Biology

BIOLOGY MCQ 2025

1. This is the largest phylum of Animal on the earth.

A. Mollusca B. Amphibia

C. Arthropoda D. Aves

2. Where is DNA present in the eukaryotic cells?

A. Inside the nucleus B. With other cellular contents

C. Inside the ribosomes D. Not present

3. Which of the following nitrogenous base is not present in DNA?

A. Thymine B. Adenine

C. Guanine D. Uracil

4. Which of the following is the function of lysosomes?

A. Autophagy B. Autolysis

C. Digestion D. All of the above

5. Who is known as the "Father of Genetics"?

A. Morgan B. Mendel

C. Watson D. Bateson

6. Glycolysis is the conversion of

A. Fructose into phosphoenolpyruvate B. Fructose into pyruvate

C. Glucose into phosphoenolpyruvate D. Glucose into pyruvate

7. Anticodon is present in

(a) DNA (b) tRNA

(c) rRNA (d) mRNA

8. Where is DNA present in the eukaryotic cells?

A. Inside the nucleus B. With other cellular contents

C. Inside the ribosomes D. Not present

9. **A single strand of mRNA attached to complex of ribosomes is called**

(a) Okazaki fragments (b) polymer

(c) polysome (d) polypeptide

10. The EMP pathway in eukaryotes usually takes place in

(a) nucleus (b) lysosome

(c) Golgi apparatus (d) cytosol

11. Which of the following enzyme catalyzes the first step of glycolysis?

a) Hexokinase b) Pyruvate kinase

c) Glucokinase d) Phosphofructokinase-1

12. The percentage of human genome which encodes proteins is approximately

A. Less than 2%

B. 5%

C. 25%

D. 99%

13. On the Origin of Species was written by _____

A. Charles Darwin

B. Ludmila Kuprianova

C. Mikhail

D. Fedonkin

14. Plasma membrane is

A. Permeable

B. Selectively permeable

C. Impermeable

D.Semi-permeable

15. Where is DNA present in the eukaryotic cells?

A. Inside the nucleus B. With other cellular contents

C. Inside the ribosomes D. Not present

16. **Book lungs are respiratory organs in**

A. Insects B. Aarachnids

C. Molluscans D. Echinoderms

17. The crossing of F1 to either of the parents is known as

A. Test cross B. Back cross

C. F1 cross D. All of the above

18. **Which is the largest phylum of Animal on the earth.**

A. Mollusca B. Amphibia

C. Arthropoda D. Aves

19. ***Taenia Solium*** **is under the Phylum of**

A. Aschelminthes B. Annelids

C. platyhelminths D. Mollusca

20. Glycolysis is the conversion of

A. Fructose into phosphoenolpyruvate B. Fructose into pyruvate

C. Glucose into phosphoenolpyruvate D. Glucose into pyruvate

21. Which substrate is used in the last step of glycolysis?

A. Glyceraldehyde 3-phosphate B. Pyruvate

C. Phosphoenolpyruvate D. 1, 3-bisphosphoglycerate

22. Which of the following immunity is present from our birth?

A. Innate Immunity B. Active immunity

C. Passive immunity D. Acquired immunity

23. Which of the following cells is involved in humoral immunity?

A. T-cells B. B-cells

C. Mast cells D. Both T and B cells

24. **Anticodon is present in**

A. DNA B. tRNA

C. tRNA D. mRNA

25. **Which of the following is a flightless bird?**

A. Pigeon B. vulture

C. Parrot D. ostrich

26. Who coined the term mitochondria?

A. Kolliker B. Benda

C. Fleenming D. Robert Brown

27. Plasma membrane is

A. Permeable B. Selectively permeable

C. Impermeable D. Semi-permeable

28. The excretory organ in the cockroach is

(A) green gland (B) malpighian tubules

(C) ne phridia (D) kidney

29. The mammary are found in

(A) Aves (B)Mammalia

(C)Amphibian (D) Reptile

30. Air bladder is absent in

(A) Dog fish (B) catla

(C) Pohu (D)flying fish

31. Which of the following is the function of lysosomes?

A. Autophagy B. Autolysis

C. Digestion D. All of the above

32. Name the RNA molecules which is used to carry genetic information copied from DNA?

A. tRNA B. mRNA

C. RRNA D. snRNA

33. Glycolysis is the conversion of

A. Fructose into phosphoenolpyruvate B. Fructose into pyruvate

C. Glucose into phosphoenolpyruvate D. Glucose into pyruvate

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C. tRNA D. mRNA

35. Which of the following purine bases is present in RNA?

(a) Uracil (b) Thymine

(c) Cytosine (d) Guanine

36. Which of the following RNAs are the most abundant in an animal cell?

(a) mRNA (b) tRNA

(c) miRNA (d) rRNA

37. In DNA, the enzyme which breaks the H_2 bonds is

(a) Ligase (b) Helicase

(c) Topoisomerase (d) Polymerase

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c) Phosphoenolpyruvate d) 1, 3-bisphosphoglycerate

39. Name the RNA molecules which is used to carry genetic information copied from DNA?

A. tRNA B. mRNA

C. RRNA D. snRNA

40. The jawless vertebrate is

A. Crocodile B. zoris

C. *Hyla* D. *Petromyzon*

41. Phylum of *Taenia Solium* is

A. Aschelminthes B. Annelids

C. platyhelminths D. Mollusca

42. On the Origin of Species was written by _____

A. Charles Darwin B. Ludmila Kuprianova

C. Mikhail A. Fedonkin D. None of the above

43. Which of these is a characteristic of prokaryotic cells?

A. Absence of cell organelles B. Absence of nucleus

C. Presence of 70S ribosomes D. All of these

44. From which structure is a mesosome derived from?

A. Plasmid B. Cell wall

C. Ribosome D. Cell membrane

45. The scaleless vertebrate is

A. Snake B. Rohu

C. Shark D. rat

46. Ctenophores, commonly known as

(A) Flat worms (B) Sea walnuts

(C) round worms (D) sponges

47. The canalsystem is a characteristic feature of

(A) Arthropods (B) Mollusca

(C)sponges (D) echinoderms

48. Which of the following is the function of lysosomes?

A. Autophagy B. Autolysis

C. Digestion D. All of the above

49. Which is cold-blooded animal

(A) horse (B)sea-horse

(C) bat (D) crane

50. Which of these is a characteristic of prokaryotic cells?

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C. Presence of 70S ribosomes D. All of these

51. **Book lungs are respiratory organs in**

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52. The percentage of human genome which encodes proteins is approximately

A.Less than 2% B. 5%

C. 25% D. 99%

2 MARKS

BIOLOGY SAQ QUESTION

1. Flame Cell

A flame cell is a specialized excretory cell found in the simplest freshwater invertebrates, including flatworms, rotifers and nemerteans; these are the simplest animals to have a dedicated excretory system. Flame cells function like a kidney, removing waste materials. Bundles of flame cells are called protonephridia.

2. Book Lung

A book lung is a type of respiration organ used for atmospheric gas exchange that is present in many arachnids, such as scorpions and spiders. Each of these organs is located inside an open ventral abdominal, air-filled cavity (atrium) and connects with the surroundings through a small opening for the purpose of respiration.

3. Pseudocoelom

The pseudocoelom is a fluid-filled body cavity lying inside the external body wall of the nematode that bathes the internal organs, including the alimentary system and the reproductive system. It is a false body cavity such as a nematode. It is also known as the second body cavity.

4. Nephridia

The nephridium (plural *nephridia*) is an invertebrate organ, found in pairs and performing a function similar to the vertebrate kidneys (which originated from the chordate nephridia). Nephridia remove metabolic wastes from an animal's body. Nephridia come in two basic categories: metanephridia and protonephridia. All nephridia- and kidney- having animals belong to the clade Nephrozoa.

5. Characteristics Of Phylum Chordata

Phylum Chordata possesses the following characteristic features:

a. Notochord
b. Dorsal Nerve Cord
c. Pharyngeal Slits
d. Post anal Tail
e. Bilaterally symmetrical, triploblastic, coelomic and segmented body.
f. The body design is complex and well-differentiated.
g. The body has an organ system level of organization.

