

Student Learning Outcomes

After studying this chapter, students will be able to::

- Explain the importance and basics of nutrition and healthy eating.
- Recognize the main biomolecules; carbohydrates, proteins, lipids and nucleic acids. their sources along with the required daily intake for young adults.
- Identify carbohydrates as a source of energy.
- Describe proteins as natural polyamides and that they are formed from amino acid monomers with the general structure.
- Draw the general structure of proteins.
- Explain the sources, use and structure of proteins, lipids and carbohydrates.
- Describe the importance of nucleic acids
- Explain vitamins, their sources and their importance to health
- Identify applications of biochemistry in testing (blood test, pregnancy test, cancer screening, parental genetic testing), genetic engineering, gene therapy and cloning

 Subjective Type Questions

Long Questions prepared in the light of new Examination Techniques
(Knowledge, Understanding, Application, Analytical & Conceptual)

25.1

The Importance of Nutrition

25.2

Carbohydrates

Q.1: What is biochemistry? Describe three main classes of food.

Ans. Biochemistry: Biochemistry is the study of chemical substances which play a vital role in the processes taking place in living organisms.

Main classes of food:

Carbohydrates, lipids or fats and proteins are the three classes of foods which not only provide energy to human beings but are also responsible for their body structures. Lipids provide, on the average, twice as much energy as provided by carbohydrates or proteins.

Proteins are present in all living organisms. They form skin, hair, muscle, blood and almost all the organs of animals. They also play a very important role in all life processes.

Fats and oils come from a variety of natural sources like animals, plants and marine organisms. Animal fats are particularly located in tissues cells. Butter and ghee are a

special type of animal fats which are made from milk.

Q.2: Write a note on the importance of nutrition?

Ans. Nutrition:

Nutrition is the study of the nutrients present in food and how they maintain a healthy body.

Nutrients:

Nutrients are the components of food that are needed on regular basis to maintain health and prevent diseases.

A healthy human body needs the following nutrients.

Carbohydrates:

They are the main source of energy for the human body. They also help body to use protein and fat efficiently.

A healthy adult needs 225 to 325 grams of carbohydrates per day for a standard 2000 calorie diet. However, individuals with higher activity levels may need more carbohydrates to meet their daily needs.

Lipids:

They are also essential nutrients because they act as major energy reserves for our body. They also provide insulation and protection for vital organs of our body. A daily intake of fats for an adult is roughly between 44 to 78 grams.

Proteins:

They also supply energy to our body. They are needed to build new cells and repair the injured ones. An adult should consume 60 grams of proteins per day.

Vitamins and minerals:

They help in growth, reproduction, the operation and maintenance of the body. A balanced diet rich in fruits, vegetables and grains can provide most of the vitamins and minerals needed daily.

Q.3: What are the basics of healthy eating? Also discuss healthy eating?

Ans. Basics of healthy eating:

The following are basics of healthy eating:

- (i) Consume a wide range of foods including fruits, vegetables, whole grains, lean proteins, and healthy fats.
- (ii) They are full of nutrients which are required by our body.
- (iii) Eat less and stay hydrated.
- (iv) Reduce intake of saturated fats, sugar, and sodium.
- (v) Avoid eating processed and poor quality foods.

Healthy Eating:

A healthy and balanced diet performs the following functions:

- (i) It prevents diseases like heart disease, diabetes, some cancers and osteoporosis.
- (ii) Adequate nutrition provides fuel for healthy growth and development, leading to

maintain a healthy weight.

- (iii) A balanced diet can positively impact brain function and supports a strong immune system.

Q.4: What are carbohydrates? Discuss some important carbohydrates in detail.

Ans. Carbohydrates:

Carbohydrates are the most abundant naturally occurring compounds on earth. They contain the elements carbon, hydrogen and oxygen.

Because of the sweet taste of some carbohydrates, they are commonly called "sugars".

Apart from a number of hydroxyl groups, they also contain aldehyde or ketonic functional groups.

Classification of carbohydrates:

Carbohydrates can be classified into three groups on the difference in their properties:

- Monosaccharide
- Polysaccharides
- Oligosaccharides

Important Carbohydrates:

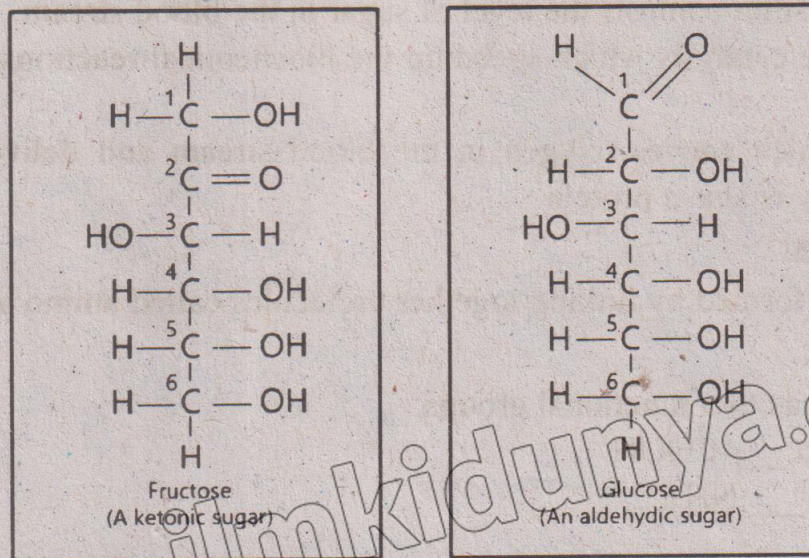
(i) Glucose:

Glucose, the most abundant carbohydrate, is also called grape sugar or dextrose. It is present in fruits such as grapes, in honey and also in the sap of plants. It is the main source of energy for all animals and is thus present in their blood and urine.

