

Cerium (Ce) - Student Datasheet

Element 58 · Lanthanide · source-reviewed learning reference

Cerium is element 58, a reactive lanthanide whose accessible $\text{Ce}^{3+}/\text{Ce}^{4+}$ redox chemistry and unusually rich solid-state allotropy connect the periodic table to catalysts, glass polishing, lighter flints and oxygen-storage materials.

Quick reference

Atomic number	58
Relative atomic mass	140.116
Electron configuration	[Xe] 4f ¹ 5d ¹ 6s ²
Period / group / block	6 / Lanthanide / f
State context	Soft gray reactive lanthanide metal
Density	6.77 g/cm ³
Melting / transition	1072 K
Boiling / gas reference	3716 K
Oxidation states	+3, +4
Electronegativity	1.12

Structure & orbitals

Cerium has unusually complex allotropy. Around room temperature γ -Ce is FCC; β -Ce can appear below roughly 283 K and δ -Ce becomes BCC near 998 K before melting. The viewer shows room-temperature γ -Ce, while the phase track makes the allotrope changes explicit.

The 4f_xyz, 5d_z2, 6s visuals are isolated-atom probability teaching models. They do not depict electron bands, bonding orbitals or the crystal electronic structure of Cerium materials.

Phase behavior

A simplified approximately standard-pressure path shows β -Ce (DHCP) below about 283 K, γ -Ce (FCC) from about 283 to 998 K, δ -Ce (BCC) from about 998 K to the 1072 K melting point, then liquid to about 3716 K.

Five things to remember

- Atomic number 58 means 58 protons.
- Neutral Cerium has [Xe] 4f¹ 5d¹ 6s².
- Its representative teaching isotope is ¹⁴⁰Ce.
- Cerium (Ce, 58) is not curium (Cm, 96).
- The ordinary material reference is γ -ce face-centred cubic near room temperature; multiple allotropes.

Cerium: Real World & Signature Science

Element-specific science, uses and history

Big idea

Cerium (Ce, 58) is not curium (Cm, 96). Their similar names hide completely different chemistry: cerium is a naturally abundant lanthanide used in catalysts and polishing materials, while curium is a radioactive synthetic/actinide element.

Why this element is scientifically distinctive

Explore Ce 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.

Catalysts	CeO ₂ and related cerium oxides participate in automotive and industrial oxidation/reduction catalysis.
Glass polishing	Cerium oxide is a major precision glass-polishing material.
Lighter flints	Cerium-rich mischmetal alloys are used in ferrocerium spark sources.
Oxygen storage	Ce ³⁺ /Ce ⁴⁺ redox cycling gives ceria useful oxygen-storage behavior.
Allotropy	Cerium's multiple solid phases make it a distinctive condensed-matter teaching element.

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

1. Rare-earth ores are processed into mixed rare-earth concentrates.
2. Cerium can be separated and oxidized/reduced between Ce³⁺ and Ce⁴⁺ chemical forms depending on the product route.
3. Ceria, mischmetal and other materials are manufactured for catalysts, polishing and specialty applications.
4. Recycling paths depend on the host product; the guide provides no industrial separation recipe.

History checkpoints

1803	Cerium was discovered independently by Berzelius and Hisinger in Sweden and by Klaproth in Germany.
1803	The name honored Ceres, the recently discovered asteroid/dwarf planet.
19th century	Rare-earth separation gradually clarified cerium chemistry and compounds.
Modern era	Ceria became important in catalysts, polishing and oxygen-storage materials.

Cerium: Isotopes, Questions & Evidence

Evidence status and learner self-check

Isotope context

¹⁴⁰ Ce	Stable natural isotope	Most abundant natural cerium isotope.
¹⁴² Ce	Very long-lived natural isotope	Radioactive only on immense timescales.
¹³⁶ Ce + ¹³⁸ Ce	Stable natural isotopes	Minor components of natural cerium.

Common questions

What is cerium?

Cerium is chemical element 58, a lanthanide metal.

Is cerium a metal?

Yes. It is a reactive gray lanthanide metal.

What is cerium used for?

Cerium compounds are important in catalysts, glass polishing and specialized glass; cerium-rich alloys are used in lighter flints.

What is the difference between cerium and curium?

Cerium is Ce, element 58, a lanthanide. Curium is Cm, element 96, a radioactive actinide.

Quick self-check

Q: What is Cerium's atomic number? | Answer: 58. Atomic number equals proton count.

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

Q: What is the representative teaching isotope? | Answer: ¹⁴⁰Ce. 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.

Cerium metal can be reactive, especially as fine material; cerium compounds have different hazards. No pyrophoric-material processing instructions are provided.

Core sources

Royal Society of Chemistry - Cerium

<https://periodic-table.rsc.org/element/58/cerium>

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>