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Nitrogen  
14.007

## Key Properties

Atomic Mass	14.007
Category	Nonmetals
State at 20°C	gas
Melting Point	-210.0°C
Boiling Point	-195.795°C
Density	1.251 g/L
Electron Config	[He] 2s22p3
Electronegativity	3.04
Year Discovered	1772
Discovered By	Daniel Rutherford

## Did You Know?

- 1 Nitrogen gas makes up 78% of the air we breathe, but most living organisms cannot use it directly from the atmosphere.
- 2 Saturn's largest moon, Titan, is the only moon in our solar system with a dense, nitrogen-rich atmosphere, even thicker than Earth's.
- 3 The condition known as \
- 4 Liquid nitrogen is so cold (-196°C or -321°F) that it can instantly freeze living tissue on contact.
- 5 Many explosives, like TNT and nitroglycerin, are powerful because they contain unstable nitrogen compounds.

## APPEARANCE

A colorless, odorless, tasteless diatomic gas.

## SUPERHERO PERSONA

*"The Cool Head, a hero who makes up most of the air, but can become super-cold and powerful as a liquid."*

## EVERYDAY CONNECTION

The fertilizer that helps grow the food we eat.

## POP CULTURE

Liquid nitrogen is a common trope in sci-fi and action movies for flash-freezing objects.

## Nitrogen: The Invisible Gas of Life and Industry

Nitrogen is a colorless, odorless gas that makes up about 78% of Earth's atmosphere—more than three-quarters of the air we breathe! Even though it seems invisible and inactive, nitrogen is essential for life and one of the most important elements in modern industry.

## Why Is Nitrogen Useful?

Nitrogen's value comes from two things: its stability as a gas, and its ability to form vital compounds.

**Fertilizers:** Through the Haber process, nitrogen gas is combined with hydrogen to make ammonia. This is then turned into fertilizers that help grow crops to feed billions of people. Each year, over 150 million tonnes of ammonia are made this way.

**Inert Atmosphere:** Nitrogen's unreactive nature makes it perfect for protecting sensitive materials from oxygen. It's used in food packaging to keep snacks fresh, in electronics when making semiconductors, and in metalworking to prevent steel from rusting during heating.

**Cryogenics:** Liquid nitrogen is an ultra-cold refrigerant. It's used to snap-freeze food, preserve cells, sperm, and eggs for medical research, and even for dramatic science demonstrations where it instantly freezes flowers or balloons.

## Nitrogen in Living Things

Nitrogen is a building block of life. It's found in DNA, RNA, and proteins—the molecules that make life possible.

**Plants & Algae:** Take up nitrogen as nitrates from soil to build essential biomolecules.

**Animals:** Get nitrogen by eating plants (or other animals) and breaking down their proteins.

**Microbes:** Soil microbes recycle nitrogen by converting waste products back into usable nitrates. Special nitrogen-fixing bacteria can even take nitrogen straight from the air and "fix" it into the soil for plants.

⚠️ Too much nitrogen fertilizer, however, can cause eutrophication—an explosion of algae in lakes and rivers that chokes out fish and other aquatic life.

## Natural Abundance &amp; History

Nitrogen is the most abundant gas in the atmosphere. Commercially, it's obtained by fractional distillation of liquid air.

**Discovery (1772):** Several scientists studied nitrogen in the 1760s, including Henry Cavendish and Joseph Priestley, who noticed that removing oxygen from air left behind a gas that couldn't sustain life. But it was Scottish student Daniel Rutherford who, in his doctoral thesis, correctly described it as a new element and gave it recognition.