

Bromine (Br) - Student Datasheet

Element 35 · Halogen · source-reviewed learning reference

Bromine is element 35 and the only nonmetal that is a liquid near room temperature. Neutral Br atoms pair into Br₂ molecules, while bromide Br⁻ in salts is a different chemical species with very different behavior.

Quick reference

Atomic number	35
Relative atomic mass	79.904
Electron configuration	[Ar] 3d ¹⁰ 4s ² 4p ⁵
Period / group / block	4 / 17 / p
Ordinary state	Deep red-brown liquid Br ₂ at 20 °C
Density	3.1028 g/cm ³
Melting point	266 K
Boiling point	332 K
Oxidation states	-1, +1, +3, +5, +7
Electronegativity	2.96

Structure & orbitals

Below its melting point bromine forms a molecular crystal of Br₂ units. The viewer emphasizes diatomic identity and packing rather than claiming refined crystallographic coordinates.

The 4s and 4p probability models describe an isolated-atom teaching approximation. p_x/p_y/p_z controls rotate the same orbital shape; they do not represent a Br₂ bond by themselves.

Phase behavior

At approximately standard pressure, Br₂ is a molecular solid below about 266 K, a liquid from about 266–332 K, and a gas above about 332 K.

Five things to remember

- Atomic number 35 means 35 protons.
- Neutral bromine has [Ar] 3d¹⁰ 4s² 4p⁵.
- Elemental bromine is Br₂ and is liquid near room temperature.
- Bromide Br⁻ is not the same substance as Br₂.
- Natural bromine resources are concentrated as bromide ions in seawater and brines rather than pools of elemental Br₂.

Bromine: Real World & Signature Science

Biq idea

Bromine's red-brown liquid is elemental Br₂—not “bromide.” The atom, molecule and ion share the same element but differ in electron count, bonding, state and chemical behavior.

Why this element is scientifically distinctive

Compare Br with Br⁻, inspect a ⁷⁹Br nucleus and 4p orbitals, rotate a Br₂ molecular-crystal teaching view, then follow temperature through solid/liquid/vapor and connect natural brines to bromine chemistry.

Br₂ liquid	Elemental bromine is a dense, volatile, deep-red/brown diatomic liquid near room temperature.
Bromide in brines	Most natural bromine is present as bromide ions in seawater, salt lakes and underground brines.
Flame-retardant chemistry	Brominated compounds have important flame-retardant uses, though individual chemicals differ greatly in persistence and regulation.
Pharmaceutical & chemical synthesis	Bromine chemistry appears in many industrial intermediates and medicines.
Species distinction	Br atom, Br ₂ molecule and Br ⁻ ion are different chemical species; properties cannot be transferred blindly between them.

From bromide-rich brine to bromine chemistry: a high-level path

1. Bromine occurs naturally mainly as bromide ions dissolved in seawater and concentrated brines.
2. Commercial production uses bromide-rich brines rather than mining native elemental bromine.
3. Industrial conversion produces bromine and downstream bromine compounds in controlled chemical facilities; no process recipe is provided here.
4. Applications depend on specific bromine compounds, and environmental/safety profiles vary by chemical.

History checkpoints

1826	Antoine Jérôme Balard announced bromine after isolating it from brine residues.
1820s	Carl Löwig also independently obtained bromine around the same period.
19th–20th centuries	Bromine chemistry expanded into photography, dyes, pharmaceuticals and industrial intermediates.
Today	Bromine is mainly recovered from bromide-rich brines and used through a wide range of compounds.

Bromine: Isotopes, Questions & Evidence

Isotope context

⁷⁹Br	Stable · about half of natural bromine	Reference teaching nucleus with 35 protons and 44 neutrons.
⁸¹Br	Stable · about half of natural bromine	Together with ⁷⁹ Br gives bromine its characteristic isotope pattern in mass spectra.
Bromine isotope context	Two stable isotopes dominate nature	Their comparable abundance is a useful spectroscopy/mass-spectrometry teaching point.

Common questions

What is bromine's atomic number?

35.

Is bromine a metal?

No. Bromine is a halogen nonmetal.

How many valence electrons does bromine have?

Seven, from 4s²4p⁵.

Why is bromine unusual at room temperature?

Elemental Br₂ is a liquid near room temperature, unlike chlorine gas above it and iodine solid below it.

Quick self-check

Q: What is bromine's atomic number? | Answer: 35. Atomic number equals proton count.

Q: What is elemental bromine near room temperature? | Answer: Br₂ liquid. Elemental bromine is predominantly diatomic Br₂ and is liquid near room temperature.

Q: How many valence electrons does Br have? | Answer: 7. The outer configuration is 4s²4p⁵.

Evidence & safety

Atomic/phase data are evaluated. The Br₂ crystal view is a molecular-packing teaching schematic. Geography points represent selected bromine-producing/brine regions and never imply natural pools of elemental Br₂.

Elemental bromine is toxic and corrosive. This page explains chemistry and industrial context without preparation, handling or exposure instructions.

Core sources

Royal Society of Chemistry - Bromine

<https://periodic-table.rsc.org/element/35/bromine>

NIST - Atomic Data for Bromine

<https://physics.nist.gov/PhysRefData/Handbook/Tables/brominetable1.htm>

USGS - Bromine statistics and information

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