6. Mollusca Characteristics

a. The organisms belonging to phylum Mollusca exhibit the following characteristics:
b. They are mostly found in marine and freshwater. Very few are terrestrial and found in moist soil.
c. They exhibit organ system level of organization.
d. Their body has a cavity.
e. The body is divided into head, visceral mass, muscular foot and mantle.

7. Osculum

The osculum (plural "oscula") is an excretory structure in the living sponge, a large opening to the outside through which the current of water exits after passing through the spongocoel. Wastes diffuse into the water and the water is pumped through the osculum carrying away with it the sponge's wastes.

8. Characteristics of Reptilia

a. These are creeping and burrowing terrestrial animals with scales on their body.
b. They are cold-blooded animals found in most of the warmer regions of the world.
c. Their skin is dry, and rough, without any glands.
d. The heart is 3 chambered. However, crocodiles have a 4-chambered heart.
e. The nervous system comprises 12 pairs of cranial nerves.
f. Reptiles do not have external ear openings. Tympanum represents ear

9. Protostomia

Protostomia is the clade of animals once thought to be characterized by the formation of the organism's mouth before its anus during embryonic development. This nature has since been discovered to be extremely variable among Protostomia's members, although the reverse is typically true of its sister clade, Deuterostomia. Well known examples of protostomes are nematodes, arthropods, flatworms, annelids and molluscs.

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11. EMP Pathway

EMP pathway is the other name of glycolysis. It is named after the three scientists Gustav Embden, Otto Meyerhof, and J. Parnas, who gave the scheme of glycolysis. It is the pathway of glucose catabolism. It occurs in the cytoplasm of all living cells, aerobic as well as anaerobic. EMP pathway or glycolysis is the primary step of cellular respiration. Glucose is partially oxidised to pyruvate in this process. In aerobic organisms, it is followed by the Krebs cycle for the complete oxidation of glucose to CO2 and water. In anaerobic organisms, glycolysis is followed by fermentation.

12.Krebs cycle

The citric acid cycle (CAC) – also known as the TCA cycle (tricarboxylic acid cycle) or the Krebs cycle – is a series of chemical reactions to release stored energy through the oxidation of acetyl-CoA derived from carbohydrates, fats, and proteins. The Krebs cycle is used by organisms that respire (as opposed to organisms that ferment) to generate energy, either by anaerobic respiration or aerobic respiration.

13.Chromosome

A chromosome is a long DNA molecule with part or all of the genetic material of an organism. Most eukaryotic chromosomes include packaging proteins called histones which, aided by chaperone proteins, bind to and condense the DNA molecule to maintain its integrity.These chromosomes display a complex three-dimensional structure, which plays a significant role in transcriptional regulation.

14.Nucleotide

Nucleotides are organic molecules consisting of a nucleoside and a phosphate. They serve as monomeric units of the nucleic acid polymers – deoxyribonucleic acid (DNA) and ribonucleic acid (RNA), both of which are essential biomolecules within all life-forms on Earth. Nucleotides are obtained in the diet and are also synthesized from common nutrients by the liver.

15.Nucleosides

Nucleosides are glycosylamines that can be thought of as nucleotides without a phosphate group. A nucleoside consists simply of a nucleobase (also termed a nitrogenous base) and a five-carbon sugar (ribose or 2'-deoxyribose) whereas a nucleotide is composed of a nucleobase, a five-carbon sugar, and one or more phosphate groups.

16.Gene

A gene (from genos (Greek) meaning generation or birth or gender) is a basic unit of heredity and a sequence of nucleotides in DNA that encodes the synthesis of a gene product, either RNA or protein.

During gene expression, the DNA is first copied into RNA. The RNA can be directly functional or be the intermediate template for a protein that performs a function. The transmission of genes to an organism's offspring is the basis of the inheritance of phenotypic traits.

17.Allele

The term allele (modern formation from Greek"other") denotes the variant of a given gene. In genetics it is normal for genes to show deviations or diversity – all alleles together make up the set of genetic information that defines a gene. For example, the ABO blood grouping is controlled by the ABO gene, which has six common variants (alleles). In population genetics nearly every living human's phenotype for the ABO gene is some combination of just these six alleles.

18.Cistron

A cistron is an alternative term for "gene".The word cistron is used to emphasize that genes exhibit a specific behavior in a cis-trans test; distinct positions (or loci) within a genome are cistronic.

19.Transcription

Transcription is the process of copying a segment of DNA into RNA. The segments of DNA transcribed into RNA molecules that can encode proteins are said to produce messenger RNA (mRNA). Other segments of DNA are copied into RNA molecules called non-coding RNAs (ncRNAs). Averaged over multiple cell types in a given tissue, the quantity of mRNA is more than 10 times the quantity of ncRNA (though in particular single cell types ncRNAs may exceed mRNAs).

20.Central Dogma

In molecular biology, central dogma illustrates the flow of genetic information from DNA to RNA to protein. It is defined as a process in which the information in DNA is converted into a functional product. It is suggested that the information present in a DNA is essential to make up all proteins and RNA acts as a messenger that carries information through the ribosomes.

21.tRNA

Transfer RNA (abbreviated tRNA and formerly referred to as sRNA, for soluble RNA) is an adaptor molecule composed of RNA, typically 76 to 90 nucleotides in length (in eukaryotes), that serves as the physical link between the mRNA and the amino acid sequence of proteins. Transfer RNA (tRNA) does this by carrying an amino acid to the protein synthesizing machinery of a cell called the ribosome. Complementation of a 3-nucleotide codon in a messenger RNA (mRNA) by a 3-nucleotide anticodon of the tRNA results in protein synthesis based on the mRNA code. As such, tRNAs are a necessary component of translation, the biological synthesis of new proteins in accordance with the genetic code.

22.Stop Codon

In molecular biology (specifically protein biosynthesis), a stop codon (or termination codon) is a codon (nucleotide triplet within messenger RNA) that signals the termination of the translation process of the current protein.[1] Most codons in messenger RNA correspond to the addition of an amino acid to a growing polypeptide chain, which may ultimately become a protein; stop codons signal the termination of this process by binding release factors, which cause the ribosomal subunits to disassociate, releasing the amino acid chain.

23.Codon

The genetic code is the set of rules used by living cells to translate information encoded within genetic material (DNA or mRNA sequences of nucleotide triplets, or codons) into proteins. Translation is accomplished by the ribosome, which links proteinogenic amino acids in an order specified by messenger RNA (mRNA), using transfer RNA

(tRNA) molecules to carry amino acids and to read the mRNA three nucleotides at a time. The genetic code is highly similar among all organisms and can be expressed in a simple table with 64 entries.

24.Exon

An exon is any part of a gene that will form a part of the final mature RNA produced by that gene after introns have been removed by RNA splicing. The term exon refers to both the DNA sequence within a gene and to the corresponding sequence in RNA transcripts. In RNA splicing, introns are removed and exons are covalently joined to one another as part of generating the mature RNA. Just as the entire set of genes for a species constitutes the genome, the entire set of exons constitutes the exome.

25.Amino acids

Amino acids are organic compounds that contain amino[a] (−NH+3) and carboxylate −CO−2 functional groups, along with a side chain (R group) specific to each amino acid.[1] The elements present in every amino acid are carbon (C), hydrogen (H), oxygen (O), and nitrogen (N) (CHON); in addition sulfur (S) is present in the side chains of cysteine and methionine, and selenium (Se) in the less common amino acid selenocysteine.

26.Difference between innate and adaptive immunity

Innate immunity is the body's first line of defence against pathogens. It is general and non-specific, which means it does not differentiate between types of pathogens. Adaptive immunity is a type of immunity that is built up as we are exposed to diseases or get vaccinated. It is also called acquired immunity for that reason.

27.T cell

A T cell is a type of lymphocyte. T cells are one of the important white blood cells of the immune system and play a central role in the adaptive immune response. T cells can be distinguished from other lymphocytes by the presence of a T-cell receptor (TCR) on their cell surface.T cells are born from hematopoietic stem cells, found in the bone marrow. Developing T cells then migrate to the thymus gland to develop (or mature).

28.Antigen

In immunology, an antigen (Ag) is a molecule or molecular structure or any foreign particulate matter or a pollen grain that can bind to a specific antibody or T-cell receptor.The presence of antigens in the body may trigger an immune response. The term antigen originally referred to a substance that is an antibody generator. Antigens can be proteins, peptides (amino acid chains), polysaccharides (chains of monosaccharides/simple sugars), lipids, or nucleic acids.

