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GSA

2nd QUARTER

Question # 1:

Describe the function of the nucleus in eukaryotic cell.

Answer:

Eukaryotic cells have a nucleus and a membrane bound organelles. Both animal and plant cell have eukaryotic cell, which means that they have a nucleus which is separated from the other organelles through nuclear membrane. Both, animal cell and plant cell being eukaryotic share several similarities and differences. **also draw the structure**

Functions of nucleus in eukaryotic cell:

(1) It houses and protects the genetic information stored in the

cell.

(2) It helps in the maturation process of RNA.

(3) It ensures the accurate DNA replication and repairs it.

(4) It regulates the gene expression and helps in coordinating various cellular processes.



Question # 2:

What are four major types of bio-molecules found in living organisms? Briefly describe the general structure and function of each type.

Answer:

Four major types of bio-molecules found in living organisms are:

(1) Carbohydrates

(2) Proteins

(3) Lipids

(4) Nucleic Acid

General Structure and Functions:

(1) Carbohydrates:

Structure: They are the organic molecules composed of oxygen, carbon and hydrogen, typically in a ratio of 1:2:1 (C:H:O)

Functions: They serve as a primary energy source for cells, e.g. glucose, structural component e.g. cellulose for plants and storage forms of energy in animals e.g. glycogen.

(2) Proteins:

Structure: Proteins are the polymers of amino acids linked by peptide bonds. Each carbon atom is linked with an amino group, a carboxyl group, a hydrogen atom and a variable R group.

Functions: They perform a wide range of functions, such as: catalyzing biochemical reactions, providing structural support, transporting molecules and defending against antibodies.

(3) Lipids

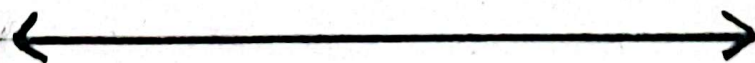
Structure: They are a diverse group of hydrophobic molecules primarily composed of carbon, hydrogen and a smaller amount of oxygen.

Functions: They serve as long term energy storage, structural components of cell membrane, signaling molecules and as a protective barriers.

(4) Nucleic Acids

Structure: Nucleic acids are the polymers of nucleotides, each consisting of a nitrogenous base, a pentose sugar and a phosphate group.

Functions: These are responsible for the storage and transferring genetic information (DNA), and plays an important role in protein synthesis (RNA).



Question # 3:

Explain the importance of

enzymes in biological process.

Answer:

Enzymes are the biological catalysts that accelerates the chemical reactions in living organisms. They are crucial for numerous cellular processes and play several important functions such as:

(1) They accelerate the biochemical reactions by lowering activation energy.

(2) They ensure specificity for substrates, leading to efficient metabolic processes.

(3) They regulate metabolic pathways for maintaining cellular homeostasis.

(4) Enzymes facilitate energy production necessary for cellular functions.

(5) They ensure accurate DNA replication and repair, preserving genetic integrity.

(6) Enzymes detoxify harmful substances and protect the organism.