(ii) Fructose:

Fructose is another carbohydrate which is present in sweet fruit juices and honey. Both glucose and fructose have the same molecular formula, $C_6H_{12}O_6$.

Open chain structures of glucose and fructose are shown here.



(iii) Sucrose, Lactose and maltose

Sucrose, lactose and maltose are other important carbohydrates. All these

carbohydrates have the same molecular formula $C_{12}H_{22}O_{11}$

Sucrose is present in sugar cane and sugar beets.

Maltose is found in breads and other cereals.

Lactose is present in milk.

(iv) Polymeric carbohydrates:

Starch and cellulose are the two examples of important polymeric carbohydrates.

They have a common formula $(C_6H_{10}O_5)_n$.

Starch is found in foods like potatoes, rice and grains.

Cellulose sources include plant materials like wood, cotton etc.

25.3 Proteins

25.4 Lipids

25.5 Vitamins

Q.5: What are proteins? How are they formed? Identify different functions of proteins in the human body.

Ans. Proteins:

Proteins are very large molecules containing C, H, O, N and sulphur atoms.

Types of proteins:

The human body contains thousands of different type of proteins where they perform a large number of functions.

There are fibrous proteins that are found in muscles, hair, nails, skin and connective tissues.

Besides fibrous proteins hormones and enzymes are also proteins in nature.

Functions of proteins in human body:

- The hormone insulin controls the level of sugar in the blood stream.
- Enzymes are the catalysts which speed up the biochemical reactions taking place in our body.
- Hemoglobin which carries oxygen in the blood stream and delivers to different parts of the body is also a protein.

Formation of proteins:

All proteins are formed by linking together molecules called amino acids.

Amino acids:

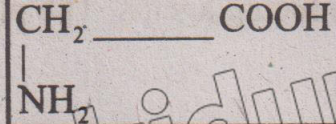
An amino acid has two functional groups,

- a carboxyl group --- COOH
- an amino group --- NH_2 .

Glycine:

The simplest amino acid is called glycine.

The structural formula of glycine is:



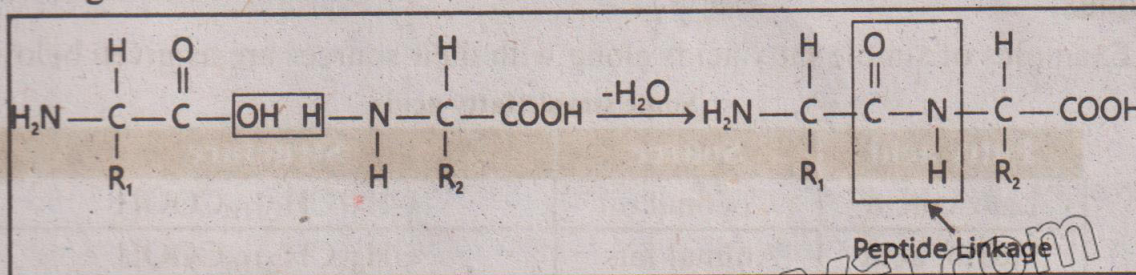
Number of proteins in the human body:

Although the number of proteins present in the human body runs into thousands, they are all formed by linking together only twenty amino acids.

Q.6: Construct peptide linkage and explain the structure of a polypeptide.

Ans. Peptide linkage:

The basic reaction which leads to the formation of long chains of proteins involves the elimination of water from two molecules of same or different amino acids. The molecule which is formed as a result of this reaction is called a peptide and it contains a peptide linkage as shown below.

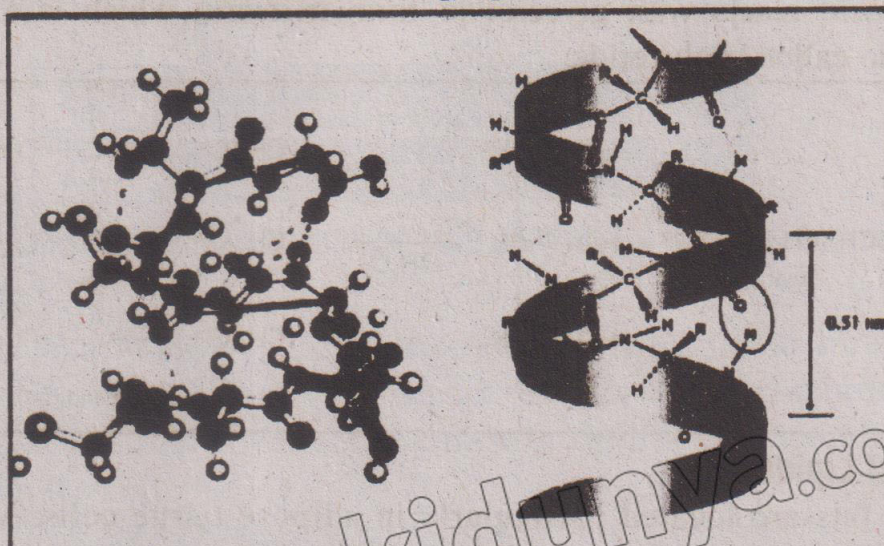


Structure of polypeptide:

This peptide molecule has a carboxyl group and an amino group at its two ends. It is capable of reacting further with two molecules of amino acids to give ultimately a long chain composed of many acid molecules called a polypeptide.

