

Beryllium (Be) - Student Datasheet

Atomic number 4 - Alkaline earth metal - Group 2 - Period 2 - s-block

Beryllium is element 4, an unusually light and stiff Group 2 metal. Its low atomic number, compact atoms and strong bonding connect atomic structure to X-ray windows, aerospace materials and a strict occupational-health boundary.

Quick reference

Atomic number	4
Relative atomic mass	9.0122
Electron configuration	[He] 2s ²
State at 20 C	Light grey solid at 20 deg C
Density	1.85 g/cm ³
Melting point	1560 K
Boiling point	2741 K
Common oxidation state	+2
Electronegativity	1.57

Structure & orbitals

Beryllium is hexagonal close-packed at ordinary conditions. The viewer is a conventional-cell teaching schematic, not a crystallographic coordinate file.

The occupied 2s orbital is shown as a spherical probability distribution with a radial node in a hydrogen-like teaching approximation; it is not an electron orbit or a bulk band-structure calculation.

Temperature / phase context

At approximately standard pressure, beryllium is solid below about 1560 K, liquid from melting to about 2741 K, and gaseous above the boiling reference. High-pressure polymorphs are outside this teaching track.

Five things to remember

- Atomic number 4 means every beryllium nucleus has 4 protons.
- Neutral beryllium has the ground-state configuration [He] 2s².
- Beryllium commonly forms +2 compounds.
- Beryllium is light and exceptionally stiff for its density.
- Beryllium dust and fumes require professional exposure controls; useful material properties do not imply harmlessness.

Beryllium: Real World & Signature Science

Beryllium combines very low density with high stiffness, but useful properties do not erase hazard: inhalation of beryllium-containing dust or fumes can cause serious disease. This guide separates the bulk metal from exposure pathways.

Why this element matters

X-ray windows Thin beryllium can transmit X-rays efficiently because of its low atomic number, while remaining mechanically useful.	Light, stiff components Beryllium and selected alloys are used where low mass, stiffness and dimensional stability matter.
Copper-beryllium alloys Small beryllium additions can strengthen copper alloys used in specialized springs, connectors and tools.	Resource geology Commercial beryllium is associated with minerals such as bertrandite and beryl; deposit geology and metal production are different maps.
Health boundary Chronic beryllium disease and carcinogenicity make occupational dust/fume control essential.	

From beryllium mineral to engineered material: a high-level path

1. Beryllium occurs in minerals such as bertrandite and beryl rather than as native metal.
2. Mining and beneficiation concentrate beryllium-bearing feed; deposit-specific methods are not described here.
3. Chemical conversion and metal/alloy production are industrial processes requiring controlled facilities and exposure management.
4. Fabrication creates specialty components, while scrap recovery can return valuable beryllium-bearing material to controlled industrial streams.

Where on Earth?

Resource geology

Spor Mountain, Utah is a specific reviewed bertrandite example; broader supply is a specialty commodity, not a complete pin map.

History

1798 - Nicolas-Louis Vauquelin recognized a new element in beryl and emerald.

1828 - Friedrich Wohler and Antoine Bussy independently isolated the metal.

20th century - Specialized uses developed in aerospace, nuclear, X-ray and high-performance alloy applications.

Today - Beryllium is a strategically important specialty material whose use is paired with strict exposure controls.

Uses

Aerospace & instruments Low density and stiffness make beryllium useful in selected precision and aerospace structures.	X-ray equipment Thin beryllium windows transmit X-rays while maintaining a physical barrier.
Copper alloys Copper-beryllium alloys combine conductivity with high strength in specialized parts.	Scientific systems Beryllium appears in selected research, detector and optical applications where its unusual material properties matter.

Beryllium: Isotopes, Questions & Evidence

Isotopes

⁹Be - Stable - essentially all natural beryllium

The reference teaching nucleus contains 4 protons and 5 neutrons.

¹⁰Be - Long-lived cosmogenic radionuclide

Produced naturally by cosmic-ray interactions and used in Earth-science dating/tracing contexts.

Beryllium isotope context - One stable natural isotope

Beryllium is effectively monoisotopic in nature, unlike many neighboring elements.

Common questions

What is beryllium's atomic number?

4. Every beryllium nucleus contains four protons.

Is beryllium a metal?

Yes. Beryllium is a Group 2 alkaline-earth metal, though its small size gives its compounds distinctive bonding behavior.

What is beryllium used for?

Selected uses include aerospace and precision components, X-ray windows and copper-beryllium alloys.

How many valence electrons does beryllium have?

Two, from the 2s² outer configuration.

Why can beryllium transmit X-rays?

Its low atomic number gives relatively weak X-ray absorption compared with many structural metals, allowing thin windows to be useful.

Is beryllium dangerous?

Beryllium-containing dust and fumes can cause serious occupational disease; safe work requires professional exposure controls.

Quick self-check

1. What is beryllium's atomic number? Answer: 4
2. How many valence electrons does neutral beryllium have? Answer: 2
3. What room-temperature crystal teaching model is used? Answer: Hexagonal close-packed
4. Why is beryllium useful for some X-ray windows? Answer: Low atomic number and useful stiffness
5. Which exposure statement is correct? Answer: Dust/fumes require strict professional control

Safety boundary

Beryllium dust/fume exposure can cause serious disease. This page is educational and does not provide processing or exposure-control procedures.

Evidence & provenance

Atomic and ordinary physical values are evaluated reference data. The HCP viewer is a teaching schematic. Geography uses reviewed deposit/commodity examples rather than claiming a complete map of beryllium occurrence.

Core sources

Royal Society of Chemistry - Beryllium	https://periodic-table.rsc.org/element/4/beryllium
NIST - Atomic Data for Beryllium	https://physics.nist.gov/PhysRefData/Handbook/Tables/berylliumtable1.htm
USGS - Mineral Commodity Summaries 2026	https://pubs.usgs.gov/publication/mcs2026