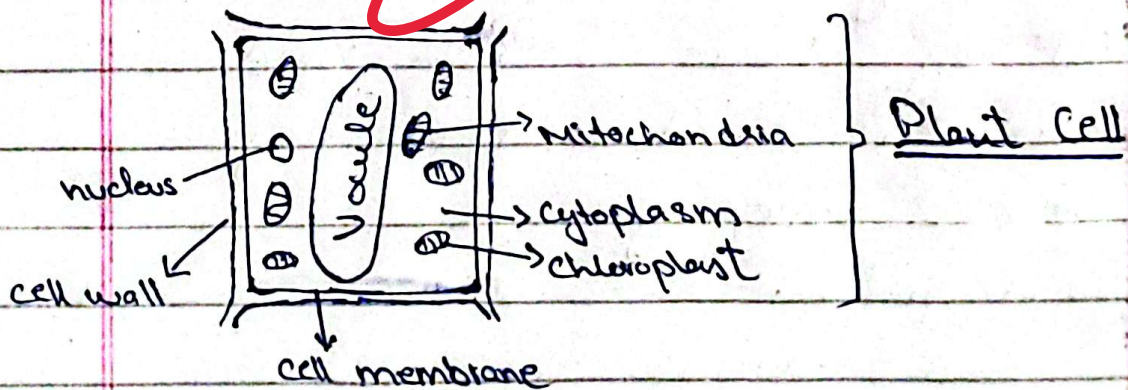
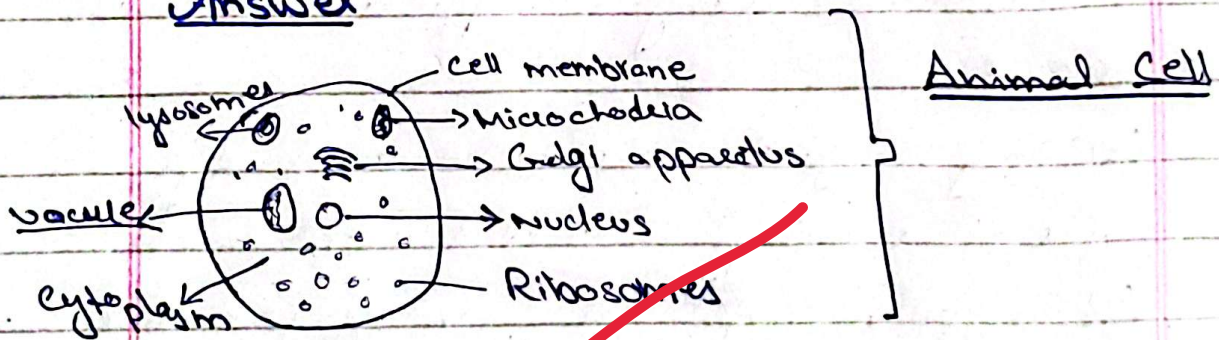
2 → Without enzymes, most biochemical reactions would take place slowly. Hence, enzymes are essential for the proper functioning of all biological systems.



Question # 4:

What are the main differences b/w plant cell and animal cell.

Answer



Animal Cell	Plant Cell
• They are circular in shape.	• They are rectangular/square in shape.
• They have cell membrane as their outermost wall.	• They have cell wall as the outermost wall.
• They are small in size, $10\mu\text{m} - 30\mu\text{m}$.	• They are large in size, $10\mu\text{m} - 100\mu\text{m}$.
• They have nucleus at the center of the cell.	• They have vacuole at the center, but nucleus on the side.
• They cannot synthesize amino acids and enzymes.	• They can synthesize amino acids, enzymes and proteins.

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Question no 5:

Briefly describe the process of cellular respiration. Why is it essential for life?

Ans: Cellular Respiration:

It is a metabolic process where cells break down glucose and oxygen to produce energy, carbon dioxide, and water.

Process of Cellular Respiration:

Cellular respiration is a multi stage process consisting of glycolysis, pyruvate oxidation, citric acid cycle, and phosphorylation that converts glucose into ATP.

1) **Glycolysis:** This takes place in cytoplasm, where glucose is broken down into two molecules of pyruvate, producing a net gain of 2 ATP molecules.

(2) **Pyruvate Oxidation:** This takes place in mitochondrial matrix where each pyruvate molecule is converted into acetyl-CoA, releasing one molecule of carbon dioxide.

(3) **Citric Acid Cycle:** This process also takes place in mitochondrial matrix, where acetyl-CoA undergoes a series of reactions that releases CO_2 and transfer electrons to NADH and FADH_2 . In this, 2 ATP molecules are produced per per glucose molecule.

(4) Oxidative Phosphorylation:

This takes place in the inner mitochondrial membrane, where NADH and FADH₂ donates electrons to the electron chain and a series of protein complexes, transfers the electrons through redox reactions. This produces almost 34 ATP molecules per one glucose molecule.

Why they are essential for life?

They are essential for life because they produce ATP, that is the primary energy source of cell. ATP provides various cellular processes like muscle contraction, nerve transmission and molecule synthesis. Without this energy production, cell would not function properly.



Question # 6:

Compare and contrast the characteristics of plants and animals, highlighting both similarities and differences.

Answer:

Both plants and animals are the fundamental groups of the living organisms. They exhibit distinct as well as some similarities.

