

Nitrogen (N) - Student Datasheet

Atomic number 7 - Nonmetal · pnictogen - Group 15 - Period 2 - p-block

Nitrogen is a Group 15 nonmetal whose half-filled 2p subshell helps explain the stability of the N₂ molecule, the strength of the N≡N triple bond and nitrogen's central role in atmosphere, biology and industry.

Quick reference

Property	Value
Atomic number	7
Relative atomic mass	14.007
Electron configuration	[He] 2s ² 2p ³
Valence electrons	5
Melting point of N ₂	≈63.15 K
Boiling point of N ₂	≈77.35 K
Dry-air abundance	78.084% by volume
State near room temperature	N ₂ gas

Structure & orbitals

Reference isotope: ¹⁴N - 7 protons + 7 neutrons. Electron configuration: [He] 2s² 2p³.

Selected 2s and 2p atomic-orbital views. A 2s orbital is spherical with one radial node; each 2p orbital has two lobes separated by a nodal plane. In N₂, atomic orbitals combine into molecular orbitals, so these isolated-atom views are only the starting point.

Phase / temperature context

On the ordinary-pressure teaching path, molecular nitrogen is solid below about 63.15 K, liquid between roughly 63.15 K and 77.35 K, and gas above its normal boiling point.

Five things to remember

1. Atomic number 7 means seven protons.
2. The neutral atom is [He] 2s² 2p³ with three unpaired 2p electrons in the isolated-atom ground state.
3. Elemental nitrogen is commonly N₂, a diatomic molecule with a strong triple bond.
4. Dry air is about 78.084% nitrogen by volume according to NOAA.
5. Nitrogen cycles among atmosphere, organisms, soils, oceans and industrial processes.

Real-world context

Atmosphere

N₂ makes up about 78.084% of dry air by volume.

Nitrogen fixation

Biological and industrial processes convert N₂ into more reactive nitrogen compounds.

Fertilizers

Ammonia-derived fertilizers are a major human-controlled nitrogen flow.

Liquid nitrogen

Cryogenic liquid nitrogen is used for cooling, preservation and laboratory work.

Proteins + DNA

Nitrogen is part of amino acids, proteins and nucleic-acid bases.

Where on Earth? / geography modes

Atmosphere - 78.084% dry air

Nitrogen is globally mixed through the atmosphere; a country-level mine map would make no sense for this reservoir.

Examples/context: Global atmosphere; Troposphere; Air

Nitrogen cycle - Biogeochemical

Nitrogen moves among atmosphere, soils, oceans, organisms and sediments through fixation, assimilation, decomposition, nitrification and denitrification.

Examples/context: Soils; Oceans; Living systems

Industrial nitrogen - Air separation

Industrial nitrogen and oxygen are commonly separated from air; production geography follows industrial infrastructure rather than ore deposits.

Examples/context: Industrial regions; Air-separation plants; Global supply

Isotopes

Isotope	Status / timescale	Why it matters
¹⁴ N	Stable	dominant natural isotope
¹⁵ N	Stable	used as a tracer in chemistry, biology and Earth science

Evidence note

Atmospheric abundance and N₂ phase data are measured/evaluated; cycle diagrams are conceptual teaching layers rather than inventories of individual nitrogen atoms.

Review questions

About what fraction of dry air is nitrogen by volume?

Answer: 78%. NOAA gives dry-air nitrogen at about 78.084% by volume.

What is the common elemental form of nitrogen near room conditions?

Answer: N₂. Elemental nitrogen is normally molecular N₂ under ordinary conditions.

Why is atmospheric N₂ difficult for most organisms to use directly?

Answer: Its N≡N bond is very strong. The strong triple bond makes N₂ comparatively unreactive; fixation converts it into more accessible compounds.

At ordinary pressure, nitrogen boils at about which temperature?

Answer: 77.35 K. The normal boiling point of molecular nitrogen is about 77.35 K.

Which two stable isotopes dominate natural nitrogen?

Answer: ^{14}N and ^{15}N . Natural nitrogen consists principally of stable ^{14}N and ^{15}N .

Reviewed sources

- Royal Society of Chemistry — Nitrogen: <https://periodic-table.rsc.org/element/7/nitrogen>
- NOAA — The Atmosphere: <https://www.noaa.gov/jetstream/atmosphere>
- NIST Chemistry WebBook — Nitrogen phase-change data: <https://webbook.nist.gov/cgi/cbook.cgi?ID=C7727379&Mask=4>
- NIST — electronic configurations of the elements:
<https://www.nist.gov/pml/atomic-reference-data-electronic-structure-calculations/atomic-reference-data-electronic-8>

ElementLookup.com - educational reference sheet. Interactive visualizations on the website include additional model/evidence notes.