

Promethium (Pm) - Student Datasheet

Element 61 · Radioactive lanthanide · source-reviewed learning reference

Promethium is element 61, a radioactive lanthanide with no stable isotopes. Minute natural quantities can arise from nuclear processes, but useful material is produced for research and specialized applications; its chemistry is dominated by Pm^{3+} .

Quick reference

Atomic number	61
Relative atomic mass	[145]
Electron configuration	[Xe] 4f ⁵ 6s ²
Period / group / block	6 / Lanthanide / f
State context	Radioactive lanthanide metal; no stable isotopes
Density	7.26 g/cm ³
Melting / transition	1315 K
Boiling / gas reference	3273 K
Oxidation states	+3
Electronegativity	Unknown / not conventionally assigned

Structure & orbitals

Metallic promethium is reported in close-packed hexagonal allotrope contexts. The viewer uses a dhcp teaching motif and labels the evidence as reviewed because bulk experimental literature is sparse compared with common metals.

The 5f/6s cloud views are isolated-atom teaching models. Lanthanide bonding, ions and solid metal involve many-electron states beyond these shapes.

Phase behavior

Using reviewed reference values, promethium metal is treated as solid below about 1315 K, liquid to about 3273 K, and gaseous above. Detailed allotrope transitions are not invented.

Five things to remember

- Atomic number 61 means 61 protons.
- Promethium has no stable isotopes.
- Pm^{3+} is the dominant ordinary chemical state.
- Minute natural promethium can occur transiently, but there is no mineable natural resource.
- ¹⁴⁵Pm is among the longest-lived promethium isotopes, while ¹⁴⁷Pm is important in application history.

Promethium: Real World & Signature Science

Element-specific science, uses and history

Big idea

“Does promethium occur naturally?” deserves more than yes/no. No primordial stable promethium survives on Earth, but minute transient quantities can arise from uranium fission and related nuclear processes. That is different from having a mineable natural promethium resource.

Why this element is scientifically distinctive

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

Radioisotope research	Promethium isotopes are studied in nuclear and lanthanide chemistry.
Beta-source history	^{147}Pm has been used in specialized beta-source and power/light-device contexts.
Rare-earth chemistry	Pm^{3+} lets scientists test lanthanide trends in a radioactive element.
Natural trace	Minute transient Pm can arise from uranium fission; this does not create an exploitable natural deposit.
Safety boundary	No isotope production, source construction or handling procedures are provided.

Promethium: from nuclear origin to research material — non-operational overview

1. Promethium isotopes arise through nuclear transformations; operational production conditions are outside this guide.
2. Chemical separation in specialist facilities can isolate promethium compounds, but no procedural parameters are provided.
3. Most ordinary chemistry involves Pm^{3+} , allowing comparison across the lanthanides.
4. Radioactive decay continually limits inventory and shapes all applications.

History checkpoints

1945	Jacob Marinsky, Lawrence Glendenin and Charles Coryell identified element 61 among fission products at Oak Ridge.
1947	The name promethium was announced, invoking the mythic Prometheus.
Mid-20th century	Promethium isotopes were investigated for beta-source and specialized power applications.
Today	Promethium remains a research and specialty radioisotope element with no stable isotope.

Promethium: Isotopes, Questions & Evidence

Evidence status and learner self-check

Isotope context

¹⁴⁵ Pm	Radioactive · ~17.7 y	Among the longest-lived promethium isotopes and the reference teaching nucleus.
¹⁴⁷ Pm	Radioactive · ~2.62 y	Historically important beta-emitting isotope.
Promethium isotope context	No stable isotopes	All promethium isotopes are radioactive.

Common questions

What is promethium?

Promethium is radioactive lanthanide element 61, symbol Pm.

Is promethium a metal?

Yes. It is a lanthanide metal.

Is promethium radioactive?

Yes. It has no stable isotopes.

Where is promethium found?

Only minute transient natural quantities occur from nuclear processes; practical material is associated with controlled production, not mining.

Quick self-check

Q: What is promethium's atomic number? | Answer: 61. Atomic number equals proton count.

Q: Does promethium have a stable isotope? | Answer: No. All known Pm isotopes are radioactive.

Q: What is its dominant chemical ion? | Answer: Pm³⁺. +3 dominates lanthanide chemistry.

Evidence & safety

Element/isotope identity and reference atomic values are evaluated. Bulk phase values and close-packed metal structure are source-reviewed but experimental literature is sparse; no detailed allotrope transition is fabricated.

Promethium is radioactive. No isotope-production, source-fabrication, acquisition, handling, exposure or disposal instructions are provided.

Core sources

Royal Society of Chemistry - Promethium

<https://periodic-table.rsc.org/element/61/promethium>

Los Alamos National Laboratory - Promethium

<https://periodic.lanl.gov/61.shtml>