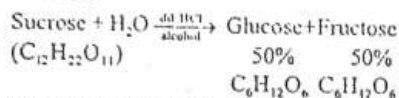


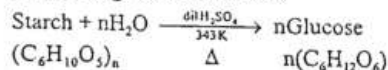
There are two methods for the preparation of glucose.

- i) **From Cane sugar/Sucrose/Laboratory method :** In this method when sucrose is heated with dil. HCl or H_2SO_4 in alcoholic solution it hydrolyzed to give glucose and fructose.



Dil HCl and alcohol is used to separate the glucose and fructose because glucose is insoluble in alcohol while fructose is soluble. Hence, glucose crystallises out first and on cooling it gives pure crystals of glucose.

- ii) **From starch / Barley / Potato Commercial method :** In this method when starch is heated with dil H_2SO_4 at 393 K under pressure it hydrolysed to give number of glucose molecules.

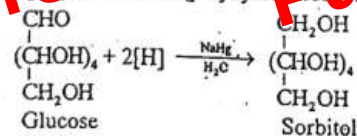


The glucose obtained in this method is impure hence it is purified by neutralisation of excess of dil H_2SO_4 by adding chalk powder ($CaCO_3$) and decolourised by adding animal charcoal. Then the solution of glucose (colourless) is concentrated by heating and on cooling it gives pure crystals of glucose.

4. Write chemical reactions of glucose.

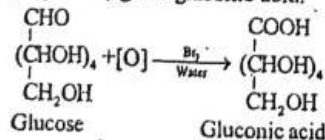
Ans: Chemical reactions of glucose : Glucose always undergo oxidation and reduction reaction easily due to presence of $-CHO$ and alcoholic ($-OH$) group in their molecule.

- i) **Reduction of glucose :** Glucose on reduction with reducing agent Na/Hg and H_2 gives sorbitol (polyhydric alcohol).

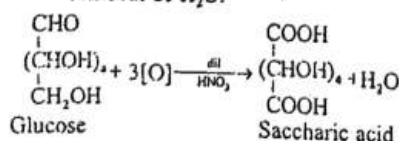


- ii) **Oxidation of Glucose :**

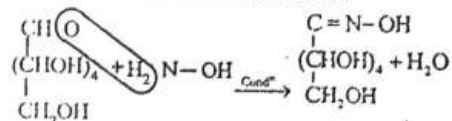
- a) By using Br_2 water : Glucose on oxidation with weak oxidising agent (Br_2 water) gives gluconic acid.



- b) By using dil HNO_3 (nitric acid) : Glucose on oxidation with strong oxidising agent such dil HNO_3 gives saccharic acid / glucaric acid with the removal of H_2O .

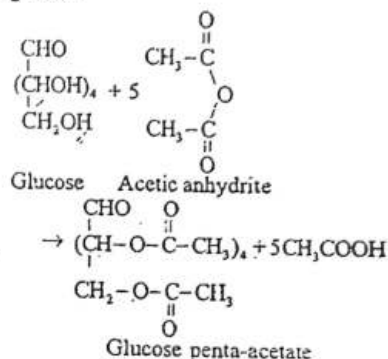


- iii) **Reaction with Hydroxylamine** (NH_2OH) : Glucose reacts with hydroxylamine undergo condensation to give oxime salt with the removal of water.



Glucose Hydroxylamine Glucose oxime

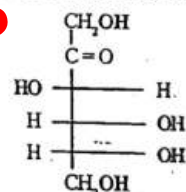
- v) **Acetylation reaction :** When glucose reacts with acetic anhydride in presence of anhydrous $ZnCl_2$ to form penta-acetyl glucose.



5. What is cyclic structure of fructose ?

Ans: The molecular formula of fructose is $C_6H_{12}O_6$.

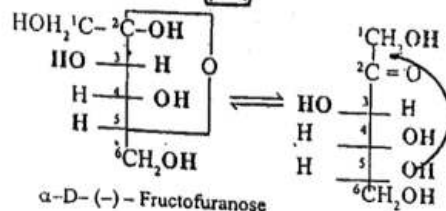
On the basis of different reaction it is shown that, fructose is pentahydroxy ketone. It contains six carbon atom straight chain having keto group at carbon atom 2. It is levorotatory compound and belongs to D - series. The open chain structure of fructose is as follows.



D - (-) - Fructose

It is assumed that a five-membered cyclic hemiacetal is formed by intramolecular nucleophilic addition of $-OH$ group at C-5 to the $C = O$ group. The cyclic five-membered structures of fructose are called furanose structures, in analogy with furan. Furan is a heterocyclic compound with one oxygen atom and four carbon atoms in the ring.

