

CHAPTER 13

BIOCHEMISTRY

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INTRODUCTION**SHORT QUESTIONS**

Q.1 What is biochemistry? (Knowledge Base) (BWP 2017)

Ans: **BIOCHEMISTRY**

Definition:

"The branch of chemistry that deals with the study of structure, composition, and chemical reactions of substances found in living organisms is called biochemistry."

Scope:

It deals with the naturally occurring macromolecules such as carbohydrates, proteins, lipids, nucleic acids and vitamins.

Importance:

Biochemistry is a field that has a great importance today in various fields like:

- Medicine
- Agriculture
- Pharmaceuticals

Q.2 How are macromolecules synthesized? Why are they important? (Knowledge Base)

Ans: **SYNTHESIS OF MACROMOLECULES**

These macromolecules are synthesized by living organisms from simple molecules present in the environment.

Examples:

- Carbohydrates
- Lipids
- Proteins
- Nucleic acids

Importance:

- Macromolecules are essential for us as they are reservoirs of energy.
- They not only provide us energy but also form new bones and muscular bones.
- They protect us against the diseases.
- They are responsible for transmitting genetic information from generation to generation.

Q.3 What are functions of macromolecules? (Knowledge Base)

Ans: **FUNCTIONS OF MACROMOLECULES**

Some important functions of macromolecules are as follows:

(i) Carbohydrates:

Carbohydrates we eat, provide us energy.

(ii) Lipids:

Lipids are major source of energy. They are stored in the body to provide emergency energy supplies. They help us to work during tough times.

(iii) Proteins:

Proteins not only provide us energy, they help us stay strong by forming new bones and muscular tissues. Moreover, proteins protect us against the diseases.

(iv) Nucleic Acids:

Nucleic acids are responsible for transmitting genetic information from generation to generation.

MULTIPLE CHOICE QUESTIONS

1. It is responsible for the transmission of genetic information: (K.B)
 (A) Nucleic acid (B) Acetic acid
 (C) Carbonic acid (D) Oxalic acid
2. Carbohydrates are synthesized by plants through: (K.B)
 (A) Photosynthesis (B) Respiration
 (C) Oxidation (D) Breathing
3. Carbohydrates are molecules: (K.B)
 (A) Macromolecules (B) Micromolecules
 (C) Homomolecules (D) Monomolecule
4. The major source of energy are: (K.B)
 (A) Proteins (B) Carbohydrates
 (C) Nucleic acids (D) Lipids

13.1 CARBOHYDRATES**LONG QUESTIONS**

- Q.1 What are carbohydrates? How monosaccharides are prepared? Give their characteristics. (Knowledge+Understanding Base) (Ex-Q.1)

Ans:

CARBOHYDRATES**Definition:**

"Carbohydrates are macromolecules defined as polyhydroxy aldehydes or ketones".

General Formula:

They have general formula $C_n(H_2O)_n$.

Classification of Carbohydrates:

Carbohydrates are classified as:

- Monosaccharides
- Oligosaccharides
- Polysaccharides

SYNTHESIS OF CARBOHYDRATES/MONOSACCHARIDES

Carbohydrates are synthesized by plants through photosynthesis process from carbon dioxide and water in the presence of sunlight and green pigment chlorophyll.



The glucose is further polymerized to form starch and cellulose.

MONOSACCHARIDES

"Monosaccharides are the simplest sugars which cannot be hydrolyzed. They consist of 3 to 9 carbon atoms".

Classification of Monosaccharides (On the Basis of No. of C-atoms)

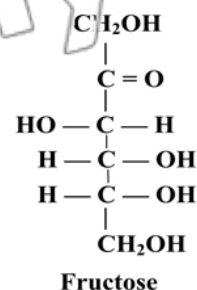
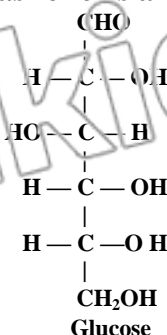
They are classified according to the number of carbon atoms in their molecules as:

- Trioses (Monosaccharides made up of 3 carbon atoms)
- Tetroses (Monosaccharides made up of 4 carbon atoms)
- Pentoses (Monosaccharides made up of 5 carbon atoms)
- Hexoses etc. (Monosaccharides made up of 6 carbon atoms)

Examples:

The important monosaccharides are **hexoses** like glucose and fructose.

Glucose is a **pentahydroxy aldehyde** while **fructose** is **pentahydroxy ketone** having the open chain structures as follows and general formula $C_6H_{12}O_6$

**Characteristics:**

The characteristics of monosaccharides are as follows:

- Monosaccharides are **white crystalline solids**.
- They are soluble in water and have **sweet taste**.
- They cannot be hydrolyzed.
- They are **reducing in nature**, therefore, these are called **reducing sugars**.

Q.2 Explain oligosaccharides in detail. (Knowledge+Understanding Base)

(SWL 2016 G-I)(Ex-Q.2)

Ans:

OLIGOSACCHARIDES**Definition:**

"The carbohydrates which give 2 to 9 units of monosaccharide on hydrolysis are called oligosaccharides".

Classification:

Depending upon the number of units they produce on hydrolysis, they are classified as:

- Disaccharides
- Trisaccharides
- Tetrasaccharides etc.

Examples:

The most important oligosaccharides are disaccharides like sucrose. Another example of disaccharide is lactose.

Hydrolysis of Sucrose:

On hydrolysis, sucrose produces one unit of glucose and one unit of fructose.

**Properties of Oligosaccharides:**

The characteristics of oligosaccharides are as follows:

- These carbohydrates are **white crystalline solids**.
- They are easily **soluble in water**.
- They are also **sweet in taste**.
- They may be **reducing or non-reducing**.

Q.3 What are polysaccharides? Give their properties. (Knowledge + Understanding Base)

(GRW 2015)(Ex-Q.3)

Ans:

POLYSACCHARIDES

Definition:

"Polysaccharides are macromolecular carbohydrates consisting of hundreds to thousands of monosaccharides".

Examples:

- Starch
- Cellulose
- Glycogen

PROPERTIES OF POLYSACCHARIDES

The properties of polysaccharides are as follows:

- They are **amorphous solids**.
- They are **tasteless and insoluble in water**.
- They are **non-reducing in nature**.

Q.4 Explain the sources and uses of carbohydrates. (Knowledge Base)

(GRW 2015, LHR 2015, 17)

Ans:

SOURCES AND USES OF CARBOHYDRATES

Carbohydrates range from simple to complex ones. They have varied sources and uses.

Sources:

(i) Simple Sugars:

- **Glucose, fructose and galactose** are found in fruits, vegetables, honey and cereals.

(ii) Disaccharides:

- **Sucrose** is found in sugar beet, sugar cane, and fruits.
- **Lactose** consisting of **glucose and galactose** is the main sugar in milk and dairy products.
- **Maltose**, a disaccharide of **two glucose molecules**, is found in cereals.

(iii) Polysaccharides:

- **Starch** is found in cereal crops; wheat, barley, maize, rice, etc.
- **Cotton** is pure cellulose.

USE OF CARBOHYDRATES

Source of energy

(MTN 2016 G-II)

(i) Glucose is the only form of carbohydrates that is used directly by muscles for energy.

(ii) It is important to note that brain needs glucose as an energy source, because it cannot use fat for this purpose.

Other than Energy:

Besides, the energy providing materials, carbohydrates also provide the following usage in our body.

- (i) They regulate the amount of sugar level in our body. Low sugar level in body results in **hypoglycemia**.
- (ii) They provide **essential nutrients** for bacteria in intestinal tract that helps in digestion.
- (iii) Dietary fiber helps to keep the **bowel functioning** properly.
- (iv) Fiber helps in lowering of cholesterol level and **regulates blood pressure**.
- (v) Carbohydrates protect our muscles from cramping.

Q.5 What is dextrose? Describe its composition and uses. (Knowledge Base)

(Science, Technology and Society Pg. # 104)

Ans:

DEXTROSE

Definition:

“Dextrose is crystallized glucose (natural sugar found in starchy food.). It provides simple carbohydrates to the body that can be easily broken down and processed.”

Dextrose Solution:

Dextrose solution is available in several concentrations. For example, five percent dextrose solution (D5W) consists of **5 grams of dextrose in each 100 ml** of solution. It is used to provide fluid replacement and energy to the body.

Importance of Dextrose:

- **Source of Energy:**

It contains approximately **170 calories of energy**, but does not contain electrolytes. Therefore, electrolytes are added according to requirements in solution.

- **Use in Drips:**

It is commonly called **drip system**. It is the fastest way to deliver fluids, electrolytes and medications throughout the body. It prevents air entering into blood stream.

Nature of Therapy:

Dextrose is given to patients directly into vein called **intravenous (IV) therapy**.

13.1 CARBOHYDRATES

SHORT QUESTIONS

Q. 1 Give the characteristics of oligosaccharides. (Knowledge Base)

(FSD 2016 G-I)

Ans:

CHARACTERISTICS OF OLIGOSACCHARIDES

The characteristics of oligosaccharides are as follows:

- These carbohydrates are white, crystalline solids easily soluble in water.
- They are also sweet in taste.
- They may be reducing or non-reducing.

Q. 2 Describe the sources of sucrose and starch. (Knowledge Base)

(DGK 2016 G-I)

Ans:

SOURCES OF SUCROSE AND STARCH

The sources of sucrose and starch are as follows:

Sucrose:

Sucrose is found in:

- Sugar beet
- Sugar cane
- Fruits

Starch:

Starch is found in:

- Cereal crops
- Wheat
- Barley
- Maize
- Rice etc.

Q. 3 What are monosaccharides? (Knowledge Base)

(BWP 2016 G-II)

Ans: **MONOSACCHARIDES**

Definition:

"Monosaccharides are the simplest sugars which cannot be hydrolyzed. They consist of 3 to 9 carbon atoms".

Examples:

- Glucose
- Fructose etc.

Classification:

They are classified according to the number of carbon atoms in their molecules as:

- Trioses
- Tetroses
- Pentoses
- Hexoses etc.

