

Lead (Pb) - Student Datasheet

Atomic number 82 - Post-transition metal - Group 14 - Period 6 - p-block

Lead is element 82, a dense Group 14 metal whose chemistry, batteries, radiation shielding, recycling and health hazards all matter to a complete explanation. Modern use requires separating the elemental metal from lead compounds and from historical exposures.

Quick reference

Atomic number	82
Relative atomic mass	207.2
Electron configuration	[Xe] 4f14 5d10 6s2 6p2
State at 20 C	Dense bluish-grey solid at 20 deg C
Density	11.3 g/cm3
Melting point	600.612 K
Boiling point	2022 K
Common oxidation state	+2 and +4
Electronegativity	2.33

Structure & orbitals

Lead is face-centred cubic near room temperature. The viewer shows a conventional cubic cell with corner and face-centre sites and does not imply an isolated eight-plus-six atom molecule.

The 6s model is spherical and the 6p model has the familiar two-lobed p angular form in a nonrelativistic teaching approximation. These isolated-atom clouds do not show metallic bands or relativistic many-electron detail.

Temperature / phase context

At approximately standard pressure, lead is solid below about 600.612 K, liquid up to about 2022 K, and gaseous above the boiling reference.

Five things to remember

- Atomic number 82 means every lead nucleus contains 82 protons.
- Neutral lead has the ground-state configuration [Xe] 4f14 5d10 6s2 6p2.
- Pb2+ is especially important in lead chemistry; +4 also occurs.
- Lead metal is dense and face-centred cubic near room temperature.
- Lead exposure is toxic; historical uses do not imply that lead is safe for unrestricted handling or consumer contact.

Lead: Real World & Signature Science

Lead's high density and useful electrochemistry helped make it important in batteries and shielding, but the same element has serious toxicological consequences. A useful page must teach both material function and exposure context.

Why this element matters

Lead-acid batteries Lead and lead compounds participate in the reversible electrochemistry of lead-acid batteries, a mature technology with established recycling systems.	Radiation shielding High density and high atomic number make lead useful as shielding in properly designed systems; shielding design itself is an engineering task.
Galena PbS (galena) is the principal lead ore mineral and is chemically different from lead metal.	Recycling A large share of lead use is tied to closed-loop battery recycling, where controlled industrial recovery is important.
Health context Lead is toxic, especially to developing nervous systems. Historical pigments, plumbing and fuels are important exposure lessons rather than use recommendations.	

From galena to lead products: a high-level materials path

1. Lead ores are mined and mineral processing concentrates lead-bearing minerals such as galena.
2. Industrial smelting and refining convert concentrates into lead metal under controlled conditions; this page does not provide process-operation instructions.
3. Lead is fabricated into battery grids, shielding and other controlled applications.
4. Collection and recycling, especially of lead-acid batteries, can return lead to production while reducing uncontrolled waste.

Where on Earth?

Lead ore production - 2025 commodity context

Selected major lead-mine producers are shown as dated commodity examples; annual rankings can change

Galena systems - Conceptual geology

Lead commonly occurs in sulfide ore systems, often with zinc and silver, rather than as widespread native lead metal

Lead material cycle - Battery-focused

Collection and controlled recycling are central to modern lead supply and exposure management

History

Ancient world - Lead's low melting point and malleability made it easy to work, leading to extensive historical use.

Industrial era - Lead entered pipes, pigments, ammunition, cable sheathing and many other products.

20th century - Evidence of health harm drove major restrictions on lead in fuels, paints and consumer exposure pathways.

Today - Lead-acid batteries remain a major use while recycling and exposure control are central parts of modern lead management.

Uses

Lead-acid batteries Lead-based electrodes support a robust rechargeable battery chemistry used in vehicles and backup systems.	Shielding Dense lead can attenuate X-rays and gamma rays when used in engineered shielding systems.
Weights & specialized alloys Lead's density and low melting point support some specialized industrial uses subject to regulation.	Recycling feed Used lead-acid batteries are an important secondary resource in regulated recycling systems.

Lead: Isotopes, Questions & Evidence

Isotopes

208Pb - Stable - most abundant natural isotope

A doubly magic nucleus and the reference teaching nucleus on this page.

206Pb - Stable - radiogenic + primordial

One of the major natural lead isotopes and an end product in uranium decay chains.

207Pb - Stable - radiogenic + primordial

A major natural isotope and an end product in the uranium-235 decay chain.

204Pb - Stable - minor natural isotope

The least abundant of the four stable natural lead isotopes.

Common questions

What is lead's element symbol?

Lead's symbol is Pb, from the Latin plumbum.

What is lead's atomic number?

Lead is atomic number 82.

Is lead a metal?

Yes. Lead is a dense post-transition metal in Group 14.

What is lead used for today?

A major use is lead-acid batteries; lead is also used in engineered shielding and selected industrial applications.

Why is Pb²⁺ common?

The 6s² electron pair is relatively inert, so losing the two 6p electrons to form +2 is often favorable in lead chemistry.

Is lead safe to handle?

Lead is toxic. Educational discussion of the element is not a recommendation for casual handling, exposure or home processing.

Quick self-check

1. What is lead's symbol? Answer: Pb

2. What is lead's atomic number? Answer: 82

3. What is the common room-temperature crystal structure of lead metal? Answer: Face-centred cubic

4. Which oxidation state is especially common for lead? Answer: +2

5. Which statement is correct? Answer: Lead has important uses but is toxic and requires exposure control

Evidence & provenance

Atomic and ordinary bulk values are measured/evaluated. The FCC viewer is a conventional-cell teaching schematic. Mine geography is a dated commodity snapshot. Health statements are high-level public-health context and do not replace site-specific professional guidance.

Core sources

Royal Society of Chemistry - Lead	https://periodic-table.rsc.org/element/82/lead
NIST - Atomic Data for Lead	https://physics.nist.gov/PhysRefData/Handbook/Tables/leadtable1.htm
USGS - Mineral Commodity Summaries 2026	https://pubs.usgs.gov/publication/mcs2026
CDC - Lead exposure information	https://www.cdc.gov/lead-prevention/