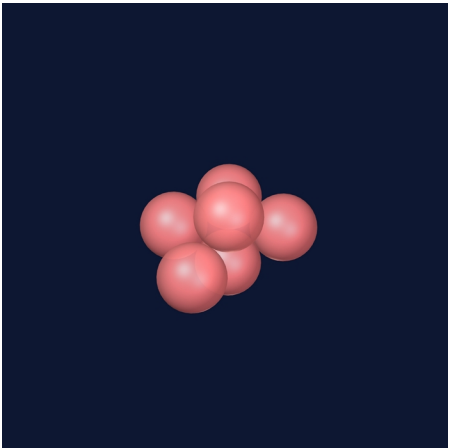
Atomic number	2
Total number of protons	4
Number of deuterons	2
Number of single protons	0
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	0
Total number of inner electrons	2
Total number of outer electrons	2
Group	18
Isotope abundance	99.9999%
Element abundance Earth	$5.5 \times 10^{-7}\%$
Half-life	Stable
Valence / Oxidation state	0
Magnetic dipole moment	0
Spin	0
Electron affinity	-0.5 eV
MBS radius	2.22
MBS Vol./#p	11.45
Average nucleon BE	7.074 MeV
Nucleus BE	28.296 MeV
SAM lines	12 (2*6)
SAM line nucleus BE	26.70 MeV



Helium is the second most abundant element in the universe. If the outer electrons are not present we speak of it as the so-called "alpha particle". Structurally we see how it is composed of two (2) deuterons creating a perfect tetrahedron as a result. This is also the first noble gas that we know of.

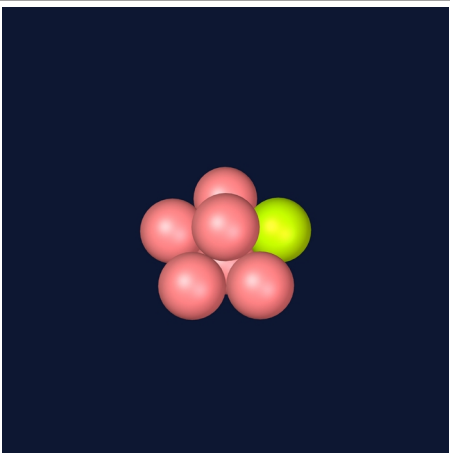
The second row

003 Li- Lithium 6

Atomic number	3	 The first solid element, appropriately called lithium, meaning “stone”. In this way for us it is the first tangible element. This configuration with six nucleons or 3 deuterons is in relation to lithium-7 left with a gap, ready to receive another proton-electron pair (PEP). It is therefore not very abundant, instead the isotope lithium-7 with the gap filled is the dominant version of this element. This is however structurally the base isotope of lithium.
Total number of protons	6	
Number of deuterons	3	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	3	
Total number of outer electrons	3	
Group	1	
Isotope abundance	7.59%	
Element abundance Earth	0.001700%	
Half-life	Stable	
Valence / Oxidation state	1	
Magnetic dipole moment	0.8200000	
Spin	1	
Electron affinity	N/A	
MBS radius	2.7	
MBS Vol./#p	13.76	
Average nucleon BE	5.33 MeV	
Nucleus BE	31.994 MeV	
SAM lines	15	
SAM line nucleus BE	33.375 MeV	

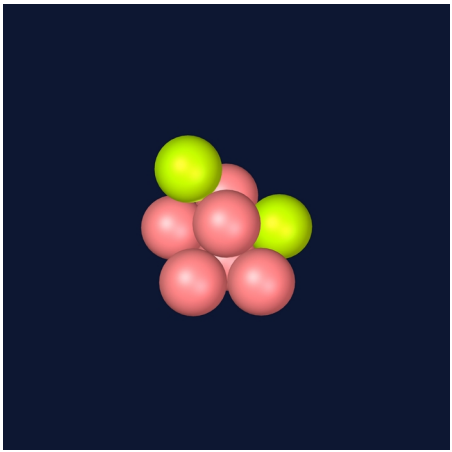
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003 Li - Lithium 7

Atomic number	3	 This configuration is called a pentagonal bi-pyramid and it is very stable. The geometry of the nucleus is directly interpretable by humans and can be recognized many times throughout the PTE. It is the only way know to create a stable 3D structure with seven (7) spheres!
Total number of protons	7	
Number of deuterons	3	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	1	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	4	
Total number of outer electrons	3	
Group	1	
Isotope abundance	92.41%	
Element abundance Earth	0.001700%	
Half-life	Stable	
Valence / Oxidation state	1	
Magnetic dipole moment	3.25	
Spin	S3/2	
Electron affinity	0.618 049 eV	
MBS radius	2.7	
MBS Vol./#p	11.8	
Average nucleon BE	5.60 MeV	
Nucleus BE	39.245 MeV	
SAM lines	19	
SAM line nucleus BE	42.28 MeV	

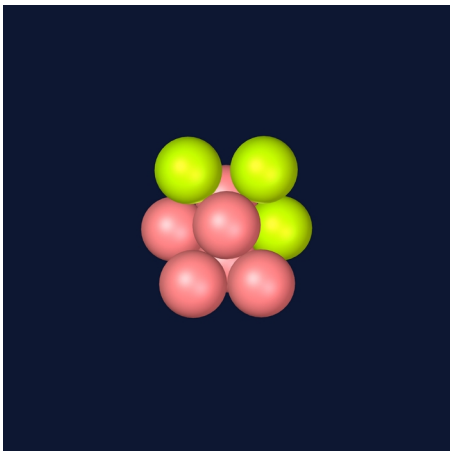
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003 Li - Lithium 8

Atomic number	3	 Lithium-8, structurally similar to beryllium-8 consists of three deuterons and two PEPs. The PEPs make contact and all that needs to happen is the emitting of an inner-electron (β^- decay) to transmute to beryllium-8. The half-life is therefore very low with about 1 second.
Total number of protons	8	
Number of deuterons	3	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	1	
Number of additional proton-electron pairs	1	
Number of quasi inner electrons	0	
Total number of inner electrons	5	
Total number of outer electrons	3	
Group	1	
Isotope abundance	Artificial	
Element abundance Earth	0.001700%	
Half-life	839.40 ms	
Valence / Oxidation state	1	
Magnetic dipole moment	1.65356 μ N	
Spin	2	
Electron affinity	N/A	
MBS radius	2.98	
MBS Vol./#p	13.88	
Average nucleon BE	5.159 MeV	
Nucleus BE	41.28 MeV	
SAM lines	21	
SAM line nucleus BE	46.73 MeV	

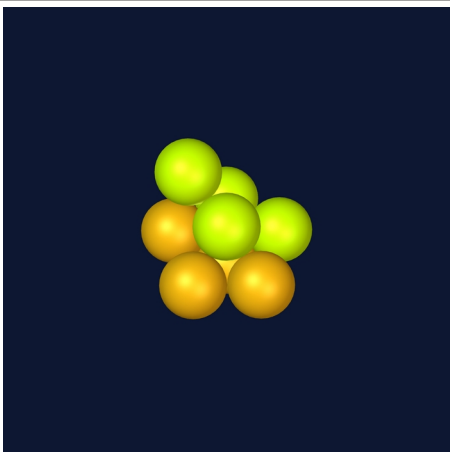
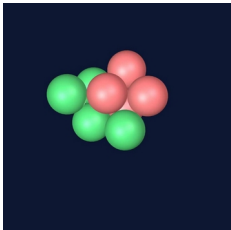
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003 Li - Lithium 9

Atomic number	3	 Negatively overcharged, this configuration clearly shows how two extra PEP's are close to each other, ready to perform β^- decay to beryllium-9 or eject one of the 2 PEP's while splitting into two alpha particles (He-4).
Total number of protons	9	
Number of deuterons	3	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	1	
Number of additional proton-electron pairs	2	
Number of quasi inner electrons	0	
Total number of inner electrons	6	
Total number of outer electrons	3	
Group	1	
Isotope abundance	Artificial	
Element abundance Earth	0.001700%	
Half-life	178.3 ms	
Valence / Oxidation state	1	
Magnetic dipole moment	3.4391 μN	
Spin	3/2	
Electron affinity	N/A	
MBS radius	2.98	
MBS Vol./#p	12.35	
Average nucleon BE	5.03 MeV	
Nucleus BE	45.34 MeV	
SAM lines	24	
SAM line nucleus BE	53.40 MeV	

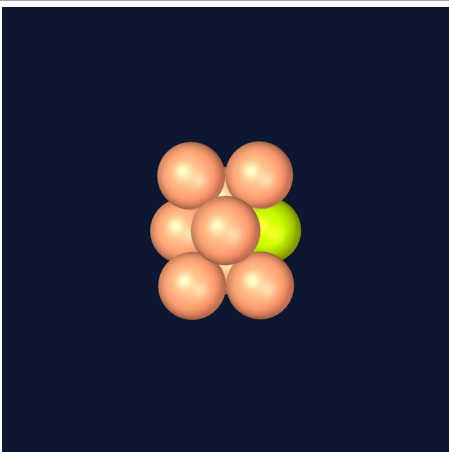
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004 Be - Beryllium 8

Atomic number	4	 Beryllium-8, structurally similar to lithium-8 consists of 4 deuterons. One would expect this to be the next stable element, yet it is not. This is because the base structure is lithium-7 and the extra proton shows locally a similar structure to the structure with 5 protons, which is not stable. In other words the extra proton is pulled inward and the rest cannot resist enough, causing the structure to actually split into two helium-4 nuclei or alpha particles. Binding energy wise this is preferable and therefore valid. The following picture better shows the two helium-4 nuclei. 
Total number of protons	8	
Number of deuterons	4	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	4	
Total number of outer electrons	4	
Group	2	
Isotope abundance	Artificial	
Element abundance Earth	0.00019%	
Half-life	8.19×10^{-17} s	
Valence / Oxidation state	1, 2	
Magnetic dipole moment	0 μ N	
Spin	0	
Electron affinity	N/A	
MBS radius	2.98	
MBS Vol./#p	13.88	
Average nucleon BE	7.06 MeV	
Nucleus BE	56.5 MeV	
SAM lines	24	
SAM line nucleus BE	53.40 MeV	

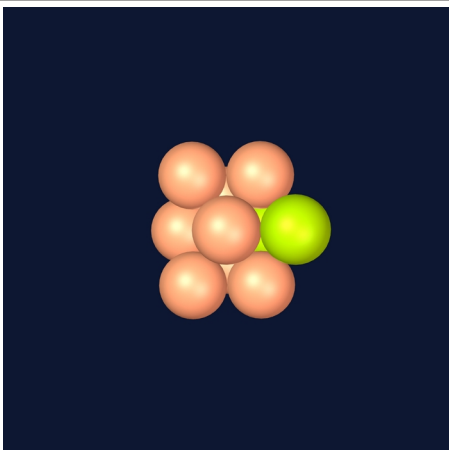
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004 Be - Beryllium 9

Atomic number	4	 This is the stable and abundant version of Beryllium. The structure shows how 4 deuterons are stabilized with the help of one PEP. One can also see this structure as two intertwined lithium-7 nuclei.
Total number of protons	9	
Number of deuterons	4	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	1	
Number of quasi inner electrons	0	
Total number of inner electrons	5	
Total number of outer electrons	4	
Group	2	
Isotope abundance	100%	
Element abundance Earth	0.00019%	
Half-life	Stable	
Valence / Oxidation state	1, 2	
Magnetic dipole moment	-1.1778 μN	
Spin	3/2	
Electron affinity	-0.5 eV	
MBS radius	2.98	
MBS Vol./#p	12.35	
Average nucleon BE	6.46 MeV	
Nucleus BE	58.16 MeV	
SAM lines	27	
SAM line nucleus BE	60.08 MeV	

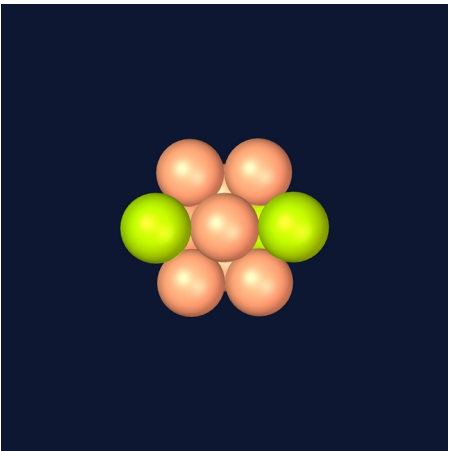
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004 Be - Beryllium 10

Atomic number	4	 Beryllium-10 is a semi-stable form of beryllium. It slowly decays through β^- decay to a boron-10 which is stable. The PEP changes into a proton by emitting the electron into the outer orbital, yielding the next element, boron.
Total number of protons	10	
Number of deuterons	4	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	2	
Number of quasi inner electrons	0	
Total number of inner electrons	6	
Total number of outer electrons	4	
Group	2	
Isotope abundance	Trace	
Element abundance Earth	0.00019%	
Half-life	1.39×10^6 y	
Valence / Oxidation state	1, 2	
Magnetic dipole moment	0 μ N	
Spin	0	
Electron affinity	N/A	
MBS radius	3.00	
MBS Vol./#p	11.28	
Average nucleon BE	6.497 MeV	
Nucleus BE	64.97 MeV	
SAM lines	31	
SAM line nucleus BE	68.98 MeV	

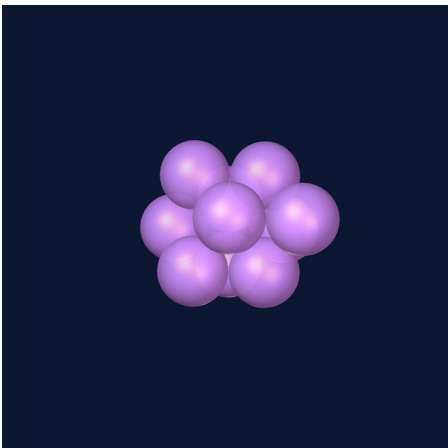
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004 Be - Beryllium 11

Atomic number	4	 This unstable configuration normally decays into a boron-11. In rare cases it can also perform β^- decay followed by an alpha particle release leaving the remainder as a lithium-7.
Total number of protons	11	
Number of deuterons	4	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	3	
Number of quasi inner electrons	0	
Total number of inner electrons	7	
Total number of outer electrons	4	
Group	2	
Isotope abundance	Artificial	
Element abundance Earth	0.00019%	
Half-life	1.39×10^6 y	
Valence / Oxidation state	1, 2	
Magnetic dipole moment	N/A	
Spin	1/2	
Electron affinity	N/A	
MBS radius	3.09	
MBS Vol./#p	11.31	
Average nucleon BE	5.95 MeV	
Nucleus BE	65.47 MeV	
SAM lines	35	
SAM line nucleus BE	77.88 MeV	

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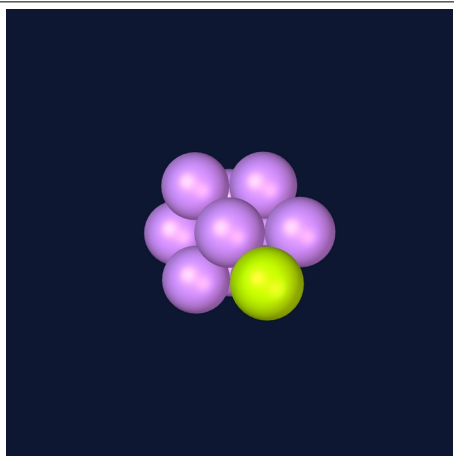
005 B - Boron 10

Atomic number	5	 Boron-10 is the first stable isotope made up of five deuterons.
Total number of protons	10	
Number of deuterons	5	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	5	
Total number of outer electrons	5	
Group	13	
Isotope abundance	19.9%	
Element abundance Earth	0.000860%	
Half-life	Stable	
Valence / Oxidation state	1, 2, 3	
Magnetic dipole moment	1.80064478 μN	
Spin	3	
Electron affinity	N/A	
MBS radius	3.05	
MBS Vol./#p	11.89	
Average nucleon BE	6.48 MeV	
Nucleus BE	64.751 MeV	
SAM lines	31	
SAM line nucleus BE	68.975 MeV	

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005 B - Boron 11

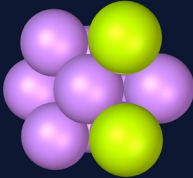
Atomic number	5
Total number of protons	11
Number of deuterons	5
Number of single protons	0
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	1
Number of quasi inner electrons	0
Total number of inner electrons	6
Total number of outer electrons	5
Group	13
Isotope abundance	80.1%
Element abundance Earth	0.000860%
Half-life	Stable
Valence / Oxidation state	1, 2, 3
Magnetic dipole moment	2.6886489 μN
Spin	3/2
Electron affinity	0.279 723 eV
MBS radius	3.23
MBS Vol./#p	12.84
Average nucleon BE	6.93 MeV
Nucleus BE	76.21 MeV
SAM lines	34
SAM line nucleus BE	75.65 MeV



A stable isotope of boron.

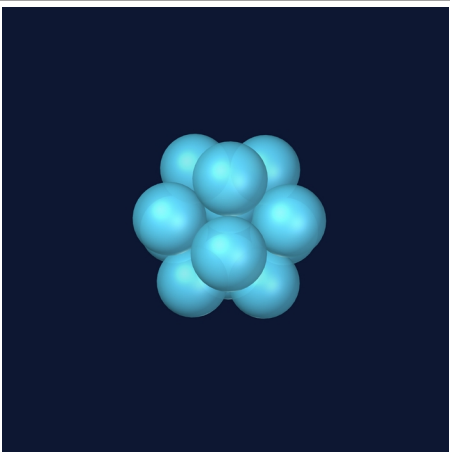
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005 B - Boron 12

Atomic number	5	 A short-lived isotope of boron which decays to carbon by booting out one inner electron out of the nucleus.
Total number of protons	12	
Number of deuterons	5	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	2	
Number of quasi inner electrons	0	
Total number of inner electrons	7	
Total number of outer electrons	5	
Group	13	
Isotope abundance	Artificial	
Element abundance Earth	0.000860%	
Half-life	20.20 ms	
Valence / Oxidation state	1, 2, 3	
Magnetic dipole moment	1.00306 μN	
Spin	1	
Electron affinity	N/A	
MBS radius	3.26	
MBS Vol./#p	12.1	
Average nucleon BE	6.631 MeV	
Nucleus BE	79.57 MeV	
SAM lines	37	
SAM line nucleus BE	82.33 MeV	

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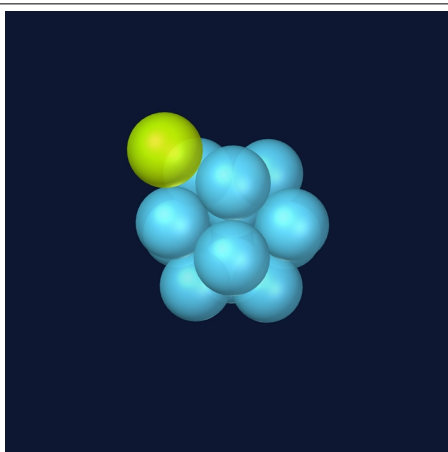
006 C- Carbon 12

Atomic number	6	 Carbon 12, the most important element for life is made up of six deuterons, creating a perfect icosahedron. It also is the most recognizable and repeating structure in the heavier elements which make up the so-called backbone of the nucleus. These carbon nucleons are intertwined by sharing one proton.
Total number of protons	12	
Number of deuterons	6	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	6	
Total number of outer electrons	6	
Group	14	
Isotope abundance	98.93%	
Element abundance Earth	0.18%	
Half-life	Stable	
Valence / Oxidation state	-4, -3, -2, -1, 1, 2, 3, 4	
Magnetic dipole moment	0 μN	
Spin	0	
Electron affinity	1.2621226 eV	
MBS radius	2.9	
MBS Vol./#p	8.53	
Average nucleon BE	7.680 MeV	
Nucleus BE	91.225 MeV	
SAM lines	41	
SAM line nucleus BE	92.16 MeV	

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006 C - Carbon 13

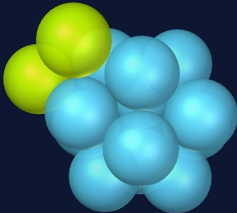
Atomic number	6
Total number of protons	13
Number of deuterons	6
Number of single protons	0
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	1
Number of quasi inner electrons	0
Total number of inner electrons	7
Total number of outer electrons	6
Group	14
Isotope abundance	1.07%
Element abundance Earth	0.18%
Half-life	Stable
Valence / Oxidation state	-4, -3, -2, -1, 1, 2, 3, 4
Magnetic dipole moment	0.7024118 μN
Spin	1/2
Electron affinity	1.2621136 eV
MBS radius	3.47
MBS Vol./#p	13.48
Average nucleon BE	7.469 MeV
Nucleus BE	97.11 MeV
SAM lines	44
SAM line nucleus BE	97.90 MeV



Carbon-13 with about 1% abundance is a normal and stable isotope of carbon with one extra PEP.

The elements and their isotopes

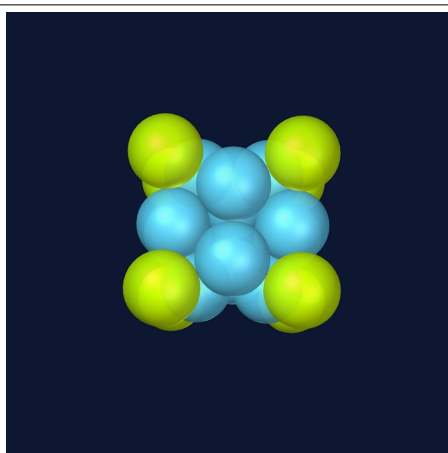
006 C - Carbon 14

Atomic number	6	 This is the well known isotope of carbon which is used for dating organic material. It is semi-stable with a half-live of about 5700 years. As we can see there are two PEPS located on one side of the nucleus, allowing the β^- decay into a nitrogen-14. Conversely, when the nitrogen-14 is hit by an energetic proton in the upper atmosphere coming from the cosmic radiation it can destroy the 7th deuteron and turn it into carbon-14. (see nitrogen-14)
Total number of protons	14	
Number of deuterons	6	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	2	
Number of quasi inner electrons	0	
Total number of inner electrons	8	
Total number of outer electrons	6	
Group	14	
Isotope abundance	Trace	
Element abundance Earth	0.18%	
Half-life	5730 y	
Valence / Oxidation state	-4, -3, -2, -1, 1, 2, 3, 4	
Magnetic dipole moment	0 μ N	
Spin	1	
Electron affinity	N/A	
MBS radius	4.14	
MBS Vol./#p	21.3	
Average nucleon BE	7.520 MeV	
Nucleus BE	105.28 MeV	
SAM lines	47	
SAM line nucleus BE	104.58 MeV	

The elements and their isotopes

006 C - Carbon 20

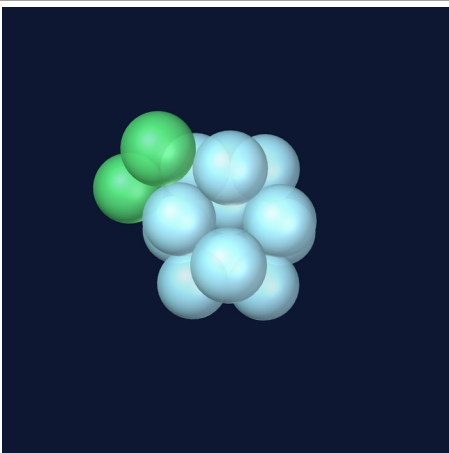
Atomic number	6
Total number of protons	20
Number of deuterons	6
Number of single protons	0
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	8
Number of quasi inner electrons	0
Total number of inner electrons	14
Total number of outer electrons	6
Group	14
Isotope abundance	N/A
Element abundance Earth	0.18%
Half-life	14 ms
Valence / Oxidation state	-4, -3, 2, 1, 1, 2, 3, +4
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	4.14
MBS Vol./#p	14.91
Average nucleon BE	5.961 MeV
Nucleus BE	119.22 MeV
SAM lines	65
SAM line nucleus BE	144.63 MeV



The “maximum” isotope for carbon.

The elements and their isotopes

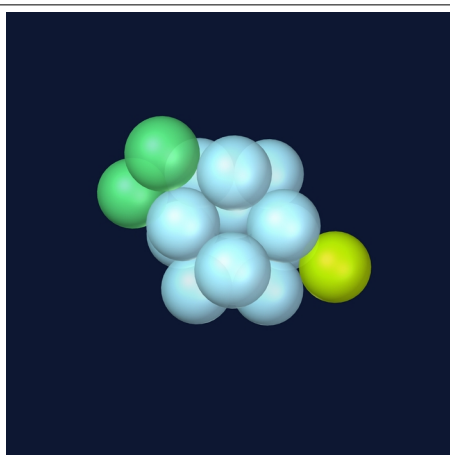
007 N - Nitrogen 14

Atomic number	7	 Nitrogen-14 is the normal isotope for nitrogen and is made up of 7 deuterons, or as we can see in its structure, a carbon base (6 deuterons) with an added deuteron. This is the moment, the first so called “gap” is created in the carbon-nuclet.
Total number of protons	14	
Number of deuterons	7	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	7	
Total number of outer electrons	7	
Group	15	
Isotope abundance	99.6%	
Element abundance Earth	0.002%	
Half-life	Stable	
Valence / Oxidation state	-3, -2, -1, 1, 2, 3, 4, 5	
Magnetic dipole moment	0.403761 μN	
Spin	1	
Electron affinity	-0.07 eV	
MBS radius	3.46	
MBS Vol./#p	12.44	
Average nucleon BE	7.475 MeV	
Nucleus BE	104.65 MeV	
SAM lines	49	
SAM line nucleus BE	109.03 MeV	

The elements and their isotopes

007 N - Nitrogen 15

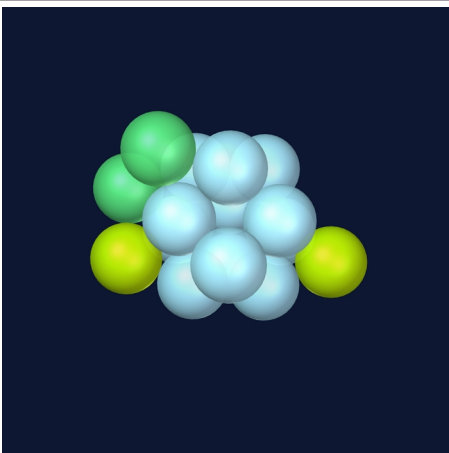
Atomic number	7
Total number of protons	15
Number of deuterons	7
Number of single protons	0
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	1
Number of quasi inner electrons	0
Total number of inner electrons	8
Total number of outer electrons	7
Group	15
Isotope abundance	0.4%
Element abundance Earth	0.00200%
Half-life	Stable
Valence / Oxidation state	-3, -2, -1, 1, 2, 3, 4, 5
Magnetic dipole moment	-0.28318884 μN
Spin	1/2
Electron affinity	N/A
MBS radius	4.02
MBS Vol./#p	18.2
Average nucleon BE	7.699 MeV
Nucleus BE	115.49 MeV
SAM lines	52
SAM line nucleus BE	115.7 MeV



Nitrogen-15 is a normal stable isotope of nitrogen.

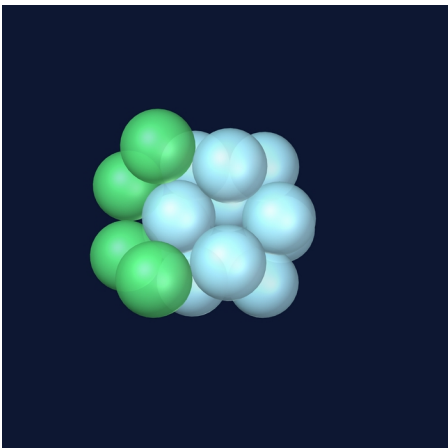
The elements and their isotopes

007 N - Nitrogen 16

Atomic number	7	 Nitrogen-16 is the unstable isotope of nitrogen which normally decays to oxygen-16 by performing β^- decay.
Total number of protons	16	
Number of deuterons	7	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	2	
Number of quasi inner electrons	0	
Total number of inner electrons	9	
Total number of outer electrons	7	
Group	15	
Isotope abundance	N/A	
Element abundance Earth	0.00200%	
Half-life	7.13 s	
Valence / Oxidation state	-3, -2, -1, 1, 2, 3, 4, 5	
Magnetic dipole moment	N/A	
Spin	2	
Electron affinity	N/A	
MBS radius	4.04	
MBS Vol./#p	17.06	
Average nucleon BE	7.373 MeV	
Nucleus BE	117.98 MeV	
SAM lines	55	
SAM line nucleus BE	122.38 MeV	

The elements and their isotopes

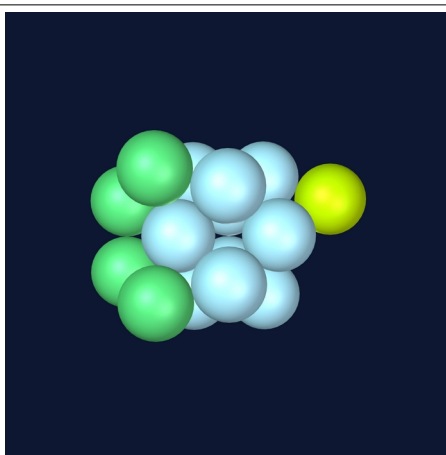
008 O - Oxygen 16

Atomic number	8	 Oxygen-16 is the normal isotope of oxygen, the element we need to breathe. Structurally it consists of a carbon-nucleus with the first so-called “neutral ending” or completing the capping phase on one side of the gap. It is therefore similar to 'half a carbon' in chemical terms resulting in a -2 charge instead of the -4 for carbon.
Total number of protons	16	
Number of deuterons	8	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	8	
Total number of outer electrons	8	
Group	16	
Isotope abundance	99.76%	
Element abundance Earth	46.00%	
Half-life	Stable	
Valence / Oxidation state	-2, -1, 1, 2	
Magnetic dipole moment	0 μ N	
Spin	0	
Electron affinity	1.4611136 eV	
MBS radius	3.55	
MBS Vol./#p	11.71	
Average nucleon BE	7.976 MeV	
Nucleus BE	127.62 MeV	
SAM lines	57	
SAM line nucleus BE	126.83 MeV	

The elements and their isotopes

008 O - Oxygen 17

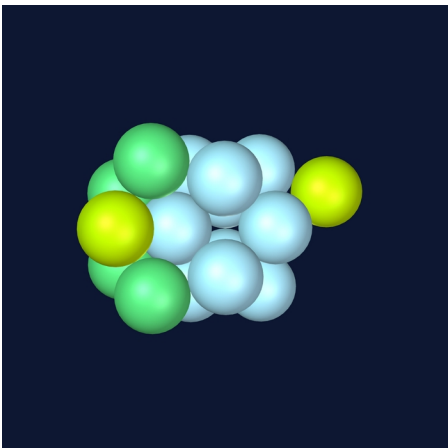
Atomic number	8
Total number of protons	17
Number of deuterons	8
Number of single protons	0
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	1
Number of quasi inner electrons	0
Total number of inner electrons	9
Total number of outer electrons	8
Group	16
Isotope abundance	0.04%
Element abundance Earth	46.00%
Half-life	Stable
Valence / Oxidation state	-2, -1, 1, 2
Magnetic dipole moment	-1.89379 μN
Spin	5/2
Electron affinity	1.461108 eV
MBS radius	4.02
MBS Vol./#p	16.06
Average nucleon BE	7.750 MeV
Nucleus BE	131.76 MeV
SAM lines	60
SAM line nucleus BE	133.50 MeV



Oxygen-17 is a stable isotope of oxygen.

The elements and their isotopes

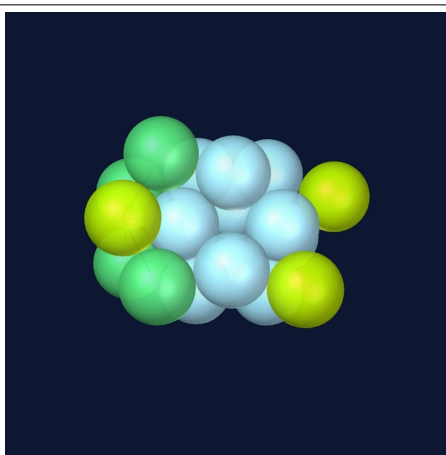
008 O - Oxygen 18

Atomic number	8	 Oxygen-18 is a stable isotope of oxygen, despite having 2 PEPs which could potentially perform β-decay. However, the structure shows how the two PEPs are distanced from each other. The reason it does not decay by forming a deuteron with the two available PEPs is that the PEP on the noble ending (left) is stronger bound than the PEP on the right. This would lead to the creation of a lithium nucleon on the carbon base which is shown in “009 Missing element 18” and is not a stable structure.
Total number of protons	18	
Number of deuterons	8	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	1	
Number of additional proton-electron pairs	1	
Number of quasi inner electrons	0	
Total number of inner electrons	10	
Total number of outer electrons	8	
Group	16	
Isotope abundance	0.20%	
Element abundance Earth	46.00%	
Half-life	Stable	
Valence / Oxidation state	-2, -1, 1, 2	
Magnetic dipole moment	0 μ N	
Spin	0	
Electron affinity	1.461105 eV	
MBS radius	4.06	
MBS Vol./#p	15.63	
Average nucleon BE	7.767 MeV	
Nucleus BE	139.81 MeV	
SAM lines	65	
SAM line nucleus BE	144.63 MeV	

The elements and their isotopes

009 O - Oxygen 19

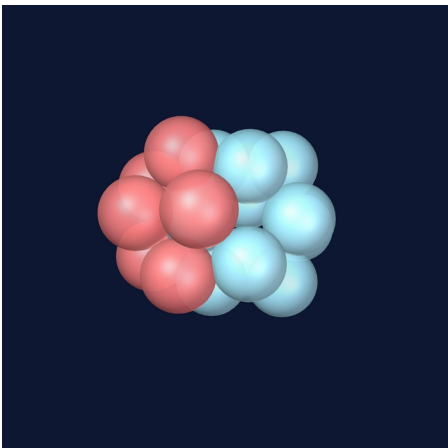
Atomic number	8
Total number of protons	18
Number of deuterons	8
Number of single protons	0
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	2
Number of quasi inner electrons	0
Total number of inner electrons	10
Total number of outer electrons	8
Group	16
Isotope abundance	0.00%
Element abundance Earth	46.00%
Half-life	26.47 s
Valence / Oxidation state	-2, -1, 1, 2
Magnetic dipole moment	N/A
Spin	5/2
Electron affinity	N/A
MBS radius	4.06
MBS Vol./#p	14.81
Average nucleon BE	7.566 MeV
Nucleus BE	143.76 MeV
SAM lines	68
SAM line nucleus BE	151.3 MeV



Oxygen-19 is an unstable isotope normally decaying to fluorine-19.

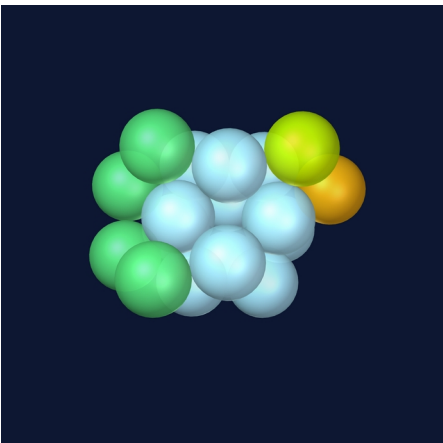
The elements and their isotopes

009 Missing element 18

Atomic number	9	 This is an unknown element configuration. It should in the normal pattern be expected to be fluorine-18. However, this configuration violates densest packing and will decay into an oxygen-18 most likely very rapidly. Any formation of this structure in the past would not show up anymore, but what we would see is the decay product: oxygen-18. A question to ask is therefore: is the occurrence/abundance of isotope oxygen-18 a result of a decaying unknown element configuration?
Total number of protons	18	
Number of deuterons	9	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	9	
Total number of outer electrons	9	
Group	N/A	
Isotope abundance	N/A	
Element abundance Earth	N/A	
Half-life	N/A	
Valence / Oxidation state	(3)	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	4.97	
MBS Vol./#p	17.77	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	65	
SAM line nucleus BE	144.63 MeV	

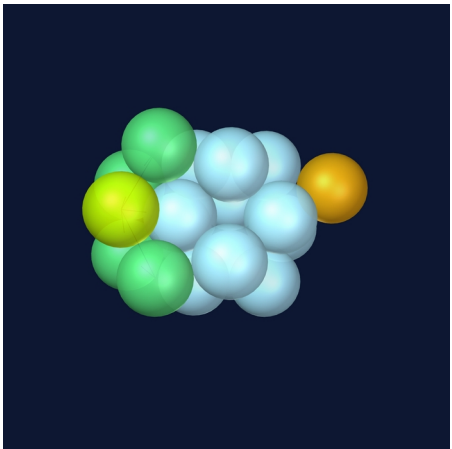
The elements and their isotopes

009 F - Fluorine 18A

Atomic number	9	 One of the two potential configurations of fluorine-18. Here it is shown with three capping deuterons on a carbon nucleon base. Fluorine-18 has two isomers and both end up decaying to an oxygen-18 via β^+ decay. This version will first move one of the protons of the 3rd capping on the right side to the position on the left as it is shown in '009 F - Fluorine 18B' through a process called 'isomeric transition'.
Total number of protons	18	
Number of deuterons	8	
Number of single protons	1	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	1	
Number of quasi inner electrons	0	
Total number of inner electrons	9	
Total number of outer electrons	9	
Group	17	
Isotope abundance	0.00%	
Element abundance Earth	0.05%	
Half-life	N/A	
Valence / Oxidation state	-1	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	4.02	
MBS Vol./#p	15.17	
Average nucleon BE	7.631 MeV	
Nucleus BE	137.37 MeV)	
SAM lines	66	
SAM line nucleus BE	146.85 MeV	

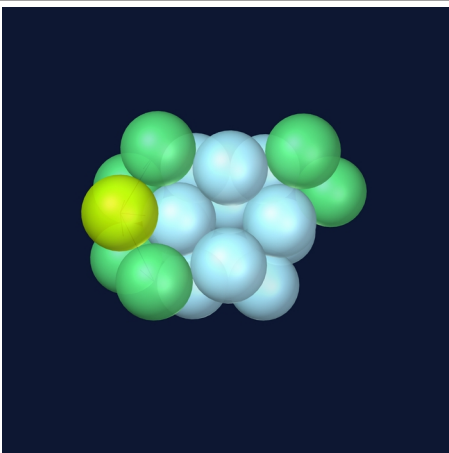
The elements and their isotopes

009 F - Fluorine 18B

Atomic number	9	 The second isomeric configuration of fluorine-18 decaying by capturing an electron (β^+) from the outer orbital and changing the (brown) proton to a (yellow) PEP.
Total number of protons	18	
Number of deuterons	8	
Number of single protons	1	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	9	
Total number of outer electrons	9	
Group	17	
Isotope abundance	0.00%	
Element abundance Earth	0.05%	
Half-life	N/A	
Valence / Oxidation state	-1	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	4.06	
MBS Vol./#p	15.63	
Average nucleon BE	7.631 MeV	
Nucleus BE	137.37 MeV)	
SAM lines	66	
SAM line nucleus BE	146.85 MeV	

The elements and their isotopes

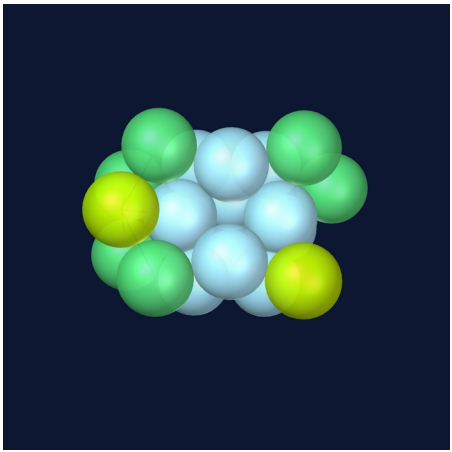
009 F - Fluorine 19

Atomic number	9	
Total number of protons	19	
Number of deuterons	9	
Number of single protons	0	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	10	
Total number of outer electrons	9	
Group	17	
Isotope abundance	100%	
Element abundance Earth	0.05%	
Half-life	Stable	
Valence / Oxidation state	-1	
Magnetic dipole moment	2.628868 μ_N	
Spin	1/2	
Electron affinity	3.4011898 eV	
MBS radius	4.06	
MBS Vol./#p	14.81	
Average nucleon BE	7.779 MeV	
Nucleus BE	147.80 MeV	
SAM lines	70	
SAM line nucleus BE	155.75 MeV	

Here we find an additional proton-electron pair, which is structurally required due to the fact that when it is not available on this so called five-ending it will, as we saw in the fluorine-18 A & B configuration, decay. This means that only the fluorine-19 configuration, as is shown here, is stable.

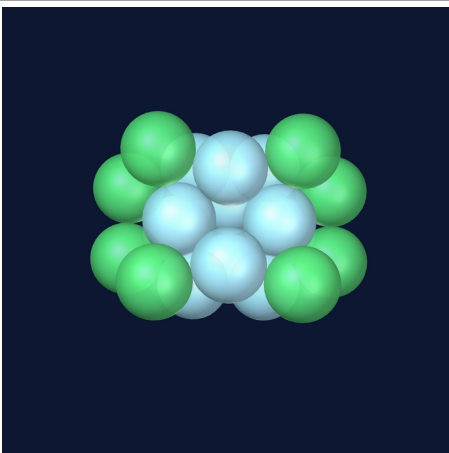
The elements and their isotopes

009 F - Fluorine 20

Atomic number	9	 Fluorine-20 can and will perform β^- decay by pulling the (previously required) 5th proton on the left side to the right side and create the 4th capping deuteron transmuting into a neon-20. The requirement of the 5th proton is no longer there. This is a very densely packed configuration.
Total number of protons	20	
Number of deuterons	9	
Number of single protons	0	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	1	
Number of quasi inner electrons	0	
Total number of inner electrons	11	
Total number of outer electrons	9	
Group	17	
Isotope abundance	0.00%	
Element abundance Earth	0.05%	
Half-life	11.16 s	
Valence / Oxidation state	-1	
Magnetic dipole moment	2.0935 μ_N	
Spin	2	
Electron affinity	N/A	
MBS radius	4.06	
MBS Vol./#p	14.07	
Average nucleon BE	7.720 MeV	
Nucleus BE	154.40 MeV	
SAM lines	73	
SAM line nucleus BE	162.43 MeV	

The elements and their isotopes

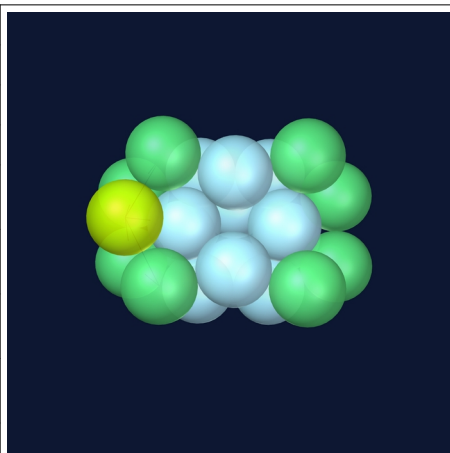
010 Ne - Neon 20

Atomic number	10	 Neon-20 is the first stable isotope of neon. This is the second noble gas in the PTE. We can see that structurally the carbon-nucleus now has both sides capped with the maximum number of deuterium building blocks. This shape repeats many times in the larger elements completing a branch as a full noble ending without any chemical reactivity left just like this base element.
Total number of protons	20	
Number of deuterons	10	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	10	
Total number of outer electrons	10	
Group	18	
Isotope abundance	0.00%	
Element abundance Earth	$3 \times 10^{-7}\%$	
Half-life	Stable	
Valence / Oxidation state	0	
Magnetic dipole moment	0 μN	
Spin	0	
Electron affinity	-1.2 eV	
MBS radius	4.02	
MBS Vol./#p	13.65	
Average nucleon BE	8.032 MeV	
Nucleus BE	160.65 MeV	
SAM lines	73	
SAM line nucleus BE	162.43 MeV	

The elements and their isotopes

010 Ne - Neon 21

Atomic number	10
Total number of protons	21
Number of deuterons	10
Number of single protons	0
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	0
Number of quasi inner electrons	0
Total number of inner electrons	11
Total number of outer electrons	10
Group	18
Isotope abundance	0.27%
Element abundance Earth	$3 \times 10^{-7}\%$
Half-life	Stable
Valence / Oxidation state	0
Magnetic dipole moment	-0.661797 eV
Spin	3/2
Electron affinity	N/A
MBS radius	4.08
MBS Vol./#p	13.52
Average nucleon BE	7.971 MeV
Nucleus BE	167.41 MeV
SAM lines	78
SAM line nucleus BE	173.55 MeV

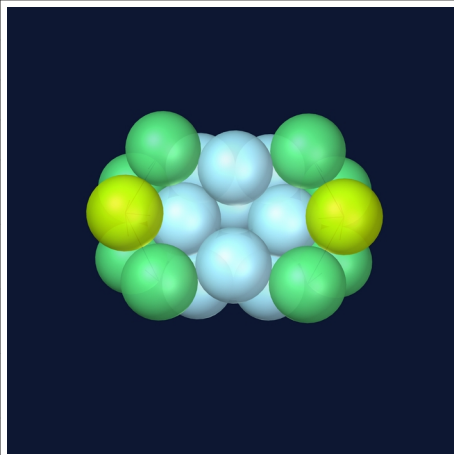


Neon-21 is a stable configuration of neon.

The elements and their isotopes

010 Ne - Neon 22

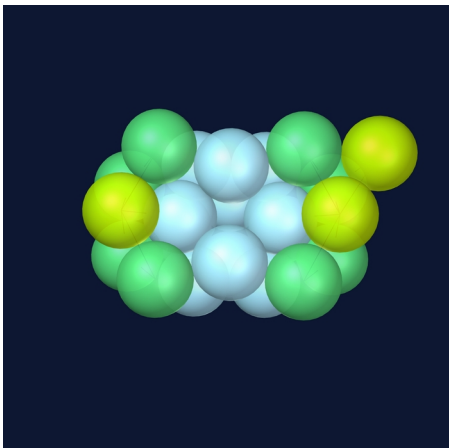
Atomic number	10
Total number of protons	22
Number of deuterons	10
Number of single protons	0
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	0
Number of quasi inner electrons	0
Total number of inner electrons	12
Total number of outer electrons	10
Group	18
Isotope abundance	9.25%
Element abundance Earth	$3 \times 10^{-7}\%$
Half-life	Stable
Valence / Oxidation state	0
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	4.08
MBS Vol./#p	12.9
Average nucleon BE	8.080 MeV
Nucleus BE	177.77 MeV
SAM lines	83
SAM line nucleus BE	184.68 MeV



Neon-22 is the second stable configuration of neon.

The elements and their isotopes

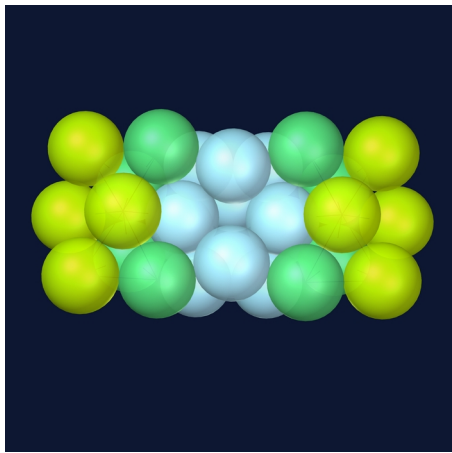
010 Ne - Neon 23

Atomic number	10	 Neon-23 is an unstable isotope of neon, decaying into sodium-23 via β^- decay. It is easy to see in this structure how two PEPs are close together and decay will be easily performed due to the densest packing principle.
Total number of protons	23	
Number of deuterons	10	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	2	
Number of additional proton-electron pairs	1	
Number of quasi inner electrons	0	
Total number of inner electrons	13	
Total number of outer electrons	10	
Group	18	
Isotope abundance	Artificial	
Element abundance Earth	$3 \times 10^{-7}\%$	
Half-life	37.140 s	
Valence / Oxidation state	0	
Magnetic dipole moment	-1.077 eV	
Spin	5/2	
Electron affinity	N/A	
MBS radius	4.72	
MBS Vol./#p	19.17	
Average nucleon BE	7.955 MeV	
Nucleus BE	182.97 MeV	
SAM lines	86	
SAM line nucleus BE	191.35 MeV	

The elements and their isotopes

010 Ne - Neon 28

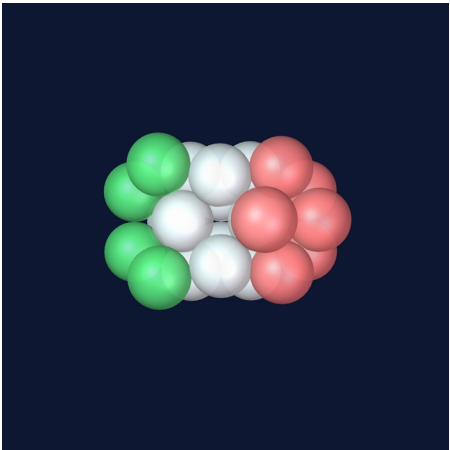
Atomic number	10
Total number of protons	28
Number of deuterons	10
Number of single protons	0
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	1
Number of quasi inner electrons	0
Total number of inner electrons	18
Total number of outer electrons	10
Group	18
Isotope abundance	Artificial
Element abundance Earth	$3 \times 10^{-7}\%$
Half-life	20 ms
Valence / Oxidation state	0
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	N/A
MBS Vol./#p	N/A
Average nucleon BE	7.388 MeV
Nucleus BE	206.87 MeV
SAM lines	101
SAM line nucleus BE	224.73 MeV



This is the maximum imagined isotope of neon. All potential available positions where a PEP can be placed on the base element are used.

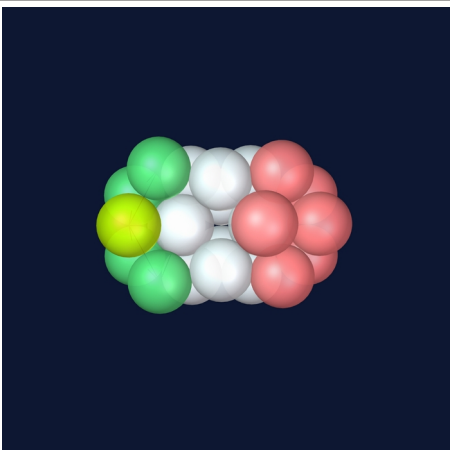
The third row

011 Na- Sodium 22

Atomic number	11	 Sodium-22 is semi-stable with a half-life of about 3.6 years. We can see that the structure is somewhat unbalanced and the 6th proton on the red Lithium nucleot can (and will) migrate towards the left side, creating neon-22 via β^+ decay (electron capture) changing a proton into a PEP.
Total number of protons	22	
Number of deuterons	11	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	11	
Total number of outer electrons	11	
Group	1	
Isotope abundance	Trace	
Element abundance Earth	2.30%	
Half-life	2.6 y	
Valence / Oxidation state	-1, 1	
Magnetic dipole moment	1.746 μN	
Spin	3	
Electron affinity	N/A	
MBS radius	4.16	
MBS Vol./#p	13.68	
Average nucleon BE	7.915 MeV	
Nucleus BE	174.14 MeV	
SAM lines	81	
SAM line nucleus BE	180.23 MeV	

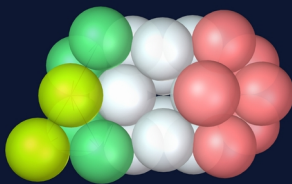
The elements and their isotopes

011 Na - Sodium 23

Atomic number	11	 Sodium-23 is the first element after neon that shows how the carbon is like a base for further integrated creation of nuclets. Sodium-23 is the only stable isotope.
Total number of protons	23	
Number of deuterons	11	
Number of single protons	0	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	12	
Total number of outer electrons	11	
Group	1	
Isotope abundance	100%	
Element abundance Earth	2.30%	
Half-life	Stable	
Valence / Oxidation state	-1, 1	
Magnetic dipole moment	2.21752 μN	
Spin	3/2	
Electron affinity	0.547926 eV	
MBS radius	4.16	
MBS Vol./#p	13.09	
Average nucleon BE	8.111 MeV	
Nucleus BE	186.56 MeV	
SAM lines	86	
SAM line nucleus BE	191.35 MeV	

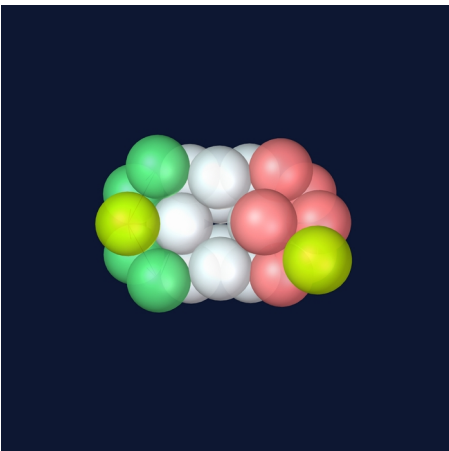
The elements and their isotopes

011 Na - Sodium 24 A

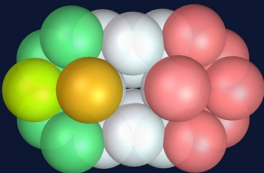
Atomic number	11	 Sodium-24 shows that the extra PEP now creates the possibility of β^- decay and it will transmute into magnesium-24. Sodium-24 has just like the fluorine-18 nucleus two isomeric configuration possibilities, which are reflected in the isomeric transition for one of the two configurations (see Sodium-24 B).
Total number of protons	24	
Number of deuterons	11	
Number of single protons	0	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	1	
Number of quasi inner electrons	0	
Total number of inner electrons	13	
Total number of outer electrons	11	
Group	1	
Isotope abundance	Trace	
Element abundance Earth	2.30%	
Half-life	14.95 h	
Valence / Oxidation state	-1, 1	
Magnetic dipole moment	1.6903 μN	
Spin	4	
Electron affinity	N/A	
MBS radius	4.71	
MBS Vol./#p	18.32	
Average nucleon BE	8.063 MeV	
Nucleus BE	193.52 MeV	
SAM lines	89	
SAM line nucleus BE	198.03 MeV	

The elements and their isotopes

012 Na - Sodium 24 B

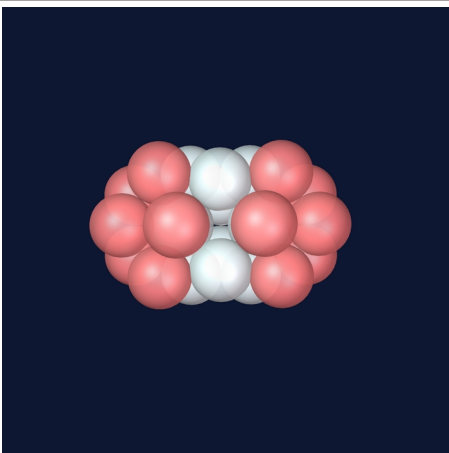
Atomic number	11	 The 2nd configuration of Sodium-24 having the extra PEP not on the 5-ending but on the red lithium-nuclet, causing a need for the IT before it can decay. See https://en.wikipedia.org/wiki/Isotopes_of_sodium
Total number of protons	24	
Number of deuterons	11	
Number of single protons	1	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	12	
Total number of outer electrons	11	
Group	1	
Isotope abundance	Trace	
Element abundance Earth	2.30%	
Half-life	20.8 ms	
Valence / Oxidation state	-1, 1	
Magnetic dipole moment	1.6903 μ N	
Spin	4	
Electron affinity	N/A	
MBS radius	4.46	
MBS Vol./#p	15.51	
Average nucleon BE	8.063 MeV	
Nucleus BE	193.52 MeV	
SAM lines	89	
SAM line nucleus BE	198.03 MeV	

012 Sodium/Magnesium 24 IT B

Atomic number	11	 This Magnesium-24 shown with the highlighted Proton-PEP (yellow) is the result of the internal shift and β^- decay for Sodium-24. It is an in-between step shown here to clarify the process.
Total number of protons	24	
Number of deuterons	11	
Number of single protons	1	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	12	
Total number of outer electrons	11	
Group	N/A	
Isotope abundance	N/A	
Element abundance Earth	N/A	
Half-life	N/A	
Valence / Oxidation state	N/A	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	4.16	
MBS Vol./#p	12.53	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	89	
SAM line nucleus BE	11.69 MeV	

The elements and their isotopes

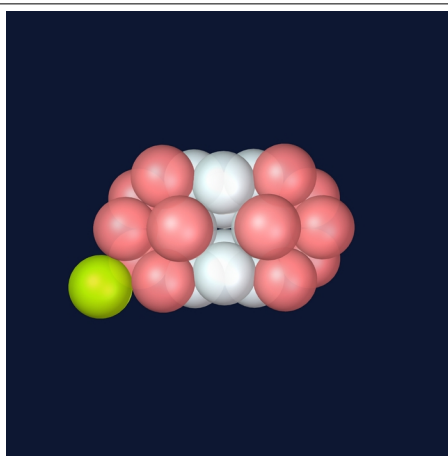
012 Mg - Magnesium 24

Atomic number	12	 Magnesium-24 shows how there are now 2 places (growth-points) parallel to each other with the lithium-nuclet in both places. We see therefore the beginning of the backbone taking shape.
Total number of protons	24	
Number of deuterons	12	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	12	
Total number of outer electrons	12	
Group	2	
Isotope abundance	79.0%	
Element abundance Earth	2.90%	
Half-life	Stable	
Valence / Oxidation state	1, 2	
Magnetic dipole moment	0 μN	
Spin	0	
Electron affinity	-0.4 μN	
MBS radius	4.16	
MBS Vol./#p	12.53	
Average nucleon BE	8.260 MeV	
Nucleus BE	198.26 MeV	
SAM lines	89	
SAM line nucleus BE	11.69 MeV	

The elements and their isotopes

012 Mg - Magnesium 25

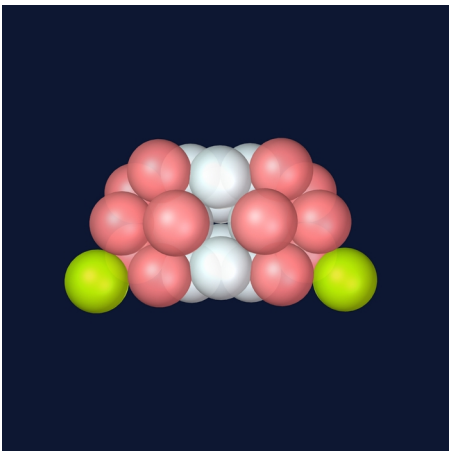
Atomic number	12
Total number of protons	25
Number of deuterons	12
Number of single protons	0
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	1
Number of quasi inner electrons	0
Total number of inner electrons	13
Total number of outer electrons	12
Group	2
Isotope abundance	10.0%
Element abundance Earth	2.90%
Half-life	Stable
Valence / Oxidation state	1, 2
Magnetic dipole moment	-0.85545 μN
Spin	5/2
Electron affinity	N/A
MBS radius	4.71987
MBS Vol./#p	17.6173
Average nucleon BE	8.223 MeV
Nucleus BE	205.59 MeV
SAM lines	92
SAM line nucleus BE	204.70 MeV



Magnesium-25 is a normal stable isotope of magnesium.

