

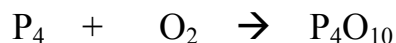
## Phosphorus (Z=15)

Only one naturally occurring isotope: P-31 Isotopic mass = 30.97376 u  
This isotope has 15 protons and electrons and 16 neutrons.

Phosphorus has an atomic weight of 30.9738 u and molar mass (M) = 30.97 grams

Phosphorus atoms gain three electrons to form 3- ions, as in  $P^{3-}$ . This ion is isoelectronic with the Argon (Ar) atom.

White phosphorus is  $P_4$ . This form of the element is stored in water with which it does not react. It does however react with oxygen in air to form tetraphosphorus decoxide.



Phosphorus was discovered in 1669 by Hennig Brandt at Hamburg, Germany. It is a key element in DNA, ATP, and  $Ca_3(PO_4)_2$  in bone. The average daily dietary intake is between 900-1200 mg/day; the RDA is 800 mg. The chief ore is fluoroapatite or  $Ca_5(PO_4)_3F$ . Fluoroapatite is also found in tooth enamel treated with fluoride containing vitamins or water. There are vast deposits on calcium phosphate  $Ca_3(PO_4)_2$  in the Earth's crust.

Phosphorus bombs consisting of burning phosphorus were used extensively in WWII, the most widespread use in the city of Dresden, Germany in July, 1943. Phosphorus produces horrific burns that are very slow to heal.

Trisodium phosphate (TSP) was found after WWII to greatly enhance the cleaning power of detergents and found large scale use for this purpose. TSP is still preferred today by painters and house cleaners. Over the past twenty years this use has decreased because of the suspected role of P in environmental pollution due to algae blooms.