13.1 CARBOHYDRATES

MULTIPLE CHOICE QUESTIONS

- The glucose is further polymerized to form (K.B)**
(A) Starch and cellulose (B) Starch and protein
(C) Lipids and carbohydrates (D) Carbohydrates
- Carbohydrates are: (K.B)**
(A) Crystalline solid (B) Amorphous solid
(C) Semisolid (D) Both A and B
- Monosaccharides consist of number of carbon atoms: (K.B)**
(A) 3 to 9 (B) 3 to 6
(C) 4 to 8 (D) 6 to 8
- Monosaccharides cannot be: (K.B)**
(A) Dehydrolyzed (B) Evaporated
(C) Condensed (D) Hydrolyzed
- Maltose is a disaccharide of two molecules of: (K.B)**
(A) Glucose (B) Starch
(C) Fructose (D) Sucrose
- Nature of polysaccharides is: (K.B)**
(A) Non-reducing (B) Reducing
(C) Oxidizing (D) Non oxidizing
- It is pure cellulose: (K.B)**
(A) Nylon (B) Silk
(C) Ebonite (D) Cotton
- Carbohydrates is directly used by: (K.B)**
(A) Bones (B) Muscles
(C) Cartilages (D) Heart
- Energy provided by carbohydrates is: (K.B)**
(A) 17 kJ/g (B) 18 kJ/g
(C) 34 kJ/g (D) 436 kJ/g

10. Dextrose solution contains how many calories of energy? (K.B)
 (A) 170 (B) 180
 (C) 350 (D) 10
11. Molecular formula of fructose is: (K.B) (LHR 2014, DGK 2017, MTN 2017, PVP 2017)
 (A) $C_{12}H_{22}O_{11}$ (B) C_2H_5OH
 (C) $C_6H_{12}O_6$ (D) C_6H_6
12. Glucose and fructose combine to form: (K.B) (GRW 2014)
 (A) Starch (B) Cellulose
 (C) Sucrose (D) Glycogen
13. General formula of carbohydrates is: (K.B) (SWL 2016 G-I)
 (A) C_nH_{2n} (B) $C_n(H_2O)_n$
 (C) $C_n(OH)_n$ (D) None of these
14. Which one of the following is crystalline solid? (K.B) (DGK 2016 G-I)
 (A) Glucose (B) Starch
 (C) Cellulose (D) Glycogen
15. Polyhydroxy ketone is called: (K.B) (FSD 2017 G-I)
 (A) Glucose (B) Starch
 (C) Sucrose (D) Fructose

13.1 TEST YOURSELF

- (i) Define carbohydrates. (Knowledge Base) (LHR 2013, FSD 2016 G-II)

Ans: CARBOHYDRATES

Definition:

“Carbohydrates are macromolecules defined as polyhydroxy aldehydes or ketones”.

General Formula:

They have general formula $C_n(H_2O)_n$.

Examples:

- Glucose
- Fructose
- Starch etc.

- (ii) Give the characteristics of disaccharides. (Knowledge Base)

Ans: CHARACTERISTICS OF DISACCHARIDES

The characteristics of disaccharides are as follows:

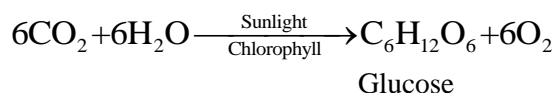
- On hydrolysis disaccharides give 2 to 9 units of monosaccharides.
- Disaccharides are easily soluble in water.
- They are white crystalline solids.
- They have sweet taste.
- They may be reducing (lactose, maltose) or non-reducing sugars (sucrose)

- (iii) Give the balanced equation for the formation of glucose. (Knowledge Base) (LHR 2013, GRW 2013)

Ans: FORMATION OF GLUCOSE

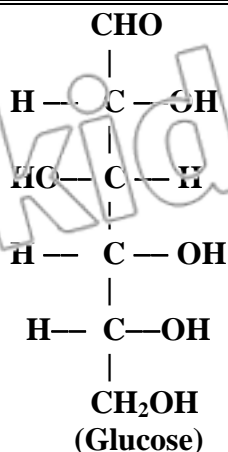
Glucose is formed from carbon dioxide and water in the presence of sunlight and green pigment chlorophyll.

Reaction:



(iv) Draw the structure of glucose. (Knowledge Base)

(GRW 2014, 2015)

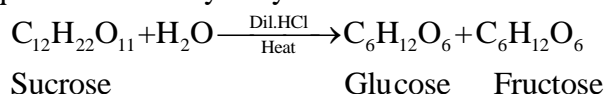
Ans: STRUCTURE OF GLUCOSE

(v) Give the balanced equation for the hydrolysis of sucrose.

(Knowledge+Understanding Base)

Ans: HYDROLYSIS OF SUCROSE

The balanced equation for the hydrolysis of sucrose is as follows:



13.2 PROTEINS

LONG QUESTIONS

Q.1 Define proteins and explain their properties. (Knowledge+Understanding Base)

Ans: PROTEINSDefinition:*"Proteins are highly complicated nitrogenous compounds made up of amino acids".*Example:

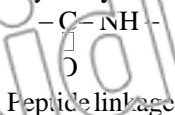
- Albumen
- Gelatin

Composition:

Proteins consist of **carbon, hydrogen, oxygen, nitrogen and sulphur**. They are **polymers of amino acids**. Amino acids are linked with each other through **peptide linkage**. Protein has more than **10,000 amino acids**.

Hydrolysis of Proteins:

All proteins yield amino acids upon hydrolysis.

Occurrence of Proteins in Living Organisms:

Occurrence of proteins in living organisms is as follows:

- (i) Proteins are **present** in all **living organisms**.
- (ii) They make up bulk of the non-bony structure of the animal bodies.
- (iii) They are major component of all cells and tissues of animals.
- (iv) **About 50% of the dry weight of cell is made up of proteins.**
- (v) They are found in muscles, skin, hair, nails, wool, feathers, etc.
- (vi) Proteins make up more than 50% of the dry weight of animals.

Q.2 What are amino acids? Explain, amino acids are the building blocks of proteins.

(Knowledge+Understanding Base)

(GRW 2016, MTN 2017)

Ans:

AMINO ACIDS

Definition:

"Amino acids are organic compounds consisting of both amino and carboxyl groups".

General formula:

They have the general formula

(side chain) $R-CH-COOH$ (carboxylic group)

|

NH_2 (amino group)

Side chain 'R' is different for different amino acids.

Types of Amino Acids:

There are 20 amino acids. These amino acids are classified into major classes on the basis of their synthesis.

(i) Non-Essential Amino Acids:

"Ten out of twenty amino acids can be synthesized by human body. These amino acids are called non-essential amino acids".

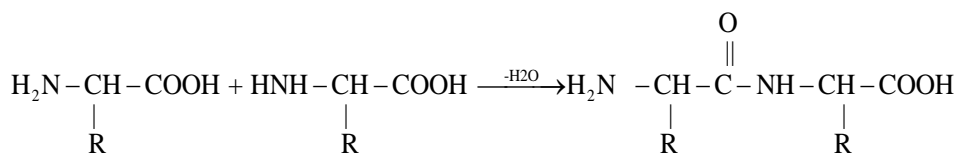
(ii) Essential Amino Acids:

"The ten amino acids which cannot be synthesized by our bodies are called essential amino acids".

Essential amino acids are required by our bodies and must be supplied through diet.

Amino Acids are Building Blocks of Proteins:

Two amino acids link through peptide linkage. Peptide linkage (bond) is formed by the elimination of water molecule between the amino group of one amino acid and carboxyl acid group of another.



1st Amino Acid

2nd Amino Acid

When thousands of amino acids polymerize they form protein.

Q.3 Explain the sources and uses of proteins. (Knowledge Base)

(Ex-Q 4)

(LHR 2013-15, DGK 2017, SWL 2017, FSD 2016 G-I, B VP 2016 G-I)

Ans:

SOURCES AND USES OF PROTEINS

Proteins make up more than 50% of the dry weight of animals. Each protein has its source and carries out a specific function.

Sources and uses of protein are as follows:

(i) Animal Proteins:

Sources:

Sources of animal's proteins are:

- Meat
- Mutton
- Chicken
- Fish
- Egg

Uses:

- These are used as food by human beings as they are essential for the formation of protoplasm.

(ii) Enzymes are Proteins:**Production:**

Enzymes are proteins that are produced by the living cells.

Functions:

- They **catalyze** the **chemical reactions** taking place in the bodies.
- They are **highly specific and have extraordinary efficiency**.
- Many enzymes are used as **drugs**.
- They **control the bleeding and treat blood cancer**.

(iii) Hides are Proteins:

These are used to make leather by tanning. Leather is used to make shoes, jackets, sports items, etc.

(iv) Proteins in Bones:

Proteins are found in bones. When bones are heated they give **gelatin**. **Gelatin is used to make bakery items**.

(v) Plant Proteins:**Sources:**

Plants also synthesize proteins, such as pulses, beans, etc.

Uses:

These are used as food.

