

BIOMOLECULES

Step 1: Watch the video on carbohydrates

<https://www.youtube.com/watch?v=Pl2K4hn7N9Y&list=RDCMUCp1IKaxGFEy-TZ0mrW-oqXA&index=1>

Step 2: Practice the reactions involved in preparation and structure of glucose from the notes given below. *Please note there is always a question in CBSE from this part. (Practice writing chemical equation)*

Step 3: Watch this Video to revise the above concept

<https://www.youtube.com/watch?v=X5sWXBj9Yj8>

Step 4: Now watch the Complete chapter Biomolecules video Shiksha House follow the following link

<https://www.youtube.com/watch?v=MkqtHP9MhDs>

Do remember you don't have to do all the structures

Step 5: Revise the chapter by learning the key points given below

Step 6: Structure of Nucleic Acid is very well explained in the following video so revise this topic by watching the following video.

<https://www.youtube.com/watch?v=0lZRAShqt0>

Step 7: Attempt Section A questions on line on the link below

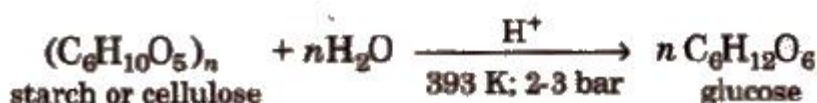
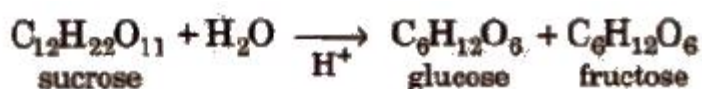
<https://forms.gle/AQ9rpFHoRQAqzJbj9>

Section B and C should be done in chemistry registers.

Preparation and Structure of Glucose

Manufacture

a) Sucrose is boiled with dil. HCl or H₂SO₄ in alcoholic solution



b) Starch is hydrolysed by boiling it with dil. H₂SO₄

Cyclic structure of Glucose

α and β glucose

In intermolecular hemiacetal formation (cyclic structure), $-\text{CHO}$ is converted into $-\text{CHOH}$ which can have two configurations as shown below.

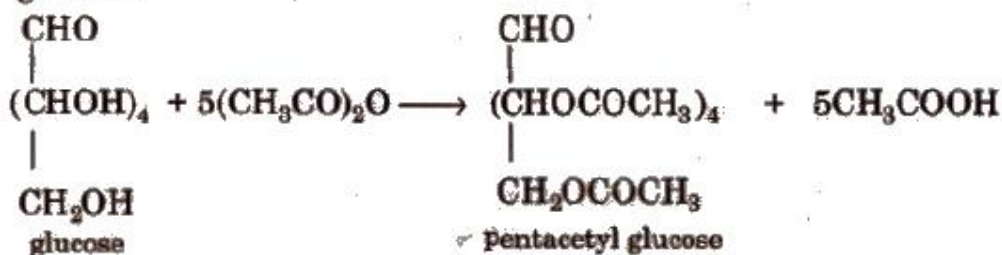


- c) Glucose having (i) configuration about C_1 is the α -glucose and having (ii) configuration about C_1 is β -glucose. The carbon C_1 is known as anomeric carbon and these compounds are called anomers. Both the forms are optically active.

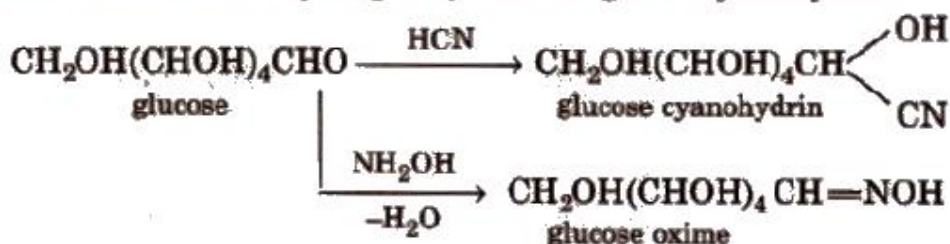
Structure of Glucose

Glucose has one aldehyde group, one primary hydroxyl ($-\text{CH}_2\text{OH}$) and four secondary hydroxyl ($-\text{CHOH}$) groups and gives the following reactions

- (i) Glucose on acetylation with acetic anhydride gives a pentaacetate confirming the presence of five hydroxyl groups in glucose.



