Phosphorus (P)

Element 15 — Complete Summary

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P

Phosphorus

30.974

Key Properties

Atomic Mass	30.974
Category	Nonmetals
State at 20°C	solid
Melting Point	44.15°C
Boiling Point	280.5°C
Density	1.823
Electron Config	[Ne] 3s23p3
Electronegativity	2.19
Year Discovered	1669
Discovered By	Hennig Brand

✨ Did You Know?

1. The element's name means 'light-bringer' in Greek, as the white phosphorus form glows faintly in the dark when exposed to air (chemiluminescence).
2. It was the first element to be discovered that was not known since ancient times; Hennig Brand discovered it in 1669 by boiling down vast quantities of urine.
3. Phosphorus is a critical component of DNA, RNA, and ATP, the main energy-carrying molecule in cells, making it essential for all known life.
4. The red phosphorus on the striking surface of a matchbox is much more stable and less toxic than the highly reactive and poisonous white phosphorus.
5. The human body contains about 1% phosphorus, with 85% of it found in bones and teeth.

APPEARANCE

A waxy white or powdery red solid. White form glows in the dark.

SUPERHERO PERSONA

"The Glow-Stick, a hero essential for life's energy, who literally glows in the dark."

EVERYDAY CONNECTION

The striking surface on a box of matches.

POP CULTURE

The eerie glow of the monster in 'The Hound of the Baskervilles' was suggested to be phosphorus.

Phosphorus: The Element of Light and Life

Phosphorus is a remarkable element that comes in several different forms, known as allotropes. The two most common are:

White phosphorus – a glowing, waxy solid that is dangerously flammable.

Red phosphorus – a safer, non-toxic solid widely used in everyday products like matches.

Why Is Phosphorus Useful?

Phosphorus compounds are vital in both industry and agriculture.

Fertilizers: The biggest use of phosphorus is in phosphate fertilizers, which are made from phosphate rock. These fertilizers are essential for healthy plant growth and high crop yields.

Matches & Flares: Red phosphorus is used on the striking surface of matchboxes to ignite safety matches, while white phosphorus is used in flares and incendiary devices because it catches fire spontaneously in air.

Other Uses: Phosphates are added to some detergents, special glasses and ceramics, and are used in steelmaking.

Phosphorus in Living Things

Phosphorus is essential for all life:

It forms the backbone of DNA and RNA, the molecules of genetic information.

It powers cells as part of ATP (adenosine triphosphate), the “energy currency” of life.

It strengthens our bones and teeth, which are mostly made of calcium phosphate.

⚠️ Overuse of phosphate fertilizers and detergents can lead to algal blooms in lakes and rivers, which block sunlight and remove oxygen from the water, killing aquatic life.

Natural Abundance & History

Phosphorus is never found pure in nature. Instead, it occurs in minerals, especially phosphate rock (rich in apatite). Scientists worry that global phosphate supplies may run low in the future, which could impact farming.

1669: German alchemist Hennig Brandt accidentally discovered phosphorus while experimenting with urine, producing a strange glowing substance. He thought it might be the Philosopher’s Stone and kept it secret.

Later: Once scientists realized that bones are rich in calcium phosphate, phosphorus became easier to produce. In the 1800s, the match industry drove large-scale production.