

October 21, 2025

Date:

General Science And Ability

PART-II

QUESTION #3

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

Answer: Cell form organelles to perform specialized functions efficiently within a confined space, ensuring proper organization, compartmentalization, and metabolic regulation. Each organelle has a unique role such as energy production, protein synthesis, or waste processing, allowing the cell to function as a coordinated unit.

Mitochondria in human cell

Mitochondria is known as the powerhouses of the cell because they generate energy in the form of ATP through cellular respiration.

Structure:

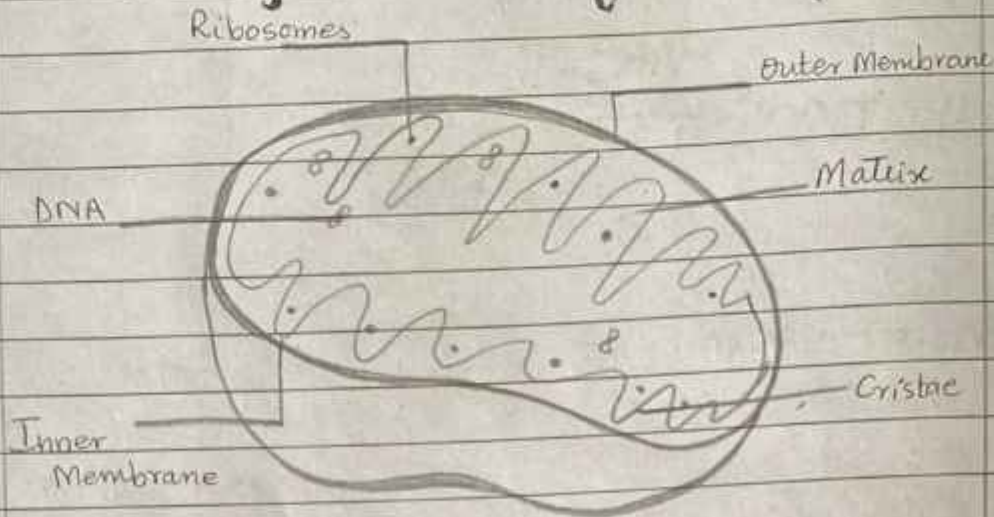
They are double-membraned organelles, an outer smooth membrane and an inner folded membrane called cristae, which increase the surface area of energy production.

Function:

Mitochondria convert glucose and oxygen into ATP, releasing carbon dioxide and water as by product.

Significance: They also play roles in cell signaling, apoptosis (programmed cell death) and metabolism regulation.

Diagram of Mitochondria



b- What is doping? Discuss different types of semi-conductors.

Answer. Doping:

Doping is the process of intentionally adding small amount of impurities (called dopants) to a pure semiconductor (like Silicon or Germanium) to change its electrical conductivity.

Pure semi-conductors have limited conductivity. Doping increases the number of free charge carriers, making them more useful in electronic devices such as diodes, transistors, and integrated circuits.

Types of Semi conductors

There are two types of semi-conductors

- 1- Intrinsic Semiconductor
- 2- Extrinsic Semiconductor

Date: _____

1- Intrinsic Semiconductor

It is a pure form of semiconductor without any impurities (e.g. pure silicon or germanium). In this type of semiconductor conductivity is low and depends upon temperature.

Number of electrons = Number of holes

Example: Pure silicon at room temperature

2- Extrinsic Semiconductor

When impurities are added to an intrinsic semiconductor, it becomes extrinsic, with improved conductivity.

There are further two types of Extrinsic semiconductor

i. n-type Semiconductor

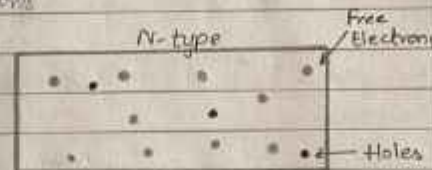
ii. P-type semiconductor

N-type Semiconductor

It is doped with pentavalent elements (having 5 valence electrons) such as phosphorus (P), arsenic (As) or antimony (Sb). The extra electron becomes a free charge carrier.