- (ii) Glucose reacts with hydroxylamine to give monoxime and adds with a molecule of hydrogen cyanide to give a cyanohydrin.



These reactions confirm the presence of a carbonyl group in glucose.

(iii) Glucose reduces ammoniacal silver nitrate solution (Tollen's reagent) to metallic silver and also Fehling's solution or Benedict solution to reddish brown cuprous oxide (Cu_2O) and itself gets oxidised to gluconic acid. This confirms the presence of an aldehydic group in glucose.

(iv) With mild oxidising agent like bromine water, glucose is oxidised to gluconic acid. This indicates that the carbonyl group is present as aldehydic group. (Equation from N.C.E.R.T)

(v) On oxidation with nitric acid glucose as well as gluconic acid both yield saccharic acid this indicates the presence of primary alcoholic group in glucose. (Equation from N.C.E.R.T)

BBPSPP

KEY POINTS	
Monosaccharides	Cannot be hydrolyzed further. e.g. glucose, fructose, ribose
Oligosaccharides	Carbohydrates that yield 2 to 10 monosaccharide units on hydrolysis
Polysaccharides	Carbohydrates that yield large number of monosaccharide units on hydrolysis e.g. starch, glycogen etc. Not sweet in taste so also called non-sugars
Reducing sugars	Aldehydic/ ketonic groups free so can reduce Fehling's/ Tollen's solution e.g. maltose and lactose
Non reducing sugars	Aldehydic/ ketonic groups are bonded so cannot reduce Fehling's and Tollen's reagent. E.g. Sucrose
Anomers.	The two cyclic hemiacetal forms of glucose differ only in the configuration of the hydroxyl group at C1, called <i>anomeric carbon</i> . Such isomers, i.e., α -form and β form, are called anomers
Glycosidic linkage	Two monosaccharide units joined together by an oxide linkage formed by the loss of water molecule
Sucrose	Glycosidic linkage between C1 of α - glucose and C2 of β - fructose since the reducing groups are bonded it is a non reducing sugar
Invert sugar	Sucrose is dextrorotatory but after hydrolysis gives Dextrorotatory glucose and laevorotatory fructose. Since the Laevorotation of fructose (-92.4°) is more than dextrorotation of glucose ($+52.5^\circ$), the mixture is laevorotatory. Thus, hydrolysis of sucrose brings about a change in the sign of rotation, from dextro (+) to laevo (-) and the product is named as invert sugar.
Maltose	C1 of one glucose is linked to C4 of another glucose since free aldehyde group is produced at C1 of second glucose it is a reducing sugar
Lactose	Also called milk sugar. The glycosidic linkage is between C1 of galactose and C4 of glucose. It is a reducing sugar
Starch	Main storage polysaccharide of plants. Imp. dietary source for human beings. Polymer of D-glucose
Amylose	Water soluble, 15-20% of starch., unbranched chain, C1– C4 glycosidic linkage.
Amylopectin	Amylopectin Water insoluble , 80 to 85% of starch, branched chain polymer, C1–C4 & C1–C6 glycosidic linkage
Cellulose	Straight chain polysaccharide of β -Dglucose units/ joined by C1-- C4 glycosidic linkage (β -link), not digestible by human / constituent of cell wall of plant cells