Furan



- iii) **Insulin**: It is peptide hormone, secreted in pancreas & controls carbohydrate metabolism.
- iv) **Sex hormone**:
 - a) **Estron (estrodial)**: These are produced by the ovaries in females. They control the development of secondary characters in female and regulate menstrual cycle.
 - b) **Testosterone and androsteron** are synthesized in the testes.
 - c) **Progesteron**: It is responsible for preparation of uterus for implantation of fertilized egg. They control secondary sex characteristic in male.

● Vitamins

19. Give classification of vitamins with Role and deficiency.

Ans: Classification of vitamins: Vitamins are classified into two groups depending upon their solubility in water or fat.

- A) **Fat soluble vitamins**: Vitamins which are soluble in fat and oils but insoluble in water and kept in this group. These are vitamins A, D, E and K. They are stored in liver and adipose tissues.
- B) **Water soluble vitamins**: B group vitamins and vitamin C are soluble in water so they are grouped together. Water soluble vitamins must be supplied regularly in diet because they are readily excreted in urine and cannot be stored (except vitamin B₁₂) in our body.

Some important vitamins, their sources and diseases caused by their deficiency are listed as follows,

Fat Soluble vitamins: D, A, E, K

Vitamin D

Sources: This vitamin is generally stored in the liver of animals. It is found in milk and fish liver oils. This vitamin is formed by action of U.V. rays on sterols. Sterol is present in the skin and other tissues. The U.V. rays cause rearrangement of atoms in the sterol molecule leading to production of vit. D. So it forms naturally by the action of sunlight on skin.

Functions: The main role of vitamin D is to increase absorption of Ca and P in the intestine. Increase the transport of Ca and P. Effect on calcification process on bones and their normal structure. Help in the development of normal teeth.

Deficiency: If the vitamin D is deficient in the body, Ca and P are not assimilated properly by the bones and result in the Rickets (bone deformities in children) and osteomalacia (Soft bones and jointed pains in adults).

Vitamin A

Sources: Fish liver oils, carrots, butter, milk.

Deficiency: Vitamin A deficiency causes the xerophthalmia (hardening of cornea of eye) night blindness etc.

Vitamin E

Vitamin E is an antisterility factor which is necessary for fertility of male and the birth process of female.

Sources: Plants are better sources than animal tissues. Wheat germ oils, cotton seed, oils, green leaves, vegetables, green nuts.

Functions: It acts as an antioxidant which prevents oxidation of certain substances like vitamin A, fatty acids, amino acids etc.

Essential for normal reproductive functions. Essential for normal functions of muscles.

Deficiency: The deficiency of vitamin E in diet causes sterility i.e. male fails to produce sperm and in female ovulation and fertilization takes place but pregnancy is not maintained. Destruction of foetus in uterus takes place. Abnormal growth

and sometimes causes degeneration of renal tubular cells and muscle cells. Increased fragility of RBCs and muscular weakness.

Vitamin K

These are the most recently discovered members of soluble vitamins. It is named 'K' because it is essential for coagulation of blood or blood clotting.

Sources: Green plants, cabbage, spinach, tomato, soybean are the richest sources.

Functions: It is essential for the synthesis of prothrombin in liver.

Deficiency: The deficiency of vitamin K causes deficiency of thrombin or prothrombin. In absence of prothrombin blood fails to clot and results in non-stop bleeding. This is also called as 'royal disease'.

Water Soluble vitamins: Vitamin B and C.

Vitamin C (Ascorbic acid)

Sources: It is found abundantly in citrus fruits like orange, lemon, tomato, pineapple, grapes, amla and green leafy vegetables.

Functions: It is responsible for formation of intercellular substances. Essential for immunity or body defence. It is an activator for growth of tissue. Play an important role in blood formation and involve in maturation of RBCs. Helps in absorption of iron from intestine. Play a major role in wound healing. It is required for synthesis of adrenal hormones.

Deficiency: Deficiency causes an abnormal condition known as 'Scurvy' (bleeding gums). Loss of appetite and weight, joints become weak. Teeth become loose and fractured. Wound takes more time for healing. Anaemia, brittleness of bones, delayed blood clotting.

Vitamin B Complex

This group consists of several water soluble vitamins. Most of them have been isolated in pure form. The vit. B is divided into 4 groups namely - B₁, B₂, B₆ & B₁₂. Thiamine (Vitamin B₁), Riboflavin (Vitamin B₂), Pyridoxine (Vitamin B₆), Vitamin B₁₂ (Cyanocobalamin).

a) Vitamin B₁ (Thiamine)

Sources: Vitamin B₁ is found in all plants and animal tissue. Best sources are yeast, milk, green vegetables and cereals, heart, kidney etc.

Functions: Thiamine is specifically needed for final metabolism of carbohydrates and many amino acids. Essential for normal growth and appetite and also for proper function of nervous system.