→ Differences:

Plants

- They have a rigid cell wall around.
- They are autotrophic, produce their own food through photosynthesis.
- They are stationary and cannot move.

Animals

- They have a flexible cell membrane.
- They are heterotrophic, relying on other plants and animals for food.
- They are mobile, and keep moving in search of food, shelter and mates.

• They can reproduce through both sexually and asexually.

• They perform both cellular respiration and photosynthesis, i.e., absorbing carbon dioxide and releases oxygen.

• They lack sensory or nervous system, but respond to the environment.

They generally reproduce sexually.

They perform cellular respiration, releases carbon dioxide and inhales oxygen.

They have a nervous system to process sensory information.

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→ Similarities

- 1) Both of them are eukaryotic.
- 2) Both undergoes basic life processes.
- 3) They also processes DNA.
- 4) Both animals and plants have complex metabolic pathways.



Question # 7:

Describe the function of the digestive system in humans. What are the key organs involved in digestion and absorption?

Answer:

The human digestion system is a complex series of organs and glands that processes food. Its primary functions are to break down food into nutrients that become a source of energy for the human body.

Key functions of digestive system:

- 1) Ingestion: Taking in food and liquids.
- 2) Mechanical digestion: Physical breakdown of food through chewing.
- 3) Chemical digestion: Chemical breakdown of food through enzymes and acids, such as saliva.
- 4) Absorption: Uptake of the nutrients into the bloodstream.
- 5) Excretion: Elimination of indigestible substances and waste products.

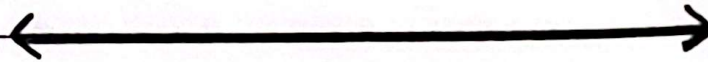
Key organs involved in Digestion and Absorption:

- 1) Mouth: This is the place where the process of digestion starts. This organ helps in chewing the food through teeth and jaws.
- 2) Salivary gland: It releases saliva, that helps in chewing the food and converting it into bolus.
- 3) Tongue: Used for the mixing of food.
- 4) Pharynx and Esophagus: These are a muscular tube, used for the transfer of bolus from mouth to the stomach.
- 5) Stomach: In stomach, further mechanical and chemical digestion process take place. It churns the food and mixes it with gastric juices to form chyme.
- 6) Small intestine: It is a major site of digestion and absorption. Bile from liver and enzymes from pancreas aids in this process.
- 7) Liver: Releases bile, which helps in the separation of fats making it easier to digest.

8) Gallbladder: It stores and concentrates bile, releasing it into the small intestine.

9) Pancreas: It produces digestive enzymes and bicarbonates and releases them into small intestine.

10) Large intestine: It is the last organ that helps in the process of absorption and digestion of food. It absorbs water and electrolytes and eliminates the waste residue through feces.



Question # 8:

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Explain the causes and symptoms of Malaria. How it spreads and what measures can be taken to prevent its transmission?

Answer:

Malaria is viral disease, that is spread by the biting of an infected female Anopheles mosquito. Through the

bite, it releases plasmodium sporozoites which is transferred to liver and causes the infection in liver cells.

Symptoms of malaria:

Here are some common symptoms of malaria:

- 1) High fever (usually more than 102°)
- 2) Feeling cold
- 3) Muscle pain
- 4) Headache
- 5) Vomiting (due to weak immune system)

Transmission of Malaria:

The transmission of malaria started with the bite of the mosquito.

It spreads plasmodium into the bloodstream that affects the liver cells and the normal functioning of body.

The parasites, through the bite multiplies themselves and affects the red blood cells.

Prevention:

- (1) Use indoor residual sprays, that keep the mosquitos away.
- (2) Wear full sleeves shirt and long trousers.
- (3) Eliminate standing water where mosquitos usually breed.
- (4) Try to clean the place with some antiseptics.
- (5) In case of any minor symptom, visit your doctor as soon as possible to tackle it before its too late.
- (6) Most importantly, educating people about malaria can help in the prevention.



Question # 9:

What are the main advantages and disadvantages of using bio-fuels? Describe a specific example of how bio fuels are produced?