The elements and their isotopes

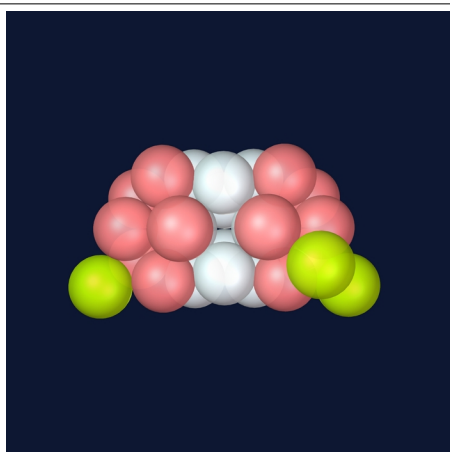
012 Mg - Magnesium 26

Atomic number	12	 Magnesium-26 is a stable isotope of magnesium, despite having 2 PEPs. The reason that this configuration is still stable, is due to the fact that the created configuration after the potential β- decay would reflect one lithium-nucleon and one beryllium-ending. This is an unstable configuration which falls back to this magnesium-26 state. It is suspected that this unstable created configuration with the beryllium-ending is the source for the magnesium-26 isotope.
Total number of protons	26	
Number of deuterons	12	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	2	
Number of quasi inner electrons	0	
Total number of inner electrons	14	
Total number of outer electrons	12	
Group	2	
Isotope abundance	11.0%	
Element abundance Earth	2.90%	
Half-life	Stable	
Valence / Oxidation state	1, 2	
Magnetic dipole moment	0 μ N	
Spin	0	
Electron affinity	N/A	
MBS radius	4.91315	
MBS Vol./#p	19.1071	
Average nucleon BE	8.334 MeV	
Nucleus BE	216.68 MeV	
SAM lines	95	
SAM line nucleus BE	211.36 MeV	

The elements and their isotopes

012 Mg - Magnesium 27

Atomic number	12
Total number of protons	27
Number of deuterons	12
Number of single protons	0
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	3
Number of quasi inner electrons	0
Total number of inner electrons	15
Total number of outer electrons	12
Group	2
Isotope abundance	Artificial
Element abundance Earth	2.90%
Half-life	9.435 min
Valence / Oxidation state	1, 2
Magnetic dipole moment	N/A
Spin	1/2
Electron affinity	N/A
MBS radius	4.91
MBS Vol./#p	18.4
Average nucleon BE	8.264 MeV
Nucleus BE	223.12
SAM lines	98
SAM line nucleus BE	218.05 MeV

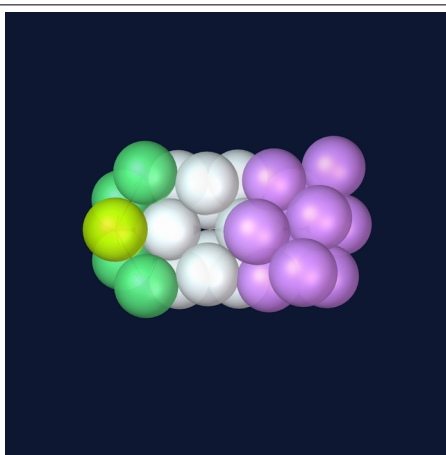


Magnesium-27, is an unstable isotope decaying into aluminum-27 due to enough available protons to actually do so.

The elements and their isotopes

013 Al - Aluminum 27

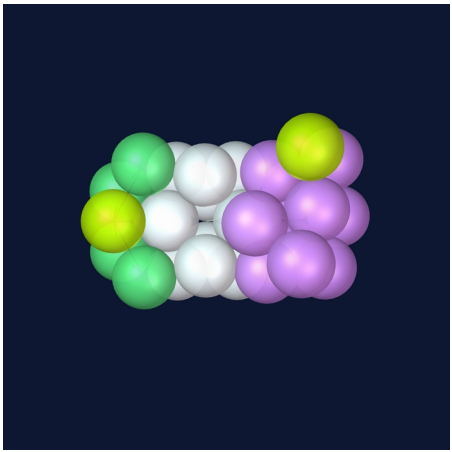
Atomic number	13
Total number of protons	27
Number of deuterons	13
Number of single protons	0
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	0
Total number of inner electrons	14
Total number of outer electrons	13
Group	13
Isotope abundance	100%
Element abundance Earth	8.10%
Half-life	Stable
Valence / Oxidation state	1, 2, 3
Magnetic dipole moment	3.6415069 μN
Spin	5/2
Electron affinity	0.43283 eV
MBS radius	4.78
MBS Vol./#p	16.9
Average nucleon BE	8,332 MeV
Nucleus BE	224.95 MeV
SAM lines	102
SAM line nucleus BE	226.95 MeV



Aluminum-27 is the only stable isotope of aluminum. Here we see the boron-ending for the first time in the stable elements.

The elements and their isotopes

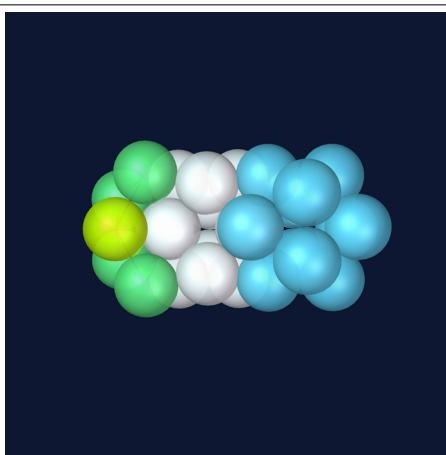
013 Al - Aluminum 28

Atomic number	13	 Aluminum-28 is an unstable isotope which decays into a silicon-28 via β^- decay. This configuration would only need a proton, instead of the here shown PEP, to directly transmute without β^- decay upwards to silicon-28.
Total number of protons	28	
Number of deuterons	13	
Number of single protons	0	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	1	
Number of quasi inner electrons	0	
Total number of inner electrons	15	
Total number of outer electrons	13	
Group	13	
Isotope abundance	Artificial	
Element abundance Earth	8.10%	
Half-life	2.245 min	
Valence / Oxidation state	1,2,3	
Magnetic dipole moment	3.242 μ N	
Spin	3	
Electron affinity	N/A	
MBS radius	4.83	
MBS Vol./#p	16.86	
Average nucleon BE	8.310 MeV	
Nucleus BE	232.68 MeV	
SAM lines	105	
SAM line nucleus BE	233.63 MeV	

The elements and their isotopes

014 Si - Silicon 28

Atomic number	14
Total number of protons	28
Number of deuterons	13
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	0
Total number of inner electrons	14
Total number of outer electrons	14
Group	14
Isotope abundance	92.2%
Element abundance Earth	27.00%
Half-life	Stable
Valence / Oxidation state	-4, -3, -2, -1, 1, 2, 3, 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	1.3895212 eV
MBS radius	4.98
MBS Vol./#p	18.45
Average nucleon BE	8.448 MeV
Nucleus BE	236.54 MeV
SAM lines	107
SAM line nucleus BE	238.08 MeV

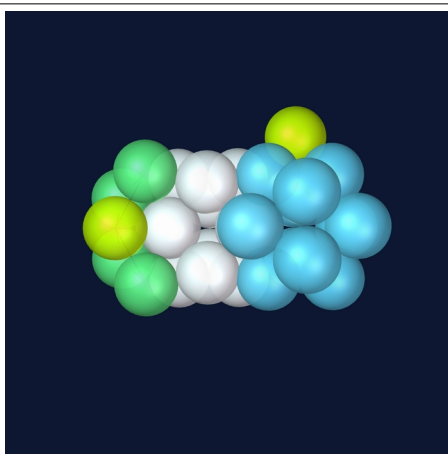


Silicon-28, the first stable configuration for silicon. It is also the first element that consists of two connected carbon-nuclei. This configuration reflects the combination of a carbon-12 and an oxygen-16. Silicon has only 13 deuterons. But there is also a single proton as part of the second carbon-nucleus.

The elements and their isotopes

014 Si - Silicon 29

Atomic number	14
Total number of protons	29
Number of deuterons	13
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	1
Number of quasi inner electrons	0
Total number of inner electrons	15
Total number of outer electrons	14
Group	14
Isotope abundance	4.7%
Element abundance Earth	27.00%
Half-life	Stable
Valence / Oxidation state	-4, -3, -2, -1, 1, 2, 3, 4
Magnetic dipole moment	-0.55529 μN
Spin	1/2
Electron affinity	N/A
MBS radius	4.98
MBS Vol./#p	17.81
Average nucleon BE	8.449 MeV
Nucleus BE	245.01 MeV
SAM lines	110
SAM line nucleus BE	244.75 MeV

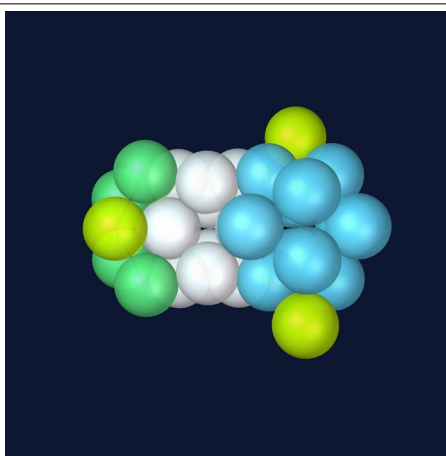


Silicon-29 is a stable isotope of silicon.

The elements and their isotopes

014 Si - Silicon 30

Atomic number	14
Total number of protons	30
Number of deuterons	13
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	2
Number of quasi inner electrons	0
Total number of inner electrons	16
Total number of outer electrons	14
Group	14
Isotope abundance	3.1%
Element abundance Earth	27.00%
Half-life	Stable
Valence / Oxidation state	-4, -3, -2, -1, 1, 2, 3, 4
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	4.98
MBS Vol./#p	17.22
Average nucleon BE	8520.65 MeV
Nucleus BE	255.62 MeV
SAM lines	113
SAM line nucleus BE	251.43 MeV

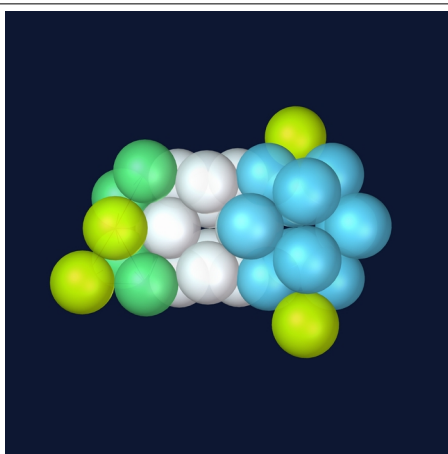


Silicon-30 is a stable isotope of silicon. The structure does not decay despite the option to do so with two PEPs. The resulting configuration would reflect an unstable element configuration and therefore it is suspected that this isotope does not β -decay upwards.

The elements and their isotopes

014 Si - Silicon 31

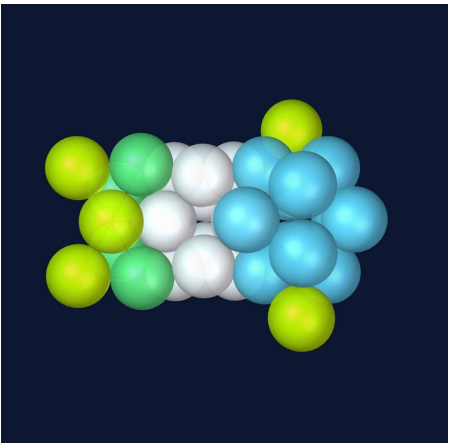
Atomic number	14
Total number of protons	31
Number of deuterons	13
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	3
Number of quasi inner electrons	0
Total number of inner electrons	17
Total number of outer electrons	14
Group	14
Isotope abundance	Trace
Element abundance Earth	27.00%
Half-life	2.62 h
Valence / Oxidation state	-4, -3, -2, -1, 1, 2, 3, 4
Magnetic dipole moment	N/A
Spin	3/2
Electron affinity	N/A
MBS radius	5.38
MBS Vol./#p	21.08
Average nucleon BE	8.458 MeV
Nucleus BE	262.21 MeV
SAM lines	116
SAM line nucleus BE	258.10 MeV



Silicon-31 is unstable and decays upwards to Phosphorus-31.

The elements and their isotopes

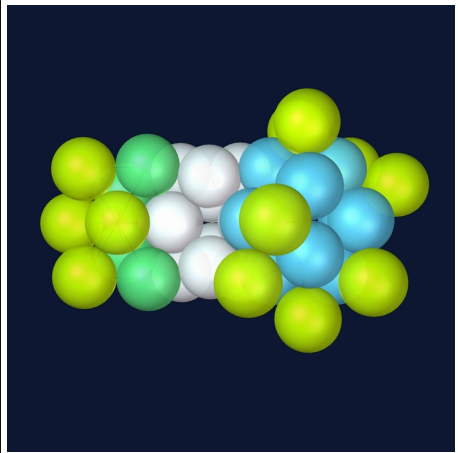
014 Si - Silicon 32

Atomic number	14	 Silicon-32 is an unstable isotope of silicon and decays to phosphorus-32 and then sulfur-32 as a stable end product.
Total number of protons	32	
Number of deuterons	13	
Number of single protons	1	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	4	
Number of quasi inner electrons	0	
Total number of inner electrons	18	
Total number of outer electrons	14	
Group	14	
Isotope abundance	0.00%	
Element abundance Earth	27.00%	
Half-life	153 j	
Valence / Oxidation state	-4, -3, -2, -1, 1, 2, 3, 4	
Magnetic dipole moment	0 μ N	
Spin	0	
Electron affinity	N/A	
MBS radius	5.44	
MBS Vol./#p	21.07	
Average nucleon BE	8.482 MeV	
Nucleus BE	271.41 MeV	
SAM lines	119	
SAM line nucleus BE	264.7 MeV	

The elements and their isotopes

014 Si - Silicon 39

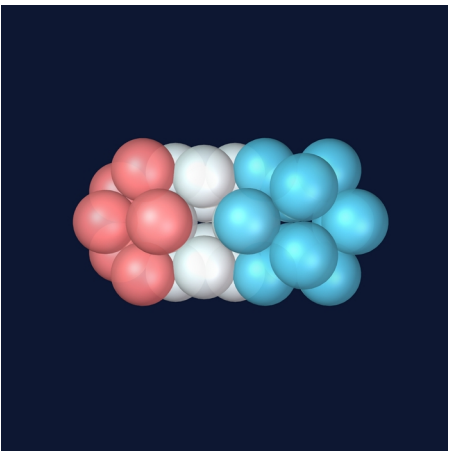
Atomic number	14
Total number of protons	39
Number of deuterons	13
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	11
Number of quasi inner electrons	0
Total number of inner electrons	25
Total number of outer electrons	14
Group	14
Isotope abundance	Artificial
Element abundance Earth	27.00%
Half-life	47.5 ms
Valence / Oxidation state	-4, -3, -2, -1, 1, 2, 3, 4
Magnetic dipole moment	N/A
Spin	7/2
Electron affinity	N/A
MBS radius	N/A
MBS Vol./#p	N/A
Average nucleon BE	7.741 MeV
Nucleus BE	301.90 MeV
SAM lines	140
SAM line nucleus BE	311.50 MeV



Silicon-39 is the 'maximum' configuration of silicon.

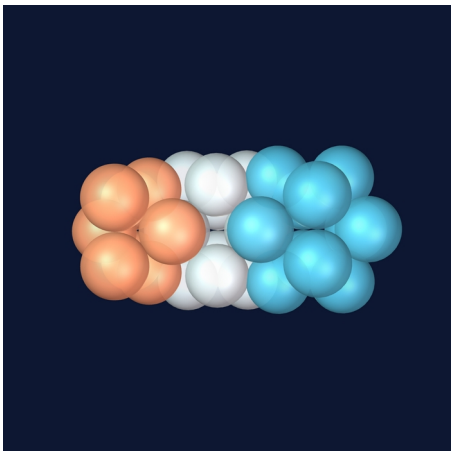
The elements and their isotopes

014 Missing element 29

Atomic number	14	 This structure reflects a 'forbidden' configuration. Due to the fact that this would be in theory a quasi inner electron case, however the lithium-nuclet is not strong enough to hold it, it is pulled apart. This decays to silicon-29 fast.
Total number of protons	29	
Number of deuterons	14	
Number of single protons	1	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	1	
Total number of inner electrons	14	
Total number of outer electrons	14	
Group	N/A	
Isotope abundance	N/A	
Element abundance Earth	N/A	
Half-life	N/A	
Valence / Oxidation state	(-1, +3, +5)	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	4.97	
MBS Vol./#p	17.77	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	110	
SAM line nucleus BE	244.75 MeV	

The elements and their isotopes

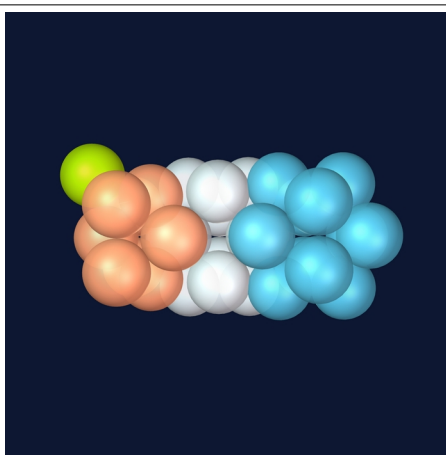
015 P - Phosphorus 31

Atomic number	15	 Phosphorus-31 is the normal isotope for phosphorus. We see a rare combination of a beryllium-ending and a carbon-nucleus. This is the first time we see a quasi inner electron. The is finally enough structure to keep it and the isotope itself stable.
Total number of protons	31	
Number of deuterons	15	
Number of single protons	1	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	1	
Total number of inner electrons	15	
Total number of outer electrons	15	
Group	15	
Isotope abundance	100%	
Element abundance Earth	0.10%	
Half-life	Stable	
Valence / Oxidation state	-3, -2, -1, 1, 2, 3, 4, 5	
Magnetic dipole moment	1.1309 μN	
Spin	1/2	
Electron affinity	0.746607 eV	
MBS radius	5.07	
MBS Vol./#p	17.6	
Average nucleon BE	8.481 MeV	
Nucleus BE	262.92 MeV	
SAM lines	118	
SAM line nucleus BE	262.55 MeV	

The elements and their isotopes

015 P - Phosphorus 32

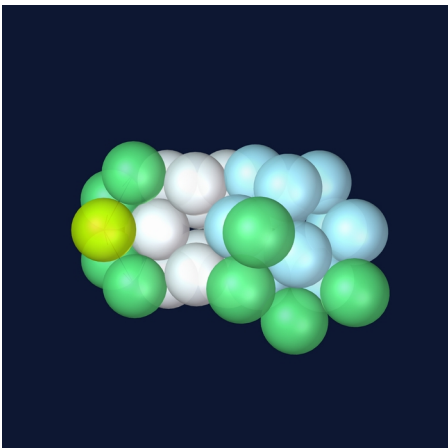
Atomic number	15
Total number of protons	32
Number of deuterons	15
Number of single protons	1
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	1
Number of quasi inner electrons	1
Total number of inner electrons	16
Total number of outer electrons	15
Group	15
Isotope abundance	Trace
Element abundance Earth	0.10%
Half-life	14.268 d
Valence / Oxidation state	-3, -2, -1, 1, 2, 3, 4, 5
Magnetic dipole moment	-0.2524 μN
Spin	1
Electron affinity	N/A
MBS radius	5.38
MBS Vol./#p	20.38
Average nucleon BE	8.464 MeV
Nucleus BE	270.85 MeV
SAM lines	121
SAM line nucleus BE	269.23 MeV



Phosphorus-32 is unstable as it decays into sulfur-32.

The elements and their isotopes

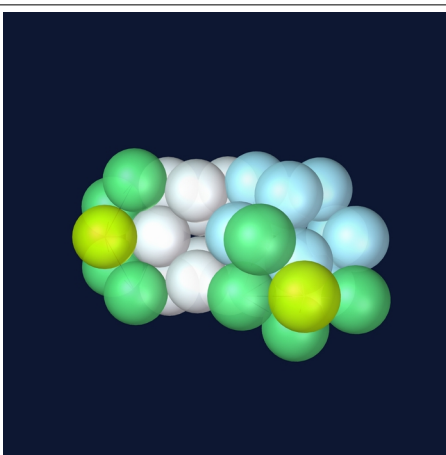
016 S - Sulfur 32

Atomic number	16	 Sulfur-32 is a stable isotope of sulfur. The structure shows an oxygen like ending on the right side.
Total number of protons	32	
Number of deuterons	15	
Number of single protons	1	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	16	
Total number of outer electrons	16	
Group	16	
Isotope abundance	94.99%	
Element abundance Earth	0.04%	
Half-life	Stable	
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6	
Magnetic dipole moment	0 μN	
Spin	0	
Electron affinity	2.077 104 2 eV	
MBS radius	5.36	
MBS Vol./#p	20.21	
Average nucleon BE	8.493 MeV	
Nucleus BE	271.78 MeV	
SAM lines	123	
SAM line nucleus BE	273.68 MeV	

The elements and their isotopes

016 S - Sulfur 33

Atomic number	16
Total number of protons	33
Number of deuterons	15
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	0
Number of quasi inner electrons	0
Total number of inner electrons	17
Total number of outer electrons	16
Group	16
Isotope abundance	0.75%
Element abundance Earth	0.04%
Half-life	Stable
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6
Magnetic dipole moment	0.6438212 μN
Spin	3/2
Electron affinity	N/A
MBS radius	5.36
MBS Vol./#p	19.59
Average nucleon BE	8.498 MeV
Nucleus BE	280.42 MeV
SAM lines	128
SAM line nucleus BE	284.80 MeV

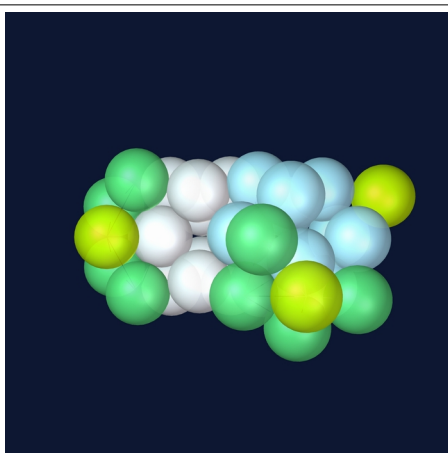


Sulfur 33 is a stable isotope of sulfur.

The elements and their isotopes

016 S - Sulfur 34

Atomic number	16
Total number of protons	34
Number of deuterons	15
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	1
Number of quasi inner electrons	0
Total number of inner electrons	18
Total number of outer electrons	16
Group	16
Isotope abundance	4.25%
Element abundance Earth	0.04%
Half-life	Stable
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	2.0771045 eV
MBS radius	5.52
MBS Vol./#p	20.68
Average nucleon BE	8.583 MeV
Nucleus BE	291.84 MeV
SAM lines	131
SAM line nucleus BE	291.48 MeV

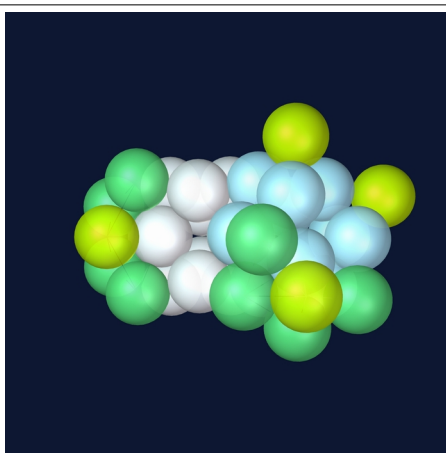


Sulfur-34 is a stable isotope of sulfur.

The elements and their isotopes

016 S - Sulfur 35

Atomic number	16
Total number of protons	35
Number of deuterons	15
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	2
Number of quasi inner electrons	0
Total number of inner electrons	16
Total number of outer electrons	19
Group	16
Isotope abundance	trace
Element abundance Earth	0.04%
Half-life	87.37 d
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6
Magnetic dipole moment	Uncertain
Spin	3/2
Electron affinity	N/A
MBS radius	5.52
MBS Vol./#p	20.08
Average nucleon BE	8.538 MeV
Nucleus BE	298.82 MeV
SAM lines	134
SAM line nucleus BE	298.15 MeV

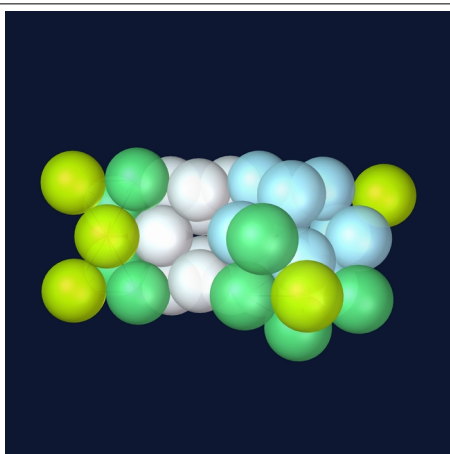


Sulfur-35 is an unstable isotope of sulfur and decays into chlorine-35.

The elements and their isotopes

016 S - Sulfur 36

Atomic number	16
Total number of protons	36
Number of deuterons	15
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	3
Number of quasi inner electrons	0
Total number of inner electrons	16
Total number of outer electrons	20
Group	16
Isotope abundance	0.01%
Element abundance Earth	0.04%
Half-life	Stable
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	6.07
MBS Vol./#p	25.99
Average nucleon BE	8.575 MeV
Nucleus BE	308.71 MeV
SAM lines	137
SAM line nucleus BE	304.83 MeV

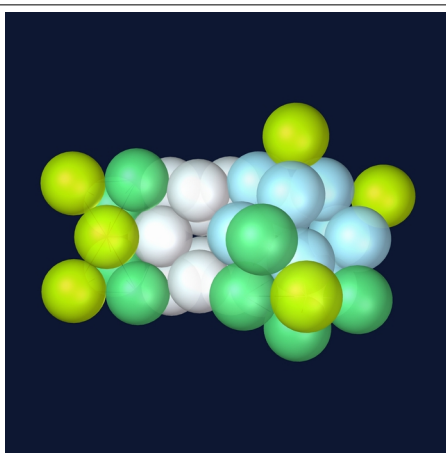


Sulfur-36 is a stable isotope of sulfur.

The elements and their isotopes

016 S - Sulfur 37

Atomic number	16
Total number of protons	37
Number of deuterons	15
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	4
Number of quasi inner electrons	0
Total number of inner electrons	16
Total number of outer electrons	21
Group	16
Isotope abundance	Artificial
Element abundance Earth	0.04%
Half-life	5.05 m
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6
Magnetic dipole moment	N/A
Spin	7/2
Electron affinity	N/A
MBS radius	6.07
MBS Vol./#p	25.29
Average nucleon BE	8.460 MeV
Nucleus BE	313.02 MeV
SAM lines	140
SAM line nucleus BE	311.5 MeV

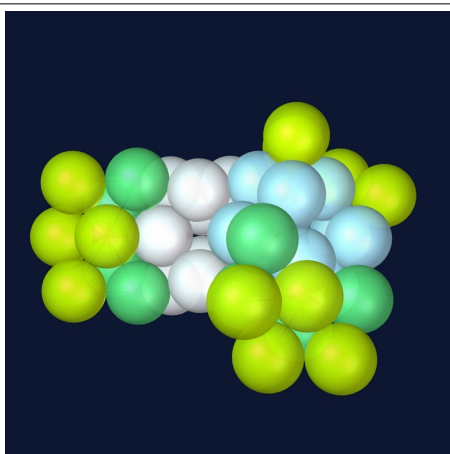


Sulfur-37 is an unstable isotope of sulfur and decays into Chlorine-37.

The elements and their isotopes

016 S - Sulfur 43

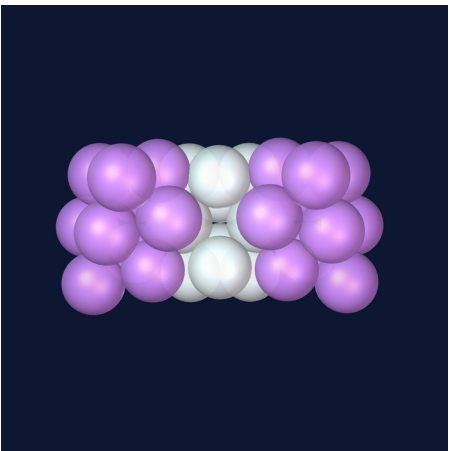
Atomic number	16
Total number of protons	43
Number of deuterons	15
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	10
Number of quasi inner electrons	0
Total number of inner electrons	21
Total number of outer electrons	16
Group	16
Isotope abundance	Artificial
Element abundance Earth	0.04%
Half-life	265 ms
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6
Magnetic dipole moment	N/A
Spin	3/2
Electron affinity	N/A
MBS radius	6.31
MBS Vol./#p	24.5
Average nucleon BE	8.064 MeV
Nucleus BE	346.74 MeV
SAM lines	143
SAM line nucleus BE	318.18 MeV



Sulfur-43 is the 'maximum' isotope of sulfur.

The elements and their isotopes

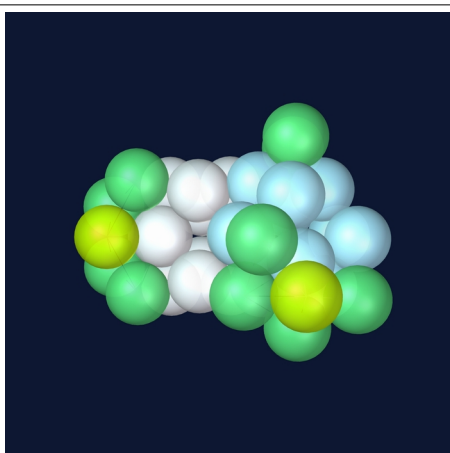
016 Missing element 32

Atomic number	16	 This missing element was a possible configuration for sulfur with 16 deuterons and no extra PEP.
Total number of protons	32	
Number of deuterons	16	
Number of single protons	0	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	16	
Total number of outer electrons	16	
Group	N/A	
Isotope abundance	N/A	
Element abundance Earth	N/A	
Half-life	N/A	
Valence / Oxidation state	(+4, +5, +6)	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	5.3	
MBS Vol./#p	19.43	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	121	
SAM line nucleus BE	269.23 MeV	

The elements and their isotopes

017 Cl - Chlorine 35

Atomic number	17
Total number of protons	35
Number of deuterons	16
Number of single protons	1
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	0
Total number of inner electrons	18
Total number of outer electrons	17
Group	17
Isotope abundance	76.00%
Element abundance Earth	0.02%
Half-life	Stable
Valence / Oxidation state	-1, 1, 2, 3, 4, 5, 6, 7
Magnetic dipole moment	0.8218743 μN
Spin	3/2
Electron affinity	3.612725 eV
MBS radius	5.36
MBS Vol./#p	18.47
Average nucleon BE	8.520 MeV
Nucleus BE	298.21 MeV
SAM lines	136
SAM line nucleus BE	302.60 MeV

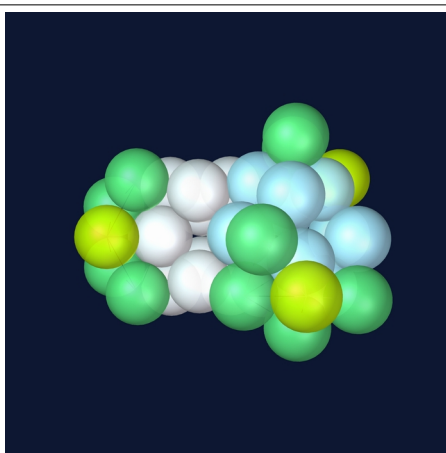


Chlorine-35 is the first stable isotope of chlorine.

The elements and their isotopes

017 Cl - Chlorine 36

Atomic number	17
Total number of protons	36
Number of deuterons	16
Number of single protons	1
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	1
Number of quasi inner electrons	0
Total number of inner electrons	19
Total number of outer electrons	17
Group	17
Isotope abundance	Trace
Element abundance Earth	0.02%
Half-life	3.01×10^5 y
Valence / Oxidation state	-1, 1, 2, 3, 4, 5, 6, 7
Magnetic dipole moment	1.28547 μ N
Spin	2
Electron affinity	N/A
MBS radius	5.38
MBS Vol./#p	18.11
Average nucleon BE	8.522 MeV
Nucleus BE	306.79 MeV
SAM lines	139
SAM line nucleus BE	309.28 MeV

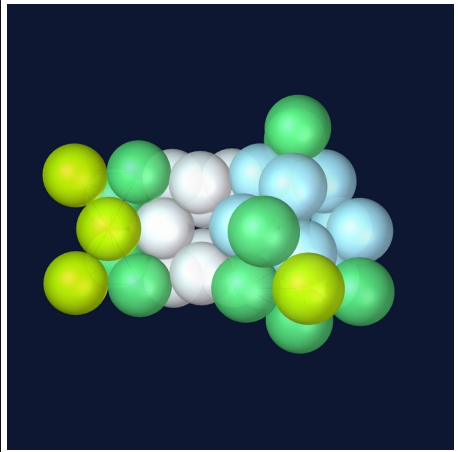


Chlorine-36 is an unstable isotope of chlorine, oddly enough the next isotope is stable again. This chlorine-36 structure can very easily decay into argon-36. It is very similar to sodium-22 which decays into neon-22. In rare cases the structure can also reduce its shape into sulfur-32.

The elements and their isotopes

017 Cl - Chlorine 37

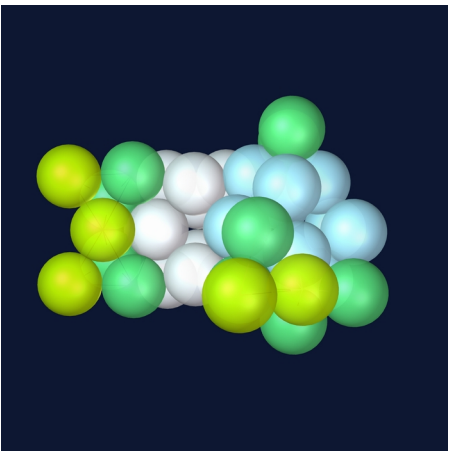
Atomic number	17
Total number of protons	37
Number of deuterons	16
Number of single protons	1
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	2
Number of quasi inner electrons	0
Total number of inner electrons	20
Total number of outer electrons	17
Group	17
Isotope abundance	24%
Element abundance Earth	0.02%
Half-life	Stable
Valence / Oxidation state	-1, 1, 2, 3, 4, 5, 6, 7
Magnetic dipole moment	0.6841236 μN
Spin	3/2
Electron affinity	N/A
MBS radius	5.73
MBS Vol./#p	21.34
Average nucleon BE	8.570 MeV
Nucleus BE	317.10 MeV
SAM lines	142
SAM line nucleus BE	315.95 MeV



This stable configuration of chlorine is not fully understood. It is most likely that this structure still resists decaying into an argon due to the different placement of the PEPs.

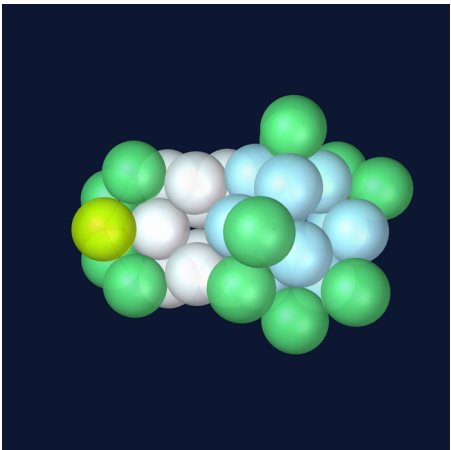
The elements and their isotopes

017 Cl - Chlorine 38

Atomic number	17	 This is an unstable isotope of chlorine. It decays into argon-38.
Total number of protons	38	
Number of deuterons	16	
Number of single protons	1	
Number of additional req. proton-electron pairs	2	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	3	
Number of quasi inner electrons	0	
Total number of inner electrons	21	
Total number of outer electrons	17	
Group	17	
Isotope abundance	Artificial	
Element abundance Earth	0.02%	
Half-life	37.24 m	
Valence / Oxidation state	-1, 1, 2, 3, 4, 5, 6, 7	
Magnetic dipole moment	2.05 μN	
Spin	2	
Electron affinity	N/A	
MBS radius	5.73	
MBS Vol./#p	20.78	
Average nucleon BE	8.505 MeV	
Nucleus BE	323.21 MeV	
SAM lines	145	
SAM line nucleus BE	322.63 MeV	

The elements and their isotopes

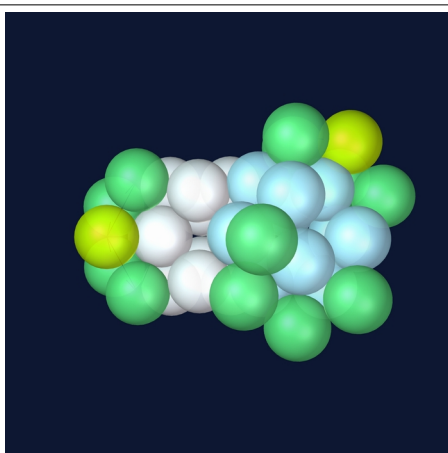
018 Ar - Argon 36

Atomic number	18	 Argon-36 is the first stable configuration of argon. It is the next noble gas as we can see in this structure with only noble (green) endings.
Total number of protons	36	
Number of deuterons	17	
Number of single protons	1	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	18	
Total number of outer electrons	18	
Group	18	
Isotope abundance	0.334%	
Element abundance Earth	0.00%	
Half-life	Stable	
Valence / Oxidation state	0	
Magnetic dipole moment	0 μ N	
Spin	0	
Electron affinity	-1.0 eV	
MBS radius	5.52	
MBS Vol./#p	19.52	
Average nucleon BE	8.520 MeV	
Nucleus BE	306.72 MeV	
SAM lines	139	
SAM line nucleus BE	309.28 MeV	

The elements and their isotopes

018 Ar - Argon 37

Atomic number	18
Total number of protons	37
Number of deuterons	17
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	0
Number of quasi inner electrons	0
Total number of inner electrons	19
Total number of outer electrons	18
Group	18
Isotope abundance	Artificial
Element abundance Earth	0.00%
Half-life	35.01 d
Valence / Oxidation state	0
Magnetic dipole moment	1.145 μ N
Spin	3/2
Electron affinity	N/A
MBS radius	5.52
MBS Vol./#p	18.99
Average nucleon BE	8.527 MeV
Nucleus BE	315.50 MeV
SAM lines	144
SAM line nucleus BE	320.40 MeV

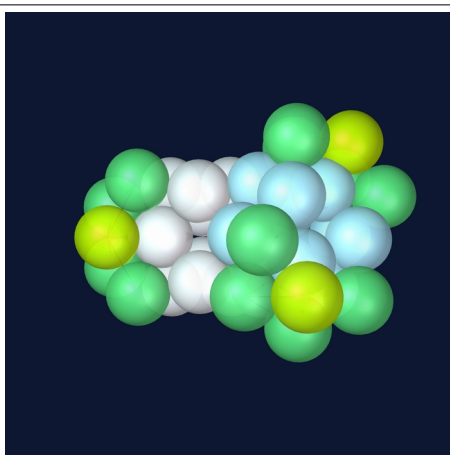


Argon-37 is an unstable configuration and will decay into chlorine-37. The configuration in essence is missing one PEP, and we cannot be sure about which one of the three location is left open especially since this is an artificially created isotope.

The elements and their isotopes

018 Ar - Argon 38

Atomic number	18
Total number of protons	38
Number of deuterons	17
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	0
Number of quasi inner electrons	0
Total number of inner electrons	20
Total number of outer electrons	18
Group	18
Isotope abundance	0.063%
Element abundance Earth	0.00%
Half-life	Stable
Valence / Oxidation state	0
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	5.52
MBS Vol./#p	18.49
Average nucleon BE	8614.28
Nucleus BE	327.34
SAM lines	149
SAM line nucleus BE	331.53 MeV

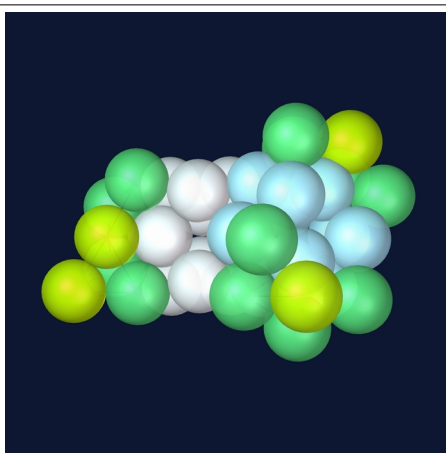


Argon-38 is a stable isotope of argon.

The elements and their isotopes

018 Ar - Argon 39

Atomic number	18
Total number of protons	39
Number of deuterons	17
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	1
Number of quasi inner electrons	0
Total number of inner electrons	21
Total number of outer electrons	18
Group	18
Isotope abundance	Trace
Element abundance Earth	0.00%
Half-life	269 y
Valence / Oxidation state	0
Magnetic dipole moment	-1.3 μN
Spin	7/2
Electron affinity	N/A
MBS radius	6.06
MBS Vol./#p	23.92
Average nucleon BE	8.563 MeV
Nucleus BE	333.94 MeV
SAM lines	152
SAM line nucleus BE	338.20 MeV

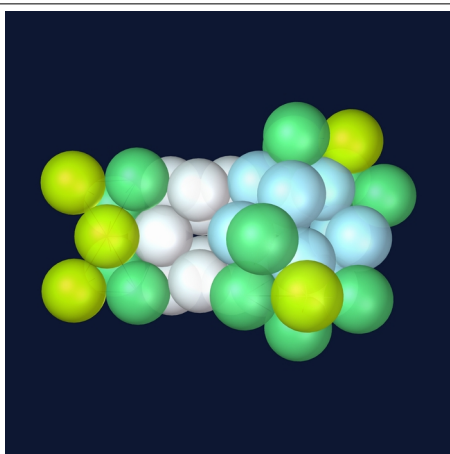


Argon-39 is an unstable, very rare, configuration which is created as a result of cosmic radiation. It will decay into potassium-39.

The elements and their isotopes

018 Ar - Argon 40

Atomic number	18
Total number of protons	40
Number of deuterons	17
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	2
Number of quasi inner electrons	0
Total number of inner electrons	22
Total number of outer electrons	18
Group	18
Isotope abundance	99.604%
Element abundance Earth	0.00%
Half-life	Stable
Valence / Oxidation state	0
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	-1.0 eV
MBS radius	6.07
MBS Vol./#p	23.39
Average nucleon BE	8.595 MeV
Nucleus BE	343.81 MeV
SAM lines	155
SAM line nucleus BE	344.88 MeV

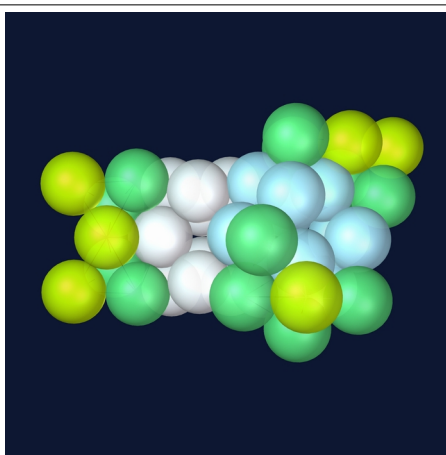


Argon-40 is the most common and stable isotope of argon on Earth. The placement of the extra two PEPs is uncertain. This configuration reflects the densest packed setup.

The elements and their isotopes

018 Ar - Argon 41

Atomic number	18
Total number of protons	41
Number of deuterons	17
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	3
Number of quasi inner electrons	0
Total number of inner electrons	23
Total number of outer electrons	18
Group	18
Isotope abundance	artificial
Element abundance Earth	0.00%
Half-life	1.826 h
Valence / Oxidation state	0
Magnetic dipole moment	N/A
Spin	7/2
Electron affinity	N/A
MBS radius	6.61
MBS Vol./#p	29.56
Average nucleon BE	8.534 MeV
Nucleus BE	349.91 MeV
SAM lines	158
SAM line nucleus BE	351.50 MeV

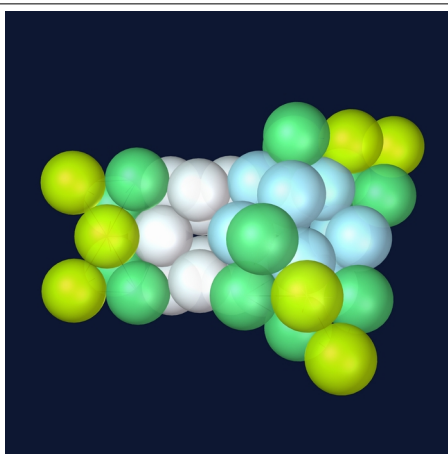


Argon-41 is an artificially created isotope.

The elements and their isotopes

018 Ar - Argon 42

Atomic number	18
Total number of protons	42
Number of deuterons	17
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	4
Number of quasi inner electrons	0
Total number of inner electrons	24
Total number of outer electrons	18
Group	18
Isotope abundance	Artificial
Element abundance Earth	0.00%
Half-life	32.98 y
Valence / Oxidation state	0
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	6.63
MBS Vol./#p	29.02
Average nucleon BE	8.556 MeV
Nucleus BE	359.34 MeV
SAM lines	161
SAM line nucleus BE	358.2 MeV

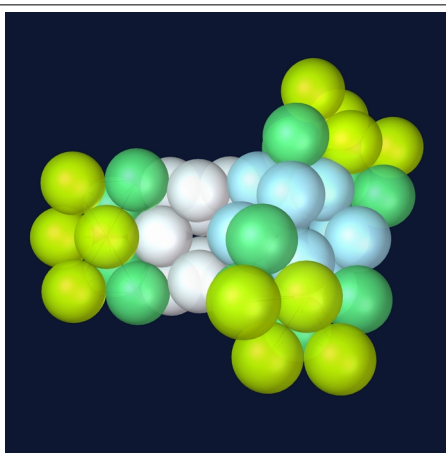


Argon-42 is an artificially created isotope.

The elements and their isotopes

018 Ar - Argon 47

Atomic number	18
Total number of protons	47
Number of deuterons	17
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	9
Number of quasi inner electrons	0
Total number of inner electrons	29
Total number of outer electrons	18
Group	18
Isotope abundance	Artificial
Element abundance Earth	0.00%
Half-life	1.23 s
Valence / Oxidation state	0
Magnetic dipole moment	N/A
Spin	3/2
Electron affinity	N/A
MBS radius	6.73
MBS Vol./#p	27.13
Average nucleon BE	8.311 MeV
Nucleus BE	390.64 MeV
SAM lines	176
SAM line nucleus BE	391.60 MeV

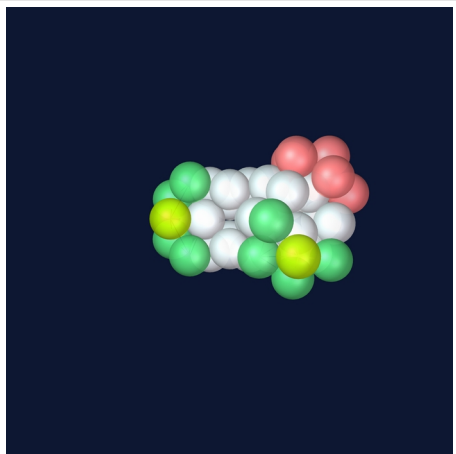


Argon-47 is the 'maximum' isotope of argon.

The fourth row

019 K - Potassium 39

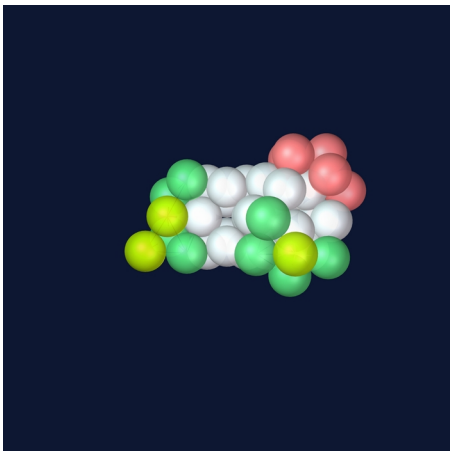
Atomic number	19
Total number of protons	39
Number of deuterons	18
Number of single protons	1
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	0
Total number of inner electrons	20
Total number of outer electrons	19
Group	1
Isotope abundance	93.26%
Element abundance Earth	1.50%
Half-life	Stable
Valence / Oxidation state	-1, 1
Magnetic dipole moment	0.3914662 μN
Spin	3/2
Electron affinity	0.501459 eV
MBS radius	5.50
MBS Vol./#p	17.88
Average nucleon BE	8.557 MeV
Nucleus BE	333.72 MeV
SAM lines	152
SAM line nucleus BE	338.2 MeV



Potassium-39 is the base isotope of potassium. The structure reflects a similar configuration as sodium has. We can recognize that the same sodium-like ending on the right side carries the same properties. The left side is neutral as well.

