

Biological Role of non-metals

• About 15 non-metals have been recognised as essential elements needed for the growth and normal function of biological process in animals and plants. Hydrogen, Carbon, Oxygen, Nitrogen, Phosphorous and Sulphur are required in large quantities for all forms of life. These elements constitute about 90% of the matter in the living organism. Hence these elements are called structural bulk elements. Chlorine is the bulk mineral element. Fluorine and iodine are required in very small concentrations, hence these are called ultra-trace elements in the life process.

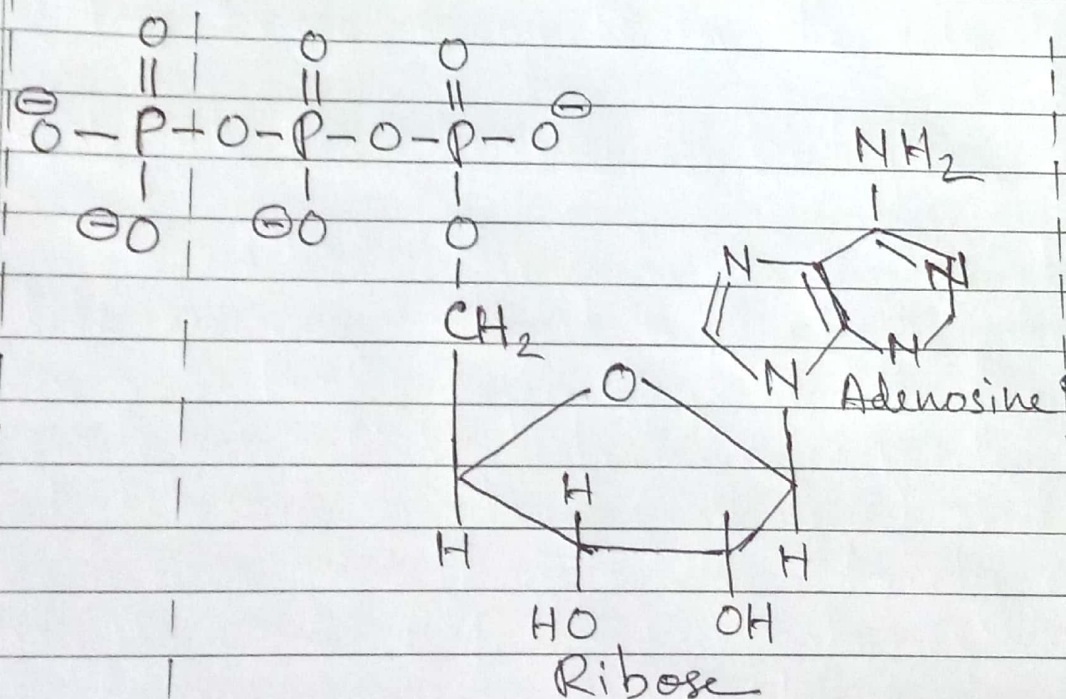
Role of Phosphorous in biological process

Phosphorous is the essential element for life process. About 85% of the phosphorous in our body is present as the bones. The bony skeleton of vertebrates is made up of mainly of fibrous protein (Collagen) and crystals of calcium phosphate. The triply charged phosphate ion (PO_4^{3-}) combines with divalent calcium ion (Ca^{2+}) to form ionic solids with high lattice energy and consequent low solubility. Tooth enamel is mostly hydroxyapatite $[\text{Ca}(\text{PO}_4)_3\text{OH}]$ and partially fluorapatite $[\text{Ca}_5(\text{PO}_4)_3\text{F}]$.

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which strengthens the structure of the teeth and makes it less soluble in the acid formed from fermentation of organic material in the teeth.

