

Dysprosium (Dy) - Student Datasheet

Element 66 · Lanthanide · source-reviewed learning reference

Dysprosium is element 66, a lanthanide whose $4f^{10}$ configuration and strong magnetic anisotropy connect the periodic table to high-temperature permanent magnets, neutron-absorbing materials and specialty lighting.

Quick reference

Atomic number	66
Relative atomic mass	162.500
Electron configuration	[Xe] $4f^{10} 6s^2$
Period / group / block	6 / Lanthanide / f
State context	Bright silvery lanthanide metal
Density	8.55 g/cm ³
Melting / transition	1685 K
Boiling / gas reference	2840 K
Oxidation states	+3
Electronegativity	1.22

Structure & orbitals

Ordinary dysprosium metal is HCP. The viewer does not represent Nd-Fe-B-Dy magnet phases or dysprosium compounds, whose structures are different.

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, dysprosium is treated as a solid below 1685 K, liquid between melting and approximately 2840 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 66 means every dysprosium nucleus has 66 protons.
- Neutral Dysprosium has the ground-state configuration [Xe] $4f^{10} 6s^2$.
- The representative teaching isotope is ^{164}Dy .
- Dysprosium's best-known magnet role is as an addition to Nd-Fe-B materials; those magnets are not pure dysprosium.
- The ordinary material reference is Hexagonal close-packed (HCP).

Dysprosium: Real World & Signature Science

Element-specific science, uses and history

Big idea

Dysprosium's best-known magnet role is as an addition to Nd-Fe-B materials; those magnets are not pure dysprosium. The metal is bright silvery, while its magnetic and optical applications depend on composition and chemical form.

Why this element is scientifically distinctive

Explore Dy 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.

Permanent magnets	Dy additions can improve resistance to demagnetization at elevated temperature in selected Nd-Fe-B magnets.
Neutron absorption	Dysprosium-containing materials can absorb neutrons and appear in selected reactor-control applications.
Lighting	Dysprosium iodide is used in some metal-halide lamp systems to shape intense white light.
Magnetostrictive alloys	Dy participates with Tb and Fe in high-magnetostriction intermetallic materials.
Compound boundary	Dy in magnets, iodides and oxides is chemically/materially different from pure HCP dysprosium metal.

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

1. Dysprosium 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

1886	Paul-Émile Lecoq de Boisbaudran separated dysprosium from holmium-rich rare-earth material.
Name	The name comes from Greek "dysprositos," meaning hard to get at, reflecting difficult separation.
20th century	High-purity rare-earth separation enabled detailed magnetic and neutron-property studies.
Today	Dy is a strategic specialty addition in high-performance magnet and nuclear-material systems.

Use contexts

- ['High-temperature magnets', 'Dy additions help some Nd-Fe-B magnets retain coercivity at elevated temperature.']
- ['Neutron absorbers', 'Dy-containing materials are used where high neutron absorption is valuable.']
- ['Lighting', 'Dysprosium compounds are used in selected high-intensity lamp chemistries.']
- ['Magnetostriction', 'Dy is a component of magnetostrictive Tb-Dy-Fe intermetallics.']

Dysprosium: Isotopes, Questions & Evidence

Evidence status and learner self-check

Isotope context

¹⁶⁴ Dy	Most abundant natural isotope	Reference teaching isotope for this page.
Natural dysprosium	Multiple-isotope element	Several naturally occurring isotopes contribute to the atomic weight.
Radioisotopes	Artificial isotopes	Used mainly in research and isotope-specific contexts.

Common questions

What is dysprosium?

Dysprosium is chemical element 66, symbol Dy, a bright silvery lanthanide metal.

What is dysprosium used for?

It is used in high-performance magnet alloys, neutron-absorbing materials, metal-halide lamps and magnetostrictive alloys.

Where is dysprosium found?

It occurs mixed with other rare earths in minerals such as monazite, bastnäsite and xenotime and is separated during rare-earth processing.

Who discovered dysprosium?

Paul-Émile Lecoq de Boisbaudran identified dysprosium in 1886.

Is dysprosium a metal?

Yes. It is a lanthanide metal, not a nonmetal or metalloid.

What does dysprosium look like?

Fresh elemental dysprosium is a bright silvery metal.

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 - Dysprosium - <https://periodic-table.rsc.org/element/66/dysprosium>

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/>