13.2 PROTEINS

SHORT QUESTIONS

Q.1 What are essential and non-essential amino acids? (*Knowledge Base*) (MTN 2016 G-II)

Ans: Answer given on Page # 223

Q.2 Define protein and name its basic unit. (*Knowledge Base*)

(FSD 2017)

Ans: Answer given on Page # 222

MULTIPLE CHOICE QUESTIONS

1. Amino acids are linked with each other through: (*K.B*) (BWP 2016 G-I)

- | | |
|---------------------|----------------------|
| (A) Peptide linkage | (B) Covalent linkage |
| (C) Hydrogen bond | (D) Ionic bond |

2. Percentage of protein in dry weight of cell is: (*K.B*)

- | | |
|----------|----------|
| (A) 50 % | (B) 90 % |
| (C) 60% | (D) 40% |

3. Protein are essential for the formation of: (*K.B*)

- | | |
|---------------|----------------|
| (A) Cytoplasm | (B) Protoplasm |
| (C) Ectoplasm | (D) Endoplasm |

4. These are proteins: (*K.B*)

- | | |
|-----------|-------------|
| (A) Hides | (B) Hooves |
| (C) Bones | (D) Caudals |

5. It is found in bones: (*K.B*)

- | | |
|-------------------|-------------------|
| (A) Lipids | (B) Proteins |
| (C) Carbohydrates | (D) Organic acids |

6. **Gelatin is used in:** (K.B)
 (A) Bakery items (B) Plastic
 (C) Glass items (D) Gems
7. **Basic building units of proteins are :** (K.P) (LHR 2014, 2016, MTN 2017)
 (A) Carbohydrates (B) Amino acids
 (C) Fatty acids (D) Monosaccharides
8. **Number of amino acids in proteins is :** (K.B)
 (A) 1000 (B) More than 1000
 (C) Less than 10000 (D) More than 10000
9. **Which one of the following does not contain protein?** (K.B) (RWP 2017, FSD 2016)
 (A) Pulses (B) Potatoes
 (C) Beans (D) Eggs

13.2 TEST YOURSELF

- i. **Which elements are found in proteins?** (Knowledge base)

Ans: ELEMENTS FOUND IN PROTEINS

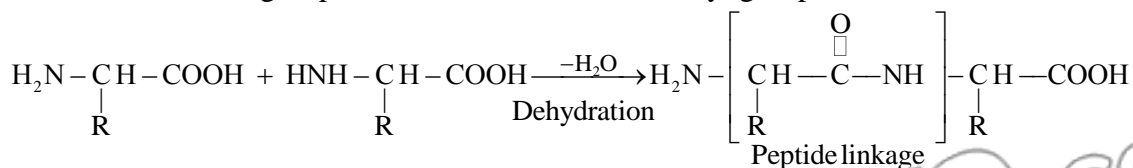
The elements found in proteins are:

- Carbon
- Hydrogen
- Oxygen
- Sulphur
- Nitrogen

- ii. **How amino acids are bonded with each other?** (Knowledge+Understanding base)

Ans: BONDING OF AMINO ACIDS

Amino acids are basic building blocks of proteins. Two Amino acids are bonded through peptide linkage. Peptide linkage (bond) is formed by the elimination of water molecule between the amino group of an amino acid and carboxyl group of another such as:

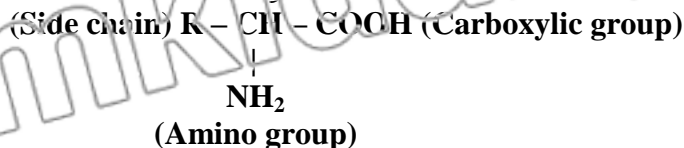


When thousands of amino acids polymerize they form protein

- iii. **Give the general formula of amino acids.** (Knowledge base) (FSD 2016 G-II, SVL 2016 G-II)

Ans: GENERAL FORMULA OF AMINO ACIDS

The general formula of amino acids is given below.



Side chain "R" is different for different 20 kinds of amino acids.

- iv. **What do you mean by non-essential amino acids?** (Knowledge base) (MTN 2016 G-I)

Ans: NON-ESSENTIAL AMINO ACIDS

"Non-essential amino acids are those amino acids which our body itself can produce or synthesize".

Synthesis by Human Body:

Ten out of twenty amino acids can be synthesized by human body and thus are called non-essential amino acids.

13.3 LIPIDS**LONG QUESTIONS**

Q.1 What are lipids? Explain their properties. (*Knowledge+Understanding base*)

(MTN 2017)

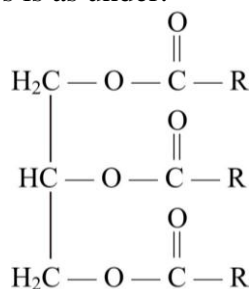
Ans: LIPIDS

Definition:

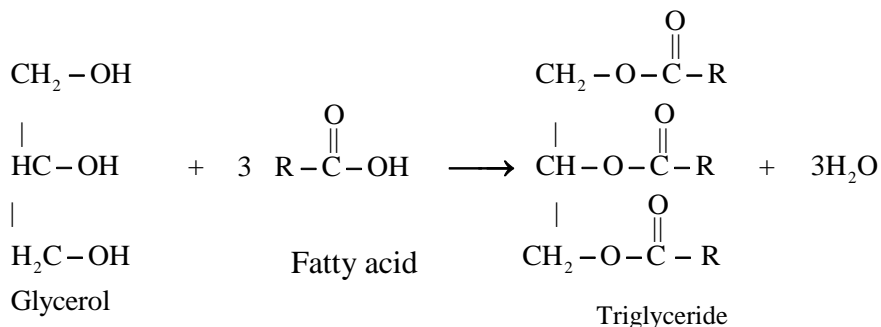
"Lipids are macromolecules made up of fatty acids. Lipids include oils and fats".

General formula:

General formula of triglycerides is as under:

**Composition:**

The esters are made of three fatty acids therefore, they are called triglycerides.

**Major Types of Lipids:**

The major types of lipids are as follows:

(i) Oils:

Oils exist in **liquid form** at room temperature. They are triglycerides of **unsaturated fatty acids**.

(ii) Fats:

Fats exist in **solid form** at room temperature. They are triglycerides of **saturated fatty acids**.

Fatty Acids:

(MTN 2017, SWL 2017)

"Fatty acids are building blocks of lipids. They are long chain saturated and unsaturated carboxylic acids."

Examples:

- Palmitic acid: $\text{C}_{15}\text{H}_{31}\text{COOH}$ (Saturated)
- Stearic acid: $\text{C}_{17}\text{H}_{35}\text{COOH}$ (Saturated)
- Oleic acid: $\text{C}_{17}\text{H}_{33}\text{COOH}$ (Unsaturated)

These acids form esters (oils or fats) with glycerol in the presence of mineral acids.

Q.2 Explain the source and uses of lipids. (Knowledge base)

(GRW 2013, 14, FSD 2017, BWP 2017, BWP 2017, DGK 2017, MIN 2016 G-117, SWI. 2017, RWP, 2017)

Ans:

SOURCES OF LIPIDS

Fats and oils are synthesized naturally by animals, plants and marine organisms.

(i) Animal Fats:**Source:**

Animal fats are found in adipose tissue cells. Animals secrete milk from which butter and ghee is obtained.

Uses:

Butter and ghee are used for cooking and frying of food, for preparing bakery products and sweets.

(ii), Animal fats are used in soap industry.

(iii) Plant Oils:**Sources:**

Plants synthesize oils and store them in seeds, such as, sunflower oil, coconut oil, groundnut oil.

Uses:

These oils are used as vegetable oils or ghee for cooking and other purposes.

(iv) Marine Animals Oils:**Sources:**

Marine animals like salmon and whales are also source of oils.

Uses:

These oils are used as medicines e.g., cod liver oil.

USES OF LIPIDS

The uses of lipids are as follows:

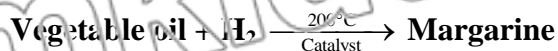
- (i) Fats and oils are high energy foods.
- (ii) They are source of vitamins A, D and E.
- (iii) They are used to build brain cells, nerve cells and cell membranes.
- (iv) They are insoluble in water but soluble in organic solvents.
- (v) The fats stored in the body insulate it as these are poor conductor of heat and electricity.

13.3 LIPIDS**SHORT QUESTIONS****Q.1 How margarine can be prepared? (Application Base)(Interesting Information Pg. #107)**

Ans:

PREPARATION OF MARGARINE

Margarine is produced by adding hydrogen to vegetable oil at 200°C in the presence of catalyst. Greater the amount of hydrogen added, the more solid the margarine becomes.

**Q.2 What is the smell of rancid butter and its cause? (Knowledge Base)**

(Interesting Information Pg. # 107)

Ans:

SMELL OF RANCID BUTTER

Rancid butter has a foul smell because of **butanoic acid**. However, the esters of butanoic acid have fruity smell. For example, methyl butanoate smells like apples and ethyl butanoate smells like pineapple.

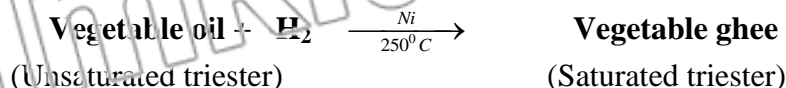
Q.3 What is meant by hydrogenation of vegetable oil? (*Application Base*)

(Science, Technology and Society Pg. # 107) (BWP 2017)

Ans:

HYDROGENATION OF VEGETABLE OIL

Vegetable oils are triesters of glycerol and fatty acids of unsaturated long chains. These oils are hydrogenated in the presence of nickel catalyst at **250 to 300 °C** to form vegetable ghee.



Q.4 What are fatty acids? (*Knowledge Base*)

Ans: Answer given on Page # 226

13.3 LIPIDS

MULTIPLE CHOICE QUESTIONS

- It is poor conductor of heat: (K.B)**
(A) Acids
(B) Lipids
(C) Carbohydrates
(D) Proteins
- Butter and fats are obtained from: (K.B)**
(A) Milk
(B) Eggs
(C) Meat
(D) Fish
- Plants synthesize: (K.B)**
(A) Oil
(B) Ghee
(C) Custard
(D) Yogurt
- Salmon and whale oil is used as: (K.B)**
(A) Bar. B.Q.
(B) Medicine
(C) Food
(D) Lemonoid
- Which gas is passed through vegetable oil to get margarine? (K.B)**
(A) Nitrogen
(B) Chlorine
(C) Hydrogen
(D) Carbon
- Esters of butanoic acids have smell: (K.B)**
(A) Pungent
(B) Rotten egg
(C) Foul
(D) Fruity
- Ethyl butanoate smells like: (K.B)**
(A) Apple
(B) Pineapple
(C) Cherry
(D) Guava
- Fat soluble vitamins are: (K.B)**
(A) A, E, D, C
(B) B, C
(C) A, B, C
(D) K, D, E
- Which of the following is monosaccharide? (K.B)**
(A) Lactose
(B) Glucose
(C) Fructose
(D) Both B and C
- Formula of palmitic acid is: (K.B)**
(A) $C_{15}H_{31}COOH$
(B) $C_{15}H_{35}COOH$
(C) $C_{15}H_{32}COOH$
(D) $C_{17}H_{36}COOH$

(RWP 2016 G-I)

13.3 TEST YOURSELF

i. What is difference between ghee and oil? (*Understanding Base*)

(LHR 2015, GRW 2017, MTN 2017, FSD 2016 G-II, SWL 2016 G-II, DCK 2016 G-II, FWP 2016 G-II)

Ans:

DIFFERENTIATION

The differences between ghee and oil are as follows:

Ghee	Oil
Physical State	
• It exists in solid form at room temperature.	• It exists in liquid form at room temperature.
Nature	
• These are the triglycerides of saturated fatty acids .	• These are the triglycerides of unsaturated fatty acids .

ii. Give the characteristics of fats. (*Knowledge Base*)

Ans:

CHARACTERISTICS OF FATS

The characteristics of fats are as follows:

- (i) Fats exist in solid form at room temperature.
- (ii) Fats are the triglycerides of saturated fatty acids.
- (iii) They are lighter than water.
- (iv) They are insoluble in water.
- (v) They are poor conductors of heat and electricity and serve excellent insulator for the animal body.

iii. Give the sources and uses of animal fats. (*Knowledge Base*) (GRW 2017, SGD 2017)

Ans:

SOURCES AND USES OF ANIMAL FATS

Sources:

Animal fats are found in adipose tissue cells. Butter and ghee is obtained from milk which is secreted by animals.

