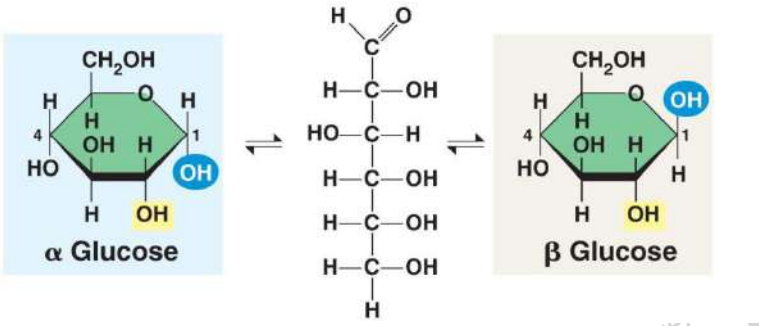
Chemistry (Part 2)

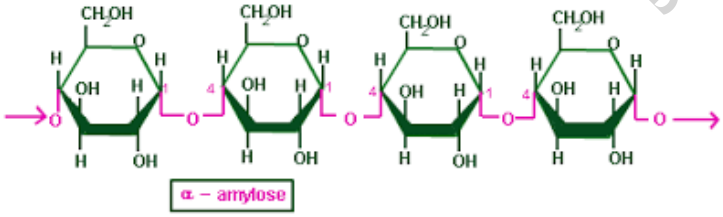
Chapter 14. Macromolecules

Short Questions

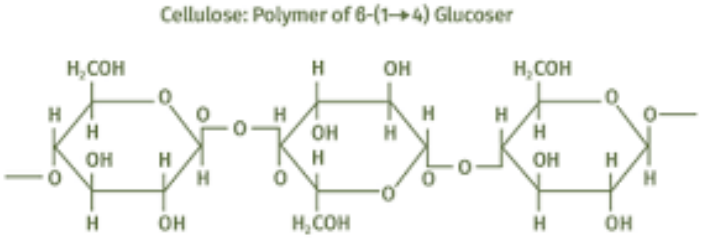
Q1. Justify by writing the structural formulas that amylase is condensation polymer of α-D glucose and cellulose is polymer of β-D glucose.



Amylase is a condensation polymer of α- D Glucos



Cellulose is a condensation polymer of β-D glucose .



Q2. Define Enzymes. Write their two properties.

Enzymes: Enzymes can be defined as reaction catalysts of biological systems produced by living cells and are capable of catalyzing chemical reactions.

Properties of enzymes:

1. Specificity: Enzymes are specific in their action which means that enzymes can act on only one substrate or group of closely related substrates. For example Hexokinase catalyses the conversion of hexoses like glucose, fructose and manose to their 6-phosphate derivatives but glucokinase is specific for glucose only.

2.Protein Nature: Enzymes with few exceptions are protein in nature. They are produced by living cells but act in vivo as well as in vitro.

Q3. Discuss Saponification number.

It is defined as the number of milligrams of Potassium Hydroxide or Sodium Hydroxide required to saponify one gram of the fat or oil. For example one mole of Glycerol Tripalmitate (mol. wt=807) requires 168,000mg of KOH for saponification. Therefore one gram of fat will require 168000/807 mg of KOH. Hence the saponification number of Glycerol Tripalmitate is 208.

Q4. Discuss saponification number and give example.

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Q5.Define saponification and Iodine number.

Saponification:

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Iodine number:

The extent of unsaturation in a fat or oil is expressed in terms of its iodine number. It is defined as the number of grams of iodine which will add to 100g of a fat or an oil. The value of iodine number depends on the number of double bonds present in the acid component of glycerides. The glycerides with no double bond will have zero iodine number.

Q6. Define Iodine number.

Iodine number:

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Q7. What are differences between DNA and RNA.

DNA	RNA
1. DNA is Deoxyribonucleic acid .	1. RNA is ribonucleic acid.
2. It carries genetic information.	2. It puts this information to work in cell
3. Sugar in DNA is 2-deoxyribose	3. Sugar in RNA is ribose.
4. It is double stranded .	4. It is single stranded.
5.Four bases are found in DNA. Cytosine, Thymine, Adenine & Guanine.	5. In RNA thymine is replaced by Uracil.