Glycogen	It is a form in which carbohydrates are stored in animal body. Also known as animal starch. Present in liver, muscles and brain. Enzymes break down glycogen to glucose when required.
Proteins	Polymers of α amino acids. Required for growth and maintenance of body.
Amino acid	Contain amino and carboxylic group..can be acidic, basic or neutral depending on number of amino and carboxyl groups in the molecule
Essential amino acids	Which cannot be synthesized in the body and must be obtained through diet, e.g. Valine, Leucine
Non-essential amino acids	Which can be synthesised in the body, eg Glycine, Alanine
Zwitter ion	In aqueous solution, amino acids exist as a dipolar ion known as <i>zwitter ion due to the presence of both acidic and basic group in the same molecule.</i>
Peptide linkage	peptide linkage is an amide formed between $-\text{COOH}$ group and $-\text{NH}_2$ group of two successive amino acids in peptide chain.
Fibrous Protein	Polypeptide chains run parallel, held together by hydrogen and disulphide bonds, fiber-like structure. Water insoluble. Eg- are keratin in hair, wool, silk) and myosin (present in muscles).
Globular Protein	chains of polypeptides coil around to give a spherical shape. Water soluble. Eg Insulin and albumins
Primary structure	The specific sequence of amino acids is said to be the primary structure of protein
Secondary structure	secondary structure of protein refers to the shape in which a long polypeptide chain can exist. They are found to exist in two types of structures viz. α -helix and β -pleated sheet structure.
Tertiary Structure	further folding of the secondary structure. It gives rise to two major molecular shapes viz. fibrous and globular.
Denaturation of protein	When a protein is subjected to physical change like change in temperature or chemical change like change in pH, the hydrogen bonds are disturbed. Due to this, globules unfold and helix get uncoiled and protein loses its biological activity. This is called denaturation of protein. (During denaturation 2° and 3° structures are destroyed but 1° structure remains intact.) eg- The coagulation of egg white on boiling, curdling of milk
Vitamins	Organic compounds required in the diet in small amounts to perform specific biological functions.
Fat soluble vitamins	These are vitamins A, D, E and K. They are stored in liver and adipose (fat storing) tissues

Water soluble vitamins	B , C . these vitamins must be supplied regularly in diet because they are readily excreted in urine
Vitamins – sources- Deficiency diseases	Vit. A (Fish liver oil, carrots)- Night blindness / Vitamin B1 (Yeast, milk,) Beri Beri
	Vit B2 (Milk, egg white) Cheilosis / Vit B6 (Yeast, milk,)- Convulsions / Vit B12 (Meat, fish,) anemia
	Vit- C(Citrus fruits)Scurvy, / Vit- D(Exposure to sunlight, fish and egg yolk) Rickets, osteomalacia
	Vit- E (wheat oil, sunflower oil) fragility of RBCs / Vit - K (leafy vegetables) Increased blood clotting time

ASSIGNMENT

GENERAL INSTRUCTIONS:

- (i) Section-A contains 30 questions of 1 mark each.
- (ii) Section-B contains questions 31 to 37 of two marks each.
- (iii) Section-C contains questions 38 to 45 of three marks each.

SECTION A

1. How many asymmetric carbon atoms are present in D (+) glucose?
2. Give the significance of (+)-sign in the name D- (+)-glucose.
3. Give the significance of prefix 'D' in the name D- (+)-glucose.
4. Name the linkage used to link different monosaccharide in a polysaccharide?
5. Name a water soluble vitamin which is not excreted from our body?
6. Which of the two bases named below, which one is present in RNA and which one is present in DNA?
(i) Thymine (ii) Uracil
7. Which nucleic acid is responsible for carrying out protein synthesis in the cell?
8. What are the products of hydrolysis of sucrose?
9. What are the products of hydrolysis of maltose?
10. Write the products of hydrolysis of lactose.
11. Name the two components of α -glucose which constitute starch.
12. What type of linkage holds together the monomers of DNA and RNA?
13. Which component of starch is a branched polymer of α -glucose and insoluble in water?
14. Which of the two components of starch is water soluble?
15. Write the name of the vitamin responsible for the coagulation of blood.