29.Antibody

An antibody (Ab), also known as an immunoglobulin (Ig), is a large, Y-shaped protein used by the immune system to identify and neutralize foreign objects such as pathogenic bacteria and viruses. The antibody recognizes a unique molecule of the pathogen, called an antigen. Each tip of the "Y" of an antibody contains a paratope (analogous to a lock) that is specific for one particular epitope (analogous to a key) on an antigen, allowing these two structures to bind together with precision.

30.Cristae

A crista (plural cristae) is a fold in the inner membrane of a mitochondrion. The name is from the Latin for *crest* or *plume*, and it gives the inner membrane its characteristic wrinkled shape, providing a large amount of surface area for chemical reactions to occur on. This aids aerobic cellular respiration, because the mitochondrion requires oxygen. Cristae are studded with proteins, including ATP synthase and a variety of cytochromes.

31.Humoral immunity

Humoral immunity is the aspect of immunity that is mediated by macromolecules - including secreted antibodies, complement proteins, and certain antimicrobial peptides - located in extracellular fluids. Humoral immunity is named so because it involves substances found in the humors, or body fluids. It contrasts with cell-mediated immunity. Humoral immunity is also referred to as antibody-mediated immunity.

32.Natural killer cells

Natural killer cells, also known as NK cells or large granular lymphocytes (LGL), are a type of cytotoxic lymphocyte critical to the innate immune system that belong to the rapidly expanding family of innate lymphoid cells (ILC) and represent 5–20% of all circulating lymphocytes in humans.[1] The role of NK cells is analogous to that of cytotoxic T cells in the vertebrate adaptive immune response. NK cells provide rapid responses to virus-infected cell and other intracellular pathogens acting at around 3 days after infection, and respond to tumor formation.

33.Nucleosome

A nucleosome is the basic structural unit of DNA packaging in eukaryotes. The structure of a nucleosome consists of a segment of DNA wound around eight histone proteins[1] and resembles thread wrapped around a spool. The nucleosome is the fundamental subunit of chromatin. Each nucleosome is composed of a little less than two turns of DNA wrapped around a set of eight proteins called histones, which are known as a histone octamer. Each histone octamer is composed of two copies each of the histone proteins H2A, H2B, H3, and H4.

34.Oxysomes

Oxysomes are the structures which are present on the surface of the folded Inner Membrane of the Mitochondria. They are also called f0-f1 particles or ATP synthase. They play the most important role in the formation of energy for the functioning of the cell.

35.Plasma Membrane

The cell membrane (also known as the plasma membrane (PM) or cytoplasmic membrane, and historically referred to as the plasmalemma) is a biological membrane that separates the interior of all cells from the outside environment (the extracellular space) and protects the cell from its environment.[1][2] The cell membrane consists of a lipid bilayer, made up of two layers of phospholipids with cholesterols (a lipid component) interspersed between them, maintaining appropriate membrane fluidity at various temperatures. The membrane also contains membrane proteins, including integral proteins that span the membrane and serve as membrane transporters, and peripheral proteins that loosely attach to the outer (peripheral) side of the cell membrane, acting as enzymes to facilitate interaction with the cell's environment.

5 MARKS

1. Mention the five features of class amphibia with examples.

   Ans:



✅ **1. Dual Life (Amphibious Nature)**

- Amphibians live **both in water and on land** at different stages of life.
- **Tadpoles** are aquatic with gills; adults are mostly terrestrial with lungs.
- 🔹 *Example:* **Frog (Rana tigrina)**

✅ **2. Moist, Glandular Skin Without Scales**

- Skin is **moist and slimy** due to **mucous glands**, which helps in **cutaneous respiration (breathing through the skin)**.
- Skin is also used for **protection and water absorption**.
- 🔹 *Example:* **Toad (Bufo)**

✅ **3. Cold-Blooded (Ectothermic)**

- Amphibians are **ectothermic**, meaning their body temperature varies with the environment.
- They **hibernate** or **aestivate** in extreme temperatures.
- 🔹 *Example:* **Salamander (Ambystoma)**

✅ **4. Three-Chambered Heart**

- Amphibians have a **three-chambered heart**: **two atria and one ventricle**.
- This allows for partial mixing of oxygenated and deoxygenated blood.
- 🔹 *Example:* **Newt (Triturus)**

✅ **5. External Fertilization and Metamorphosis**

- Most amphibians show **external fertilization** (in water).
- The life cycle includes **metamorphosis**, where larvae (tadpoles) develop into adults.
- 🔹 *Example:* **Tree Frog (Hyla)**

2. Difference between antibody and antigen.

Ans:

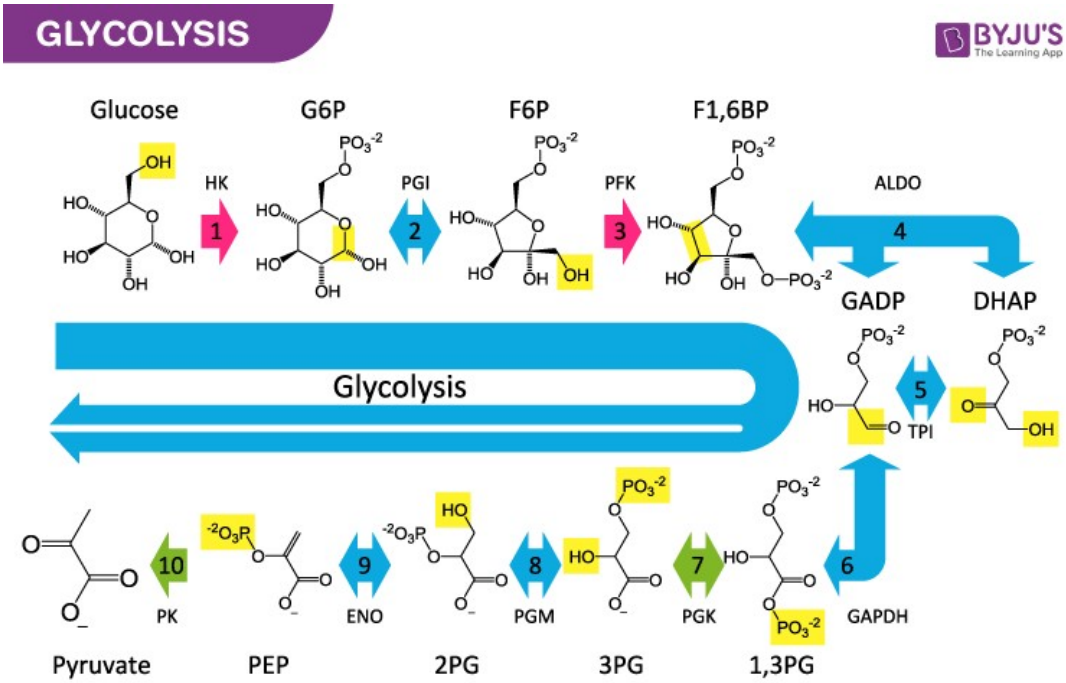
Antigen	Antibody
Any foreign material which brings about an immune response in the body is called an antigen	Glycoproteins formed in the body to fight against antigen is called an antibody.
It triggers the formation of antibodies.	It is produced against antigens.
It may be a free molecule or component of the microbial cell surface.	It is extruded from the surface of plasma cells.
The structure of the antigen is variable.	The antibody is Y-shaped.
	

3. Discuss the glycolysis process in step down way.

Ans:

"Glycolysis is the metabolic process that converts glucose into pyruvic acid."