Q8. What is the difference between fat and oil?

Difference between fats and oils is that **fats** are composed **of** high amounts **of** saturated fatty acids which will take a solid form at room temperature whereas **oils** are composed **of** mainly unsaturated fatty acids which will take a liquid form at room temperature.

Q9. In what ways fats and oil are different?

Difference between fats and oils is that **fats** are composed **of** high amounts **of** saturated fatty acids which will take a solid form at room temperature whereas **oils** are composed **of** mainly unsaturated fatty acids which will take a liquid form at room temperature.

Q10. What are lipids? Give two physical properties.

Lipids:

Lipids (Greek, lipo means fat) are naturally occurring organic compounds of animal and plant origin which are soluble in organic solvents and belong to a very heterogeneous group of substances.

Properties:

1.They are insoluble in water and soluble in non polar solvents eg. ether, chloroform and benzene.etc.

2. Their primary building blocks are fatty acids, glycerols and sterols.

Q11. Define polymerization. Explain the term degree of polymerization.

Polymerization:

Polymerization is a process of reacting monomer molecules together in a chemical reaction to form polymer chains or three-dimensional networks.

Degree of polymerization:

The degree of polymerization, or DP, is the number of monomeric units in a macromolecule or *polymer* , or in other words the number of repeating units in a chain of a polymer is called degree of polymerization. It is very helpful in calculating the molecular mass of the polymer. The molecular mass of the polymer is the product of molecular mass of the repeating unit and the DP. For example poly vinyl chloride, a polymer of DP 1000 has a molecular mass

Mol.mass of P.V.C = Mol.mass of the repeating unit × DP

$-(CH_2—CH)_n-$ = 63 × 1000

| = 63000

Cl

Q12. Define acid number. What is Rancidity?

Acid number:

The acid number of a fat or oil tells the amount of free fatty acids present in it. It is expressed as the number of milligrams of potassium hydroxide required to neutralize one gram of fat.

Rancidity:

Fats or oils are liable to spoilage and give off an odour known as rancidity. It is mainly caused by the hydrolytic or oxidative reactions which release foul smelling aldehydes and fatty acids. Oils from sea animals which contain a relatively high proportion of unsaturated acid chains deteriorate rapidly.

Q13. What is acid number?

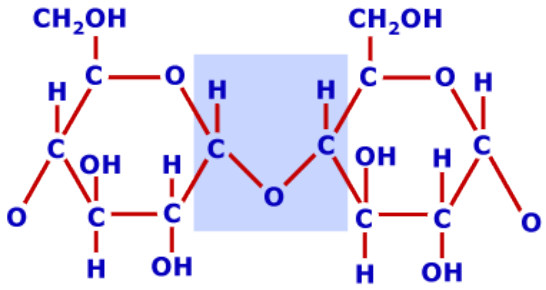
Acid number:

The acid number of a fat or oil tells the amount of free fatty acids present in it. It is expressed as the number of milligrams of potassium hydroxide required to neutralize one gram of fat.

Q14. Write the structure of Starch.

Starch is a polymer of α-D glucose.

Simple starch



Q15. Give classification of macromolecules.

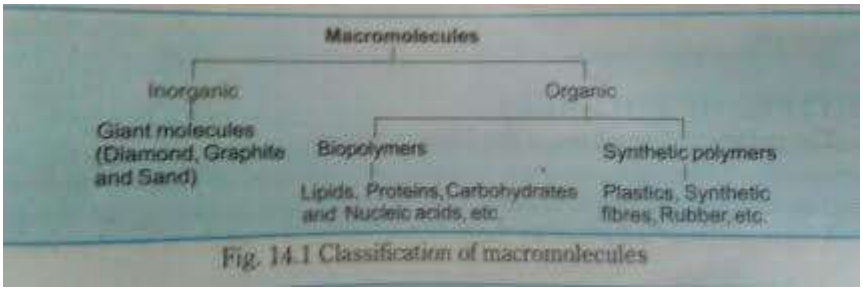


Fig. 14.1 Classification of macromolecules

Q16. What are Carbohydrates? Why are they called so?

