

Actinium (Ac) - Student Datasheet

Element 89 · Actinide · source-reviewed learning reference

Actinium is element 89, a scarce radioactive actinide whose best-established chemistry is +3. Natural ^{227}Ac occurs in the ^{235}U decay series, while ^{225}Ac has become important in targeted-alpha-therapy research under tightly controlled medical/nuclear systems.

Quick reference

Atomic number	89
Relative atomic mass	[227]
Electron configuration	[Rn] 6d ¹ 7s ²
Period / group / block	7 / Actinides / d
Ordinary state	Radioactive silvery-white solid
Density	10 g/cm ³
Melting point	1323 K
Boiling point	3473 K
Oxidation states	+3
Electronegativity	1.1 (approx.)

Structure & orbitals

Bulk actinium measurements are difficult because the element is scarce and radioactive. The material viewer uses the reported face-centred-cubic metallic reference with an evidence note rather than implying abundant bulk samples.

The 7s and representative 6d probability models are isolated-atom teaching approximations. They do not show radioactive decay or the electronic bands of bulk actinium.

Phase behavior

Using evaluated reference values, actinium is treated as solid below about 1323 K, liquid to about 3473 K and gas above. Scarcity/radioactivity make bulk-property evidence less abundant than for common metals.

Five things to remember

- Atomic number 89 means 89 protons.
- The reference configuration is [Rn] 6d¹ 7s².
- Actinium commonly forms +3 chemistry.
- ^{227}Ac occurs naturally in the ^{235}U decay series.
- ^{225}Ac is researched/used in specialized targeted-alpha medical contexts; this does not make actinium a general-purpose material.

Actinium: Real World & Signature Science

Big idea

Actinium's nuclear isotope story is more prominent than everyday bulk-material use. The page separates natural ^{227}Ac , medically researched ^{225}Ac , metallic structure data and safety controls.

Why this element is scientifically distinctive

Compare Ac with Ac^{3+} , inspect a ^{227}Ac teaching nucleus and 7s/6d probability models, view the reported metallic structure cautiously, then connect decay-series occurrence, discovery history and high-level ^{225}Ac research.

Decay-series occurrence	Trace ^{227}Ac occurs naturally as part of the ^{235}U decay chain.
^{225}Ac research	^{225}Ac is important in targeted-alpha therapy research and regulated radiopharmaceutical development.
Research material	Because actinium is scarce and radioactive, most chemistry/material data come from specialized research rather than common engineering use.
Discovery history	André Debierne reported actinium in Paris in 1899; Friedrich Giesel independently isolated it soon afterward.
Safety boundary	All isotope production, source handling and clinical use belong in licensed professional systems; this page remains high-level.

Actinium isotope context: occurrence, research and regulated use

1. Natural ^{227}Ac appears only in trace amounts within the ^{235}U decay series.
2. Research/medical isotopes such as ^{225}Ac are produced only in specialized nuclear facilities; no production route is described here.
3. Radiochemical purification, source preparation and clinical formulation require licensed infrastructure and are outside this educational page.
4. The science focus here is isotope identity, decay context, chemistry and evidence—not operational handling.

History checkpoints

1899	André Debierne reported a new radioactive element from pitchblende residues in Paris.
1902	Friedrich Giesel independently isolated the element and described its strong radioactivity.
20th century	Actinium became important mainly in nuclear/radiochemical research.
Today	^{225}Ac is an important radionuclide in targeted-alpha therapy research and clinical development under regulated systems.

Actinium: Isotopes, Questions & Evidence

Isotope context

²²⁷Ac	Radioactive · natural decay-series isotope	Reference teaching nucleus: 89 protons and 138 neutrons.
²²⁵Ac	Radioactive · targeted-alpha medical research/therapy	A high-interest isotope used in highly regulated radiopharmaceutical contexts.
²²⁸Ac	Short-lived radioactive isotope	Appears in the ²³² Th decay series and is important in decay-series measurements.

Common questions

What is actinium's atomic number?

89.

Is actinium a metal?

Yes. It is a radioactive actinide metal.

What is actinium used for?

Mostly specialized nuclear research; ²²⁵Ac is important in targeted-alpha radiopharmaceutical research and therapy.

Where is actinium found naturally?

Trace ²²⁷Ac occurs in uranium ores as part of the ²³⁵U decay series.

Quick self-check

Q: What is actinium's atomic number? | Answer: 89. Atomic number equals proton count.

Q: What is the common actinium oxidation state? | Answer: +3. Ac³⁺ dominates ordinary actinium chemistry.

Q: Which isotope is prominent in targeted-alpha research? | Answer: ²²⁵Ac. Ac-225 is a major targeted-alpha radionuclide.

Evidence & safety

Element identity, isotope data and reference phase values are evaluated. The metallic structure is evidence-limited and labelled as a reported teaching reference. Medical/nuclear context stays non-operational.

Actinium isotopes are radioactive. This educational page does not provide production, separation, source fabrication, access, dose, handling or clinical instructions.

Core sources

Royal Society of Chemistry - Actinium

<https://periodic-table.rsc.org/element/89/actinium>

NIST - Atomic Data for Actinium

<https://physics.nist.gov/PhysRefData/Handbook/Tables/actiniumtable1.htm>

IAEA - Actinium-225 / alpha-emitter context

<https://www.iaea.org/>