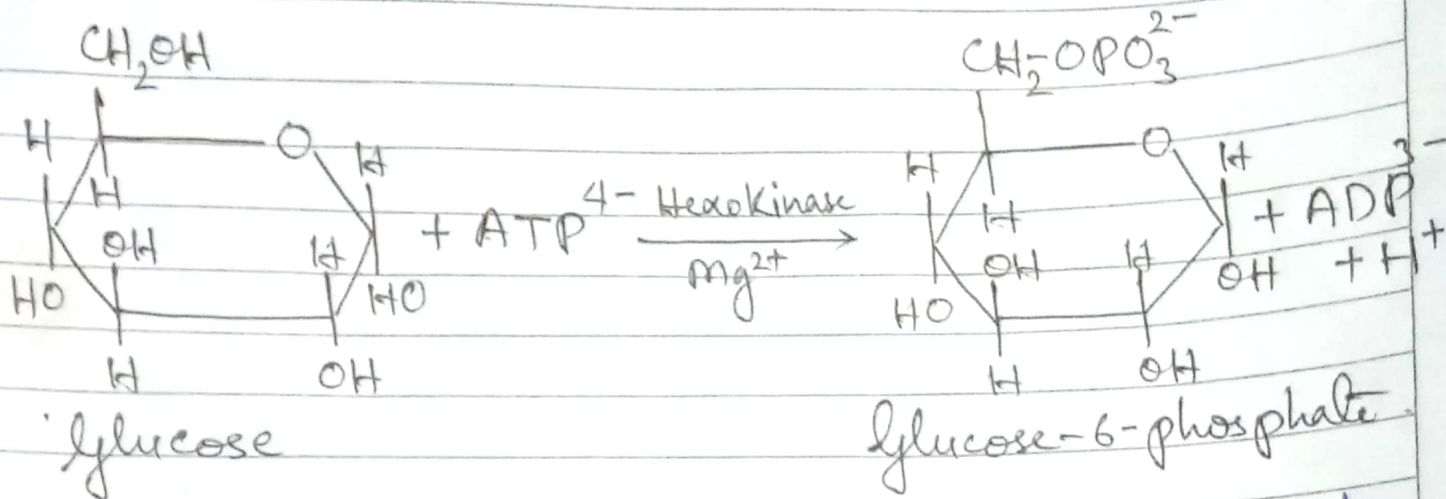
Phosphorous is an essential constituent of an energy rich molecule Adenosine Tri Phosphate (ATP). ATP transfer a phosphate group, usually the terminal one, to glucose under the influence of the enzyme hexokinase (aided by Mg^{2+} ion) to produce ADP (Adenosine diphosphate) and glucose-6-phosphate, the energy released in the process supplies the energy necessary for all biological process



← Adenosine diphosphate, ADP^{3-} →

← Adenosine triphosphate, ATP^{4-} →

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Phosphorous as phosphate group acts as bridge between sugar units in DNA and RNA. The phosphate group plays a crucial role during cell replication.

Phospholipids are another class of important biophosphorous compounds. These are mostly derived from glycerol. Two hydroxyl groups of glycerol being esterified by long chain fatty acids and the third hydroxyl group by phosphoric acid. Most cell membrane contain such phospholipids together with cholesterol and protein.

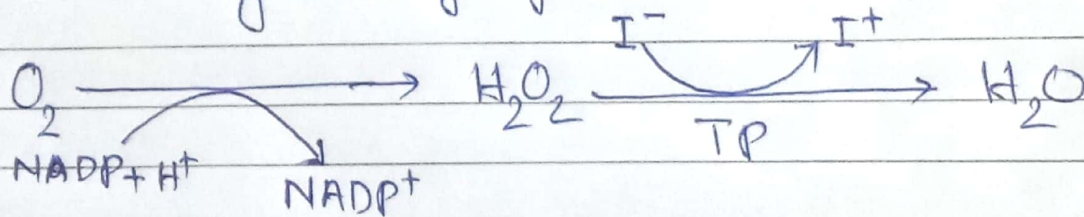
Phospholipases are group of digestive enzymes which catalyse the hydrolysis of membrane phospholipids. The catalytic function involves Ca^{2+} ion. They are present in intestinal juice.

Role of iodine in biological process

A full grown human body contains about 20 mg iodine, most of which bounded to protein thyroglobin in the thyroid gland. Some amount of iodine is also present in the muscle, salivary glands and ovaries.

