

Iodine (I) - Student Datasheet

Atomic number 53 - Halogen - Group 17 - Period 5 - p-block

Iodine is element 53, a halogen that appears as a dark molecular solid and violet vapor. Its chemistry makes a crucial distinction among I atoms, I₂ molecules and iodide I⁻, while ¹²⁷I dominates natural iodine.

Quick reference

Atomic number	53
Relative atomic mass	126.90447
Electron configuration	[Kr] 4d ¹⁰ 5s ² 5p ⁵
State at 20 C	Bluish-black lustrous molecular solid at 20 deg C
Density	4.933 g/cm ³
Melting point	386.9 K
Boiling point	457.6 K
Common oxidation state	-1, +1, +3, +5, +7
Electronegativity	2.66

Structure & orbitals

Solid elemental iodine consists of I₂ molecules arranged in an orthorhombic molecular crystal. The viewer emphasizes molecular identity and packing rather than exact refined coordinates.

The 5p probability distributions belong to an isolated iodine atom. Elemental iodine is I₂ and solid iodine is a molecular crystal, so the atomic orbital is not a picture of the bulk solid.

Temperature / phase context

At approximately standard pressure, elemental iodine is solid below about 386.9 K, liquid to about 457.6 K, and gaseous above. Iodine also has appreciable vapor pressure below its melting point, so sublimation/deposition can be observed without contradicting the phase boundaries.

Five things to remember

- Atomic number 53 means 53 protons.
- Neutral iodine has seven valence electrons and often forms iodide I⁻.
- Elemental iodine at ordinary conditions is molecular I₂, not isolated I atoms.
- Solid iodine is dark and lustrous; iodine vapor is violet.
- ¹²⁷I is the only stable natural iodine isotope.

Iodine: Real World & Signature Science

The word "iodine" is often used casually for very different chemical forms. Elemental iodine is I₂; iodide is I⁻ in salts and biology. Keeping those forms separate prevents many health and chemistry misconceptions.

Why this element matters

Nutrition as iodide Iodine is an essential nutrient, but biology uses iodide/iodinated molecules rather than chunks of elemental I ₂ .	Medical imaging & medicine Iodine-containing compounds and radioisotopes are used in selected diagnostic and therapeutic contexts under professional control.
Industrial chemistry Iodine compounds are used in catalysts, pharmaceuticals, disinfectant formulations and specialty chemicals.	Caliche & brines Commercial iodine is recovered from particular nitrate/caliche deposits and iodine-rich brines.
Phase color Heating iodine produces violet vapor, a visually powerful molecular phase-change demonstration.	

From iodine-bearing brine or caliche to iodine products: high-level context

1. Iodine occurs mainly as iodide/iodate species in specialized brines and mineral deposits rather than as native I₂ accumulations.
2. Industrial recovery concentrates iodine-bearing streams from resource-specific operations.
3. Chemical conversion produces elemental iodine and iodine compounds for controlled commercial uses.
4. Products enter pharmaceutical, nutritional, industrial and analytical supply chains; radioactive iodine use is handled under specialized medical/nuclear controls.

Where on Earth?

Supply systems

Northern Chile, Japan and Oklahoma illustrate caliche and iodine-rich brine supply systems.

History

1811 - Bernard Courtois discovered iodine while processing seaweed ash in France.

1813 - Gay-Lussac and Davy helped establish iodine as a new element.

19th-20th centuries - Iodine compounds became important in medicine, photography and chemical synthesis.

Today - Iodine supply comes mainly from specialized brines and caliche/nitrate deposits, while iodine chemistry remains important in health and industry.

Uses

Nutrition Iodized salt and other food systems supply iodine in safe chemical forms needed for thyroid hormone production.	Medical applications Stable iodine compounds and selected radioisotopes support imaging, antisepsis and thyroid medicine.
Specialty chemistry Iodine reagents and compounds are used in pharmaceuticals, catalysts and organic synthesis.	Optical/electronic materials Iodine-containing materials appear in specialized polarizers, lamps and other technical applications.

Iodine: Isotopes, Questions & Evidence

Isotopes

127I - Stable - essentially all natural iodine

Reference teaching nucleus: 53 protons and 74 neutrons.

129I - Long-lived radionuclide

Important in environmental and nuclear-science tracing; it is not a stable natural isotope.

131I - Short-lived medical radionuclide

Widely known in thyroid diagnostics/therapy and nuclear monitoring; use requires professional controls.

Common questions

What is iodine's atomic number?

53.

Is iodine a metal?

No. Iodine is a halogen nonmetal.

What color is iodine?

Solid iodine is bluish-black/dark lustrous; the vapor is violet.

How many valence electrons does iodine have?

Seven in the neutral atom.

Is iodide the same as elemental iodine?

No. Iodide is I⁻; elemental iodine is mainly I₂ molecules.

Why is iodine important in nutrition?

The body needs iodine to make thyroid hormones, normally supplied in ionic/compound forms rather than elemental iodine.

Quick self-check

1. Atomic number? Answer: 53
2. Ordinary elemental form? Answer: I₂
3. Typical iodide charge? Answer: -1
4. Vapor color? Answer: Violet
5. Stable natural isotope? Answer: 127I

Safety boundary

Elemental iodine vapor can irritate and concentrated iodine/radioiodine use requires appropriate professional controls. This guide is educational, not medical advice.

Evidence & provenance

Atomic/phase values and I₂ molecular identity are evaluated/measured. Resource pins are dated supply examples and are kept separate from nutritional and medical chemistry.

Core sources

Royal Society of Chemistry - Iodine	https://periodic-table.rsc.org/element/53/iodine
NIST - Atomic Data for Iodine	https://physics.nist.gov/PhysRefData/Handbook/Tables/iodinetable1.htm
USGS - Mineral Commodity Summaries 2026	https://pubs.usgs.gov/publication/mcs2026