

Europium (Eu) - Student Datasheet

Element 63 · Lanthanide · source-reviewed learning reference

Europium is element 63, a reactive lanthanide whose half-filled $4f^7$ configuration makes Eu^{2+} unusually accessible and helps europium compounds produce distinctive red and blue luminescence in phosphors and security markings.

Quick reference

Atomic number	63
Relative atomic mass	151.964
Electron configuration	$[\text{Xe}] 4f^7 6s^2$
Period / group / block	6 / Lanthanide / f
State context	Soft silvery reactive lanthanide metal
Density	5.24 g/cm^3
Melting / transition	1095 K
Boiling / gas reference	1802 K
Oxidation states	+3, +2
Electronegativity	~ 1.2

Structure & orbitals

Ordinary europium metal is BCC. The structure viewer represents elemental Eu metal, not the oxide, nitride, aluminate or other host crystals used in luminescent materials.

The $4f_{xyz}$, $6s$ visuals are isolated-atom probability teaching models. They do not depict electron bands, bonding orbitals or the crystal electronic structure of Europium materials.

Phase behavior

At approximately standard pressure, europium is BCC solid below 1095 K, liquid to about 1802 K, and gaseous above the boiling reference.

Five things to remember

- Atomic number 63 means 63 protons.
- Neutral Europium has $[\text{Xe}] 4f^7 6s^2$.
- Its representative teaching isotope is ^{153}Eu .
- The color of a europium phosphor does not come from elemental europium metal glowing.
- The ordinary material reference is body-centred cubic.

Europium: Real World & Signature Science

Element-specific science, uses and history

Big idea

The color of a europium phosphor does not come from elemental europium metal glowing. It depends on the europium oxidation state, host lattice and electronic transitions: Eu^{3+} commonly gives sharp red emission, while Eu^{2+} can give broader blue-to-green emission in suitable hosts.

Why this element is scientifically distinctive

Explore Eu 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.

Red phosphors	Eu^{3+} ions provide characteristic red emission in suitable host lattices.
Blue/green phosphors	Eu^{2+} can produce broader blue or green emission depending on the host material.
Security markings	Europium luminescence is used in anti-counterfeit and authentication technologies.
Lighting & displays	Eu-doped phosphors have been important in lamps, screens and LEDs.
Isotope nuance	Natural europium contains ^{151}Eu , an extremely long-lived radioactive isotope, and stable ^{153}Eu .

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

1. Europium begins in mixed rare-earth mineral concentrates.
2. Chemical separation isolates europium compounds from closely related lanthanides.
3. Controlled valence and host-lattice chemistry produce Eu^{2+} - or Eu^{3+} -activated phosphors and optical materials.
4. Recycling is tied to phosphor, lighting and rare-earth recovery systems rather than elemental-metal collection alone.

History checkpoints

Late 1800s	Spectroscopic observations showed that samarium-group rare-earth material contained another component.
1901	Eugène-Anatole Demarçay isolated europium sufficiently to establish it as a distinct element.
20th century	Europium phosphors became central to color television and fluorescent lighting.
Today	Eu-doped materials remain important in LEDs, security inks and optical research.

Europium: Isotopes, Questions & Evidence

Evidence status and learner self-check

Isotope context

¹⁵³ Eu	Stable natural isotope	Slightly more abundant of the two natural europium isotopes.
¹⁵¹ Eu	Extremely long-lived radioactive natural isotope	Decays so slowly that it persists naturally.
Natural europium	Two-isotope mixture	Relative atomic mass reflects ¹⁵¹ Eu and ¹⁵³ Eu.

Common questions

What is europium?

Europium is chemical element 63, a reactive lanthanide metal.

What is europium used for?

Europium compounds are widely used as luminescent activators in phosphors, lighting, displays and security markings.

Is europium a metal?

Yes. It is a soft, silvery lanthanide metal.

Why does europium glow red?

Eu³⁺ ions in suitable host lattices have characteristic electronic transitions that can produce red emission; elemental Eu metal is not the same material.

Quick self-check

Q: What is Europium's atomic number? | Answer: 63. Atomic number equals proton count.

Q: Which classification best fits Europium? | Answer: Lanthanide. Periodic position and chemistry define the classification.

Q: What is the representative teaching isotope? | Answer: ¹⁵³Eu. An isotope mass number is not the same thing as relative atomic mass.

Evidence & safety

Atomic identity, reference values and ordinary structures are source-reviewed. Material viewers are teaching representations, not crystallographic refinements. Search demand never overrides measured/evaluated evidence or compound-vs-element distinctions.

Europium metal is reactive and europium compounds vary in hazard; luminescent-material applications should not be generalized to bare elemental europium.

Core sources

Royal Society of Chemistry - Europium

<https://periodic-table.rsc.org/element/63/europium>

NIST - Atomic Weights and Isotopic Compositions

https://physics.nist.gov/cgi-bin/Compositions/stand_alone.pl

USGS - Mineral Commodity Summaries 2026

<https://pubs.usgs.gov/publication/mcs2026>