ASSERTION - REASON TYPE

A statement of assertion is followed by a statement of reason. Mark the correct choice from the options given below:

- (a) Both assertion and reason are true and reason is the correct explanation of assertion.
- (b) Both assertion and reason are true but reason is not the correct explanation of assertion.
- (c) Assertion is true but reason is false.
- (d) Both assertion and reason are false.

16. Assertion: All enzymes found in cells are invariably proteins which catalyse biological reactions.

Reason: Enzymes act efficiently at a moderate temperature and pH. (

17. Assertion: D - glucose is dextrorotatory whereas L - glucose is laevorotatory.

Reason: D - compounds are always dextro and L - compounds are always laevo.

18. Assertion: Vitamin D cannot be stored in our body.

Reason: Vitamin D is fat soluble vitamin and is excreted from the body in urine.

19. Assertion: Purine bases present in DNA are adenine and guanine.

Reason: The base thymine is present in RNA while base uracil is present in DNA.

20. Assertion: α - Amino acids are the building blocks of proteins.

Reason: Natural amino acids are mostly α - amino acids.

MCQ TYPE QUESTIONS (1 - MARK EACH)

21. The function of enzymes in the living system is to-

(a) Transport oxygen (b) Provide immunity (c) Catalyze biochemical reactions (d) Provide energy

22. Vitamin A is called -

(a) Ascorbic acid (b) Retinol (c) Calciferol (d) Tocopherol

23. Which carbohydrate is an essential constituent of plant cells?

(a) Starch (b) Cellulose (c) Sucrose (d) Vitamins

24. Vitamin B1 is -

(a) Riboflavin (b) Cobalamin (c) Thiamine (d) Pyridoxine

25. The vitamins absorbed from intestine along with fats are -

(a) A, D (b) A, B (c) A,C (d) D, B

26. The functional group which is found in amino acid is

(a) - COOH (b) - NH₂ (c) - CH₃ (d) both (a) and (b)

27. Complete hydrolysis of cellulose gives -

(a) L - glucose (b) D-Fructose (c) D-ribose (d) D-glucose

28. Which base is present in RNA but not in DNA?

(a) Uracil (b) Cytosine (c) Guanine (d) Thymine

29. The human body does not produce -

(a) Enzymes (b) DNA (c) Vitamins (d) Hormones

30. The Pyrimidine bases present in DNA are -

a) cytosine and adenine (b) cytosine and guanine

c) cytosine and thymine (d) cytosine, thiamine and uracil

SECTION B

31. Write the main structural difference between DNA and RNA.

32. Write any two reactions of glucose which cannot be explained by open chain structure.

33. State what you understand by primary structure and secondary structure of proteins.

34. Explain what is meant by

(i) a peptide linkage,

(ii) a glycosidic linkage.

35. What are essential and non-essential amino acids in human food? Give one example of each type.

36. What are vitamins? Deficiency of which vitamin causes

(i) Pernicious anaemia?

(ii) Convulsions?

37. Name the four bases present in DNA. Which one of these is not present in RNA?

SECTION C

38. What do you understand by denaturation of protein? What will be the outcome of denaturation on the structure of proteins?

39. Define the following terms:

(i) Anomers

(ii) Invert sugar

(iii) Oligosaccharides

40. Name two fat soluble vitamins, their sources and the diseases caused due to their deficiency in diet.

41. Differentiate between fibrous proteins and globular proteins and give one example of each.

42. What is glycogen? How is it different from starch? How is starch structurally different from cellulose?

43. What will happen when a D - glucose is treated with the reagents given below? Write chemical equation for the reaction involved.

(a) HI

(b) Bromine water

(b) HNO_3

44 “The two strands in DNA are not identical but are complementary”. Explain

45a) What are the nucleic acids? Give their two important functions.

b) Differentiate between nucleoside and nucleotide.

BBK