28.04 - Hydrogen, rare gases and other non-metals.

2804.10 - Hydrogen

- Rare gases :

2804.21 - - Argon

2804.29 - - Other

2804.30 - Nitrogen

2804.40 - Oxygen

2804.50 - Boron; tellurium

- Silicon :

2804.61 - - Containing by weight not less than 99.99 % of silicon

2804.69 - - Other

2804.70 - Phosphorus

2804.80 - Arsenic

2804.90 - Selenium

(A) HYDROGEN

Hydrogen is obtained by electrolysing water, or from water-gas, coke-oven gas or hydrocarbons.

It is generally regarded as a non-metal. It is presented under pressure in thick steel cylinders.

It is used for hydrogenating oils (preparation of solid fats), for cracking petroleum products, in the synthesis of ammonia, for cutting or welding metals (oxy-hydrogen blow lamps), etc.

The heading **excludes** deuterium (stable hydrogen isotope) which falls in **heading 28.45**, and tritium (radioactive hydrogen isotope) which falls in **heading 28.44**.

(B) RARE GASES

The term " rare gases " (inert gases) applies to the elements listed below. They are remarkable for their lack of chemical affinity and for their electrical properties - particularly that of emitting coloured rays (used, for example, in neon signs) under the action of high voltage discharges.

(1) **Helium** (non-inflammable, used, e.g., for inflating balloons).

(2) **Neon** (gives a rosy orange-yellow light or, combined with mercury vapour, " daylight " lighting).

(3) **Argon** (a colourless and odourless gas used to provide an inert atmosphere in electric lamp bulbs).

(4) **Krypton** (same use as argon, or to give a pale violet light).

(5) **Xenon** (gives a blue light).

Rare gases are obtained by fractionating liquid air, or also (in the case of helium) from certain natural gases. They are presented under pressure.

Radon is a radioactive inert gas of **heading 28.44** formed by the radioactive decay of radium.

(C) OTHER NON-METALS

The other non-metals covered by this heading are :

(1) **Nitrogen**.

Nitrogen is a gas which neither burns nor supports combustion, but extinguishes flames. It is obtained by fractional distillation of liquid air, and is presented under pressure in steel cylinders.

Nitrogen is chiefly used for the manufacture of ammonia and calcium cyanamide, but is also used to provide an inert atmosphere in electric lamp bulbs, etc.

(2) **Oxygen**.

This is a combustion-supporting gas, chiefly obtained by fractional distillation of liquid air.

It is presented under pressure in steel cylinders, or sometimes as a liquid in double-walled containers.

Compressed oxygen is used in oxyhydrogen and oxyacetylene blow lamps for welding (autogenous welding) or cutting metals such as iron. It is also used in iron or steel metallurgy and in medicine (inhalations).

This heading also includes **ozone**, an allotropic form of oxygen obtained by the action of electric sparks or discharges. It is used for sterilising water (ozonisation), for the oxidation of drying oils, for bleaching cotton, as an antiseptic and for therapeutic purposes.

(3) **Boron**.

Boron is a chestnut-coloured solid generally in powder form. It is used in metallurgy, and for the manufacture of heat regulators and highly sensitive thermometers.

Because of its very high rate of absorption of slow neutrons, boron is also used, pure or alloyed with steel, for the manufacture of mobile control rods for nuclear reactors.

(4) **Tellurium**.

A solid (specific gravity 6.2), amorphous or crystalline. It is a relatively good conductor of heat and electricity, and has certain metallic properties. It is used in certain alloys (e.g., tellurium-lead alloys), and also as a vulcanising agent.

(5) **Silicon**.

Silicon is obtained almost exclusively by carbothermal reduction of silicon dioxide using electric arc-furnaces. It is a poor conductor of heat and electricity, is harder than glass, and is put up as a chestnut-coloured powder or, more often, in shapeless lumps. It crystallises as grey needles with a metallic lustre.

Silicon is one of the most important materials used in electronics. Very pure silicon, obtained by, for example, crystal pulling, may be in forms unworked as drawn, or in the form of cylinders or rods; when doped with boron, phosphorus, etc., it is used for the manufacture of, for example, diodes, transistors and other semi-conductor devices and solar cells.

Silicon is also used in metallurgical industries (e.g., ferrous or aluminium alloys), and in chemistry for the preparation of silicon compounds (e.g., silicon tetrachloride).

(6) **Phosphorus**.

Phosphorus is a soft flexible solid obtained by treating mineral phosphates mixed with sand and carbon in an electric furnace.

There are two main varieties of phosphorus :

(a) **" White " phosphorus**, transparent and yellowish, toxic, dangerous to handle, highly inflammable. This is put up as moulded rods packed in water-filled containers of black glass, stoneware or, more often, metal; these containers should not be exposed to frost.

(b) **Red phosphorus**, known as " amorphous ", but which can actually be crystallised. This is an opaque solid, non-toxic, non-phosphorescent, denser and less active than white phosphorus. Red phosphorus is used for the manufacture of match compounds, in pyrotechnics, or as a catalyst (e.g., in the chlorination of acyclic acids).

Certain medicaments contain phosphorus (e.g., phosphorised cod liver oil). It is also used as rat poison, or in the preparation of phosphoric acids, phosphinates (hypophosphites), calcium phosphide, etc.

(7) **Arsenic**.

Arsenic (regulus of arsenic) is a solid extracted from natural arsenical pyrites.

It exists in two main forms :

(a) Common, so-called " metallic " arsenic, in brilliant, steelgrey crystals, brittle, insoluble in water.

(b) Yellow arsenic, crystalline, rather unstable.

Arsenic is used in the manufacture of arsenic disulphide, buck-shot, hard bronzes and various other alloys (of tin, copper, etc.).

(8) **Selenium**.

Selenium, which is rather similar to sulphur, exists in several forms :

(a) Amorphous selenium, in reddish flakes (flowers of selenium).

(b) Vitreous selenium, a poor conductor of heat and electricity. It has a brilliant fracture, brown or reddish.

(c) Crystallised selenium, grey or red crystals. It is a relatively good conductor of heat and electricity, especially when exposed to light. It is used in the manufacture of photoelectric cells and, when doped, of semi-conductor devices, in photography, in powder form (red selenium), for the manufacture of rubber, of special lenses, etc.

28.04

The heading **excludes** selenium in colloidal suspension (used in medicine) (**Chapter 30**).

In the Nomenclature, antimony is classified as a metal (**heading 81.10**).

Some of the non-metals in this group (for example, silicon and selenium) may be doped with elements such as boron, phosphorus, etc., in a proportion generally of the order of one part per million, with a view to their use in electronics. They are classified in this heading **provided** that they are in forms unworked as drawn, or in the form of cylinders or rods. When cut in the form of discs, wafers or similar forms, they are classified in **heading 38.18**.