Three Dimensional Structure:

This polypeptide chain then undergoes twists and turns and assumes a three dimensional structure shown in the following figure:



Ball and stick model of polypeptide.

Q.7: Explain denaturation of proteins with examples.

Ans. Denaturation of Proteins:

Complex changes in proteins occur when they are subjected to heat, a change in pH

or an attack by oxidizing and reducing agents. The phenomenon is called denaturation of proteins.

Example:

A familiar example is the frying or boiling of an egg which involves the denaturation of egg albumin (protein), the principal component of egg white.

Q.8: Describe lipids in detail.

Ans. Lipids:

Lipids are the nutrients. Most lipids are composed of simpler substances called fatty acids which serve as their building blocks.

Fatty acids:

Fatty acids are long chain carboxylic acids containing from 12 to 28 carbon atoms.

Examples:

Examples of simple fatty acids along with their sources are as given below.

Some simple fatty acids.

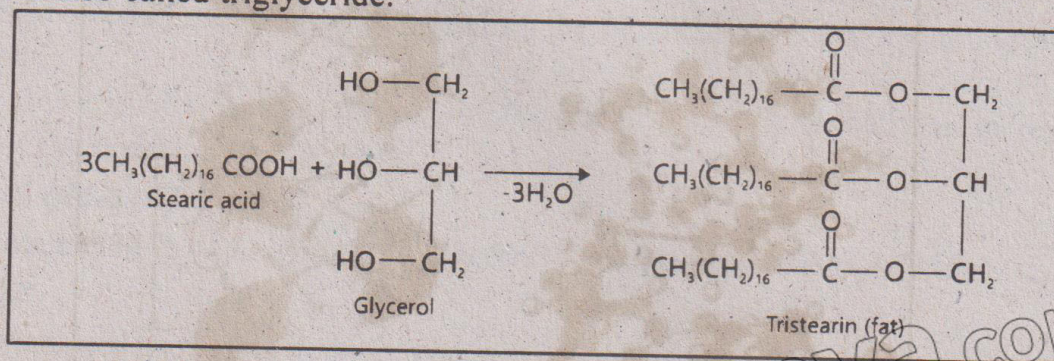
Fatty acid	Source	Structure
Lauric acid	Coconut oil	$\text{CH}_3(\text{CH}_2)_{10}\text{COOH}$
Stearic acid	Animal fats	$\text{CH}_3(\text{CH}_2)_{16}\text{COOH}$
Palmitic acid	Palm oil	$\text{CH}_3(\text{CH}_2)_{14}\text{COOH}$
Oleic acid	Olive oil	$\text{CH}_3(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$

Fats:

Fatty acids react with an alcohol called glycerol to give triester which are called fats.

For example:

Stearic acid reacts with glycerol to form tristearin which is a fat. A triester of glycerol is also called triglyceride.



Importance of Lipids:

Animal fats are located particularly in adipose tissue cells. Vegetable oils are present in seeds and roots of plants. Lipids mainly serve as energy rich source in animals.

Q.9: What are vitamins? Explain the importance of vitamins.

Ans. Vitamins:

These are organic substances which do not directly serve the purpose of providing

energy and building cells of our body like carbohydrates, lipids and proteins.

Biological Function:

Vitamins are necessary to maintain normal health and growth of our body. These compounds are known to function as catalysts for the biological processes going on in our body.

Origin of the name:

Since the first such compound discovered was an amine, so they were named vital amines or vitamins. Over the years, scientists have prepared 13 vitamins needed by the human body.

Importance of vitamins:

Vitamin A is present in milk, egg, fish and liver.

Essential for skin health and vision. Its deficiency causes night blindness and dry skin.

Vitamin D:

Vitamin D may be obtained from butter and fish liver oils. Our skin can also prepare vitamin D directly in the presence of sunlight. This vitamin is related to normal teeth and bone development. Its deficiency causes a disease called rickets.

Vitamin C:

Vitamin C, also called ascorbic acid. Vitamin C is found in citrus fruits, green pepper and tomatoes. Its deficiency in our body causes scurvy.

Vitamins B₁ and B₂:

Vitamins B₁ and B₂ are distributed widely in nature. They are present in red meat, nuts and leafy vegetables. Deficiency of vitamin B₁ leads to fatigue and depression. Deficiency of vitamin B₂ causes inflammation of the lips and dryness and burning of eyes.

25.6

Nucleic Acids

25.7

Applications of Biochemistry

Q.10: What are DNA and RNA? Describe the role played by them in our body.

Ans. DNA and RNA:

Deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) both are nucleic acids. These compounds are responsible for the existence, development and reproduction of all forms of life. Both DNA and RNA are chemically similar compounds which play different roles within the cell.

Molecules of DNA are very large as compared to those of RNA.

A DNA molecule may have molecular mass of up to 660 Da.

A DNA molecule lengths of up to 12 cm when stretched out.

They are mostly found in the nucleus of the cells.

Molecules of RNA are much smaller as compared to those of DNA.

A RNA molecule may have molecular mass 340 Da.

RNA molecules are mostly found outside the cell nucleus.

Function of DNA:

The function of DNA is to store information and pass it on to RNA, at the proper time.

Function of RNA:

The function of RNA, in turn, is to read, decode and use the information to make proteins.

Q.11: Discuss applications of biochemistry in different fields.