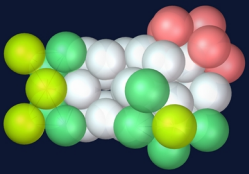
The elements and their isotopes

019 K - Potassium 40

Atomic number	19	 Potassium-40 is a semi-unstable isotope of potassium with a half-life of about 1.2 billion years. This is why it is considered to be a good isotope to use for dating purposes. In 90% of the cases, through β^+ decay, the result is argon-40. This is why we have an atmosphere that contains about 1% argon-40 on average. In 10% of the cases the structure of potassium-40 decays upwards via β^- decay to calcium-40.
Total number of protons	40	
Number of deuterons	18	
Number of single protons	1	
Number of additional req. proton-electron pairs	2	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	1	
Number of quasi inner electrons	0	
Total number of inner electrons	21	
Total number of outer electrons	19	
Group	1	
Isotope abundance	0.01%	
Element abundance Earth	1.50%	
Half-life	1.248×10^9 y	
Valence / Oxidation state	-1,1	
Magnetic dipole moment	-1.2981 μ N	
Spin	4	
Electron affinity	N/A	
MBS radius	6.03	
MBS Vol./#p	22.96	
Average nucleon BE	8.538 MeV	
Nucleus BE	341.52 MeV	
SAM lines	155	
SAM line nucleus BE	344.88 MeV	

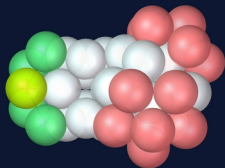
The elements and their isotopes

019 K - Potassium 41

Atomic number	19	 Potassium-41 is a stable isotope of potassium. We see here the same effect as with argon, that there is a PEP configuration which is stable. We suspect this is, as is shown here, with two PEPs residing on the initial five-ending.
Total number of protons	41	
Number of deuterons	18	
Number of single protons	1	
Number of additional req. proton-electron pairs	2	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	2	
Number of quasi inner electrons	0	
Total number of inner electrons	22	
Total number of outer electrons	19	
Group	1	
Isotope abundance	6.73%	
Element abundance Earth	1.50%	
Half-life	Stable	
Valence / Oxidation state	-1, 1	
Magnetic dipole moment	0.21487009 μN	
Spin	3/2	
Electron affinity	N/A	
MBS radius	6.03	
MBS Vol./#p	22.43	
Average nucleon BE	8.576 MeV	
Nucleus BE	351.62 MeV	
SAM lines	158	
SAM line nucleus BE	351.55 MeV	

The elements and their isotopes

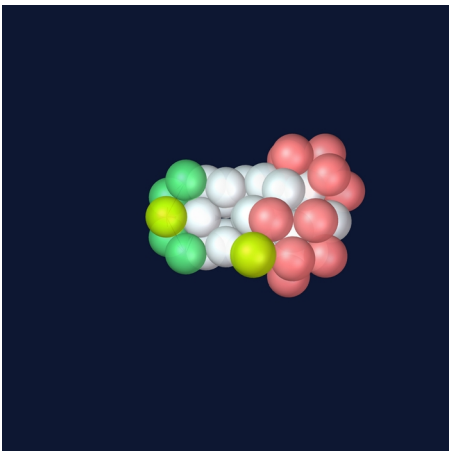
020 Ca - Calcium 40

Atomic number	20	 Calcium-40 is the first and stable isotope of calcium. The structure reflects magnesium on the right side with the two red lithium-nuclelets. This is why it is so similar to magnesium in the second column of the PTE.
Total number of protons	40	
Number of deuterons	19	
Number of single protons	1	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	0	
Total number of inner electrons	20	
Total number of outer electrons	20	
Group	2	
Isotope abundance	96.94%	
Element abundance Earth	5.00%	
Half-life	Stable	
Valence / Oxidation state	1, 2	
Magnetic dipole moment	0 μ N	
Spin	0	
Electron affinity	0.024 55 eV	
MBS radius	5.49	
MBS Vol./#p	17.37	
Average nucleon BE	8.551 MeV	
Nucleus BE	342.05 MeV	
SAM lines	155	
SAM line nucleus BE	344.88 MeV	

The elements and their isotopes

020 Ca - Calcium 41

Atomic number	20
Total number of protons	41
Number of deuterons	19
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	1
Number of quasi inner electrons	0
Total number of inner electrons	21
Total number of outer electrons	20
Group	2
Isotope abundance	Trace
Element abundance Earth	5.00%
Half-life	9.94×10^4 y
Valence / Oxidation state	1, 2
Magnetic dipole moment	$-1.594781 \mu\text{N}$
Spin	7/2
Electron affinity	N/A
MBS radius	5.53
MBS Vol./#p	17.28
Average nucleon BE	8.547 MeV
Nucleus BE	350.41 MeV
SAM lines	158
SAM line nucleus BE	351.55 MeV

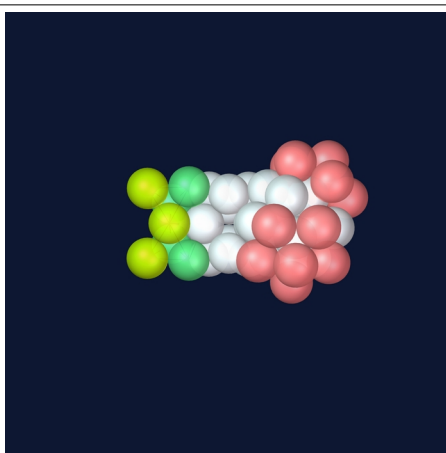


Calcium-41 is considered to be a 'cosmogenic nuclide' as it is very rare. It is an unstable isotope with a decay time of about 100K years and transmutes into stable potassium-41.

The elements and their isotopes

020 Ca - Calcium 42

Atomic number	20
Total number of protons	42
Number of deuterons	19
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	2
Number of quasi inner electrons	0
Total number of inner electrons	22
Total number of outer electrons	20
Group	2
Isotope abundance	0.65%
Element abundance Earth	5.00%
Half-life	Stable
Valence / Oxidation state	1, 2
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	6.03
MBS Vol./#p	21.9
Average nucleon BE	8.617 MeV
Nucleus BE	361.9 MeV
SAM lines	161
SAM line nucleus BE	358.23 MeV

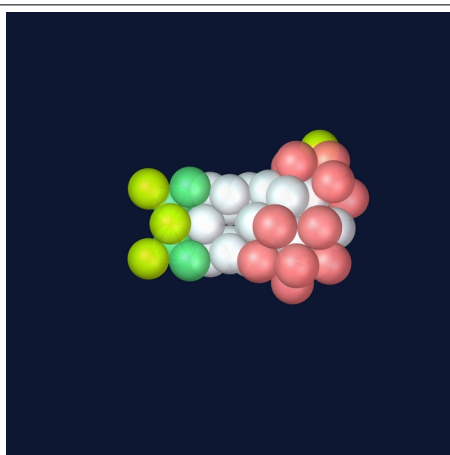


This is one of the stable isotopes of calcium.

The elements and their isotopes

020 Ca - Calcium 43

Atomic number	20
Total number of protons	43
Number of deuterons	19
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	3
Number of quasi inner electrons	0
Total number of inner electrons	23
Total number of outer electrons	20
Group	2
Isotope abundance	0.14%
Element abundance Earth	5.00%
Half-life	Stable
Valence / Oxidation state	1, 2
Magnetic dipole moment	-1.317643 μN
Spin	7/2
Electron affinity	N/A
MBS radius	6.17
MBS Vol./#p	22.84
Average nucleon BE	8.601 MeV
Nucleus BE	369.83 MeV
SAM lines	164
SAM line nucleus BE	364.9 MeV

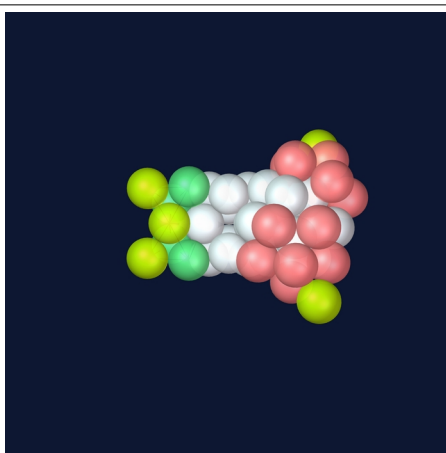


This is one of the stable isotopes of calcium.

The elements and their isotopes

020 Ca - Calcium 44

Atomic number	20
Total number of protons	44
Number of deuterons	19
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	4
Number of quasi inner electrons	0
Total number of inner electrons	24
Total number of outer electrons	20
Group	2
Isotope abundance	2.09%
Element abundance Earth	5.00%
Half-life	Stable
Valence / Oxidation state	1, 2
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	6.36
MBS Vol./#p	24.55
Average nucleon BE	8.658.MeV
Nucleus BE	380.96 MeV
SAM lines	167
SAM line nucleus BE	371.58 MeV

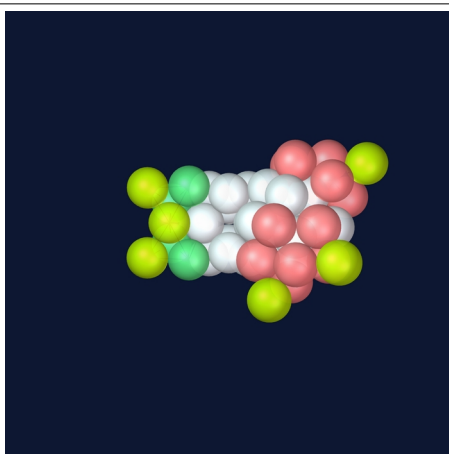


This is one of the stable isotopes of calcium.

The elements and their isotopes

020 Ca - Calcium 45

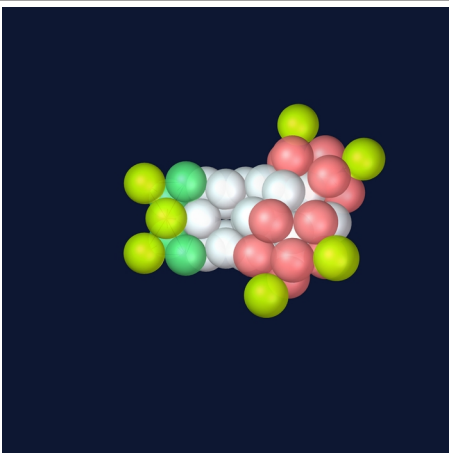
Atomic number	20
Total number of protons	45
Number of deuterons	19
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	5
Number of quasi inner electrons	0
Total number of inner electrons	25
Total number of outer electrons	20
Group	2
Isotope abundance	Artificial
Element abundance Earth	5.00%
Half-life	162.6 d
Valence / Oxidation state	1, 2
Magnetic dipole moment	-1.3274 μN
Spin	7/2
Electron affinity	N/A
MBS radius	6.68
MBS Vol./#p	27.70
Average nucleon BE	8.631 MeV
Nucleus BE	388.37 MeV
SAM lines	170
SAM line nucleus BE	378.25 MeV



Calcium-45 is an unstable isotope of calcium. The specific number of protons (45) allows the configuration to re-arrange into a scandium nucleus.

The elements and their isotopes

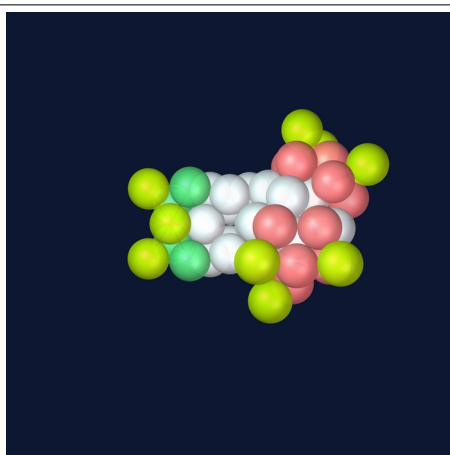
020 Ca - Calcium 46

Atomic number	20	 Calcium-46 is a strange stable isotope. This configuration should show β^- decay. However, the result would be a missing element configuration and goes against the whole nucleus being stable. See element 41 and 43. In other words, the normally expected β^- decay step does not work due to the fact that the decay product is not a viable stable structure and the result is that this isotope remains stable despite the oddly high number of extra PEPs and resists changing into a heavier element (scandium).
Total number of protons	46	
Number of deuterons	19	
Number of single protons	1	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	6	
Number of quasi inner electrons	0	
Total number of inner electrons	26	
Total number of outer electrons	20	
Group	2	
Isotope abundance	0.00%	
Element abundance Earth	5.00%	
Half-life	Stable	
Valence / Oxidation state	1, 2	
Magnetic dipole moment	0 μ N	
Spin	0	
Electron affinity	N/A	
MBS radius	6.68	
MBS Vol./#p	27.09	
Average nucleon BE	8.669 MeV	
Nucleus BE	398.77 MeV	
SAM lines	173	
SAM line nucleus BE	384.93 MeV	

The elements and their isotopes

020 Ca - Calcium 48

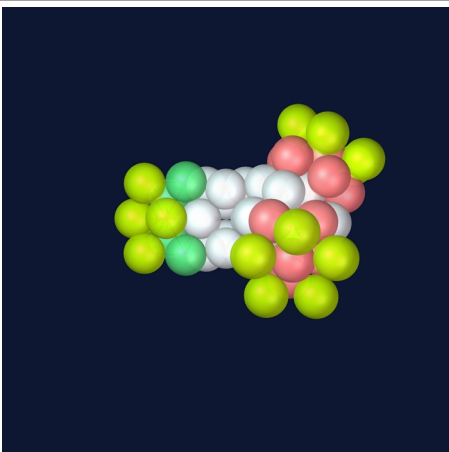
Atomic number	20
Total number of protons	48
Number of deuterons	19
Number of single protons	1
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	8
Number of quasi inner electrons	0
Total number of inner electrons	28
Total number of outer electrons	20
Group	2
Isotope abundance	0.19%
Element abundance Earth	5.00%
Half-life	6.4×10^{19} y
Valence / Oxidation state	1, 2
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	6.68
MBS Vol./#p	25.97
Average nucleon BE	8.667 MeV
Nucleus BE	416 MeV
SAM lines	176
SAM line nucleus BE	391.6 MeV



Calcium-48 is just like calcium-46 a strange stable isotope that resists β - decay due to structural issues.

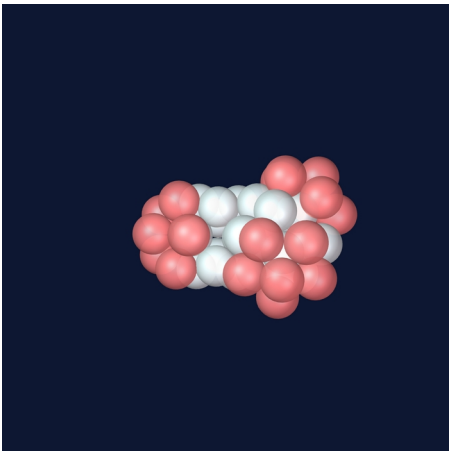
The elements and their isotopes

020 Ca - Calcium 53

Atomic number	20	 Calcium- 53 would be the ' maximum' isotope of calcium.
Total number of protons	53	
Number of deuterons	19	
Number of single protons	1	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	8	
Number of quasi inner electrons	0	
Total number of inner electrons	33	
Total number of outer electrons	20	
Group	2	
Isotope abundance	Artificial	
Element abundance Earth	5.00%	
Half-life	461 ms	
Valence / Oxidation state	1, 2	
Magnetic dipole moment	N/A	
Spin	Uncertain	
Electron affinity	N/A	
MBS radius	6.78	
MBS Vol./#p	24.63	
Average nucleon BE	8.331 MeV	
Nucleus BE	441.52 MeV	
SAM lines	179	
SAM line nucleus BE	398.28 MeV	

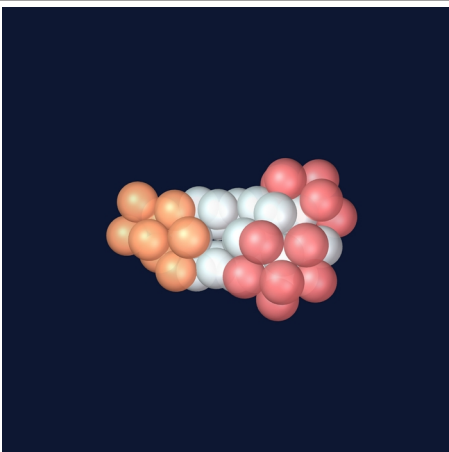
The elements and their isotopes

020 Missing element 41

Atomic number	20	 This missing element is considered to be a stressed structure and the red lithium-nuclet on the left side will show β^+ decay and leave a noble five-ending with one proton released from that lithium nuclet to migrate to the right side turning into a PEP. The result would be calcium-41. Is this perhaps the parent nucleus of the isotope calcium-41?
Total number of protons	41	
Number of deuterons	20	
Number of single protons	1	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	1	
Total number of inner electrons	20	
Total number of outer electrons	20	
Group	N/A	
Isotope abundance	N/A	
Element abundance Earth	N/A	
Half-life	N/A	
Valence / Oxidation state	(-3)	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	5.49	
MBS Vol./#p	16.92	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	158	
SAM line nucleus BE	351.55 MeV	

The elements and their isotopes

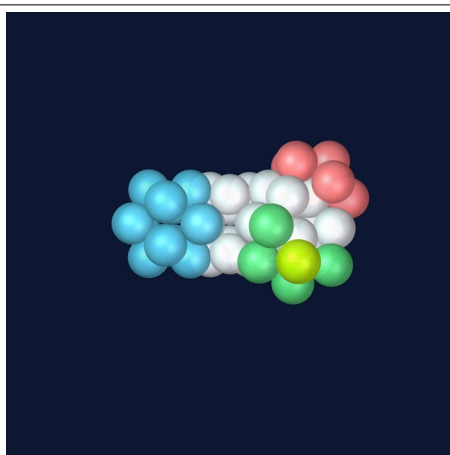
021 Missing element 43

Atomic number	21	 This missing element is considered to be a stressed structure just as the prior one is.
Total number of protons	43	
Number of deuterons	21	
Number of single protons	1	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	1	
Total number of inner electrons	21	
Total number of outer electrons	21	
Group	N/A	
Isotope abundance	N/A	
Element abundance Earth	N/A	
Half-life	N/A	
Valence / Oxidation state	(+2, +3, +4)	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	6.15	
MBS Vol./#p	22.68	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	166	
SAM line nucleus BE	369.35 MeV	

The elements and their isotopes

021 Sc - Scandium 45

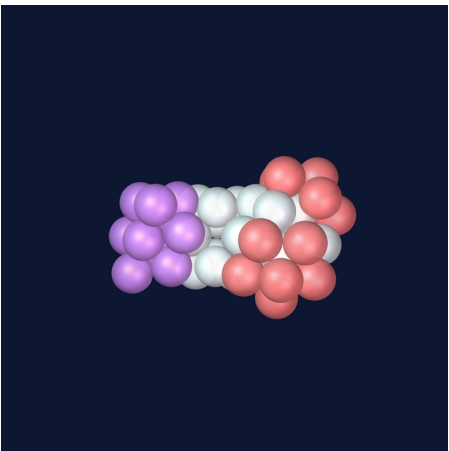
Atomic number	21
Total number of protons	45
Number of deuterons	21
Number of single protons	2
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	2
Total number of inner electrons	22
Total number of outer electrons	21
Group	3
Isotope abundance	100.00%
Element abundance Earth	0.00%
Half-life	Stable
Valence / Oxidation state	1, 2, 3
Magnetic dipole moment	4.7564866 μN
Spin	7/2
Electron affinity	0.188 eV
MBS radius	6.20
MBS Vol./#p	22.15
Average nucleon BE	8.619 MeV
Nucleus BE	387.85 MeV
SAM lines	176
SAM line nucleus BE	391.6 MeV



Scandium-45 is the only stable isotope of scandium.

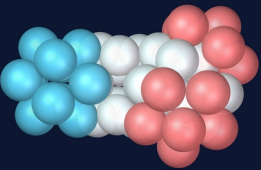
The elements and their isotopes

022 Missing element 45

Atomic number	22	 This missing element is considered to be a stressed structure, not yet able to resist the quasi electron between the boron-ernding and the lithium-nuclet. This could also be the 'father' configuration of scandium-45.
Total number of protons	45	
Number of deuterons	22	
Number of single protons	1	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	1	
Total number of inner electrons	22	
Total number of outer electrons	22	
Group	N/A	
Isotope abundance	N/A	
Element abundance Earth	N/A	
Half-life	N/A	
Valence / Oxidation state	(3, 4, 5)	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	6.10	
MBS Vol./#p	21.17	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	174	
SAM line nucleus BE	387.15 MeV	

The elements and their isotopes

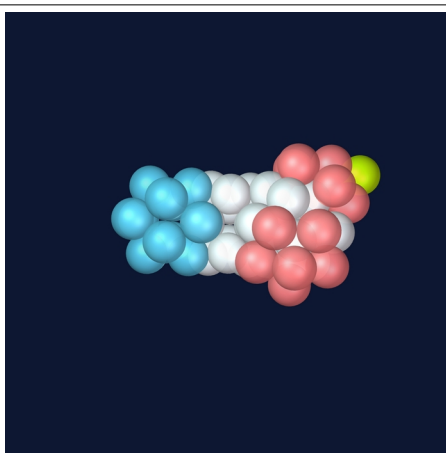
022 Titanium 46

Atomic number	22	 Titanium-46 is the first stable isotope of titanium. The configuration shows in effect the carbon and two lithium (=magnesium). This is one of the strongest metals known, due to the “all around” many “chemical” connection points.
Total number of protons	46	
Number of deuterons	22	
Number of single protons	2	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	2	
Total number of inner electrons	22	
Total number of outer electrons	22	
Group	4	
Isotope abundance	8.25%	
Element abundance Earth	0.66%	
Half-life	Stable	
Valence / Oxidation state	-1, 2, 3, 4	
Magnetic dipole moment	0 μ N	
Spin	0	
Electron affinity	N/A	
MBS radius	6.20	
MBS Vol./#p	21.67	
Average nucleon BE	8.656 MeV	
Nucleus BE	398.2 MeV	
SAM lines	179	
SAM line nucleus BE	398.28 MeV	

The elements and their isotopes

022 Titanium 47

Atomic number	22
Total number of protons	47
Number of deuterons	22
Number of single protons	2
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	1
Number of quasi inner electrons	2
Total number of inner electrons	23
Total number of outer electrons	22
Group	4
Isotope abundance	7.44%
Element abundance Earth	0.66%
Half-life	Stable
Valence / Oxidation state	-1, 2, 3, 4
Magnetic dipole moment	-0.78848 μN
Spin	5/2
Electron affinity	N/A
MBS radius	6.73
MBS Vol./#p	27.18
Average nucleon BE	8.661 MeV
Nucleus BE	407.08 MeV
SAM lines	182
SAM line nucleus BE	404.95 MeV

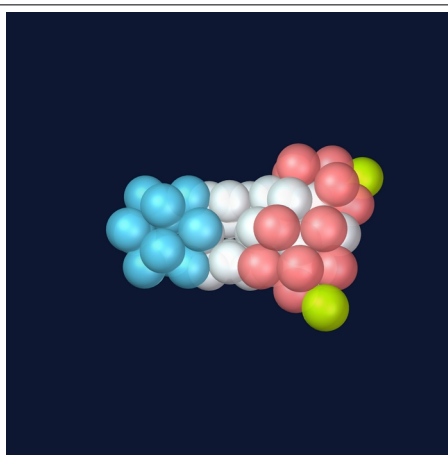


Titanium-47 is a stable isotope of titanium.

The elements and their isotopes

022 Titanium 48

Atomic number	22
Total number of protons	48
Number of deuterons	22
Number of single protons	2
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	2
Number of quasi inner electrons	2
Total number of inner electrons	24
Total number of outer electrons	22
Group	4
Isotope abundance	73.72%
Element abundance Earth	0.66%
Half-life	Stable
Valence / Oxidation state	-1, 2, 3, 4
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	0.07554 eV
MBS radius	6.78
MBS Vol./#p	27.17
Average nucleon BE	8.723 MeV
Nucleus BE	418.7 MeV
SAM lines	185
SAM line nucleus BE	411.63 MeV

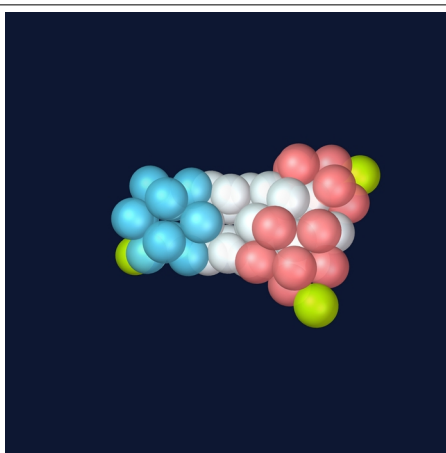


Titanium-48 is a stable isotope of titanium.

The elements and their isotopes

022 Titanium 49

Atomic number	22
Total number of protons	49
Number of deuterons	22
Number of single protons	2
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	3
Number of quasi inner electrons	2
Total number of inner electrons	25
Total number of outer electrons	22
Group	4
Isotope abundance	5.41%
Element abundance Earth	0.66%
Half-life	Stable
Valence / Oxidation state	-1, 2, 3, 4
Magnetic dipole moment	-1.10417 μN
Spin	7/2
Electron affinity	N/A
MBS radius	7.00
MBS Vol./#p	29.34
Average nucleon BE	8.711 MeV
Nucleus BE	426.85 MeV
SAM lines	188
SAM line nucleus BE	418.3 MeV

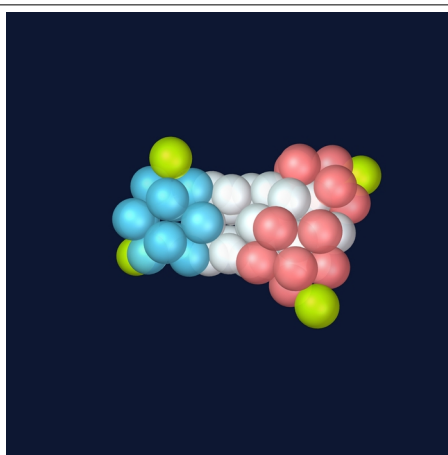


Titanium 49 is a stable isotope of titanium.

The elements and their isotopes

022 Ti - Titanium 50

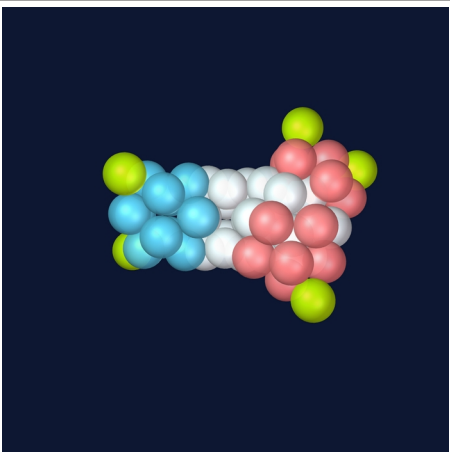
Atomic number	22
Total number of protons	50
Number of deuterons	22
Number of single protons	2
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	4
Number of quasi inner electrons	2
Total number of inner electrons	26
Total number of outer electrons	22
Group	4
Isotope abundance	5.18%
Element abundance Earth	0.66%
Half-life	Stable
Valence / Oxidation state	-1, 2, 3, 4
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	7.00
MBS Vol./#p	28.75
Average nucleon BE	8.756 MeV
Nucleus BE	437.79 MeV
SAM lines	191
SAM line nucleus BE	424.98 MeV



Titanium-50 is a stable isotope of titanium.

The elements and their isotopes

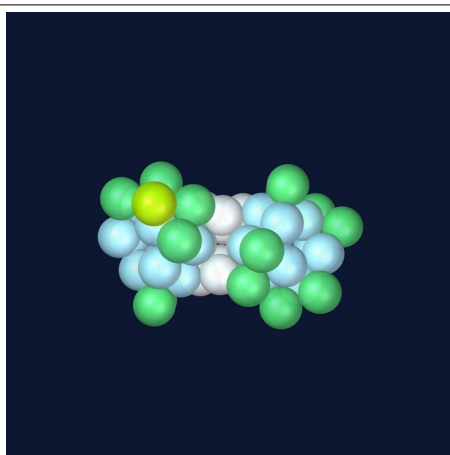
022 Ti - Titanium 51

Atomic number	22	 Titanium-51 is an unstable isotope of titanium decaying into a vanadium-51 via β^- decay. We can see that the separated placement of extra PEPs is used up and the two PEPs on one growth-point can and will decay.
Total number of protons	51	
Number of deuterons	22	
Number of single protons	2	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	5	
Number of quasi inner electrons	2	
Total number of inner electrons	27	
Total number of outer electrons	22	
Group	4	
Isotope abundance	Artificial	
Element abundance Earth	0.66%	
Half-life	5.76 m	
Valence / Oxidation state	-1, 2, 3, 4	
Magnetic dipole moment	N/A	
Spin	3/2	
Electron affinity	N/A	
MBS radius	7.08	
MBS Vol./#p	29.12	
Average nucleon BE	8.709 MeV	
Nucleus BE	444.16 MeV	
SAM lines	194	
SAM line nucleus BE	431.65 MeV	

The elements and their isotopes

023 Missing element 49

Atomic number	23
Total number of protons	49
Number of deuterons	23
Number of single protons	2
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	0
Number of quasi inner electrons	2
Total number of inner electrons	24
Total number of outer electrons	23
Group	(17)
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	(-1)
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	6.37
MBS Vol./#p	22.1
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	192
SAM line nucleus BE	427.2 MeV

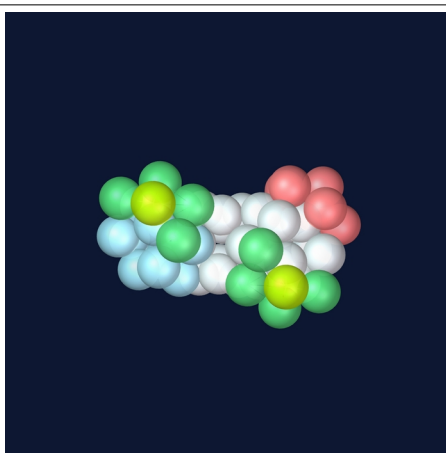


This missing element would be a halogen.

The elements and their isotopes

023 Missing element 50

Atomic number	23
Total number of protons	50
Number of deuterons	23
Number of single protons	2
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	0
Number of quasi inner electrons	2
Total number of inner electrons	25
Total number of outer electrons	23
Group	N/A
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	(-1, 2, 3)
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	6.31
MBS Vol./#p	21.09
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	197
SAM line nucleus BE	438.33 MeV

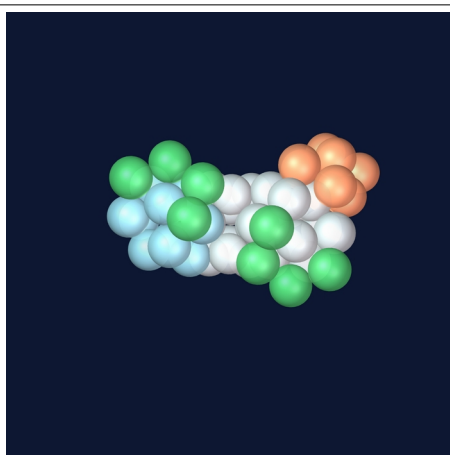


This missing element would be a metal.

The elements and their isotopes

024 V - Vanadium 50

Atomic number	24 (23)
Total number of protons	50
Number of deuterons	24
Number of single protons	2
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	3
Total number of inner electrons	24
Total number of outer electrons	23
Group	5
Isotope abundance	0.25%
Element abundance Earth	0.02%
Half-life	1.5×10^{17} y
Valence / Oxidation state	-1, 1, 2, 3, 4, 5
Magnetic dipole moment	$3.3456889 \mu_N$
Spin	6
Electron affinity	N/A
MBS radius	6.79
MBS Vol./#p	26.21
Average nucleon BE	8.696 MeV
Nucleus BE	434.8 MeV
SAM lines	195
SAM line nucleus BE	433.88 MeV

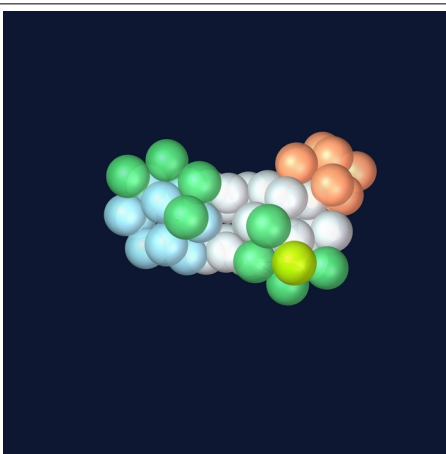


Vanadium-50 is a semi-stable isotope of vanadium. It decays slowly to a titanium-50 (electron capture). The half-life is about 1.5×10^{15} years.

The elements and their isotopes

024 V - Vanadium 51

Atomic number	24 (23)
Total number of protons	51
Number of deuterons	24
Number of single protons	2
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	0
Number of quasi inner electrons	3
Total number of inner electrons	25
Total number of outer electrons	23
Group	5
Isotope abundance	99.75%
Element abundance Earth	0.02%
Half-life	Stable
Valence / Oxidation state	-1, 1, 2, 3, 4, 5
Magnetic dipole moment	5.14870573 μN
Spin	7/2
Electron affinity	0.52766 eV
MBS radius	6.79
MBS Vol./#p	25.7
Average nucleon BE	8.742 MeV
Nucleus BE	445.85 MeV
SAM lines	200
SAM line nucleus BE	445 MeV

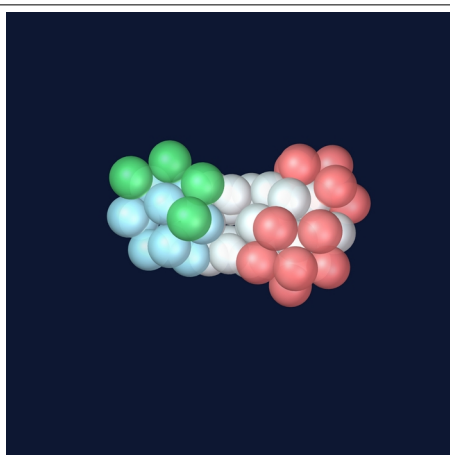


Vanadium-51 is the stable isotope of vanadium.

The elements and their isotopes

024 Cr - Chromium 50

Atomic number	24
Total number of protons	50
Number of deuterons	24
Number of single protons	2
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	2
Total number of inner electrons	24
Total number of outer electrons	24
Group	6
Isotope abundance	4.35%
Element abundance Earth	0.01%
Half-life	Stable
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	6.31
MBS Vol./#p	21.09
Average nucleon BE	8.701 MeV
Nucleus BE	435.05 MeV
SAM lines	195
SAM line nucleus BE	433.88 MeV

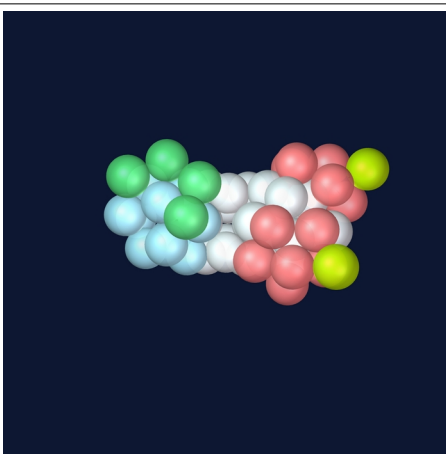


Chromium-50 is a different configuration with 50 protons and the first stable isotope for chromium.

The elements and their isotopes

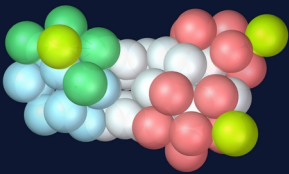
024 Cr - Chromium 52

Atomic number	24
Total number of protons	52
Number of deuterons	24
Number of single protons	2
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	2
Number of quasi inner electrons	2
Total number of inner electrons	26
Total number of outer electrons	24
Group	6
Isotope abundance	83.79%
Element abundance Earth	0.01%
Half-life	Stable
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	0.67584 eV
MBS radius	6.80
MBS Vol./#p	25.36
Average nucleon BE	8.776 MeV
Nucleus BE	456.35 MeV
SAM lines	201
SAM line nucleus BE	447.23 MeV



Chromium-52 is a stable isotope of chromium.

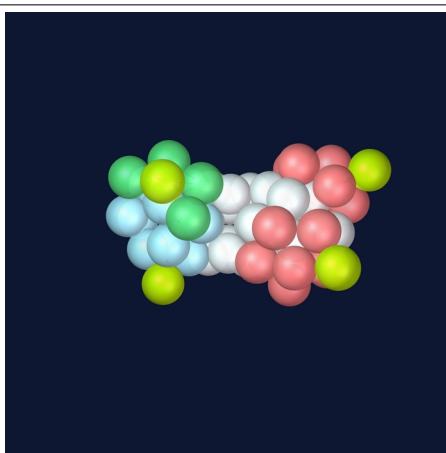
024 Cr - Chromium 53

Atomic number	24	 Chromium-53 is a stable isotope of chromium.
Total number of protons	53	
Number of deuterons	24	
Number of single protons	2	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	3	
Number of quasi inner electrons	2	
Total number of inner electrons	27	
Total number of outer electrons	24	
Group	6	
Isotope abundance	9.50%	
Element abundance Earth	0.01%	
Half-life	Stable	
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6	
Magnetic dipole moment	0.47454 μN	
Spin	3/2	
Electron affinity	N/A	
MBS radius	6.80	
MBS Vol./#p	24.88	
Average nucleon BE	8.760 MeV	
Nucleus BE	464.29 MeV	
SAM lines	204	
SAM line nucleus BE	453.9 MeV	

The elements and their isotopes

024 Cr - Chromium 54

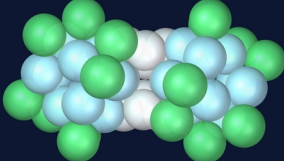
Atomic number	24
Total number of protons	54
Number of deuterons	24
Number of single protons	2
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	4
Number of quasi inner electrons	2
Total number of inner electrons	28
Total number of outer electrons	24
Group	6
Isotope abundance	2.37%
Element abundance Earth	0.01%
Half-life	Stable
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	6.8
MBS Vol./#p	24.42
Average nucleon BE	8.778 MeV
Nucleus BE	474.01 MeV
SAM lines	207
SAM line nucleus BE	460.58 MeV



Chromium-54 is a stable isotope of chromium.

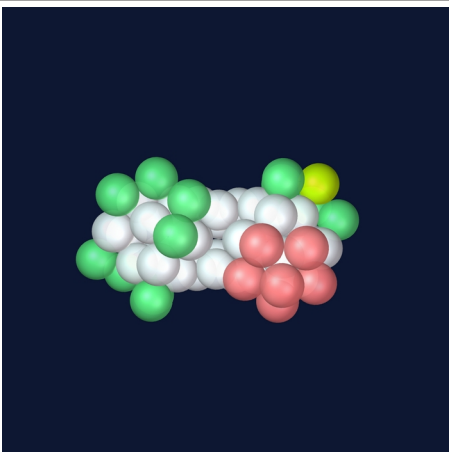
The elements and their isotopes

024 Missing element 50

Atomic number	24	 This would be the base isotope for this missing element which shows a noble gas configuration.
Total number of protons	50	
Number of deuterons	24	
Number of single protons	2	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	2	
Total number of inner electrons	24	
Total number of outer electrons	24	
Group	(18)	
Isotope abundance	N/A	
Element abundance Earth	N/A	
Half-life	N/A	
Valence / Oxidation state	(0)	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	6.91	
MBS Vol./#p	27.64	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	195	
SAM line nucleus BE	433.88 MeV	

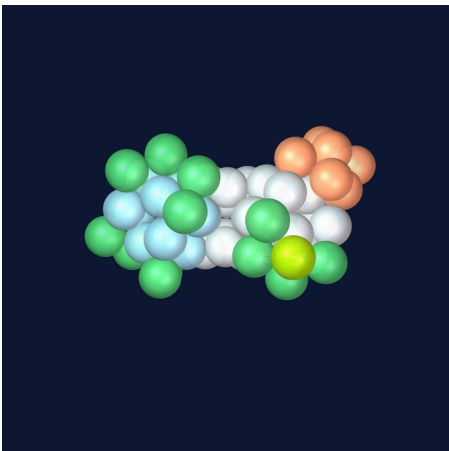
The elements and their isotopes

025 Missing element 53

Atomic number	25	 This missing element would resemble an alkaline-metal.
Total number of protons	53	
Number of deuterons	25	
Number of single protons	2	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	2	
Total number of inner electrons	26	
Total number of outer electrons	25	
Group	(1)	
Isotope abundance	N/A	
Element abundance Earth	N/A	
Half-life	N/A	
Valence / Oxidation state	(1)	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	6.91	
MBS Vol./#p	26.08	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	208	
SAM line nucleus BE	462.8 MeV	

The elements and their isotopes

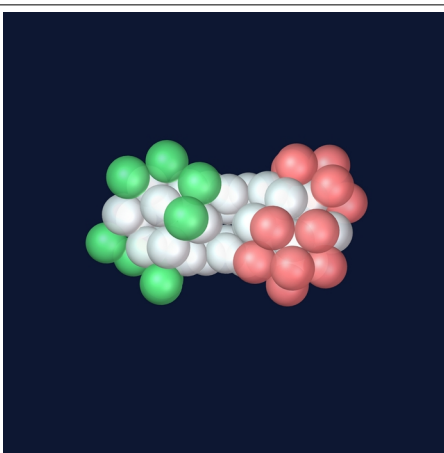
026 Mn - Manganese 55

Atomic number	26 (25)	 Manganese-55 is the only stable isotope of manganese.
Total number of protons	55	
Number of deuterons	26	
Number of single protons	2	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	3	
Total number of inner electrons	27	
Total number of outer electrons	25	
Group	7	
Isotope abundance	100.00%	
Element abundance Earth	0.11%	
Half-life	Stable	
Valence / Oxidation state	-3, -2, -1, 1, 2, 3, 4, 5, 6, 7	
Magnetic dipole moment	3.4532 μN	
Spin	5/2	
Electron affinity	-0.5 eV	
MBS radius	7.37	
MBS Vol./#p	30.5	
Average nucleon BE	8.765 MeV	
Nucleus BE	482.08 MeV	
SAM lines	216	
SAM line nucleus BE	480.6 MeV	

The elements and their isotopes

026 Fe - Iron 54

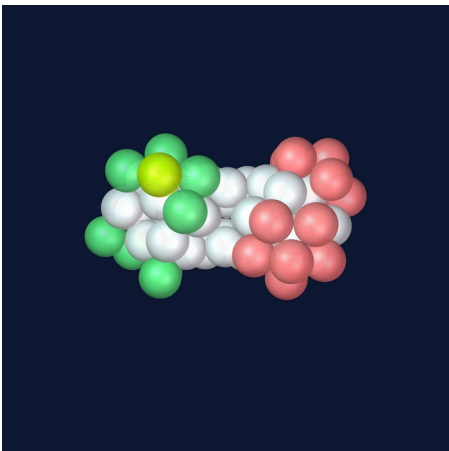
Atomic number	26
Total number of protons	54
Number of deuterons	26
Number of single protons	2
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	2
Total number of inner electrons	26
Total number of outer electrons	26
Group	8
Isotope abundance	5.85%
Element abundance Earth	6.30%
Half-life	Stable
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	6.87
MBS Vol./#p	25.2
Average nucleon BE	8.736 MeV
Nucleus BE	471.77 MeV
SAM lines	211
SAM line nucleus BE	469.48 MeV



Iron-54 is the first stable isotope of iron, with a magnesium configuration on the right and a neon configuration on the left.

The elements and their isotopes

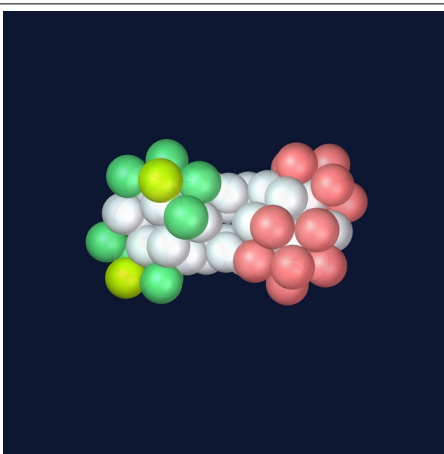
026 Fe - Iron 55

Atomic number	26	 Iron-55 is an unstable isotope of iron and resettles into manganese.
Total number of protons	55	
Number of deuterons	26	
Number of single protons	2	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	1	
Number of quasi inner electrons	2	
Total number of inner electrons	27	
Total number of outer electrons	26	
Group	8	
Isotope abundance	Artificial	
Element abundance Earth	6.30%	
Half-life	2.73 y	
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6	
Magnetic dipole moment	N/A	
Spin	3/2	
Electron affinity	N/A	
MBS radius	6.87	
MBS Vol./#p	24.74	
Average nucleon BE	8.747 MeV	
Nucleus BE	481.06 MeV	
SAM lines	216	
SAM line nucleus BE	480.6 MeV	

The elements and their isotopes

026 Fe - Iron 56

Atomic number	26
Total number of protons	56
Number of deuterons	26
Number of single protons	2
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	0
Number of quasi inner electrons	2
Total number of inner electrons	28
Total number of outer electrons	26
Group	8
Isotope abundance	91.75%
Element abundance Earth	6.30%
Half-life	Stable
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	0.153 236 eV
MBS radius	6.87
MBS Vol./#p	24.3
Average nucleon BE	8.790 MeV
Nucleus BE	492.26 MeV
SAM lines	221
SAM line nucleus BE	491.73 MeV

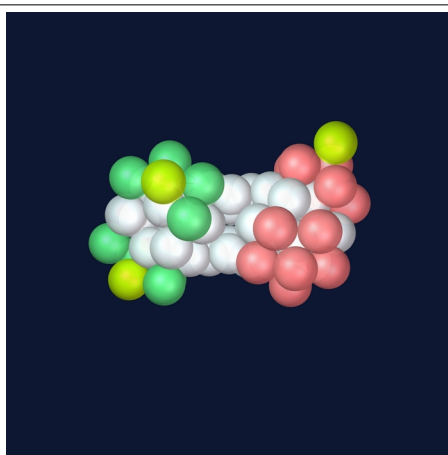


Iron-56 is the (normal) isotope of iron that is most abundant.

The elements and their isotopes

026 Fe - Iron 57

Atomic number	26
Total number of protons	57
Number of deuterons	26
Number of single protons	2
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	1
Number of quasi inner electrons	2
Total number of inner electrons	29
Total number of outer electrons	26
Group	8
Isotope abundance	2.12%
Element abundance Earth	6.30%
Half-life	Stable
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6
Magnetic dipole moment	0.09044 μN
Spin	1/2
Electron affinity	N/A
MBS radius	9.95
MBS Vol./#p	24.67
Average nucleon BE	8770 MeV
Nucleus BE	499.91 MeV
SAM lines	224
SAM line nucleus BE	498.40 MeV

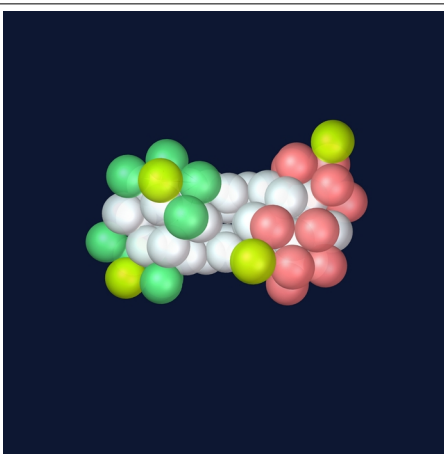


Iron-57 is a stable isotope of iron.

The elements and their isotopes

026 Fe - Iron 58

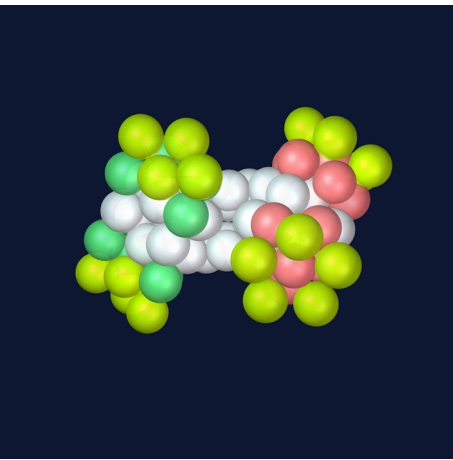
Atomic number	26
Total number of protons	58
Number of deuterons	26
Number of single protons	2
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	2
Number of quasi inner electrons	2
Total number of inner electrons	30
Total number of outer electrons	26
Group	8
Isotope abundance	0.28%
Element abundance Earth	6.30%
Half-life	Stable
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	9.95
MBS Vol./#p	24.24
Average nucleon BE	8.792 MeV
Nucleus BE	509.95 MeV
SAM lines	227
SAM line nucleus BE	505.08 MeV



Iron-58 is a stable isotope of iron.

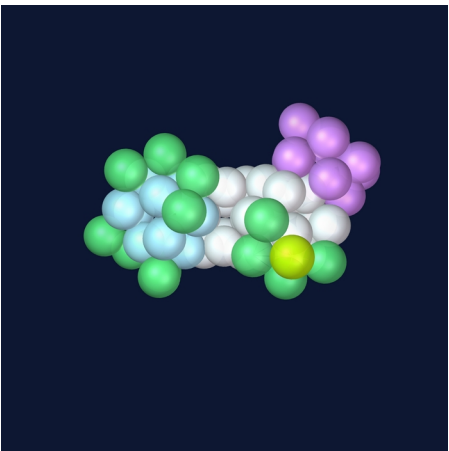
The elements and their isotopes

026 Fe - Iron 72

Atomic number	26	 Iron-72 envisions the 'maximum' isotope for iron. Shown here are all the potential connection points filled by a PEP.
Total number of protons	72	
Number of deuterons	26	
Number of single protons	2	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	2	
Number of additional proton-electron pairs	16	
Number of quasi inner electrons	2	
Total number of inner electrons	44	
Total number of outer electrons	26	
Group	8	
Isotope abundance	6.30%	
Element abundance Earth	n.a.	
Half-life	10 ms	
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6	
Magnetic dipole moment	0 μN	
Spin	0	
Electron affinity	N/A	
MBS radius	8.06	
MBS Vol./#p	30.46	
Average nucleon BE	8.184 MeV	
Nucleus BE	589.25 MeV	
SAM lines	269	
SAM line nucleus BE	598.53 MeV	

The elements and their isotopes

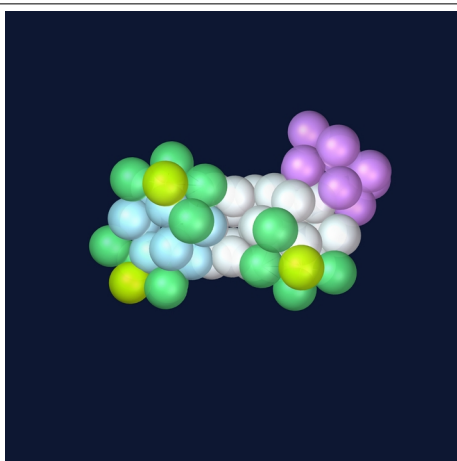
027 Co - Cobalt 57

Atomic number	27	 Cobalt-57 is thought to have a single boron nucleot and the remainder of the branches are noble. The structure seems unable to hold this configuration as it can (and will) decay into a more densely packed state: iron-57.
Total number of protons	57	
Number of deuterons	27	
Number of single protons	2	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	2	
Total number of inner electrons	28	
Total number of outer electrons	27	
Group	9	
Isotope abundance	Artificial	
Element abundance Earth	0.0030%	
Half-life	271.79 d	
Valence / Oxidation state	-1, 1, 2, 3, 4, 5	
Magnetic dipole moment	4.72 μ N	
Spin	7/2	
Electron affinity	N/A	
MBS radius	7.48	
MBS Vol./#p	30.71	
Average nucleon BE	8.742 MeV	
Nucleus BE	498.29 MeV	
SAM lines	224	
SAM line nucleus BE	498.4 MeV	

The elements and their isotopes

027 Co - Cobalt 59

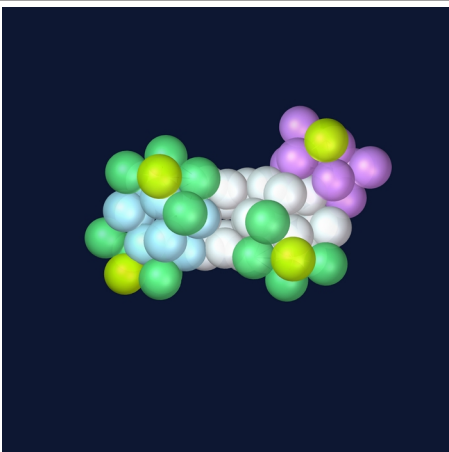
Atomic number	27
Total number of protons	59
Number of deuterons	27
Number of single protons	2
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	0
Number of quasi inner electrons	2
Total number of inner electrons	30
Total number of outer electrons	27
Group	9
Isotope abundance	100.00%
Element abundance Earth	0.0030%
Half-life	Stable
Valence / Oxidation state	-1, 1, 2, 3, 4, 5
Magnetic dipole moment	4.627 μN
Spin	7/2
Electron affinity	0.66226 eV
MBS radius	7.48
MBS Vol./#p	29.67
Average nucleon BE	8.768 MeV
Nucleus BE	517.31 MeV
SAM lines	234
SAM line nucleus BE	520.65 MeV



Cobalt-59 is the only stable isotope of cobalt. Decay or falling back of the boron-ending is prevented due to the presence of the stabilizing five-endings.

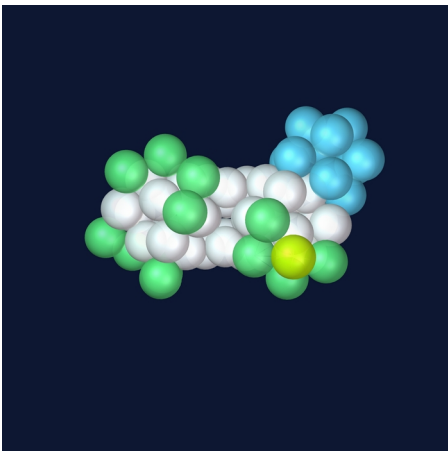
The elements and their isotopes

027 Co - Cobalt 60

Atomic number	27	 Cobalt-60 is an unstable isotope of cobalt and will decay to nickel-60 and emit a gamma ray.
Total number of protons	60	
Number of deuterons	27	
Number of single protons	2	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	2	
Number of additional proton-electron pairs	1	
Number of quasi inner electrons	2	
Total number of inner electrons	31	
Total number of outer electrons	27	
Group	9	
Isotope abundance	Artificial	
Element abundance Earth	0.0030%	
Half-life	5.2714 y	
Valence / Oxidation state	-1, 1, 2, 3, 4, 5	
Magnetic dipole moment	3.799 μ N	
Spin	5	
Electron affinity	N/A	
MBS radius	7.54	
MBS Vol./#p	29.88	
Average nucleon BE	8.747 MeV	
Nucleus BE	524.81 MeV	
SAM lines	237	
SAM line nucleus BE	527.33 MeV	

The elements and their isotopes

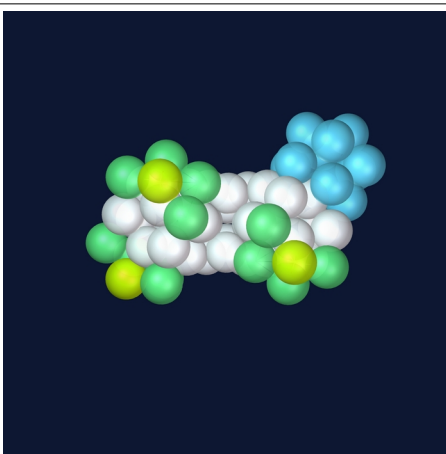
028 Ni - Nickel 58

Atomic number	28	 Nickel-58 is the first stable isotope of nickel. We can see that it is very similar to silicon as it has one (blue) carbon nucleon with the rest of the nucleus being noble endings.
Total number of protons	58	
Number of deuterons	27	
Number of single protons	3	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	2	
Total number of inner electrons	28	
Total number of outer electrons	28	
Group	10	
Isotope abundance	68.08%	
Element abundance Earth	0.0090%	
Half-life	Stable	
Valence / Oxidation state	-1, 1, 2, 3, 4	
Magnetic dipole moment	0 μ N	
Spin	0	
Electron affinity	1.15716 eV	
MBS radius	7.44	
MBS Vol./#p	29.69	
Average nucleon BE	8.732 MeV	
Nucleus BE	506.46 MeV	
SAM lines	229	
SAM line nucleus BE	509.53 MeV	

The elements and their isotopes

028 Ni - Nickel 60

Atomic number	28
Total number of protons	60
Number of deuterons	27
Number of single protons	3
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	0
Number of quasi inner electrons	2
Total number of inner electrons	30
Total number of outer electrons	28
Group	10
Isotope abundance	26.22%
Element abundance Earth	0.0090%
Half-life	Stable
Valence / Oxidation state	-1, 1, 2, 3, 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	7.44
MBS Vol./#p	28.7
Average nucleon BE	8.781 MeV
Nucleus BE	526.85 MeV
SAM lines	239
SAM line nucleus BE	531.78 MeV

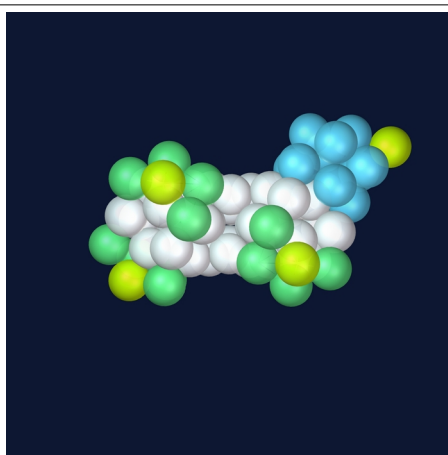


Nickel-60 is a stable isotope of nickel.

