

Samarium (Sm) - Student Datasheet

Element 62 · Lanthanide · source-reviewed learning reference

Samarium is element 62, a lanthanide whose $4f^6$ configuration connects the periodic table to Sm-Co permanent magnets, neutron-absorbing materials, optical compounds and isotope geochronology.

Quick reference

Atomic number	62
Relative atomic mass	150.36
Electron configuration	[Xe] $4f^6 6s^2$
Period / group / block	6 / Lanthanide / f
State context	Silvery-white lanthanide metal
Density	7.52 g/cm ³
Melting / transition	1345 K
Boiling / gas reference	2067 K
Oxidation states	+3, +2
Electronegativity	1.17

Structure & orbitals

Samarium has its namesake Sm-type rhombohedral structure at ordinary temperature. The viewer uses a simplified rhombohedral teaching motif rather than pretending to reproduce the full crystallographic basis. The displayed $4f_{xyz}$ orbital is one representative real f cubic harmonic. It is not a picture of the whole 4f subshell or the electronic bands in the bulk material.

Phase behavior

At approximately standard pressure, samarium is treated as a solid below 1345 K, liquid between melting and approximately 2067 K, and gas above the boiling reference. The ordinary crystal label applies to the stated material reference; unmodeled solid allotropy is not fabricated.

Five things to remember

- Atomic number 62 means every samarium nucleus has 62 protons.
- Neutral Samarium has the ground-state configuration [Xe] $4f^6 6s^2$.
- The representative teaching isotope is ^{152}Sm .
- Samarium-cobalt magnets are intermetallic materials, not pieces of elemental samarium.
- The ordinary material reference is Sm-type rhombohedral structure.

Samarium: Real World & Signature Science

Element-specific science, uses and history

Big idea

Samarium-cobalt magnets are intermetallic materials, not pieces of elemental samarium. Natural samarium also contains both stable and extremely long-lived radioactive isotopes, so “is samarium radioactive?” needs an isotope-specific answer.

Why this element is scientifically distinctive

Explore Sm across the teaching nucleus, isolated-atom orbitals, evidence-aware material structure and temperature/evidence views, then connect those models to uses, isotopes, search-led questions and source-backed context.

Sm-Co magnets	Samarium-cobalt intermetallic magnets offer strong permanent magnetism with good high-temperature performance.
Neutron applications	Some samarium isotopes have strong neutron-capture behavior, making Sm compounds relevant to selected nuclear/control materials.
Catalysis and chemistry	Samarium compounds are used in specialized chemical research and materials contexts; properties depend on oxidation state and ligand/host.
Optical materials	Sm ions can provide characteristic absorption/emission features in glasses and crystals.
Isotope distinction	Medical or research uses of particular Sm radioisotopes do not make every samarium material equivalent to that isotope.

From source material to Samarium applications: high-level material path

1. Samarium is obtained from mineral or metallurgical feedstocks in which it is chemically associated with other elements rather than mined as abundant native metal.
2. Industrial separation and refining produce element-specific compounds or metal feedstock; this guide does not provide operational extraction recipes.
3. The refined material is converted into the particular alloy, compound, doped host or component required by the application.
4. Recycling and recovery depend on the host product, concentration and economics; application materials must not be confused with pure element.

History checkpoints

1879	Paul-Émile Lecoq de Boisbaudran identified samarium spectroscopically from material related to samarskite.
Late 19th century	Rare-earth separation and spectroscopy established samarium as distinct from neighboring lanthanides.
20th century	Sm-Co intermetallics became important permanent-magnet materials.
Today	Samarium remains a specialized magnet, neutron and optical material element.

Use contexts

- ['Sm-Co magnets', 'Samarium-cobalt magnets combine high magnetic performance with useful high-temperature stability.']
- ['Neutron absorbers', 'High neutron-capture isotopes make samarium useful in selected nuclear-material contexts.']
- ['Optics', 'Samarium-doped glasses and crystals provide characteristic optical transitions.']
- ['Research chemistry', 'Sm compounds such as Sm(II) reagents are important in specialized chemical synthesis and research.']

Samarium: Isotopes, Questions & Evidence

Evidence status and learner self-check

Isotope context

¹⁵²Sm	Most abundant natural isotope	Stable reference isotope used for the teaching nucleus.
¹⁴⁷Sm	Long-lived natural radioisotope	Used in Sm-Nd geochronology because of its very long alpha-decay timescale.
Natural samarium	Mixed isotope set	Includes stable and extremely long-lived radioactive isotopes.

Common questions

What is samarium?

Samarium is chemical element 62, symbol Sm, a silvery lanthanide metal.

What is samarium used for?

Major uses include samarium-cobalt magnets, neutron-absorbing materials, optical materials and specialized chemistry.

Where is samarium found?

It occurs with other lanthanides in minerals such as monazite and bastnäsite and is separated during rare-earth processing.

Who discovered samarium?

Paul-Émile Lecoq de Boisbaudran identified samarium in 1879.

Is samarium a metal?

Yes. It is a lanthanide metal.

Is samarium radioactive?

Natural samarium contains both stable isotopes and extremely long-lived radioactive isotopes such as ¹⁴⁷Sm.

Evidence & safety

Atomic identity and reference values are source-reviewed. Material viewers are teaching representations, not crystallographic refinements. Search demand shapes headings and FAQs but never overrides measured/evaluated evidence or element-versus-compound distinctions.

This page is educational. Chemical, occupational, radiological or medical safety decisions require the specific material/isotope, its current safety data and qualified guidance.

Core sources

Royal Society of Chemistry - Samarium - <https://periodic-table.rsc.org/element/62/samarium>

NIST - Atomic Weights and Isotopic Compositions - https://physics.nist.gov/cgi-bin/Compositions/stand_alone.pl

IUPAC - Periodic Table of Elements - <https://iupac.org/what-we-do/periodic-table-of-elements/>