Ans. Applications of biochemistry:

Blood Test:

Doctors use the blood tests to identify various health conditions including infections, diabetes, anemia, organ failure and much more. Basic blood chemistry tests check the amount of electrolytes, fats, proteins, glucose and enzymes. These tests give important information about how well a person's kidneys, liver, and other organs are working.

Pregnancy Test:

A pregnancy test checks the urine or blood to see if a woman is pregnant or not. HCG is a hormone produced in the body when a woman gets pregnant. Doctors usually perform two tests to check pregnancy. Quantitative blood tests can measure the exact amount of HCG present in the blood. It can also give information about how far long the pregnancy has progressed.

Blood test for cancer screening:

A specific type of blood test called the Galleri test is performed to detect cancer in early stages. It uses DNA sequencing to find the characteristic patterns which may tell whether a person is suffering from cancer or not.

Parental genetic testing:

Genetic tests are often performed by taking a sample of blood or saliva. Persons get genetic testing to know if they have genetic changes themselves or if they can pass on genetic changes to their children.

Genetic engineering:

Genetic engineering is a method for changing an organism's genome. This can involve changing one single DNA base or can involve deleting or inserting a whole region of DNA. It is done to modify the genes to enhance the capabilities of the organism beyond what is normal. Plants can be made to fight diseases or pollution by changing them through genetic engineering.

Gene Therapy:

In gene therapy doctor fixes a faulty gene or replaces it with a healthy gene in order to cure a disease or enable the body to fight the disease in a better way. This technique

may be helpful in future to fight with a wide range of diseases like diabetes, AIDs, cancer and haemophilia.

Cloning:

Cloning describes the methods used to create an exact genetic replica of a cell, a tissue or the whole organism. The copied material is called a clone and it will have the same genetic characteristics as the original one.

25.1 Quick Check!

1. Which two functions are performed by proteins?

Ans. Functions of Proteins:

- They form skin, hair, muscle, blood and almost all the organs of animals.
- They also play a very important role in all life processes.

2. Is milk a fat, a protein or both?

Ans. Milk is both a fat and a protein.

25.2 Quick Check!

1. What is a balanced diet?

Ans. **Balanced Diet:** A balanced diet is one rich in fruits, vegetables and grains that provides most of the vitamins and minerals needed by the body daily for growth, reproduction and body maintenance.

2. Name any three nutrients.

Ans. • Carbohydrates • Lipids • Proteins

25.3 Quick Check!

1. Name any two sources of starch.

Ans. Two sources of starch: • Potatoes • Rice

2. Are all carbohydrates equally beneficial for our health?

Ans. No, while they are a main energy source, different types serve different roles.

For example:

Complex carbohydrates like starch provide sustained energy, while excess intake of simple sugars (like sucrose) can lead to health issues.

25.4 Quick Check!

1. What are hormones made of?

Ans. Most hormones are made of proteins (specifically chains of amino acids) or steroids (lipids derived from cholesterol).

Examples:

- Insulin is a protein hormone.
- Testosterone is a steroid hormone.

2. What is denaturation?

Ans. **Denaturation of Protein:** Complex changes in proteins occur when they are subjected to heat, a change in pH or an attack by oxidizing and reducing agents. The phenomenon is called denaturation of proteins.

Example:

A familiar example is the frying or boiling of an egg.

25.5 Quick Check!

1. What is the role of lipids in our body?

Ans. Role of Lipids in Our Body:

- They provide, on the average, twice as much energy as provided by carbohydrates or proteins.
- They are key parts of cell membranes.
- They help maintain body temperature and cushion internal organs.
- Some lipids act as hormones.

2. Which is an unsaturated fatty acid?

Ans. Unsaturated Fatty Acid:

An unsaturated fatty acid is a fatty acid that contains one or more double bonds between carbon atoms in its chain. Because of these double bonds, they are typically liquid at room temperature (e.g., vegetable oils like olive oil or sunflower oil).

25.6 Quick Check!

1. Which vitamin is present in lemon?

Ans. Vitamin C (ascorbic acid) is present in lemon.

2. Compare the roles played by vitamins and carbohydrates in our body?

Ans. Roles of vitamins in our body:

They are necessary to maintain normal health and growth of our body.

These compounds are known to function as catalysts for the biological processes going on in body.

Roles of carbohydrates in our body:

- Carbohydrates are the main sources of energy for the human body. Their main role is to provide immediate energy for cellular activities.
- They also help body to use protein and fat efficiently.

25.7 Quick Check!

1. What is the function of RNA?

Ans. The function of RNA is to read, decode and use the information received from DNA to make proteins.

2. What are the basic differences between DNA and RNA?

Ans.

Feature	DNA	RNA
Sugar	Deoxyribose	Ribose
Structure	Double stranded (Helix)	Single-stranded
Bases	Adenine, Guanine, Cytosine, Thymine	Adenine, Guanine, Cytosine, Uracil
Function	To store information and pass it on to RNA, at the proper time.	To read, decode and use the information to make proteins.

INTERESTING INFORMATION

- Acesulfame potassium is the most recently approved sweetener. It is used in soft drinks.
- Glycogen is a carbohydrate that serves the same energy storage function in animals that starch serves in plants.



- Molecular mass of polymers are often expressed in millions or billions of Daltons (Da).
- Lactose is widely used in baking and in commercial milk used for infants unlike sucrose, it is a reducing sugar.
- Everyone, from infants to adult, needs protein. Children need large amounts of proteins for proper growth, and adults need protein to replace what is lost each day by the body's normal biochemical reactions.