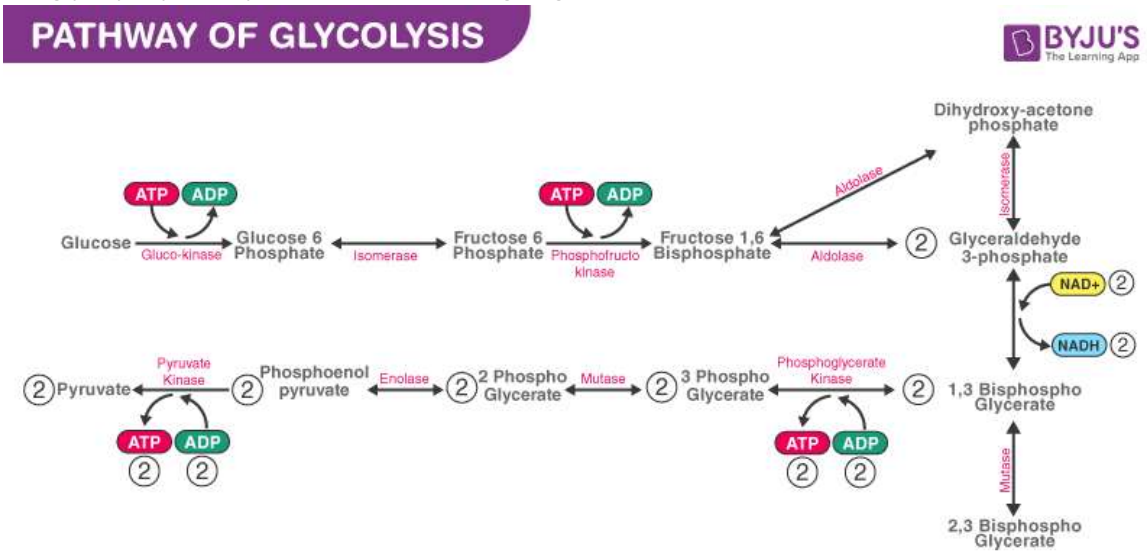
Glycolysis is the process in which glucose is broken down to produce energy. It produces two molecules of pyruvate, ATP, NADH and water. The process takes place in the cytoplasm of a cell and does not require oxygen. It occurs in both aerobic and anaerobic organisms.



Glycolysis is the primary step of cellular respiration, which occurs in all organisms. Glycolysis is followed by the Krebs cycle during aerobic respiration. In the absence of oxygen, the cells make small amounts of ATP as glycolysis is followed by fermentation.

Glycolysis Pathway

The glycolysis pathway occurs in the following stages:



Stage 1

- A phosphate group is added to glucose in the cell cytoplasm, by the action of enzyme hexokinase.
- In this, a phosphate group is transferred from ATP to glucose forming glucose,6-phosphate.

Stage 2

Glucose-6-phosphate is isomerised into fructose,6-phosphate by the enzyme phosphoglucomutase.

Stage 3

The other ATP molecule transfers a phosphate group to fructose 6-phosphate and converts it into fructose 1,6-bisphosphate by the action of the enzyme phosphofructokinase.

Stage 4

The enzyme aldolase converts fructose 1,6-bisphosphate into glyceraldehyde 3-phosphate and dihydroxyacetone phosphate, which are isomers of each other.

Step 5

Triose-phosphate isomerase converts dihydroxyacetone phosphate into glyceraldehyde 3-phosphate which is the substrate in the successive step of glycolysis.

Step 6

This step undergoes two reactions:

- The enzyme glyceraldehyde 3-phosphate dehydrogenase transfers 1 hydrogen molecule from glyceraldehyde phosphate to nicotinamide adenine dinucleotide to form NADH + H^+.
- Glyceraldehyde 3-phosphate dehydrogenase adds a phosphate to the oxidised glyceraldehyde phosphate to form 1,3-bisphosphoglycerate.

Step 7

Phosphate is transferred from 1,3-bisphosphoglycerate to ADP to form ATP with the help of phosphoglycerokinase. Thus two molecules of phosphoglycerate and ATP are obtained at the end of this reaction.

Step 8

The phosphate of both the phosphoglycerate molecules is relocated from the third to the second carbon to yield two molecules of 2-phosphoglycerate by the enzyme phosphoglyceromutase.

Step 9

The enzyme enolase removes a water molecule from 2-phosphoglycerate to form phosphoenolpyruvate.

Step 10

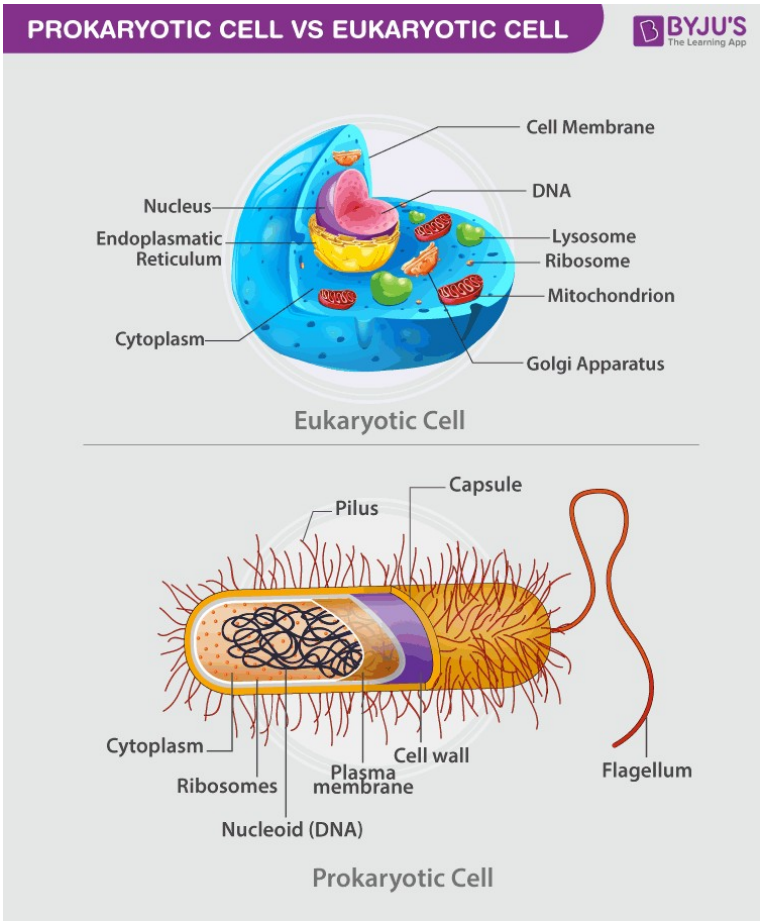
A phosphate from phosphoenolpyruvate is transferred to ADP to form pyruvate and ATP by the action of pyruvate kinase. Two molecules of pyruvate and ATP are obtained as the end products.

4. Difference between eukaryotic and procaryotic cell.

Ans:

	Prokaryotes	Eukaryotes
Type of Cell	Always unicellular	Unicellular and multi-cellular
Cell size	Ranges in size from 0.2 µm – 2.0 µm in diameter	Size ranges from 10 µm – 100 µm in diameter
Cell wall	Usually present; chemically complex in nature	When present, chemically simple in nature
Nucleus	Absent. Instead, they have a nucleoid region in the cell	Present
Ribosomes	Present. Smaller in size and spherical in shape	Present. Comparatively larger in size and linear in shape
DNA arrangement	Circular	Linear
Mitochondria	Absent	Present
Cytoplasm	Present, but cell organelles absent	Present, cell organelles present
Endoplasmic reticulum	Absent	Present
Plasmids	Present	Very rarely found in eukaryotes

Ribosome	Small ribosomes	Large ribosomes
Lysosome	Lysosomes and centrosomes are absent	Lysosomes and centrosomes are present
Cell division	Through binary fission	Through mitosis
Flagella	The flagella are smaller in size	The flagella are larger in size
Reproduction	Asexual	Both asexual and sexual
Example	Bacteria and Archaea	Plant and Animal cell

