

# CARBOHYDRATES AND PROTEINS

## Important points to keep remember:

1. Polyhydroxy aldehydes or ketones called as carbohydrates (or) Compound of carbon and water are called carbohydrates.
2. General formula of carbohydrates  $C_x (H_2O)_y$
3. Carbohydrates are classified based on taste as sugars and non-sugars.
4. Carbohydrates containing aldehyde functional groups are called Aldoses, if carbohydrates contain ketone functional group are called ketoses.
5. Depending on number of carbon atoms in carbohydrates they are classified as Trioses (Three Carbon atoms), tetroses (4 carbon atom) and Pentoses with 5 carbon atoms.
6. Based on the character of hydrolysis of carbohydrates they are classified as monosaccharides, oligosaccharides and polysaccharides.

## Example for

**Monosaccharides:** a) Glucose, Fructose and Mannose

**Oligosaccharides:** (They form 2 to 9 monosaccharides on hydrolysis).Ex: Sucrose, Maltose.

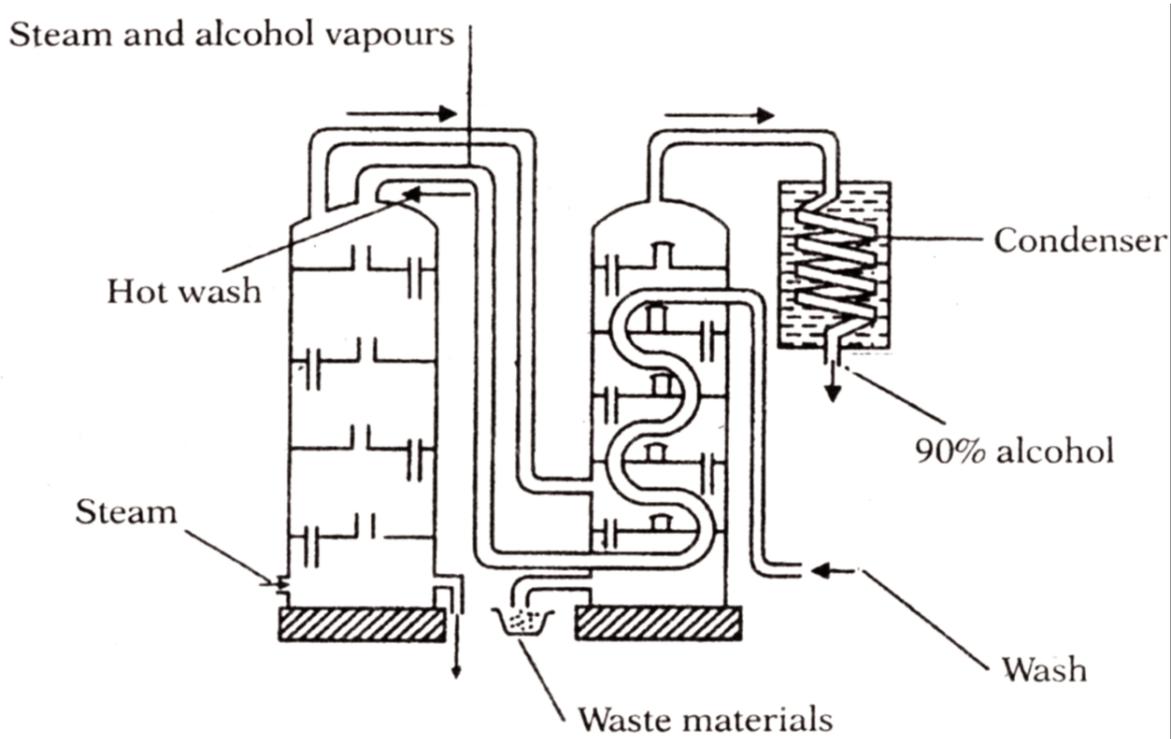
**Polysaccharides:**(They give more monosaccharides on Hydrolysis. General formula is  $(C_6H_{10}O_5)_n$ )Ex: Starch, Cellulose.

7. Carbohydrates (glucose) is prepared by plants by a process known as photosynthesis.
8. Glucose gives energy to the living cells.
9. Carbohydrates provide food, clothes and shelter for us.
10. Glucose is tested by Tollen's and Benedict's reagent.
11. Sugar is manufactured from sugar-cane which involves broadly four steps.
  - a. Extraction of juice from sugar-cane
  - b. Purification of sugar-cane juice
  - c. Concentration of juice and crystallisation.
  - d. Separation of Crystals and drying.
12. The byproducts of sugar industry are bagasse, wax, press mud and molasses. Alcohol is prepared from molasses by fermenting the same with yeast cells. Yeast cells contain two types of enzymes.  $CO_2$  is a byproduct of alcohol industry.
13. Amino acids contain amino ( $NH_2$ ) and Carboxylic Acid ( $COOH$ ) groups in a molecule.
14. Amino acids have salt like or zwitter ionic structure.
15. Amino acids are the building blocks of proteins.
16. Human body cannot prepare nine amino acids which are called as essential amino acids.
17. The  $-CO-NH-$  bond is called peptide bond.
18. The result product obtained by the joint of a large number of amino acids, is called polypeptide. Hemoglobin which carries oxygen is a protein consists 574 amino acids. By changing one amino acid in Hemoglobin this will be converted to sickle cell hemoglobin.
19. Each protein has its own number and sequence of amino acids and performs a specific function.