The elements and their isotopes

028 Ni - Nickel 61

Atomic number	28
Total number of protons	61
Number of deuterons	27
Number of single protons	3
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	1
Number of quasi inner electrons	2
Total number of inner electrons	31
Total number of outer electrons	28
Group	10
Isotope abundance	1.14%
Element abundance Earth	0.0090%
Half-life	Stable
Valence / Oxidation state	-1, 1, 2, 3, 4
Magnetic dipole moment	-0.75002 μN
Spin	3/2
Electron affinity	N/A
MBS radius	8.19
MBS Vol./#p	37.7
Average nucleon BE	8.765 MeV
Nucleus BE	534.67 MeV
SAM lines	242
SAM line nucleus BE	538.45 MeV

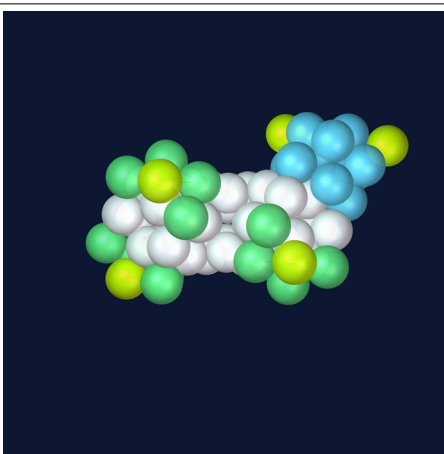


Nickel-61 is a stable isotope of nickel.

The elements and their isotopes

028 Ni - Nickel 62

Atomic number	28
Total number of protons	62
Number of deuterons	27
Number of single protons	3
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	2
Number of quasi inner electrons	2
Total number of inner electrons	32
Total number of outer electrons	28
Group	10
Isotope abundance	3.64%
Element abundance Earth	0.0090%
Half-life	Stable
Valence / Oxidation state	-1, 1, 2, 3, 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	8.19
MBS Vol./#p	37.09
Average nucleon BE	8.795 MeV
Nucleus BE	545.26 MeV
SAM lines	245
SAM line nucleus BE	545.13 MeV

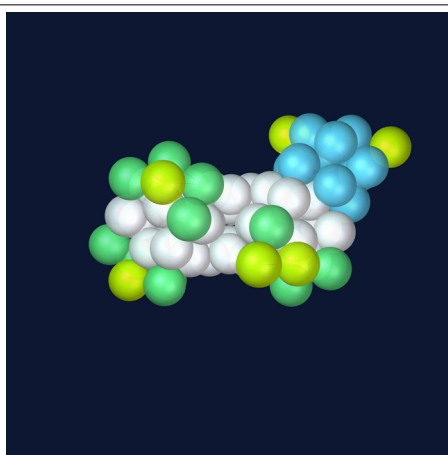


Nickel-62 is a stable isotope of nickel.

The elements and their isotopes

028 Ni - Nickel 63

Atomic number	28
Total number of protons	63
Number of deuterons	27
Number of single protons	3
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	3
Number of quasi inner electrons	2
Total number of inner electrons	33
Total number of outer electrons	28
Group	10
Isotope abundance	Artificial
Element abundance Earth	0.0090%
Half-life	100 y
Valence / Oxidation state	-1, 1, 2, 3, 4
Magnetic dipole moment	N/A
Spin	1/2
Electron affinity	N/A
MBS radius	8.19
MBS Vol./#p	36.5
Average nucleon BE	8.763 MeV
Nucleus BE	552.10 MeV
SAM lines	248
SAM line nucleus BE	551.8 MeV

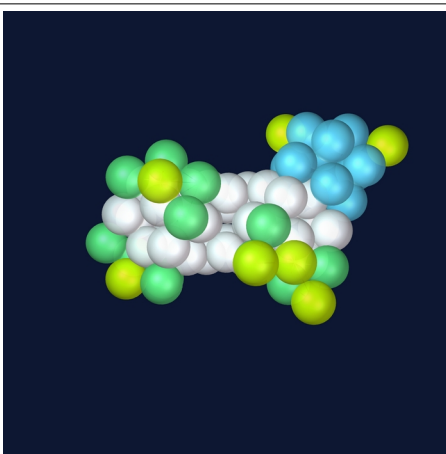


Nickel-63 is a stable isotope of nickel.

The elements and their isotopes

028 Ni - Nickel 64

Atomic number	28
Total number of protons	64
Number of deuterons	27
Number of single protons	3
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	4
Number of quasi inner electrons	2
Total number of inner electrons	34
Total number of outer electrons	28
Group	10
Isotope abundance	0.93%
Element abundance Earth	0.0090%
Half-life	Stable
Valence / Oxidation state	-1, 1, 2, 3, 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	8.19
MBS Vol./#p	35.93
Average nucleon BE	8.777 MeV
Nucleus BE	561.76 MeV
SAM lines	251
SAM line nucleus BE	558.48 MeV

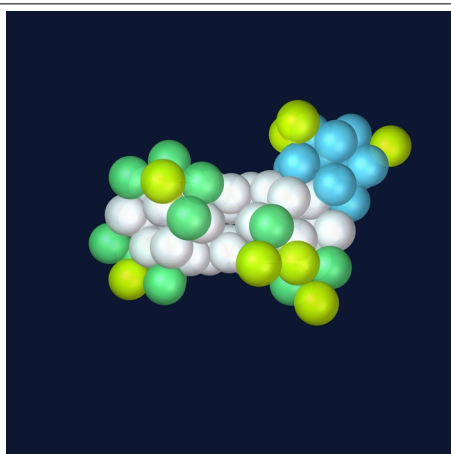


Nickel-64 is a stable isotope of nickel.

The elements and their isotopes

028 Ni - Nickel 65

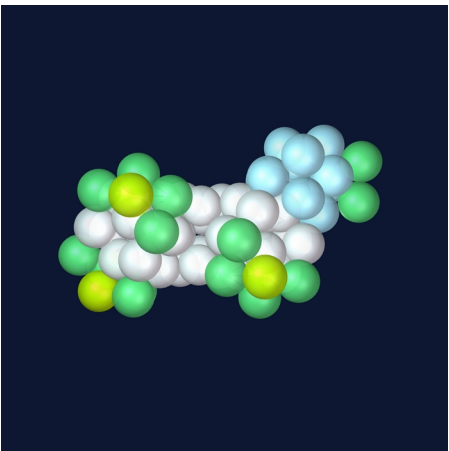
Atomic number	28
Total number of protons	65
Number of deuterons	27
Number of single protons	3
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	5
Number of quasi inner electrons	2
Total number of inner electrons	35
Total number of outer electrons	28
Group	10
Isotope abundance	Artificial
Element abundance Earth	0.0090%
Half-life	2.5172 h
Valence / Oxidation state	-1, 1, 2, 3, 4
Magnetic dipole moment	0.69 μN
Spin	5/2
Electron affinity	N/A
MBS radius	8.19
MBS Vol./#p	35.38
Average nucleon BE	8.736 MeV
Nucleus BE	567.86 MeV
SAM lines	254
SAM line nucleus BE	565.15 MeV



Nickel-65 is an unstable isotope of nickel.

The elements and their isotopes

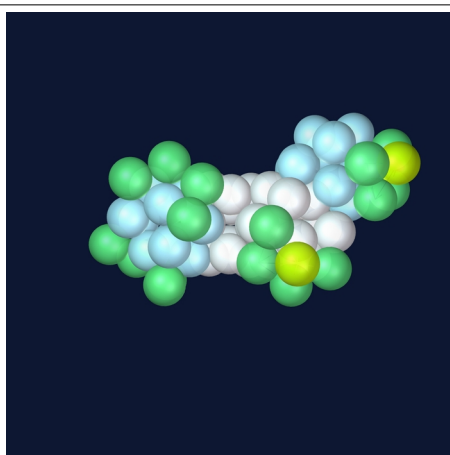
028 Missing element 62

Atomic number	28	 This missing element shows a nitrogen like ending on the right side. This configuration is considered unstable (except for nitrogen itself). It would most likely transmute into nickel-62.
Total number of protons	62	
Number of deuterons	28	
Number of single protons	3	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	2	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	3	
Total number of inner electrons	31	
Total number of outer electrons	28	
Group	N/A	
Isotope abundance	N/A	
Element abundance Earth	N/A	
Half-life	N/A	
Valence / Oxidation state	(-3, +5)	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	8.18	
MBS Vol./#p	37.03	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	247	
SAM line nucleus BE	549.58 MeV	

The elements and their isotopes

029 Cu - Copper 63

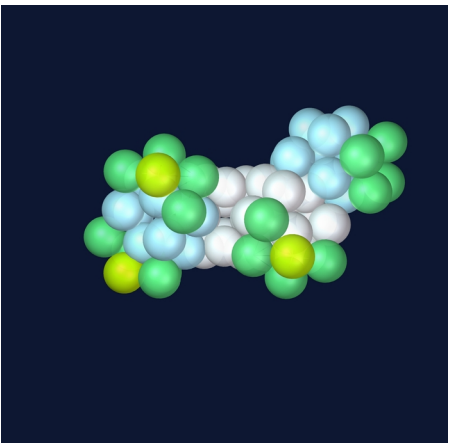
Atomic number	29
Total number of protons	63
Number of deuterons	29
Number of single protons	3
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	0
Number of quasi inner electrons	3
Total number of inner electrons	31
Total number of outer electrons	29
Group	11
Isotope abundance	69.17%
Element abundance Earth	0.00680%
Half-life	Stable
Valence / Oxidation state	1, 2, 3, 4
Magnetic dipole moment	2.22329 μN
Spin	3/2
Electron affinity	1.23578 eV
MBS radius	8.18
MBS Vol./#p	36.45
Average nucleon BE	8.752 MeV
Nucleus BE	551.39 MeV
SAM lines	250
SAM line nucleus BE	556.25 MeV



Copper-63 is the first stable isotope of copper.

The elements and their isotopes

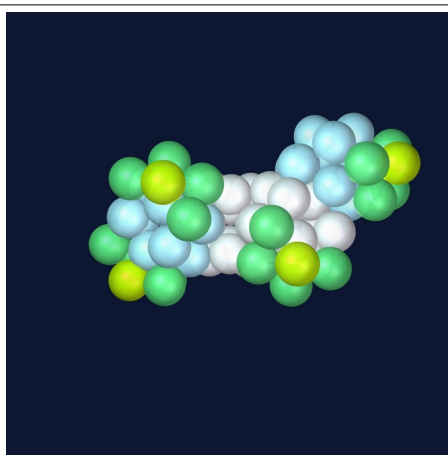
029 Cu - Copper 64

Atomic number	29	 Copper-64 is not stable and will decay into nickel-64 via β^+ or zinc-64 via β^- decay.
Total number of protons	64	
Number of deuterons	29	
Number of single protons	3	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	1	
Number of additional proton-electron pairs	1	
Number of quasi inner electrons	3	
Total number of inner electrons	32	
Total number of outer electrons	29	
Group	11	
Isotope abundance	Artificial	
Element abundance Earth	0.00680%	
Half-life	12.7 h	
Valence / Oxidation state	1, 2, 3, 4	
Magnetic dipole moment	-0.217 μ_N	
Spin	1	
Electron affinity	N/A	
MBS radius	8.18	
MBS Vol./#p	35.88	
Average nucleon BE	8.739 MeV	
Nucleus BE	559.30 MeV	
SAM lines	255	
SAM line nucleus BE	567.38 MeV	

The elements and their isotopes

029 Cu - Copper 65

Atomic number	29
Total number of protons	65
Number of deuterons	29
Number of single protons	3
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	3
Number of additional proton-electron pairs	0
Number of quasi inner electrons	3
Total number of inner electrons	33
Total number of outer electrons	29
Group	11
Isotope abundance	30.83%
Element abundance Earth	0.00680%
Half-life	Stable
Valence / Oxidation state	1, 2, 3, 4
Magnetic dipole moment	2.38167 μN
Spin	3/2
Electron affinity	N/A
MBS radius	8.18
MBS Vol./#p	35.33
Average nucleon BE	8.757 MeV
Nucleus BE	569.21 MeV
SAM lines	260
SAM line nucleus BE	578.5 MeV

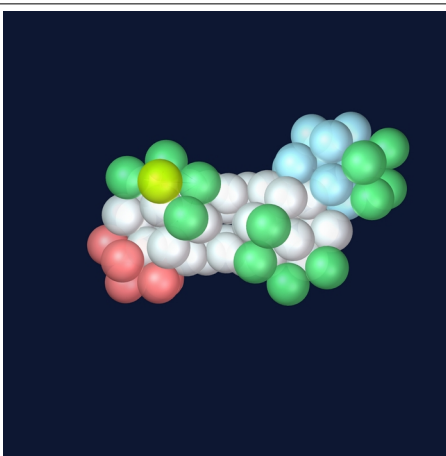


This is the 2nd stable isotope of copper.

The elements and their isotopes

030 Zn - Zinc 64

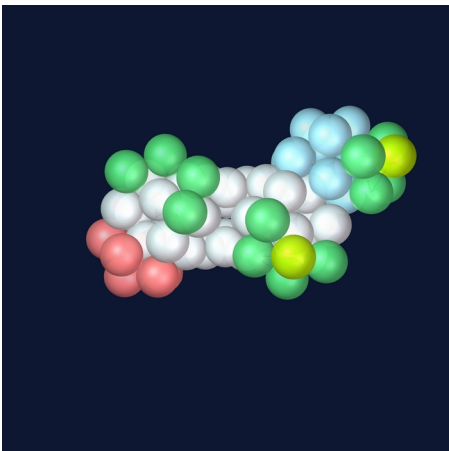
Atomic number	30
Total number of protons	64
Number of deuterons	30
Number of single protons	3
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	3
Total number of inner electrons	31
Total number of outer electrons	30
Group	12
Isotope abundance	49.20%
Element abundance Earth	0.00780%
Half-life	Stable
Valence / Oxidation state	1, 2
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	- 0.6 eV
MBS radius	8.16
MBS Vol./#p	35.56
Average nucleon BE	8.736 MeV
Nucleus BE	559.10 MeV
SAM lines	253
SAM line nucleus BE	562.93 MeV



This is the first stable isotope of zinc.

The elements and their isotopes

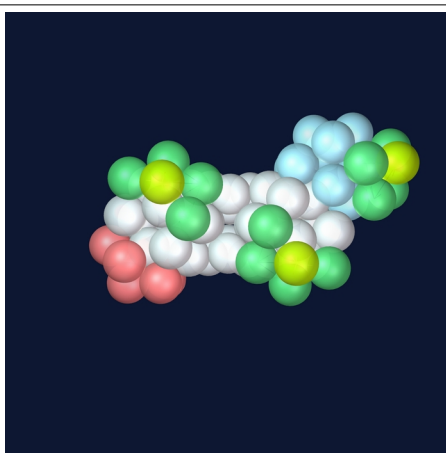
030 Zn - Zinc 65

Atomic number	30	 Zinc-65 is an unstable isotope of zinc and decays into copper-65. The half-life however is about 240 days and this shows that the reorganizing of the nucleus is not easily performed due to the distance between the red lithium-nucleus and the oxygen ending on the right side.
Total number of protons	65	
Number of deuterons	30	
Number of single protons	3	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	2	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	3	
Total number of inner electrons	32	
Total number of outer electrons	30	
Group	12	
Isotope abundance	Artificial	
Element abundance Earth	0.00780%	
Half-life	244 d	
Valence / Oxidation state	1, 2	
Magnetic dipole moment	0.769 μN	
Spin	5/2	
Electron affinity	N/A	
MBS radius	8.16	
MBS Vol./#p	35.01	
Average nucleon BE	8.724 MeV	
Nucleus BE	567.08 MeV	
SAM lines	258	
SAM line nucleus BE	574.05 MeV	

The elements and their isotopes

030 Zn - Zinc 66

Atomic number	30
Total number of protons	66
Number of deuterons	30
Number of single protons	3
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	0
Number of quasi inner electrons	3
Total number of inner electrons	33
Total number of outer electrons	30
Group	12
Isotope abundance	27.70%
Element abundance Earth	0.00780%
Half-life	Stable
Valence / Oxidation state	1, 2
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	8.16
MBS Vol./#p	34.48
Average nucleon BE	8.760 MeV
Nucleus BE	578.14 MeV
SAM lines	263
SAM line nucleus BE	585.18 MeV

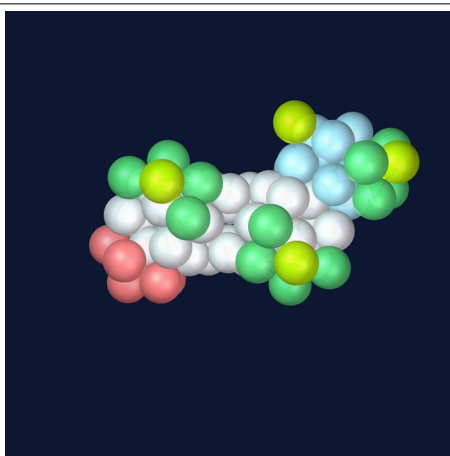


Zinc-66 is a stable isotope of zinc.

The elements and their isotopes

030 Zn - Zinc 67

Atomic number	30
Total number of protons	67
Number of deuterons	30
Number of single protons	3
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	1
Number of quasi inner electrons	3
Total number of inner electrons	34
Total number of outer electrons	30
Group	12
Isotope abundance	4.00%
Element abundance Earth	0.00780%
Half-life	Stable
Valence / Oxidation state	1, 2
Magnetic dipole moment	0.875479 μN
Spin	5/2
Electron affinity	N/A
MBS radius	8.16
MBS Vol./#p	33.97
Average nucleon BE	8.734 MeV
Nucleus BE	585.19 MeV
SAM lines	266
SAM line nucleus BE	591.85 MeV

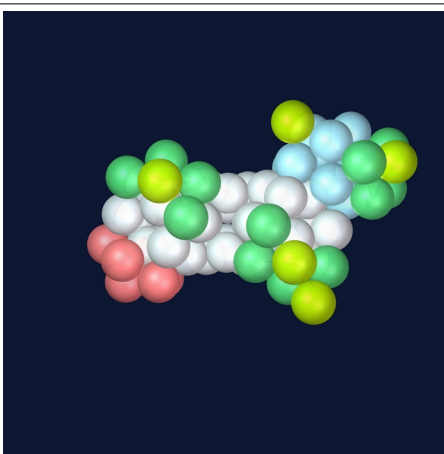


Zinc-67 is a stable isotope of zinc.

The elements and their isotopes

030 Zn - Zinc 68

Atomic number	30
Total number of protons	68
Number of deuterons	30
Number of single protons	3
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	2
Number of quasi inner electrons	3
Total number of inner electrons	35
Total number of outer electrons	30
Group	12
Isotope abundance	18.50%
Element abundance Earth	0.00780%
Half-life	Stable
Valence / Oxidation state	1, 2
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	8.16
MBS Vol./#p	33.47
Average nucleon BE	8.756 MeV
Nucleus BE	595.39 MeV
SAM lines	269
SAM line nucleus BE	598.53 MeV

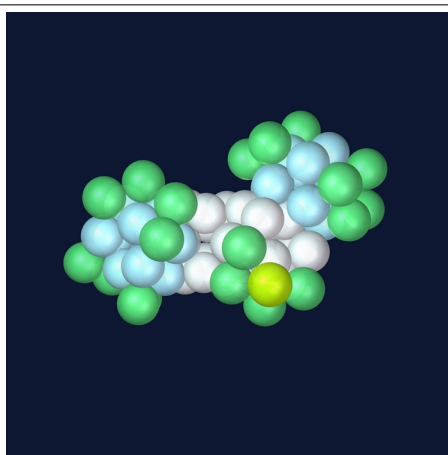


Zinc-68 is a stable isotope of zinc.

The elements and their isotopes

031 Missing element 66

Atomic number	31
Total number of protons	66
Number of deuterons	31
Number of single protons	3
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	4
Total number of inner electrons	32
Total number of outer electrons	30
Group	(18)
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	(0)
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	8.18
MBS Vol./#p	34.79
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	261
SAM line nucleus BE	580.73 MeV

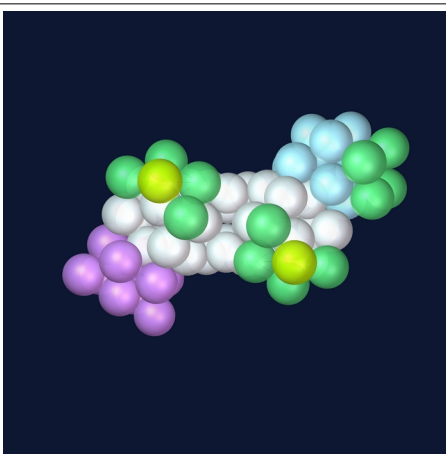


This missing element is a noble gas.

The elements and their isotopes

032 Ga - Gallium 69

Atomic number	32 (31)
Total number of protons	69
Number of deuterons	32
Number of single protons	3
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	4
Total number of inner electrons	34
Total number of outer electrons	31
Group	13
Isotope abundance	60.11%
Element abundance Earth	0.00190%
Half-life	Stable
Valence / Oxidation state	1, 2, 3
Magnetic dipole moment	2.01659 μN
Spin	3/2
Electron affinity	0.301 20 eV
MBS radius	8.89
MBS Vol./#p	42.65
Average nucleon BE	8.725 MeV
Nucleus BE	602 MeV
SAM lines	274
SAM line nucleus BE	609.65 MeV

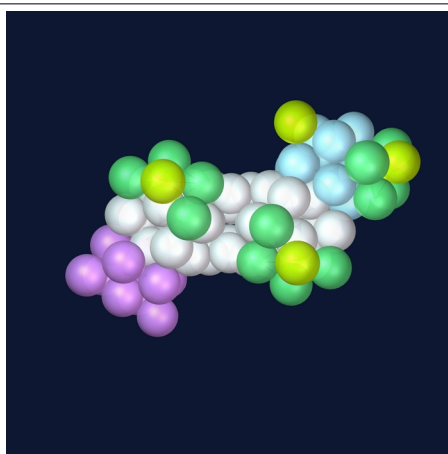


Gallium-69 is a stable isotope of gallium.

The elements and their isotopes

032 Ga - Gallium 71

Atomic number	32 (31)
Total number of protons	71
Number of deuterons	32
Number of single protons	3
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	1
Number of quasi inner electrons	4
Total number of inner electrons	36
Total number of outer electrons	31
Group	13
Isotope abundance	39.89%
Element abundance Earth	0.00190%
Half-life	Stable
Valence / Oxidation state	1, 2, 3
Magnetic dipole moment	2.562266 μN
Spin	3/2
Electron affinity	N/A
MBS radius	8.89
MBS Vol./#p	41.46
Average nucleon BE	8.718 MeV
Nucleus BE	618.95 MeV
SAM lines	282
SAM line nucleus BE	627.45 MeV

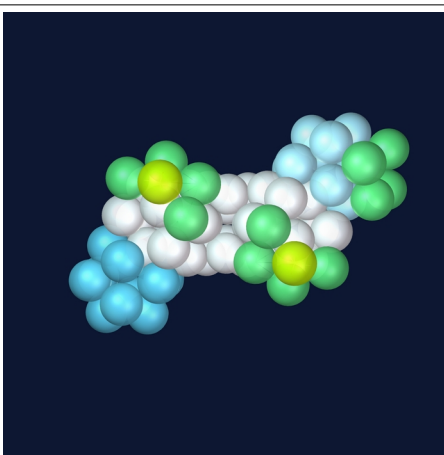


Gallium-71 is a stable isotope of gallium.

The elements and their isotopes

032 Ge - Germanium 70

Atomic number	32
Total number of protons	70
Number of deuterons	32
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	4
Total number of inner electrons	34
Total number of outer electrons	32
Group	14
Isotope abundance	20.52%
Element abundance Earth	0.00014%
Half-life	Stable
Valence / Oxidation state	-4, 1, 2, 3, 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	8.87
MBS Vol./#p	42.05
Average nucleon BE	8.722 MeV
Nucleus BE	610.52 MeV
SAM lines	279
SAM line nucleus BE	620.78 MeV

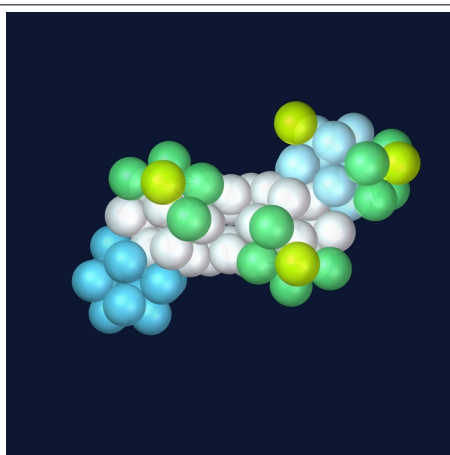


Germanium-70 is the first stable isotope of germanium. The configuration, in effect, shows the combination of a blue carbon and an oxygen ending on the right side.

The elements and their isotopes

032 Ge - Germanium 72

Atomic number	32
Total number of protons	72
Number of deuterons	32
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	1
Number of quasi inner electrons	4
Total number of inner electrons	36
Total number of outer electrons	32
Group	14
Isotope abundance	27.45%
Element abundance Earth	0.00014%
Half-life	Stable
Valence / Oxidation state	-4, 1, 2, 3, 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	8.87
MBS Vol./#p	40.64
Average nucleon BE	8.732 MeV
Nucleus BE	628.69 MeV
SAM lines	287
SAM line nucleus BE	638.58 MeV

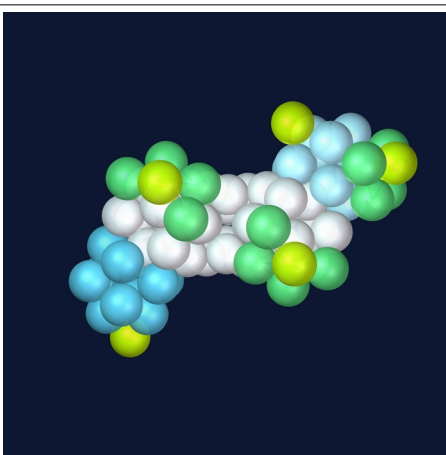


Germanium-72 is a stable isotope of germanium.

The elements and their isotopes

032 Ge - Germanium 73

Atomic number	32
Total number of protons	73
Number of deuterons	32
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	2
Number of quasi inner electrons	4
Total number of inner electrons	37
Total number of outer electrons	32
Group	14
Isotope abundance	7.76%
Element abundance Earth	0.00014%
Half-life	Stable
Valence / Oxidation state	-4, 1, 2, 3, 4
Magnetic dipole moment	-0.8794677 μN
Spin	9/2
Electron affinity	N/A
MBS radius	8.88
MBS Vol./#p	40.15
Average nucleon BE	8.705 MeV
Nucleus BE	635.47 MeV
SAM lines	290
SAM line nucleus BE	645.25 MeV

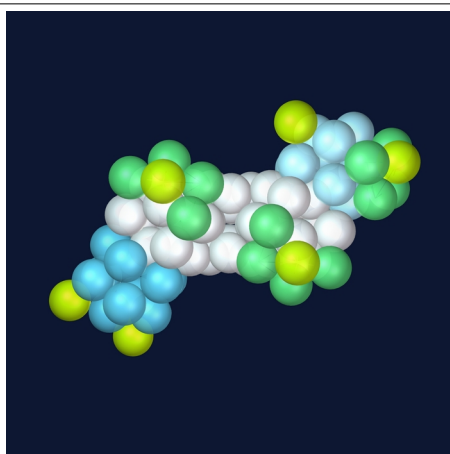


Germanium-73 is a stable isotope of germanium.

The elements and their isotopes

032 Ge - Germanium 74

Atomic number	32
Total number of protons	74
Number of deuterons	32
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	3
Number of quasi inner electrons	4
Total number of inner electrons	37
Total number of outer electrons	32
Group	14
Isotope abundance	36.52%
Element abundance Earth	0.00014%
Half-life	Stable
Valence / Oxidation state	-4, 1, 2, 3, 4
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	1.232 676 4 eV
MBS radius	9.59
MBS Vol./#p	50.00
Average nucleon BE	8.725 MeV
Nucleus BE	645.66 MeV
SAM lines	293
SAM line nucleus BE	651.93 MeV

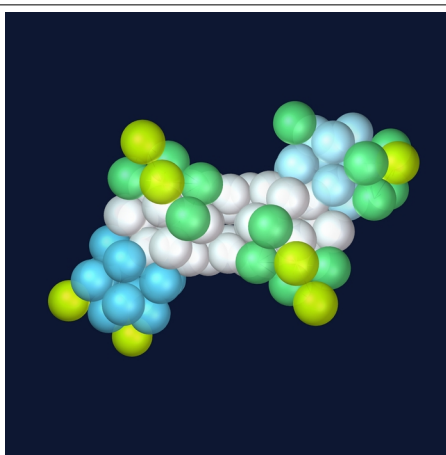


Germanium-74 is a stable isotope of germanium.

The elements and their isotopes

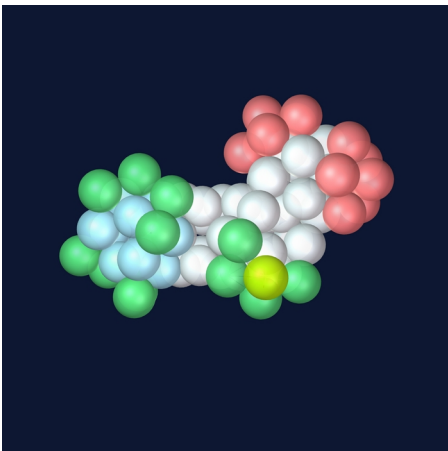
032 Ge - Germanium 76

Atomic number	32
Total number of protons	76
Number of deuterons	32
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	5
Number of quasi inner electrons	4
Total number of inner electrons	40
Total number of outer electrons	32
Group	14
Isotope abundance	7.75%
Element abundance Earth	0.00014%
Half-life	1.78×10^{21} y
Valence / Oxidation state	-4, 1, 2, 3, 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	9.59
MBS Vol./#p	48.7
Average nucleon BE	8.705 MeV
Nucleus BE	661.60 MeV
SAM lines	299
SAM line nucleus BE	665.28 MeV



Germanium-76 is a stable isotope of germanium.

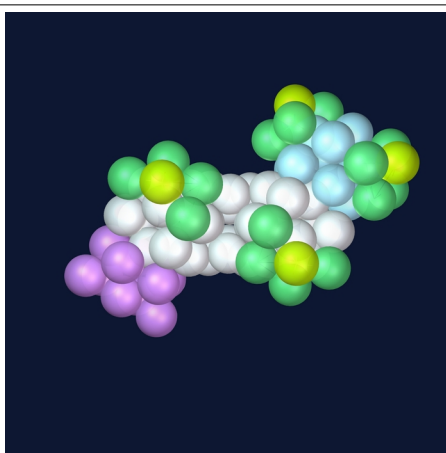
033 Missing element 70

Atomic number	33	 This missing element would reflect magnesium or iron in chemical attributes.
Total number of protons	70	
Number of deuterons	33	
Number of single protons	3	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	4	
Total number of inner electrons	34	
Total number of outer electrons	32	
Group	N/A	
Isotope abundance	N/A	
Element abundance Earth	N/A	
Half-life	N/A	
Valence / Oxidation state	(2)	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	8.18	
MBS Vol./#p	32.77	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	277	
SAM line nucleus BE	616.33 MeV	

The elements and their isotopes

034 As - Arsenic 75

Atomic number	34 (33)
Total number of protons	75
Number of deuterons	34
Number of single protons	3
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	0
Number of quasi inner electrons	4
Total number of inner electrons	38
Total number of outer electrons	33
Group	15
Isotope abundance	100.00%
Element abundance Earth	0.00%
Half-life	Stable
Valence / Oxidation state	-3, 2, 3, 5
Magnetic dipole moment	1.43947 μN
Spin	3/2
Electron affinity	0.804 8
MBS radius	8.89
MBS Vol./#p	39.24
Average nucleon BE	8.701 MeV
Nucleus BE	652.57 MeV
SAM lines	300
SAM line nucleus BE	667.50 MeV

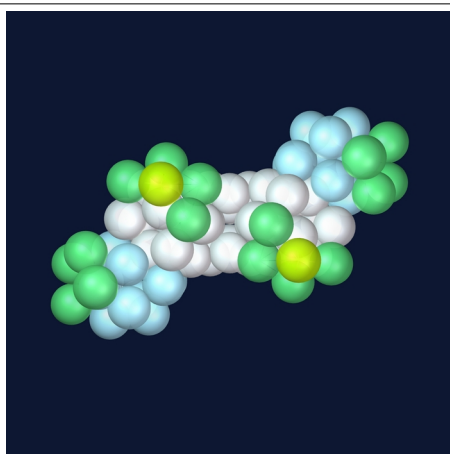


Arsenic-75 is the only stable isotope of arsenic.

The elements and their isotopes

034 Se - Selenium 74

Atomic number	34
Total number of protons	74
Number of deuterons	34
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	4
Total number of inner electrons	36
Total number of outer electrons	34
Group	16
Isotope abundance	86.00%
Element abundance Earth	$5 \times 10^{-6}\%$
Half-life	Stable
Valence / Oxidation state	-2, 1, 2, 4, 6
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	9.59
MBS Vol./#p	49.83
Average nucleon BE	8.688 MeV
Nucleus BE	642.89 MeV
SAM lines	295
SAM line nucleus BE	656.28 MeV

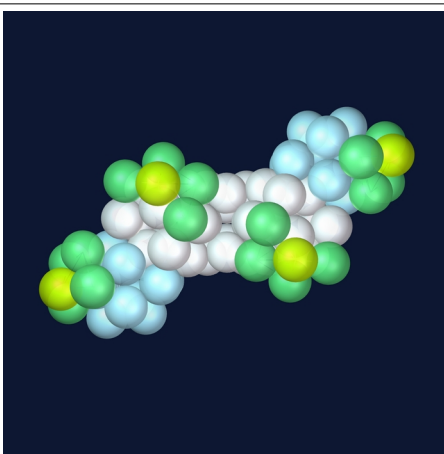


Selenium-74 is the first stable isotope of selenium.

The elements and their isotopes

034 Se - Selenium 76

Atomic number	34
Total number of protons	76
Number of deuterons	34
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	0
Number of quasi inner electrons	4
Total number of inner electrons	38
Total number of outer electrons	34
Group	16
Isotope abundance	9.23%
Element abundance Earth	$5 \times 10^{-6}\%$
Half-life	Stable
Valence / Oxidation state	-2, 1, 2, 4, 6
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	9.59
MBS Vol./#p	48.52
Average nucleon BE	8711 MeV
Nucleus BE	662.07 MeV
SAM lines	305
SAM line nucleus BE	678.63 MeV

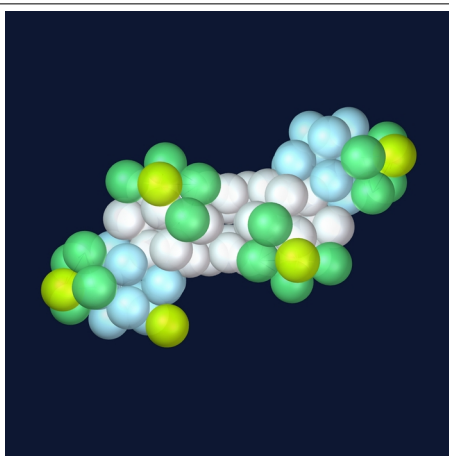


Selenium-76 is a stable isotope of selenium.

The elements and their isotopes

034 Se - Selenium 77

Atomic number	34
Total number of protons	77
Number of deuterons	34
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	1
Number of quasi inner electrons	4
Total number of inner electrons	39
Total number of outer electrons	34
Group	16
Isotope abundance	7.60%
Element abundance Earth	$5 \times 10^{-6}\%$
Half-life	Stable
Valence / Oxidation state	-2, 1, 2, 4, 6
Magnetic dipole moment	0.5350422 μN
Spin	1/2
Electron affinity	N/A
MBS radius	9.59
MBS Vol./#p	47.89
Average nucleon BE	8.695 MeV
Nucleus BE	669.49 MeV
SAM lines	308
SAM line nucleus BE	685.30 MeV

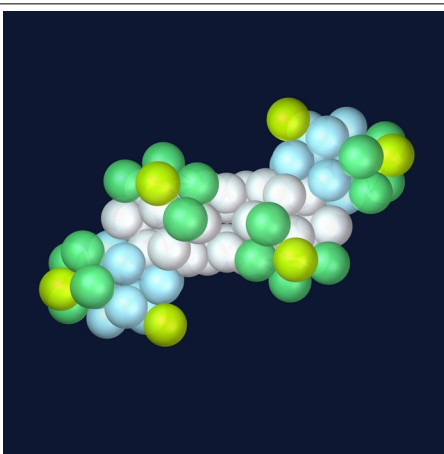


Selenium-77 is a stable isotope of selenium.

The elements and their isotopes

034 Se - Selenium 78

Atomic number	34
Total number of protons	78
Number of deuterons	34
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	2
Number of quasi inner electrons	4
Total number of inner electrons	40
Total number of outer electrons	34
Group	16
Isotope abundance	23.69%
Element abundance Earth	$5 \times 10^{-6}\%$
Half-life	Stable
Valence / Oxidation state	-2, 1, 2, 4, 6
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	2.020 604 7 eV
MBS radius	9.59
MBS Vol./#p	47.28
Average nucleon BE	8.718 MeV
Nucleus BE	679.99 MeV
SAM lines	311
SAM line nucleus BE	691.98 MeV

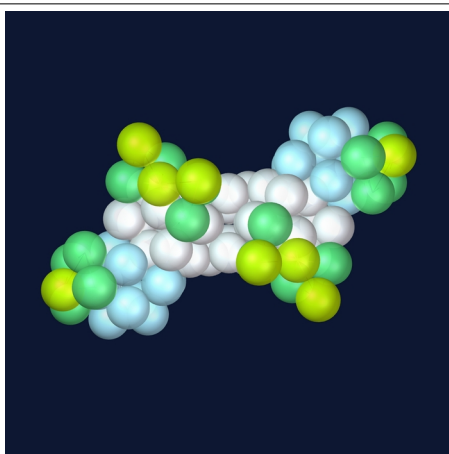


Selenium-78 is a stable isotope of selenium.

The elements and their isotopes

034 Se - Selenium 80

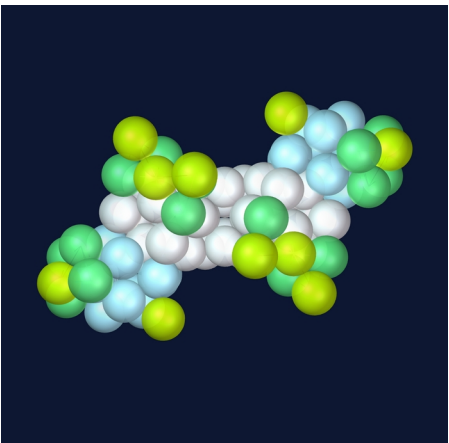
Atomic number	34
Total number of protons	80
Number of deuterons	34
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	4
Number of quasi inner electrons	4
Total number of inner electrons	42
Total number of outer electrons	34
Group	16
Isotope abundance	49.80%
Element abundance Earth	$5 \times 10^{-6}\%$
Half-life	Stable
Valence / Oxidation state	-2, 1, 2, 4, 6
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	2.020 604 7 eV
MBS radius	9.59
MBS Vol./#p	46.1
Average nucleon BE	8.711 MeV
Nucleus BE	696.87 MeV
SAM lines	317
SAM line nucleus BE	705.33 MeV



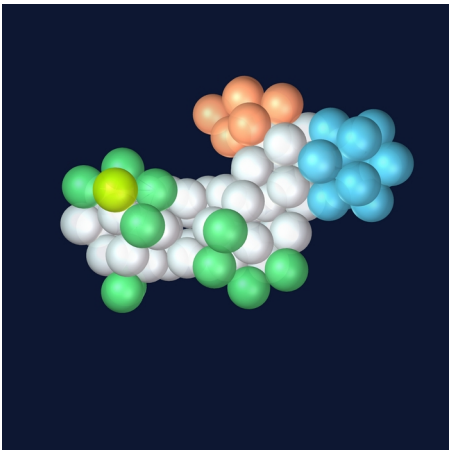
Selenium-80 is a stable isotope of Selenium.

The elements and their isotopes

034 Se - Selenium 82

Atomic number	34	 Selenium-82 is a semi-stable isotope of selenium. It is expected to perform double β^- decay to krypton-82. Through SAM, it would even be a quadruple decay step, however, we think, there are also two more quasi inner electron positions created which in effect means a shift of two outer electrons.
Total number of protons	82	
Number of deuterons	34	
Number of single protons	4	
Number of additional req. proton-electron pairs	2	
Number of additional gap proton-electron pairs	2	
Number of additional proton-electron pairs	6	
Number of quasi inner electrons	4	
Total number of inner electrons	44	
Total number of outer electrons	34	
Group	16	
Isotope abundance	8.82%	
Element abundance Earth	$5 \times 10^{-6}\%$	
Half-life	1.08×10^{20} y	
Valence / Oxidation state	-2, 1, 2, 4, 6	
Magnetic dipole moment	0	
Spin	0	
Electron affinity	N/A	
MBS radius	9.59	
MBS Vol./#p	44.97	
Average nucleon BE	8.693 MeV	
Nucleus BE	712.84 MeV	
SAM lines	323	
SAM line nucleus BE	718.68 MeV	

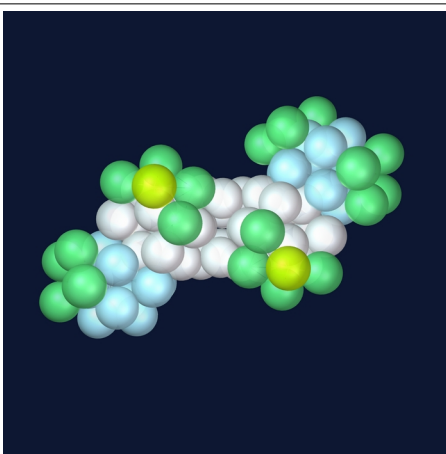
035 Missing element 75

Atomic number	35	 This missing element would reflect a transition metal and is thought to be highly unstable.
Total number of protons	75	
Number of deuterons	35	
Number of single protons	4	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	1	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	4	
Total number of inner electrons	36	
Total number of outer electrons	35	
Group	N/A	
Isotope abundance	N/A	
Element abundance Earth	N/A	
Half-life	N/A	
Valence / Oxidation state	N/A	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	8.3	
MBS Vol./#p	31.95	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	298	
SAM line nucleus BE	663.05 MeV	

The elements and their isotopes

036 Missing element 78

Atomic number	36
Total number of protons	78
Number of deuterons	36
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	4
Total number of inner electrons	38
Total number of outer electrons	36
Group	N/A
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	(-2)
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	9.58
MBS Vol./#p	47.28
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	311
SAM line nucleus BE	691.98 MeV

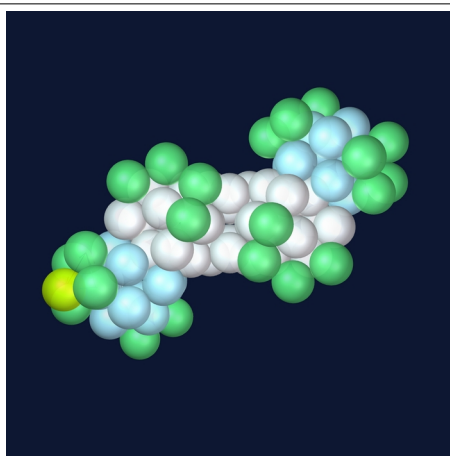


This missing element would reflect copper or cadmium attributes.

The elements and their isotopes

037 Br - Bromine 79

Atomic number	37 (35)
Total number of protons	79
Number of deuterons	37
Number of single protons	4
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	6
Total number of inner electrons	38
Total number of outer electrons	35
Group	17
Isotope abundance	51.00%
Element abundance Earth	0.00%
Half-life	Stable
Valence / Oxidation state	-1, 1, 3, 4, 5, 7
Magnetic dipole moment	2.1064 μN
Spin	3/2
Electron affinity	3.363 588 eV
MBS radius	9.59
MBS Vol./#p	46.68
Average nucleon BE	8.688 MeV
Nucleus BE	686.32 MeV
SAM lines	314
SAM line nucleus BE	698.65 MeV

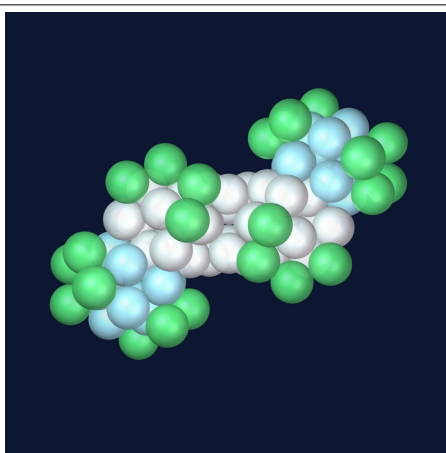


Bromine-79 is a stable isotope of bromine.

The elements and their isotopes

038 Kr - Krypton 80

Atomic number	38 (36)
Total number of protons	80
Number of deuterons	38
Number of single protons	4
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	6
Total number of inner electrons	38
Total number of outer electrons	36
Group	18
Isotope abundance	2.29%
Element abundance Earth	$1.5 \times 10^{-8}\%$
Half-life	Stable
Valence / Oxidation state	0, 2
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	9.59
MBS Vol./#p	46.1
Average nucleon BE	8.693 MeV
Nucleus BE	695.43 MeV
SAM lines	317
SAM line nucleus BE	705.33 MeV

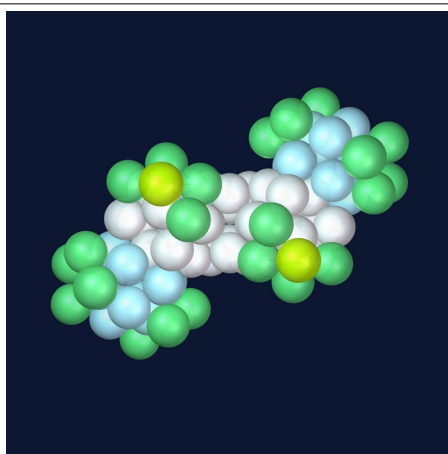


Krypton-80 is a stable isotope of krypton.

The elements and their isotopes

038 Kr - Krypton 82

Atomic number	38 (36)
Total number of protons	82
Number of deuterons	38
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	6
Total number of inner electrons	40
Total number of outer electrons	36
Group	18
Isotope abundance	11.59%
Element abundance Earth	$1.5 \times 10^{-8}\%$
Half-life	Stable
Valence / Oxidation state	0, 2
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	9.59
MBS Vol./#p	44.97
Average nucleon BE	8.711 MeV
Nucleus BE	714.28 MeV
SAM lines	327
SAM line nucleus BE	727.58 MeV

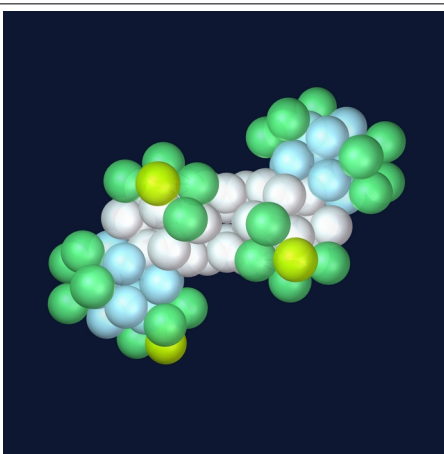


Krypton-82 is a stable isotope of krypton.

The elements and their isotopes

038 Kr - Krypton 83

Atomic number	38 (36)
Total number of protons	83
Number of deuterons	38
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	0
Number of quasi inner electrons	6
Total number of inner electrons	41
Total number of outer electrons	36
Group	18
Isotope abundance	11.50%
Element abundance Earth	$1.5 \times 10^{-8}\%$
Half-life	Stable
Valence / Oxidation state	0, 2
Magnetic dipole moment	$-0.970669 \mu\text{N}$
Spin	9/2
Electron affinity	N/A
MBS radius	9.59
MBS Vol./#p	44.43
Average nucleon BE	8.696 MeV
Nucleus BE	721.75 MeV
SAM lines	332
SAM line nucleus BE	738.70 MeV

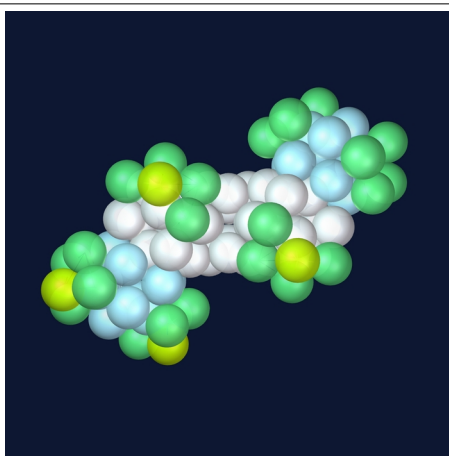


Krypton-83 is a stable isotope of krypton.

The elements and their isotopes

038 Kr - Krypton 84

Atomic number	38 (36)
Total number of protons	84
Number of deuterons	38
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	0
Number of quasi inner electrons	6
Total number of inner electrons	42
Total number of outer electrons	36
Group	18
Isotope abundance	56.99%
Element abundance Earth	$1.5 \times 10^{-8}\%$
Half-life	Stable
Valence / Oxidation state	0, 2
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	-1.0 eV
MBS radius	9.59
MBS Vol./#p	43.9
Average nucleon BE	8717 MeV
Nucleus BE	732.27 MeV
SAM lines	337
SAM line nucleus BE	749.83 MeV

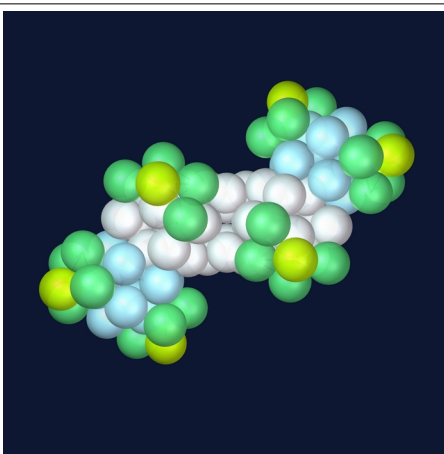


Krypton-84 is a stable isotope of krypton.

The elements and their isotopes

038 Kr - Krypton 86

Atomic number	38 (36)
Total number of protons	86
Number of deuterons	38
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	4
Number of additional proton-electron pairs	0
Number of quasi inner electrons	6
Total number of inner electrons	44
Total number of outer electrons	36
Group	18
Isotope abundance	17.28%
Element abundance Earth	$1.5 \times 10^{-8}\%$
Half-life	Stable
Valence / Oxidation state	0, 2
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	9.59
MBS Vol./#p	42.88
Average nucleon BE	8.712 MeV
Nucleus BE	749.23 MeV
SAM lines	347
SAM line nucleus BE	772.08 MeV

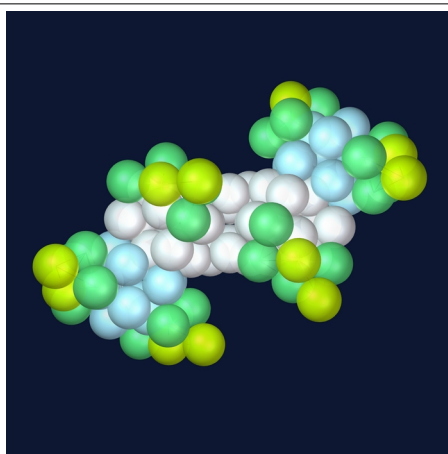


Krypton-86 is a stable isotope of krypton.

The elements and their isotopes

038 Kr - Krypton 91

Atomic number	38 (36)
Total number of protons	91
Number of deuterons	38
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	4
Number of additional proton-electron pairs	5
Number of quasi inner electrons	6
Total number of inner electrons	49
Total number of outer electrons	36
Group	18
Isotope abundance	Artificial
Element abundance Earth	$1.5 \times 10^{-8}\%$
Half-life	8.57 s
Valence / Oxidation state	0, 2
Magnetic dipole moment	N/A
Spin	5/2
Electron affinity	N/A
MBS radius	9.59
MBS Vol./#p	40.55
Average nucleon BE	8.542 MeV
Nucleus BE	777.30 MeV
SAM lines	362
SAM line nucleus BE	805.45 MeV

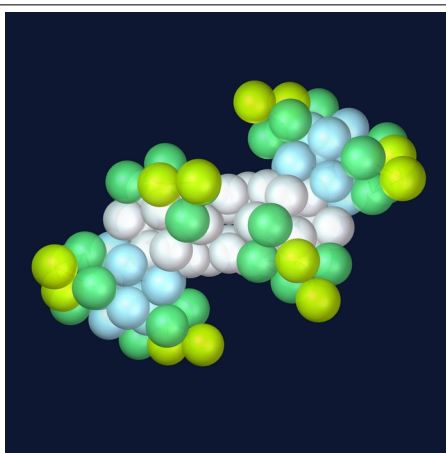


Krypton-91 is a fission product and envisioned here with an evenly distributed PEP placement.

The elements and their isotopes

038 Kr - Krypton 92

Atomic number	38 (36)
Total number of protons	92
Number of deuterons	38
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	4
Number of additional proton-electron pairs	6
Number of quasi inner electrons	6
Total number of inner electrons	50
Total number of outer electrons	36
Group	18
Isotope abundance	1.84 s
Element abundance Earth	$1.5 \times 10^{-8}\%$
Half-life	1.84 s
Valence / Oxidation state	0, 2
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	9.59
MBS Vol./#p	40.11
Average nucleon BE	8.513 MeV
Nucleus BE	783.17 MeV
SAM lines	365
SAM line nucleus BE	812.13 MeV

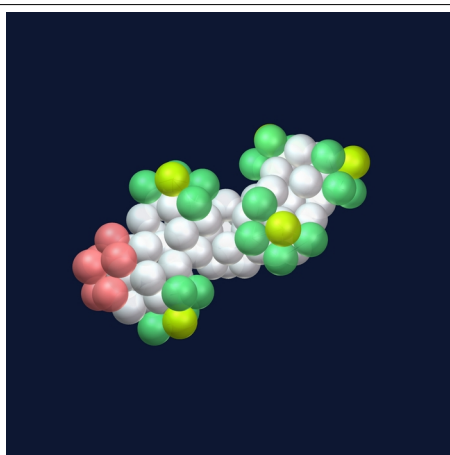


Krypton-92 is a fission product too.