Answer:

Bio-fuels are the re-nawable energy sources made from the organic material, such as plant and animal waste. They posses both; advantages and disadvantages.

Advantages of bio-fuels.

- 1) Re-nawable: They are re-nawable energy sources, usually derived from crops and animal waste.
- 2) Cheap alternative of fossil fuels: They are very economic and can easily replace fossil fuels who costs a lot.
- 3) Less emission of greenhouse gases: Being organic, they exhibit less amount of toxic gases into the atmosphere.
- 4) Energy security: They can be produced locally without having large plants.
- 6) Waste reduction: Most of the organic waste is used to produce bio-fuels, which lessens the amount of waste on ground.

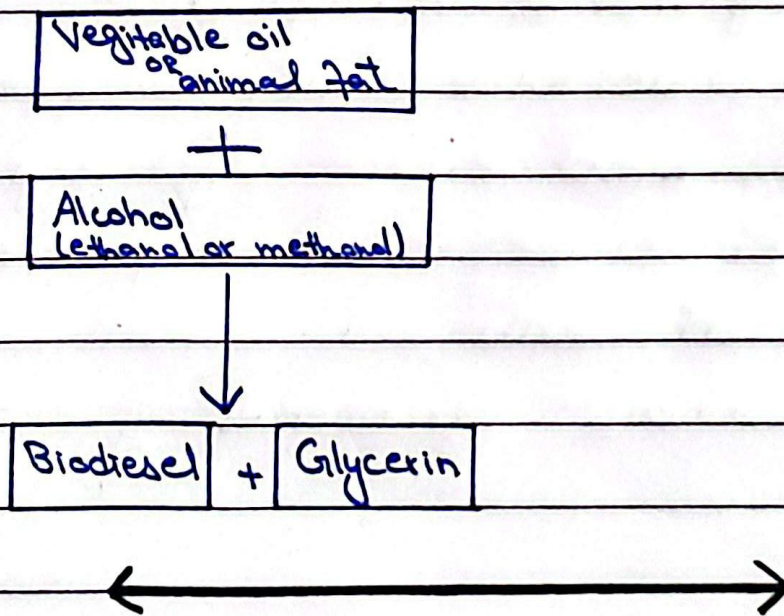
Disadvantages of bio-fuels

- (1) Use land and food security: People tend to grow more and more bio-fuel crops, resulting in less yield of crops for consumption.
- (2) Water usage: Bio-fuel crops require a lot of water for their growth. Even a large amount of water is also used in processing of bio-fuels.
- (3) Energy balance: Their process also consumes energy, from cultivation till harvesting and then in processing. Most importantly, their output is not as much efficient as they take much input.
- (4) Deforestation: A massive amount of plants have been used in this process, which resulted an imbalance situation in the environment.
- (5) Emission of pollutants: Although, they produce less greenhouse gases but still they effect the atmosphere through emitting other pollutants, such

as nitrogen oxides.

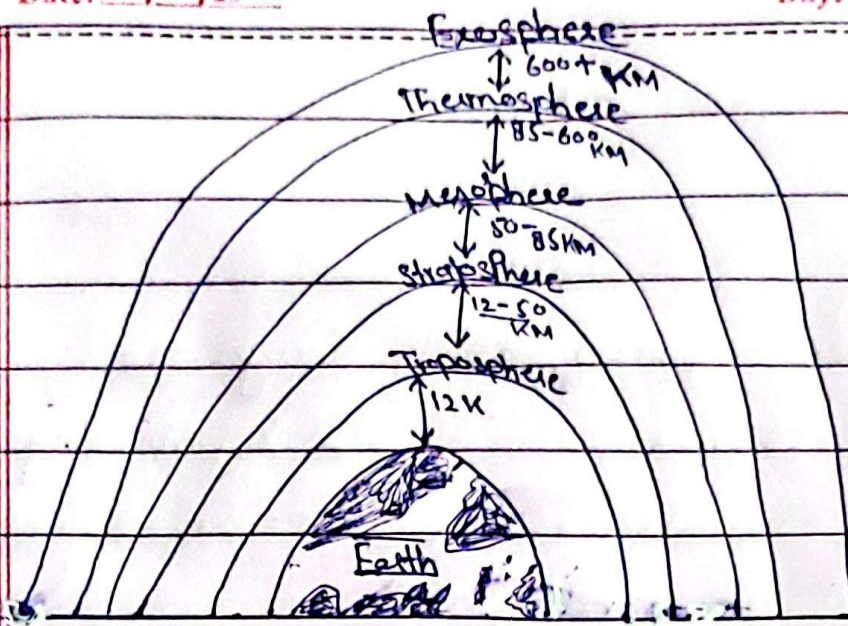
How bio-fuels are produced?