Uses:

- Animal fats are used in soap industry.
- Butter and ghee (animal fat products) are used for cooking and frying of food for preparing bakery products and sweets.

iv. Plants are the source of oil, justify. (*Understanding Base*)

Ans:

PLANTS AS SOURCE OF OIL

Justification:

Plants synthesize oils and store them in seeds such as: sunflower oil, coconut oil, ground nut oil, corn oil. These oils are used as vegetable oils or ghee for cooking and other purposes.

13.4 NUCLEIC ACIDS

LONG QUESTIONS

Q.1 What are nucleic acids? Explain their types in detail.

(*Knowledge + Understanding Base*)

Ans:

NUCLEIC ACIDS

Definition:

"Nucleic acids are essential components of every living cell. They are generally long chain molecules made up of nucleotides".

Components of Nucleic Acids:

Each nucleotide consists of three components.

- (i) Nitrogenous base
- (ii) Pentose sugar
- (iii) Phosphate group

Types of Nucleic Acids:

There are two types of nucleic acids.

- (i) Deoxyribonucleic Acid (DNA)
- (ii) Ribonucleic acid (RNA)
- (i) **Deoxyribonucleic Acid (DNA):** (DGK 2016 G-I)

“The type of nucleic acid which contains deoxyribose sugar in its nucleotides is called DNA.”

Discovery:

DNA consists of **deoxyribose sugar**. Its structure was discovered by **J. Watson and F. Crick in 1953**.

Structure of DNA:

(BWP 2017)

It is long double stranded molecule consisting of two chains. Each chain is made up of sugar, phosphate group and a base. The sugar and phosphate groups make the backbone of the chains and two chains are linked through bases. The chains are wrapped around each other in a double helix form.

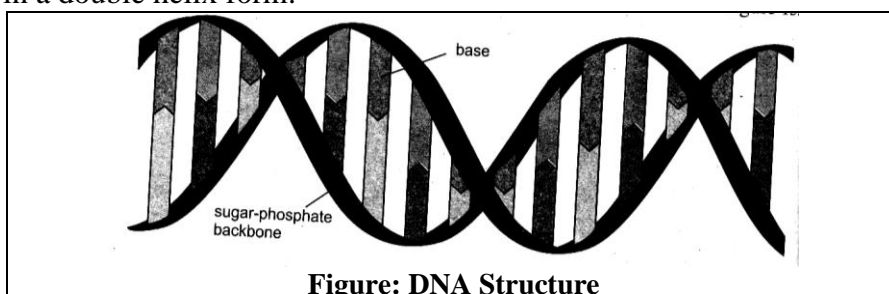


Figure: DNA Structure

Functions of DNA:

The functions of DNA are as follows:

- DNA is the permanent storage place for genetic information in the nucleus of a cell.
- It carries and stores all genetic informations of the cell.
- It passes the information as instructions from generation to generation how to synthesize particular proteins from amino acids.
- DNA carries genes that control the synthesis of RNA.

What are Instructions?

These instructions are genetic code of life. They determine whether an organism is a man or a tree or a donkey and whether cell is a nerve cell or a muscle cell.

Sequence of Nitrogenous Base:

The sequence of nitrogenous bases in DNA determines the protein development in new cells.

Function of Double Helix:

The function of the double helix formation of DNA is ensuring that no disorder takes place. DNA carries genes that control the synthesis of RNA.

Genetic Disease:

Errors introduced into the genes synthesize faulty RNA. It synthesizes faulty proteins that do not function the way they are supposed to. This disorder causes genetic diseases.

(ii) Ribonucleic Acid (RNA):

"The type of nucleic acid which contains ribose sugar in its nucleotides is called RNA."

Structure:

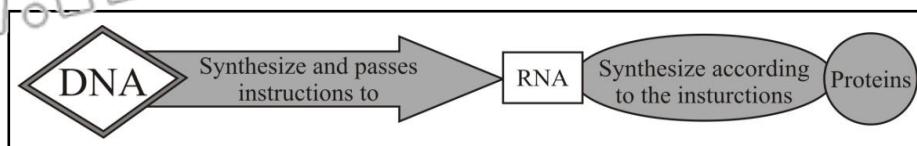
It consists of ribose sugar. It is a single stranded molecule.

Function:

It is responsible for putting the genetic information to work in the cell to build proteins.

RNA as a Messenger:

Its role is like a messenger. RNA is synthesized by DNA to transmit the genetic information. RNA receives, reads, decodes and uses the given information to synthesize new proteins. Thus RNA is responsible for directing the synthesis of new proteins.



13.4 NUCLEIC ACIDS

SHORT QUESTIONS

Q.4 What are nucleic acids? (*Knowledge Base*)

(BWP 2016 G-I, 17)

Ans: Answer given on Page # 229

Q.5 What is cause of cancer and how it can be cured? (*Knowledge + Understanding Base*)

(Interesting Information Pg. # 109)

Ans:

CAUSE AND CURE OF CANCER

Cause:

Cancer is caused by damage to DNA or interfering with the mechanism of its replication or passing informations.

Cure:

By understanding the mechanism of action of DNA, cancer can be cured.

MULTIPLE CHOICE QUESTIONS

1. It is responsible for decoding of genetic information present in DNA: (*K.B*)

- | | |
|---------|------------------|
| (A) RNA | (B) Acetic acid |
| (C) DNA | (D) Nucleic acid |

2. DNA structure was discovered in: (*K.B*)

- | | |
|----------|----------|
| (A) 1953 | (B) 1919 |
| (C) 1983 | (D) 1913 |

3. RNA stands for: (*K.B*)

- | | |
|---------------------------|------------------|
| (A) Deoxyribonucleic acid | (E) Stearic acid |
| (C) Ribonucleic acid | (D) Nucleic acid |

4. RNA acts as: (*K.B*)

- | | |
|-----------------|----------------------|
| (A) Synthesizer | (B) Messenger |
| (C) Transporter | (D) All of the above |

5. Which scientist discovered the structure of DNA? (*K.B*)

(GRW 2015)

- | | |
|----------------------|------------------|
| (A) Hopkins | (B) John |
| (C) Watson and Crick | (D) Robert Hooke |

6. Basic structural unit of nucleic acid is: (K.B) (GRW 2014)
(A) Amino acid (B) Glucose
(C) Nucleoside (D) Nucleotide

13.5 VITAMINS

LONG QUESTIONS

Q.1 What are vitamins? Explain their types and importance in detail.

(Knowledge + Understanding Base)

(LHR 2013, 14 SWL 2017, SGD 2017, BWP 2016 G-II)

Ans:

VITAMINS

Definition:

“Organic compounds essential to health that must be supplied in small amounts in the diet are called vitamins”.

Historical Background:

- In 1912 Hopkins noticed that in addition to carbohydrates, proteins and fats there are other substances needed for normal growth. Although these substances were needed in small quantity, yet these substances were called “Accessory Growth Factors.”
- Later Funk proposed the name 'Vitamin' for these substances. He discovered Vitamin B₁ (Thiamin).

Types of Vitamins:

(BWP 2017)

Vitamins are divided into two types:

(i) Fat Soluble Vitamins:

“The vitamins which dissolve in fats are called fat soluble vitamins”.

Examples:

- Vitamin A
- Vitamin D
- Vitamin E
- Vitamin K

Effects of Accumulation:

They are stored in the liver and fatty tissues of the body. If these vitamins are taken in large quantity, they accumulate in the body and cause diseases.

Example:

- Accumulation of vitamin D in the body causes bone-pain and bone-like deposits in the kidney.

Effects of Deficiency:

However, their deficiency also causes diseases.

Sources, Uses and Diseases:

Sources, uses and diseases due to deficiency of fat soluble vitamins are as follows:

Sr.No.	Vitamin	Sources	Uses	Diseases
i.	Vitamin A	Dairy products, eggs, oils, fats and fish. It can also be obtained from the beta-carotene found in green vegetables, carrots and liver.	Maintains the health of the epithelium and acts on the retina's dark adaptation mechanism.	Night blindness. Eye inflammation.
ii.	Vitamin D	Fish liver, dairy products, oils and fats. Vitamin D is formed in the skin when it is exposed to sunlight.	Has a role in the absorption of calcium which is essential for the maintenance of healthy bones.	Rickets

(ii) Water Soluble Vitamins:

(GRW 2013)

"The vitamins that dissolve in water are called water soluble vitamins".

Examples:

- Vitamin B complex (this includes 10 vitamins)
- **Vitamin C (Ascorbic acid).**

Advantages:

Water soluble vitamins are rapidly excreted from the body. Hence these vitamins are not toxic even if taken in large quantity. However, their deficiency causes diseases.

Sources:

Sources of water soluble vitamins are:

- Grains
- Green vegetables
- Milk
- Cheese
- Curd
- Fish
- Egg etc.