The fifth row

039 Rb - Rubidium 87

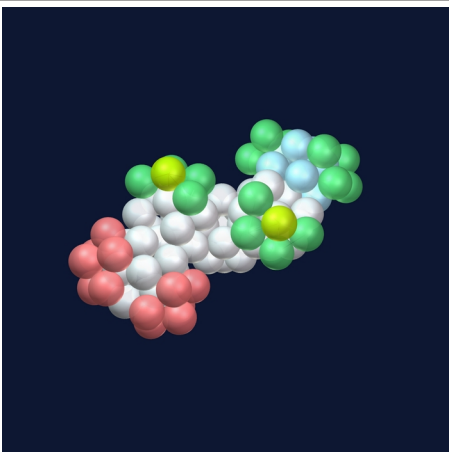
Atomic number	39 (37)
Total number of protons	85
Number of deuterons	39
Number of single protons	4
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	0
Number of quasi inner electrons	6
Total number of inner electrons	44
Total number of outer electrons	37
Group	1
Isotope abundance	27.83%
Element abundance Earth	0.006%
Half-life	4.9×10^{10} y
Valence / Oxidation state	-1, 1
Magnetic dipole moment	2.75131 μN
Spin	3/2
Electron affinity	0.485916 eV
MBS radius	9.56
MBS Vol./#p	42.06
Average nucleon BE	8.711 MeV
Nucleus BE	757.86 MeV
SAM lines	350
SAM line nucleus BE	778.75 MeV



Rubidium-87 is a stable isotope of rubidium. With only one lithium-nuclelet and the rest of the structure noble endings, it is an alkaline metal.

The elements and their isotopes

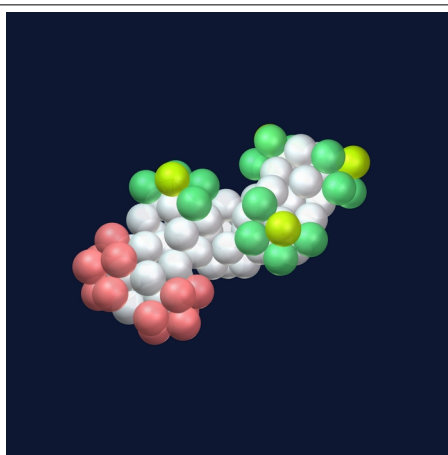
040 Sr - Strontium 86

Atomic number	40 (38)	 Strontium-86 is a stable isotope of strontium and an alkaline-earth metal.
Total number of protons	86	
Number of deuterons	40	
Number of single protons	4	
Number of additional req. proton-electron pairs	2	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	6	
Total number of inner electrons	42	
Total number of outer electrons	38	
Group	2	
Isotope abundance	9.56%	
Element abundance Earth	0.036%	
Half-life	Stable	
Valence / Oxidation state	1, 2	
Magnetic dipole moment	0 μ N	
Spin	0	
Electron affinity	N/A	
MBS radius	9.56	
MBS Vol./#p	41.52	
Average nucleon BE	8.708 MeV	
Nucleus BE	748.93 MeV	
SAM lines	343	
SAM line nucleus BE	763.18 MeV	

The elements and their isotopes

040 Sr - Strontium 88

Atomic number	40 (38)
Total number of protons	88
Number of deuterons	40
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	2
Number of quasi inner electrons	6
Total number of inner electrons	44
Total number of outer electrons	38
Group	2
Isotope abundance	82.58%
Element abundance Earth	0.036%
Half-life	Stable
Valence / Oxidation state	1, 2
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	0.052 06 eV
MBS radius	9.56
MBS Vol./#p	41.58
Average nucleon BE	8.732 MeV
Nucleus BE	768.50 MeV
SAM lines	353
SAM line nucleus BE	785.43 MeV

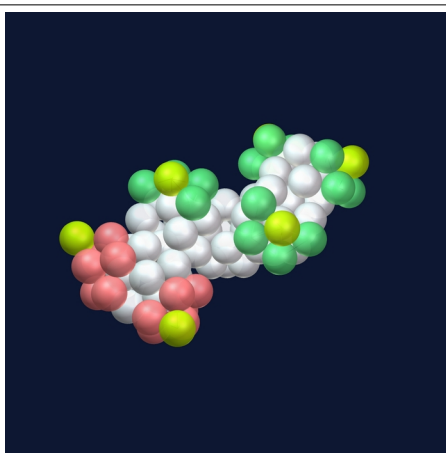


Strontium-88 is a stable isotope of strontium.

The elements and their isotopes

040 Sr - Strontium 90

Atomic number	40 (38)
Total number of protons	90
Number of deuterons	40
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	4
Number of quasi inner electrons	6
Total number of inner electrons	46
Total number of outer electrons	38
Group	2
Isotope abundance	Trace
Element abundance Earth	0.036%
Half-life	28.9 y
Valence / Oxidation state	1, 2
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	9.59
MBS Vol./#p	41.06
Average nucleon BE	8.696 MeV
Nucleus BE	782.64 MeV
SAM lines	359
SAM line nucleus BE	798.78 MeV

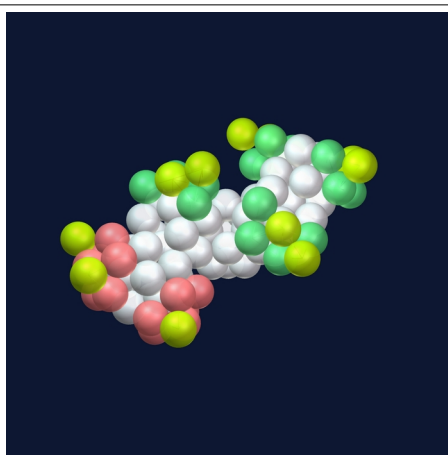


Strontium-90 is an unstable isotope of strontium.

The elements and their isotopes

040 Sr - Strontium 95

Atomic number	40 (38)
Total number of protons	95
Number of deuterons	40
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	9
Number of quasi inner electrons	6
Total number of inner electrons	51
Total number of outer electrons	38
Group	2
Isotope abundance	Artificial
Element abundance Earth	0.036%
Half-life	23.9 s
Valence / Oxidation state	1, 2
Magnetic dipole moment	-0.537 μN
Spin	1/2
Electron affinity	N/A
MBS radius	9.8
MBS Vol./#p	41.55
Average nucleon BE	8.549 MeV
Nucleus BE	812.17 MeV
SAM lines	374
SAM line nucleus BE	832.15 MeV

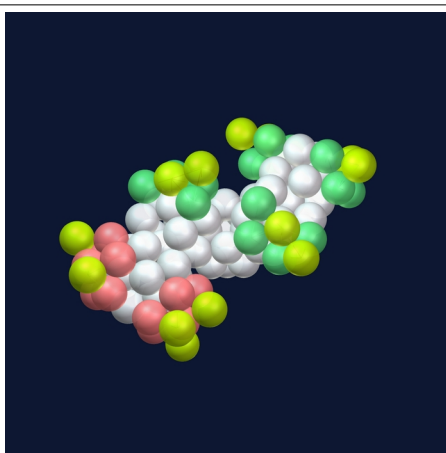


Strontium-95 is an unstable isotope of strontium.

The elements and their isotopes

040 Sr - Strontium 97

Atomic number	40 (38)
Total number of protons	97
Number of deuterons	40
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	11
Number of quasi inner electrons	6
Total number of inner electrons	53
Total number of outer electrons	38
Group	2
Isotope abundance	Artificial
Element abundance Earth	0.036%
Half-life	429 ms
Valence / Oxidation state	1, 2
Magnetic dipole moment	-0.4983 μ N
Spin	1/2
Electron affinity	N/A
MBS radius	9.8
MBS Vol./#p	40.7
Average nucleon BE	8.472 MeV
Nucleus BE	821.77 MeV
SAM lines	380
SAM line nucleus BE	845.5 MeV

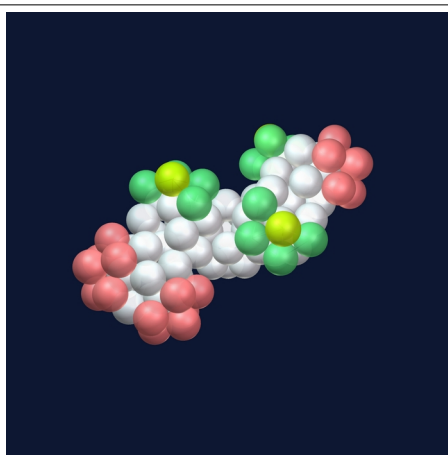


Strontium-97 is an unstable isotope of strontium.

The elements and their isotopes

041 Y - Yttrium 89

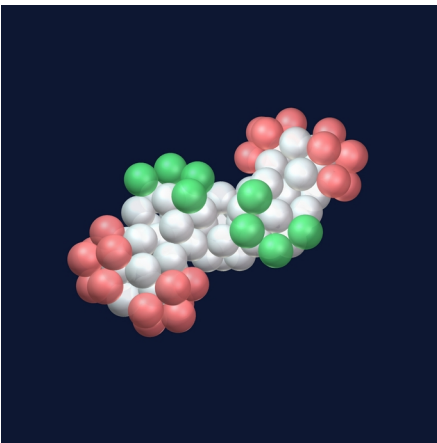
Atomic number	41 (39)
Total number of protons	89
Number of deuterons	41
Number of single protons	4
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	6
Total number of inner electrons	44
Total number of outer electrons	39
Group	3
Isotope abundance	100.00%
Element abundance Earth	0.0029%
Half-life	Stable
Valence / Oxidation state	1, 2, 3
Magnetic dipole moment	-0.1374154 μN
Spin	1/2
Electron affinity	0.307 eV
MBS radius	9.53
MBS Vol./#p	40.78
Average nucleon BE	8.714 MeV
Nucleus BE	775.54 MeV
SAM lines	356
SAM line nucleus BE	792.10 MeV



Yttrium-89 is a stable isotope of yttrium.

The elements and their isotopes

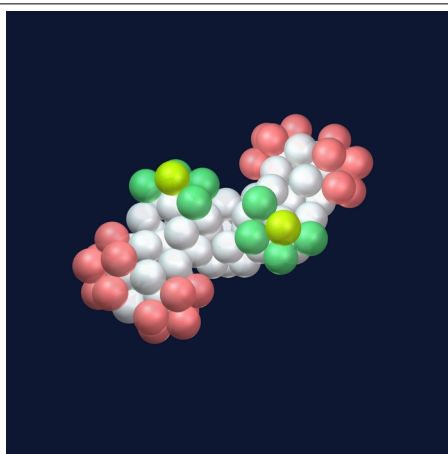
042 Zr - Zirconium 88

Atomic number	42 (40)	 Zirconium-88 is an unstable isotope of zirconium. It is one of the strongest “PEP/neutron absorbers” that is known.
Total number of protons	88	
Number of deuterons	42	
Number of single protons	4	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	6	
Total number of inner electrons	42	
Total number of outer electrons	40	
Group	4	
Isotope abundance	Artificial	
Element abundance Earth	0.0130%	
Half-life	83.4 d	
Valence / Oxidation state	1, 2, 3, 4	
Magnetic dipole moment	0 μ N	
Spin	0	
Electron affinity	N/A	
MBS radius	9.53	
MBS Vol./#p	41.24	
Average nucleon BE	8.666 MeV	
Nucleus BE	762.61 MeV	
SAM lines	349	
SAM line nucleus BE	779.53 MeV	

The elements and their isotopes

042 Zr - Zirconium 90

Atomic number	42 (40)
Total number of protons	90
Number of deuterons	42
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	6
Total number of inner electrons	44
Total number of outer electrons	40
Group	4
Isotope abundance	51.45%
Element abundance Earth	0.0130%
Half-life	Stable
Valence / Oxidation state	1, 2, 3, 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	0.433 28 eV
MBS radius	9.53
MBS Vol./#p	40.33
Average nucleon BE	8.710 MeV
Nucleus BE	783.90 MeV
SAM lines	359
SAM line nucleus BE	798.78 MeV

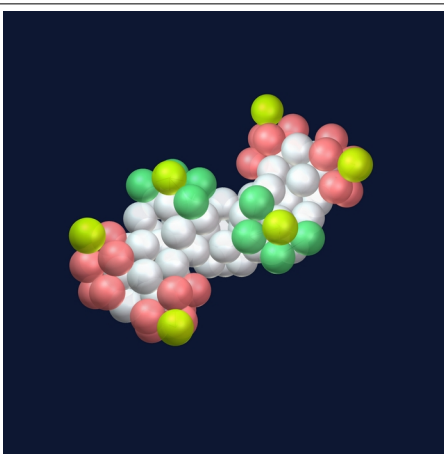


Zirconium-90 is a stable isotope of zirconium.

The elements and their isotopes

042 Zr - Zirconium 94

Atomic number	42 (40)
Total number of protons	94
Number of deuterons	42
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	4
Number of quasi inner electrons	6
Total number of inner electrons	48
Total number of outer electrons	40
Group	4
Isotope abundance	17.38%
Element abundance Earth	0.0130%
Half-life	Stable
Valence / Oxidation state	1, 2, 3, 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	9.53
MBS Vol./#p	38.61
Average nucleon BE	8.667 MeV
Nucleus BE	814.68 MeV
SAM lines	371
SAM line nucleus BE	825.48 MeV

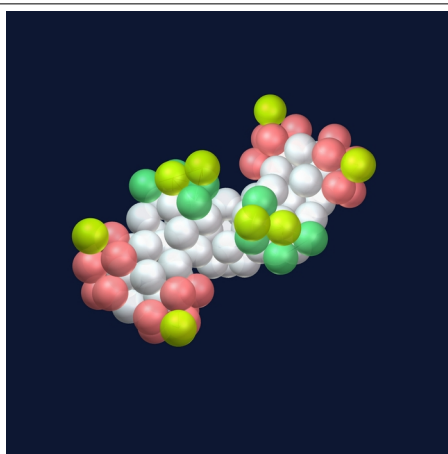


Zirconium-94 is a stable isotope of zirconium.

The elements and their isotopes

042 Zr - Zirconium 96

Atomic number	42 (40)
Total number of protons	96
Number of deuterons	42
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	6
Number of quasi inner electrons	6
Total number of inner electrons	50
Total number of outer electrons	40
Group	4
Isotope abundance	2.80%
Element abundance Earth	0.0130%
Half-life	$20(4) \times 10^{18}$ y
Valence / Oxidation state	1, 2, 3, 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	9.53
MBS Vol./#p	37.81
Average nucleon BE	8.635 MeV
Nucleus BE	828.99 MeV
SAM lines	377
SAM line nucleus BE	838.83 MeV

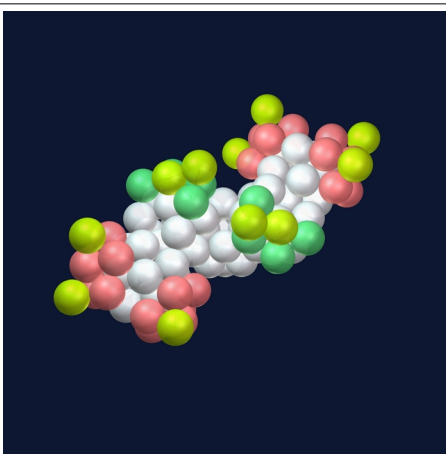


Zirconium-96 is a semi-stable isotope of zirconium showing double β^- decay.

The elements and their isotopes

042 Zr - Zirconium 99

Atomic number	42 (40)
Total number of protons	99
Number of deuterons	42
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	9
Number of quasi inner electrons	6
Total number of inner electrons	53
Total number of outer electrons	40
Group	4
Isotope abundance	Artificial
Element abundance Earth	0.0130%
Half-life	2.1 s
Valence / Oxidation state	1, 2, 3, 4
Magnetic dipole moment	N/A
Spin	1/2
Electron affinity	N/A
MBS radius	10.88
MBS Vol./#p	54.51
Average nucleon BE	8.539 MeV
Nucleus BE	845.39 MeV
SAM lines	386
SAM line nucleus BE	858.85 MeV

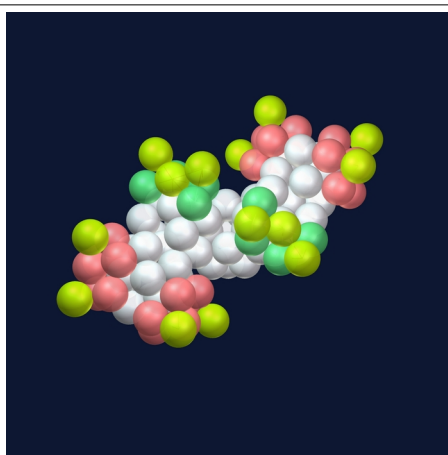


Zirconium-99 is an unstable isotope of zirconium.

The elements and their isotopes

042 Zr - Zirconium 102

Atomic number	42 (40)
Total number of protons	102
Number of deuterons	42
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	12
Number of quasi inner electrons	6
Total number of inner electrons	56
Total number of outer electrons	40
Group	4
Isotope abundance	artificial
Element abundance Earth	0.0130%
Half-life	2.9 s
Valence / Oxidation state	1, 2, 3, 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	10.88
MBS Vol./#p	52.91
Average nucleon BE	8.466 MeV
Nucleus BE	863.57 MeV
SAM lines	395
SAM line nucleus BE	878.88 MeV

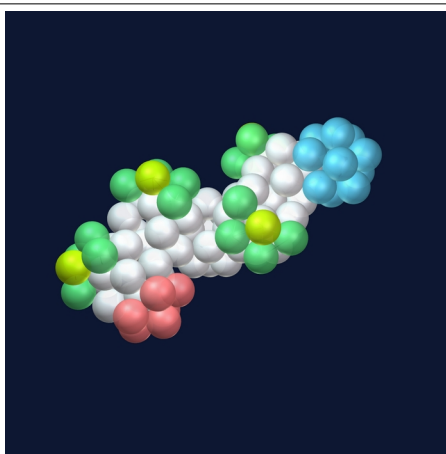


Zirconium-102 is an unstable isotope of zirconium.

The elements and their isotopes

042 Nb - Niobium 93

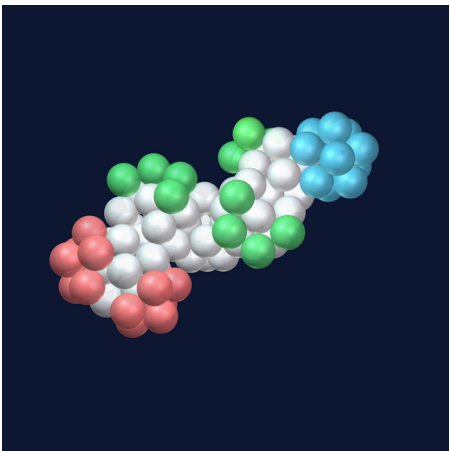
Atomic number	42 (41)
Total number of protons	93
Number of deuterons	42
Number of single protons	5
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	0
Number of quasi inner electrons	6
Total number of inner electrons	46
Total number of outer electrons	41
Group	5
Isotope abundance	100.00%
Element abundance Earth	0.0170%
Half-life	Stable
Valence / Oxidation state	-1, 2, 3, 4, 5
Magnetic dipole moment	6.1705 μN
Spin	9/2
Electron affinity	0.917 40 eV
MBS radius	10.25
MBS Vol./#p	48.53
Average nucleon BE	8.664 MeV
Nucleus BE	805.77 MeV
SAM lines	374
SAM line nucleus BE	832.15 MeV



Niobium-93 is a stable isotope of niobium.

The elements and their isotopes

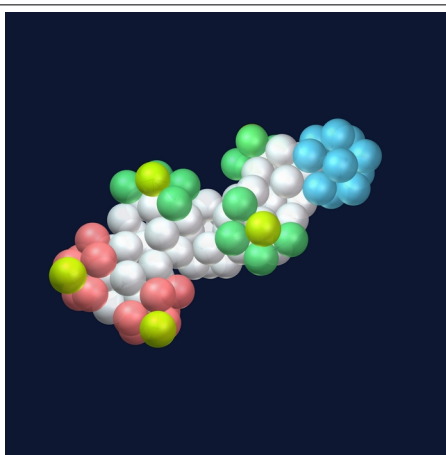
043 Mb - Molybdenum 92

Atomic number	43 (42)	 Molybdenum-92 is a stable isotope of molybdenum. The structure shows how the normal periodicity of adding another lithium on the left side from niobium on, is similar to the growth pattern of sodium to magnesium. The only difference is that this larger nucleus has on the right side also a carbon nucleon. The structure is therefore a combination of a alkaline-earth metal and carbon.
Total number of protons	92	
Number of deuterons	43	
Number of single protons	5	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	6	
Total number of inner electrons	44	
Total number of outer electrons	42	
Group	6	
Isotope abundance	14.65%	
Element abundance Earth	0.00011%	
Half-life	Stable	
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6	
Magnetic dipole moment	0 μ N	
Spin	0	
Electron affinity	N/A	
MBS radius	10.22	
MBS Vol./#p	48.57	
Average nucleon BE	8.658 MeV	
Nucleus BE	796.51 MeV	
SAM lines	367	
SAM line nucleus BE	816.58 MeV	

The elements and their isotopes

043 Mb - Molybdenum 96

Atomic number	43 (42)
Total number of protons	96
Number of deuterons	43
Number of single protons	5
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	2
Number of quasi inner electrons	6
Total number of inner electrons	48
Total number of outer electrons	42
Group	6
Isotope abundance	16.67%
Element abundance Earth	0.00011%
Half-life	Stable
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	NA/
MBS radius	10.29
MBS Vol./#p	47.55
Average nucleon BE	8.654 MeV
Nucleus BE	830.78 MeV
SAM lines	379
SAM line nucleus BE	843.028 MeV

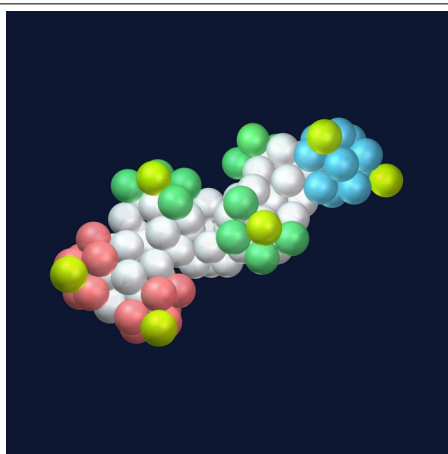


Molybdenum-96 is a stable isotope of molybdenum.

The elements and their isotopes

043 Mb - Molybdenum 98

Atomic number	43 (42)
Total number of protons	98
Number of deuterons	43
Number of single protons	5
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	4
Number of quasi inner electrons	6
Total number of inner electrons	50
Total number of outer electrons	42
Group	6
Isotope abundance	24.29%
Element abundance Earth	0.00011%
Half-life	Stable
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	0.7473 eV
MBS radius	10.6134
MBS Vol./#p	51.1005
Average nucleon BE	8.635 MeV
Nucleus BE	846.23 MeV
SAM lines	389
SAM line nucleus BE	865.525 MeV

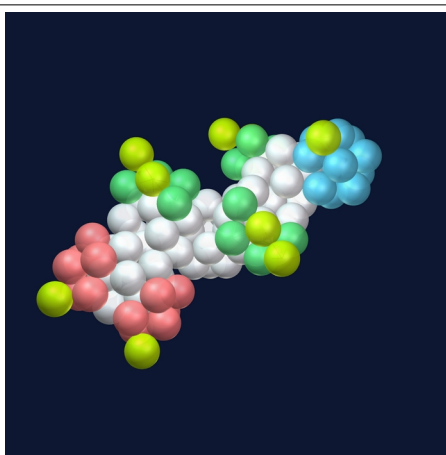


Molybdenum-98 is a stable isotope of molybdenum.

The elements and their isotopes

043 Mb - Molybdenum 100

Atomic number	43 (42)
Total number of protons	100
Number of deuterons	43
Number of single protons	5
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	6
Number of quasi inner electrons	6
Total number of inner electrons	52
Total number of outer electrons	42
Group	6
Isotope abundance	9.74%
Element abundance Earth	0.00011%
Half-life	7.8×10^{18} y
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	10.84
MBS Vol./#p	53.37
Average nucleon BE	8.605 MeV
Nucleus BE	860.47 MeV
SAM lines	391
SAM line nucleus BE	869.98 MeV

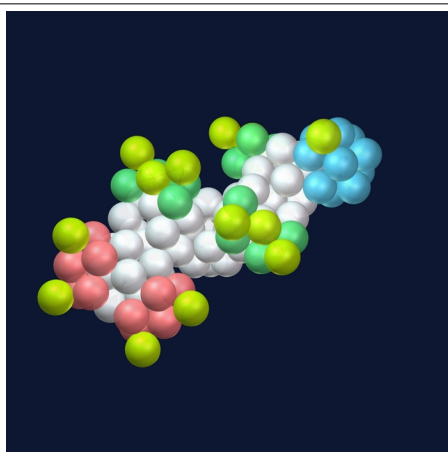


Molybdenum-100 is a stable isotope of molybdenum.

The elements and their isotopes

043 Mb - Molybdenum 105

Atomic number	43 (42)
Total number of protons	105
Number of deuterons	43
Number of single protons	5
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	11
Number of quasi inner electrons	6
Total number of inner electrons	57
Total number of outer electrons	42
Group	6
Isotope abundance	Artificial
Element abundance Earth	0.00011%
Half-life	35.6 s
Valence / Oxidation state	-2, -1, 1, 2, 3, 4, 5, 6
Magnetic dipole moment	N/A
Spin	5/2
Electron affinity	N/A
MBS radius	10.84
MBS Vol./#p	50.83
Average nucleon BE	8.495 MeV
Nucleus BE	891.97 MeV
SAM lines	406
SAM line nucleus BE	903.35 MeV



Molybdenum-105 is an unstable isotope of molybdenum.

The elements and their isotopes

044 Tc - Technetium 94

Atomic number	44 (43)
Total number of protons	94
Number of deuterons	44
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	5
Total number of inner electrons	46
Total number of outer electrons	43
Group	7
Isotope abundance	Artificial
Element abundance Earth	0.00%
Half-life	293 m
Valence / Oxidation state	-3, -1, 1, 2, 3, 4, 5, 6, 7
Magnetic dipole moment	5.08 μN
Spin	7
Electron affinity	N/A
MBS radius	10.09
MBS Vol./#p	45.83
Average nucleon BE	8.609 MeV
Nucleus BE	809.22 MeV
SAM lines	375
SAM line nucleus BE	834.38 MeV

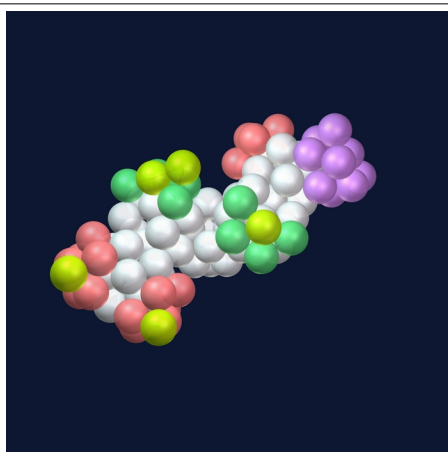


Technetium-94 is an unstable isotope of technetium. This element has only unstable isotopes and no stable ones.

The elements and their isotopes

044 Tc - Technetium 97

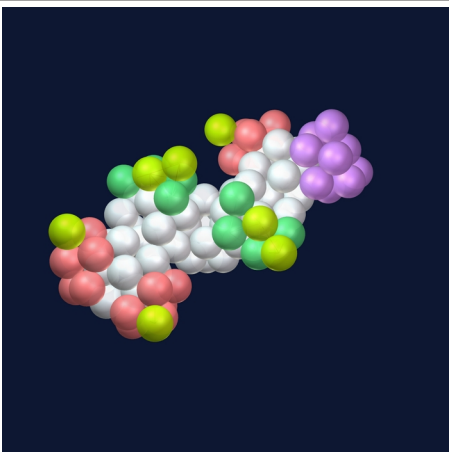
Atomic number	44 (43)
Total number of protons	97
Number of deuterons	44
Number of single protons	4
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	3
Number of quasi inner electrons	5
Total number of inner electrons	49
Total number of outer electrons	43
Group	7
Isotope abundance	Artificial
Element abundance Earth	0.00%
Half-life	293 m
Valence / Oxidation state	-3, -1, 1, 2, 3, 4, 5, 6, 7
Magnetic dipole moment	N/A
Spin	09/02/20
Electron affinity	0.55 eV
MBS radius	10.28
MBS Vol./#p	46.9606
Average nucleon BE	8.624 MeV
Nucleus BE	836.53 MeV
SAM lines	384
SAM line nucleus BE	854.40 MeV



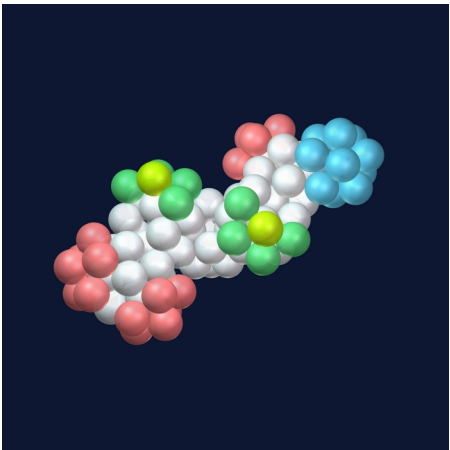
Technetium-97 is an unstable isotope of technetium. This element has only unstable isotopes and no stable ones.

The elements and their isotopes

044 Tc - Technetium 99

Atomic number	44 (43)	 Technetium-99 is unstable, has a half-life of about 200.000 years and is a fission product as a result of nuclear fission of uranium. The excited isomer technetium-99 (with a mislocated PEP) has a half-life of about 6 hours and is used a lot in medical purposes as a radioactive tracer. The structure has an isomeric transition to the normal technetium-99 and emits a gamma ray of about 140 KeV. It is not clear here, which PEP has been relocated.
Total number of protons	99	
Number of deuterons	44	
Number of single protons	4	
Number of additional req. proton-electron pairs	2	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	5	
Number of quasi inner electrons	5	
Total number of inner electrons	51	
Total number of outer electrons	43	
Group	7	
Isotope abundance	Trace	
Element abundance Earth	0.00%	
Half-life	2.111×10^5 y	
Valence / Oxidation state	-3, -1, 1, 2, 3, 4, 5, 6, 7	
Magnetic dipole moment	$5.6847 \mu\text{N}$	
Spin	9/2	
Electron affinity	N/A	
MBS radius	10.09	
MBS Vol./#p	43.52	
Average nucleon BE	8.614 MeV	
Nucleus BE	852.75 MeV	
SAM lines	390	
SAM line nucleus BE	867.75 MeV	

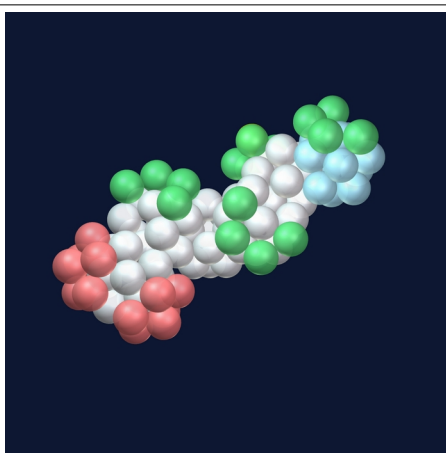
044 Missing element 95

Atomic number	44	 This missing element would reflect molybdenum and technetium somewhat. The lithium- and carbon nucleon on the right side are considered to be a very unstable configuration and this would decay to molybdenum-95.
Total number of protons	95	
Number of deuterons	44	
Number of single protons	5	
Number of additional req. proton-electron pairs	2	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	6	
Total number of inner electrons	46	
Total number of outer electrons	43	
Group	N/A	
Isotope abundance	N/A	
Element abundance Earth	N/A	
Half-life	N/A	
Valence / Oxidation state	N/A	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	10.22	
MBS Vol./#p	47.04	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	380	
SAM line nucleus BE	845.50 MeV	

The elements and their isotopes

045 Ru - Ruthenium 96

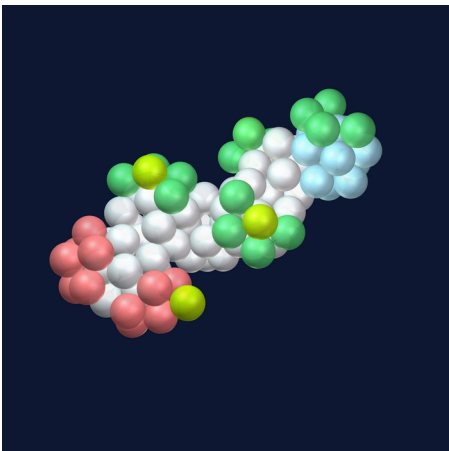
Atomic number	45 (44)
Total number of protons	96
Number of deuterons	45
Number of single protons	5
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	6
Total number of inner electrons	46
Total number of outer electrons	44
Group	8
Isotope abundance	5.54%
Element abundance Earth	$1 \times 10^{-7}\%$
Half-life	Stable
Valence / Oxidation state	-2, 1, 2, 3, 4, 5, 6, 7, 8
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	10.26
MBS Vol./#p	47.18
Average nucleon BE	8.609 MeV
Nucleus BE	826.50 MeV
SAM lines	383
SAM line nucleus BE	852.18 MeV



Ruthenium-96 is a stable isotope of ruthenium.

The elements and their isotopes

045 Ru - Ruthenium 99

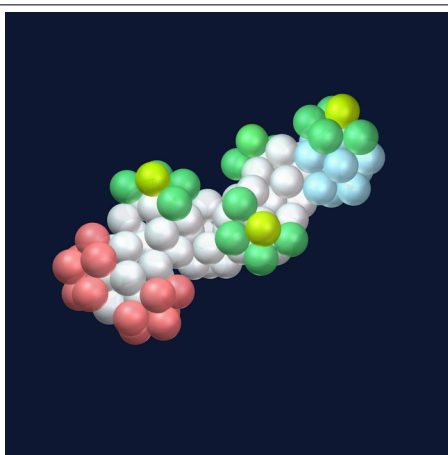
Atomic number	45 (44)	
Total number of protons	99	
Number of deuterons	45	
Number of single protons	5	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	3	
Number of quasi inner electrons	6	
Total number of inner electrons	49	
Total number of outer electrons	44	
Group	8	
Isotope abundance	12.76%	
Element abundance Earth	$1 \times 10^{-7}\%$	
Half-life	Stable	
Valence / Oxidation state	-2, 1, 2, 3, 4, 5, 6, 7, 8	
Magnetic dipole moment	-0.641 μN	
Spin	5/2	
Electron affinity	N/A	
MBS radius	10.26	
MBS Vol./#p	45.75	
Average nucleon BE	8.609 MeV	
Nucleus BE	852.26 MeV	
SAM lines	396	
SAM line nucleus BE	881.10 MeV	

Ruthenium-99 is a stable isotope of ruthenium.

The elements and their isotopes

045 Ru - Ruthenium 100

Atomic number	45 (44)
Total number of protons	100
Number of deuterons	45
Number of single protons	5
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	4
Number of quasi inner electrons	6
Total number of inner electrons	50
Total number of outer electrons	44
Group	8
Isotope abundance	12.60%
Element abundance Earth	$1 \times 10^{-7}\%$
Half-life	Stable
Valence / Oxidation state	-2, 1, 2, 3, 4, 5, 6, 7, 8
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	10.32
MBS Vol./#p	48.44
Average nucleon BE	8.619 MeV
Nucleus BE	861.94 MeV
SAM lines	401
SAM line nucleus BE	892.23 MeV

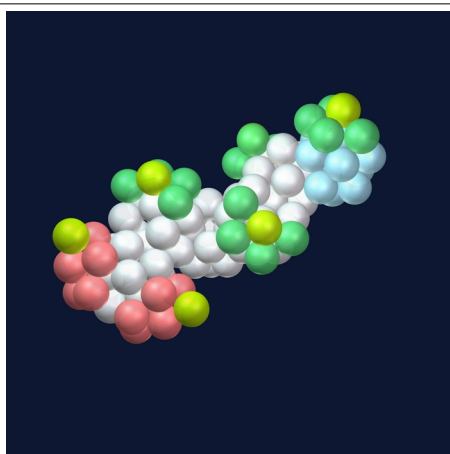


Ruthenium-100 is a stable isotope of ruthenium.

The elements and their isotopes

045 Ru - Ruthenium 102

Atomic number	45 (44)
Total number of protons	102
Number of deuterons	45
Number of single protons	5
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	6
Number of quasi inner electrons	6
Total number of inner electrons	52
Total number of outer electrons	44
Group	8
Isotope abundance	31.55%
Element abundance Earth	$1 \times 10^{-7}\%$
Half-life	Stable
Valence / Oxidation state	-2, 1, 2, 3, 4, 5, 6, 7, 8
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	1.046 38 eV
MBS radius	10.496
MBS Vol./#p	47.4858
Average nucleon BE	8.607 MeV
Nucleus BE	877.91MeV
SAM lines	407
SAM line nucleus BE	905.575 MeV

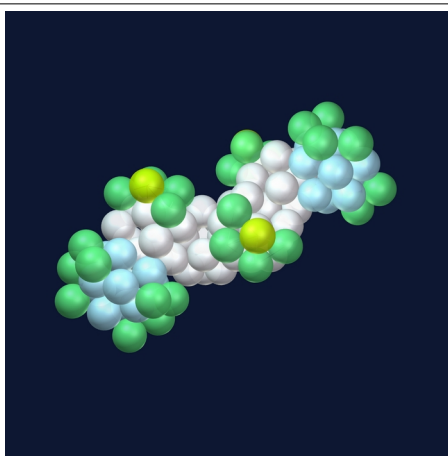


Ruthenium-102 is a stable isotope of ruthenium.

The elements and their isotopes

045 Missing element 98

Atomic number	45
Total number of protons	98
Number of deuterons	45
Number of single protons	5
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	6
Total number of inner electrons	48
Total number of outer electrons	44
Group	(18)
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	(0)
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	10.57
MBS Vol./#p	50.53
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	393
SAM line nucleus BE	874.43 MeV

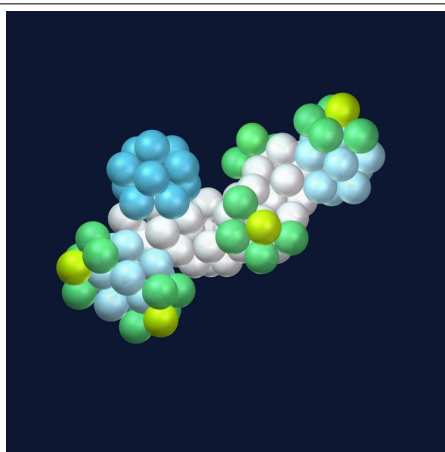


This missing element would represent a noble gas.

The elements and their isotopes

046 Rn - Rhodium 103

Atomic number	46 (45)
Total number of protons	103
Number of deuterons	46
Number of single protons	6
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	3
Number of additional proton-electron pairs	0
Number of quasi inner electrons	7
Total number of inner electrons	58
Total number of outer electrons	45
Group	9
Isotope abundance	100.00%
Element abundance Earth	$7 \times 10^{-8}\%$
Half-life	Stable
Valence / Oxidation state	-1, 1, 2, 3, 4, 5, 6
Magnetic dipole moment	-0.0884 μN
Spin	1/2
Electron affinity	1.142 89 eV
MBS radius	10.3
MBS Vol./#p	11.5
Average nucleon BE	8.584 MeV
Nucleus BE	884.17 MeV
SAM lines	416
SAM line nucleus BE	925.6 MeV

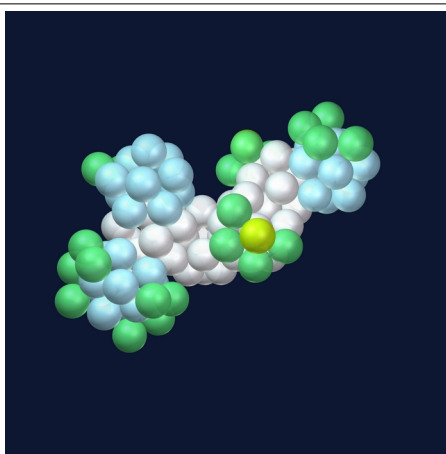


Rhodium-103 is a stable isotope of rhodium.

The elements and their isotopes

047 Missing element 108

Atomic number	47 (45)
Total number of protons	108
Number of deuterons	47
Number of single protons	6
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	8
Total number of inner electrons	55
Total number of outer electrons	45
Group	N/A
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	N/A
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	10.3
MBS Vol./#p	44.87
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	409
SAM line nucleus BE	910.03 MeV

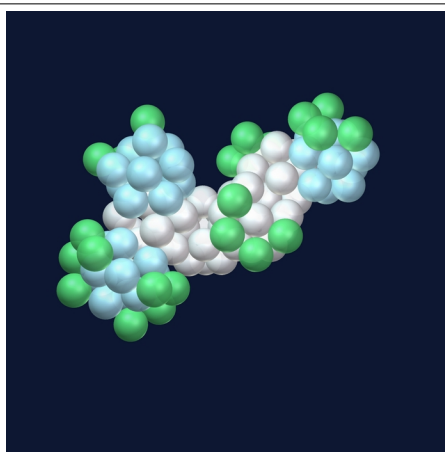


This missing element shows a nitrogen- and oxygen-like ending, which is considered to be an unstable configuration.

The elements and their isotopes

048 Pd - Palladium 102

Atomic number	48 (46)
Total number of protons	102
Number of deuterons	48
Number of single protons	6
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	8
Total number of inner electrons	48
Total number of outer electrons	46
Group	10
Isotope abundance	1.02%
Element abundance Earth	$6.3 \times 10^{-7}\%$
Half-life	Stable
Valence / Oxidation state	2, 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	10.3
MBS Vol./#p	44.86
Average nucleon BE	8.580 MeV
Nucleus BE	875.19 MeV
SAM lines	407
SAM line nucleus BE	905.58 MeV

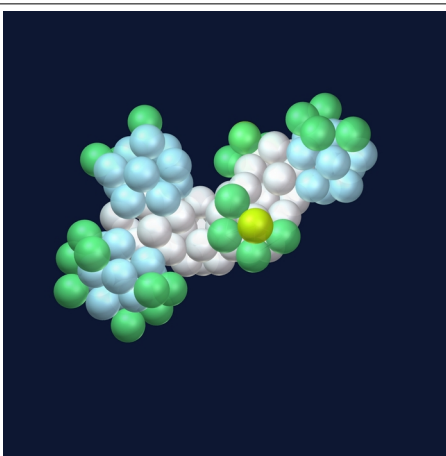


Palladium-102 is a stable isotope of palladium. The structure shows two oxygen-like endings.

The elements and their isotopes

048 Pf - Palladium 104

Atomic number	48 (46)
Total number of protons	104
Number of deuterons	48
Number of single protons	6
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	8
Total number of inner electrons	50
Total number of outer electrons	46
Group	10
Isotope abundance	11.14%
Element abundance Earth	$6.3 \times 10^{-7}\%$
Half-life	Stable
Valence / Oxidation state	2, 4
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	10.3
MBS Vol./#p	44
Average nucleon BE	8.585 MeV
Nucleus BE	892.83 MeV
SAM lines	417
SAM line nucleus BE	927.83 MeV

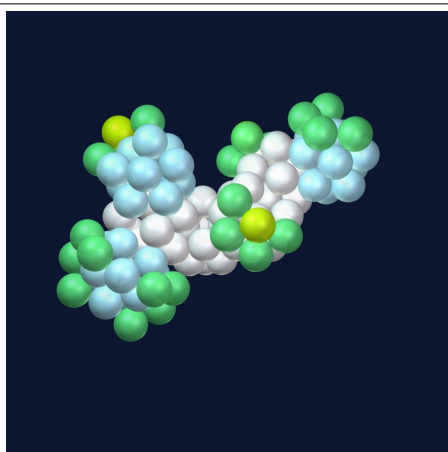


Palladium-104 is a stable isotope of palladium.

The elements and their isotopes

048 Pd - Palladium 105

Atomic number	48 (46)
Total number of protons	105
Number of deuterons	48
Number of single protons	6
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	1
Number of quasi inner electrons	8
Total number of inner electrons	51
Total number of outer electrons	46
Group	10
Isotope abundance	22.33%
Element abundance Earth	$6.3 \times 10^{-7}\%$
Half-life	Stable
Valence / Oxidation state	2, 4
Magnetic dipole moment	-0.642 μN
Spin	5/2
Electron affinity	N/A
MBS radius	10.3
MBS Vol./#p	43.58
Average nucleon BE	8.571 MeV
Nucleus BE	899.92 MeV
SAM lines	422
SAM line nucleus BE	938.95 MeV

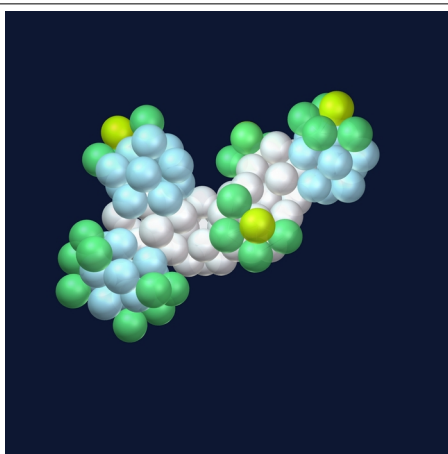


Palladium-105 is a stable isotope of palladium.

The elements and their isotopes

048 Pd - Palladium 106

Atomic number	48 (46)
Total number of protons	106
Number of deuterons	48
Number of single protons	6
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	2
Number of quasi inner electrons	8
Total number of inner electrons	52
Total number of outer electrons	46
Group	10
Isotope abundance	27.33%
Element abundance Earth	$6.3 \times 10^{-7}\%$
Half-life	Stable
Valence / Oxidation state	2, 4
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	0.562 14 eV
MBS radius	10.3
MBS Vol./#p	43.24
Average nucleon BE	8.580 MeV
Nucleus BE	909.48 MeV
SAM lines	427
SAM line nucleus BE	950.08 MeV

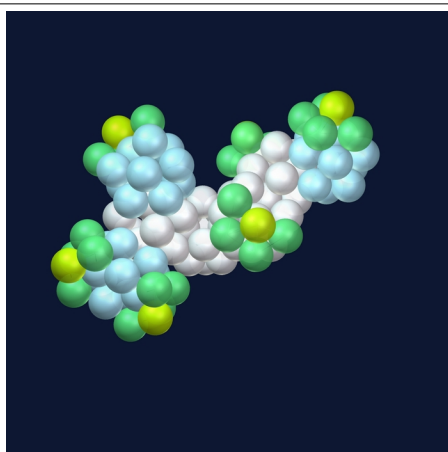


Palladium-106 is a stable isotope of palladium.

The elements and their isotopes

048 Pd - Palladium 108

Atomic number	48 (46)
Total number of protons	108
Number of deuterons	48
Number of single protons	6
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	4
Number of quasi inner electrons	8
Total number of inner electrons	54
Total number of outer electrons	46
Group	10
Isotope abundance	26.46%
Element abundance Earth	$6.3 \times 10^{-7}\%$
Half-life	Stable
Valence / Oxidation state	2, 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	10.3
MBS Vol./#p	42.44
Average nucleon BE	8.567 MeV
Nucleus BE	925.24 MeV
SAM lines	433
SAM line nucleus BE	963.43 MeV

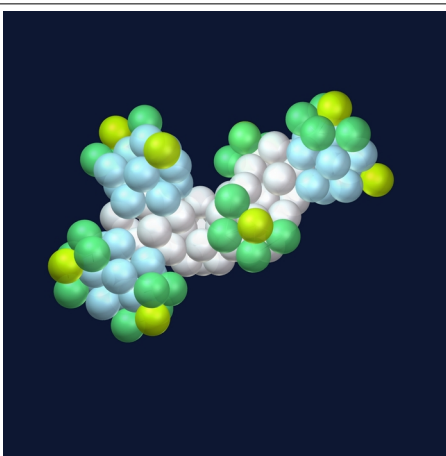


Palladium-108 is a stable isotope of palladium.

The elements and their isotopes

048 Pd - Palladium 110

Atomic number	48 (46)
Total number of protons	110
Number of deuterons	48
Number of single protons	6
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	6
Number of quasi inner electrons	8
Total number of inner electrons	56
Total number of outer electrons	46
Group	10
Isotope abundance	11.72%
Element abundance Earth	$6.3 \times 10^{-7}\%$
Half-life	Stable
Valence / Oxidation state	2, 4
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	10.55
MBS Vol./#p	44.67
Average nucleon BE	8.547 MeV
Nucleus BE	940.19 MeV
SAM lines	443
SAM line nucleus BE	985.68 MeV

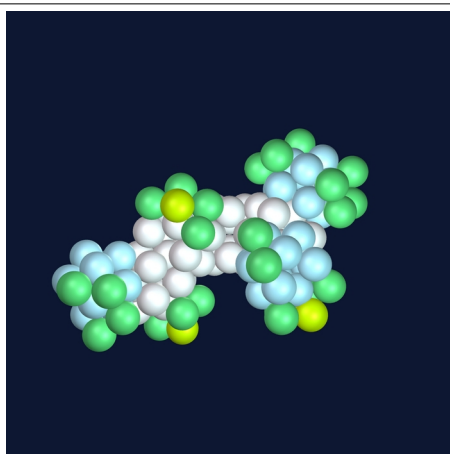


Palladium-110 is a stable isotope of palladium.

The elements and their isotopes

049 Ag - Silver 107

Atomic number	49 (47)
Total number of protons	107
Number of deuterons	49
Number of single protons	6
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	0
Number of quasi inner electrons	8
Total number of inner electrons	52
Total number of outer electrons	47
Group	11
Isotope abundance	51.84%
Element abundance Earth	$7.9 \times 10^{-6}\%$
Half-life	Stable
Valence / Oxidation state	1, 2, 3, 4
Magnetic dipole moment	$-0.11357 \mu\text{N}$
Spin	1/2
Electron affinity	1.304 47 eV
MBS radius	10.30
MBS Vol./#p	42.77
Average nucleon BE	8.554 MeV
Nucleus BE	915.27 MeV
SAM lines	430
SAM line nucleus BE	956.75 MeV

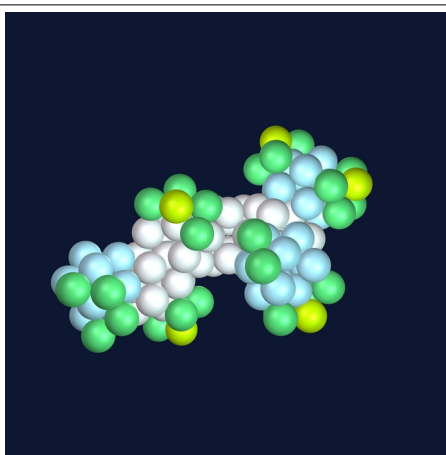


Silver-107 is one of the two stable isotopes of silver. It is in effect the combination of a fluorine-like ending combined with an oxygen-like ending.

The elements and their isotopes

049 Ag - Silver 109

Atomic number	49 (47)
Total number of protons	109
Number of deuterons	49
Number of single protons	6
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	2
Number of quasi inner electrons	8
Total number of inner electrons	54
Total number of outer electrons	47
Group	11
Isotope abundance	48.16%
Element abundance Earth	$7.9 \times 10^{-6}\%$
Half-life	Stable
Valence / Oxidation state	1, 2, 3, 4
Magnetic dipole moment	$-0.1306906 \mu_N$
Spin	1/2
Electron affinity	N/A
MBS radius	10.30
MBS Vol./#p	41.98
Average nucleon BE	8.548 MeV
Nucleus BE	931.72 MeV
SAM lines	440
SAM line nucleus BE	979.00 MeV

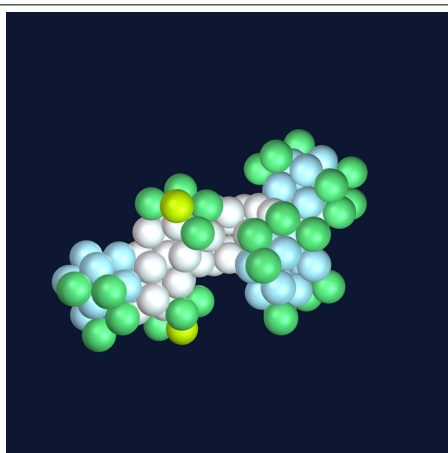


Silver-109 is the 2nd stable isotope of silver.

The elements and their isotopes

050 Cd - Cadmium 108

Atomic number	50 (48)
Total number of protons	108
Number of deuterons	50
Number of single protons	6
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	8
Total number of inner electrons	52
Total number of outer electrons	48
Group	12
Isotope abundance	0.89%
Element abundance Earth	0.000015%
Half-life	Stable
Valence / Oxidation state	1, 2
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	10.30
MBS Vol./#p	42.37
Average nucleon BE	8.550 MeV
Nucleus BE	923.4 MeV
SAM lines	433
SAM line nucleus BE	963.43 MeV

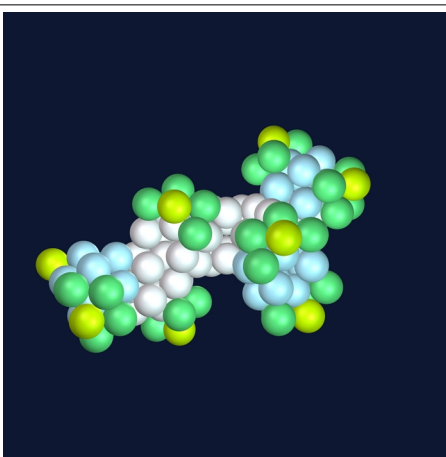


Cadmium-108 is a stable isotope of cadmium. The structure has in effect one oxygen-like ending.

The elements and their isotopes

050 Cd - Cadmium 114

Atomic number	50 (48)
Total number of protons	114
Number of deuterons	50
Number of single protons	6
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	6
Number of quasi inner electrons	8
Total number of inner electrons	58
Total number of outer electrons	48
Group	12
Isotope abundance	28.75%
Element abundance Earth	0.000015%
Half-life	Stable
Valence / Oxidation state	1, 2
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	-0.7 Cd114
MBS radius	10.55
MBS Vol./#p	43.10
Average nucleon BE	8.531 MeV
Nucleus BE	972.592 MeV
SAM lines	461
SAM line nucleus BE	1025.73 MeV

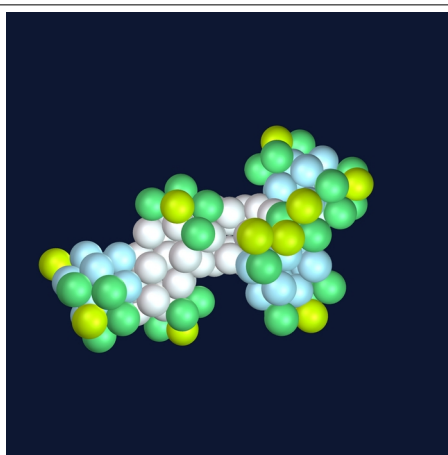


Cadmium-114 is a stable isotope of cadmium.

