

Holmium (Ho) - Student Datasheet

Element 67 · Lanthanide · source-reviewed learning reference

Holmium is element 67, a lanthanide with one of the largest atomic magnetic moments. Its Ho^{3+} chemistry connects the periodic table to specialized magnets, neutron absorption and infrared laser materials.

Quick reference

Atomic number	67
Relative atomic mass	164.930
Electron configuration	[Xe] $4f^{11} 6s^2$
Period / group / block	6 / Lanthanide / f
State context	Bright silvery lanthanide metal
Density	8.80 g/cm ³
Melting / transition	1745 K
Boiling / gas reference	2973 K
Oxidation states	+3
Electronegativity	1.23

Structure & orbitals

Ordinary holmium metal is HCP. Optical laser hosts and holmium-containing magnets have different structures from the elemental metal.

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, holmium is treated as a solid below 1745 K, liquid between melting and approximately 2973 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 67 means every holmium nucleus has 67 protons.
- Neutral Holmium has the ground-state configuration [Xe] $4f^{11} 6s^2$.
- The representative teaching isotope is ^{165}Ho .
- Holmium can be strongly magnetic, but a “holmium laser” uses Ho ions doped into a host crystal; the laser medium is not a bar of elemental Ho.
- The ordinary material reference is Hexagonal close-packed (HCP).

Holmium: Real World & Signature Science

Element-specific science, uses and history

Big idea

Holmium can be strongly magnetic, but a “holmium laser” uses Ho ions doped into a host crystal; the laser medium is not a bar of elemental Ho. Nuclear and optical applications are likewise material- or isotope-specific.

Why this element is scientifically distinctive

Explore Ho 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.

Laser materials	Ho ³⁺ -doped crystals such as Ho:YAG support infrared laser transitions; the host crystal is part of the device.
Magnetic materials	Holmium's large magnetic moment makes it useful in specialized magnetic research and selected alloys.
Neutron absorption	Holmium can absorb neutrons and is used in selected nuclear-control contexts.
Spectroscopy	Ho ions have sharp spectral features useful in calibration and optical research.
Compound boundary	Ho:YAG, holmium salts and elemental Ho metal are distinct materials with different structures and hazards.

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

1. Holmium 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

1878	Marc Delafontaine and Louis Soret observed spectral evidence for holmium; Per Teodor Cleve independently separated holmium-containing material.
Name	Holmium is named from Holmia, the Latin name for Stockholm.
Late 19th century	Further rare-earth separation clarified holmium from neighboring erbium and dysprosium.
Today	Holmium remains a specialized magnetic, optical and neutron-absorbing element.

Use contexts

- ['Infrared lasers', 'Ho-doped host crystals support useful near-2 μm laser transitions.']
- ['Magnetic research', 'Holmium's large magnetic moment makes it valuable in specialized magnetic materials and experiments.']
- ['Neutron absorbers', 'Holmium-containing materials can be used where neutron capture is useful.']
- ['Spectral standards', 'Sharp Ho absorption features support wavelength calibration in some optical contexts.']

Holmium: Isotopes, Questions & Evidence

Evidence status and learner self-check

Isotope context

¹⁶⁵Ho	Natural isotope	Essentially all natural holmium is ¹⁶⁵ Ho.
Radioisotopes	Artificial isotopes	Used in research and isotope-specific applications.
Natural holmium	Single-isotope natural element	Relative atomic mass is close to the ¹⁶⁵ Ho isotope mass.

Common questions

What is holmium?

Holmium is chemical element 67, symbol Ho, a bright silvery lanthanide metal.

What is holmium used for?

Uses include Ho-doped lasers, specialized magnetic materials, neutron absorbers and optical calibration.

Who discovered holmium?

Holmium was identified in 1878 through work by Marc Delafontaine and Louis Soret and independently by Per Teodor Cleve.

Where is holmium found?

It occurs as a minor component of rare-earth minerals such as monazite and bastnäsite and is separated with other lanthanides.

Is holmium a metal?

Yes. It is a lanthanide metal.

Is holmium magnetic?

Yes. Ho atoms/ions have very large magnetic moments, but bulk magnetic behavior depends on temperature and material context.

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 - Holmium - <https://periodic-table.rsc.org/element/67/holmium>

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/>