They are formed directly through the food crops or animal fats by abstracting the oil which is then proceeded further to get the end product. Let us take the example of how biodiesel is formed.



Question # 10:

Describe the layered structure of Earth's Atmosphere. Briefly explain the composition and importance of each layer.



Earth's atmosphere is layered in 5 layers. These are; Troposphere, Stratosphere, Mesosphere, Thermosphere and Exosphere. Each layer plays a crucial role in protecting the life on earth and supports various atmospheric phenomena.

Composition and Importance of each layer.

1) **Troposphere:** It is the nearest and first atmospheric layer from the surface of earth. It is extended above 12 km and holds maximum number of gases due to the gravitational pull of the earth. It solely holds almost

almost 72% of the total mass of these layers. As we go above in this layer the temperature decreases.

(2) **Stratosphere:** It is next to the troposphere. It is nearly spreaded beyond 12 km in the sky from the earth surface. It has a higher concentration of ozone (O_3). It is an important layer because it protects the earth from harmful UV (ultraviolet rays).

(3) **Mesosphere:** It is the third and next layer to stratosphere. In this layer the concentration of gases decreases as we go upward. It is also the coldest layer of the atmosphere (-90° to $-105^{\circ}C$). It protects earth from meteors.

(4) **Thermosphere:** It is the fourth and the next layer to mesosphere. It is predominately composed of oxygen and nitrogen, and also contains ionized particles. It is the layer where auroras occur. It facilitates the satellites. Temperature rises significantly, due to the absorption

of high solar energy radiation.

(i) **Exosphere:** It is the last layer of our atmosphere, composed of hydrogen and helium along with trace amount of gases. It is the outermost layer gradually transitioning into the space. It facilitates the geo-stationary satellites to orbit within the layer.



Question # 11:

Explain the process of water cycle, highlighting the major water compartments involved.

Answer:

Water cycle also known as hydrological cycle is the process of continuous movement of water on, above and below the surface of the earth. This cycle is driven by the help of solar energy.

It involves such process, such as:

1) **Evaporation:** The process of changing water into gas i.e., vapours.

(2) **Transpiration:** The release of water vapours from plants and soil into the atmosphere.

(3) **Condensation:** The process in which water vapours changes back into water due to decrease in temperature.

(4) **Infiltration:** The process by which ground water is entered into the soil.

(5) **Run off:** The movement of water, usually from the land surface towards rivers, lakes and oceans.

(6) **Sublimation:** The process by which snow and ice turns into vapours without first changing into water.

Major water Compartment:

1) **Oceans:** Oceans hold 71% total earth's surface and has the large amount of water. They are the primary reservoirs of water.

2) **Atmosphere:** Water is also present in the atmosphere in the form of water vapours. They usually become the source of rainfall.

(4) Ground water: Beneath the earth surface a good and appropriate reserve of water lies. It is also useable form of water by the humans, and for the purpose of farming.

(5) Glaciers and ice caps: They are also the source of fresh water, used by the human when they change their state i.e., from ice to liquid with the natural increase in temperature.

Water cycle is a dynamic process that continuously redistributes water across the earth, supporting all forms of life and maintaining environmental balance.



Question # 12:-

Identify and describe the sources, causes, and effects of at least three major air pollutions.

Answer:

Such substance, which when

added into the air, pollutes it and making it harmful for the consumption we know as air pollutants.

Major air pollutants:

(1) Carbon dioxide: Also a greenhouse gas.

Sources: combustion, burning of fossil fuels, woods, etc

effects: climate degradation, respiratory and cardiovascular diseases. Moreover, also effects the water bodies.