The term carbohydrate is applied to a large number of relatively heterogeneous compounds. They are the most abundant bio-molecules on earth. The name carbohydrate (hydrate of carbon) is derived from the fact that the first compound of this group which was studied had an empirical formula $C_x(H_2O)_y$. They are commonly called sugars and are poly-hydroxy compounds of aldehydes and ketones.

Carbohydrates are so called because they are bio-molecules made up of carbon, hydrogen and oxygen.

Q17. What are thermoplastic and thermosetting polymers?

Thermoplastic polymer: A thermoplastic polymer is one which can be softened repeatedly when heated and hardened when cooled with a little change in properties. For example, PVC pipes, plastic toys etc.

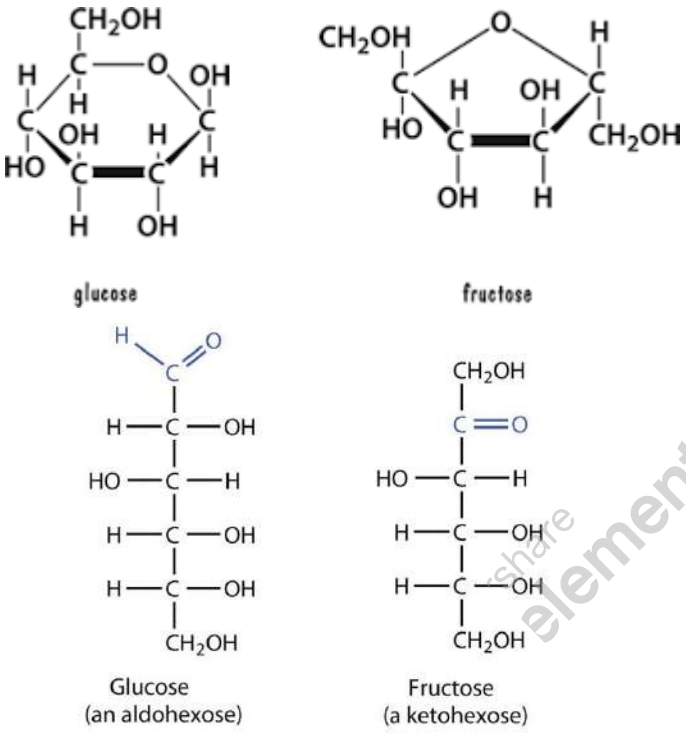
Thermosetting polymer: The polymers which become hard on heating and cannot be softened again are called thermosetting polymers. A thermosetting polymer, on heating, decomposes instead of melting. For example, synthetic varnish, epoxy resins etc.

Q18. What are thermosetting polymers?

Thermosetting polymer: The polymers which become hard on heating and cannot be softened again are called thermosetting polymers. A thermosetting polymer, on heating, decomposes instead of melting. For example, synthetic varnish, epoxy resins etc.

Q19. What is difference between glucose and fructose?

The **difference** in **glucose and fructose** is their chemical **structure**. Both are sugars, but **glucose** in solution forms a 6 atom ring, while **fructose** makes a 5 atom ring.

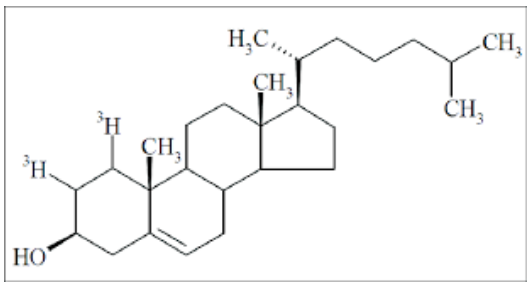


Q20. What is rancidity of fats and oils?

<u>Rancidity:</u>

Fats or oils are liable to spoilage and give off an odour known as rancidity. It is mainly caused by the hydrolytic or oxidative reactions which release foul smelling aldehydes and fatty acids. Oils from sea animals which contain a relatively high proportion of unsaturated acid chains deteriorate rapidly.

Q21. Write structure of cholesterol.



Q22. What are polymers? Give two examples.

Polymers:

The word polymer is derived from Greek word, poly means **many** and mer means **parts**. Polymers or macromolecules are defined as large molecules build up from small repeating units called monomers. The repetition may be linear or branched or interconnected to form three dimentional network.

Examples: Artificial fibres, plastics, synthetic varnish etc.

