

SHANZAE MAZHAR-908-B

SECTION IQuestion no 3

(a)

Why cells form organelles? Discuss mitochondria in a human cell.

Why cells form organelles:

Cells are the basic building blocks of all living organisms.

Inside cells, many important activities take place, such as producing energy, making proteins, and removing waste. To perform these tasks efficiently, cells organize themselves into smaller structures called organelles.

Organelles act like tiny organs inside the cell, each with a specific role. By having organelles, cells can separate different processes so that they do not interfere with each other. This organisation makes the cell more efficient and helps it survive, grow, and reproduce.

Mitochondria:

One of the most important organelles in a human cell is mitochondria (plural: mitochondria). Mitochondria are often called the power houses of cell because they produce energy. The energy comes in the form of a molecule called (ATP) -> adenosine triphosphate, which cells need to perform all their functions, from

moving and dividing to transmitting signals in the nervous system. Structurally, mitochondria are oval or bean shaped and have two membranes.

Structure of Mitochondria:

The outer membrane covers the organelle, while the inner membrane forms finger like folding called cristae. These foldings increase the surface area, allowing mitochondria to produce more energy. Inside the mitochondria there is present liquid material called matrix, which contains enzymes, DNA, and ribosomes.

Mitochondria have their own DNA, separate from the cell's DNA, and can produce some of their own proteins.

Function of Mitochondria:

Mitochondria are involved in more than just energy production. They help regulate cell growth and death, maintain the balance of certain chemicals, and play a role in cell signaling. In human cells, tissues that need a lot of energy, like muscles and the brain, contain many mitochondria. Without properly functioning mitochondria, cells cannot produce enough energy, which can lead to diseases or cell death.

(b)

What is doping? Discuss different type of semi-conductors.

→ Doping; types

Semi-conductors

Semiconductors are special materials which allow electricity to pass through them only partly. They do not conduct as well as metals (like copper), but also do not resist completely like insulators (rubber or plastic). Instead, they fall in between. Examples are silicon, germanium, and selenium. Their conductivity can be improved if we add certain impurities to them.

1. Doping

The method of adding impurities to semiconductors to increase their conductivity is called Doping. Depending on the impurity used, semiconductors are divided into N-type and P-type semiconductors.

N-type Semiconductors.

When pentavalent elements (having 5 valence electrons), such as arsenic or antimony, are mixed into pure silicon or germanium, they form an N-type semiconductor.

Normally, pure silicon has all its electrons locked in covalent bonds, so it conducts very poorly. But when arsenic is added, four of its five outer electrons form

bonds, and the fifth electron is left free. This free electron can move and carry current. Therefore in N-type semiconductors, electrons are the majority charge carriers, and conductivity increases.

P-type Semiconductors

When trivalent elements (having 3 valence electrons), such as boron or indium, are added to silicon or germanium, a P-type semiconductor is formed. In this case, the impurity atom forms only three bonds with the neighboring silicon atoms, leaving one place empty. This empty place is called a hole. A hole behaves like a positive charge. Under applied voltage, holes can move around in the crystal and conduct electricity. Therefore, in P-type semi-conductors, holes are the majority charge carriers.

(5)

State some of the merits and demerits of volcanic eruption.

Volcanic eruption

A volcanic eruption is when magma, gases, and ash from beneath the Earth's surface are forcefully released through a volcano. This happens because

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pressure builds up inside the Earth, causing the magma to rise and escape. Volcanic eruptions can be explosive or gentle, depending on the type of volcano and magma properties.

Merits of Volcanic Eruption

1- Fertile Soil

Volcanic ash and lava break down over time to create rich soil, which is excellent for agriculture.

2- Mineral Resources

Eruptions bring valuable minerals like gold, silver and copper to the surface.

3- Geothermal Energy

Heat from volcanic areas can be used to generate electricity and provide hot water.

4- Tourism

Volcanoes attract tourists for sightseeing, hiking and studying natural phenomenon, boosting local economies.

5- Creation of New land

Lava flows can solidify and form new lands, islands, or volcanic mountains.

Demerits of Volcanic eruption

1- Loss of life and Property:

Eruptions can destroy homes, towns, and sometimes cause deaths.

2- Air Pollution:

Ash and gases like sulphur dioxide can pollute the air, causing breathing problems and climate effects.

3- Destruction of crops:

Lava and ash can cover farmland, destroying crops and affecting food supply.

4- Earthquakes and Tsunamis:

Volcanic activity can trigger earthquakes or tsunamis causing additional disasters.

5- Disruption of Transport or Communication

Ash clouds can block roads, railways, disrupting travel and communication.

(d)

What is dengue? Discuss symptomatology, causative agents and remedies.