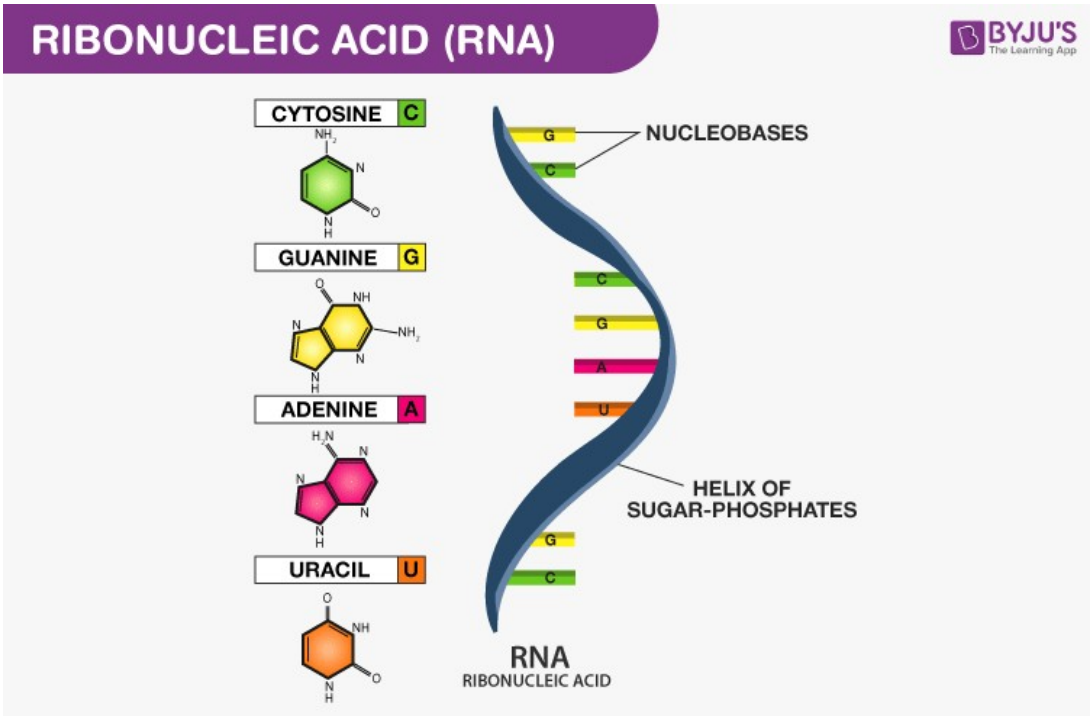


5. Short note on RNA.

Ans:

Structure of RNA

RNA is a ribonucleic acid that helps in the synthesis of proteins in our body. This nucleic acid is responsible for the production of new cells in the human body. It is usually obtained from the DNA molecule. RNA resembles the same as that of DNA, the only difference being that it has a single strand unlike the DNA which has two strands and it consists of an only single ribose sugar molecule in it. Hence is the name Ribonucleic acid. RNA is also referred to as an enzyme as it helps in the process of chemical reactions in the body.



Basic Structure of RNA

The basic structure of RNA is shown in the figure below-

The ribonucleic acid has all the components same to that of the DNA with only 2 main differences within it. RNA has the same nitrogen bases called the adenine, Guanine, Cytosine as that of the DNA except for the Thymine which is replaced by the uracil. Adenine and uracil are considered as the major building blocks of RNA and both of them form base-pair with the help of 2 hydrogen bonds.

RNA resembles a hairpin structure and like the nucleotides in DNA, nucleotides are formed in this ribonucleic material(RNA). Nucleosides are nothing but the phosphate groups which sometimes also helps in the production of nucleotides in the DNA.

Functions of RNA

The ribonucleic acid – RNA, which are mainly composed of nucleic acids, are involved in a variety of functions within the cell and are found in all living organisms including bacteria, viruses, plants, and animals. These nucleic acid functions as a structural molecule in cell organelles and are also involved in the catalysis of biochemical reactions. The different types of RNA are involved in various cellular process. The primary functions of RNA:

- Facilitate the translation of DNA into proteins
- Functions as an adapter molecule in protein synthesis
- Serves as a messenger between the DNA and the ribosomes.
- They are the carrier of genetic information in all living cells
- Promotes the ribosomes to choose the right amino acid which is required in building up of new proteins in the body.

RNA Types

There are various types of RNA, out which most well-known and most commonly studied in the human body are :

- tRNA – Transfer RNA

  The transfer RNA is held responsible for choosing the correct protein or the amino acids required by the body in-turn helping the ribosomes. It is located at the endpoints of each amino acid. This is also called as soluble RNA and it forms a link between the messenger RNA and the amino acid.
- rRNA-Ribosomal RNA

  The rRNA is the component of the ribosome and are located within the in the cytoplasm of a cell, where ribosomes are found. In all living cells, the ribosomal RNA plays a fundamental role in the synthesis and translation of mRNA into proteins. The rRNA is mainly composed of cellular RNA and are the most predominant RNA within the cells of all living beings.
- mRNA – Messenger RNA.

  This type of RNA functions by transferring the genetic material into the ribosomes and pass the instructions about the type of proteins, required by the body cells. Based on the functions, these types of RNA is called the messenger RNA. Therefore, the mRNA plays a vital role in the process of transcription or during the protein synthesis process.

6. Define Coelom , differentiate between coelom and pseudocoelom. Mention two characters of annelida.

Ans:

Coelom Definition-

"The coelom is the fluid-filled body cavity present between the alimentary canal and the body wall."

Feature	Coelom (True Coelom)	Pseudocoelom (False Coelom)
Definition	A fluid-filled body cavity **completely lined by mesoderm**	A body cavity **partially lined by mesoderm**
Mesoderm Lining	Both **inner and outer walls** of the cavity are lined	Only **outer side** of the cavity is lined with mesoderm
Organ Suspension	Organs are **suspended** and held in place by mesoderm	Organs are **loosely held** in the cavity
Body Structure	More **complex and organized**	Less complex, **less organized**
Examples	Earthworm, Humans, Insects (**Annelida, Chordata**)	Roundworms (**Nematoda**)

✅ **1. Segmented Body (Metamerism)**

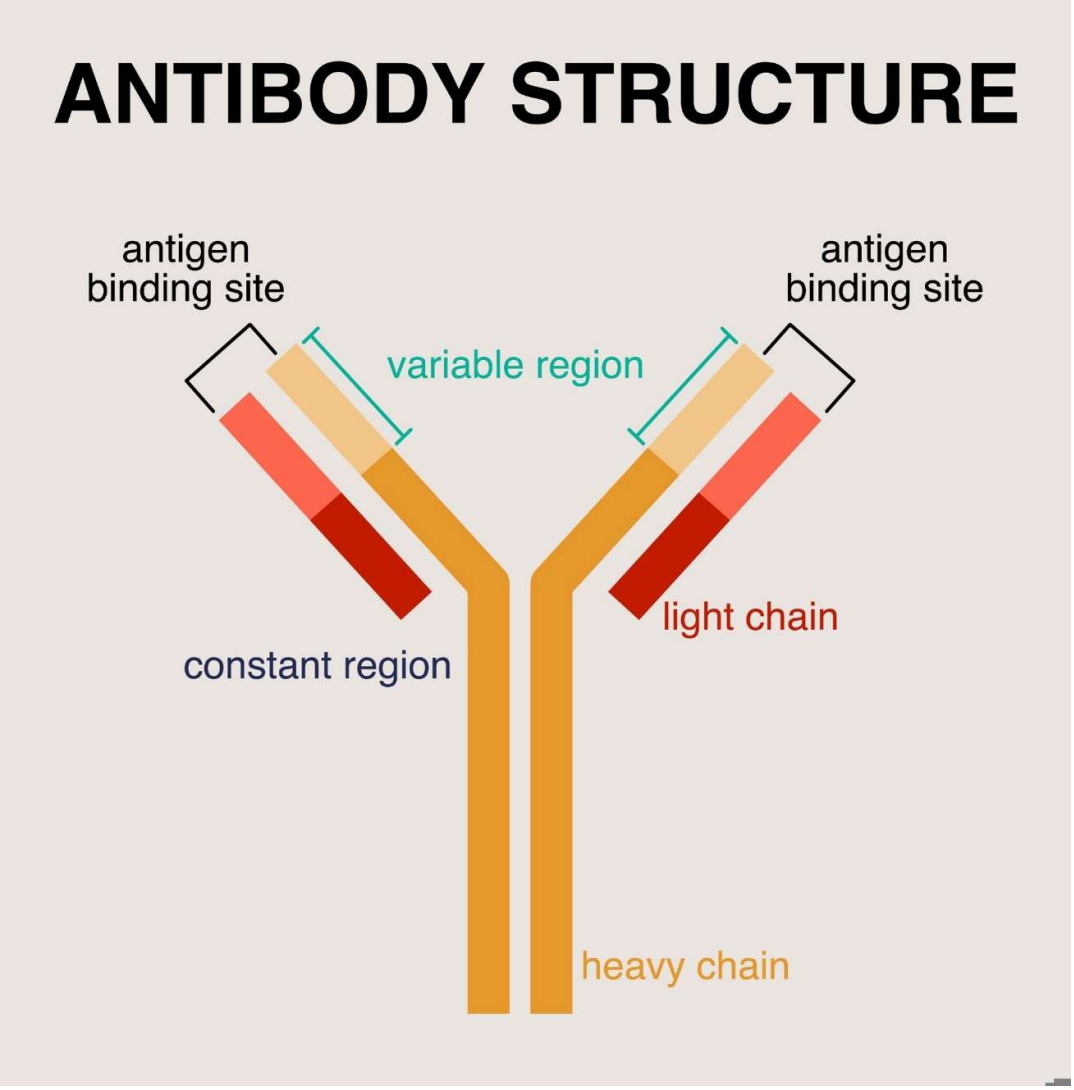
- The body is divided into **repeating segments** (called metameres), both **externally and internally**.
- This segmentation helps in **movement and flexibility**.
- 🔹 *Example:* Earthworm