INTERESTING INFORMATION

- Soap has been known since at least 600BC when it was prepared by boiling goat fat with extracts of wood ash. The cleansing properties of soap did not become widespread until the 18th century. Chemically, soap is a mixture of sodium salts of the long chain fatty acids produced by hydrolysis of animal fat with alkali.

Objective Type Questions

Additional MCQ's

Multiple Choice Questions prepared in the light of new Examination Techniques
(Knowledge, Understanding, Application, Analytical & Conceptual)

25.1

The Importance of Nutrition

25.2

Carbohydrates

1. Which class of food provides, on average, twice as much energy as carbohydrates and proteins?
(a) Proteins (b) Lipids (c) Minerals (d) Vitamins
2. What are the primary elements that compose carbohydrates?
(a) Hydrogen, Helium and Carbon (b) Carbon, Nitrogen and Oxygen
(c) Carbon, Hydrogen and Oxygen (d) Phosphorus, Carbon and Hydrogen
3. Based on the functional groups, how is fructose classified?
(a) Ketonic sugar (b) Oligosaccharide (c) Polymeric sugar (d) Aldehydic sugar
4. Which of the following is a common source of the carbohydrates known as Lactose?
(a) Cereals (b) Milk (c) Potatoes (d) Sugar cane
5. The recommended daily intake of proteins for a healthy adult is:
(a) 60 grams (b) 225 to 325 grams (c) 44 to 78 grams (d) 100 grams
6. It is the carbohydrate that serves as the energy storage function in animals, similar as the starch works in plants.
(a) Glycogen (b) Cellulose (c) Glucose (d) Maltose
7. According to the "Basics of Healthy Eating" which of the following should be reduced in the diet?
(a) Lean proteins (b) Water intake

- (c) Sodium and sugar (d) Whole grains
8. What is the shared molecular formula for Glucose and Fructose?
 (a) $(C_6H_{10}O_5)_n$ (b) $C_6H_{12}O_6$ (c) $C_{12}H_{22}O_{11}$ (d) CH_4
9. It is a source of cellulose.
 (a) Potato (b) Grain (c) Cotton (d) Honey
10. Which of the following is present in sugar cane and sugar beets?
 (a) Glucose (b) Fructose (c) Maltose (d) Sucrose
11. Which of the following is also known as grape sugar or dextrose?
 (a) Sucrose (b) Maltose (c) Glucose (d) Fructose

25.3 Proteins

25.4 Lipids

25.5 Vitamins

12. Which of the following element is NOT typically a component of the proteins?
 (a) Sulphur (b) Phosphorus (c) Nitrogen (d) Carbon
13. It is a protein that is responsible for controlling the level of sugar in the bloodstream.
 (a) Albumin (b) Insulin (c) Hemoglobin (d) Glycine
14. These are the two functional groups present in an amino acid.
 (a) Hydroxyl and carboxyl (b) Ester and Amine
 (c) Carboxyl and Amino (d) Aldehyde and Amine
15. The formation of a peptide linkage involves the elimination of which molecules?
 (a) Water (b) Hydrogen gas (c) Carbon dioxide (d) Ammonia
16. Which of these factors can cause the denaturation of proteins?
 (a) Heat and change in pH (b) Exposure to light
 (c) Freezing only (d) Distilled water
17. It is the source of Lauric acid.
 (a) Coconut oil (b) Palm oil (c) Olive oil (d) Animal fats
18. What is the chemical name for the 'fat' molecule formed from three stearic acid molecules and glycerol?
 (a) Cholesterol (b) Tristearin (c) Glyceryl palmitate (d) Oleic acid
19. Chemically, soap is defined as:
 (a) Sodium salts of long chain fatty acids
 (b) Pure glycerol
 (c) A type of fibrous protein (d) A mixture of vitamins
20. Deficiency of which vitamin leads to the disease 'Scurvy'?
 (a) Vitamin D (b) Vitamin B₁ (c) Vitamin C (d) Vitamin A
21. Which vitamin can the body prepare directly in the presence of sunlight?
 (a) Vitamin A (b) Vitamin B₂ (c) Vitamin C (d) Vitamin D

22. The source of stearic acid is:
 (a) Coconut oil (b) Animal fats (c) Palm oil (d) Olive oil
23. From olive oil, we get fatty acid:
 (a) Lauric acid (b) Palmitic acid (c) Oleic acid (d) Stearic acid
24. Which of the following is the source of palmitic acid?
 (a) Palm oil (b) Olive oil (c) Coconut oil (d) Animal fats
25. Deficiency of which vitamin causes night blindness and dry skin?
 (a) Vitamin A (b) Vitamin C (c) Vitamin B₁ (d) Vitamin B₂
26. Fatigue and depression are due to the deficiency of vitamin:
 (a) A (b) B₁ (c) D (d) B₂

