Calcium (Ca)

Element 20 — Complete Summary

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20
Ca
Calcium
40.078

Key Properties

Atomic Mass	40.078
Category	Alkaline Earth Metals
State at 20°C	solid
Melting Point	842°C
Boiling Point	1484°C
Density	1.55
Electron Config	[Ar] 4s2
Electronegativity	1.0
Year Discovered	1808
Discovered By	Humphry Davy

✨ Did You Know?

1. It is the most abundant metal in the human body, making up about 1.5% of our body weight, with 99% of it stored in bones and teeth.
2. Limestone, marble, and chalk are all different forms of calcium carbonate.
3. Coral reefs and the shells of many marine organisms are built from calcium carbonate.
4. Early forms of cement and mortar used by ancient Egyptians and Romans were based on heating limestone (calcium carbonate).
5. When pure, calcium is a relatively soft, silvery metal that reacts with air and water.

APPEARANCE
A relatively soft, silvery-white metal.

SUPERHERO PERSONA
"The Bone Builder, the hero who provides the strong framework for our bodies and for buildings."

EVERYDAY CONNECTION
The chalk used on a blackboard or the cement in a sidewalk.

POP CULTURE
The element that makes up the bones of iconic skeletons like Jack Skellington.

Overview of Calcium

Calcium is a soft, silvery-white alkaline earth metal that tarnishes quickly in air and reacts with water. While the pure element is rarely encountered outside laboratories, its compounds are abundant and indispensable. From construction materials to biological processes, calcium is one of the most important elements for both industry and life.

Uses of Calcium

Most uses of calcium come from its compounds rather than the pure metal:

Construction: Limestone ($CaCO_3$) is a key building material. When heated, it forms quicklime (CaO), which reacts with water to make slaked lime ($Ca(OH)_2$). Slaked lime is crucial for making cement, and when mixed with sand it creates traditional lime plaster.

Medicine: Gypsum ($CaSO_4 \cdot 2H_2O$), also known as plaster of Paris, is used for casts that set broken bones.

Agriculture and water treatment: Slaked lime is applied to farmland to neutralize acidic soil and used in water treatment to adjust pH levels.

Metallurgy: Calcium compounds are employed in steelmaking to remove impurities from molten iron.

Metal production: Pure calcium serves as a reducing agent in extracting reactive metals such as uranium, zirconium, and thorium.

Natural Occurrence and Production of Calcium

Calcium makes up about 4.1% of Earth's crust, making it the fifth most abundant element. It is never found in pure form but occurs in minerals such as limestone, gypsum, and fluorite.

Pure calcium was first isolated in 1808 by Sir Humphry Davy, who used electrolysis on a mixture of lime and mercury oxide to separate the element.

History of Calcium

18th century: French chemist Antoine Lavoisier classified lime as an "earth" but suspected it was an oxide of an unknown element.

1808 – Isolation: English chemist Humphry Davy successfully isolated calcium metal using electrolysis, confirming it as a new element.

Biological Role of Calcium

Calcium is essential to life. In humans, it is the primary component of bones and teeth, with the average adult body containing about 1 kilogram of calcium, mostly as calcium phosphate in the skeleton. Adequate calcium intake is critical for children, teenagers, and pregnant women to support growth and development. Calcium also plays a vital role in muscle contraction, blood clotting, and nerve signaling.