5 Marks (Diagram)

1. Draw the diagram showing the parts of sugar industry

(March 2007, 2006, 2004, 2001)

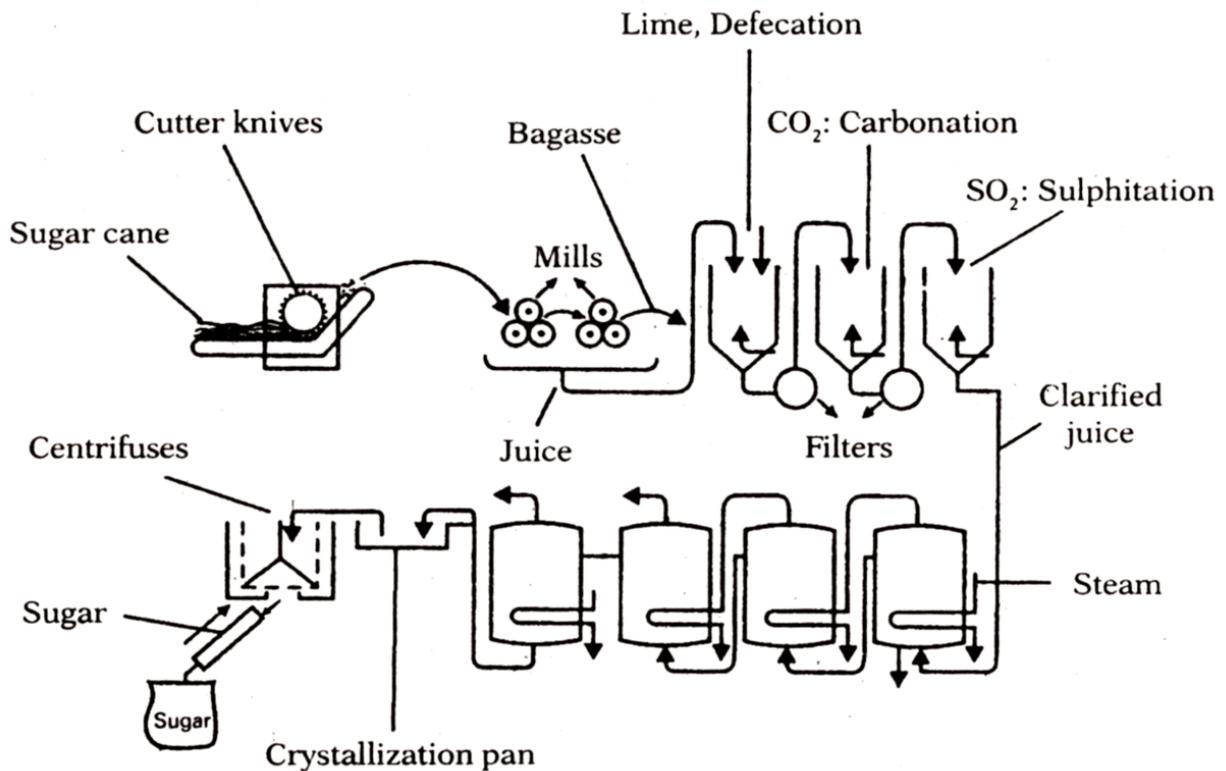


2. Draw the chart showing the alcohol manufacture

(or)

Draw the block diagram of manufacture of alcohol and label the parts

(April 2008, June 2008, March 08, 05, 03, Jan 05, 01, 00)



**Note:** Ten out of nine times diagram questions is covered from this chapter

## 4 Marks Questions

### 1. How is the alcohol manufactured industrially?

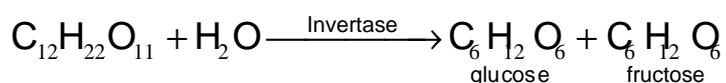
(March 09)

#### Manufacture of Alcohol:

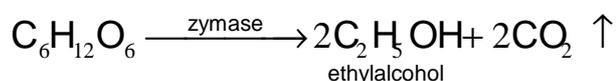
1. Molasses is diluted to 10% sugar by adding
2. Salts like ammonium sulphate and ammonium phosphate are added to sugar solution. This acts as food to the growth of yeast.
3. The solution of molasses and the salt is transferred to a fermentation tank.
4. The yeast is added to the above solution.
5. By maintaining 30°C temperature the solution is kept for 2, 3 days for the fermentation to complete. Yeast Produces two enzymes namely Invertase and Zymase.