The elements and their isotopes

050 Cd - Cadmium 116

Atomic number	50 (48)
Total number of protons	116
Number of deuterons	50
Number of single protons	6
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	8
Number of quasi inner electrons	8
Total number of inner electrons	60
Total number of outer electrons	48
Group	12
Isotope abundance	7.51%
Element abundance Earth	0.000015%
Half-life	3.1×10^{19} y
Valence / Oxidation state	1, 2
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	10.55
MBS Vol./#p	42.36
Average nucleon BE	8.512 MeV
Nucleus BE	987.43 MeV
SAM lines	467
SAM line nucleus BE	1039.08 MeV

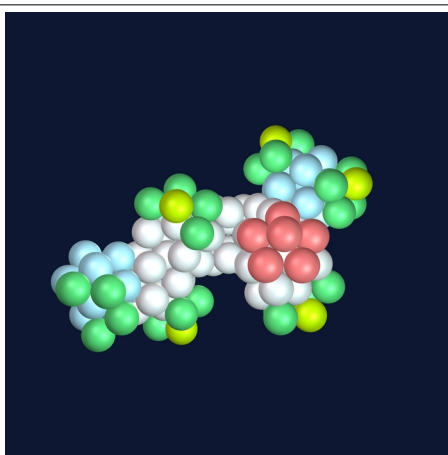


Cadmium-116 is the last (semi) stable isotope of cadmium with a half-life of 3.1×10^{19} years via a double β^- decay process.

The elements and their isotopes

051 In - Indium 113

Atomic number	51 (49)
Total number of protons	113
Number of deuterons	51
Number of single protons	6
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	0
Number of quasi inner electrons	8
Total number of inner electrons	56
Total number of outer electrons	49
Group	13
Isotope abundance	4.28%
Element abundance Earth	0.000016%
Half-life	Stable
Valence / Oxidation state	1, 2, 3
Magnetic dipole moment	5.5408 μN
Spin	9/2
Electron affinity	0.38392 eV
MBS radius	10.30
MBS Vol./#p	40.50
Average nucleon BE	8.523 MeV
Nucleus BE	963.09 MeV
SAM lines	456
SAM line nucleus BE	1014.6 MeV

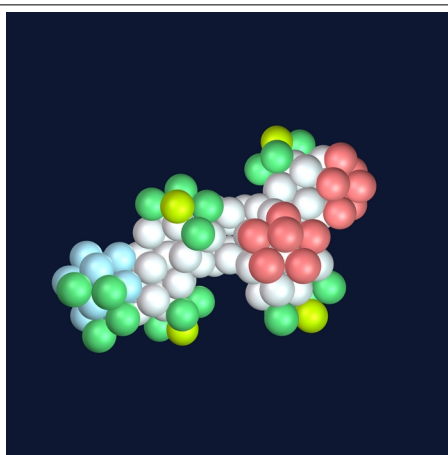


Indium-113 is a stable isotope of indium.

The elements and their isotopes

052 Sn - Tin 114

Atomic number	52 (50)
Total number of protons	114
Number of deuterons	52
Number of single protons	6
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	0
Number of quasi inner electrons	8
Total number of inner electrons	56
Total number of outer electrons	50
Group	14
Isotope abundance	0.66%
Element abundance Earth	0.00022%
Half-life	Stable
Valence / Oxidation state	-4, 2, 4
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	10.26
MBS Vol./#p	39.73
Average nucleon BE	8.523 MeV
Nucleus BE	971.57 MeV
SAM lines	459
SAM line nucleus BE	1021.28 MeV

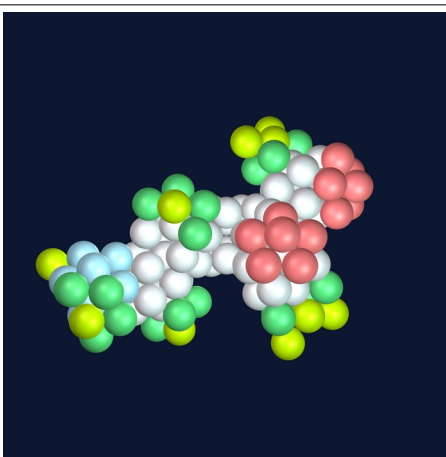


Tin-114 is a stable isotope of tin.

The elements and their isotopes

052 Sn - Tin 120

Atomic number	52 (50)
Total number of protons	120
Number of deuterons	52
Number of single protons	6
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	5
Number of quasi inner electrons	8
Total number of inner electrons	62
Total number of outer electrons	50
Group	14
Isotope abundance	32.58%
Element abundance Earth	0.00022%
Half-life	Stable
Valence / Oxidation state	-4, 2, 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	1.112070 eV
MBS radius	10.52
MBS Vol./#p	40.60
Average nucleon BE	8.504 MeV
Nucleus BE	1020.540 MeV
SAM lines	479
SAM line nucleus BE	1065.76 MeV

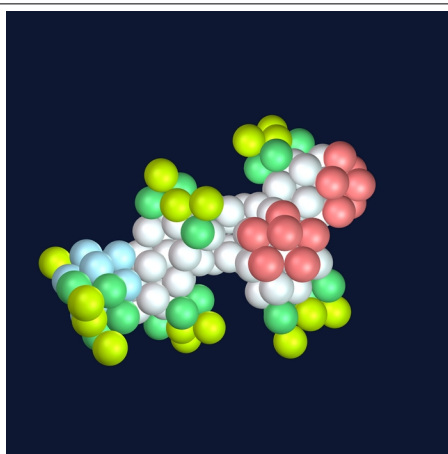


Tin-120 is a stable isotope of tin.

The elements and their isotopes

052 Sn - Tin 126

Atomic number	52 (50)
Total number of protons	126
Number of deuterons	52
Number of single protons	6
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	12
Number of quasi inner electrons	8
Total number of inner electrons	68
Total number of outer electrons	50
Group	14
Isotope abundance	Trace
Element abundance Earth	0.00022%
Half-life	2.3×10^5 y
Valence / Oxidation state	-4, 2, 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	10.54
MBS Vol./#p	38.91
Average nucleon BE	8.444 MeV
Nucleus BE	1063.88 MeV
SAM lines	497
SAM line nucleus BE	1105.83 MeV

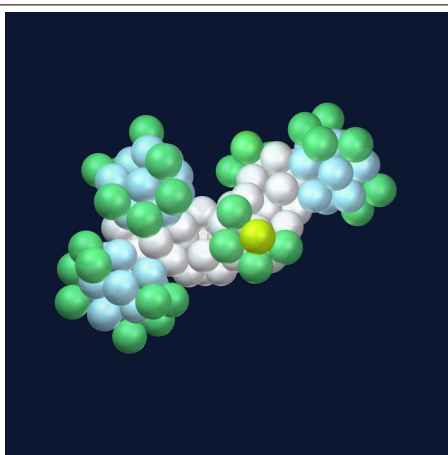


Tin-126 is an unstable isotope of tin which will decay into antimony-126.

The elements and their isotopes

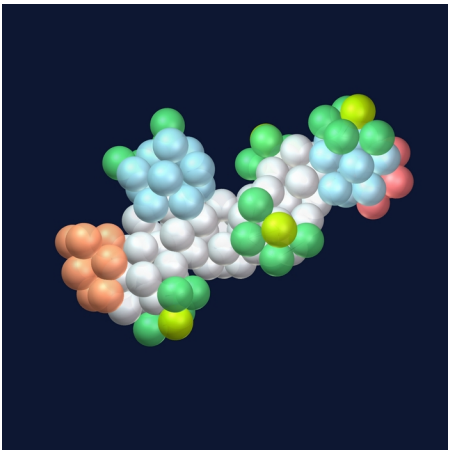
052 Missing element 112

Atomic number	52
Total number of protons	112
Number of deuterons	52
Number of single protons	6
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	8
Total number of inner electrons	54
Total number of outer electrons	50
Group	(18)
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	(0)
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	10.57
MBS Vol./#p	44.21
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	449
SAM line nucleus BE	999.23 MeV



This missing element is a noble gas.

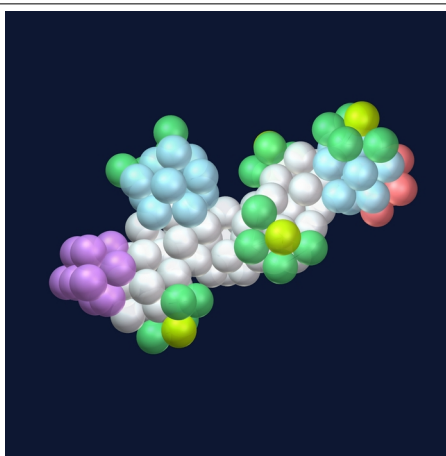
053 Missing element 116

Atomic number	53	 This missing element reflects a complex metal and is expected to be highly unstable.
Total number of protons	116	
Number of deuterons	53	
Number of single protons	6	
Number of additional req. proton-electron pairs	4	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	8	
Total number of inner electrons	57	
Total number of outer electrons	51	
Group	N/A	
Isotope abundance	N/A	
Element abundance Earth	N/A	
Half-life	N/A	
Valence / Oxidation state	N/A	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	10.97	
MBS Vol./#p	47.63	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	467	
SAM line nucleus BE	1039.08 MeV	

The elements and their isotopes

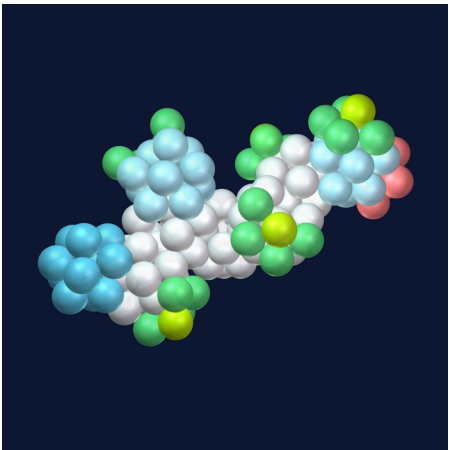
054 Missing element 118

Atomic number	54
Total number of protons	118
Number of deuterons	54
Number of single protons	6
Number of additional req. proton-electron pairs	4
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	8
Total number of inner electrons	58
Total number of outer electrons	52
Group	N/A
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	N/A
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	11.45
MBS Vol./#p	53.26
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	475
SAM line nucleus BE	1056.88 MeV



This missing element reflects a complex metal and is expected to be highly unstable.

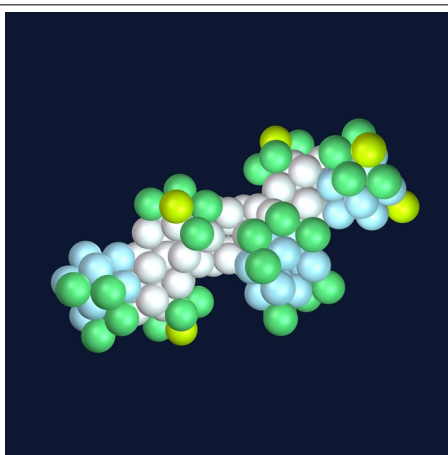
054 Missing element 119

Atomic number	54	 This missing element reflects a complex metal and is considered unstable.
Total number of protons	119	
Number of deuterons	54	
Number of single protons	7	
Number of additional req. proton-electron pairs	4	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	10	
Total number of inner electrons	58	
Total number of outer electrons	51	
Group	N/A	
Isotope abundance	N/A	
Element abundance Earth	N/A	
Half-life	N/A	
Valence / Oxidation state	N/A	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	11.48	
MBS Vol./#p	53.31	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	480	
SAM line nucleus BE	1068 MeV	

The elements and their isotopes

055 Te - Tellurium 122

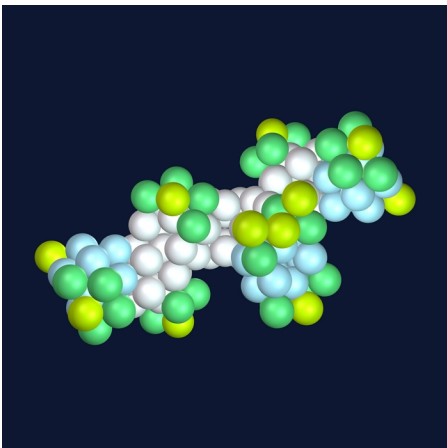
Atomic number	55 (52)
Total number of protons	122
Number of deuterons	55
Number of single protons	7
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	1
Number of quasi inner electrons	10
Total number of inner electrons	60
Total number of outer electrons	52
Group	16
Isotope abundance	2.55%
Element abundance Earth	$1 \times 10^{-7}\%$
Half-life	Stable
Valence / Oxidation state	-2, 2, 4, 5, 6
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	11.26
MBS Vol./#p	49.05
Average nucleon BE	8.478 MeV
Nucleus BE	1034.33 MeV
SAM lines	491
SAM line nucleus BE	1092.48 MeV



Tellurium-122 is a stable isotope of tellurium.

The elements and their isotopes

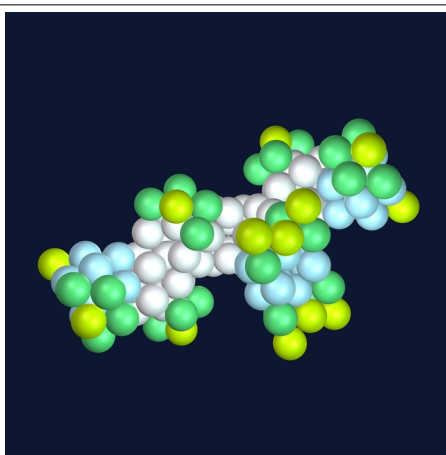
055 Te - Tellurium 128

Atomic number	55 (52)	 Tellurium-128 is a (semi) stable isotope of tellurium. It is measured to have a half-life of 2.2×10^{24} years and transmutes via double β^- decay to xenon-128.
Total number of protons	128	
Number of deuterons	55	
Number of single protons	7	
Number of additional req. proton-electron pairs	3	
Number of additional gap proton-electron pairs	1	
Number of additional proton-electron pairs	7	
Number of quasi inner electrons	10	
Total number of inner electrons	66	
Total number of outer electrons	52	
Group	16	
Isotope abundance	31.74%	
Element abundance Earth	$1 \times 10^{-7}\%$	
Half-life	2.2×10^{24} y	
Valence / Oxidation state	-2, 2, 4, 5, 6	
Magnetic dipole moment	0 μ N	
Spin	0	
Electron affinity	N/A	
MBS radius	11.67	
MBS Vol./#p	52.02	
Average nucleon BE	8.449 MeV	
Nucleus BE	1081.44 MeV	
SAM lines	509	
SAM line nucleus BE	1132.53 MeV	

The elements and their isotopes

055 Te - Tellurium 130

Atomic number	55 (52)
Total number of protons	130
Number of deuterons	55
Number of single protons	7
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	9
Number of quasi inner electrons	10
Total number of inner electrons	68
Total number of outer electrons	52
Group	16
Isotope abundance	34.08%
Element abundance Earth	$1 \times 10^{-7}\%$
Half-life	8.2×10^{20} y
Valence / Oxidation state	-2, 2, 4, 5, 6
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	1.970875 eV
MBS radius	11.67
MBS Vol./#p	51.22
Average nucleon BE	8.430 MeV
Nucleus BE	1095.94 MeV
SAM lines	515
SAM line nucleus BE	1145.88 MeV

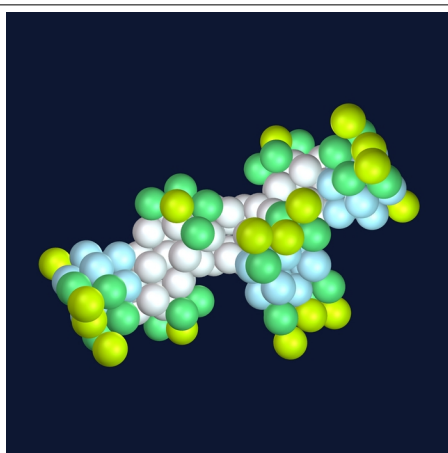


Tellurium-130 is a (semi) stable isotope of tellurium. It is suspected of undergoing double β -decay to xenon-130.

The elements and their isotopes

055 Te - Tellurium 134

Atomic number	55 (52)
Total number of protons	134
Number of deuterons	55
Number of single protons	7
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	13
Number of quasi inner electrons	10
Total number of inner electrons	72
Total number of outer electrons	52
Group	16
Isotope abundance	Artificial
Element abundance Earth	$1 \times 10^{-7}\%$
Half-life	41.8 m
Valence / Oxidation state	-2, 2, 4, 5, 6
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	11.67
MBS Vol./#p	49.69
Average nucleon BE	8.384 MeV
Nucleus BE	1123.41 MeV
SAM lines	527
SAM line nucleus BE	1172.58 MeV

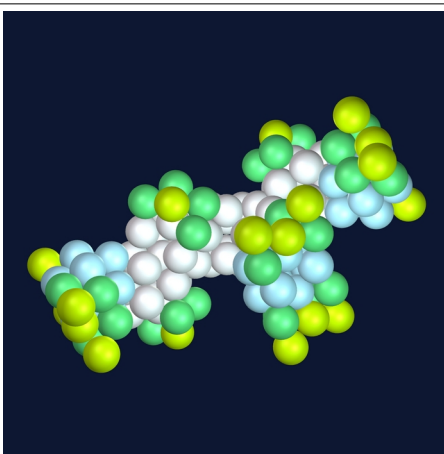


Tellurium-134 is an unstable isotope of tellurium.

The elements and their isotopes

055 Te - Tellurium 135

Atomic number	55 (52)
Total number of protons	135
Number of deuterons	55
Number of single protons	7
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	14
Number of quasi inner electrons	10
Total number of inner electrons	73
Total number of outer electrons	52
Group	16
Isotope abundance	Artificial
Element abundance Earth	$1 \times 10^{-7}\%$
Half-life	19 s
Valence / Oxidation state	-2, 2, 4, 5, 6
Magnetic dipole moment	-0.69 μN
Spin	7/2
Electron affinity	N/A
MBS radius	11.67
MBS Vol./#p	49.32
Average nucleon BE	8.348 MeV
Nucleus BE	1126.67 MeV
SAM lines	530
SAM line nucleus BE	1179.25 MeV

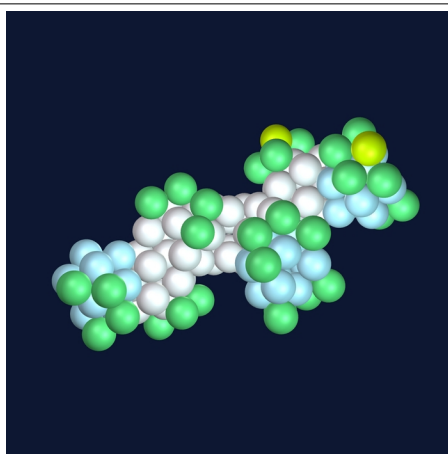


Tellurium-135 is an unstable isotope of tellurium.

The elements and their isotopes

056 Sb - Antimony 121

Atomic number	56 (51)
Total number of protons	121
Number of deuterons	56
Number of single protons	7
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	12
Total number of inner electrons	58
Total number of outer electrons	51
Group	15
Isotope abundance	57.21%
Element abundance Earth	0.00002%
Half-life	Stable
Valence / Oxidation state	-3, 3, 5
Magnetic dipole moment	3.3634 μN
Spin	5/2
Electron affinity	1.047401 eV
MBS radius	11.26
MBS Vol./#p	49.46
Average nucleon BE	8.482 MeV
Nucleus BE	1026.33 MeV
SAM lines	486
SAM line nucleus BE	1081.35 MeV

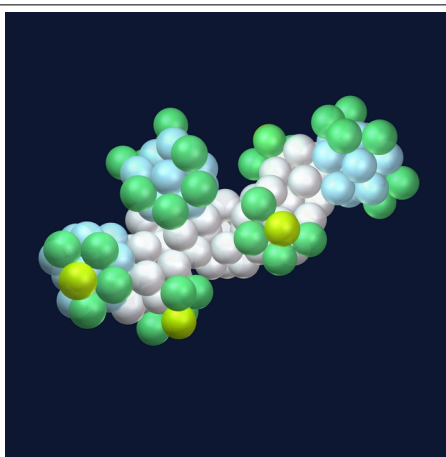


Antimony-121 is a stable isotope of antimony.

The elements and their isotopes

057 Missing element 125

Atomic number	57
Total number of protons	125
Number of deuterons	57
Number of single protons	7
Number of additional req. proton-electron pairs	4
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	12
Total number of inner electrons	61
Total number of outer electrons	52
Group	N/A
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	(-1, -2, +1, +2)
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	11.29
MBS Vol./#p	48.18
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	504
SAM line nucleus BE	1121.4 MeV

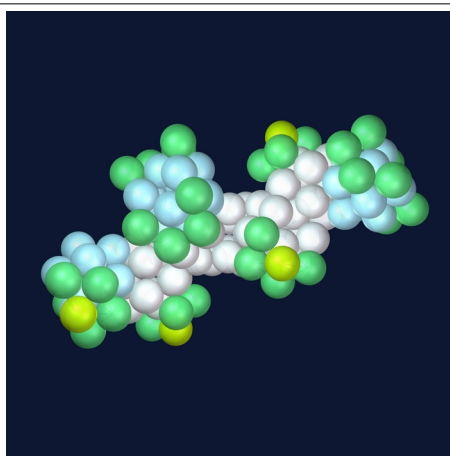


This missing element reflects a metal with one oxygen-like ending.

The elements and their isotopes

058 I - Iodine 127

Atomic number	58 (53)
Total number of protons	127
Number of deuterons	58
Number of single protons	7
Number of additional req. proton-electron pairs	4
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	12
Total number of inner electrons	62
Total number of outer electrons	53
Group	17
Isotope abundance	100.00%
Element abundance Earth	0.000049%
Half-life	Stable
Valence / Oxidation state	-1, 1, 3, 4, 5, 7
Magnetic dipole moment	2.813273 μN
Spin	5/2
Electron affinity	3.059 046 5 eV
MBS radius	11.51
MBS Vol./#p	50.28
Average nucleon BE	8.445 MeV
Nucleus BE	1072.58 MeV
SAM lines	512
SAM line nucleus BE	1139.20 MeV

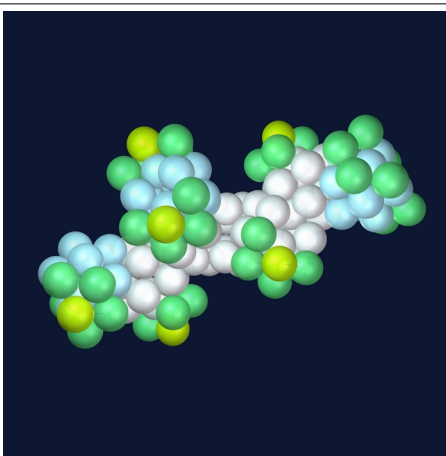


Iodine-127 is a stable isotope of iodine.

The elements and their isotopes

058 I - Iodine 129

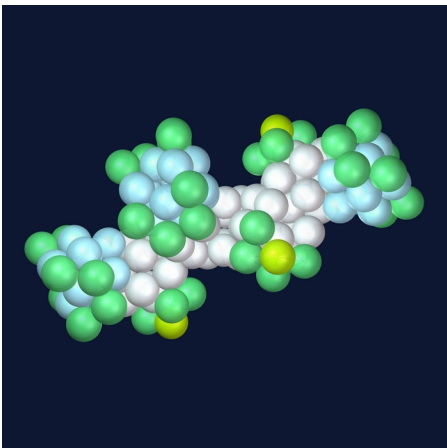
Atomic number	58 (53)
Total number of protons	129
Number of deuterons	58
Number of single protons	7
Number of additional req. proton-electron pairs	4
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	2
Number of quasi inner electrons	12
Total number of inner electrons	64
Total number of outer electrons	53
Group	17
Isotope abundance	Trace
Element abundance Earth	0.000049%
Half-life	1.57×10^7 y
Valence / Oxidation state	-1, 1, 3, 4, 5, 7
Magnetic dipole moment	2.621 μ N
Spin	7/2
Electron affinity	N/A
MBS radius	11.51
MBS Vol./#p	49.5
Average nucleon BE	8.436 MeV
Nucleus BE	1088.24 MeV
SAM lines	522
SAM line nucleus BE	1161.45 MeV



Iodine-129 is an unstable isotope of iodine and decays into xenon-129.

The elements and their isotopes

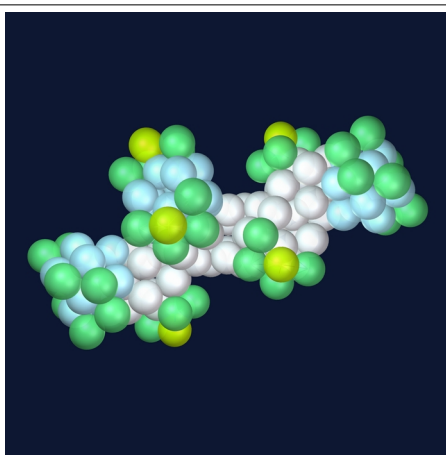
059 Xe - Xenon 128

Atomic number	59 (54)	 Xenon-128 is a stable isotope of xenon. Xenon is one of the known noble gasses.
Total number of protons	128	
Number of deuterons	59	
Number of single protons	7	
Number of additional req. proton-electron pairs	3	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	12	
Total number of inner electrons	62	
Total number of outer electrons	54	
Group	18	
Isotope abundance	1.91%	
Element abundance Earth	$2 \times 10^{-9}\%$	
Half-life	Stable	
Valence / Oxidation state	0, 2, 4, 6, 8	
Magnetic dipole moment	0 μN	
Spin	0	
Electron affinity	N/A	
MBS radius	11.67	
MBS Vol./#p	52.02	
Average nucleon BE	8.443 MeV	
Nucleus BE	1080.74 MeV	
SAM lines	515	
SAM line nucleus BE	1145.88 MeV	

The elements and their isotopes

059 Xe - Xenon 130

Atomic number	59 (54)
Total number of protons	130
Number of deuterons	59
Number of single protons	7
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	2
Number of quasi inner electrons	12
Total number of inner electrons	64
Total number of outer electrons	54
Group	18
Isotope abundance	4.07%
Element abundance Earth	$2 \times 10^{-9}\%$
Half-life	4.071%
Valence / Oxidation state	0, 2, 4, 6, 8
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	11.67
MBS Vol./#p	51.22
Average nucleon BE	8.438 MeV
Nucleus BE	1096.91 MeV
SAM lines	525
SAM line nucleus BE	1168.13 MeV

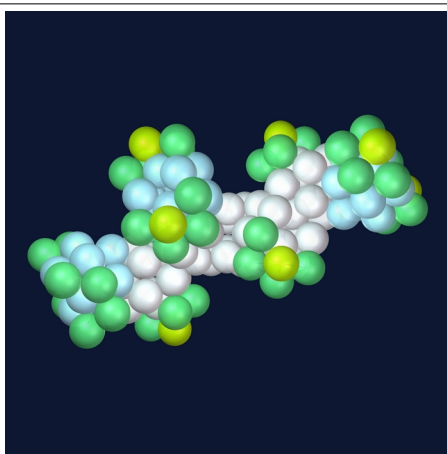


Xenon-130 is a stable isotope of xenon.

The elements and their isotopes

059 Xe - Xenon 132

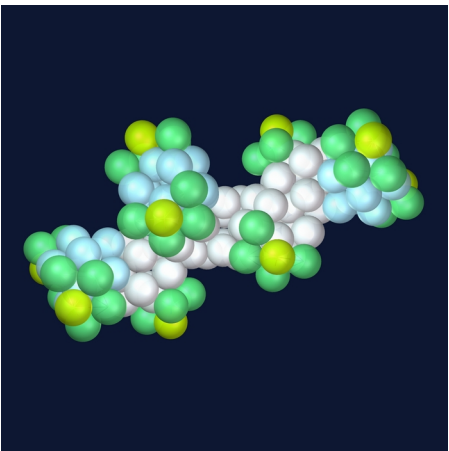
Atomic number	59 (54)
Total number of protons	132
Number of deuterons	59
Number of single protons	7
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	4
Number of quasi inner electrons	12
Total number of inner electrons	66
Total number of outer electrons	54
Group	18
Isotope abundance	26.91%
Element abundance Earth	$2 \times 10^{-9}\%$
Half-life	Stable
Valence / Oxidation state	0, 2, 4, 6, 8
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	-0.8 eV
MBS radius	11.8
MBS Vol./#p	52.2
Average nucleon BE	8.427 MeV
Nucleus BE	1112.45 MeV
SAM lines	535
SAM line nucleus BE	1190.38 MeV



Xenon-132 is a stable isotope of xenon.

The elements and their isotopes

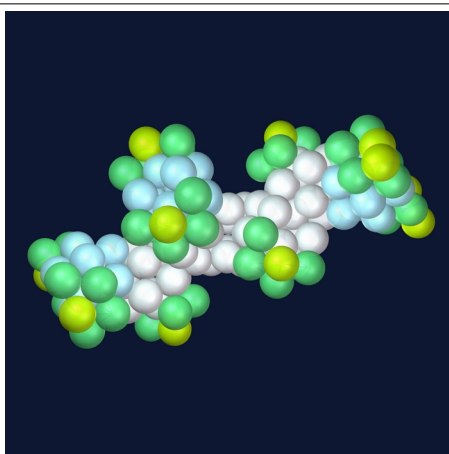
059 Xe - Xenon 134

Atomic number	59 (54)	 Xenon-134 is a stable isotope of xenon.
Total number of protons	134	
Number of deuterons	59	
Number of single protons	7	
Number of additional req. proton-electron pairs	3	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	6	
Number of quasi inner electrons	12	
Total number of inner electrons	68	
Total number of outer electrons	54	
Group	18	
Isotope abundance	10.436%	
Element abundance Earth	$2 \times 10^{-9}\%$	
Half-life	Stable	
Valence / Oxidation state	0, 2, 4, 6, 8	
Magnetic dipole moment	0 μN	
Spin	0	
Electron affinity	N/A	
MBS radius	11.91	
MBS Vol./#p	52.78	
Average nucleon BE	8.414 MeV	
Nucleus BE	1127.44 MeV	
SAM lines	545	
SAM line nucleus BE	1212.63 MeV	

The elements and their isotopes

059 Xe - Xenon 136

Atomic number	59 (54)
Total number of protons	136
Number of deuterons	59
Number of single protons	7
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	8
Number of quasi inner electrons	12
Total number of inner electrons	70
Total number of outer electrons	54
Group	18
Isotope abundance	8.857%
Element abundance Earth	$2 \times 10^{-9}\%$
Half-life	2.165×10^{21} y
Valence / Oxidation state	0, 2, 4, 6, 8
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	12.13
MBS Vol./#p	54.92
Average nucleon BE	8.396 MeV
Nucleus BE	1141.88 MeV
SAM lines	551
SAM line nucleus BE	1225.98 MeV

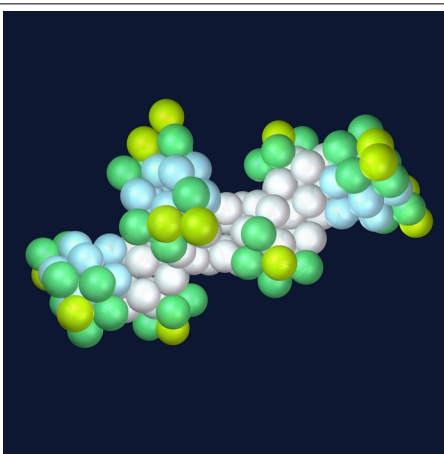


Xenon-136 is a (semi) stable isotope of xenon. It shows double β - decay into barium-136 and is used for the search of so called “neutrinoless” double β decay steps.

The elements and their isotopes

059 Xe - Xenon 138

Atomic number	59 (54)
Total number of protons	138
Number of deuterons	59
Number of single protons	7
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	10
Number of quasi inner electrons	12
Total number of inner electrons	72
Total number of outer electrons	54
Group	18
Isotope abundance	Artificial
Element abundance Earth	$2 \times 10^{-9}\%$
Half-life	14.08 m
Valence / Oxidation state	0, 2, 4, 6, 8
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A
MBS radius	12.13
MBS Vol./#p	54.13
Average nucleon BE	8.345 MeV
Nucleus BE	1151.57 MeV
SAM lines	557
SAM line nucleus BE	1239.33 MeV

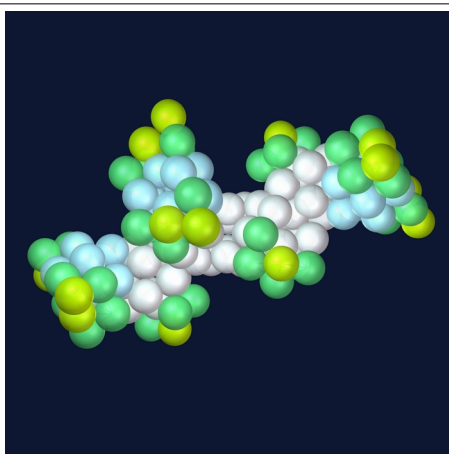


Xenon-138 is an unstable isotope of xenon.

The elements and their isotopes

059 Xe - Xenon 139

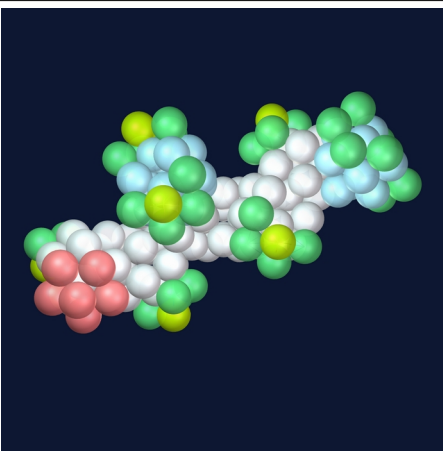
Atomic number	59 (54)
Total number of protons	139
Number of deuterons	59
Number of single protons	7
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	11
Number of quasi inner electrons	12
Total number of inner electrons	73
Total number of outer electrons	54
Group	18
Isotope abundance	Artificial
Element abundance Earth	$2 \times 10^{-9}\%$
Half-life	39.68 s
Valence / Oxidation state	0, 2, 4, 6, 8
Magnetic dipole moment	-0.304 μN
Spin	3/2
Electron affinity	N/A
MBS radius	12.13
MBS Vol./#p	53.74
Average nucleon BE	8.311 MeV
Nucleus BE	1155.31 MeV
SAM lines	560
SAM line nucleus BE	1246.00 MeV



Xenon-139 is an unstable isotope of xenon.

The sixth row

060 Cs - Cesium 133

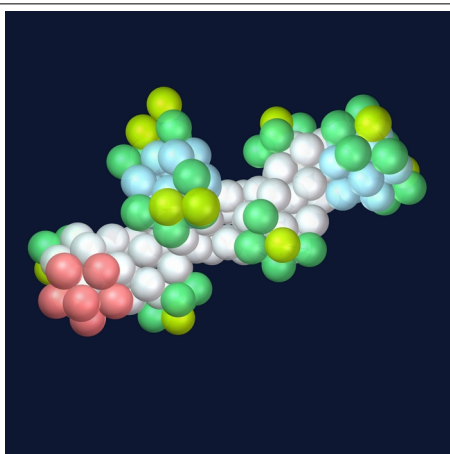
Atomic number	60 (55)	
Total number of protons	133	
Number of deuterons	60	
Number of single protons	7	
Number of additional req. proton-electron pairs	4	
Number of additional gap proton-electron pairs	2	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	12	
Total number of inner electrons	66	
Total number of outer electrons	55	
Group	1	
Isotope abundance	100.00%	
Element abundance Earth	0.00019%	
Half-life	Stable	
Valence / Oxidation state	-1, 1	
Magnetic dipole moment	2.582025 μN	
Spin	7/2	
Electron affinity	0.471630 eV	
MBS radius	11.8	
MBS Vol./#p	51.81	
Average nucleon BE	8.410 MeV	
Nucleus BE	1118.53 MeV	
SAM lines	538	
SAM line nucleus BE	1197.05 MeV	

Cesium-133 is a stable isotope of cesium. This is an alkali metal again.

The elements and their isotopes

060 Cs - Cesium 137

Atomic number	60 (55)
Total number of protons	137
Number of deuterons	60
Number of single protons	7
Number of additional req. proton-electron pairs	4
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	4
Number of quasi inner electrons	12
Total number of inner electrons	70
Total number of outer electrons	55
Group	1
Isotope abundance	Artificial
Element abundance Earth	0.00019%
Half-life	30.17 y
Valence / Oxidation state	-1, 1
Magnetic dipole moment	2.8413 μN
Spin	7/2
Electron affinity	N/A
MBS radius	11.93
MBS Vol./#p	51.85
Average nucleon BE	8.389 MeV
Nucleus BE	1149.29 MeV
SAM lines	554
SAM line nucleus BE	1232.65 MeV

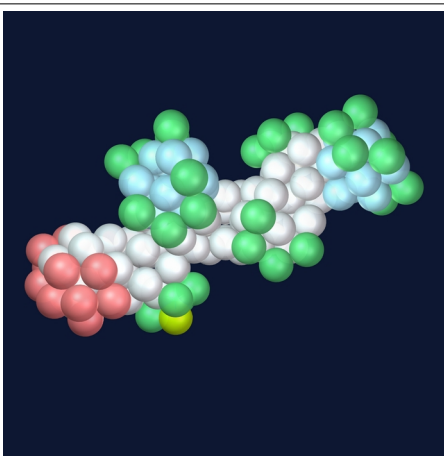


Cesium-137 is an unstable isotope of cesium and a fission product, which will transmute into barium-137 via β^- decay.

The elements and their isotopes

061 Ba - Barium 130

Atomic number	61 (56)
Total number of protons	130
Number of deuterons	61
Number of single protons	7
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	12
Total number of inner electrons	62
Total number of outer electrons	56
Group	2
Isotope abundance	0.11%
Element abundance Earth	0.034%
Half-life	$0.5-2.7 \times 10^{21}$ y
Valence / Oxidation state	2
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	11.95
MBS Vol./#p	54.97
Average nucleon BE	8.406 MeV
Nucleus BE	1092.72 MeV
SAM lines	521
SAM line nucleus BE	1159.23 MeV

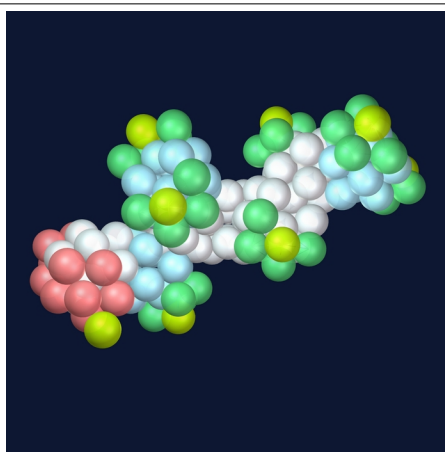


Barium-130 is a stable isotope of barium. This is an alkaline-earth metal.

The elements and their isotopes

061 Ba - Barium 137

Atomic number	61 (56)
Total number of protons	137
Number of deuterons	61
Number of single protons	7
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	7
Number of quasi inner electrons	12
Total number of inner electrons	69
Total number of outer electrons	56
Group	2
Isotope abundance	11.23%
Element abundance Earth	0.034%
Half-life	Stable
Valence / Oxidation state	2
Magnetic dipole moment	0.937365 μN
Spin	3/2
Electron affinity	N/A
MBS radius	12.03
MBS Vol./#p	53.22
Average nucleon BE	8.392 MeV
Nucleus BE	1149.68 MeV
SAM lines	554
SAM line nucleus BE	1232.65 MeV

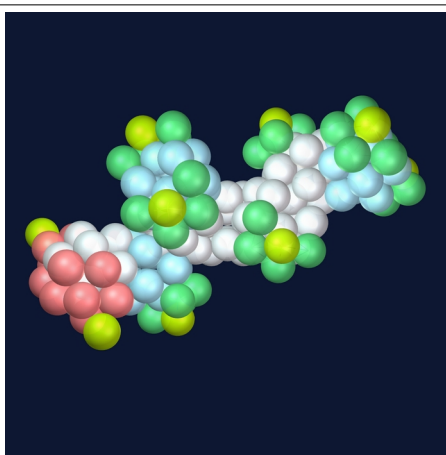


Barium-137 is a stable isotope of barium.

The elements and their isotopes

061 Ba - Barium 138

Atomic number	61 (56)
Total number of protons	138
Number of deuterons	61
Number of single protons	7
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	8
Number of quasi inner electrons	12
Total number of inner electrons	70
Total number of outer electrons	56
Group	2
Isotope abundance	71.70%
Element abundance Earth	0.034%
Half-life	Stable
Valence / Oxidation state	2
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	0.14462 eV
MBS radius	12.04
MBS Vol./#p	52.63
Average nucleon BE	8.393 MeV
Nucleus BE	1158.29 MeV
SAM lines	557
SAM line nucleus BE	1239.33 MeV

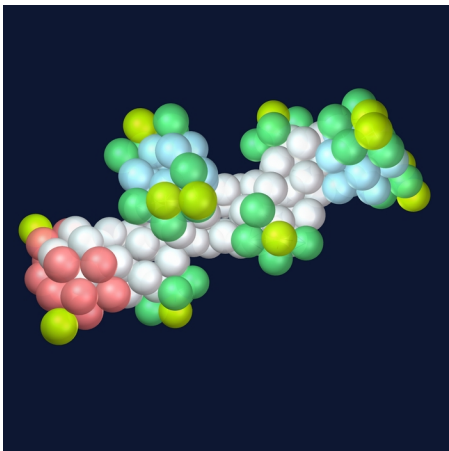


Barium-138 is a stable isotope of barium and a fission product.

The elements and their isotopes

061 Ba - Barium 141

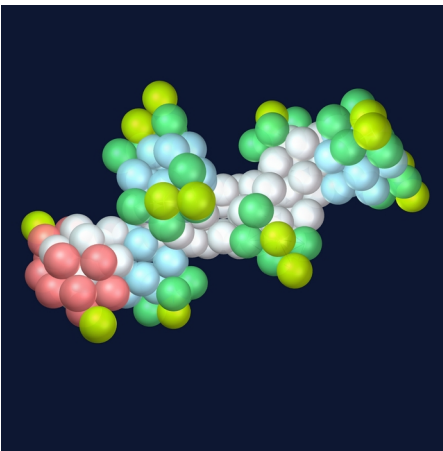
Atomic number	61 (56)
Total number of protons	141
Number of deuterons	61
Number of single protons	7
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	11
Number of quasi inner electrons	12
Total number of inner electrons	73
Total number of outer electrons	56
Group	2
Isotope abundance	Artificial
Element abundance Earth	0.034%
Half-life	18.27 m
Valence / Oxidation state	2
Magnetic dipole moment	-0.337 μ N
Spin	S3/2
Electron affinity	N/A
MBS radius	12.46
MBS Vol./#p	57.41
Average nucleon BE	8.326 MeV
Nucleus BE	1173.98 MeV
SAM lines	566
SAM line nucleus BE	1259.35 MeV



Barium-141 is an unstable isotope of barium, a fission product and will transmute into lanthanum-141 via β^- decay.

The elements and their isotopes

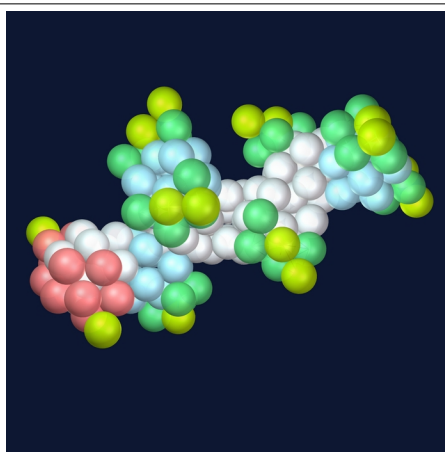
061 Ba - Barium 143

Atomic number	61 (56)	 Barium-143 is an unstable isotope of barium, a fission product and will transmute into lanthanum-143 via β^- decay.
Total number of protons	143	
Number of deuterons	61	
Number of single protons	7	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	13	
Number of quasi inner electrons	12	
Total number of inner electrons	75	
Total number of outer electrons	56	
Group	2	
Isotope abundance	Artificial	
Element abundance Earth	0.034%	
Half-life	14.5 s	
Valence / Oxidation state	2	
Magnetic dipole moment	0.443 μN	
Spin	5/2	
Electron affinity	N/A	
MBS radius	12.3	
MBS Vol./#p	54.48	
Average nucleon BE	8.282 MeV	
Nucleus BE	1184.32 MeV	
SAM lines	572	
SAM line nucleus BE	1272.7 MeV	

The elements and their isotopes

061 Ba - Barium 144

Atomic number	61 (56)
Total number of protons	144
Number of deuterons	61
Number of single protons	7
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	14
Number of quasi inner electrons	12
Total number of inner electrons	76
Total number of outer electrons	56
Group	2
Isotope abundance	Artificial
Element abundance Earth	0.034%
Half-life	11.5 s
Valence / Oxidation state	2
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	12.3
MBS Vol./#p	54.1
Average nucleon BE	8.265 MeV
Nucleus BE	1190.23 MeV
SAM lines	575
SAM line nucleus BE	1279.38 MeV

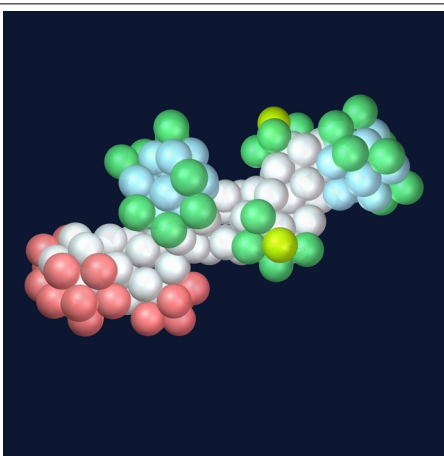


Barium-144 is an unstable isotope of barium, a fission product and will transmute into lanthanum-144 via β^- decay.

The elements and their isotopes

062 Missing element 133

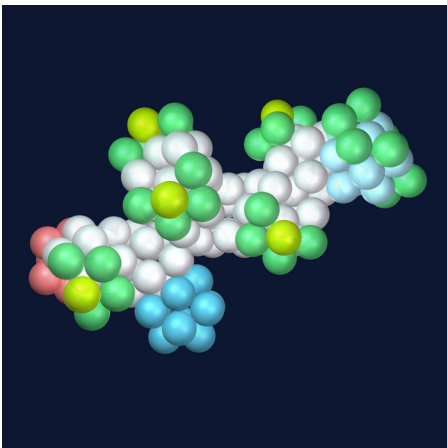
Atomic number	62
Total number of protons	133
Number of deuterons	62
Number of single protons	7
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	12
Total number of inner electrons	64
Total number of outer electrons	57
Group	N/A
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	(3)
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	11.95
MBS Vol./#p	53.73
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	534
SAM line nucleus BE	1188.15 MeV



This missing element would show attributes of the element yttrium. This could be a stable or semi-stable element.

The elements and their isotopes

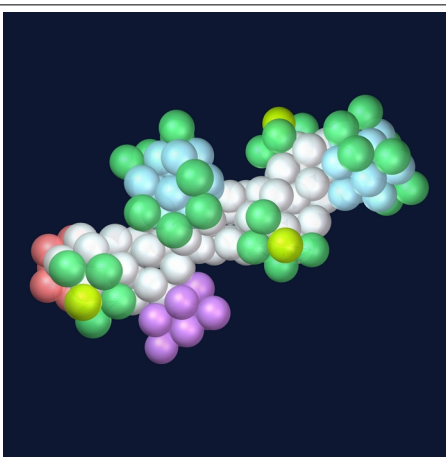
063 La - Lanthanum 139

Atomic number	63 (57)	 Lanthanum-139 is the stable isotope of lanthanum. This is the first element of the so-called rare earth elements row also known as the lanthanides. This structure reflects the maximum elongation of the nucleus.
Total number of protons	139	
Number of deuterons	63	
Number of single protons	8	
Number of additional req. proton-electron pairs	3	
Number of additional gap proton-electron pairs	2	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	14	
Total number of inner electrons	68	
Total number of outer electrons	57	
Group	N/A	
Isotope abundance	99.911%	
Element abundance Earth	0.0034%	
Half-life	Stable	
Valence / Oxidation state	2, 3	
Magnetic dipole moment	2.7830455 μN	
Spin	S7/2	
Electron affinity	0.557546 eV	
MBS radius	11.67	
MBS Vol./#p	48.6	
Average nucleon BE	8.378 MeV	
Nucleus BE	1164.55 MeV	
SAM lines	562	
SAM line nucleus BE	1250.45 MeV	

The elements and their isotopes

063 Ce - Cerium 136

Atomic number	63 (58)
Total number of protons	136
Number of deuterons	63
Number of single protons	7
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	12
Total number of inner electrons	66
Total number of outer electrons	58
Group	N/A
Isotope abundance	0.186%
Element abundance Earth	0.006%
Half-life	Stable
Valence / Oxidation state	2, 3, 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	11.95
MBS Vol./#p	52.54
Average nucleon BE	8.373 MeV
Nucleus BE	1138.83 MeV
SAM lines	547
SAM line nucleus BE	1217.08 MeV

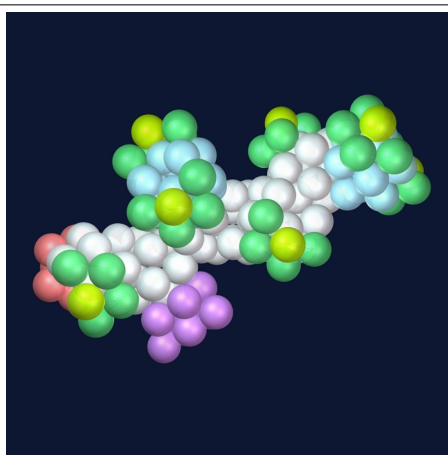


Cerium-136 is a stable isotope of cerium.

The elements and their isotopes

063 Ce - Cerium 140

Atomic number	63 (58)
Total number of protons	140
Number of deuterons	63
Number of single protons	7
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	4
Number of quasi inner electrons	12
Total number of inner electrons	70
Total number of outer electrons	58
Group	N/A
Isotope abundance	88.449%
Element abundance Earth	0.006%
Half-life	Stable
Valence / Oxidation state	2, 3, 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	0.57 eV
MBS radius	11.95
MBS Vol./#p	51.04
Average nucleon BE	8.376 MeV
Nucleus BE	1172.68 MeV
SAM lines	567
SAM line nucleus BE	1261.58 MeV

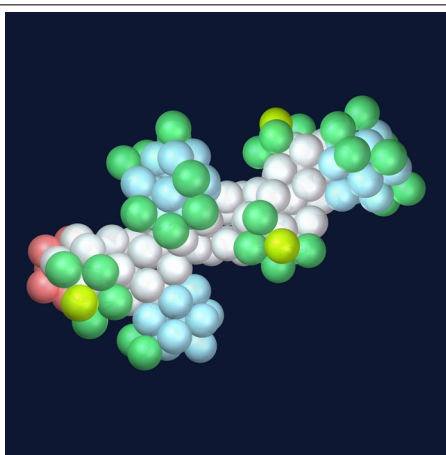


Cerium-140 is a stable isotope of cerium.

The elements and their isotopes

064 Missing element 139

Atomic number	64
Total number of protons	139
Number of deuterons	64
Number of single protons	8
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	14
Total number of inner electrons	67
Total number of outer electrons	58
Group	N/A
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	N/A
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	11.95
MBS Vol./#p	51.41
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	560
SAM line nucleus BE	1246 MeV

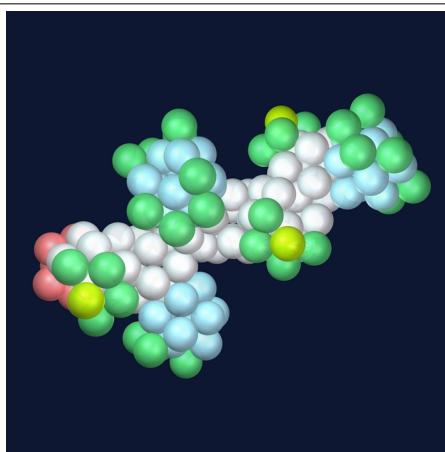


This missing element would have a lithium-nuclelet and a nitrogen-like ending. This is considered to be an unstable configuration.

The elements and their isotopes

065 Pr - Praseodymium 141

Atomic number	65 (59)
Total number of protons	141
Number of deuterons	65
Number of single protons	8
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	14
Total number of inner electrons	68
Total number of outer electrons	59
Group	N/A
Isotope abundance	100.00%
Element abundance Earth	0.00086%
Half-life	Stable
Valence / Oxidation state	2, 3, 4
Magnetic dipole moment	4.2754 μN
Spin	5/2
Electron affinity	0.109 23 eV
MBS radius	11.95
MBS Vol./#p	50.68
Average nucleon BE	8.354 MeV
Nucleus BE	1177.91 MeV
SAM lines	568
SAM line nucleus BE	1263.80 MeV

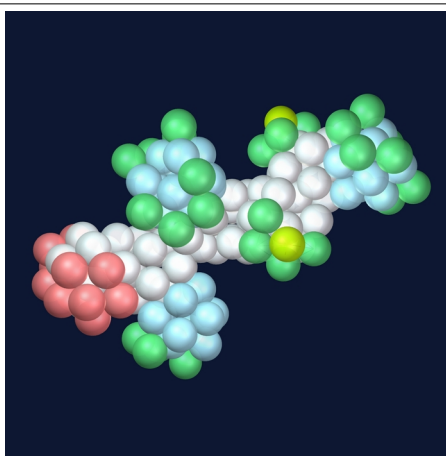


Praseodymium-141 is the only stable isotope of praseodymium.

The elements and their isotopes

066 Nd - Neodymium 142

Atomic number	66 (60)
Total number of protons	142
Number of deuterons	66
Number of single protons	8
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	14
Total number of inner electrons	68
Total number of outer electrons	60
Group	N/A
Isotope abundance	27.20%
Element abundance Earth	0.0033%
Half-life	Stable
Valence / Oxidation state	2, 3
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	0.09749 eV
MBS radius	11.95
MBS Vol./#p	50.32
Average nucleon BE	8.346 MeV
Nucleus BE	1185.14 MeV
SAM lines	571
SAM line nucleus BE	1270.48 MeV

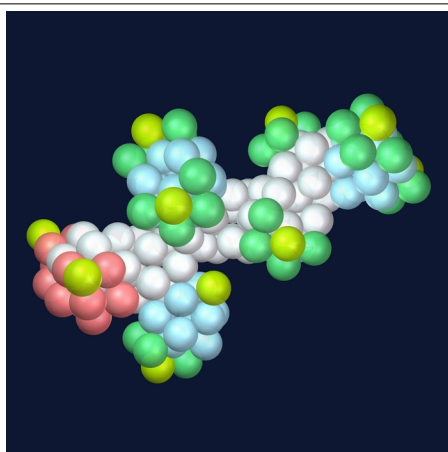


Neodymium-142 is a stable isotope of neodymium.

The elements and their isotopes

066 Nd - Neodymium 150

Atomic number	66 (60)
Total number of protons	150
Number of deuterons	66
Number of single protons	8
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	8
Number of quasi inner electrons	14
Total number of inner electrons	76
Total number of outer electrons	60
Group	N/A
Isotope abundance	5.60%
Element abundance Earth	0.0033%
Half-life	6.7×10^{18} y
Valence / Oxidation state	2, 3
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	12.14
MBS Vol./#p	49.99
Average nucleon BE	8.250 MeV
Nucleus BE	1237.44 MeV
SAM lines	607
SAM line nucleus BE	1350.58 MeV

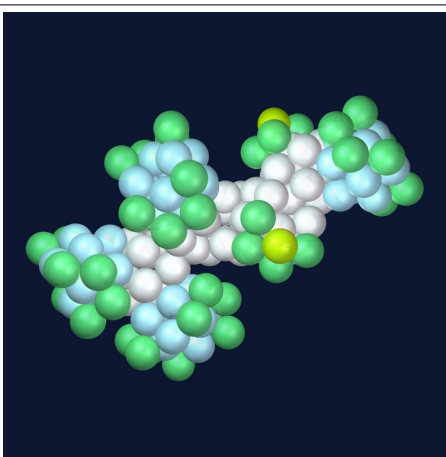


Neodymium-150 is a stable isotope of neodymium.

