

III. Occurrence of Nonmetals

Many nonmetals occur free in nature, whereas many more occur only in the form of their compounds as minerals.

The modes of occurrence of some typical nonmetals are described below :

Nonmetal	Free native form	Combined form
Nitrogen	Air contains about 78% (by volume) of nitrogen	In all living organisms as proteins, in the soil as nitrogen compounds
Oxygen	Air contains about 21% (by volume) of oxygen	As water, oxides in the soil/rocks
Noble gases	Air contains these gases in smaller amounts	—
Hydrogen	Free hydrogen is present in stars	As water
Sulphur	Native sulphur occurs inside the earth.	As sulphide, sulphate ores, as H ₂ S in certain spring water
Phosphorus	—	As phosphate rocks, in bones of our body as calcium phosphate
Silicon	—	As oxide (SiO ₂ , Silica, Sand), As silicate rocks
Carbon	As diamonds, graphite	As carbonate rocks, minerals As hydrocarbons – petroleum, natural gas etc. As carbon dioxide in the air.

Most nonmetals are either mined directly from their mines or obtained as by-products in some industrial processes.

- (i) Nitrogen and Oxygen are obtained from the air by fractional distillation of liquid air.
- (ii) Chlorine is obtained from common salt by electrolytic method.
- (iii) Sulphur is mined in its elemental form
- (iv) Nonmetals such as phosphorus and silica are obtained from their ores by chemical methods.

IV. Physical Properties of Nonmetals

Some common general physical properties of nonmetals are given below :

- (i) Physical state : Nonmetals may occur as solids, liquids or gases at room temperature.

For example, under normal conditions, sulphur, phosphorus are solids, bromine is a liquid, whereas hydrogen, oxygen and nitrogen are gases.

- (ii) Colour : Nonmetals come in many colours.

For example, sulphur is yellow, phosphorus is white, or red, chlorine is greenish-yellow, bromine is reddish-brown. Hydrogen, oxygen and nitrogen are colourless.

- (iii) Appearance : Nonmetals have dull appearance i.e., they do not shine. However, graphite and iodine are the only nonmetals which have metallic lustre.

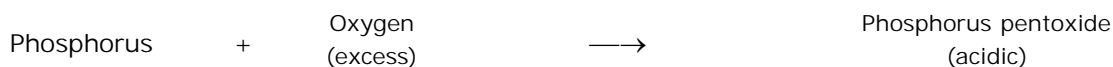
- (iv) Malleability and ductility : Nonmetals are neither ductile nor malleable. Nonmetals cannot be drawn into wires, and beaten into leaves/sheets.

- (v) Conductivity : Nonmetals do not conduct heat and electricity, i.e., nonmetals are insulators. Graphite however, is a good conductor of heat and electricity.

(ii) Carbon : Carbon reacts with oxygen to form two oxides – carbon monoxide (CO) and carbon dioxide (CO₂). Carbon monoxide is neutral, whereas carbon dioxide (CO₂) is acidic in nature. Carbon dioxide dissolves in water to give carbonic acid.



(iii) Phosphorus : Phosphorus reacts with oxygen to give two oxides – phosphorus trioxide (P₂O₃) and phosphorus pentoxide (P₂O₅). Both are acidic oxides.



(iv) Sulphur : Sulphur on burning in air forms two oxides – sulphur dioxide (SO₂) and sulphur trioxide (SO₃). Both these oxides are acidic.



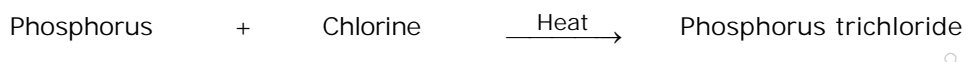
(v) Hydrogen : Hydrogen reacts with oxygen to form an oxide H₂O. H₂O is called water. Water (H₂O) is a neutral oxide



VII. Reaction with Halogens

Nonmetals react with halogen to give covalent halides. In pure state, the halides of nonmetals do not conduct electricity.

For example with chlorine,



Sulphur reacts with fluorine at higher temperature to give sulphur hexafluoride.



VIII. Reaction with Hydrogen

Nonmetals react with hydrogen to form covalent hydrides. Thus in the hydrides of nonmetals, hydrogen is bonded to the nonmetal atom by covalent bonds. The hydrides of nonmetals atom by covalent bonds. The hydrides of nonmetals do not conduct electricity. The hydrides of nonmetals may be acidic, basic or neutral depending upon the nature of the nonmetal.