Dengue:

Dengue is a viral disease spread to humans through the bite of infected *Aedes* mosquitos, mainly *Aedes aegypti* and *Aedes albopictus*. It is most common in tropical and subtropical regions. Dengue infections can vary in severity, ranging from mild fever to serious conditions like dengue hemorrhagic fever and dengue shock syndrome, which can be life-threatening if not treated promptly. The disease puts a high burden on public health, especially during the rainy season when mosquito populations increase.

Causative Agents:

Dengue is caused by the dengue virus, which belongs to the flaviviridae family. There are four main serotypes of the virus: DENV-1, DENV-2, DENV-3, DENV-4. Infection with one provides immunity only against that specific type. If a person is later affected with a different serotype, the risk of severe dengue increases. The virus enters the bloodstream when an infected mosquito bites a person. It then multiplies in white blood cells, triggering an immune response that causes the characteristic symptoms of the disease.

Symptomology:

Symptoms of dengue usually appear 4-10 days after the mosquito bite. The most common symptom is a sudden high fever, often reaching up to 104°F . Severe headache, particularly behind the eyes, along with joint and muscle pain, are also common. Other symptoms include nausea, vomiting, loss of appetite, and skin rashes that appear a few days after the fever begins. Some patients experience mild bleeding, such as nosebleeds, gum bleeding, or easy bruising. In severe cases, symptoms may include persistent abdominal pain, rapid breathing and fatigue, which require immediate medical attention.

Remedies:

There is no specific antiviral treatment for dengue, so care focuses on relieving symptoms and preventing complications. Staying well-hydrated is essential, as fever and vomiting can cause dehydration. Medications like paracetamol are recommended to reduce pain and fever while aspirin should be avoided due to bleeding risks. Severe cases may require hospitalization for intravenous fluids, blood transfusions, or platelet therapy. Prevention is also critical and includes controlling mosquito populations by removing standing water, using mosquito repellents and nets, and

prompting community awareness. Early diagnosis and proper care can greatly reduce complications and save lives.

Question no 4.

(a)

Write a note on plant kingdom "Chlorophyll".

Chlorophyll

Chlorophyll is a green pigment found in the chloroplasts of plant cells. It is essential for photosynthesis, the process by which plants produce their own food using sunlight, water and carbon dioxide. The presence of chlorophyll gives plants their characteristic green color and plays a vital role in capturing light energy from the sun. Without chlorophyll, plants would not be able to convert light energy into chemical energy, which is necessary for their growth and survival.

Types of Chlorophyll

There are several types of chlorophyll, but the most common in higher plants are chlorophyll a and chlorophyll b. Chlorophyll a is directly involved in the conversion of light energy into chemical energy, while chlorophyll b assists by expanding

the range of light wavelengths a plant can use. Some lower plants, algae, and bacteria contain other forms of chlorophyll, such as chlorophyll c, or d, which help them adapt to different light environments.

Structure of Chlorophyll

Chlorophyll is located in the thylakoid membranes of chloroplasts. Its structure includes a porphyrin ring with a central magnesium atom and a long hydrophobic tail that anchors it in the membrane. This arrangement allows chlorophyll molecules to absorb light efficiently and participate in the light-dependent reactions of photosynthesis. When light strikes chlorophyll, electrons are excited and transferred through a series of proteins called the electron transport chain, ultimately leading to the production of ATP and NADPH, which are energy carriers used in the synthesis of glucose.

Functions of Chlorophyll.

Apart from photosynthesis, chlorophyll also plays a role in protecting plants from photooxidative damage by neutralizing harmful free radicals generated by sunlight. Additionally, chlorophyll

has economic importance for humans. It is used in food coloring, medicine and even as a natural deodorizer in some products.

(b)

Discuss role of ribosomes in protein synthesis.

Ribosomes

Ribosomes are essential cellular organelles responsible for protein synthesis, a process vital for the growth, repair and maintenance of cells. They are found in both prokaryotic and eukaryotic cells, either floating freely in the cytoplasm or attached to the rough endoplasmic reticulum in eukaryotes. Structurally, ribosomes are composed of ribosomal RNA (rRNA) and proteins, forming two subunits - a large subunit and a small subunit. These subunits work together to translate genetic information from messenger RNA (mRNA) into functional proteins.

Protein synthesis occurs in two main stages: transcription and translation. During transcription, DNA is used as a template to produce mRNA, which carries the genetic code from the nucleus to the ribosome in eukaryotic cells. In

prokaryotes, mRNA is synthesized in the cytoplasm. Ribosomes play a central role in the translation stage, where the genetic code on mRNA is read in sets of three nucleotides called codons. Each codon specifies a particular amino acid. Transfer RNA (tRNA) molecules bring the corresponding amino acids to the ribosome, where they are joined together to form a polypeptide chain.

The ribosome ensures that amino acids are linked in the correct sequence through peptide bonds, a process catalyzed by the ribosomal RNA in the large subunit. This assembly continues until a stop codon is reached, signaling the completion of the protein.