The elements and their isotopes

066 Missing element 142

Atomic number	66
Total number of protons	142
Number of deuterons	66
Number of single protons	8
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	14
Total number of inner electrons	68
Total number of outer electrons	60
Group	(18)
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	(0)
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	11.67
MBS Vol./#p	46.89
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	571
SAM line nucleus BE	1270.48 MeV

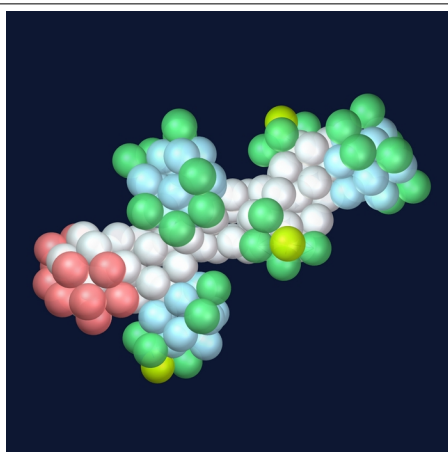


This missing element is a noble gas.

The elements and their isotopes

067 Pr - Promethium 145

Atomic number	67 (61)
Total number of protons	145
Number of deuterons	67
Number of single protons	8
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	14
Total number of inner electrons	70
Total number of outer electrons	61
Group	N/A
Isotope abundance	Trace
Element abundance Earth	0.00%
Half-life	17.7 y
Valence / Oxidation state	3
Magnetic dipole moment	N/A
Spin	5/2
Electron affinity	0.129 eV
MBS radius	11.5
MBS Vol./#p	49.28
Average nucleon BE	8.303 MeV
Nucleus BE	1203.89 MeV
SAM lines	584
SAM line nucleus BE	1299.40 MeV

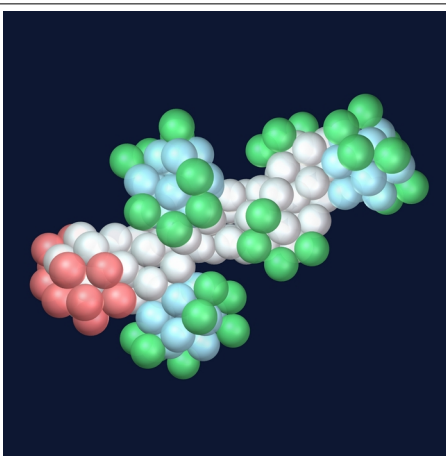


Promethium-145 is like all isotopes of promethium unstable.

The elements and their isotopes

068 Sm - Samarium 144

Atomic number	68 (62)
Total number of protons	144
Number of deuterons	68
Number of single protons	8
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	14
Total number of inner electrons	68
Total number of outer electrons	62
Group	N/A
Isotope abundance	3.08%
Element abundance Earth	0.0006%
Half-life	Stable
Valence / Oxidation state	2, 3
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	11.95
MBS Vol./#p	49.62
Average nucleon BE	8.304 MeV
Nucleus BE	1195.73 MeV
SAM lines	577
SAM line nucleus BE	1283.83 MeV

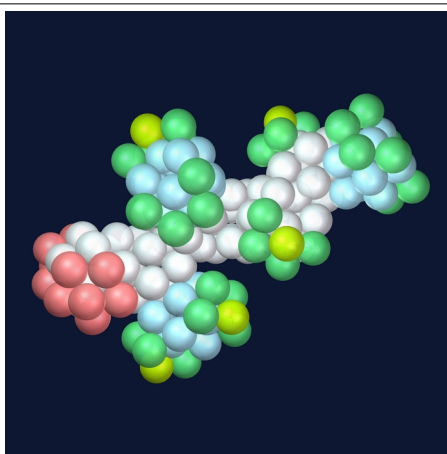


Samarium-144 is a stable isotope of samarium. It is however suspected to undergo double β^+ decay to neodymium-144.

The elements and their isotopes

068 Sm - Samarium 149

Atomic number	68 (62)
Total number of protons	149
Number of deuterons	68
Number of single protons	8
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	5
Number of quasi inner electrons	14
Total number of inner electrons	73
Total number of outer electrons	62
Group	N/A
Isotope abundance	13.82%
Element abundance Earth	0.0006%
Half-life	Stable
Valence / Oxidation state	2, 3
Magnetic dipole moment	-0.6677 μN
Spin	7/2
Electron affinity	N/A
MBS radius	11.95
MBS Vol./#p	47.96
Average nucleon BE	8.263 MeV
Nucleus BE	1231.26 MeV
SAM lines	602
SAM line nucleus BE	1339.45 MeV

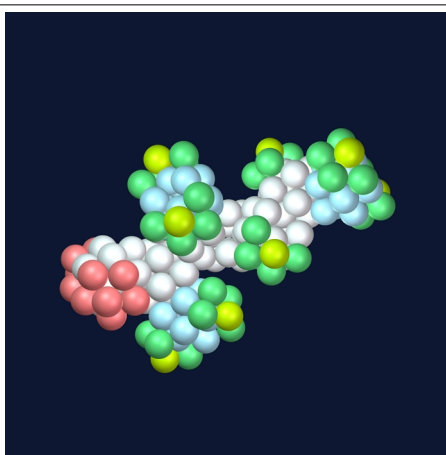


Samarium-149 is a stable isotope of samarium. It is suspected to be able to undergo α decay into neodymium-145.

The elements and their isotopes

068 Sm - Samarium 152

Atomic number	68 (62)
Total number of protons	152
Number of deuterons	68
Number of single protons	8
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	8
Number of additional proton-electron pairs	0
Number of quasi inner electrons	14
Total number of inner electrons	76
Total number of outer electrons	62
Group	N/A
Isotope abundance	26.74%
Element abundance Earth	0.0006%
Half-life	Stable
Valence / Oxidation state	2, 3
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	0.162 eV
MBS radius	12.11
MBS Vol./#p	48.99
Average nucleon BE	8.244 MeV
Nucleus BE	1253.10 MeV
SAM lines	617
SAM line nucleus BE	1372.83 MeV

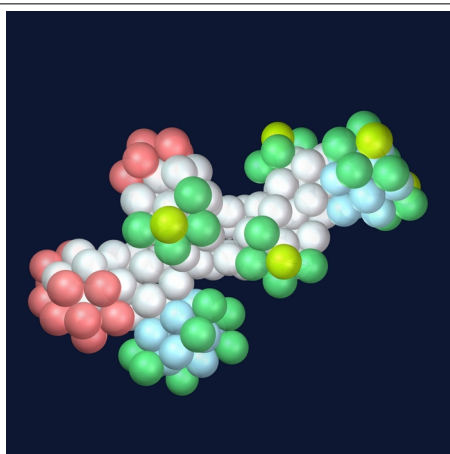


Samarium-152 is a stable isotope of samarium.

The elements and their isotopes

069 Eu - Europium 151

Atomic number	69 (63)
Total number of protons	151
Number of deuterons	69
Number of single protons	8
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	0
Number of quasi inner electrons	14
Total number of inner electrons	74
Total number of outer electrons	63
Group	N/A
Isotope abundance	47.80%
Element abundance Earth	0.00018%
Half-life	5×10^{18} y
Valence / Oxidation state	2, 3
Magnetic dipole moment	3.4717 μ N
Spin	5/2
Electron affinity	N/A
MBS radius	12.11
MBS Vol./#p	49.32
Average nucleon BE	8.239 MeV
Nucleus BE	1244.13 MeV
SAM lines	610
SAM line nucleus BE	1357.25 MeV

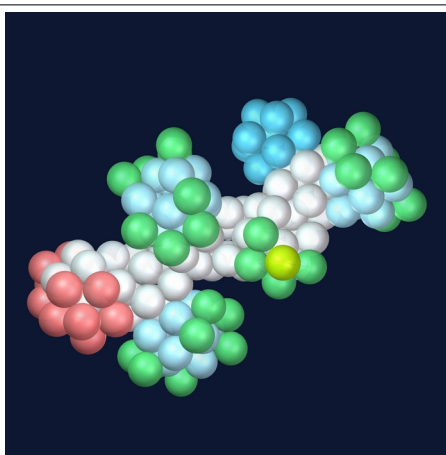


Europium-151 is a (semi) stable isotope of europium. It undergoes α decay to promethium-147.

The elements and their isotopes

069 Eu - Europium 153

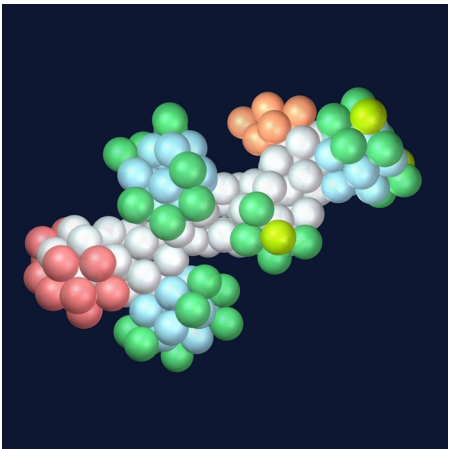
Atomic number	69 (63)
Total number of protons	153
Number of deuterons	69
Number of single protons	8
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	4
Number of additional proton-electron pairs	0
Number of quasi inner electrons	14
Total number of inner electrons	76
Total number of outer electrons	63
Group	N/A
Isotope abundance	52.20%
Element abundance Earth	0.00018%
Half-life	Stable
Valence / Oxidation state	2, 3
Magnetic dipole moment	1.533 μN
Spin	5/2
Electron affinity	0.116 eV
MBS radius	12.11
MBS Vol./#p	48.67
Average nucleon BE	8.229 MeV
Nucleus BE	1258.99 MeV
SAM lines	620
SAM line nucleus BE	1379.50 MeV



Europium-153 is a stable isotope of europium.

070 Missing element 151

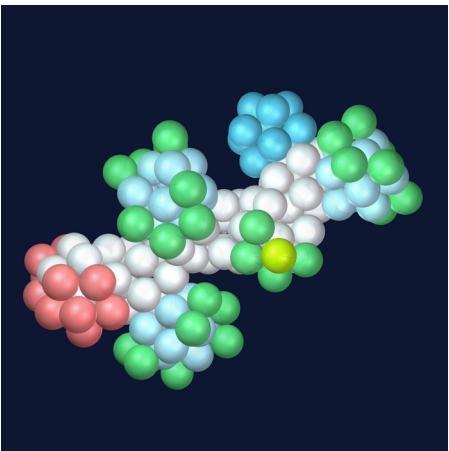
Atomic number	70
Total number of protons	151
Number of deuterons	70
Number of single protons	8
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	0
Number of quasi inner electrons	14
Total number of inner electrons	73
Total number of outer electrons	64
Group	N/A
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	N/A
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	12.11
MBS Vol./#p	49.32
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	608
SAM line nucleus BE	1352.80 MeV



This missing element reflects a complex metal.

The elements and their isotopes

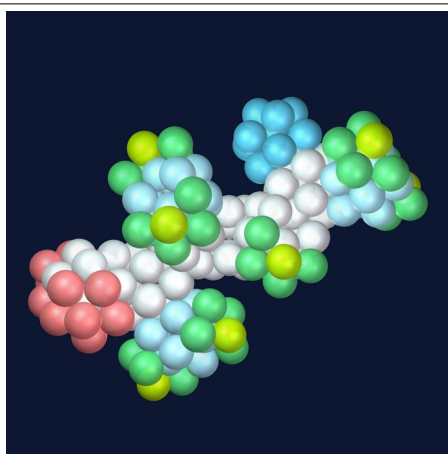
071 Gd - Gadolinium 152

Atomic number	71 (64)	 Gadolinium-152 is a (semi) stable isotope of gadolinium. It undergoes α decay into samarium-148.
Total number of protons	152	
Number of deuterons	71	
Number of single protons	9	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	16	
Total number of inner electrons	72	
Total number of outer electrons	64	
Group	N/A	
Isotope abundance	0.20%	
Element abundance Earth	0.00052%	
Half-life	1.08×10^{14} y	
Valence / Oxidation state	1, 2, 3	
Magnetic dipole moment	0 μ N	
Spin	0	
Electron affinity	N/A	
MBS radius	11.95	
MBS Vol./#p	47.01	
Average nucleon BE	8.233 MeV	
Nucleus BE	1251.48 MeV	
SAM lines	611	
SAM line nucleus BE	1359.48 MeV	

The elements and their isotopes

071 Gd - Gadolinium 158

Atomic number	71 (64)
Total number of protons	158
Number of deuterons	71
Number of single protons	9
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	6
Number of additional proton-electron pairs	0
Number of quasi inner electrons	16
Total number of inner electrons	78
Total number of outer electrons	64
Group	N/A
Isotope abundance	24.84%
Element abundance Earth	0.00052%
Half-life	Stable
Valence / Oxidation state	1, 2, 3
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	0.137 eV
MBS radius	12.11
MBS Vol./#p	47.13
Average nucleon BE	8.201 MeV
Nucleus BE	1295.89 MeV
SAM lines	641
SAM line nucleus BE	1426.23 MeV

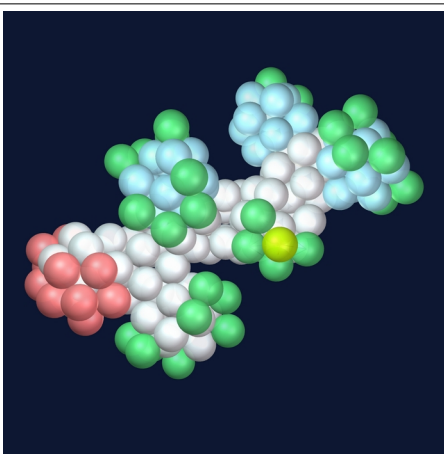


Gadolinium-158 is a stable isotope of gadolinium.

The elements and their isotopes

072 Missing element 154

Atomic number	72
Total number of protons	154
Number of deuterons	72
Number of single protons	9
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	16
Total number of inner electrons	73
Total number of outer electrons	65
Group	N/A
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	N/A
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	11.95
MBS Vol./#p	46.4
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	619
SAM line nucleus BE	1377.28 MeV

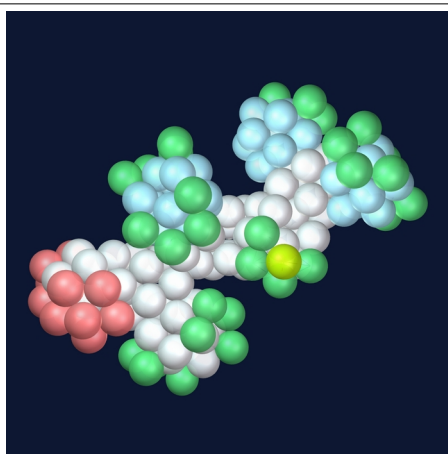


This missing element reflects a complex metal and is considered to be unstable.

The elements and their isotopes

073 Dy - Dysprosium 156

Atomic number	73 (66)
Total number of protons	156
Number of deuterons	73
Number of single protons	9
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	16
Total number of inner electrons	74
Total number of outer electrons	66
Group	N/A
Isotope abundance	0.056%
Element abundance Earth	0.00062%
Half-life	Stable
Valence / Oxidation state	2, 3
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	11.95
MBS Vol./#p	45.81
Average nucleon BE	8.192 MeV
Nucleus BE	1278.02 MeV
SAM lines	627
SAM line nucleus BE	1395.08 MeV

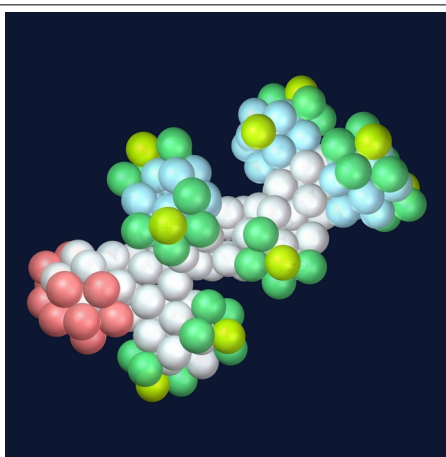


Dysprosium-156 is a stable isotope of dysprosium.

The elements and their isotopes

073 Dy - Dysprosium 164

Atomic number	73 (66)
Total number of protons	164
Number of deuterons	73
Number of single protons	9
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	8
Number of additional proton-electron pairs	0
Number of quasi inner electrons	16
Total number of inner electrons	82
Total number of outer electrons	66
Group	N/A
Isotope abundance	28.260%
Element abundance Earth	0.00062%
Half-life	Stable
Valence / Oxidation state	2, 3
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	0.352 eV
MBS radius	12.11
MBS Vol./#p	45.41
Average nucleon BE	8.186 MeV
Nucleus BE	1338.03 MeV
SAM lines	665
SAM line nucleus BE	1479.63 MeV

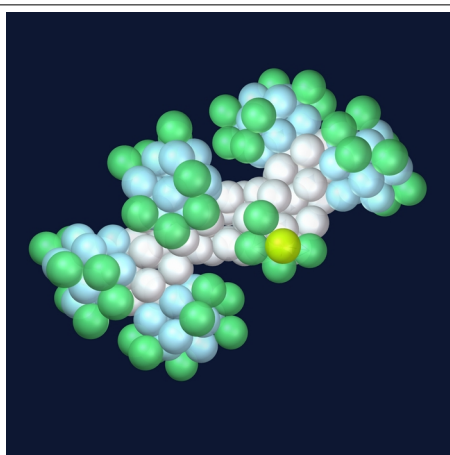


Dysprosium-164 is a stable isotope of dysprosium.

The elements and their isotopes

073 Missing element 156

Atomic number	73
Total number of protons	156
Number of deuterons	73
Number of single protons	9
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	16
Total number of inner electrons	74
Total number of outer electrons	66
Group	N/A
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	(0)
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	11.67
MBS Vol./#p	42.68
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	627
SAM line nucleus BE	1395.08 MeV

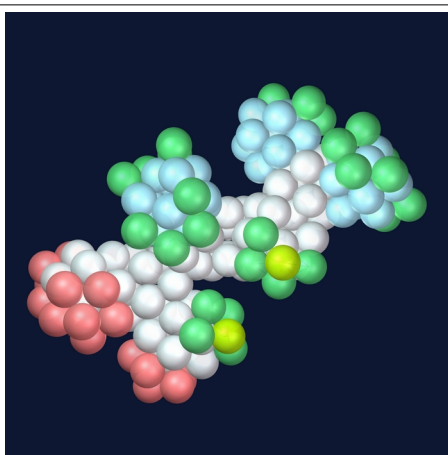


This missing element is a noble gas.

The elements and their isotopes

074 Tb - Terbium 159

Atomic number	74 (65)
Total number of protons	159
Number of deuterons	74
Number of single protons	9
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	18
Total number of inner electrons	76
Total number of outer electrons	65
Group	N/A
Isotope abundance	100.00%
Element abundance Earth	0.000093%
Half-life	Stable
Valence / Oxidation state	1, 3, 4
Magnetic dipole moment	2.014 μ N
Spin	3/2
Electron affinity	0.131 31 eV
MBS radius	11.95
MBS Vol./#p	44.94
Average nucleon BE	8.189 MeV
Nucleus BE	1302.02 MeV
SAM lines	640
SAM line nucleus BE	1424.00 MeV

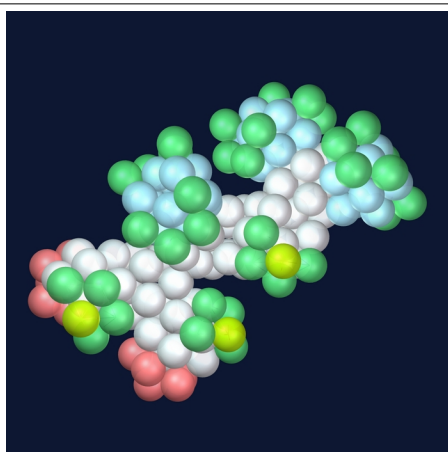


Terbium-159 is the only stable isotope of terbium.

The elements and their isotopes

075 Er - Erbium 162

Atomic number	75 (68)
Total number of protons	162
Number of deuterons	75
Number of single protons	9
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	16
Total number of inner electrons	78
Total number of outer electrons	68
Group	N/A
Isotope abundance	0.139%
Element abundance Earth	0.0003%
Half-life	Stable
Valence / Oxidation state	3
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	11.95
MBS Vol./#p	44.11
Average nucleon BE	8.150 MeV
Nucleus BE	1320.69 MeV
SAM lines	653
SAM line nucleus BE	1452.93 MeV

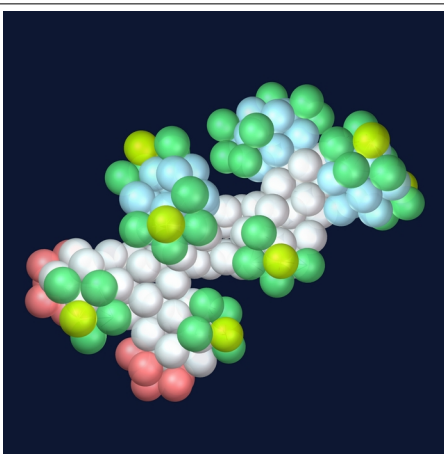


Erbium-162 is a stable isotope of erbium.

The elements and their isotopes

075 Er - Erbium 166

Atomic number	75 (68)
Total number of protons	166
Number of deuterons	75
Number of single protons	9
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	4
Number of additional proton-electron pairs	0
Number of quasi inner electrons	16
Total number of inner electrons	82
Total number of outer electrons	68
Group	N/A
Isotope abundance	33.500%
Element abundance Earth	0.0003%
Half-life	Stable
Valence / Oxidation state	3
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	0.312 eV
MBS radius	12.11
MBS Vol./#p	44.86
Average nucleon BE	8.141 MeV
Nucleus BE	1351.57 MeV
SAM lines	673
SAM line nucleus BE	1497.43 MeV

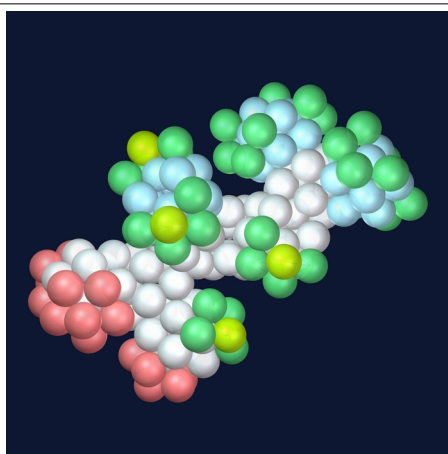


Erbium-166 is a stable isotope of erbium.

The elements and their isotopes

076 Ho - Holmium 165

Atomic number	76 (67)
Total number of protons	165
Number of deuterons	76
Number of single protons	9
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	0
Number of quasi inner electrons	18
Total number of inner electrons	80
Total number of outer electrons	67
Group	N/A
Isotope abundance	100.00%
Element abundance Earth	0.00012%
Half-life	Stable
Valence / Oxidation state	3
Magnetic dipole moment	4.177 μN
Spin	7/2
Electron affinity	0.338 eV
MBS radius	11.95
MBS Vol./#p	43.31
Average nucleon BE	8.147 MeV
Nucleus BE	1344.25 MeV
SAM lines	666
SAM line nucleus BE	1481.85 MeV

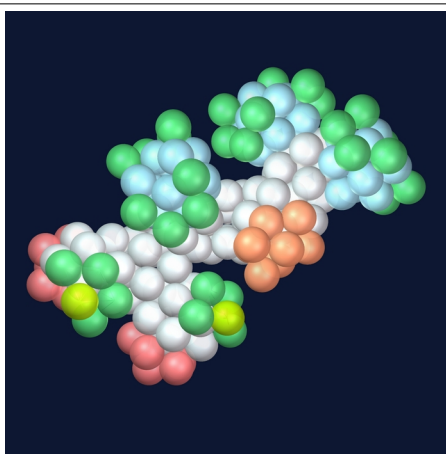


Holmium-165 is a stable isotope of holmium.

The elements and their isotopes

077 Missing element 165

Atomic number	77
Total number of protons	165
Number of deuterons	77
Number of single protons	9
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	18
Total number of inner electrons	79
Total number of outer electrons	68
Group	N/A
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	N/A
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	11.95
MBS Vol./#p	43.31
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	664
SAM line nucleus BE	1477.4 MeV

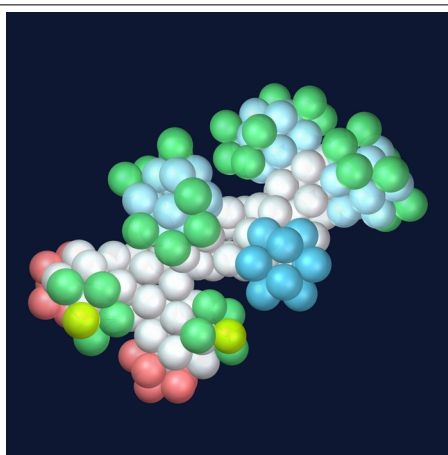


This missing element reflects a complex metal.

The elements and their isotopes

078 Yb - Ytterbium 168

Atomic number	78 (70)
Total number of protons	168
Number of deuterons	78
Number of single protons	10
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	18
Total number of inner electrons	80
Total number of outer electrons	70
Group	N/A
Isotope abundance	0.126%
Element abundance Earth	0.00028%
Half-life	Stable
Valence / Oxidation state	2, 3
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	11.95
MBS Vol./#p	42.53
Average nucleon BE	8.112 MeV
Nucleus BE	1362.80 MeV
SAM lines	677
SAM line nucleus BE	1506.33 MeV

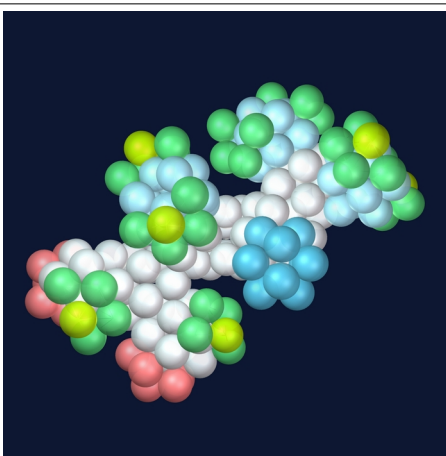


Ytterbium-168 is a stable isotope of ytterbium.

The elements and their isotopes

078 Yb - Ytterbium 172

Atomic number	78 (70)
Total number of protons	172
Number of deuterons	78
Number of single protons	10
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	4
Number of additional proton-electron pairs	0
Number of quasi inner electrons	18
Total number of inner electrons	84
Total number of outer electrons	70
Group	N/A
Isotope abundance	21.680%
Element abundance Earth	0.00028%
Half-life	Stable
Valence / Oxidation state	2, 3
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	-0.02 eV
MBS radius	12.11
MBS Vol./#p	43.3
Average nucleon BE	8.097 MeV
Nucleus BE	1392.76 MeV
SAM lines	697
SAM line nucleus BE	1550.83 MeV

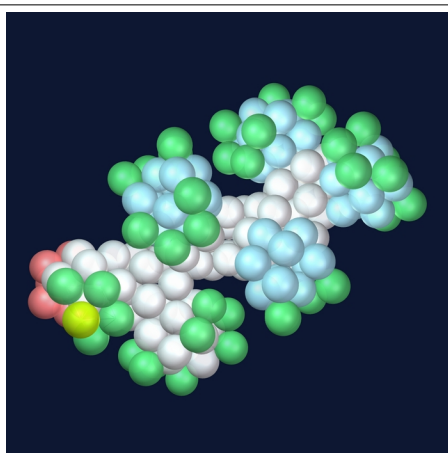


Ytterbium-172 is a stable isotope of ytterbium.

The elements and their isotopes

079 Tm - Thulium 169

Atomic number	79 (69)
Total number of protons	169
Number of deuterons	79
Number of single protons	10
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	20
Total number of inner electrons	80
Total number of outer electrons	69
Group	N/A
Isotope abundance	100.00%
Element abundance Earth	0.000045%
Half-life	Stable
Valence / Oxidation state	2, 3
Magnetic dipole moment	-0.2316 μN
Spin	1/2
Electron affinity	1.029 eV
MBS radius	11.95
MBS Vol./#p	42.28
Average nucleon BE	8.114 MeV
Nucleus BE	1371.35 MeV
SAM lines	680
SAM line nucleus BE	1513.00 MeV

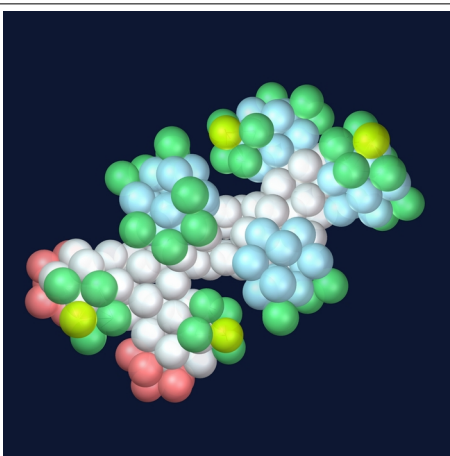


Thulium-169 is a stable isotope of thulium.

The elements and their isotopes

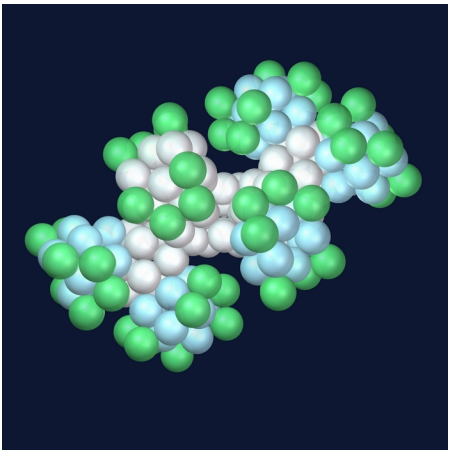
080 Hf - Hafnium 174

Atomic number	80 (72)
Total number of protons	174
Number of deuterons	80
Number of single protons	10
Number of additional req. proton-electron pairs	4
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	18
Total number of inner electrons	84
Total number of outer electrons	72
Group	4
Isotope abundance	0.16%
Element abundance Earth	0.00033%
Half-life	2×10^{15} y
Valence / Oxidation state	2, 3, 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	0.1780 eV
MBS radius	11.95
MBS Vol./#p	41.07
Average nucleon BE	8.069 MeV
Nucleus BE	1403.93 MeV
SAM lines	703
SAM line nucleus BE	1564.18 MeV



Hafnium-174 is (semi) stable isotope which transmutes into ytterbium-170 via α decay. It is not a rare earth element, despite being put before lutetium.

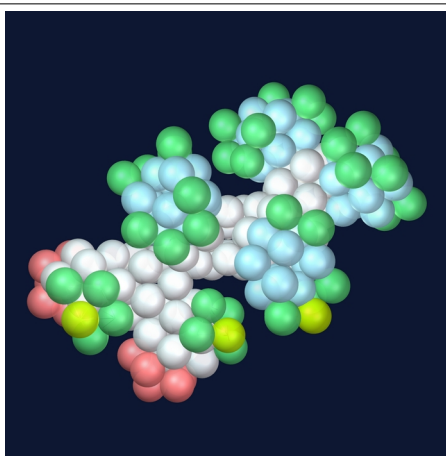
080 Missing element 170

Atomic number	80	 This missing element shows a noble gas configuration.
Total number of protons	170	
Number of deuterons	80	
Number of single protons	10	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	20	
Total number of inner electrons	80	
Total number of outer electrons	70	
Group	(18)	
Isotope abundance	N/A	
Element abundance Earth	N/A	
Half-life	N/A	
Valence / Oxidation state	(0)	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	11.67	
MBS Vol./#p	39.17	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	683	
SAM line nucleus BE	1519.68 MeV	

The elements and their isotopes

081 Lu - Lutetium 175

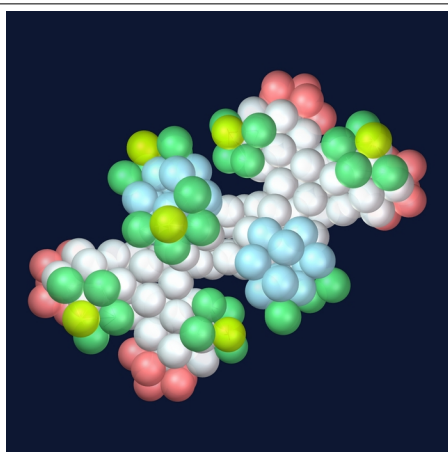
Atomic number	81 (71)
Total number of protons	175
Number of deuterons	81
Number of single protons	10
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	0
Number of quasi inner electrons	20
Total number of inner electrons	84
Total number of outer electrons	71
Group	3
Isotope abundance	97.401%
Element abundance Earth	0.000057%
Half-life	Stable
Valence / Oxidation state	3
Magnetic dipole moment	2.2327 μN
Spin	7/2
Electron affinity	0.2388 eV
MBS radius	11.95
MBS Vol./#p	40.83
Average nucleon BE	8.069 MeV
Nucleus BE	1412.10 MeV
SAM lines	706
SAM line nucleus BE	1570.85 MeV



Lutetium-175 is the only stable isotope of lutetium. Lutetium is considered the last element of the lanthanides or rare earth elements group.

082 W - Tungsten 180

Atomic number	82 (74)
Total number of protons	180
Number of deuterons	82
Number of single protons	10
Number of additional req. proton-electron pairs	4
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	0
Number of quasi inner electrons	18
Total number of inner electrons	88
Total number of outer electrons	74
Group	6
Isotope abundance	0.12%
Element abundance Earth	0.00011%
Half-life	1.8×10^{18} y
Valence / Oxidation state	-2, -1, 1, 2, 3, 4 , 5, 6
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	12.29
MBS Vol./#p	43.19
Average nucleon BE	8.025 MeV
Nucleus BE	1444.58 MeV
SAM lines	729
SAM line nucleus BE	1622.03 MeV

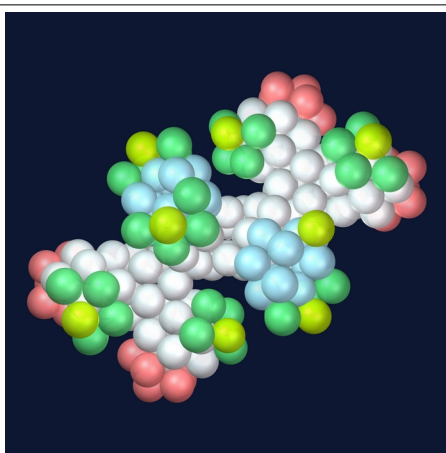


Tungsten-180 is a stable isotope of tungsten.

The elements and their isotopes

082 W - Tungsten 182

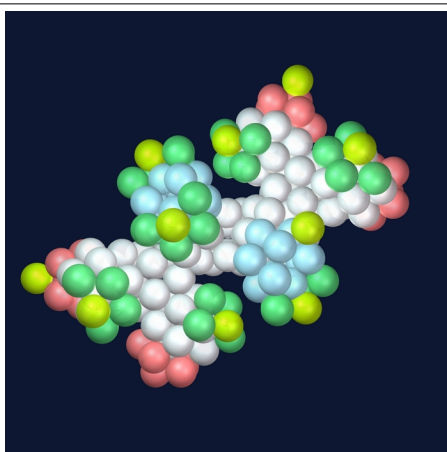
Atomic number	82 (74)
Total number of protons	182
Number of deuterons	82
Number of single protons	10
Number of additional req. proton-electron pairs	4
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	2
Number of quasi inner electrons	18
Total number of inner electrons	90
Total number of outer electrons	74
Group	6
Isotope abundance	26.50%
Element abundance Earth	0.00011%
Half-life	Stable
Valence / Oxidation state	-2, -1, 1, 2, 3, 4 , 5, 6
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	N/A(
MBS radius	12.29
MBS Vol./#p	42.72
Average nucleon BE	8.018 MeV
Nucleus BE	1459.33 MeV
SAM lines	737
SAM line nucleus BE	1639.83 MeV



Tungsten-182 is a stable isotope of tungsten.

082 W - Tungsten 184

Atomic number	82 (74)
Total number of protons	184
Number of deuterons	82
Number of single protons	10
Number of additional req. proton-electron pairs	4
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	4
Number of quasi inner electrons	18
Total number of inner electrons	92
Total number of outer electrons	74
Group	6
Isotope abundance	30.64%
Element abundance Earth	0.00011%
Half-life	Stable
Valence / Oxidation state	-2, -1, 1, 2, 3, 4 , 5, 6
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	0.81626 eV
MBS radius	12.88
MBS Vol./#p	48.69
Average nucleon BE	8.005 MeV
Nucleus BE	1472.93 MeV
SAM lines	743
SAM line nucleus BE	1653.18 MeV

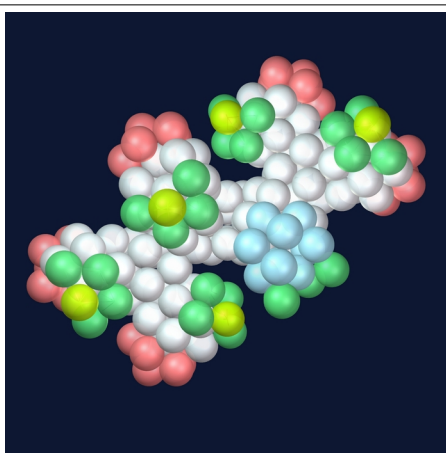


Tungsten-184 is a stable isotope of tungsten.

The elements and their isotopes

083 Missing element 181

Atomic number	83
Total number of protons	181
Number of deuterons	83
Number of single protons	10
Number of additional req. proton-electron pairs	5
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	18
Total number of inner electrons	88
Total number of outer electrons	75
Group	N/A
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	(+5. +7)
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	12.29
MBS Vol./#p	42.95
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	732
SAM line nucleus BE	1628.7 MeV

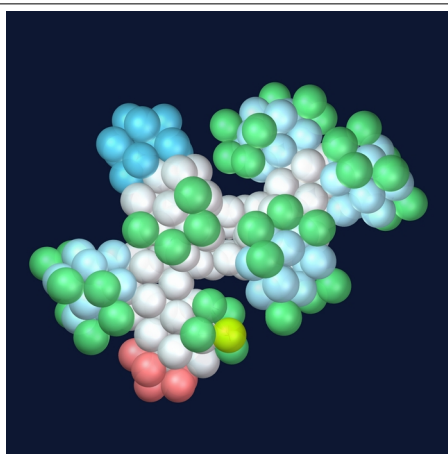


This missing element would reflect a tungsten-180 that has captured one extra proton. The result would be another lithium-nuclet on the base structure. This is regarded as a stressed configuration.

The elements and their isotopes

084 Ta - Tantalum 180

Atomic number	84 (73)
Total number of protons	180
Number of deuterons	84
Number of single protons	11
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	22
Total number of inner electrons	85
Total number of outer electrons	73
Group	5
Isotope abundance	0.012%
Element abundance Earth	0.00017%
Half-life	Stable
Valence / Oxidation state	-1, 2, 3, 4, 5
Magnetic dipole moment	N/A
Spin	1
Electron affinity	N/A
MBS radius	11.67
MBS Vol./#p	36.99
Average nucleon BE	8.026 MeV
Nucleus BE	1444.66 MeV
SAM lines	725
SAM line nucleus BE	1613.13 MeV

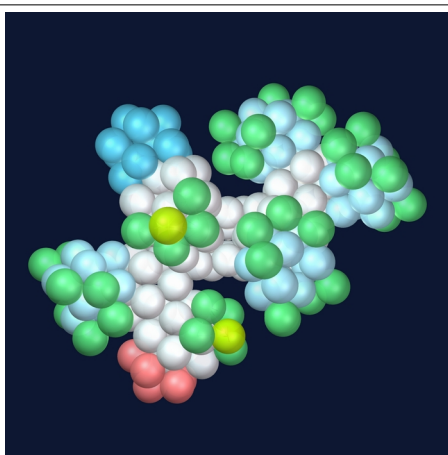


Tantalum-180 is a stable isotope of tantalum.

The elements and their isotopes

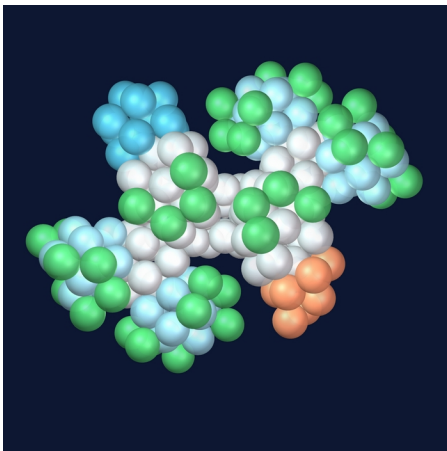
084 Ta - Tantalum 181

Atomic number	84 (73)
Total number of protons	181
Number of deuterons	84
Number of single protons	11
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	0
Number of quasi inner electrons	22
Total number of inner electrons	86
Total number of outer electrons	73
Group	5
Isotope abundance	99.990%
Element abundance Earth	0.00017%
Half-life	Stable
Valence / Oxidation state	-1, 2, 3, 4, 5
Magnetic dipole moment	2.3705 μN
Spin	$S7/2$
Electron affinity	0.323 eV
MBS radius	11.67
MBS Vol./#p	36.79
Average nucleon BE	8.023 MeV
Nucleus BE	1452.24 MeV
SAM lines	730
SAM line nucleus BE	1624.25 MeV



Tantalum-181 is a stable isotope of tantalum.

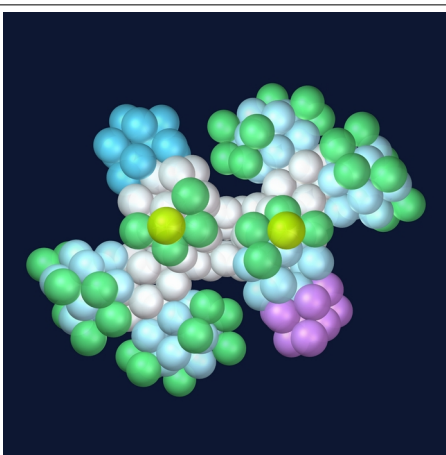
085 Missing element 181

Atomic number	85	
Total number of protons	181	
Number of deuterons	85	
Number of single protons	11	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	22	
Total number of inner electrons	85	
Total number of outer electrons	74	
Group	N/A	
Isotope abundance	N/A	
Element abundance Earth	N/A	
Half-life	N/A	
Valence / Oxidation state	N/A	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	11.67	
MBS Vol./#p	36.78	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	728	
SAM line nucleus BE	1619.8 MeV	
This missing element would reflect tantalum somewhat. It is considered unstable.		

The elements and their isotopes

086 Re - Rhenium 185

Atomic number	86 (75)
Total number of protons	185
Number of deuterons	86
Number of single protons	11
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	22
Total number of inner electrons	88
Total number of outer electrons	75
Group	7
Isotope abundance	37.40%
Element abundance Earth	$2.6 \times 10^{-7}\%$
Half-life	Stable
Valence / Oxidation state	-3, -1, 1, 2, 3, 4 , 5, 6, 7
Magnetic dipole moment	$3.1871 \mu\text{N}$
Spin	$5/2$
Electron affinity	$0.060\,396 \text{ eV}$
MBS radius	11.67
MBS Vol./#p	35.99
Average nucleon BE	7991.01 MeV
Nucleus BE	1478.34 MeV
SAM lines	746
SAM line nucleus BE	1659.85 MeV

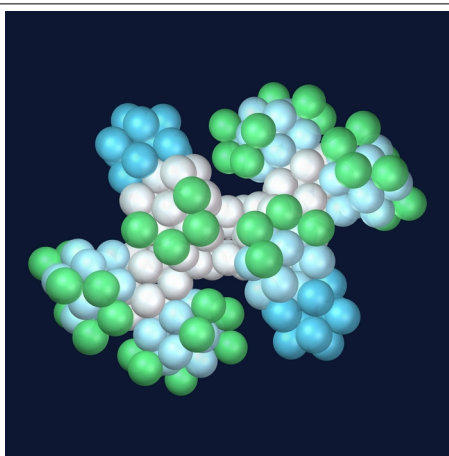


Rhenium-185 is a stable isotope of rhenium.

The elements and their isotopes

086 Os - Osmium 184

Atomic number	86 (76)
Total number of protons	184
Number of deuterons	86
Number of single protons	12
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	22
Total number of inner electrons	86
Total number of outer electrons	76
Group	8
Isotope abundance	0.02%
Element abundance Earth	$1.8 \times 10^{-7}\%$
Half-life	Stable
Valence / Oxidation state	-2, 1, 2, 3, 4 , 5, 6, 7, 8
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	1.077 80 eV
MBS radius	11.67
MBS Vol./#p	36.19
Average nucleon BE	7.989 MeV
Nucleus BE	1469.92 MeV
SAM lines	741
SAM line nucleus BE	1648.73 MeV

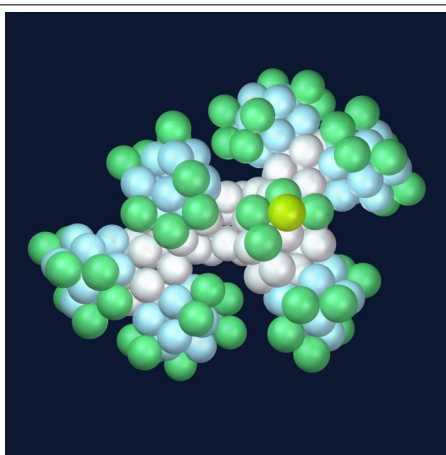


Osmium-184 is a stable isotope of osmium.

The elements and their isotopes

087 Missing element 186

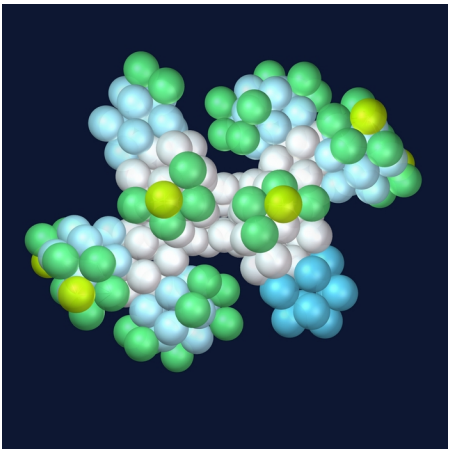
Atomic number	87
Total number of protons	186
Number of deuterons	87
Number of single protons	11
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	22
Total number of inner electrons	88
Total number of outer electrons	76
Group	(18)
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	(0)
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	11.67
MBS Vol./#p	35.8
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	749
SAM line nucleus BE	1666.53 MeV



This missing element is a noble gas.

087 Missing element 192

Atomic number	87
Total number of protons	192
Number of deuterons	87
Number of single protons	12
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	4
Number of additional proton-electron pairs	0
Number of quasi inner electrons	22
Total number of inner electrons	93
Total number of outer electrons	77
Group	N/A
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	N/A
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	11.91
MBS Vol./#p	36.84
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	779
SAM line nucleus BE	1733.28 MeV

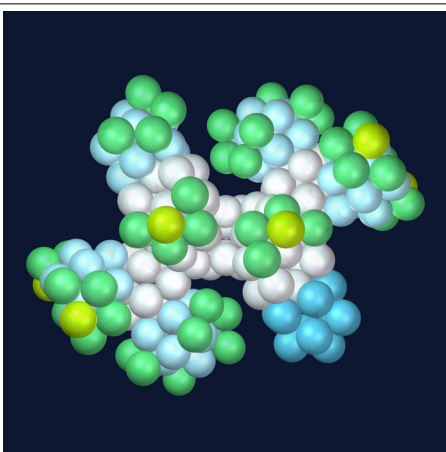


This missing element shows a nitrogen-like ending combined with a carbon-nucleus. The structure is considered unstable.

The elements and their isotopes

088 Pt - Platinum 194

Atomic number	88 (78)
Total number of protons	194
Number of deuterons	88
Number of single protons	12
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	4
Number of additional proton-electron pairs	0
Number of quasi inner electrons	22
Total number of inner electrons	94
Total number of outer electrons	78
Group	10
Isotope abundance	32.864%
Element abundance Earth	$3.7 \times 10^{-6}\%$
Half-life	Stable
Valence / Oxidation state	2, 4, 5, 6
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	2.125 10 eV
MBS radius	11.91
MBS Vol./#p	36.46
Average nucleon BE	7.935 MeV
Nucleus BE	1539.57 MeV
SAM lines	787
SAM line nucleus BE	1751.08 MeV

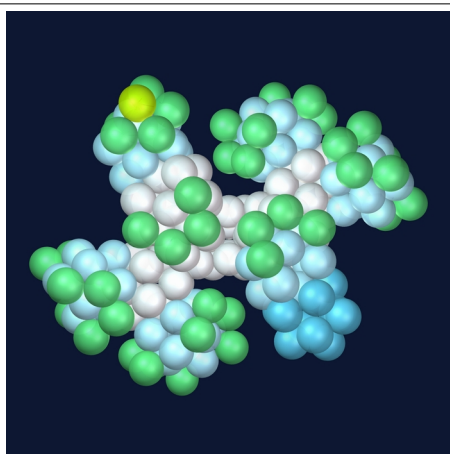


Platinum-184 is a stable isotope of platinum. It consists of an oxygen-like ending in combination with a carbon-nucleus.

The elements and their isotopes

089 Ir - Iridium 191

Atomic number	89 (77)
Total number of protons	191
Number of deuterons	89
Number of single protons	12
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	0
Number of quasi inner electrons	24
Total number of inner electrons	90
Total number of outer electrons	77
Group	9
Isotope abundance	37.30%
Element abundance Earth	$4 \times 10^{-8}\%$
Half-life	Stable
Valence / Oxidation state	-3, -1, 1, 2, 3, 4, 5, 6, 7, 8
Magnetic dipole moment	0.1507 μN
Spin	3/2
Electron affinity	N/A
MBS radius	11.67
MBS Vol./#p	34.86
Average nucleon BE	7.948 MeV
Nucleus BE	1518.09 MeV
SAM lines	770
SAM line nucleus BE	1713.25 MeV

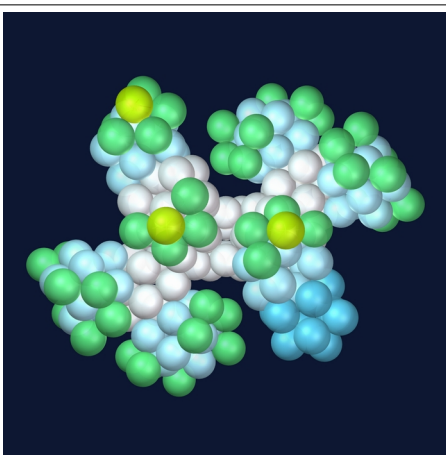


Iridium-191 is a stable isotope of iridium.

The elements and their isotopes

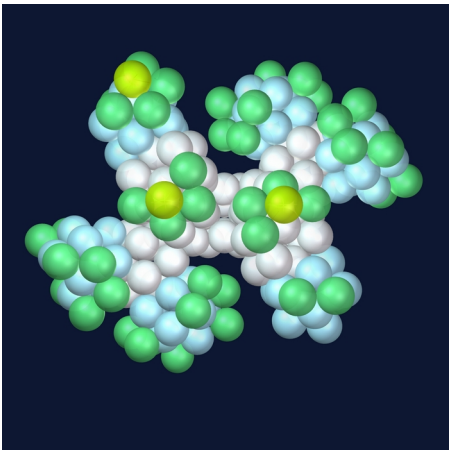
089 Ir - Iridium 193

Atomic number	89 (77)
Total number of protons	192
Number of deuterons	89
Number of single protons	12
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	3
Number of additional proton-electron pairs	0
Number of quasi inner electrons	24
Total number of inner electrons	92
Total number of outer electrons	77
Group	9
Isotope abundance	62.70%
Element abundance Earth	$4 \times 10^{-8}\%$
Half-life	Stable
Valence / Oxidation state	-3, -1, 1, 2, 3, 4, 5, 6, 7, 8
Magnetic dipole moment	0.1637 μ
Spin	3/2
Electron affinity	1.564 36 eV
MBS radius	11.67
MBS Vol./#p	34.5
Average nucleon BE	7.938 MeV
Nucleus BE	1532.06 MeV
SAM lines	780
SAM line nucleus BE	1733.50 MeV



Iridium-191 is a stable isotope of iridium.

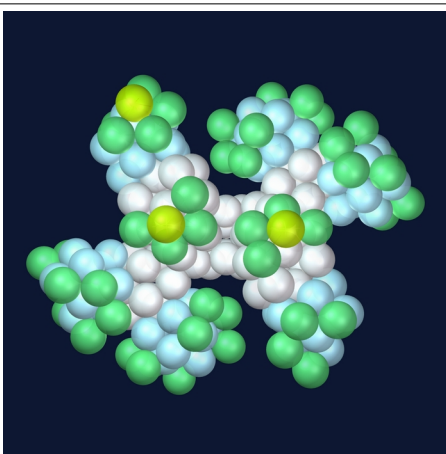
090 Missing element 195

Atomic number	90	 This missing element shows a nitrogen-like ending and is considered to be unstable.
Total number of protons	195	
Number of deuterons	90	
Number of single protons	12	
Number of additional req. proton-electron pairs	2	
Number of additional gap proton-electron pairs	1	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	24	
Total number of inner electrons	93	
Total number of outer electrons	78	
Group	N/A	
Isotope abundance	N/A	
Element abundance Earth	N/A	
Half-life	N/A	
Valence / Oxidation state	N/A	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	11.67	
MBS Vol./#p	34.15	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	788	
SAM line nucleus BE	433.88 MeV	

The elements and their isotopes

091 Au - Gold 197

Atomic number	91 (79)
Total number of protons	197
Number of deuterons	91
Number of single protons	12
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	24
Total number of inner electrons	94
Total number of outer electrons	79
Group	11
Isotope abundance	100.00%
Element abundance Earth	$3.1 \times 10^{-7}\%$
Half-life	Stable
Valence / Oxidation state	-1, 1, 2, 3, 5
Magnetic dipole moment	$0.145746 \mu\text{N}$
Spin	$3/2$
Electron affinity	$2.308\,610 \text{ eV}$
MBS radius	11.67
MBS Vol./#p	33.8
Average nucleon BE	7.916 MeV
Nucleus BE	1559.38 MeV
SAM lines	796
SAM line nucleus BE	1771.10 MeV

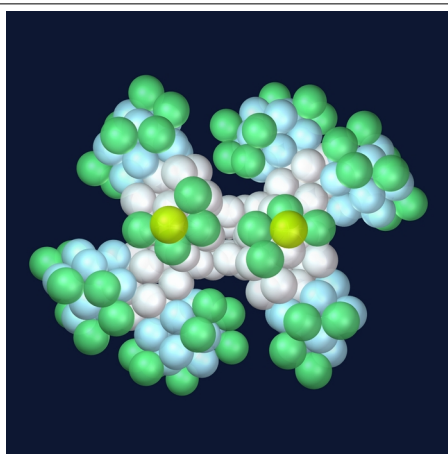


Gold-197 is the only stable configuration of gold.