IMPORTANCE OF VITAMINS

(GLW 2017, RVP 2017)

The importance of vitamins is as follows:

- Each vitamin plays an important role in the **healthy development** of our body.
- Natural vitamins are organic food substances **found only in plants and animals**. Our body is unable to synthesize vitamins. Because of this, they must be supplied either directly in the diet or by way of dietary supplements. They are **absolutely necessary for our normal growth**.
- Vitamins **cannot be assimilated without ingesting food**. This is why, it is suggested that vitamins **must be taken with meal**.
- They help to **regulate our body's metabolism**.

13.5 VITAMINS

SHORT QUESTIONS

Q.1 Give the uses of vitamins? (Knowledge Base)

(GRW 2017, 14)

Ans:

USES OF VITAMINS

The uses of vitamins are as follows:

- Vitamins play an important role in the healthy development of our body.
- Vitamins help to regulate our body's metabolism.
- They assist the food for formation of bones and tissues.
- Vitamins are absolutely necessary for our normal growth.

Q.2 What is role of vitamin A in body? (Knowledge Base)

Ans:

ROLE OF VITAMIN A

Vitamin A performs various functions in the body like:

- It maintains the health of epithelium.
- It controls (affects) the retina's dark adaptation mechanism.

Q.3 Write down diseases born by the deficiency of vitamin A. (Knowledge Base)(LHR-2015)

Ans:

DEFICIENCY OF VITAMIN A

The diseases born by the deficiency of vitamin A are as follows:

- Night blindness
- Eye inflammation.

Q.4 Describe the sources and uses of vitamin D. (Knowledge Base) (GRW 2017, BWP 2016 G-II)

Ans:

SOURCE AND USES OF VITAMIN D

Sources:

The sources of vitamin D are as follows:

- Fish liver
- Dairy products
- Oils and fats
- Vitamin D is formed in the skin when it is exposed to sunlight.

Uses:

- Vitamin D helps in the absorption of calcium which is essential for the maintenance of healthy bones.

Q.5 What are vitamins? (Knowledge Base)

(FSD 2016 G-I, EWP 2017)

Ans: Answer given on Page # 232

13.5 VITAMINS

MULTIPLE CHOICE QUESTIONS

1. Vitamins were discovered in: (K.B)

- | | |
|----------|----------|
| (A) 1912 | (B) 1914 |
| (C) 1932 | (D) 1924 |

2. Accessory growth factors later named vitamins by: (K.B)

- | | |
|-----------|--------------|
| (A) Drude | (B) Loren |
| (C) Funk | (D) De' duve |

3. **Funk discovered vitamin: (K.B)**
 (A) B₁(thiamin) (B) C (creatinin)
 (C) B (sucrose) (D) Urea
4. **Vitamin C is also called: (K.B)**
 (A) Nucleic acid (B) Carlic acid
 (C) Ascorbic acid (D) Maleic acid
5. **Which vitamin is fat soluble? (K.B)** (LHR 2014, 2016; GRW 2016)
 (A) A (B) E
 (C) K (D) All of these
6. **Which one of the following vitamins is water soluble? (K.B)** (GRW 2015, MTN 2017)
 (A) Vitamin D (B) Vitamin E
 (C) Vitamin A (D) Vitamin C
7. **Deficiency of which vitamin causes night blindness? (K.B)** (GRW 2016, DGK 2017)
 (A) Vitamin D (B) Vitamin C
 (C) Vitamin E (D) Vitamin A
8. **Eye inflammation is caused by the deficiency of vitamin: (K.B)** (LHR 2014, DGK 2017)
 (A) Vitamin D (B) Vitamin C
 (C) Vitamin B (D) Vitamin A
9. **Rickets disease is caused by the deficiency of: (K.B)** (SGD 2017)
 (A) Vitamin D (B) Vitamin A
 (C) Vitamin E (D) Vitamin B
10. **Who proposed the name of vitamin? (K.B)** (SWL 2016 G-I)
 (A) Funk (B) Watson
 (C) F.Crick (D) Lewis

13.4 TEST YOURSELF

- i. **What are the disadvantages of fat soluble vitamins? (Knowledge Base)** (SWL 2016 G-I)

Ans: DISADVANTAGES

If these vitamins are taken in large quantity, they accumulate in the body and cause diseases.

- ii. **What are advantages of water soluble vitamins? (Knowledge Base)**

Ans: ADVANTAGES

Water soluble vitamins are rapidly excreted from the body. Hence, these vitamins are not toxic even if taken in large quantity.

Examples:

- Vitamin B complex
- Vitamin C

- iii. **Give examples of fat soluble vitamins. (Knowledge Base)**

Ans: FAT SOLUBLE VITAMINS

The examples of the fat soluble vitamins are:

- Vitamin A
- Vitamin D
- Vitamin E
- Vitamin K

- iv. **What are the components of nucleotide? (Knowledge Base)** (FSD 2017)

Ans: COMPONENTS OF NUCLEOTIDE

Each nucleotide consists of three components:

- (i) Nitrogenous base
- (ii) A pentose sugar
- (iii) A phosphate group

Pentose sugar and phosphate group make the backbone of the chain and two chains are link through bases.

v. What is the function of DNA? (*Knowledge Base*)

(RWP 2014, 16 G-I, FSD 2017, SWL 2016 G-I, II, SGD 2016 G-I, GRW 2013)

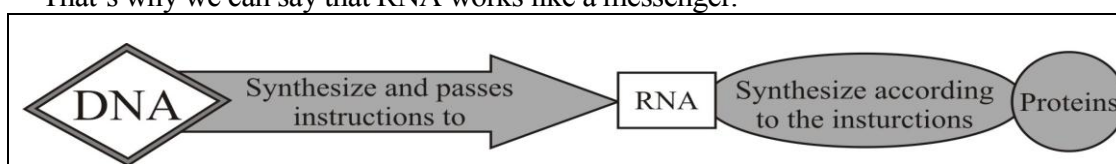
Ans: **FUNCTIONS OF DNA**

The functions of DNA are as follows:

- DNA is the permanent storage place for genetic information in the nucleus of a cell.
- It carries and stores all genetic information of the cell.
- It passes the information as instructions from generation to generation how to synthesize particular proteins from amino acids.
- DNA carries genes that control the synthesis of RNA.

vi. Why RNA is called a messenger? (*Understanding Base*)Ans: **RNA AS A MESSENGER**

The whole activity of DNA depends upon the RNA. DNA stores genetic information and passes this information to RNA, then RNA reads, decodes and uses this given information to synthesize new proteins. Thus RNA is responsible for directing the synthesis of new proteins. That's why we can say that RNA works like a messenger.

**COMMERCIAL USES OF ENZYMES****LONG QUESTION**Q.1 Write down the commercial uses of enzymes. (*Knowledge Base*)

(Science, Technology and Society Pg. # 111)

Ans: **COMMERCIAL USES OF ENZYMES****Enzymes:**

"The substances which are used to catalyze the reactions in living organisms are called enzymes".

Examples:

- Protease
- Amylase
- Lipase

Common Types of Enzymes and Their Commercial Uses:

Enzymes are used on commercial scale for different purposes. Common types of enzymes and their role in industry is described as:

(i) Fermentation of Molasses and Starch:

Enzymes present in the yeast are commercially used for the fermentation of molasses and starch to produce alcohol (Ethanol).

Examples:

- Diastase
- Invertase
- Zymase

(ii) Detergent Industry:

Microbial enzymes are used in detergents (powder or liquid).

Examples:

- Lipases decompose fats into more water soluble compounds.
- Amylase removes starch based stains.
- Cellulose degrades cellulose to glucose, a water soluble compound.
- Bacterial proteases break down protein stains on the clothes.

Thus enzymes containing detergents clean effectively and remove all stains and dirt.

(iii) Purification of Fruit Juices:

Enzymes are used for the purification of fruit juices. They are added to fruit that has been crushed like grapes. This increases the yield of the juice extracted by removing suspended particles. It also improves the colour derived from the fruit skins.

(iv) Bread making:

Amylase enzymes are used in bread making because they can yield more starch of the flour. Even they are efficient enough to convert starch to sweet glucose syrup. This can be used as sweetener in the food as well as bread making.

(v) Sweetness in ice cream:

Lactose in milk is broken down to galactose and glucose, which are sweeter than lactose.

Example:

Lactase enzyme is used to increase sweetness in ice cream.

(vi) Enzymes in Dairy Industry:

In the dairy industry some enzymes are used for the production of cheeses, yogurt and other dairy products while others are used to improve texture or flavours of the products.

COMMERCIAL USES OF ENZYMES

SHORT QUESTIONS

Q.1 How we can check the solubility of starch and sugar? (*Knowledge Base*)

(Skills Pg. # 112)

Ans: SOLUBILITY OF STARCH AND SUGAR

Solubility of starch and sugar in water can be checked in laboratory as well as at home. Starch is insoluble in water while sugar is soluble in water forming a clear solution in water.

Q.3 Give a commercial uses of enzymes (*Knowledge Base*)

Ans: COMMERCIAL USES OF ENZYMES

Two commercial uses of enzymes are as follows:

(i) Fermentation of Molasses and Starch:

Enzymes present in the yeast are commercially used for the fermentation of molasses and starch to produce alcohol (Ethanol).