✅ **2. True Coelom (Coelomate)**

- Annelids have a **true coelom**, meaning the body cavity is **completely lined with mesoderm**.
- This allows for well-developed **organ systems** and **circulation**.

7. Describe the Structure of antibody with diagram.

Ans:



💉 **Structure of Antibody**

An antibody is a **Y-shaped protein** made up of **four polypeptide chains**:

🔸 **1. Heavy Chains (2)**

- Shown in **orange**.
- These are **longer** polypeptide chains.
- Each antibody has **two identical heavy chains**.
- They form the **main structure** and base of the "Y".

🔸 **2. Light Chains (2)**

- Shown in **red**.
- These are **shorter** and are located on the outer arms of the Y.
- Each antibody has **two identical light chains**.

🌐 **Regions of the Antibody**

🔹 **1. Variable Region**

- Marked in **aqua blue** in the diagram.
- Found at the **tips** of the Y arms.
- **Differs** in each antibody to recognize specific **antigens**.
- Responsible for **binding to antigens**.

🔹 **2. Constant Region**

- Shown in **dark blue**.
- This part is the **same** in all antibodies of the same class.
- Determines the **class** and **function** of the antibody (e.g., IgG, IgA, etc.).

🎯 **Antigen Binding Site**

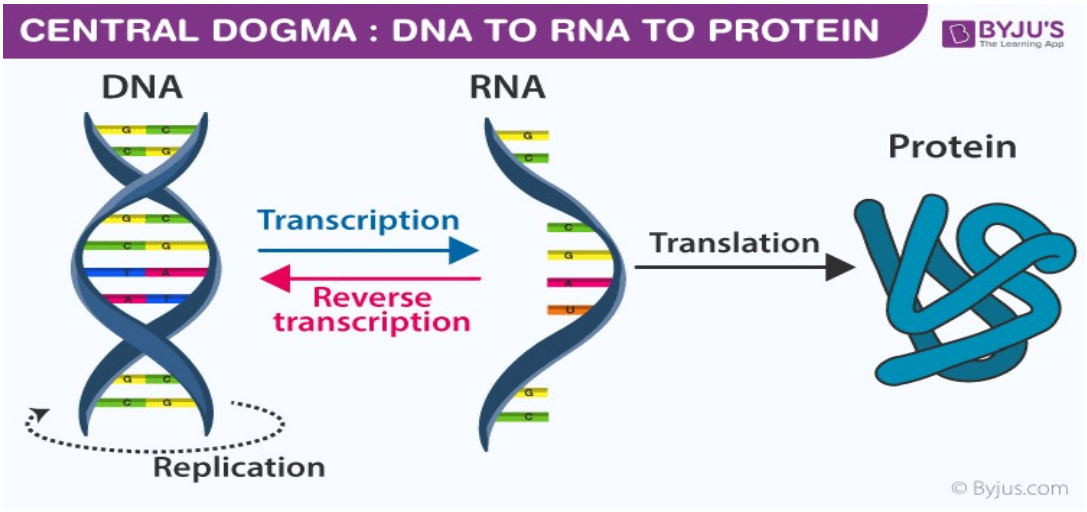
- Shown as black brackets at the **ends of the arms**.
- Formed by the **variable regions** of one heavy and one light chain.
- This is the specific site that binds to a **foreign antigen** (e.g., virus, bacteria).

8. Short note on central dogma.

Ans:

Central Dogma Definition

"Central dogma is the process in which the genetic information flows from DNA to RNA, to make a functional product protein."



The central dogma illustrates the flow of genetic information in cells, the DNA replication, and coding for the RNA through the transcription process and further RNA codes for the proteins by translation.
The concept of a sequence of interaction can be understood through the framework. The most common includes biopolymers. The major category of biopolymers include Proteins, RNA and DNA that are further divided into general transfers, unknown transfers, and special transfers.
Special transfers occur in an exceptional case in the laboratory. General transfer occurs in almost all cells. It describes the regular flow of information through transcription and translation. Unknown transfers are said never to occur.

9. Differentiate between chordata and non-chordata. Mention two features of arthropoda.

Ans:

Chordates	Non-chordates
The chordates are bilaterally symmetrical.	The body of non-chordates can be radial, cylindrical, bi-radial.
Notochord is present at some stage in its life.	Notochord is absent in non-chordates.
Chordates respire through gills or lungs.	Non-chordates take respire through their body surface, gills or trachea.
There is a post-anal-tail at some stage in the life cycle of chordates.	Non-chordates do not have a post-anal-tail.
The pharyngeal gill slits occur in the early embryonic stages or adult stage.	Pharyngeal gill slits do not occur in non-chordates.
Chordates possess endoskeleton and exoskeleton.	Non-chordates only have an exoskeleton.

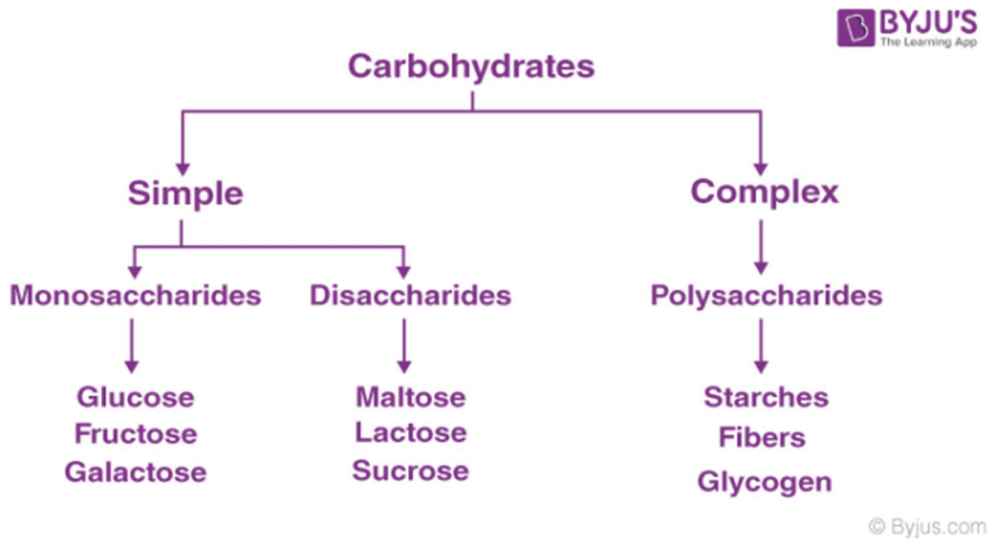
The arthropoda characteristics are mentioned below:

1. The body is triploblastic, segmented, and bilaterally symmetrical.
2. They exhibit organ system level of organization.

10 MARKS

1. Describe different types of carbohydrates.

Ans:



Types of Carbohydrates

Carbohydrates are organic compounds composed of **carbon (C), hydrogen (H), and oxygen (O)**, typically in the ratio $\mathbf{C_n(H_2O)_n}$. They are a major source of energy for living organisms and are classified into three main types based on their structure and complexity:

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1. Monosaccharides (Simple Sugars)

These are the **simplest** form of carbohydrates that **cannot be hydrolyzed** into smaller units.

