

Nickel (Ni) - Student Datasheet

Atomic number 28 - Transition metal - Group 10 - Period 4 - d-block

Nickel is a corrosion-resistant Group 10 transition metal used widely in alloys, plating, catalysts and batteries. Its 3d electrons connect atomic structure to magnetism, bonding and surface chemistry, while its ore geology spans both laterite and sulfide deposits.

Quick reference

Atomic number	28
Relative atomic mass	58.6934
Electron configuration	[Ar] 3d ⁸ 4s ²
Common oxidation state	+2
Density	8.90 g/cm ³
Melting point	1728 K
Boiling point	3186 K
Crystal near room temperature	FCC

Structure & orbitals

Reference isotope: ⁵⁸Ni - 28 protons + 30 neutrons. Ground-state electron configuration: [Ar] 3d⁸ 4s².

The selected orbital models include occupied 4s and two named members of the occupied 3d subshell: 3d z² and 3d xy. A d subshell contains five spatial orbitals; these buttons are representative members, not a claim that “3d” has one single shape.

Material / molecular structure: Face-centred cubic nickel metal near room temperature (Fm-3m teaching cell)

Phase / temperature context

On this approximately standard-pressure teaching path, nickel is solid below 1728 K, liquid from 1728 K to 3186 K, and gaseous above 3186 K.

Five things to remember

1. Atomic number 28 means every nickel nucleus has 28 protons.
2. The common reference configuration is [Ar] 3d⁸ 4s².
3. Nickel metal is face-centred cubic near room temperature.
4. ⁵⁸Ni and ⁶⁰Ni are the two most abundant natural isotopes.
5. Modern nickel supply comes from both laterite ores and magmatic sulfide deposits, and production geography changes with time.

Real-world context

Stainless & alloys

Nickel is a major alloying element in stainless steels and superalloys, improving corrosion resistance and high-temperature performance.

Batteries

Nickel appears in several rechargeable-battery chemistries, including nickel-metal hydride and nickel-containing lithium-ion cathodes.

Catalysis

Nickel surfaces and compounds are used as catalysts in many industrial chemical reactions.

Plating

Nickel electroplating can provide corrosion resistance, wear resistance and decorative finishes.

Geology & meteorites

Nickel occurs in laterites and sulfide ores and is also common in iron meteorites, reflecting its siderophile geochemical behavior.

Where on Earth? / geography modes

Nickel mine production - 2025 estimate

Recent mine output is highly concentrated, especially in Indonesia

Examples/context: Indonesia; Philippines; Russia

Deposit types - Laterite + sulfide

Nickel resources occur in major laterite belts and magmatic sulfide provinces

Examples/context: Sulawesi laterites; Philippine laterites; Sudbury; Norilsk

Nickel material cycle - Secondary supply

Nickel-bearing alloys and batteries can return through recycling systems

Examples/context: Alloy scrap; Batteries; Refining; Manufacturing

Isotopes

Isotope	Status / timescale	Why it matters
⁵⁸ Ni	Stable · ≈68.1% natural abundance	The dominant natural isotope; 28 protons and 30 neutrons.
⁶⁰ Ni	Stable · ≈26.2%	The second most abundant natural isotope.
⁶¹ Ni / ⁶² Ni / ⁶⁴ Ni	Stable · minor natural isotopes	Three additional stable isotopes complete the natural isotopic mixture.

Evidence note

Atomic/isotope and ordinary physical data are measured/evaluated. Mine-production geography is a dated commodity dataset, while deposit-type maps are geological context rather than a production ranking.

Review questions

What is nickel's atomic number?

Answer: 28. Nickel is element 28.

What crystal structure does nickel have near room temperature?

Answer: Face-centred cubic (FCC). Nickel metal is FCC.

Which are the two most abundant natural nickel isotopes?

Answer: ^{58}Ni and ^{60}Ni . ^{58}Ni and ^{60}Ni dominate the natural isotopic mixture.

Which statement about nickel orbitals is best?

Answer: The 3d subshell contains five spatial orbitals. The page shows named representative d orbitals, not one shape for the entire subshell.

Which country dominates recent nickel mine output?

Answer: Indonesia. Recent USGS data show Indonesia as the largest nickel mine producer by a wide margin.

Frequently asked questions

What is nickel?

Nickel is chemical element 28, a silvery transition metal in Group 10.

Is nickel a metal?

Yes. Nickel is a transition metal and is solid at room temperature.

What is nickel used for?

Its major uses include stainless steel and other alloys, batteries, catalysts and electroplating.

How many valence electrons does nickel have?

For transition metals, "valence electron" counting depends on context. The neutral ground-state reference configuration is $[\text{Ar}] 3d^8 4s^2$, and both 3d and 4s electrons can participate in chemistry.

Where is nickel found?

Important ore systems include laterites and magmatic sulfides. Recent mine production is concentrated in countries such as Indonesia, but rankings change with year and dataset.

What color is nickel?

Nickel metal is silvery-white with a metallic luster.

Sources used for this guide

- Royal Society of Chemistry - Nickel
<https://periodic-table.rsc.org/element/28/nickel>
- NIST - Atomic Data for Nickel
<https://physics.nist.gov/PhysRefData/Handbook/Tables/nickeltable1.htm>
- USGS - Mineral Commodity Summaries 2026
<https://pubs.usgs.gov/publication/mcs2026>
- WebElements - Nickel crystal structure
https://www.webelements.com/nickel/crystal_structure.html

This datasheet is a learning aid. Interactive 3D models are teaching models; uncertainty and predicted values must remain labelled. Search-demand data may guide explanation, but scientific values come from cited scientific sources.