Examples:

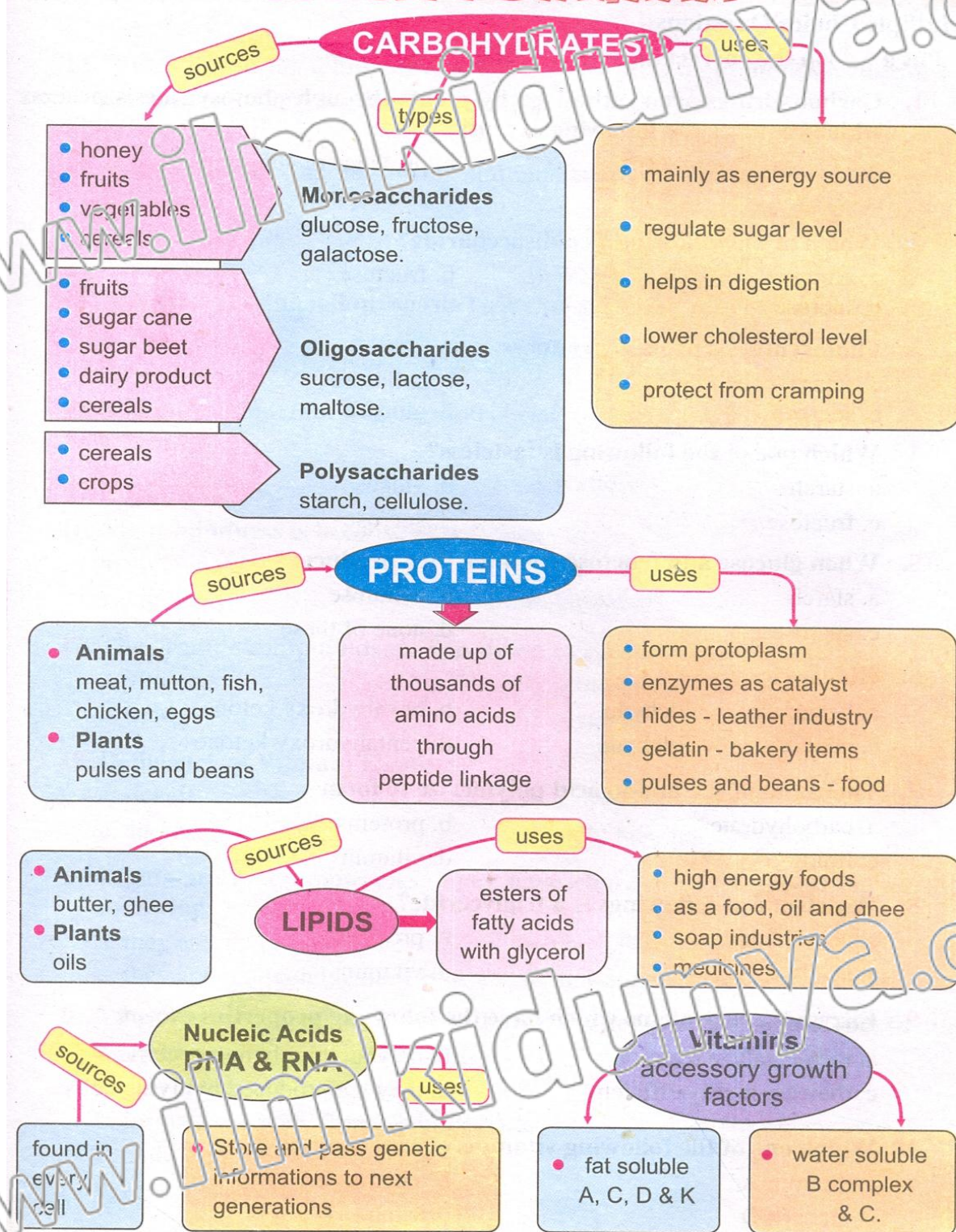
- Diastase
- Invertase
- Zymase

COMMERCIAL USES OF ENZYMES

MULTIPLE CHOICE QUESTIONS

1. Which one of the following is used in bread making? (*K.B*)
 (A) Lactase (B) Amylase
 (C) Urease (D) Ligase
2. Alcohol is obtained mainly by the fermentation of: (*K.B*)
 (A) Molasses (E) Proteins
 (C) Starch (D) Both A and C
3. Which one of the following decomposes fats into more water soluble compounds? (*K.B*)
 (A) Lactase (B) Amylase
 (C) Lipase (D) Protease
4. Which one of the following decomposes protein stains on the clothes? (*K.B*)
 (A) Lactase (B) Amylase
 (C) Lipase (D) Protease
5. Cellulase degrades cellulose to: (*K.B*)
 (A) Fructose (B) Glucose
 (C) Lactose (D) Ribose

CONCEPT DIAGRAM



ANSWER KEY**MULTIPLE CHOICE QUESTIONS****INTRODUCTION**

1	A	3	A
2	A	4	D

13.1 CARBOHYDRATES

1	A	6	A	11	C
2	D	7	D	12	C
3	A	8	B	13	B
4	D	9	A	14	A
5	A	10	A	15	D

13.2 PROTEINS

1	A	6	A
2	A	7	B
3	B	8	D
4	A	9	B
5	B		

13.3 LIPIDS

1	B	6	D
2	A	7	B
3	A	8	D
4	B	9	D
5	C	10	A

13.4 NUCLEIC ACIDS

1	A	6	D
2	A		
3	C		
4	B		
5	C		

13.5 VITAMINS

1	A	6	D
2	C	7	D
3	A	8	D
4	C	9	A
5	D	10	A

COMMERCIAL USES OF ENZYMES

1	B	4	D
2	D	5	B
3	C		

EXERCISE SOLUTION**MULTIPLE CHOICE QUESTIONS**

1. Carbohydrates are synthesized by plants through photosynthesis process which requires the following except: (K.B)
(a) CO₂ and water (b) Presence of sunlight
(c) O₂ (d) Chlorophyll
2. Which of the following is a disaccharide? (K.B)
(GRW 2013, 15, FSD 2016 G-I, II, LHR 2015, SWL 2017)
(a) Glucose (b) Fructose
(c) Sucrose (d) Starch
3. Photosynthesis process produces: (K.B) (LHR 2015)
(a) Starch (b) Cellulose
(c) Sucrose (d) Glucose
4. Which one of the following is tasteless? (K.B)
(LHR 2014, GRW 2013, DGK 2017, RWP 2016 G-II, 17, MTN 2016 G-I, 17, FSD 2016 G-I, SGD 2017, G-II)
(a) Starch (b) Glucose
(c) Fructose (d) Sucrose
5. When glucose and fructose combine they produce: (K.B)
(GRW 2013, DGK 2017, MTN 2016 G-II)
(a) Starch (b) Cellulose
(c) Sucrose (d) None of these
6. Glucose is: (K.B) (LHR 2014, SGD 2017)
(a) Hexahydroxy aldehyde (c) Pentahydroxy aldehyde
(b) Hexahydroxy ketone (d) Pentahydroxy ketone
7. Thousands of the amino acids polymerize to form: (K.B)
(GRW 2014, LHR 2014, 16, SGD 2016 G-I, MTN 2017, RWP 2017, FSD 2017)
(a) Carbohydrates (b) Proteins
(c) Lipids (d) Vitamins
8. Which one of following is a triglyceride? (K.B)
(SWL 2016 G-II, LHR 2015, 16, BWP 2016 G-I, 17)
(a) Carbohydrates (b) Proteins
(c) Lipids (d) Vitamins
9. Enzymes are proteins which have the following properties except: (K.B)
(a) They catalyze reaction (b) They are highly non-specific
(c) They are highly efficient (d) They are produced by living cells
10. Which one of the following vitamins is water soluble? (K.B)
(SGD 2017, DGK 2016 G-II, 17, GRW 2016, BWP 2016 G-II, FSD 2017 G-II)
(a) Vitamin A (b) Vitamin C
(c) Vitamin D (d) Vitamin E
11. Which one of the following is a fat soluble vitamin? (K.B)
(GRW 2013, LHR 2014, BWP 2017, SWL 2017, RWP 2016 G-II, SWL 2016 G-II MTN 2016 II)
(a) A (b) E
(c) K (d) All of these

12. Which one of the following is not the characteristic of monosaccharide? (K.B)
 (a) White crystalline solids (b) Soluble in water
 (c) Hydrolysable (d) Reducing in nature
13. Which one of the following statements about glucose and sucrose is incorrect? (K.B)
 (a) Soluble in water (b) Naturally occurring
 (c) Carbohydrates (d) Disaccharides
14. Which one of the following is a reducing sugar? (K.B)
 (FSD 2016 G-II, SWL 2016 G-II, DGK 2016 G-II)
 (a) Glucose (b) Maltose
 (c) Sucrose (d) Starch
15. The most important oligosaccharide is: (K.B) (SGD 2016, G-I,17, GRW 2016 G-II)
 (a) Sucrose (b) Glucose
 (c) Fructose (d) Maltose
16. Night blindness is because of deficiency of: (K.B) (MTN 2017, RWP 2017, BWP 2017 G-I)
 (a) Vitamin A (b) Vitamin E
 (c) Vitamin C (d) Vitamin D
17. The organic compounds used as drugs to control bleeding are: (K.B)
 (LHR 2013, SWL 2017, SGD 2016 G-II)
 (a) Vitamins (b) Proteins
 (c) Lipids (d) Glycerides
18. Deficiency of Vitamin E causes: (K.B) (GRW 2017, MTN 2016 G-I)
 (a) Rickets (c) Anemia in babies
 (b) Scurvy (d) Night blindness
19. Lipids are macromolecules. They have characteristics except one of the following: (K.B)
 (a) They are high energy foods (b) They are soluble in water
 (c) They are poor conductor of heat (d) They are esters of fatty acids
20. Vitamins are Accessory Growth Factors. They play important role in our body like: (K.B)
 (a) Provide energy to the body (b) Insulate our body from electric shock
 (c) Build brain cells (d) Regulate metabolic process

ANSWER KEY

1	c	6	c	11	d	16	a
2	e	7	b	12	c	17	b
3	d	8	c	13	d	18	c
4	a	9	b	14	a	19	b
5	c	10	e	15	a	20	d

EXERCISE SHORT QUESTIONS

1. How plants synthesize carbohydrates? (*Knowledge Base*)

(DGK 2017, SGD 2016 G-II, RWP 2016 G-II, MTN 2016 G-II)

Ans: SYNTHESIS OF CARBOHYDRATES

Carbohydrates are synthesized by plants through photosynthesis process, from carbon dioxide and water in the presence of sunlight and green pigment chlorophyll.



The glucose is further polymerized to form starch and cellulose.

2. Give the characteristics of monosaccharides. (*Knowledge Base*)

(DGK 2016 G-II, SGD 2016 G-I, 17, RWP 2016 G-II, MTN 2016 G-I)

Ans: CHARACTERISTICS OF MONOSACCHARIDES

The characteristics of monosaccharides are as follows:

- Monosaccharides are the **simplest sugars** which cannot be hydrolyzed.
- They are usually **white crystalline solids**.
- They are **soluble in water**.
- They have **sweet taste**.
- Monosaccharides are **reducing in sugar** therefore they are called **reducing sugars**.