- **Structure**: Single sugar unit
- **Solubility**: Soluble in water
- **Sweetness**: Sweet in taste
- **Examples**:
    - Glucose (grape sugar)
    - Fructose (fruit sugar)
    - Galactose

◆ **Importance:**

- Glucose is the **primary energy source** for cells.
- Fructose is the **sweetest natural sugar**.
-

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2. Disaccharides

Formed by the **condensation of two monosaccharides**, with the elimination of one water molecule.

- **Structure**: Two sugar units joined by a **glycosidic bond**
- **Solubility**: Soluble and sweet
- **Examples**:
    - Sucrose = Glucose + Fructose (table sugar)
    - Lactose = Glucose + Galactose (milk sugar)
    - Maltose = Glucose + Glucose

◆ **Importance:**

- Common in human diet.
- Lactose is important in milk digestion.

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3. Oligosaccharides

Contain **3 to 10 monosaccharide units** linked by glycosidic bonds.

- **Less common** in diet
- Found in: legumes, onions, bananas
- Examples: Raffinose, Stachyose

◆ **Importance:**

- Prebiotics: Promote growth of healthy gut bacteria.

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4. Polysaccharides (Complex Carbohydrates)

These are **large, complex molecules** formed by **many monosaccharides** (hundreds to thousands).

- **Structure**: Long chains, branched or unbranched
- **Taste**: Not sweet
- **Examples**:
    - **Starch** – Storage form in plants (e.g., rice, potato)
    - **Glycogen** – Storage form in animals (mainly liver, muscles)
    - **Cellulose** – Structural component of plant cell walls
    - **Chitin** – Structural component in fungal cell walls and arthropod exoskeletons

◆ **Importance:**

- Starch and glycogen are major **energy storage molecules**.
- Cellulose is important for **dietary fiber**.

2. Determine the TCA/kreb cycle with diagram.

Ans:

Introduction:

The Krebs cycle or TCA cycle (tricarboxylic acid cycle) or Citric acid cycle is a series of enzyme catalysed reactions occurring in the mitochondrial matrix, where acetyl-CoA is oxidised to form carbon dioxide and coenzymes are reduced, which generate ATP in the electron transport chain.

Krebs cycle was named after Hans Krebs, who postulated the detailed cycle. He was awarded the Nobel prize in 1953 for his contribution.

It is a series of eight-step processes, where the acetyl group of acetyl-CoA is oxidised to form two molecules of CO_2 and in the process, one ATP is produced. Reduced high energy compounds, NADH and $FADH_2$ are also produced.

Two molecules of acetyl-CoA are produced from each glucose molecule so two turns of the Krebs cycle are required which yields four CO_2, six NADH, two $FADH_2$ and two ATPs.

Krebs Cycle is a part of Cellular Respiration

Cellular respiration is a catabolic reaction taking place in the cells. It is a biochemical process by which nutrients are broken down to release energy, which gets stored in the form of ATP and waste products are released. In aerobic respiration, oxygen is required.

Cellular respiration is a four-stage process. In the process, glucose is oxidised to carbon dioxide and oxygen is reduced to water. The energy released in the process is stored in the form of ATPs. 36 to 38 ATPs are formed from each glucose molecule.

The four stages are:

1. Glycolysis: Partial oxidation of a glucose molecule to form 2 molecules of pyruvate. This process takes place in the cytosol.

2. Formation of Acetyl CoA: Pyruvate formed in glycolysis enters the mitochondrial matrix. It undergoes oxidative decarboxylation to form two molecules of Acetyl CoA. The reaction is catalysed by the pyruvate dehydrogenase enzyme.

3. Krebs cycle (TCA cycle or Citric Acid Cycle): It is the common pathway for complete oxidation of carbohydrates, proteins and lipids as they are metabolised to acetyl coenzyme A or other intermediates of the cycle. The Acetyl CoA produced enters the Tricarboxylic acid cycle or Citric acid cycle. Glucose is fully oxidized in this process. The acetyl CoA combines with 4-carbon compound oxaloacetate to form 6C citrate. In this process, 2 molecules of CO_2 are released and oxaloacetate is recycled. Energy is stored in ATP and other high energy compounds like NADH and $FADH_2$.

4. Electron Transport System and Oxidative Phosphorylation: ATP is generated when electrons are transferred from the energy-rich molecules like NADH and $FADH_2$, produced in glycolysis, citric acid cycle and fatty acid oxidation to molecular O_2 by a series of electron carriers. O_2 is reduced to H_2O. It takes place in the inner membrane of mitochondria.

Krebs Cycle Steps

It is an eight-step process. Krebs cycle or TCA cycle takes place in the matrix of mitochondria under aerobic condition.

Step 1: The first step is the condensation of acetyl CoA with 4-carbon compound oxaloacetate to form 6C citrate, coenzyme A is released. The reaction is catalysed by *citrate synthase*.

Step 2: Citrate is converted to its isomer, isocitrate. The enzyme *aconitase* catalyses this reaction.

Step 3: Isocitrate undergoes dehydrogenation and decarboxylation to form 5C **α**-ketoglutarate. A molecular form of CO_2 is released. *Isocitrate dehydrogenase* catalyses the reaction. It is an NAD^+ dependent enzyme. NAD^+ is converted to NADH.

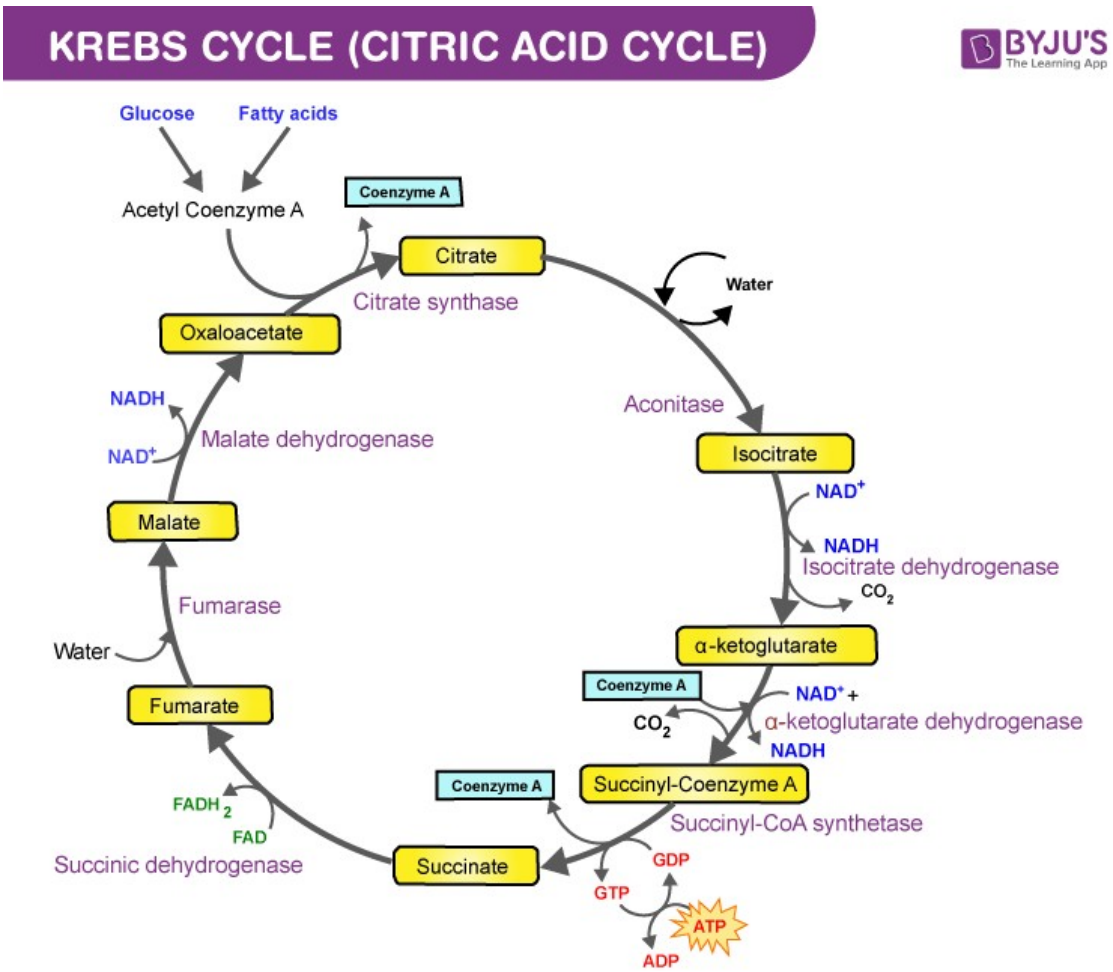
Step 4: **α**-ketoglutarate undergoes oxidative decarboxylation to form succinyl CoA, a 4C compound. The reaction is catalyzed by the ***α-ketoglutarate dehydrogenase*** enzyme complex. One molecule of CO_2 is released and NAD^+ is converted to NADH.