(2) Nitrogen dioxide:

Sources: combustion of fossil fuels, vehicles, power plants, fertilizers etc

effects: formation of ground level ozone, soil degradation, asthma, lungs problem etc.

(3) Sulphur Dioxide:

Sources: Volcanic eruption, geothermal activities etc.

effects: Respiratory problems, irritation

of eyes, nose, throat, sometime rashes etc.

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Question no. 13:

What is greenhouse effect?
Explain how it contributes to global warming?

Answer:

A greenhouse effect is a natural process which warms the earth's surface and that is essential for all living beings. It occurs when so-called "greenhouse gases", in the atmosphere trap heat and as a result the temperature increases. Such gases are known as greenhouse gases. These include CO_2 , NO_2 , CH_4 (methane) and water vapour (H_2O). They absorb the heat directly from the sun and warm the planet. The warmed surface again re-radiates energy back to the atmosphere in the form of infrared radiation.

How it is contributing to global warming?

There are two major contributors of the greenhouse gases that causes global warming:

- (1) Natural greenhouse phenomena
- (2) Man made activities.

1) Natural greenhouse phenomena:

When the heat energy comes from the sun to the earth, the earth re-radiates it back, but it does not go back to the space. It stays in your atmosphere and results in the form of global warming.

2) Human activities:

Human activities such as combustion of fossil fuels, deforestation, burning of woods and other industrial process, contributes vastly and results in the form of global warming.

Question # 14:

Discuss the impact of water pollution on human health and ecosystems. Give examples of major water pollutants and their sources.

Answer:

Water pollution refers to the contamination of water bodies like oceans, rivers, lakes and ground water by harmful substances. These pollutants can come from industries, agriculture, domestic waste, sewage and chemicals. They have a bad impact on human health.

Impact of water pollution on human bodies:

1) Waterborne diseases: Pathogens such as bacteria, viruses and parasites in contaminated water can cause diseases like cholera, hepatitis and giardiasis.

(2) Reproductive problems: Exposure to chemicals like pesticides and other heavy metals along with industrial

industrial waste can lead to serious health problem including cancer, neurological disorder and even reproductive problems.

3) **Blue Baby Syndrome:** High level of nitrates in the contaminated water primarily from the agricultural runoff can cause "blue baby syndrome" in infants, which reduces the ability to carry oxygen.

4) **Liver and kidney problem:** Consumption of water with heavy metals such as lead can cause serious problems to liver and kidney.

Major water pollutants and their sources.

(1) name →	Pathogens
source →	sewage discharge and animal waste
(2) name →	Nutrients
source →	agricultural runoff and industrial discharge

(3) Name →

Heavy metals

Source →

Industrial waste
and
mining operations

(4) Name →

Plastics and Microplastics

Source →

Improper disposal of waste
urban runoff and industrial
waste

(5) Name →

Sediments

Source →

construction sites
and
deforestation

Question # 15:-

Explain the concept of 'drinking water quality standards'. Why are these standards necessary?

Answer:

Water is the most essential element of this earth. Almost 71% area is composed of with water bodies. However, only 2.1% water out of this is considered to be drinkable. Which is also known as fresh water and consumable water.

Drinking water quality standards:

Not every available water is safe or recommended for drinking purpose, there are some parameters that need to be fulfilled in order to use that water for drinking purposes. There are some quality standards, that can help in understanding the standard of water:

(1) **Microbiological Standards:** limits the presence of pathogens like bacteria and viruses to prevent waterborne diseases.

(2) **Chemical Standards:** Helps in identifying the presence of heavy metals in the water such as lead, arsenic and phosphorus.

(3) **Physical Standards:** Parameters such as color, odor, taste and litmus test can help in identifying the water's quality.

Importance of quality standards:

1) They help us to stay safe from chemical diseases.

(2) They tell us the real quality of water. Either consumable or not.

(3) WHO also provides some guidelines for drinking water standards. Water ranging from 6.5-8.5 on litmus paper is good for consumption.

(4) Suppliers and regulatory agencies use these standards to ensure the quality of water.