3. What is difference between glucose and fructose? (*Knowledge+Understanding Base*)

(GRW 2014, LHR 2015, FSD 2017, SGD 2016, FSD 2016-G-I,II, DGK 2016 G-I)

Ans: DIFFERENTIATION

The differences between glucose and fructose are as follows:

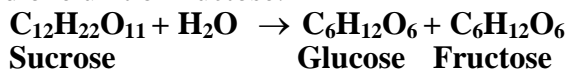
Glucose	Fructose
Definition	
• Glucose is pentahydroxy aldehyde in nature.	• Fructose is pentahydroxy ketone in nature.
Functional Group	
• It has aldehydic functional group. (Aldose)	• It has ketonic functional group. (Ketose)
Structure	
<pre> CHO H — C — OH HO — C — H H — C — OH H — C — OH CH₂OH Glucose </pre>	<pre> CH₂OH C = O HO — C — H H — C — OH H — C — CH₂OH CH₂OH Fructose </pre>

4. Give an example of a disaccharide. How it is hydrolyzed into monosaccharides? (*Knowledge Base*)

(BWP 2016 G-I)

Ans: DISACCHARIDES

The most common example of disaccharide is sucrose. When it hydrolyses it produces one unit of glucose and one unit of fructose.



5. Give the characteristics of polysaccharides. (*Knowledge Base*)

(GRW 2015, SWL 2017, SGD 2017, MTN 2016 G-II, DGK 2016 G-II)

Ans:

CHARACTERISTICS OF POLYSACCHARIDES**Definition:**

"Polysaccharides are macromolecular carbohydrates consisting of hundreds to thousands of monosaccharides".

The characteristics of polysaccharides are as follows:

- These are **amorphous solids**.
- These are **non-reducing in nature**.
- They are **insoluble in water**.
- They are **tasteless**.

Examples:

- Starch
- Cellulose
- Glycogen

6. Where the proteins are found? (*Knowledge Base*)

(SGD 2016 G-I, II, RWP 2016 G-I)

Ans:

OCCURRENCE OF PROTEINS

Proteins occur as follows:

(i) Animal Proteins:**Sources:**

Sources of animal's proteins are:

- Meat
- Mutton
- Chicken
- Fish
- Egg

Uses:

- These are used as food by human beings as they are essential for the formation of protoplasm.

(ii) Enzymes are Proteins:**Production:**

Enzymes are proteins that are produced by the living cells.

Functions:

- They **catalyze the chemical reactions** taking place in the bodies.
- They are **highly specific** and have **extraordinary efficiency**.
- Many enzymes are used as **drugs**.
- They **control the bleeding and treat blood cancer**.

(iii) Hides are Proteins:

These are used to make leather by tanning. Leather is used to make shoes, jackets, sports items, etc.

(iv) Proteins in Bones:

Proteins are found in bones. When bones are heated they give gelatin. Gelatin is used to make bakery items.

(v) Plant Proteins:**Sources:**

Plants also synthesize proteins, such as pulses, beans, etc.

Uses:

These are used as food.

7. Describe the uses of carbohydrates. (*Knowledge Base*) (RWP 2016, MTN 2016 G-I)

Ans: USE OF CARBOHYDRATES

The uses of carbohydrates are as follows:

As Source of Energy:

- Glucose is the only form of carbohydrates that is used directly by muscles for energy.
- It is important to note that brain needs glucose as an energy source, because it cannot use fat for this purpose.

Uses Other Than Energy:

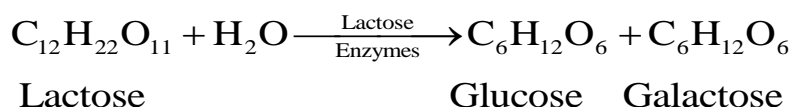
Besides, the energy providing materials, carbohydrates also provide the following usage in our body.

- They regulate the amount of sugar level in our body. Low sugar level in body results in hypoglycemia.
- They provide essential nutrients for bacteria in intestinal tract that helps in digestion.
- Dietary fiber helps to keep the bowel functioning properly.
- Fiber helps in lowering of cholesterol level and regulates blood pressure.
- Carbohydrates protect our muscles from cramping.

8. Lactose is disaccharide; which monosaccharide is present in it? (*Knowledge Base*)(GRW 2013)

Ans: MONOSACCHARIDES PRESENT IN LACTOSE

Two monosaccharides glucose and galactose are present in lactose.



9. Why the ten amino acids are essential for us? (*Knowledge Base*) (BWP 2016 G-I)

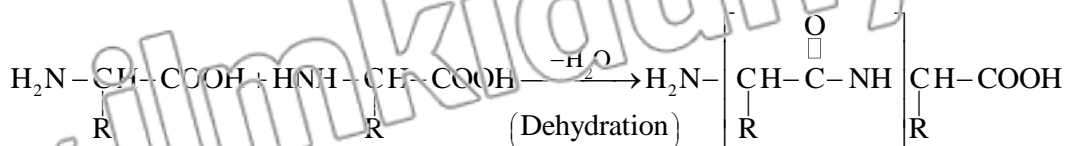
Ans: ESSENTIAL AMINO ACIDS

Ten amino acids called essential amino acids cannot be synthesized by our body. Thus these amino acids must be supplied through diet to fulfill the requirement of our body.

10. How proteins are formed? (*Knowledge + Understanding Base*) (RWP 2017)

Ans: FORMATION OF PROTEINS

Amino acids are the building blocks of proteins. Two amino acids link through peptide linkage is formed by the elimination of water molecule between the amino group of one amino acid and carboxyl acid group of another amino acid.



When thousands of amino acids polymerize they form proteins.

11. How gelatin is obtained? (*Knowledge Base*) (RWP 2014, SGD 2017, DGK 2016 G-II)

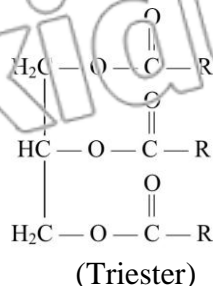
Ans: PREPARATION OF GELATIN

Proteins are found in bones. Gelatin is obtained on heating bones.

12. Give the general formula of the lipids. (*Knowledge Base*)

Ans: GENERAL FORMULA OF LIPIDS

The general formula of the lipids is as follows:



13. Name two fatty acids with their formulae. (*Knowledge Base*)

(GRW 2013,14,15, MTN2017)

Ans: FATTY ACIDS

Following are the names of two fatty acids with their formulae:

Palmitic acid : $\text{C}_{15}\text{H}_{31}\text{COOH}$

Stearic acid : $\text{C}_{17}\text{H}_{35}\text{COOH}$

14. Give the types of vitamins. (*Knowledge Base*)

(RWP 2016, G-I MTN 2016 G-I, II)

Ans: TYPES OF VITAMINS

Vitamins are divided into two types:

(i) **Fat Soluble Vitamins:**

“The vitamins which dissolve in fats are called fat soluble vitamins”.

Example:

- Vitamin A
- Vitamin D
- Vitamin E
- Vitamin K

(ii) **Water Soluble Vitamins:**

“The vitamins that dissolve in water are called water soluble vitamins”.

Example:

- Vitamin B complex
- Vitamin C (Ascorbic acid)

15. What is the significance of vitamins? (*Knowledge Base*)

(SGD 2016 G-I)

Ans: SIGNIFICANCE OF VITAMINS

The significance of vitamins is as follows:

- Vitamins play an important role in the healthy development of our body.
- Vitamins help to regulate our body's metabolism.
- They assist the food for formation of bones and tissues.
- Vitamins are absolutely necessary for our normal growth.

16. Describe the sources and uses of vitamin A. (Knowledge Base)

(GRW 2015, RWP 2016 G-II, 17, SWL 2016 G-I, EWP 2016 G-I)

Ans:**SOURCES AND USES OF VITAMIN A**

The sources and uses of vitamin A are as follows:

Sources:

- Dairy products
- Eggs
- Oils/fats
- Fish
- Beta carotene found in green vegetables, carrots and liver

Uses:

(MTN 2017)

- It maintains the health of epithelium.
- It controls (affects) the retina's dark adaptation mechanism.

17. Justify water soluble vitamins are not injurious to health. (Knowledge Base)

(GRW 2017, LHR 2015, SWL 2017)

Ans:**WATER SOLUBLE VITAMINS****Justification:**

Water soluble vitamins are rapidly excreted from the body (environment of body is aqueous) hence, these are not toxic even if taken in large quantity. However, their deficiency causes diseases.

Examples:

- Vitamin B complex
- Vitamin C (Ascorbic acid)

18. What do you mean by genetic code of life? (Knowledge Base)

(BWP 2016 G-I)

Ans:**GENETIC CODE OF LIFE**

“Genetic Code of Life” means those specific instructions which pass from generation to generation, to synthesize the particular proteins from amino acids.”

Importance:

It determines whether an organism is a man, a tree, or a donkey. DNA is considered the genetic code of life.

19. What is the function of DNA? (Knowledge Base)

(GRW 2013, SGD 2016 G-I, RWP 2016 G-I, SWL 2016 G-I, II, FSD 2017, RWP 2014, DGK 2016 G-I, II)

Ans:**FUNCTIONS OF DNA**

The functions of DNA are as follows:

- DNA is the permanent storage place for genetic information in the nucleus of a cell.
- It carries and stores all genetic information of the cell.
- It passes the information as instructions from generation to generation how to synthesize particular proteins from amino acids.
- DNA carries genes that control the synthesis of RNA.

20. How you justify RNA works like a messenger? (Knowledge Base)**Ans:****RNA AS A MESSENGER**

The whole activity of DNA depends upon the RNA. DNA stores genetic information and passes this information to RNA. RNA receives, reads, decodes and uses the given information to synthesize new proteins. Thus RNA is responsible for directing the synthesis of new proteins. That's why we can say that RNA works like a messenger.

EXERCISE LONG QUESTIONS

Q.1 What are carbohydrates? How monosaccharides are prepared? Give their characteristics.

Ans: See LQ.1 (Topic 13.1)

Q.2 Explain oligosaccharides.

Ans: See LQ.2 (Topic 13.1)

Q.3 What are polysaccharides? Give their properties.

Ans: See LQ.3 (Topic 13.1)

Q.4 Explain the sources and uses of proteins.