(c)

Define the terms

(1)

Biofuel

A biofuel is a type of fuel that is produced from organic matter, such as plants, algae, or animal waste. It is renewable and can be used as an alternative to fossil fuels for energy.

production. Examples include ethanol, biodiesel, and biogas.

(ii)

Adulteration

Adulteration is the act of adding impure, cheap or harmful substances to a product, especially food or medicines, to increase quantity or reduce cost. It makes the product unsafe or reduces its quality. For example, mixing water in milk or synthetic colors in spices.

(iii)

Hydrosphere

The hydrosphere refers to all the water present on Earth, including oceans, rivers, lake, glaciers, groundwater, and atmospheric water which makes up 71% of Earth's surface. It plays a key role in climate regulation, supporting life, and shaping the Earth's surface.

(iv)

Troposphere

The troposphere is the lowest layer of the Earth's atmosphere extending up to about (4-12 miles) 16 to 20 km above the surface. It contains most of

atmosphere's mass, weather phenomenon, and clouds.
Temperature generally decreases with the altitude in this layer.

(c) Isotopes.

Isotopes are atoms of the same element that have the same number of protons but different number of neutrons. This gives them the same chemical properties but different atomic masses. For example carbon-12 and carbon-14 are isotopes of carbon.

(d)

Discuss different methods of solid waste Management.

Solid waste management is the process of collecting, treating and disposing of solid waste in a way that minimizes its impact on the environment and human health. Various methods are used depending on the type of wastes, available resources, and environmental degradation.

Methods of Solid Waste Management

Landfilling:

Landfilling is one of the most common methods for disposing of solid waste. Waste is collected, compacted, and buried in specially designed sites called landfills. Modern landfills are lined with with clay or plastic to prevent leachate from contaminating ground water.

Incineration:

It involves burning solid waste at high temperature to reduce its volume. This method is effective for hazardous and non-recyclable waste and can generate energy in the form of heat or electricity. However, it may release toxic gases if not properly controlled, contributing to air pollution.

Recycling:

Recycling is the process of converting waste materials into new products. Materials like paper, plastic, glass and metals can be reused after processing, reducing the need for raw materials. Recycling conserves natural resources, saves energy, and decreases the amount of waste sent to landfills.

Composting:

Composting is a biological process in which organic waste, such as kitchen scraps, garden waste, and agricultural residues, decomposes to form nutrient-rich compost. This method improves fertility and reduces the volume of biodegradable waste.

SECTION-II

Question no 6

(a)

Unscramble these math terms:

STSTAICITS: Statistics

LCIEBAR: ALGebra.

(b)

A bicycle covers 36km at 18km/hr....

Given Data:

Distance = 36 km

Speed = 18 km/hr

start time : 1:00 pm

Step 1: calculating time taken

$$\text{Time} = \text{Distance} \div \text{Speed}$$

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$$\text{Time} = \frac{36}{18} = 2 \text{ hours}$$

Step 2: Adding time to start time.

$$1:00 \text{ pm} + 2 \text{ hours} = 3:00 \text{ pm.}$$

(c)

A camera priced at

Given Data:

$$\text{Price of camera} = \$200$$

$$\text{Discount} = 25\%$$

$$\text{Tax} = 6\%$$

Step 1: Calculating the discount

$$\text{Discount} = 25\% \text{ of } 200 = \frac{25}{100} \times 200 = 50$$

Step 2: Subtracting discount from original price

$$\text{Price after discount} = 200 - 50 = 150$$

Step 3: Calculating tax on discounted price.

$$\text{Tax} = 6\% \text{ of } 150 = \frac{6}{100} \times 150 = 9$$

Step 4: Add tax to discounted price

$$\text{Total amount paid} = 150 + 9 = 159.$$

Question no 7

a,

Complete the series

(i) 2, 6, 18, 54, 162, 486

All number fit; no error. It is a geometric series. Each number is being multiplied by 3.

(ii) 3, 5, 7, 11, 13

This is a series of prime numbers.

After 13, the next prime number is 17. So

Answer is 17.

(b)

Calculate volume of a sphere...

Given Data:

Diameter of sphere = 14cm.

$$\pi = 22/7$$

Step 1: Finding the radius

$$\text{Radius } r = \frac{\text{Diameter}}{2} = \frac{14}{2} = 7\text{cm}$$

Step 2: Volume of a sphere

$$\text{Volume} = \frac{4}{3} \pi r^3$$

Step 3: Substituting values.

$$\text{Volume} = \frac{4}{3} \times \frac{22}{7} \times 7^3$$

Simplifying $7^3 = 343$

$$\text{Volume} = \frac{4}{3} \times \frac{22}{1} = 343$$

$$\frac{22}{7} \times 343 = 22 \times 49 = 1078$$

$$\text{Volume} = \frac{4}{3} \times 1078 = \frac{4312}{3} \approx 1437.33 \text{ cm}^3$$

Answer is 1437.33 cm^3 .