

Bismuth (Bi) - Student Datasheet

Element 83 · Post-transition metal · source-reviewed learning reference

Bismuth is element 83, a heavy post-transition metal with a rhombohedral structure, unusually low toxicity relative to many neighboring heavy metals, and a natural isotope—²⁰⁹Bi—that is radioactive only on an immense timescale.

Quick reference

Atomic number	83
Relative atomic mass	208.980
Electron configuration	[Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ³
Period / group / block	6 / 15 / p
State context	Brittle silvery-white metal with a pinkish cast
Density	9.79 g/cm ³
Melting / transition	544.556 K
Boiling / gas reference	1837 K
Oxidation states	+3, +5
Electronegativity	1.9

Structure & orbitals

Ordinary bismuth adopts the rhombohedral A7 structure. The viewer is a simplified rhombohedral teaching cell rather than a crystallographic coordinate file.

The 6s/6p views are isolated-atom probability models and do not reproduce the bands or bonding of rhombohedral bismuth.

Phase behavior

At approximately standard pressure, bismuth is solid below 544.556 K, liquid to about 1837 K, and gaseous above the boiling reference.

Five things to remember

- Atomic number 83 means 83 protons.
- Bismuth is a Group 15 post-transition metal, not a metalloid.
- Ordinary bismuth has a rhombohedral A7 structure.
- Natural bismuth is essentially ²⁰⁹Bi, an extraordinarily long-lived alpha emitter.
- Bismuth compounds and elemental bismuth must be distinguished when discussing uses or safety.

Bismuth: Real World & Signature Science

Element-specific science, uses and history

Big idea

“Is bismuth radioactive?” needs a precise answer. Natural bismuth is essentially all ^{209}Bi , which undergoes alpha decay with a half-life around 2×10^{19} years. That makes it radioactive in nuclear physics, while its activity is extraordinarily low in ordinary material.

Why this element is scientifically distinctive

Explore Bi 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.

Low-melting alloys	Bismuth is used in fusible and low-melting alloy systems.
Medicinal compounds	Some bismuth compounds are used in medicines; those compounds are chemically distinct from the metal.
Crystal growth	Slow solidification can produce colorful oxide-coated hopper crystals, a visual consequence of growth geometry and thin surface films.
Lead substitution	Bismuth is used in selected applications seeking lower-toxicity alternatives to lead.
Nuclear nuance	^{209}Bi is radioactive, but with an enormous half-life.

From by-product metal to bismuth materials: high-level path

1. Bismuth is commonly obtained as a by-product of processing lead, copper, tin or other ores rather than from a single universal dedicated ore route.
2. Refining separates bismuth into metal or compound feedstocks.
3. Manufacturing uses bismuth in alloys, compounds and specialty materials.
4. Recycling can recover bismuth from selected industrial streams.

History checkpoints

Ancient use	Bismuth-containing materials were known long before the element was clearly distinguished from lead and tin.
1753	Claude François Geoffroy is commonly credited with demonstrating bismuth as distinct from lead.
20th century	High-purity bismuth and compounds gained specialized metallurgical and pharmaceutical roles.
2003	Alpha decay of ^{209}Bi was directly observed, establishing its extremely long half-life.

Bismuth: Isotopes, Questions & Evidence

Evidence status and learner self-check

Isotope context

²⁰⁹Bi	Extremely long-lived natural alpha emitter	Essentially all natural bismuth; half-life is of order 10 ¹⁹ years.
Bismuth radioisotopes	Synthetic radioactive isotopes	Shorter-lived isotopes are used in nuclear research.
Evidence lesson	Radioactive does not mean highly active	Half-life and isotope abundance determine activity.

Common questions

What is bismuth?

Bismuth is chemical element 83, a heavy post-transition metal.

Is bismuth a metal?

Yes. It is a post-transition metal in Group 15.

Is bismuth radioactive?

Yes in a precise nuclear sense: natural ²⁰⁹Bi alpha-decays, but its half-life is around 2 × 10¹⁹ years, so its activity is extremely low.

What is bismuth used for?

Uses include low-melting alloys, selected medicinal compounds, metallurgy and specialized materials.

Quick self-check

Q: What is bismuth's atomic number? | Answer: 83. Atomic number equals proton count.

Q: Is natural bismuth radioactive? | Answer: Yes, ²⁰⁹Bi is extraordinarily long-lived radioactive. Radioactivity is an isotope property.

Q: What is its ordinary crystal class? | Answer: Rhombohedral A7. Bulk bismuth structure is measured.

Evidence & safety

Atomic and phase values are evaluated. The A7 material viewer is a simplified structural model. The radioactivity statement explicitly preserves the extraordinary ²⁰⁹Bi half-life rather than calling bismuth simply "stable."

Low relative toxicity does not mean every bismuth compound is harmless. Use substance-specific safety data for real materials.

Core sources

Royal Society of Chemistry - Bismuth

<https://periodic-table.rsc.org/element/83/bismuth>

NIST - Atomic Weights / Bismuth

https://physics.nist.gov/cgi-bin/Compositions/stand_alone.pl?ele=Bi

USGS - Mineral Commodity Summaries 2026

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