25.6

Nucleic Acids

25.7

Applications of Biochemistry

27. Which of the following molecules are primarily responsible for the storage of genetic information?
 (a) Carbohydrates (b) Proteins (c) DNA (d) Lipids
28. The approximate molecular mass of an RNA molecule is:
 (a) 12 cm (b) 340 Da (c) 660 Da (d) 10 cm
29. Where is RNA mostly found within a cell?
 (a) Outside the cell nucleus (b) Inside the nucleus
 (c) In the mitochondria only (d) Attached to cell wall
30. Which hormone is detected in the body to confirm pregnancy through a urine or blood test?
 (a) Adrenalin (b) Insulin (c) Estrogen (d) HCG
31. The Galleri test is a specific type of blood test used for:
 (a) Anemia detection (b) Cancer screening
 (c) Pregnancy (d) Organ failure diagnosis
32. Which medical technique involves replacing a 'faulty gene' with a healthy one?
 (a) Parental Genetic testing (b) Gene Therapy
 (c) DNA sequencing (d) Blood chemistry test
33. Carbohydrates, proteins and fats together with water constitute about _____ of the most living organisms.
 (a) 69 % (b) 79 % (c) 89 % (d) 99 %
34. What is the specific role of RNA in protein synthesis?
 (a) To store information forever (b) To identify infections in blood
 (c) To acts as genetic replica of the cell (d) To read, decode and use information
35. The molecules mass of DNA molecule is up to:
 (a) 460 Da (b) 560 Da (c) 660 Da (d) 760 Da
36. Molecules of DNA are mostly found in the _____ of the cells.
 (a) Nucleus (b) cytoplasm (c) Lysosome (d) Cell membrane

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|---------|---------|---------|---------|---------|---------|---------|
| 1. (b) | 2. (c) | 3. (a) | 4. (b) | 5. (a) | 6. (a) | 7. (c) |
| 8. (b) | 9. (c) | 10. (d) | 11. (c) | 12. (b) | 13. (b) | 14. (c) |
| 15. (a) | 16. (a) | 17. (a) | 18. (b) | 19. (a) | 20. (c) | 21. (d) |
| 22. (b) | 23. (c) | 24. (a) | 25. (a) | 26. (b) | 27. (c) | 28. (b) |
| 29. (a) | 30. (d) | 31. (b) | 32. (b) | 33. (d) | 34. (d) | 35. (c) |
| 36. (a) | | | | | | |

Additional Short Questions

Short Answer Questions prepared in the light of new Examination Techniques
(Knowledge, Understanding, Application, Analytical & Conceptual)

25.1

The Importance of Nutrition

25.2

Carbohydrates

1. Define Biochemistry.

Ans. Biochemistry:

Biochemistry is the study of chemical substances which play a vital role in the processes taking place in living organisms.

2. What are three classes of foods? Discuss their importance.

Ans. Classes of foods:

Carbohydrates, lipids, fats and proteins are the three classes of foods.

Importance:

- They provide energy to human beings.
- They are also responsible for their body structures.

3. Which nutrient provides the most energy?

Ans. Lipids provide, on the average, twice as much energy as provided by carbohydrates or proteins.

4. From where fats and oils come?

Ans. Fats and oils come from a variety of natural sources like animals, plants and marine organisms.

5. Where are animal fats located?

Ans. Animal fats are particularly located in tissues cell.

6. Name the type of animal fats which are made from milk.

Ans. Butter and ghee are a special type of animal fats which are made from milk.

7. What is the general chemical composition of carbohydrates.

Ans. They contain the elements carbon, hydrogen and oxygen. Most contain aldehyde or ketonic functional groups.

8. Define nutrition.

Ans. Nutrition:

Nutrition is the study of the nutrients present in food and how they maintain a

healthy body.

9. What are nutrients?

Ans. Nutrients:

Nutrients are the components of food that are needed on regular basis to maintain health and prevent diseases.

10. What nutrients does a healthy human body need?

Ans. A healthy human body needs the following nutrients:

- Carbohydrates • Lipids • Proteins • Vitamins and minerals

11. How are carbohydrates classified?

Ans. Carbohydrates are classified into three groups:

- Monosaccharides • Oligosaccharides • Polysaccharides

12. How much carbohydrates does a healthy adult need?

Ans. A healthy adult needs 225 to 325 grams of carbohydrates per day for a standard 2000 calorie diet.

13. What is a daily intake of fats for an adult?

Ans. A daily intake of fats for an adult is roughly between 44 to 78 grams.

14. How much proteins does an adult consume?

Ans. An adult should consume 60 grams of proteins per day.

15. Define balanced diet.

Ans. Balanced diet:

A balanced diet is one rich in fruits, vegetables and grains that provides most of the vitamins and minerals needed by the body daily for growth, reproduction and body maintenance.

16. What is the molecular formula of sucrose, lactose and maltose?

Ans. The molecular formula of sucrose, lactose and maltose is $C_{12}H_{22}O_{11}$.

17. Name the carbohydrates present in sugar cane, sugar beets, breads, cereals and milk.

- Ans. • Sucrose is present in sugar cane and sugar beets.
• Maltose is found in breads and other cereals.
• Lactose is present in milk.

18. What is the molecular formula of starch and cellulose?

Ans. The molecular formula of starch and cellulose is $(C_6H_{10}O_5)_n$.

19. Name the sources of starch.

Ans. Sources of starch:

Starch is found in foods like potatoes, rice and grains.

20. What is Glycogen?

Ans. Glycogen:

Glycogen is a carbohydrate that serves the same energy storage function in animals that starch serves in plants.

25.3

Proteins

25.4

Lipids

25.5

Vitamins

21. What elements are proteins composed of?

Ans. Proteins are very large molecules containing carbon (C), Hydrogen (H), Oxygen (O), Nitrogen (N) and Sulphur (S).

22. What is the function of the hormone insulin?

Ans. Insuline is a protien that controls the level of sugar in the blood stream.

23. Define enzymes

Ans. Enzymes:

Enzymes are the catalysts which speed up in the biochemical reactions taking place in our body.

23. What are buliding blocks of proteins?

Ans. All proteins are formed by linking together molecules called amino acids.

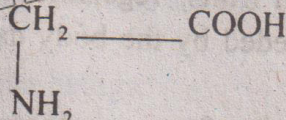
24. What are the two functional group of an amino acid?

