

Aluminium (Al) - Student Datasheet

Atomic number 13 - Post-transition metal - Group 13 - Period 3 - p-block

Aluminium is a light, corrosion-resistant metal whose three valence electrons connect Period 3 electronic structure to Al^{3+} chemistry, metallic bonding and an exceptionally important materials economy.

Quick reference

Property	Value
Atomic number	13
Relative atomic mass	26.9815385
Electron configuration	$[\text{Ne}] 3s^2 3p^1$
Common oxidation state	+3
Density	2.70 g/cm ³
Melting point	933.473 K
Boiling point	2792 K
Crystal near room temperature	FCC

Structure & orbitals

Reference isotope: ^{27}Al - 13 protons + 14 neutrons. Electron configuration: $[\text{Ne}] 3s^2 3p^1$.

Selected 3s and 3p valence-region views. The 3s teaching cloud includes two radial nodes; the 3p view includes one radial node and a selectable p-orbital orientation. These are one-electron probability-shape models, not electron paths.

Phase / temperature context

Below 933.473 K the simplified path is solid aluminium; between melting and boiling it is liquid; above 2792 K it is gas on this approximate standard-pressure teaching path.

Five things to remember

1. Atomic number 13 means every aluminium nucleus contains 13 protons.
2. $[\text{Ne}] 3s^2 3p^1$ gives three valence electrons in the neutral atom.
3. ^{27}Al is the only stable naturally occurring aluminium isotope.
4. Ordinary aluminium metal is face-centred cubic.
5. Bauxite is the principal ore feed for alumina and aluminium production.

Real-world context

Bauxite

Aluminium is obtained industrially from alumina derived mainly from bauxite ores.

Oxide film

A nanometre-scale oxide layer can passivate the metal surface and slow further corrosion.

Transport

Low density and useful alloys make aluminium important in aircraft, vehicles and structures.

Packaging

Formability, barrier properties and recyclability support cans, foil and other packaging.

Recycling

Recycling aluminium typically uses only a small fraction of the energy required for primary production from ore; exact savings depend on scrap quality, collection and process route.

Where on Earth? / geography modes

Bauxite resources - Ore feed

Bauxite deposits occur in many tropical and subtropical regions; current mine output is concentrated in a smaller set of countries.

Examples/context: Australia; Guinea; China

Primary production - Smelters

Primary aluminium production depends on alumina, electricity and smelting infrastructure—not simply on where bauxite is mined.

Examples/context: China; India; Russia

Recycling loop - Secondary metal

Aluminium can be repeatedly recycled; scrap flows are industrial rather than geological geography.

Examples/context: Global cities; Manufacturing regions; Recycling systems

Isotopes

Isotope	Status / timescale	Why it matters
^{27}Al	Stable	essentially all natural aluminium
^{26}Al	Radioactive	cosmogenic isotope used in geochronology and astrophysical studies

Evidence note

Measured/evaluated bulk data are used for ordinary aluminium; production geography is year-dependent and should not be confused with natural occurrence.

Review questions

How many valence electrons does a neutral aluminium atom have?

Answer: 3. The reference configuration ends $3s^2 3p^1$, so there are three valence electrons.

What is aluminium's ordinary crystal structure near room temperature?

Answer: Face-centred cubic (FCC). Ordinary aluminium metal is face-centred cubic.

Why can aluminium appear corrosion-resistant even though it is reactive?

Answer: A thin adherent oxide film passivates the surface. Aluminium rapidly forms a protective oxide layer that slows further reaction in many environments.

What is the principal ore feed used to produce alumina for aluminium?

Answer: Bauxite. Bauxite is the main industrial ore feed for alumina production.

Which isotope accounts for essentially all naturally occurring aluminium?

Answer: ^{27}Al . ^{27}Al is the only stable naturally occurring aluminium isotope.

Reviewed sources

- Royal Society of Chemistry — Aluminium: <https://periodic-table.rsc.org/element/13/aluminium>

- NIST — electronic configurations of the elements:

<https://www.nist.gov/pml/atomic-reference-data-electronic-structure-calculations/atomic-reference-data-electronic-8>

- USGS — Bauxite and Alumina Statistics and Information:

<https://www.usgs.gov/centers/national-minerals-information-center/bauxite-and-alumina-statistics-and-information>

- USGS — Mineral Commodity Summaries 2026: <https://pubs.usgs.gov/publication/mcs2026>

ElementLookup.com - educational reference sheet. Interactive visualizations on the website include additional model/evidence notes.