Ans: See LQ.3 (Topic 13.2)

Q.5 Explain that amino acids are building blocks of proteins.

Ans: See LQ.2 (Topic 13.2)

Q.6 Explain the sources and uses of lipids.

Ans: See LQ.2 (Topic 13.3)

Q.7 Give the importance of vitamins.

Ans: See LQ.1 (Topic 13.5)

Q.8 Describe the sources, uses and deficiency symptoms of water soluble vitamins.

Ans: SOURCES, USES AND DEFICIENCY SYMPTOMS OF WATER SOLUBLE VITAMINS

Vitamin	Sources	Uses	Diseases
Vitamin B (Thiamine)	Yeast, egg yolk, liver, wheat, nuts, red meat and whole cereals	Carbohydrate metabolism	Fatigue, irritability, loss of appetite
Vitamin B₂ (riboflavin)	Liver, eggs, whole cereals, fruits and yeasts	Intracellular metabolism	Glossitis (inflammation of tongue) anemia dermatitis.
Vitamin B₁₂	Liver, red meat, dairy products and fresh vegetables	Essential for manufacturing of genetic material in cells, involved in production of WBC's	Pernicious anemia, retarded growth
Vitamin C (Ascorbic acid)	Green vegetables, citrus fruits	Essential for maintenance of bones, teeth, gums and ligaments	Scurvey (bleeding of gums)

ADDITIONAL CONCEPTUAL QUESTIONS

Q. 1 Carbohydrates are a source of energy, comment.

(Science, Technology and Society Pg. # 104) (GRW 2014, SWL 2017)

Ans:

CARBOHYDRATES AS SOURCE OF ENERGY

Carbohydrates provide 17 kilo joules of energy per gram. We take carbohydrates as food.

Mechanism:

Long chains of starch (carbohydrates) are broken down into simple sugars (glucose) by digestive enzymes. The glucose is absorbed directly by small intestine into the blood stream. Blood stream transports the glucose to its place of use, e.g., muscles.

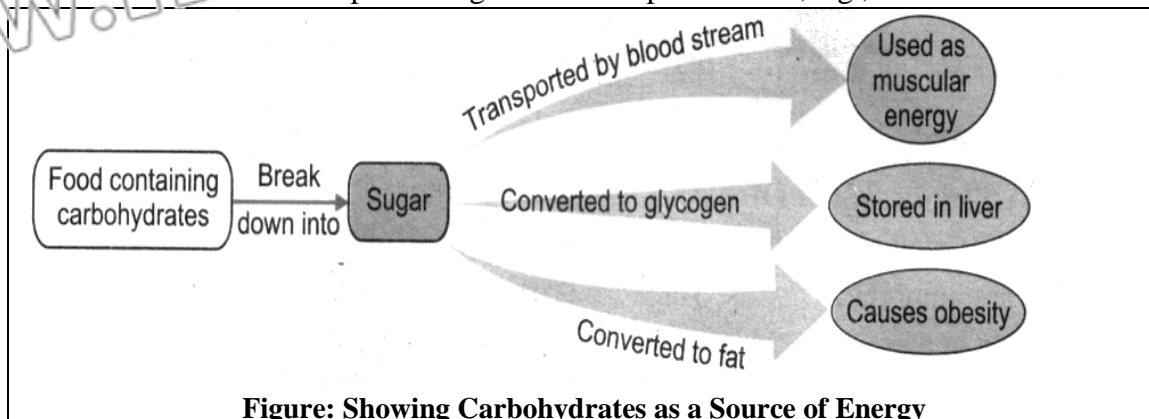


Figure: Showing Carbohydrates as a Source of Energy

Q. 2 Differentiate between monosaccharides and oligosaccharides.

(BWP 2016 G-II)

Ans:

DIFFERENTIATION

The differences between monosaccharides and oligosaccharides are as follows:

Monosaccharides	Oligosaccharides
<u>Definition:</u> Monosaccharides are the simplest sugars which cannot be hydrolyzed. They consist of 3 to 9 carbon atoms.	<u>Definition:</u> The carbohydrates which give 2 to 9 units of monosaccharide on hydrolysis are called oligosaccharides.
<u>Classification:</u> They are classified according to the number of carbon atoms in their molecules as trioses, tetroses, pentoses, hexoses, and so on.	<u>Classification:</u> They are classified as disaccharides, trisaccharides, tetrasaccharides, etc. depending upon the number of units they produce on hydrolysis.
<u>Examples:</u> <ul style="list-style-type: none"> • Glucose • Fructose 	<u>Examples:</u> <ul style="list-style-type: none"> • Sucrose • Lactose

Q. 3 Differentiation between fat soluble and water soluble vitamins.**Ans:** **DIFFERENTIATION**

The differences between fat soluble vitamins and water soluble vitamins are as follows:

Fat Soluble Vitamins	Water Soluble Vitamins
<u>Definition:</u> <ul style="list-style-type: none"> The vitamins which dissolve in fats are called fat soluble vitamins. 	<u>Definition:</u> <ul style="list-style-type: none"> The vitamins that dissolve in water are called water soluble vitamins.
<u>Examples:</u> <ul style="list-style-type: none"> Vitamin A Vitamin D Vitamin E Vitamin K 	<u>Examples:</u> <ul style="list-style-type: none"> Vitamin B-complexes Vitamin C (Ascorbic acid).

Q. 4 What is meant by denaturation of proteins?**Ans:** **DENATURATION OF PROTEINS***"Denaturing of protein means precipitation or coagulation of protein."***Method:**

It can be carried out by heating or changing pH.

Example:

A simple common method for denaturing of protein is boiling of an egg. White viscous fluid (albumen) present in an egg is protein. When egg is boiled for a few minutes, albumen coagulates i.e., solidifies.

Q. 5 How can you distinguish between DNA and RNA?**Ans:** **DIFFERENCE**

DNA	RNA
<u>Definition:</u> The type of nucleic acid which contains deoxyribose sugar in its nucleotides is called DNA.	<u>Definition:</u> The type of nucleic acid which contains ribose sugar in its nucleotides is called RNA.
<u>Structure:</u> It is a double stranded molecule	<u>Structure:</u> It is a single stranded molecule.
<u>Function:</u> DNA is the permanent storage place for genetic information in the nucleus of a cell.	<u>Function:</u> RNA is responsible for putting the genetic information to work in the cell to build proteins.

Q. 6 How esters are formed?**Ans:** Fatty acids formed esters (oil or fats) with glycerol in the presence of mineral acids.

TERMS TO KNOW

Terms	Definitions
Biochemistry	The branch of chemistry that deals with the study of structure, composition, and chemical reactions of substances found in living organisms is called biochemistry.
Carbohydrates	Carbohydrates are macromolecules defined as polyhydroxy aldehydes or ketones.
Monosaccharides	Monosaccharides are the simplest sugars which cannot be hydrolyzed. They consist of 3 to 9 carbon atoms.
Polysaccharides	The carbohydrates which give a large number of monosaccharides on hydrolysis are called polysaccharides.
Dextrose	Dextrose is crystallized glucose (natural sugar found in starchy foods). It provides simple carbohydrates to the body that can be easily broken down and processed.
Oligosaccharides	The carbohydrates which give 2 to 9 units of monosaccharide on hydrolysis are called oligosaccharides. OR Oligosaccharides give 2 to 9 units of monosaccharides on hydrolysis.
Proteins	Proteins are highly complicated nitrogenous compounds made up of amino acids.
Amino Acids	Amino acids are organic compounds consisting of both amino and carboxyl groups.
Essential Amino Acids	Ten out of twenty amino acids can be synthesized by human body. These amino acids are called non-essential amino acids.
Lipids	Lipids are macromolecules made up of fatty acids. Lipids include oils and fats. OR Esters of long chain carboxylic (fatty) acids with glycerol are called lipids.
Fatty Acids	Fatty acids are building blocks of lipids. They are long chain saturated and unsaturated carboxylic acids.
Fat	It exists in solid form at room temperature.
Oil	It exists in liquid form at room temperature.
Nucleic Acids	Nucleic acids are essential components of every living cell. They are generally long chain molecules made up of nucleotides.
Genetic Code of Life	Genetic Code of Life means those specific instructions which pass from generation to generation, to synthesize the particular proteins from amino acids.
Vitamins	Organic compounds essential to health that must be supplied in small amounts in the diet are called vitamins.
Fat Soluble Vitamins	The vitamins which dissolve in fats are called fat soluble vitamins.
Water Soluble Vitamins	The vitamins that dissolve in water are called water soluble vitamins.
Enzymes	The substances which are used to catalyze the reactions in living organisms are called enzymes.
Denaturation of Protein	Denaturation of protein means precipitation or coagulation of protein.



CUT HERE

SELF TEST**Time: 35 Minutes****Marks: 25****Q.1 Four possible answers (A), (B), (C) and (D) to each question are given, mark the correct answer. (6×1=6)****1. Which one is found in sugar?**

- (A) Sucrose (B) Lactose
(C) Maltose (D) Starch

2. One gram carbohydrate provides energy:

- (A) 17 KJ (B) 18 KJ
(C) 21 KJ (D) 30 KJ

3. Lipids include oils and:

- (A) Acids (B) Fats
(C) Fatty Acids (D) Bases

4. In industry, margarine is produced by adding:

- (A) Nitrogen (B) Oxygen
(C) Carbon (D) Hydrogen

5. It is caused by damage to DNA:

- (A) Hepatitis (B) Tetanus
(C) Cancer (D) Headache

6. These are fat soluble vitamins:

- (A) A, D (B) C, D
(C) D, B (D) B, C

Q.2 Give short answers to the following questions.**(5×2=10)**

- (i) Differentiate between glucose and fructose.
(ii) Define polysaccharides?
(iii) Give general formula of lipids
(iv) What is hydrogenation of vegetable oil?
(v) Why RNA acts like a messenger?

Q.3 Answer the following questions in detail.**(5+4=9)**

- (i) What are Carbohydrates? How monosaccharides are prepared? (5)
(ii) Define vitamins. Explain fat soluble and water soluble vitamins. (4)

NOTE: Parents or guardians can conduct this test in their supervision in order to check the skill of students.