

Rhodium (Rh) - Student Datasheet

Element 45 · Transition metal · platinum-group metal · source-reviewed learning reference

Rhodium is element 45, a rare platinum-group transition metal. Its FCC lattice and surface chemistry underpin catalytic-converter and industrial-catalysis roles, while rhodium plating is a distinct thin-coating application—not the definition of the element.

Quick reference

Atomic number	45
Relative atomic mass	102.906
Electron configuration	[Kr] 4d ⁸ 5s ¹
Period / group / block	5 / 9 / d
State context	Hard silvery-white noble metal
Density	12.4 g/cm ³
Melting / transition	2236 K
Boiling / gas reference	3968 K
Oxidation states	+3, +1; others occur
Electronegativity	2.28

Structure & orbitals

Pure rhodium is face-centred cubic near room temperature. The viewer shows a conventional FCC teaching cell.

Representative 4d and 5s isolated-atom clouds do not show metallic bands or ligand-field orbitals in rhodium catalysts.

Phase behavior

At approximately standard pressure, rhodium is solid below 2236 K, liquid to about 3968 K, and gaseous above the boiling reference.

Five things to remember

- Atomic number 45 means 45 protons.
- Rh is the symbol for rhodium.
- Rhodium is a platinum-group transition metal.
- Pure rhodium is FCC and extremely corrosion resistant.
- Rhodium plating and rhodium catalysts are applications of the element, not separate elements.

Rhodium: Real World & Signature Science

Element-specific science, uses and history

Big idea

Searches for “rhodium” often mix chemistry with jewelry price and plating. The science page should first establish Rh as element 45, then explain that plating is a thin rhodium coating and that market price is volatile rather than an intrinsic atomic property.

Why this element is scientifically distinctive

Explore Rh 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.

Emission-control catalysts	Rhodium is especially important in catalytic converters for reactions that reduce nitrogen oxides.
Industrial catalysis	Rhodium complexes and surfaces catalyze selected high-value chemical transformations.
Plating	Thin rhodium coatings provide a bright, hard, corrosion-resistant surface on selected jewelry and components.
PGM supply	Primary supply is tied to platinum-group ore systems, especially in southern Africa, with recycling important.
Price caution	Market price changes rapidly and is not a fixed element property, so the core guide does not present a live price as science data.

From platinum-group ore or recycling to rhodium materials: high-level path

1. Rhodium is recovered with other platinum-group metals from complex ore and refining streams.
2. Separation and refining produce high-purity rhodium metal or chemical precursors.
3. Catalyst and plating industries convert the element into application-specific forms.
4. Spent automotive and industrial catalysts are important secondary sources; no refining recipe is provided here.

History checkpoints

1803	William Hyde Wollaston discovered rhodium while studying platinum ores.
19th-20th centuries	Rhodium chemistry expanded through complex chemistry, plating and catalysis.
Automotive era	Rhodium became important in emission-control catalysts.
Today	Scarce primary supply and catalyst recycling make rhodium a high-value circular-material story.

Rhodium: Isotopes, Questions & Evidence

Evidence status and learner self-check

Isotope context

^{103}Rh	Stable natural isotope	Rhodium is monoisotopic in nature: ^{103}Rh accounts for natural rhodium.
Radioisotopes	Synthetic isotopes	Radioactive rhodium isotopes are used primarily in research.
Natural rhodium	One stable isotope	This simplifies natural-isotope composition compared with many neighboring elements.

Common questions

What is rhodium?

Rhodium is chemical element 45, a rare platinum-group transition metal.

Is rhodium a metal?

Yes. It is a transition metal and platinum-group metal.

What is rhodium used for?

Major uses include emission-control catalysts, chemical catalysis and thin protective/decorative plating.

What is rhodium plating?

A thin coating of rhodium deposited on another material; the plated object is not solid rhodium throughout.

Quick self-check

Q: What is rhodium's symbol? | Answer: Rh. Rh identifies element 45.

Q: What structure does rhodium metal use? | Answer: FCC. Pure Rh is face-centred cubic.

Q: What is rhodium plating? | Answer: A thin Rh coating on another material. Plating is a surface process/application.

Evidence & safety

Atomic and phase values are evaluated. FCC structure is measured. Geography uses broad PGM production/recycling context and does not imply that every PGM mine has the same rhodium output.

Rhodium metal, soluble rhodium compounds and catalyst residues can have different hazards. Plating/catalyst work requires process-specific controls.

Core sources

Royal Society of Chemistry - Rhodium

<https://periodic-table.rsc.org/element/45/rhodium>

USGS - Platinum-Group Metals

<https://www.usgs.gov/centers/national-minerals-information-center/platinum-group-metals-statistics-and-information>

USGS - Mineral Commodity Summaries 2026

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