

Francium (Fr) - Student Datasheet

Element 87 · Radioactive alkali metal · evidence-limited bulk element · source-reviewed learning reference

Francium is element 87, the heaviest naturally occurring alkali metal and one of the rarest naturally occurring elements. Its $7s^1$ configuration supports +1 chemistry, but no macroscopic francium sample exists to establish ordinary bulk structure or appearance.

Quick reference

Atomic number	87
Relative atomic mass	[223]
Electron configuration	[Rn] $7s^1$
Period / group / block	7 / 1 / s
State context	Expected alkali-metal condensed state near room temperature; no macroscopic sample exists
Density	Unknown
Melting / transition	Estimated ≈ 294 K
Boiling / gas reference	Estimated ≈ 923 K
Oxidation states	+1 expected and chemically supported at tracer scale
Electronegativity	≈ 0.7 (estimate)

Structure & orbitals

Francium exists atom-at-a-time or in tiny transient quantities. A bulk alkali-metal lattice has not been measured, so the material viewer does not copy a cesium-like crystal as if it were experimental fact.

The $7s$ cloud is an isolated-atom nonrelativistic teaching model. Heavy-atom relativistic effects are important and the visual is not a measured bulk-electron distribution.

Phase behavior

Francium has no measured macroscopic phase diagram. Estimated boundaries near 294 K and 923 K may be shown only as predicted teaching references, not as ordinary measured bulk constants.

Five things to remember

- Atomic number 87 means 87 protons.
- The reference configuration is [Rn] $7s^1$.
- ^{223}Fr has a half-life of only about 22 minutes, so francium never accumulates in macroscopic natural samples.
- Francium commonly behaves as a +1 alkali-metal ion in tracer chemistry.
- Bulk density and crystal structure are not measured.

Francium: Real World & Signature Science

Element-specific science, uses and history

Big idea

The periodic table predicts a strong family resemblance to cesium, but family resemblance is not measurement. Francium's bulk state, density and crystal structure must remain evidence-limited.

Why this element is scientifically distinctive

Toggle the neutral $7s^1$ atom to the Fr^+ electron-count teaching state, rotate a ^{223}Fr nucleus, and use the Evidence Lens to separate tracer-scale chemistry from estimated phase properties and unknown bulk structure.

Natural decay chain	Francium appears transiently in the actinium decay series and disappears through radioactive decay.
Discovery in Paris	Marguerite Perey identified francium in 1939 while studying actinium at the Curie Institute.
Alkali-metal chemistry	Tracer experiments support strong +1 alkali-metal behavior without requiring a visible lump of metal.
Atomic research	Very small numbers of francium atoms have been trapped/studied in specialized atomic-physics research.
No practical bulk use	Short half-lives and scarcity mean there is no macroscopic commercial francium application.

How francium is observed: natural decay and atom-scale research

1. Francium appears transiently in natural decay chains; it does not form mineable deposits.
2. Radioactive decay measurements establish isotope identity and nuclear behavior.
3. Tracer-scale chemistry tests ionic behavior without accumulating bulk material.
4. Specialized research may create or trap small numbers of atoms; this guide gives no production or apparatus settings.

History checkpoints

1939	Marguerite Perey discovered francium while studying actinium decay at the Curie Institute in Paris.
20th century	Tracer chemistry established alkali-metal-like behavior.
Modern research	Small numbers of francium atoms have been used in specialized atomic-physics experiments.
Evidence boundary	No macroscopic sample has been available for ordinary bulk property measurements.

Francium: Isotopes, Questions & Evidence

Evidence status and learner self-check

Isotope context

²²³ Fr	Radioactive natural isotope	Reference teaching nucleus with 87 protons and 136 neutrons; half-life about 22 minutes.
²²¹ Fr	Radioactive isotope	Another short-lived francium isotope.
Francium isotope context	No stable isotopes	All known francium isotopes are radioactive.

Common questions

What is francium?

Francium is element 87, a radioactive Group 1 element.

What is francium used for?

Fundamental atomic and nuclear research; it has no practical bulk use.

Is francium a metal?

It is classified as an alkali metal by periodic position and tracer chemistry, but macroscopic metallic properties cannot be measured from a bulk sample.

Where is francium found?

Only transiently in natural radioactive decay chains and in specialized research.

Quick self-check

Q: What is francium's atomic number? | Answer: 87. Atomic number equals proton count.

Q: What is the reference outer configuration? | Answer: 7s¹. Francium is the Period 7 Group 1 element.

Q: What is the measured bulk crystal structure? | Answer: Unknown. No macroscopic sample has established a lattice.

Evidence & safety

Atomic number, isotope identities and tracer chemistry are measured/evaluated. Bulk density and crystal structure are unknown. Melting/boiling values are literature estimates and remain visibly predicted.

Francium is radioactive and exists only in trace/research quantities. This page provides no production, separation, trapping, access or handling procedures.

Core sources

Royal Society of Chemistry - Francium

<https://periodic-table.rsc.org/element/87/francium>

NIST - Atomic Data for Francium

<https://physics.nist.gov/PhysRefData/Handbook/Tables/franciumtable1.htm>