Astatine (At)

Element 85 — Complete Summary

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85

At

Astatine

[210]

Key Properties

Atomic Mass	[210]
Category	Halogens
State at 20°C	solid
Melting Point	300°C
Boiling Point	350°C
Density	7.0*
Electron Config	[Xe] 4f145d106s26p5
Electronegativity	2.2
Year Discovered	1940
Discovered By	Dale R. Corson, Kenneth R. MacKenzie & Emilio Segrè

✨ Did You Know?

1. It is the rarest naturally occurring element in the Earth's crust. It is estimated that less than one gram of astatine exists on the entire planet at any given moment.
2. Its name comes from the Greek word 'astatos', meaning 'unstable', which is appropriate as all of its isotopes are highly radioactive.
3. It is a halogen, and its properties are predicted to be similar to iodine, but it is so radioactive that it's difficult to study.
4. If enough could be gathered, it would likely appear as a black or dark metallic solid.
5. Scientists are studying its radioactive isotopes for potential use in targeted alpha-particle therapy to treat cancer.

APPEARANCE

Astatine is a highly radioactive halogen.

SUPERHERO PERSONA

"The Ghost, the rarest hero on Earth, so unstable that it disappears almost as soon as it appears."

EVERYDAY CONNECTION

Astatine has no everyday connection due to its extreme rarity.

POP CULTURE

Astatine is the rarest naturally occurring element less than a gram exists on Earth at any time.

Overview of Astatine

Astatine is the rarest naturally occurring halogen and one of the most elusive elements in the periodic table. It is dangerously radioactive, and even its most stable isotope, astatine-210, has a half-life of only about 8 hours. Because of this extreme instability, astatine is impossible to isolate in visible amounts and remains one of the least studied elements. Chemically, it resembles other halogens such as iodine.

Why Astatine Is Hard to Study

Astatine's short half-life and strong radioactivity make experiments difficult. It has no practical applications beyond scientific research. Laboratory studies show that its chemical behavior mirrors that of iodine, though measuring these properties requires highly sensitive techniques such as mass spectrometry. Researchers primarily study astatine to better understand the trends of the halogen group at the heavier end of the periodic table.

History of Astatine

Near discoveries (1939): Two groups reported evidence of a new element in minerals. Horia Hulubei and Yvette Cauchois observed X-ray patterns consistent with element 85, while Walter Minder used chemical tests. Neither claim was accepted as definitive.

Confirmed synthesis (1940): At the University of California, Dale R. Corson, K.R. Mackenzie, and Emilio Segrè successfully created astatine by bombarding bismuth with alpha particles, providing the first convincing evidence of its existence.

World War II delay: The outbreak of the Second World War and the Manhattan Project shifted research priorities, slowing further study of the element.

Natural Occurrence and Production of Astatine

Astatine does not exist on Earth in measurable quantities because of its rapid decay. It is thought to occur in trace amounts in uranium and thorium ores, but the total natural supply at any given time is estimated to be less than one gram across the entire planet.

For research, astatine is artificially produced by bombarding bismuth-209 with alpha particles or neutrons in a nuclear reactor, generating isotopes suitable for short-term experiments.

Biological Role of Astatine

Astatine has no known biological function. It is highly toxic because of its intense radioactivity, and its instability prevents it from playing any natural role in living systems.