#### Invertase and Zymase:

a) Invertase converts sucrose into glucose and fructose.



a) Zymase converts glucose and fructose to ethyl alcohol and CO<sub>2</sub>



6. When the concentration of alcohol reaches 15 - 20% in the solution the yeast cells are killed and the fermentations will end.
7. The alcohol produced in fermentation tank is called 'wash' which is subjected to fractional distillation to get 96% alcohol which is commercially called as rectified spirit. By adding dry lime 100% alcohol is obtained by removing 4% water. This is called as absolute alcohol.

### 2. Describe a suitable diagram the different steps involved in the manufacture of sugar (June - 2002, March 2000)

- Sugar from sugarcane is manufactured by 4 steps.

#### 1 Extraction of juice from sugarcane:

- a. Sugarcane is through is cleaned and cut into short length.
- b. These pieces are fed into roll crushers where juice is extracted.
- c. About 93% of the juice is extracted from the cane. The spent cane is called bagasse.

#### 2. Purification of Sugarcane juice:

- a. The juice obtained from the above process is slightly acidic, lime, Ca(OH)<sub>2</sub> is added to precipitate the impurities as well to neutralise the juice.
- b. This is called defecation. The juice is then heated in large tanks.
- c. Excess lime is removed as carbonates by passing CO<sub>2</sub> gas into the solution. This process is called carbonation.
- d. SO<sub>2</sub> gas in also passed through the solution to remove any traces of lime. This is known as sulphitation.

#### 3. Concentration of juice and Crystallization:

- a. The purified juice is called 'clarified juice'. This contains 85% water.

- The juice is concentrated at low pressure in the beginning and in vacuum in later stages.
- The resulting thick juice goes to vacuum pans and is concentrated to super saturation.

#### 4. Separation of Crystals and drying:

- The sugar crystals are formed in the pan above the thick juice containing 10% water
- The crystals are separated by centrifugation. In the centrifuges, crystals and juice are separates
- sugar crystals obtained are heated by dry not air to remove traces of water. The thick black liquid obtained after separation of crystals is called "molasses".

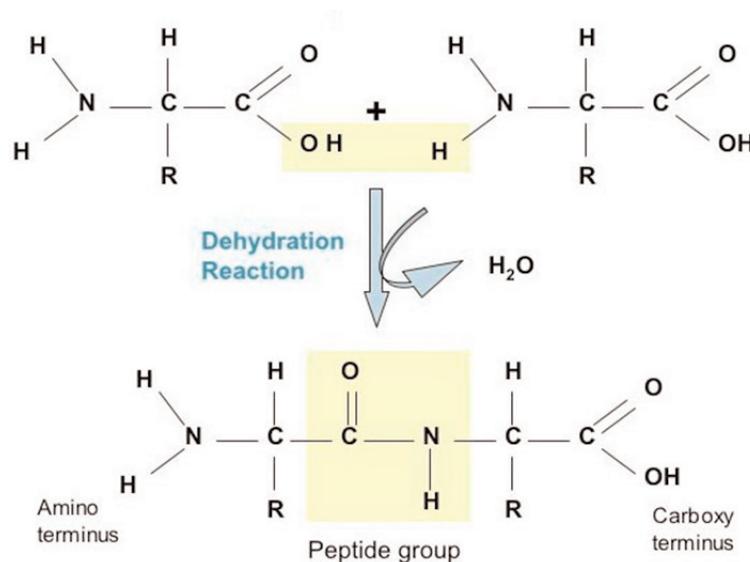
**Note: If there is a choice to write other answer, better to avoid this answer as this involve time consuming)**

### 3. What are proteins? How does a peptide bond form? Mention the important functions of proteins? (March 2002, Oct 1999)

- Modified polypeptides are known as proteins.
- Formation of peptide bond:

When any two amino acids combined they are joined by the elimination of water molecule and also between them a – CO – NH bond is formed. Such a bond is called peptide bond

The formation of the peptide bond is observed in the following figure



#### Function of Proteins:

- Proteins serve as chief structural material of animal tissues.
- Some proteins function as enzymes and they catalyze biological reactions.
- They regulate metabolic process.
- Some proteins act as antibodies. They protect body form the disease causing groups.

