

Niobium (Nb) - Student Datasheet

Element 41 · Transition metal · source-reviewed learning reference

Niobium is element 41, a Group 5 transition metal whose BCC lattice, stable ^{93}Nb isotope and superconducting/alloy chemistry connect atomic structure to high-strength steels, accelerator magnets and MRI/NMR technology.

Quick reference

Atomic number	41
Relative atomic mass	92.906
Electron configuration	[Kr] 4d ⁴ 5s ¹
Period / group / block	5 / 5 / d
State context	Silvery corrosion-resistant transition metal
Density	8.57 g/cm ³
Melting / transition	2750 K
Boiling / gas reference	5014 K
Oxidation states	+5, +3
Electronegativity	1.6

Structure & orbitals

Pure niobium is body-centred cubic under ordinary conditions. The viewer shows a conventional BCC teaching cell and stays separate from superconducting Nb-Ti and Nb₃Sn material structures.

The 4d_{z²}, 4d_{xy}, 5s visuals are isolated-atom probability teaching models. They do not depict electron bands, bonding orbitals or the crystal electronic structure of Niobium materials.

Phase behavior

At approximately standard pressure, niobium is BCC solid below 2750 K, liquid to about 5014 K, and gaseous above the boiling reference.

Five things to remember

- Atomic number 41 means 41 protons.
- Neutral Niobium has [Kr] 4d⁴ 5s¹.
- Its representative teaching isotope is ^{93}Nb .
- Niobium used to be called columbium, which explains older technical terminology.
- The ordinary material reference is body-centred cubic.

Niobium: Real World & Signature Science

Element-specific science, uses and history

Big idea

Niobium used to be called columbium, which explains older technical terminology. Modern chemistry uses niobium (Nb), and many high-profile applications rely on niobium alloys or compounds rather than pure metal alone.

Why this element is scientifically distinctive

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

High-strength steels	Small niobium additions can strengthen microalloyed structural and pipeline steels.
Superconducting magnets	Nb-Ti and Nb ₃ Sn are important superconducting materials used in magnets; they are alloys/compounds, not pure Nb.
Aerospace alloys	Niobium participates in high-temperature superalloy systems.
Optical materials	Niobium oxides can raise refractive index in specialty glass.
Historical name	Columbium is the former name that still appears in some older specifications.

From source material to Niobium applications: high-level material path

1. Niobium-bearing minerals are concentrated and processed, commonly alongside tantalum-bearing material.
2. Refining separates niobium compounds and metal feedstocks.
3. Most niobium enters steel in small additions; high-purity routes feed superconducting alloys and specialty materials.
4. Scrap and alloy recycling can return niobium to material cycles.

History checkpoints

1801	Charles Hatchett identified a new element in columbite and called it columbium.
1844	Heinrich Rose showed the element was distinct from tantalum and promoted the name niobium.
1864	Christian Blomstrand produced metallic niobium by reducing a chloride.
1950	IUPAC adopted niobium as the international name, though columbium persisted in some industries.

Niobium: Isotopes, Questions & Evidence

Evidence status and learner self-check

Isotope context

⁹³Nb	Stable natural isotope	Essentially all naturally occurring niobium.
Radioisotopes	Artificial isotopes	Used mainly in nuclear and materials research.
Natural niobium	Single stable-isotope element	Relative atomic mass closely follows ⁹³ Nb.

Common questions

What is niobium?

Niobium is chemical element 41, a Group 5 transition metal.

What is niobium used for?

It is used in high-strength steels, superalloys and superconducting materials such as Nb-Ti and Nb₃Sn.

Is niobium a metal?

Yes. It is a silvery transition metal.

Where is niobium found?

It occurs in minerals including pyrochlore and columbite, commonly associated with tantalum.

Quick self-check

Q: What is Niobium's atomic number? | Answer: 41. Atomic number equals proton count.

Q: Which classification best fits Niobium? | Answer: Transition metal. Periodic position and chemistry define the classification.

Q: What is the representative teaching isotope? | Answer: ⁹³Nb. An isotope mass number is not the same thing as relative atomic mass.

Evidence & safety

Atomic identity, reference values and ordinary structures are source-reviewed. Material viewers are teaching representations, not crystallographic refinements. Search demand never overrides measured/evaluated evidence or compound-vs-element distinctions.

Niobium metal and niobium compounds have different safety profiles; superconducting magnets also involve engineering hazards beyond element chemistry.

Core sources

Royal Society of Chemistry - Niobium

<https://periodic-table.rsc.org/element/41/niobium>

NIST - Atomic Weights and Isotopic Compositions

https://physics.nist.gov/cgi-bin/Compositions/stand_alone.pl

USGS - Mineral Commodity Summaries 2026

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