The elements and their isotopes

092 Hg - Mercury 198

Atomic number	92 (80)
Total number of protons	198
Number of deuterons	92
Number of single protons	12
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	24
Total number of inner electrons	94
Total number of outer electrons	80
Group	12
Isotope abundance	10.40%
Element abundance Earth	$6.7 \times 10^{-6}\%$
Half-life	Stable
Valence / Oxidation state	1, 2, 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	11.67
MBS Vol./#p	33.63
Average nucleon BE	7.912 MeV
Nucleus BE	1566.49 MeV
SAM lines	799
SAM line nucleus BE	1777.78 MeV

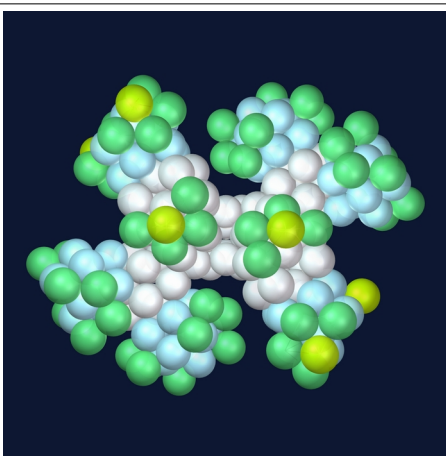


Mercury-198 is a stable isotope of mercury. The structure has only one oxygen-like ending on a large nucleus. This is a liquid metal at room temperature.

The elements and their isotopes

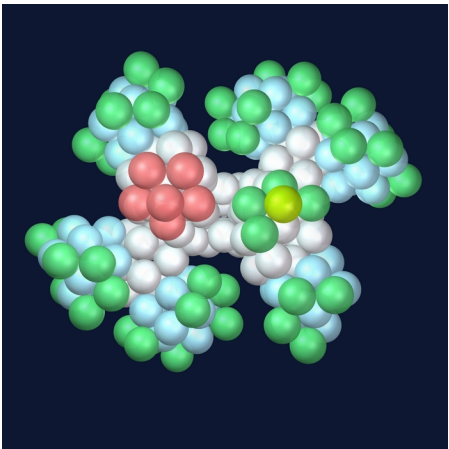
092 Hg - Mercury 202

Atomic number	92 (80)
Total number of protons	202
Number of deuterons	92
Number of single protons	12
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	4
Number of additional proton-electron pairs	0
Number of quasi inner electrons	24
Total number of inner electrons	98
Total number of outer electrons	80
Group	12
Isotope abundance	29.86%
Element abundance Earth	$6.7 \times 10^{-6}\%$
Half-life	Stable
Valence / Oxidation state	1, 2, 4
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	-0.5 eV
MBS radius	11.67
MBS Vol./#p	32.96
Average nucleon BE	7.897 MeV
Nucleus BE	1595.16 MeV
SAM lines	817
SAM line nucleus BE	1817.83 MeV



Mercury-202 is a stable isotope of mercury.

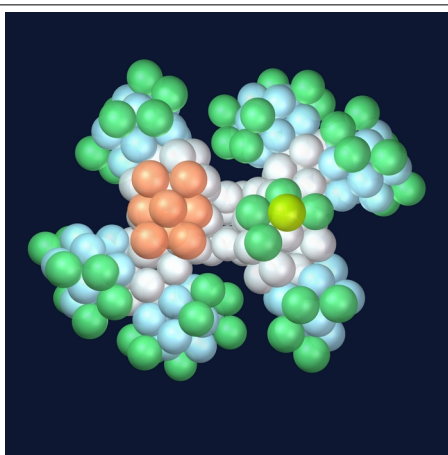
093 Missing element 199

Atomic number	93	 This missing element is considered to be an unstable configuration.
Total number of protons	199	
Number of deuterons	93	
Number of single protons	12	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	24	
Total number of inner electrons	94	
Total number of outer electrons	81	
Group	N/A	
Isotope abundance	N/A	
Element abundance Earth	N/A	
Half-life	N/A	
Valence / Oxidation state	N/A	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	11.67	
MBS Vol./#p	33.46	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	802	
SAM line nucleus BE	1784.45 MeV	

The elements and their isotopes

094 Missing element 201

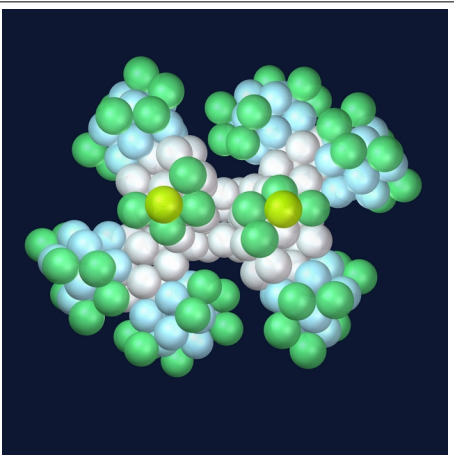
Atomic number	94
Total number of protons	201
Number of deuterons	94
Number of single protons	12
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	24
Total number of inner electrons	95
Total number of outer electrons	82
Group	N/A
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	N/A
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	11.67
MBS Vol./#p	33.13
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	810
SAM line nucleus BE	1802.25 MeV



This missing element is considered to be an unstable configuration.

094 Missing element 202

Atomic number	94
Total number of protons	202
Number of deuterons	94
Number of single protons	12
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	24
Total number of inner electrons	96
Total number of outer electrons	82
Group	(18)
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	(0)
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	11.67
MBS Vol./#p	32.96
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	815
SAM line nucleus BE	1813.38 MeV

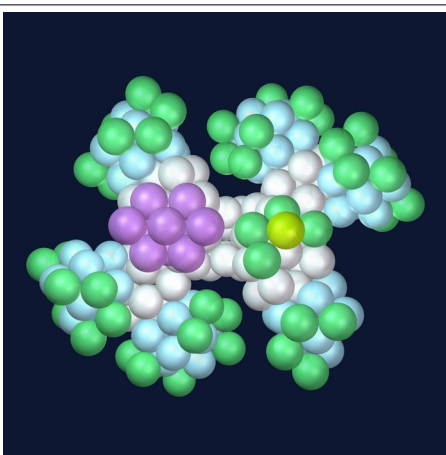


This missing element is a noble gas.

The elements and their isotopes

095 Tl - Thallium 203

Atomic number	95 (81)
Total number of protons	203
Number of deuterons	95
Number of single protons	12
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	26
Total number of inner electrons	96
Total number of outer electrons	81
Group	13
Isotope abundance	29.50%
Element abundance Earth	0.000054%
Half-life	Stable
Valence / Oxidation state	1, 3
Magnetic dipole moment	1.62225787 μN
Spin	1/2
Electron affinity	0.320 053 eV
MBS radius	11.67
MBS Vol./#p	32.8
Average nucleon BE	7.886 MeV
Nucleus BE	1600.87 MeV
SAM lines	818
SAM line nucleus BE	1820.05 MeV

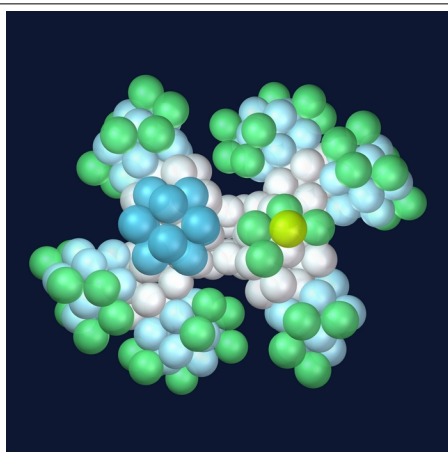


Thallium-203 is a stable isotope of thallium.

The elements and their isotopes

095 Pb - Lead 204

Atomic number	95 (82)
Total number of protons	204
Number of deuterons	95
Number of single protons	13
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	26
Total number of inner electrons	96
Total number of outer electrons	82
Group	14
Isotope abundance	1.40%
Element abundance Earth	0.001%
Half-life	Stable
Valence / Oxidation state	-4, 2 , 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	11.67
MBS Vol./#p	32.64
Average nucleon BE	7.880 MeV
Nucleus BE	1607.51 MeV
SAM lines	823
SAM line nucleus BE	1831.18 MeV

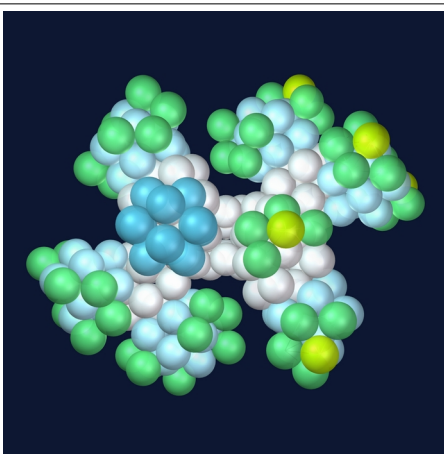


Lead-204 is the first stable isotope of lead. Lead is the last element in the PTE that is considered to be a real stable element. All elements and isotopes after lead are always unstable.

The elements and their isotopes

095 Pb - Lead 208

Atomic number	95 (82)
Total number of protons	208
Number of deuterons	95
Number of single protons	13
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	4
Number of quasi inner electrons	26
Total number of inner electrons	100
Total number of outer electrons	82
Group	14
Isotope abundance	52.40%
Element abundance Earth	0.001%
Half-life	Stable
Valence / Oxidation state	-4, 2 , 4
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	0.356721 eV
MBS radius	11.8
MBS Vol./#p	33.13
Average nucleon BE	7.867 MeV
Nucleus BE	1636.43 MeV
SAM lines	843
SAM line nucleus BE	1875.68 MeV

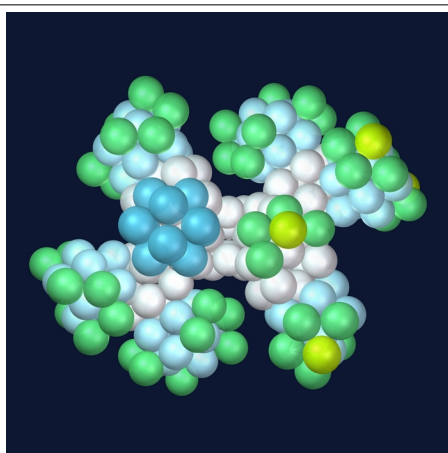


Lead-208 is a stable isotope of lead. Many decay schemes of the actinides result in this last stable element via α decay and β^+ decay steps.

The elements and their isotopes

096 Bi - Bismuth 209

Atomic number	96 (83)
Total number of protons	209
Number of deuterons	96
Number of single protons	13
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	2
Number of quasi inner electrons	26
Total number of inner electrons	100
Total number of outer electrons	83
Group	15
Isotope abundance	100.00%
Element abundance Earth	$2.5 \times 10^{-6}\%$
Half-life	2.01×10^{19} y
Valence / Oxidation state	-3, 3 , 5
Magnetic dipole moment	4.1103 μ N
Spin	9/2
Electron affinity	0.942362 eV
MBS radius	11.8
MBS Vol./#p	32.97
Average nucleon BE	7.848 MeV
Nucleus BE	1640.23 MeV
SAM lines	846
SAM line nucleus BE	1882.35 MeV

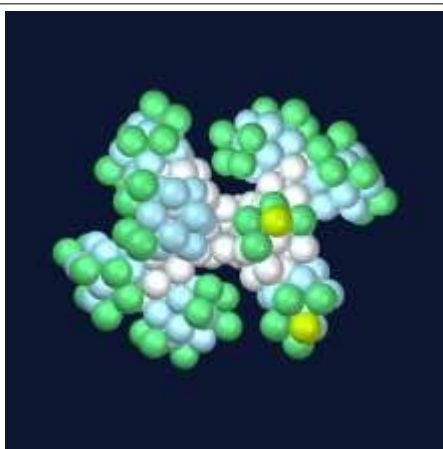


Bismuth-209 is a semi stable isotope of bismuth with a half-life of 2×10^{19} years which will transmute into thallium-205 via α decay.

The elements and their isotopes

097 Po - Polonium 209

Atomic number	97 (84)
Total number of protons	209
Number of deuterons	97
Number of single protons	13
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	0
Number of quasi inner electrons	26
Total number of inner electrons	99
Total number of outer electrons	84
Group	16
Isotope abundance	Artificial
Element abundance Earth	0.00%
Half-life	125.2 y
Valence / Oxidation state	-2, 2, 4 , 6
Magnetic dipole moment	0.77 μN
Spin	1/2
Electron affinity	1.40 eV
MBS radius	11.67
MBS Vol./#p	32.86
Average nucleon BE	7.835 MeV
Nucleus BE	1637.55 MeV
SAM lines	844
SAM line nucleus BE	1877.90 MeV

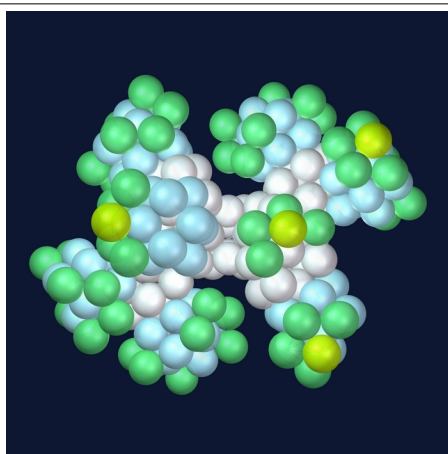


Polonium-209 is a unstable isotope of polonium with a half-life of about 125 years. No isotopes of polonium are stable.

The elements and their isotopes

097 Po - Polonium 211

Atomic number	97 (84)
Total number of protons	211
Number of deuterons	97
Number of single protons	13
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	2
Number of quasi inner electrons	26
Total number of inner electrons	101
Total number of outer electrons	84
Group	16
Isotope abundance	Trace
Element abundance Earth	0.00%
Half-life	0.516 s
Valence / Oxidation state	-2, 2, 4, 6
Magnetic dipole moment	-1.197 μN
Spin	9/2
Electron affinity	N/A
MBS radius	11.67
MBS Vol./#p	31.56
Average nucleon BE	7.819 MeV
Nucleus BE	1649.76 MeV
SAM lines	854
SAM line nucleus BE	1900.15 MeV

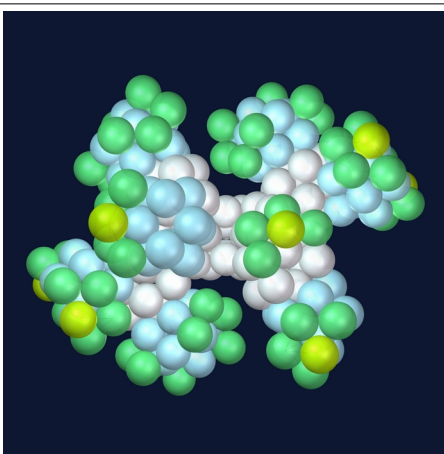


Polonium-211 is a unstable isotope of polonium. It is an intermediate decay product of uranium-235 and transmutes into lead-207 via α decay.

The elements and their isotopes

097 Po - Polonium 214

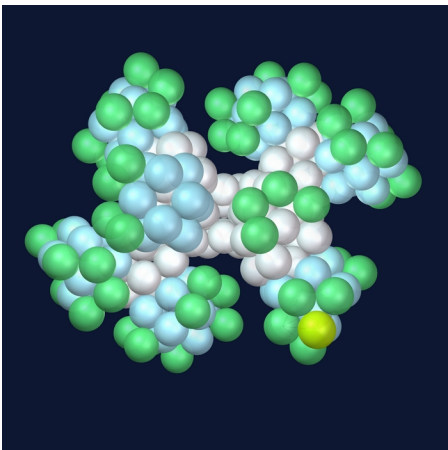
Atomic number	97 (84)
Total number of protons	214
Number of deuterons	97
Number of single protons	13
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	5
Number of quasi inner electrons	26
Total number of inner electrons	104
Total number of outer electrons	84
Group	16
Isotope abundance	Trace
Element abundance Earth	0.00%
Half-life	164.3 μ s
Valence / Oxidation state	-2, 2, 4 , 6
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	11.91
MBS Vol./#p	33.05
Average nucleon BE	7.785 MeV
Nucleus BE	1666.01 MeV
SAM lines	869
SAM line nucleus BE	1933.53 MeV



Polonium-214 is a unstable isotope of polonium and an intermediate decay product of uranium-238. It will perform α decay to lead-210.

098 Missing element 210

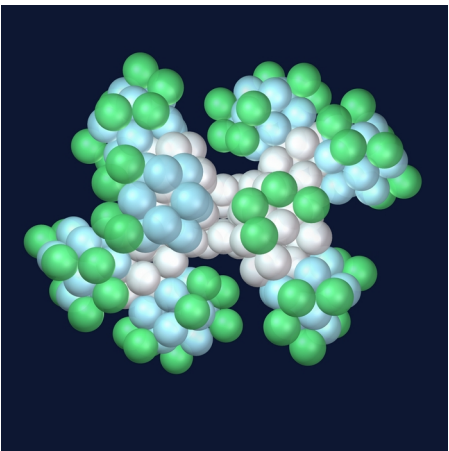
Atomic number	98
Total number of protons	210
Number of deuterons	98
Number of single protons	13
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	0
Number of quasi inner electrons	26
Total number of inner electrons	99
Total number of outer electrons	85
Group	N/A
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	N/A
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	11.67
MBS Vol./#p	31.71
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	847
SAM line nucleus BE	1884.58 MeV



This missing element is considered to be unstable.

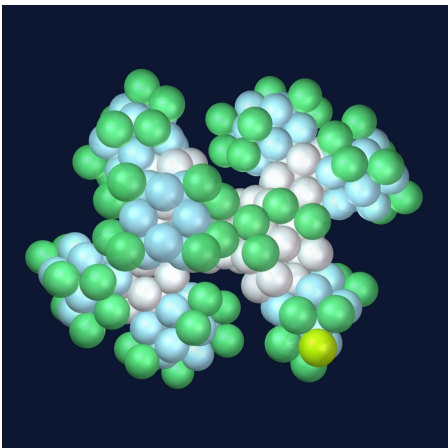
The elements and their isotopes

099 Missing element 211

Atomic number	99	 This missing element has only one oxygen-like ending.
Total number of protons	211	
Number of deuterons	99	
Number of single protons	13	
Number of additional req. proton-electron pairs	0	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	26	
Total number of inner electrons	99	
Total number of outer electrons	86	
Group	N/A	
Isotope abundance	N/A	
Element abundance Earth	N/A	
Half-life	N/A	
Valence / Oxidation state	N/A	
Magnetic dipole moment	N/A	
Spin	N/A	
Electron affinity	N/A	
MBS radius	11.67	
MBS Vol./#p	31.56	
Average nucleon BE	N/A	
Nucleus BE	N/A	
SAM lines	850	
SAM line nucleus BE	1891.25 MeV	

The elements and their isotopes

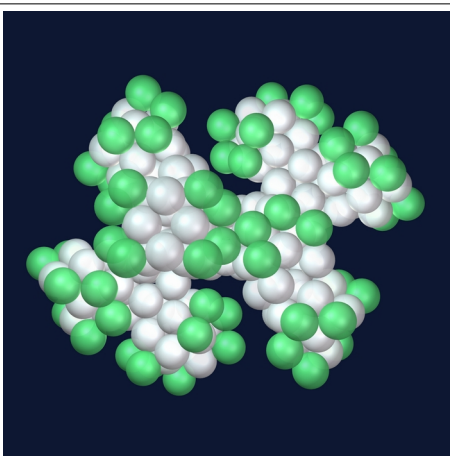
100 At - Astatine 214

Atomic number	100 (85)	 Astatine-214 is an unstable isotope of astatine which would reflect a halogen somewhat due to its fluorine-like ending. From Wiki: https://en.wikipedia.org/wiki/Astatine “The bulk properties of astatine are not known with any certainty. Many of them have been estimated based on the element's position on the periodic table as a heavier analog of iodine, and a member of the halogens (the group of elements including fluorine, chlorine, bromine, and iodine).”
Total number of protons	214	
Number of deuterons	100	
Number of single protons	13	
Number of additional req. proton-electron pairs	1	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	28	
Total number of inner electrons	101	
Total number of outer electrons	85	
Group	17	
Isotope abundance	0.00%	
Element abundance Earth	0.00%	
Half-life	558 ns	
Valence / Oxidation state	-1, 1, 3, 5, 7	
Magnetic dipole moment	N/A	
Spin	5	
Electron affinity	N/A	
MBS radius	11.67	
MBS Vol./#p	31.12	
Average nucleon BE	7.776 MeV	
Nucleus BE	1664.14 MeV	
SAM lines	863	
SAM line nucleus BE	1920.18 MeV	

The elements and their isotopes

101 Rn - Radon 215

Atomic number	101 (86)
Total number of protons	215
Number of deuterons	101
Number of single protons	13
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	28
Total number of inner electrons	101
Total number of outer electrons	86
Group	18
Isotope abundance	0.00%
Element abundance Earth	0% / Trace in oceans
Half-life	2.3 μ s
Valence / Oxidation state	2
Magnetic dipole moment	N/A
Spin	9/2
Electron affinity	N/A
MBS radius	11.67
MBS Vol./#p	30.97
Average nucleon BE	7.764 MeV
Nucleus BE	1669.22 MeV
SAM lines	866
SAM line nucleus BE	1926.85 MeV

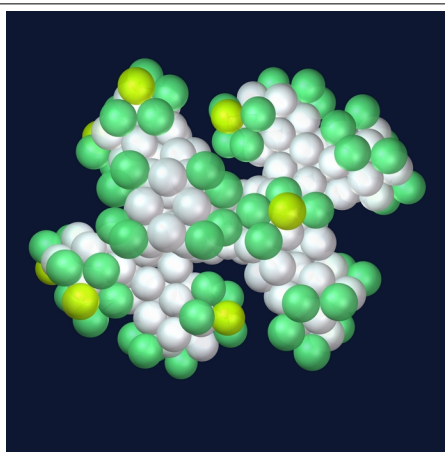


Radon-215 is the base unstable isotope of radon and is the last known noble gas in the original PTE. It transmutes to polonium-211 via α decay.

The elements and their isotopes

101 Rn - Radon 222

Atomic number	101 (86)
Total number of protons	222
Number of deuterons	101
Number of single protons	13
Number of additional req. proton-electron pairs	0
Number of additional gap proton-electron pairs	7
Number of additional proton-electron pairs	0
Number of quasi inner electrons	28
Total number of inner electrons	108
Total number of outer electrons	86
Group	18
Isotope abundance	Trace
Element abundance Earth	0% /Trace in oceans
Half-life	3.8235 d
Valence / Oxidation state	2
Magnetic dipole moment	0 μN
Spin	0
Electron affinity	-0.7 eV
MBS radius	11.8
MBS Vol./#p	31.04
Average nucleon BE	7.694 MeV
Nucleus BE	1708.18 MeV
SAM lines	901
SAM line nucleus BE	2004.73 MeV

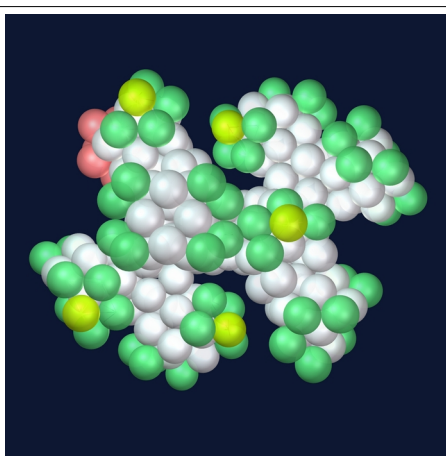


Radon-222 is the most stable of the isotopes of radon with a half-life of almost 4 days. It is an intermediate decay product of uranium-238.

The seventh row

102 Fr - Francium 222

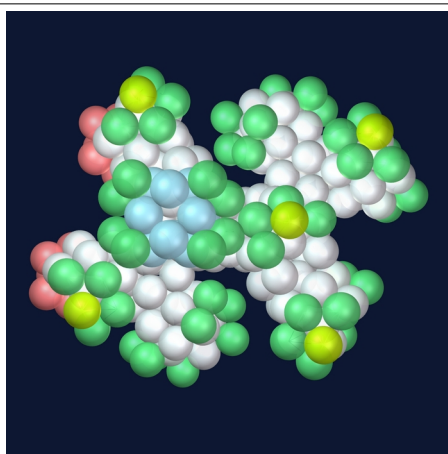
Atomic number	102 (87)
Total number of protons	222
Number of deuterons	102
Number of single protons	13
Number of additional req. proton-electron pairs	1
Number of additional gap proton-electron pairs	4
Number of additional proton-electron pairs	0
Number of quasi inner electrons	28
Total number of inner electrons	107
Total number of outer electrons	87
Group	1
Isotope abundance	Artificial
Element abundance Earth	0.00%
Half-life	14.2 m
Valence / Oxidation state	1
Magnetic dipole moment	0.63 μN
Spin	2
Electron affinity	0.486 eV
MBS radius	11.67
MBS Vol./#p	29.99
Average nucleon BE	7.691 MeV
Nucleus BE	1707.39 MeV
SAM lines	899
SAM line nucleus BE	2000.28 MeV



Francium-222 is an unstable isotope of francium. The half-life is a mere 14.2 minutes. It reflects an alkaline metal with one lithium-nuclelet. It transmutes to radium-222 via β^- decay.

103 Ra - Radium 224

Atomic number	103 (88)
Total number of protons	224
Number of deuterons	103
Number of single protons	13
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	2
Number of additional proton-electron pairs	0
Number of quasi inner electrons	28
Total number of inner electrons	108
Total number of outer electrons	88
Group	2
Isotope abundance	Trace
Element abundance Earth	$1 \times 10^{-11}\%$
Half-life	3.6319 d
Valence / Oxidation state	2
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	11.95
MBS Vol./#p	31.9
Average nucleon BE	7.680 MeV
Nucleus BE	1720.30 MeV
SAM lines	907
SAM line nucleus BE	2018.08 MeV

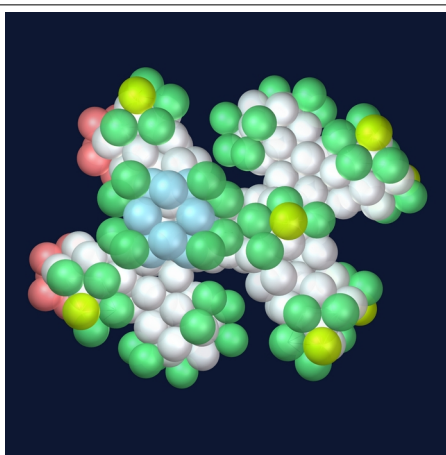


Radium-224 is an unstable isotope of radium. The half-life is about 3.6 days and is an intermediate decay product of thorium-232. It transmutes into radon-220 via α decay. Radium reflects an alkaline earth metal with two lithium nucleons.

The elements and their isotopes

103 Ra - Radium 226

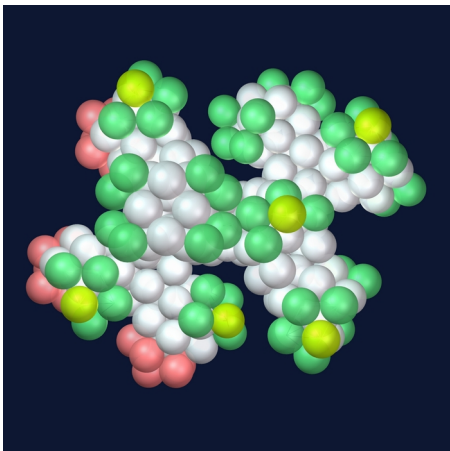
Atomic number	103 (88)
Total number of protons	226
Number of deuterons	103
Number of single protons	13
Number of additional req. proton-electron pairs	3
Number of additional gap proton-electron pairs	4
Number of additional proton-electron pairs	0
Number of quasi inner electrons	28
Total number of inner electrons	110
Total number of outer electrons	88
Group	2
Isotope abundance	Trace
Element abundance Earth	$1 \times 10^{-11}\%$
Half-life	1,600 y
Valence / Oxidation state	2
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	0.10 eV
MBS radius	12.11
MBS Vol./#p	32.95
Average nucleon BE	7.662 MeV
Nucleus BE	1731.60 MeV
SAM lines	917
SAM line nucleus BE	2040.33 MeV



Radium-226 is an unstable isotope of radium. Radium reflects an alkaline earth metal with two lithium-nuclets.

The elements and their isotopes

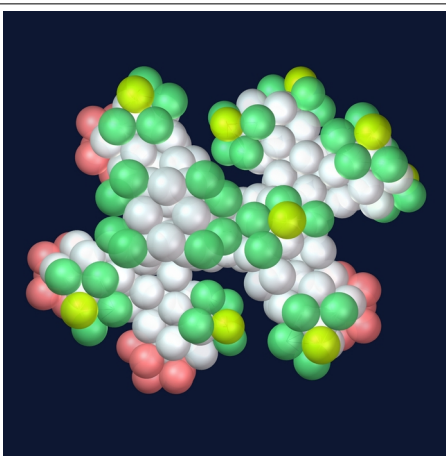
104 Ac - Actinium 227

Atomic number	104 (89)	 Actinium-227 is an unstable isotope of actinium with a half-life of about 22 years. Actinium is also the first element of the so-called actinides group. This group seems to continue the adding-on of lithium-nuclei, one by one after francium and radium. In short the group shows having only lithium-nuclei that increase by one each element step. Interestingly the valence also shows this. Francium is +1, radium is +2, actinium is +3, thorium is +4, protactinium is +5, uranium is +6 and neptunium is +7. Actinium-227 normally transmutes to thorium-227 via β^- decay and sometimes to francium-223 via α decay.
Total number of protons	227	
Number of deuterons	104	
Number of single protons	13	
Number of additional req. proton-electron pairs	4	
Number of additional gap proton-electron pairs	2	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	28	
Total number of inner electrons	110	
Total number of outer electrons	89	
Group	N/A	
Isotope abundance	Trace	
Element abundance Earth	0.00%	
Half-life	21.772 y	
Valence / Oxidation state	2, 3	
Magnetic dipole moment	1.1 μN	
Spin	3/2	
Electron affinity	0.35 eV	
MBS radius	11.95	
MBS Vol./#p	31.48	
Average nucleon BE	7.651 MeV	
Nucleus BE	1736.71 MeV	
SAM lines	920	
SAM line nucleus BE	2047 MeV	

The elements and their isotopes

105 Th - Thorium 232

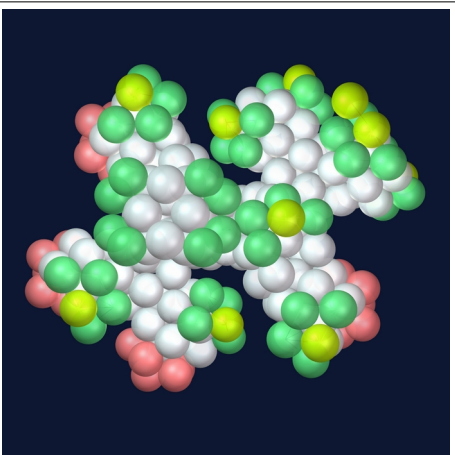
Atomic number	105 (90)
Total number of protons	232
Number of deuterons	105
Number of single protons	13
Number of additional req. proton-electron pairs	5
Number of additional gap proton-electron pairs	4
Number of additional proton-electron pairs	0
Number of quasi inner electrons	28
Total number of inner electrons	114
Total number of outer electrons	90
Group	N/A
Isotope abundance	99.98%
Element abundance Earth	0.0006%
Half-life	1.405×10^{10} y
Valence / Oxidation state	2, 3, 4
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	1.17 eV
MBS radius	12.11
MBS Vol./#p	32.1
Average nucleon BE	7.615 MeV
Nucleus BE	1766.69 MeV
SAM lines	943
SAM line nucleus BE	2098.18 MeV



Thorium-232 is the normal and semi-unstable isotope of Thorium with a half-life of about 1.4×10^{10} years. It has four lithium-nuclelets and a valence of +4. The structure normally transmutes into radium-229 via α decay.

105 Th - Thorium 233

Atomic number	105 (90)
Total number of protons	232
Number of deuterons	105
Number of single protons	13
Number of additional req. proton-electron pairs	5
Number of additional gap proton-electron pairs	4
Number of additional proton-electron pairs	1
Number of quasi inner electrons	28
Total number of inner electrons	115
Total number of outer electrons	90
Group	N/A
Isotope abundance	Artificial
Element abundance Earth	0.0006%
Half-life	21.83 m
Valence / Oxidation state	2, 3, 4
Magnetic dipole moment	N/A
Spin	1/2
Electron affinity	N/A
MBS radius	12.11
MBS Vol./#p	31.96
Average nucleon BE	7.603 MeV
Nucleus BE	1771.47 MeV
SAM lines	946
SAM line nucleus BE	2104.85 MeV

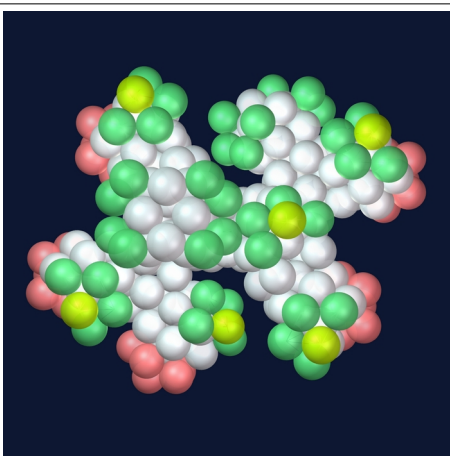


Thorium-233 is an unstable isotope of thorium.

The elements and their isotopes

106 Pa - Protactinium 231

Atomic number	106 (91)
Total number of protons	231
Number of deuterons	106
Number of single protons	13
Number of additional req. proton-electron pairs	6
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	28
Total number of inner electrons	112
Total number of outer electrons	91
Group	N/A
Isotope abundance	100.00%
Element abundance Earth	$9.9 \times 10^{-13}\%$
Half-life	3.276×10^4 y
Valence / Oxidation state	2, 3, 4, 5
Magnetic dipole moment	2.01 μ N
Spin	3/2
Electron affinity	0.55 eV
MBS radius	12.29
MBS Vol./#p	33.66
Average nucleon BE	7.618 MeV
Nucleus BE	1759.86 MeV
SAM lines	936
SAM line nucleus BE	2082.60 MeV

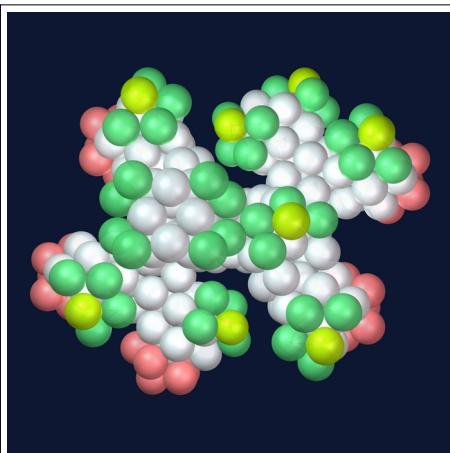


Protactinium-231 is an unstable isotope of protactinium with a half-life of about 32,000 years. The structure shows five lithium nuclei and the valence is +5. This isotope transmutes to actinium-227 via α decay.

The elements and their isotopes

106 Pa - Protactinium 233

Atomic number	106 (91)
Total number of protons	233
Number of deuterons	106
Number of single protons	13
Number of additional req. proton-electron pairs	6
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	2
Number of quasi inner electrons	28
Total number of inner electrons	114
Total number of outer electrons	91
Group	N/A
Isotope abundance	Trace
Element abundance Earth	$9.9 \times 10^{-13}\%$
Half-life	26.967 d
Valence / Oxidation state	2, 3, 4, 5
Magnetic dipole moment	3.39 μN
Spin	3/2
Electron affinity	N/A
MBS radius	12.29
MBS Vol./#p	33.37
Average nucleon BE	7.605 MeV
Nucleus BE	1771.93 MeV
SAM lines	944
SAM line nucleus BE	2100.40 MeV

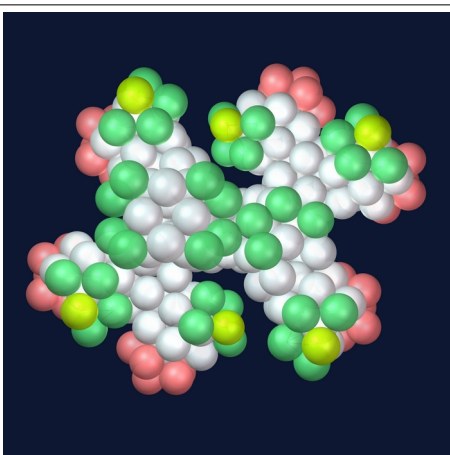


Protactinium-233 is an unstable isotope of protactinium.

The elements and their isotopes

107 U - Uranium 233

Atomic number	107 (92)
Total number of protons	233
Number of deuterons	107
Number of single protons	13
Number of additional req. proton-electron pairs	6
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	28
Total number of inner electrons	113
Total number of outer electrons	92
Group	N/A
Isotope abundance	Trace
Element abundance Earth	0.00018%
Half-life	1.592×10^5 y
Valence / Oxidation state	2, 3, 4, 5, 6
Magnetic dipole moment	0.6 μ N
Spin	5/2
Electron affinity	N/A
MBS radius	12.29
MBS Vol./#p	33.37
Average nucleon BE	7.604 MeV
Nucleus BE	1771.72 MeV
SAM lines	944
SAM line nucleus BE	2100.40 MeV

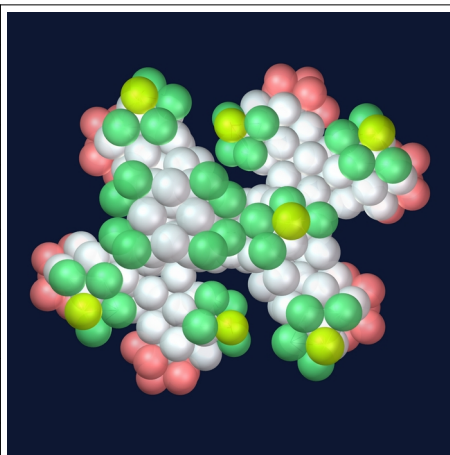


Uranium-233 is an unstable isotope of uranium with a half-life of about 150,000 years. Uranium has six lithium nuclets and its valence is +6. Uranium-233 normally transmutes to thorium-229 via α decay.

The elements and their isotopes

107 U - Uranium 234

Atomic number	107 (92)
Total number of protons	234
Number of deuterons	107
Number of single protons	13
Number of additional req. proton-electron pairs	6
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	1
Number of quasi inner electrons	28
Total number of inner electrons	114
Total number of outer electrons	92
Group	N/A
Isotope abundance	0.01%
Element abundance Earth	0.00018%
Half-life	2.455×10^5 y
Valence / Oxidation state	2, 3, 4, 5, 6
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	12.29
MBS Vol./#p	33.22
Average nucleon BE	7.601 MeV
Nucleus BE	1778.57 MeV
SAM lines	949
SAM line nucleus BE	2111.53 MeV

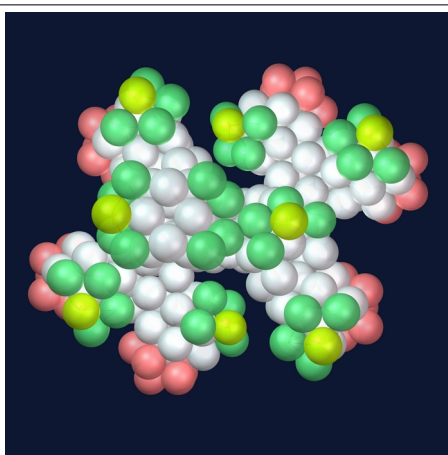


Uranium-234 is an unstable isotope of uranium with a half-life of about 250,000 years and transmutes to thorium-230 via α decay.

The elements and their isotopes

107 U - Uranium 235

Atomic number	107 (92)
Total number of protons	235
Number of deuterons	107
Number of single protons	13
Number of additional req. proton-electron pairs	6
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	2
Number of quasi inner electrons	28
Total number of inner electrons	115
Total number of outer electrons	92
Group	N/A
Isotope abundance	0.72%
Element abundance Earth	0.00018%
Half-life	7.04×10^8 y
Valence / Oxidation state	2, 3, 4, 5, 6
Magnetic dipole moment	-0.38 μ N
Spin	7/2
Electron affinity	N/A
MBS radius	12.92
MBS Vol./#p	33.08
Average nucleon BE	7.591 MeV
Nucleus BE	1783.87 MeV
SAM lines	954
SAM line nucleus BE	2122.65 MeV

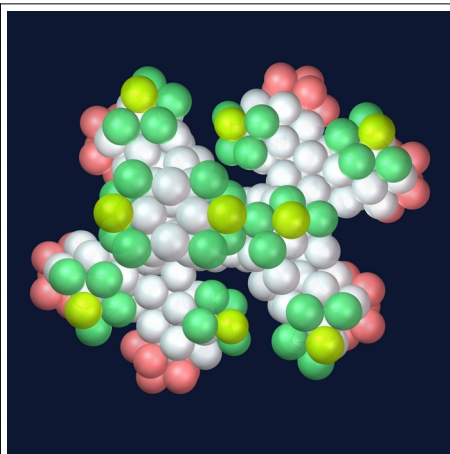


Uranium-235, perhaps the most known isotope next to deuterium, is a semi-unstable isotope of uranium with a half-life of about 700,000,000 years. Uranium-235 normally transmutes to thorium-231 via α decay. Uranium-235 is also the isotope used in nuclear devices due to its ability to fission and yield more PEPs (neutrons) that will trigger the next uranium-235 atom to fission.

The elements and their isotopes

107 U - Uranium 236

Atomic number	107 (92)
Total number of protons	236
Number of deuterons	107
Number of single protons	13
Number of additional req. proton-electron pairs	6
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	3
Number of quasi inner electrons	28
Total number of inner electrons	116
Total number of outer electrons	92
Group	N/A
Isotope abundance	Trace
Element abundance Earth	0.00018%
Half-life	2.342×10^7 y
Valence / Oxidation state	2, 3, 4, 5, 6
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	N/A
MBS radius	12.29
MBS Vol./#p	32.94
Average nucleon BE	7.586 MeV
Nucleus BE	1790.41 MeV
SAM lines	959
SAM line nucleus BE	2133.78 MeV

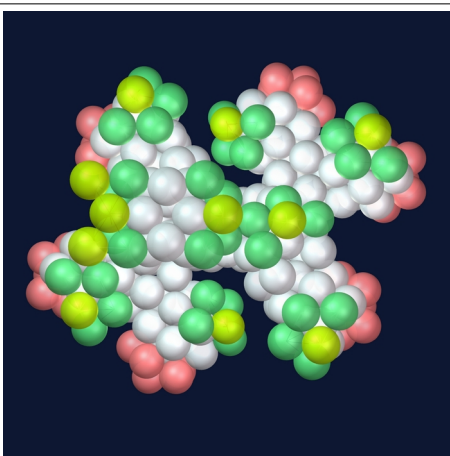


Uranium-236 is an unstable isotope of Uranium with a half-life of about 20,000,000 years, and will transmute to thorium-232 via α decay.

The elements and their isotopes

107 U - Uranium 238

Atomic number	107 (92)
Total number of protons	238
Number of deuterons	107
Number of single protons	13
Number of additional req. proton-electron pairs	6
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	5
Number of quasi inner electrons	28
Total number of inner electrons	118
Total number of outer electrons	92
Group	N/A
Isotope abundance	99.274%
Element abundance Earth	0.00018%
Half-life	4.468×10^9 y
Valence / Oxidation state	2, 3, 4, 5, 6
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	0.53 eV
MBS radius	12.29
MBS Vol./#p	32.67
Average nucleon BE	7.570 MeV
Nucleus BE	1801.69 MeV
SAM lines	965
SAM line nucleus BE	2147.13 MeV

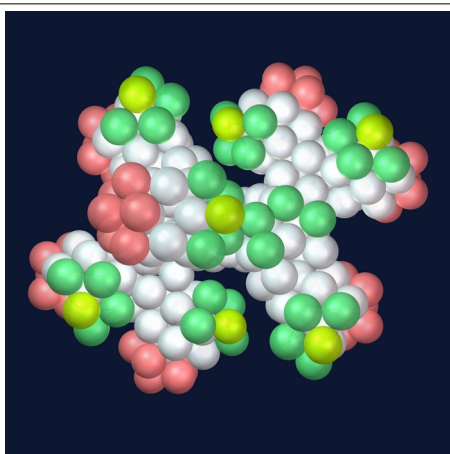


Uranium-238, the most common semi unstable isotope of uranium, has a half-life of about 4.5 billion years, or as is assumed, about the age of the earth. Uranium-238 normally transmutes into thorium-234 but can in rare cases perform double β - decay into plutonium-238.

The elements and their isotopes

108 Np - Neptunium 236

Atomic number	108 (93)
Total number of protons	236
Number of deuterons	108
Number of single protons	13
Number of additional req. proton-electron pairs	7
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	28
Total number of inner electrons	115
Total number of outer electrons	93
Group	N/A
Isotope abundance	Artificial
Element abundance Earth	0.00%
Half-life	1.54×10^5 y
Valence / Oxidation state	2, 4, 5, 6, 7
Magnetic dipole moment	N/A
Spin	6
Electron affinity	N/A
MBS radius	12.29
MBS Vol./#p	32.94
Average nucleon BE	7.579 MeV
Nucleus BE	1788.70 MeV
SAM lines	957
SAM line nucleus BE	2129.33 MeV

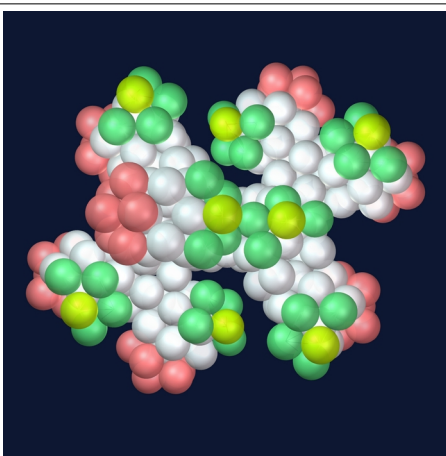


Neptunium-236 is an unstable isotope of neptunium with a half-life of about 150,000 years. The structure normally transmutes to uranium-236 via electron capture, and sometimes to plutonium-236 via β -decay. The structure has seven lithium-nuclets and a valence of +7.

The elements and their isotopes

108 Np - Neptunium 237

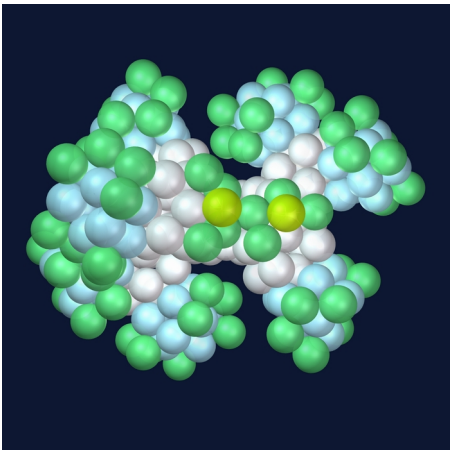
Atomic number	108 (93)
Total number of protons	237
Number of deuterons	108
Number of single protons	13
Number of additional req. proton-electron pairs	7
Number of additional gap proton-electron pairs	1
Number of additional proton-electron pairs	0
Number of quasi inner electrons	28
Total number of inner electrons	116
Total number of outer electrons	93
Group	N/A
Isotope abundance	Trace
Element abundance Earth	0.00%
Half-life	2.144×10^6 y
Valence / Oxidation state	2, 4, 5, 6, 7
Magnetic dipole moment	$3.14 \mu\text{N}$
Spin	5/2
Electron affinity	0.48 eV
MBS radius	12.29
MBS Vol./#p	32.8
Average nucleon BE	7.575 MeV
Nucleus BE	1795.27 MeV
SAM lines	962
SAM line nucleus BE	2140.45 MeV



Neptinium-237 is an unstable isotope of neptunium.

108 Missing element 232

Atomic number	108
Total number of protons	232
Number of deuterons	108
Number of single protons	14
Number of additional req. proton-electron pairs	2
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	30
Total number of inner electrons	110
Total number of outer electrons	92
Group	(18)
Isotope abundance	N/A
Element abundance Earth	N/A
Half-life	N/A
Valence / Oxidation state	(0)
Magnetic dipole moment	N/A
Spin	N/A
Electron affinity	N/A
MBS radius	11.75
MBS Vol./#p	29.25
Average nucleon BE	N/A
Nucleus BE	N/A
SAM lines	937
SAM line nucleus BE	2084.83 MeV

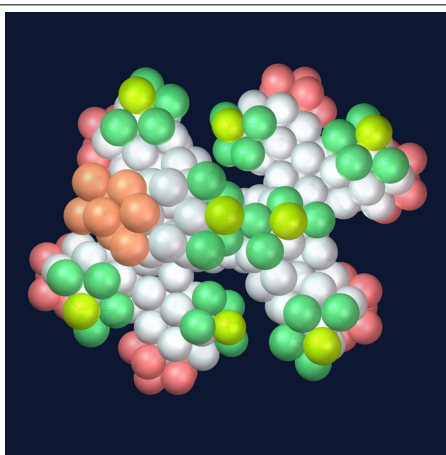


This missing element reflects a noble gas and is in SAM considered to be the last possible noble element that exists. It is unstable.

The elements and their isotopes

109 Pu - Plutonium 239

Atomic number	109 (94)
Total number of protons	239
Number of deuterons	109
Number of single protons	13
Number of additional req. proton-electron pairs	8
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	0
Number of quasi inner electrons	28
Total number of inner electrons	117
Total number of outer electrons	94
Group	N/A
Isotope abundance	Trace
Element abundance Earth	0.00%
Half-life	2.41×10^4 y
Valence / Oxidation state	3, 4, 5, 6, 7, 8
Magnetic dipole moment	$0.203 \mu\text{N}$
Spin	1/2
Electron affinity	N/A
MBS radius	12.29
MBS Vol./#p	32.53
Average nucleon BE	7.560 MeV
Nucleus BE	1806.92 MeV
SAM lines	970
SAM line nucleus BE	2158.25 MeV

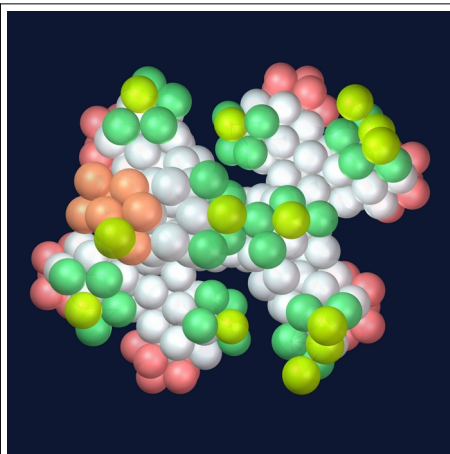


Plutonium-239 is an unstable isotope of plutonium with a half-life of about 24,000 years that will normally transmute to uranium-235 via α decay. Plutonium-239 is used widely for atomic explosive devices since it so readily fissions.

The elements and their isotopes

109 Pu - Plutonium 244

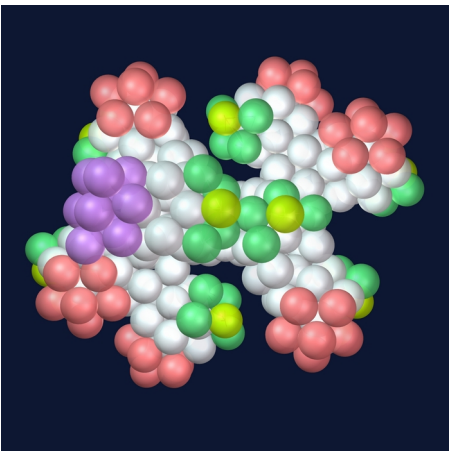
Atomic number	109 (94)
Total number of protons	244
Number of deuterons	109
Number of single protons	13
Number of additional req. proton-electron pairs	8
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	5
Number of quasi inner electrons	28
Total number of inner electrons	122
Total number of outer electrons	94
Group	N/A
Isotope abundance	Trace
Element abundance Earth	0.00%
Half-life	8.08×10^7 y
Valence / Oxidation state	3, 4, 5, 6, 7, 8
Magnetic dipole moment	0 μ N
Spin	0
Electron affinity	-0.50 eV
MBS radius	12.42
MBS Vol./#p	32.96
Average nucleon BE	7.525 MeV
Nucleus BE	1836.05 MeV
SAM lines	985
SAM line nucleus BE	2191.63 MeV



Plutonium-244 is an unstable isotope of plutonium.

The elements and their isotopes

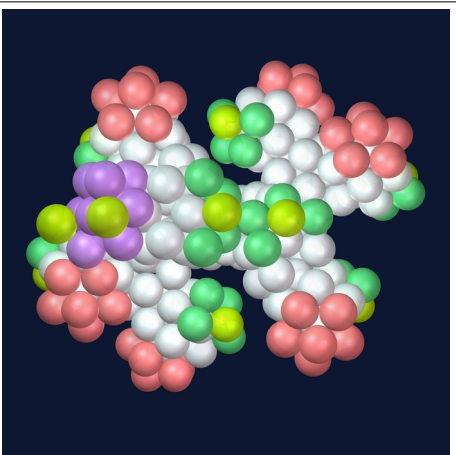
110 Am - Americium 241

Atomic number	110 (95)	 Americium-241, the last element that is considered in SAM to be realistic is an unstable isotope of americium, with a half-life of about 400 years, and it transmutes normally to neptunium-237 via α decay.
Total number of protons	241	
Number of deuterons	110	
Number of single protons	13	
Number of additional req. proton-electron pairs	8	
Number of additional gap proton-electron pairs	0	
Number of additional proton-electron pairs	0	
Number of quasi inner electrons	28	
Total number of inner electrons	118	
Total number of outer electrons	95	
Group	N/A	
Isotope abundance	Artificial	
Element abundance Earth	0.00%	
Half-life	432.2 y	
Valence / Oxidation state	2, 3, 4, 5, 6	
Magnetic dipole moment	1.61 μ N	
Spin	5/2	
Electron affinity	N/A	
MBS radius	11.94	
MBS Vol./#p	29.59	
Average nucleon BE	7.543 MeV	
Nucleus BE	1817.93 MeV	
SAM lines	978	
SAM line nucleus BE	2176.05 MeV	

The elements and their isotopes

110 Am - Americium 243

Atomic number	110 (95)
Total number of protons	243
Number of deuterons	110
Number of single protons	13
Number of additional req. proton-electron pairs	8
Number of additional gap proton-electron pairs	0
Number of additional proton-electron pairs	2
Number of quasi inner electrons	28
Total number of inner electrons	120
Total number of outer electrons	95
Group	N/A
Isotope abundance	Artificial
Element abundance Earth	0.00%
Half-life	7370 y
Valence / Oxidation state	2, 3, 4, 5, 6
Magnetic dipole moment	1.53 μ N
Spin	5/2
Electron affinity	0.10 eV
MBS radius	11.99
MBS Vol./#p	29.75
Average nucleon BE	7.530 MeV
Nucleus BE	1829.83 MeV
SAM lines	984
SAM line nucleus BE	2189.40 MeV



Americium-243, the last element that is considered in SAM to be realistic is an unstable isotope of americium.