### 4. What are the main steps involved in the production sugar from sugar-cane? Mention the important by-products and its use? (June - 2002)

**Main steps involved in the production of sugar from sugar cane:**

- Extraction juice from sugar cane
- Purification of sugar cane juice
- Concentration of juice and crystallization

4. Separation of crystals and drying by products and their uses:
- Spent cane observed during extraction of juice from cane is called Bagasse. It is used as fuel in the production of electricity or manure of paper and hard boards.
  - The precipitates after defecation, carbonations and sulphitation are called press mud which is useful as manure.
  - The thick black liquid finally obtained after separation of crystals is called 'molasses'. It is used in the manufacture of alcohol by fermentation and as animal feed supplement.

## 2 Marks Questions

### 1. How do you perform Tollen's test and Benedict's test for detecting "sugar"? (March 2002)

- Take some sugar solution in a test-tube. Perform Tollen's test and Benedict's test. These tests are not answered by sugar. Silver mirror in Tollen's test and red precipitate in Benedict's test are not observed. So sugar is a non reducing sugar.
- Take some sugar solution in a test-tube. Add a few drops of concentrated HCl. Wait for 10 minutes. Now perform Tollen's test and Benedict's test. This time the formation of silver mirror in Tollen's test and red precipitate in Benedict's test is observed. Sugar is hydrolysed to glucose and fructose in this attempt. Glucose responds to the above tests as it is a reducing carbohydrate.

### 2. What are the evil effects of alcohol?

- Consumption of alcohol in the form of beverages is harmful to health.
- It causes severe damage to blood circulation system and nervous system.
- Addiction to alcohol drinking heads to heart diseases and damages the lines.
- It causes ulcers in the small intestine due to increased acidity and damages the digestive system.
- Drinking of denatured spirit causes blindness and death.

### 3. Mention the various steps involved in the manufacture of sugar from sugar cane? (June 2002, March 2000)

- Sugar is manufactured from sugar-cane which involves broadly four steps.
  - Extraction of juice from sugar-cane
  - Purification of sugar-cane juice
  - Concentration of juice and crystallisation.
  - Separation of Crystals and drying.

## 1 Marks Questions

### 1. What is Sulphitation?

(June 03)

- A- The process of removing the remaining traces of lime by passing  $\text{SO}_2$  gas through juice is called sulphitation.

## 2. What is defecation?

A- The process of addition of lime to precipitate the impurities as well as to neutralise the juice is called defecation.

## 3. What is Carbonation?

A - The process of removing excess of lime from the juice by passing CO<sub>2</sub> gas is called defecation.

## 4. What is rectified spirit?

A- 96% alcohol is called rectified spirit.

## 5. Name the sweetest sugar?

A-Fructose

## 6. Which substance is added to prepared denatured spirit?

A- Pyridine

## 7. How many Amino acids are present in Hemoglobin?

A- 574

### Fill in the blanks

(1/2 Marks)

- \_\_\_\_\_ is the sweetest sugar (March 04, 09, April 08, Oct 99)
- Among sucrose, Glucose and maltose \_\_\_\_\_ is the sweetest sugar
- The sweetness of Lactose is \_\_\_\_\_
- Energy required to run a person for 11 km in one hour is \_\_\_\_\_ Calories.
- Energy required by a person to swim in back stroke for 3.5 km in one hour is \_\_\_\_\_ calories.
- Example for polysaccharide is \_\_\_\_\_ (june 03)
- Hexoses contain \_\_\_\_\_ carbons (March 06)
- In the Tollen's test glucose reduces \_\_\_\_\_ (June 00)
- Defecation is addition of \_\_\_\_\_ (June 07, 06, 01)
- Among sugar, Bagasse, press mud and molasses \_\_\_\_\_ is not a byproduct. (March 05)
- Benedict's solution contains \_\_\_\_\_ (Oct 99)
- The general formula of polysaccharides is \_\_\_\_\_
- Ammonical silver nitrate solution is called \_\_\_\_\_ (Oct 99)
- The - CO - NH bond is called as \_\_\_\_\_ (March 2004)
- \_\_\_\_\_ used to separate the crystals of sugar and liquid juice.
- \_\_\_\_\_ is the micro organism used for fermentation of molasses.
- \_\_\_\_\_ enzyme breaks the sucrose.
- \_\_\_\_\_ enzyme breaks the glucose.
- The precipitates of defecation, carbonation and sulphitation are called \_\_\_\_\_
- Amino acids are building blocks of \_\_\_\_\_

## Answers

1. Fructose
2. Sucrose
3. 16
4. 870
5. 2000
6. Starch
7. Six
8. Ag<sup>+</sup> ion to Ag metal
9. CaO
10. Sugar
11. Copper Sulphate
12.  $(C_6H_{10}O_5)_n$
13. Tollen's reagent
14. Peptide bond
15. Centrifuge
16. Yeast
17. Invertase
18. Zymase
19. Press mud
20. Proteins