Ans. An amino acid has two functional groups:

- A carboxyl group —COOH
- An amino group —NH_2

25. Name the simplest amino acid with its structural formula.

Ans. The simplest amino acid is called glycine. Its structural formula is:



26. What are the building blocks of lipids?

Ans. Most lipids are composed of simpler substances called fatty acids which serve as their building blocks.

27. Define fatty acids. Give examples.

Ans. Fatty Acids:

Fatty acids are long chain carboxylic acids containing from 12 to 28 carbon atoms.

Examples:

Lauric acid, stearic acid, palmitic acid, oleic acid etc.

28. Define fats.

Ans. Fats:

Fatty acids react with an alcohol called glycerol to give tristearin which are called fats.

Example:

Stearic acid reacts with glycerol to form tristearin which is a fat.

29. What is triglyceride?

Ans. A triester of glycerol is also called triglyceride.

30. Tell the role of lipids in our body.

Ans. Lipids serve as an energy rich source and are stored in adipose tissue cells.

31. Where are animal fats located in the body?

Ans. Animal fats are located particularly in adipose tissue cells.

32. Where are vegetable oil present in plants?

Ans. Vegetable oils are present in seeds and roots of plants.

33. What is the chemical composition of soap?

Ans. Chemically, soap is a mixture of sodium salts of the long chain fatty acids produced by hydrolysis of animal fat with alkali.

34. What are vitamins?

Ans. Vitamins:

These are organic substances which do not directly serve the purpose of providing energy and building cells of our body like carbohydrates, lipids and proteins.

35. Mention biological function of vitamins.

Ans. Biological function of vitamins:

Vitamins are necessary to maintain normal health and growth of our body. These compounds are known to function as catalysts for the biological processes going on in our body.

36. Which vitamin is called ascorbic acid?

Ans. Vitamin C is also called ascorbic acid.

37. Which vitamin can our skin prepare?

Ans. Our skin can prepare vitamin D directly in the presence of sunlight.

38. What are two types of nucleic acids?

Ans. Two types of nucleic acids are:

- Deoxyribonucleic acid (DNA)
- Ribonucleic acid (RNA)

39. What are nucleic acids responsible for?

Ans. These compounds are responsible for the existence, development and reproduction of all forms of life.

40. Compare molecular mass of DNA and RNA molecules.

Ans. A DNA molecule may have molecular mass of up to 660 Da.

A RNA molecule may have molecular mass 340 Da.

41. What is function of DNA?

Ans. Function of DNA:

The function of DNA is to store information and pass it on to RNA, at the proper time.

42. Explain the function of RNA?

Ans. Function of RNA:

The function of RNA is to read, decode and use the information received from DNA to make proteins.

43. For what purposes do doctors use the blood tests?

Ans. Doctors use the blood tests to identify various health conditions including

infections, diabetes, anemia, organ failure and much more.

44. What do the basic blood chemistry tests check?

Ans. The basic blood chemistry tests check the amount of electrolytes, fats, proteins, glucose and enzymes.

45. What does a pregnancy test check for?

Ans. It checks for HCG (Human chorionic Gonadotropin), a hormone produced in the body when a woman becomes pregnant.

46. What is the Galleri test?

Ans. Galleri Test:

It is a specific type of blood test which is performed to detect cancer in early stages.

47. What is genetic engineering?

Ans. Genetic Engineering:

It is a method for changing an organism's genome. It can involve changing one single DNA base or can involve deleting or inserting a whole region of DNA.

48. How may gene therapy be helpful in future?

Ans. Gene therapy may be helpful in future to fight with a wide range of diseases like diabetes, AIDS, Cancer and hemophilia.

49. Define Cloning.

Ans. Cloning:

Cloning describes the methods used to create an exact genetic replica of a cell, a tissue or the whole organism.

50. What is clone?

Ans. Clone:

Clone is an exact genetic replica of a cell, a tissue or the whole organism. It has the same genetic characteristics as the original one.

Exercise Questions (Solved)

A. Multiple Choice Questions

☆ **Choose and tick the correct answer from the given choices.**

1. Functional groups present in fructose are:

- (a) Hydroxyl and aldehyde
- (b) Hydroxyl and Ketone
- (c) Hydroxyl and ester
- (d) Hydroxyl and amide

2. Which functional group is present in a fat?

- (a) Carboxyl group
- (b) Ester group
- (c) Carbonyl group
- (d) Hydroxyl group

3. Which function is not performed by proteins in our body?

- (a) They serve as chemical messengers.
- (b) They serve as storage of energy-rich fuel.
- (c) They store genetic information.
- (d) They serve as catalysts for biochemical reactions.

4. Which functional groups react to produce a peptide linkage in proteins?

- (a) Carboxyl group and hydroxyl group
- (b) Carboxyl group and amino group

- (c) Hydroxyl group and amino group (d) Ester group and amino group
5. The test performed to detect cancer in early stages is:
(a) Genetic test (b) Urine test (c) Galleri test (d) Electrolyte test
6. Fatigue and depression are caused by deficiency of:
(a) Vitamin A (b) Vitamin C (c) Vitamin D (d) Vitamin B₁

Answers

1. (b) 2. (b) 3. (c) 4. (b) 5. (c) 6. (c)

B. Short Answer Questions

25.1 What is the difference between glucose and fructose?

Ans. Glucose and fructose both are carbohydrates. They both have the same molecular formula, $C_6H_{12}O_6$, but Glucose is an aldehydic sugar (containing an aldehyde group), while fructose is a ketonic sugar (containing a ketone group).