Step 5: Succinyl CoA forms succinate. The enzyme *succinyl CoA synthetase* catalyses the reaction. This is coupled with substrate-level phosphorylation of GDP to get GTP. GTP transfers its phosphate to ADP forming ATP.

Step 6: Succinate is oxidised by the enzyme *succinate dehydrogenase* to fumarate. In the process, FAD is converted to $FADH_2$.

Step 7: Fumarate gets converted to malate by the addition of one H_2O. The enzyme catalysing this reaction is *fumarase*.

Step 8: Malate is dehydrogenated to form oxaloacetate, which combines with another molecule of acetyl CoA and starts the new cycle. Hydrogens removed, get transferred to NAD^+ forming NADH. *Malate dehydrogenase* catalyses the reaction.

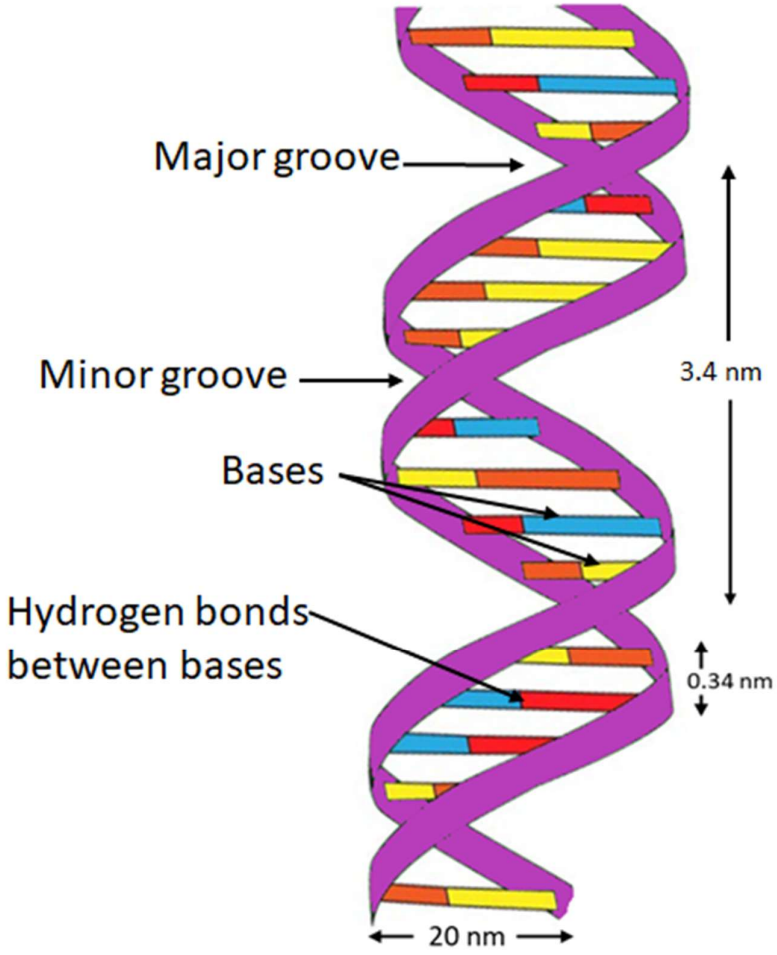


3. Define genetic code. Mention the helical structure of DNA with diagram.

Ans:

Definition of Genetic Code:

The **genetic code** is the set of rules by which the **information encoded in DNA or RNA** is translated into **proteins** by living cells. It determines how sequences of **nucleotide bases (A, T/U, G, C)** are grouped into **codons** (triplets), and how each codon corresponds to a specific **amino acid**.



🔬 **Key Features of DNA Helix:**

1. **Double Helix**:
   DNA is composed of **two strands** that wind around each other like a twisted ladder.
2. **Backbone**:
   Each strand has a **sugar-phosphate backbone** made of **deoxyribose sugar** and **phosphate groups**.
3. **Nitrogen Bases**:
   The "rungs" of the ladder are **pairs of nitrogen bases**:
   - **Adenine (A)** pairs with **Thymine (T)**
   - **Guanine (G)** pairs with **Cytosine (C)**
     These pairs are held together by **hydrogen bonds**.
4. **Antiparallel Strands**:
   The two strands run in **opposite directions** (5′ to 3′ and 3′ to 5′).

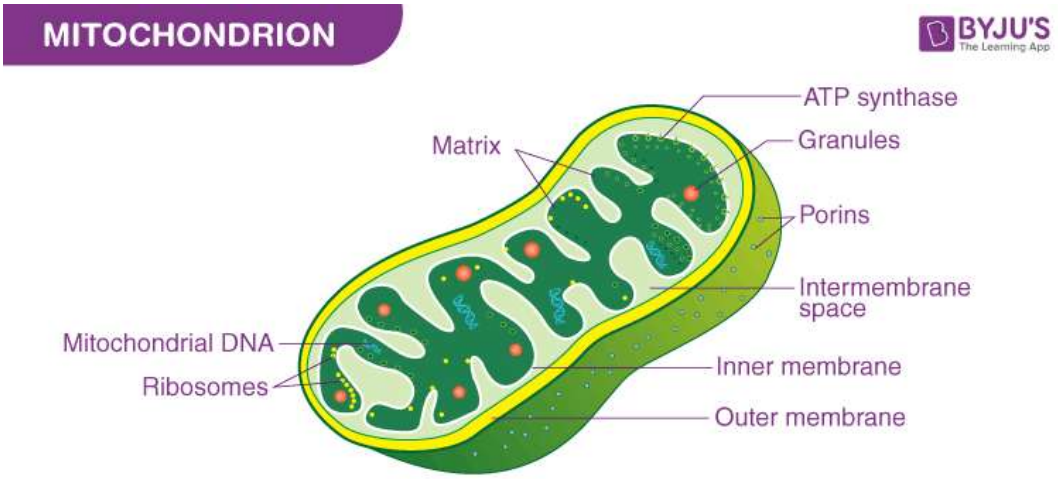
5. **Right-Handed Helix**:
   DNA typically twists in a **right-handed spiral**.
6. **Pitch and Distance**:
   - One complete turn: **10 base pairs**
   - Pitch (height of one turn): **3.4 nm**
   - Distance between base pairs: **0.34 nm**

4. Mention the Structure and function of mitochondria.

Ans:

Mitochondria Diagram

The diagram of mitochondria below illustrates several structural features of mitochondria.



Structure of Mitochondria

- The mitochondrion is a double-membraned, rod-shaped structure found in both plant and **animal cell.**
- Its size ranges from 0.5 to 1.0 micrometre in diameter.
- The structure comprises an outer membrane, an inner membrane, and a gel-like material called the matrix.
- The outer membrane and the inner membrane are made of proteins and phospholipid layers separated by the intermembrane space.
- The outer membrane covers the surface of the mitochondrion and has a large number of special proteins known as porins.

Functions of Mitochondria

The most important function of mitochondria is to produce energy through the process of oxidative phosphorylation. It is also involved in the following process:

1. **Regulates the metabolic activity of the cell**
2. **Promotes the growth of new cells and cell multiplication**
3. **Helps in detoxifying ammonia in the liver cells**
4. **Plays an important role in apoptosis or programmed cell death**
5. **Responsible for building certain parts of the blood and various hormones like testosterone and oestrogen**
6. **Helps in maintaining an adequate concentration of calcium ions within the compartments of the cell**
7. **It is also involved in various cellular activities like cellular differentiation, cell signalling, cell senescence, controlling the cell cycle and also in cell growth.**