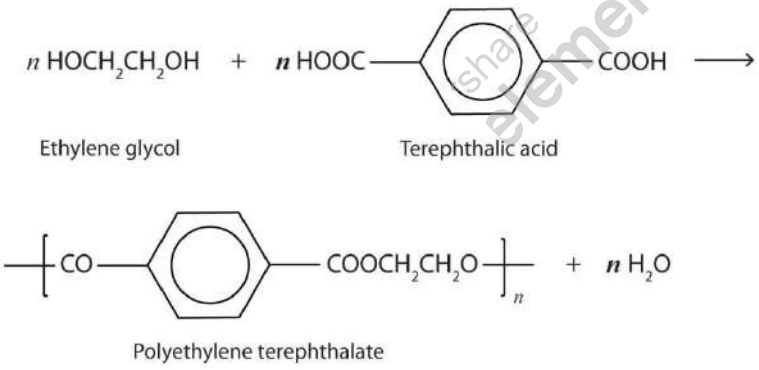
Q23. Define with example condensation polymerization.

Condensation polymerization:

Condensation polymerization is that which results from the mutual reaction of two functional groups. The reaction usually involves the removal of a water molecule or a methanol molecule. It takes place at both ends of the growing chain.

Example:

Dicarboxylic acids or esters combine with Diols to get the desired polymer like Nylon and polyester fibre. Such polymerizations are generally ionic in nature.



Q24. Give four properties of enzymes.

Properties of enzymes:

1. Specificity: Enzymes are specific in their action which means that enzymes can act on only one substrate or group of closely related substrates. For example Hexokinase catalyses the conversion of hexoses like glucose, fructose and manose to their 6-phosphate derivatives but glucokinase is specific for glucose only.

2.Protein Nature: Enzymes with few exceptions are protein in nature. They are produced by living cells but act in vivo as well as in vitro.

3.The direction of enzyme reactions: Most enzymatic reactions are reversible i.e the same enzyme can catalyze reactions in both directions.

4.Isoenzymes: These are the enzymes from the same organisms which catalyze the same reaction but are chemically and physically distinct from each other.

Q25. Write a note on condensation polymerization.

Condensation polymerization:

Condensation polymerization is that which results from the mutual reaction of two functional groups. The reaction usually involves the removal of a water molecule or a methanol molecule. It takes place at both ends of the growing chain.

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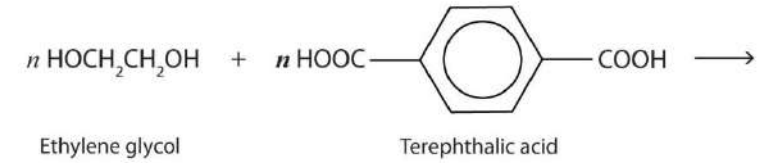

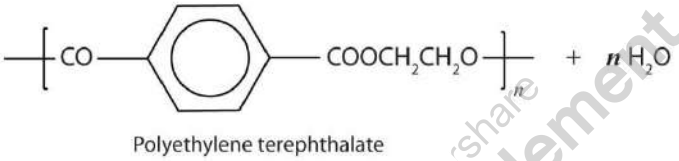

Q26. Define iodine number and acid number.

Iodine number:

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Acid number:

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Q27. What is denaturation of proteins.

Denaturation of Proteins:

The structure of proteins can be disrupted easily by heat, change in PH and under strong oxidizing and reducing conditions. Under such conditions the proteins undergo denaturation. The most familier example of denaturation is the change that takes place in albumin, the principle component of egg white, when it is cooked. In this particular case the change is irreversible.

Q28. Briefly describe the two factors that affect the activity of enzymes.

Factors affecting enzyme activity:

1. Enzyme concentration:

The rate of an enzymatic reaction is directly propotional to the concentration of the substrate. The rate of reaction is also directly propotinal to the square root of the concentration of enzyme. It means that the rate of reaction also increases with the increase in the concentration of enzyme.

2. Temperature:

The enzymatic reaction occurs best at or around 37^{o}C which is the average normal body temperature. The rate of chemical reactions is increased by a rise in temperature but this is true only over a limited range of temperature. Enzymes usually destroy at high temperature. The activity of enzymes is reduced at low temperature. The temperature at which an enzyme reaction occurs the fastest is called its optimum temperature.