25.2 Give two examples of denaturation of proteins.

Ans. Examples of denaturation of proteins:

(i) **Boiling an egg:**

The liquid albumin becomes a solid white mass.

(ii) **Curdling of milk:**

Adding acid (like lemon juice) causes milk proteins to clump together.

25.3 What are the sources of vitamin D?

Ans. Sources of Vitamin D:

Vitamin D may be obtained from butter and fish liver oils. Our skin can also prepare vitamin D directly in the presence of sunlight.

25.4 What is the role of enzymes in our body?

Ans. Role of Enzymes in our body:

Enzymes are protein in nature. They are the catalysts which speed up the biochemical reactions taking place in our body such as digestion and metabolism, without being consumed in the process.

25.5 Which commercial products are obtained from oils and fats?

Ans. Soap (via saponification), margarine, paints, and cosmetics are the commercial products which are obtained from oils and fats.

25.6 Which vitamin helps in blood clotting?

Ans. Vitamin K helps in blood clotting.

C. Constructed Response Questions

25.1 What is the function of DNA?

Ans. Functions of DNA:

Deoxyribonucleic Acid is a nucleic acid carrying the genetic instructions. It is responsible for the existence, development and reproduction of all forms of life.

Function of DNA:

The function of DNA is to store information and pass it on to RNA, at the proper time.

25.2 Write down three important functions played by proteins in our body.

Ans. Functions of proteins in our body:

1. Structural support:

Protein builds and repairs muscles, skin, bones, tendons and ligaments after injuries, collagen provides elasticity and strength to skin and connective tissue.

2. Metabolic Catalysis:

Enzymes are specialized proteins that speed up essential chemical reactions, such as digestion (e.g., amylase in saliva breaking down carbohydrates) or energy production.

3. Transport:

Hemoglobin is a protein which carries oxygen in blood stream and delivers to different parts of the body.

25.3 Fatty acids serve as building blocks of lipids just like amino acids are for proteins. Comment on this statement.

Ans. This statement is correct. Just as proteins are polymers made of amino acid monomers linked by peptide bonds, many lipids (specifically triglycerides) are formed by the combination of glycerol and fatty acids. Proteins and lipids are the fundamental building blocks of their respective biomolecules.

25.4 Write down about the sources of vitamin C. Which diseases are caused by its deficiency?

Ans. Sources of Vitamin C:

Vitamin C, also called ascorbic acid is found in citrus fruits, green pepper and tomatoes.

Deficiency Disease:

Deficiency of vitamin C in our body causes scurvy (bleeding gums).

25.5 Write down the names of two polymeric carbohydrates.

Ans. Two examples of polymeric carbohydrates are:

- Starch
- Cellulose

D. Descriptive Questions

25.1 What are the sources of fructose, maltose and lactose?

Ans. Sources of Fructose:

Fructose is a carbohydrate which is present in sweet fruit juices and honey.

Sources of Maltose:

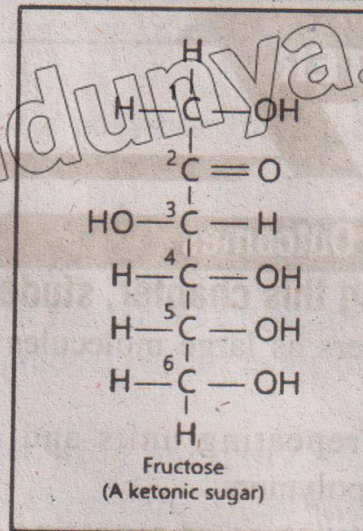
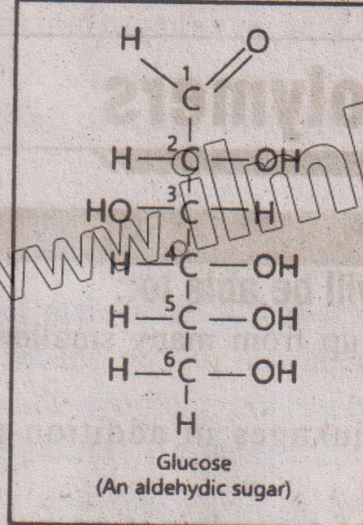
Maltose is a carbohydrate which is found in breads and cereals.

Sources of Lactose:

Lactose is a carbohydrate which is present in milk.

25.2 Draw open chain structures of glucose and fructose.

Ans. Open structures of glucose and fructose:



25.3 Construct peptide linkage and explain the structure of a polypeptide.

Ans. For Answer See Q 6

25.4 What are DNA and RNA? Describe the role played by them in our body.

Ans. For Answer See Q 10

25.5 Compare the roles played by carbohydrates, proteins and lipids in our body.

Ans. Comparison of roles played by carbohydrates, proteins and lipids in our body:

	Carbohydrates	Proteins	Lipids
Unit Basis	Monosaccharides (e.g: Glucose)	Amino Acids	Fatty acids and Glycerol
Energy yield	4 k cal / g	4 k cal / g	6 k cal / g
Storage form	Glycogen	Not stored	Adipose Tissue
Primary Role	Provides immediate energy for the body and brain.	Building blocks for tissues, muscles and enzymes.	Long-term energy reserve and insulation
Specific functions	Spare protein from being broken down for energy, support digestive health via fiber and assist in structural and functional roles like cell membrane formation.	catalyzes chemical reactions; carries oxygen (homoglobin); provides immunity (antibodies).	Protect vital organs; help in the absorption of fat soluble vitamins (A, D, E, K); forms cell membrane.