



>>Entry Name: Phosphorus

CAS Registry Number: 7723-14-0

Related CAS Registry Numbers(s): 12185-09-0 12185-10-3 14596-37-3 16427-80-8 16427-81-9 16999-00-1 18925-96-7 20337-88-6 22537-25-3 55030-78-9  
P

Molecular Formula: P

Molecular Weight: 30.974

Accurate Mass: 30.973762

Percentage Composition: P 100.00%

Phosphorus has one stable isotope  $^{31}\text{P}$  (100%), but has 6 radioactive isotopes of which  $^{32}\text{P}$  is the most important. Important element in nmr spectroscopy. Abundance: 1120 ppm (earth's crust); 0.07 ppm (sea water). Vap. contains  $\text{P}_4$ ,  $\text{P}_2$  molecules and atomic P

Use/Importance: One of the elements forming the basis of life (DNA, RNA) and basis of a secondary biological cycle.  $^{32}\text{P}$  useful in trace work

Aldrich: 20967-8

Fluka: 79530

Sigma: P7894

>>Variant: White-form

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three independent  $\text{P}_4$  tetrahedra per cell. Quenching the  $\alpha$ -form to  $-185^\circ$  followed by slow warming gives the  $\gamma$ -form which transforms into the  $\beta$ -form at  $-120^\circ$

Source/Synthesis: Synth. from phosphate minerals e.g. Calcium phosphate ( $\text{Ca}_3(\text{PO}_4)_2$ ) [HTM71-D](#), by heating with  $\text{SiO}_2 + \text{C}$  at  $1400-1500^\circ$

Use/Importance: Used mainly in manuf. of 2,4,6,8,9,10-Hexaoxa-1,3,5,7-tetraphosphatrimethyldecane 1,3,5,7-tetraoxide [HTK74-W](#), Phosphorus pentoxide [HTN80-K](#), and thence Phosphoric acid [HTV82-A](#)

Physical Description: White (yellow when impure), waxy solid. V. reactive, inflames in air

Melting Point: Mp  $44.1-44.3^\circ$

Boiling Point: Bp  $280.5^\circ$

Solubility: V. sol.  $\text{CS}_2$ ,  $\text{PCl}_3$ ,  $\text{POCl}_3$ ,  $\text{SO}_2(\text{l})$ ,  $\text{NH}_3(\text{l})$ ; sol.  $\text{CCl}_4$  (1.27 g per 100 g),  $\text{Et}_2\text{O}$  (1.39 g per 100 g);  $\text{C}_6\text{H}_6$  (3.7 g per 100 g); sl. sol.  $\text{Me}_2\text{CO}$ ; insol.  $\text{H}_2\text{O}$

Other Data:  $d^{20}_{400}$  1.82-1.83 ( $\alpha$ ),  $d^{20}_{400}$  1.88 ( $\beta$ ). V. slow oxidation  $\rightarrow$  greenish phosphorescence. Reacts vigorously with halogens, S and many metals

Hazard & Toxicity: V. poisonous. Spont. ignites when dry at  $35^\circ$

>>Variant: Red-form

Molecular Formula: P

Molecular Weight: 30.974

Accurate Mass: 30.973762

Percentage Composition: P 100.00%

Source/Synthesis: Synth. by heating yellow, tetra-atomic P at  $400^\circ$  in absence of air

Physical Description: Red amorphous or cryst. solid, but colour may vary. \*Hittorf's phosphorus\* is violet, \*Schlenck's phosphorus\* is scarlet

Melting Point: Mp *ca.*  $585-600^\circ$

Solubility: Insol. org. solvs.

Other Data: Less reactive than the white form, e.g. no reaction with aq. alkali.  $d$  2.0-2.4

Hazard & Toxicity: Essentially non-toxic. Ignites only at  $>260^\circ$

>>Variant: Black-form

Molecular Formula: P

Molecular Weight: 30.974

Accurate Mass: 30.973762

Percentage Composition: P 100.00%

continuous double layer struct. (b) Has hexagonal lattice layer struct. In (c) atoms have octahedral environment

Source/Synthesis: The action of v. high pressure on white or red P  $\rightarrow 200^\circ \rightarrow$  orthorhombic form

Physical Description: Flaky, metallic and graphite-like. A vitreous grey form is hard and brittle

Solubility: Insol. most solvs.

Other Data: Electrical insulator. Stable in air. Practically non-flammable