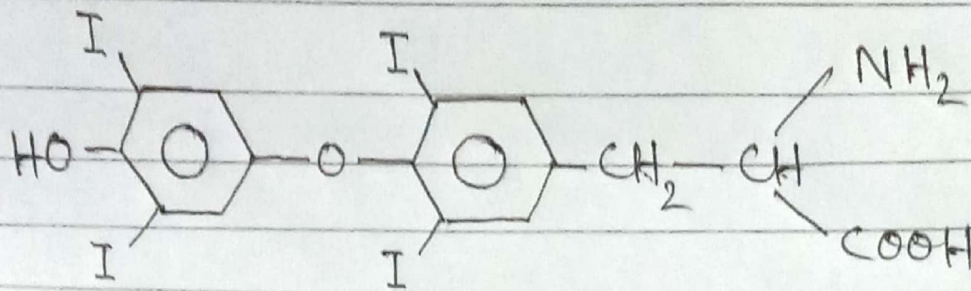
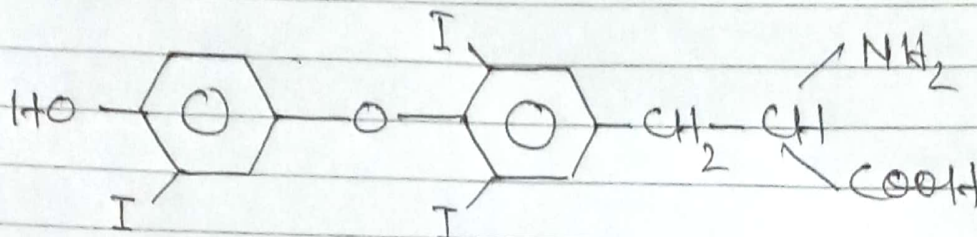
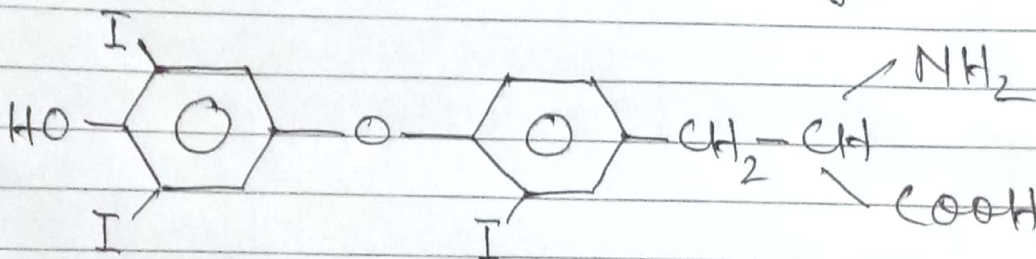
The dietary requirement of 100-150 ~~mg~~ μg iodine per day is mostly supplied through sea food, drinking water, vegetables and fruits. ~~In case of dietary~~ In order to remove dietary deficiency of iodide, potassium iodide is added to table salt. Such salt is known as ~~iodized~~ iodized salt.

Most of the iodine is absorbed through the small intestine as iodide. In the thyroid the I^- ion is oxidised to I^+ ion by H_2O_2 catalysed by the enzyme thyroperoxidase (TP)



The iodine binds to tyrosine residues of protein thyroglobin and ultimately produces three thyroid hormones, thyroxine T_3 , thyroxine T_4 and reverse thyroxine $r\text{T}_3$. Stimulated by thyroid stimulating hormone (TSH), T_3 and T_4 are released into the blood stream where they bind to specific thyroxine binding proteins for transportation.

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3,5,3',5'-tetraiodothyronine (Thyroxine, T_4)3,5,3'-triiodothyronine (Thyroxine, T_3)3,3',5'-triiodothyronine (reverse thyroxine, rT_3)

The hormones influence metabolic rates, protein synthesis, carbohydrate metabolism, lipid utilization and maintenance of electrolyte balance.

Deficiency of iodine results in enlargement of thyroid gland and swelling of the neck, the disease is called 'Goitre'. Deficiency of iodine also causes mental sluggishness, lack of energy and other disorders.

Iodine-131 is used in the diagnosis of goitre and tumour. ~~It~~ I-131 is radioactive and β -emitter.