Major carrier - Electrons

Minor carrier - Holes

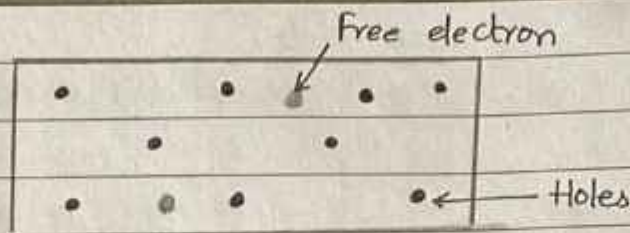


P-type Semiconductor

It is doped with trivalent elements (having 3 valence electrons) such as Boron (B), aluminium (Al) or Gallium (Ga). It creates a hole (absence of electron) in the lattice. Major carrier - Hole

Minor carrier - Electron

P-type:



C- State some of the merits and de-merits of volcanic eruption.

Answer: Merits of Volcanic Eruption

1. Fertile Soil

Volcanic ash and lava break down over time to form minerals-rich, fertile soils, ideal for agricultural purposes.

Example: Coffee and Java plantation in Hawaii

2. Mineral Resources

Volcanic regions are rich in valuable minerals such as copper, gold, silver and diamonds, which form due to intense heat and pressure.

3. Geothermal Energy

Hot magma ~~low~~ beneath the surface can be harnessed for geothermal power, providing a renewable energy source.

Example: Iceland and New Zealand

4. Tourism

Volcanoes and their landscapes attract tourists, boosting local economies.

Example: Mount Vesuvius in Italy

5. Land Formation

Volcanic eruption create a new landforms such as islands and mountains.

Example: Hawaii Islands

De-merits of Volcanic Eruption

1. Loss of life and property:

Explosive eruptions causes casualties, destruction of settlements, and infrastructure damage.

2. Environmental pollution:

Eruption releases toxic gases (SO_2 , CO_2) and ash polluting air and water, leading to health issues.

3. Climate Impact:

Volcanic dust and gases can block sunlight, causing temporary global cooling and affecting water patterns.

4. Displacement and Economic loss:

Eruptions forces mass migration, destroying livelihoods and agriculture, especially in developing countries or regions.

5. Lava and pyroclastic Flows:

Hot lava and pyroclastic materials can bury entire towns and make regions uninhabitable for decades.

d- What is Dengue? Discuss Symptomology, causative, agents and remedies

Answer: Dengue

Dengue is a mosquito-borne viral infection that causes a severe flu-like illness and, in serious cases, can lead to dengue hemorrhagic fever or dengue shock syndrome, which can be fatal. It is a major public health problem in tropical and subtropical regions, including Pakistan, especially during the monsoon season.

Causative Agent

1. Dengue is caused by dengue virus (DENV), which belongs to the Flavivirus genus of the Flaviviridae family.
2. There are four distinct ~~a~~ serotypes of the viruses: DENV-1, DENV-2, DENV-3 and DENV-4.
3. It is transmitted to humans through the bite of infected female *Aedes aegypti* and sometimes *Aedes albopictus* mosquitoes.

Symptomology

Initial Symptoms:

Sudden high fever, severe headache and pain behind the eyes, Muscles and joint pain, Nausea, Vomiting and fatigue and sometimes skin rash.

Severe Dengue Symptoms

Bleeding from nose, gums, or under the skin, Severe abdominal pain and persistent vomiting, Rapid breathing, restlessness and fatigue, Drop in blood pressure.

Remedies and Treatment

Medical treatment

1. There is no specific antiviral treatment for dengue.
But supportive care can be given such as:
Hydration therapy oral fluids or intravenous fluids to prevent dehydration.
Paracetamol for fever and pain.
Hospitalization in severe cases for close monitoring.

of platelet count and blood pressure.

Preventive Measures

- 1 Mosquito control ^{by} removing stagnant water, cover water containers, and by using insecticides.
- 2 Personal protection by using mosquito repellents, bed nets and wear long-sleeved clothing.
- 3 Public awareness campaigns and community sanitation programs to reduce breeding sites.
- 4 Vaccination of Dengue (like Dengvaxia) are available in some countries for who have had prior dengue infection.

QUESTION NO # 4

a- Write a note on plant kingdom "chlorophyll"

Answer: Chlorophyll

Chlorophyll is a green-pigment found mainly in the chloroplasts of plants, algae, and cyanobacteria and it plays a vital role in the plant kingdom by enabling the process of photosynthesis. the conversion of light energy into chemical energy.

Chemical Nature

- 1 Chlorophyll is an organic pigment molecule composed of carbon, hydrogen, oxygen, nitrogen and magnesium (Mg). Its structure consist of porphyrin ring with a central magnesium ion, responsible for capturing light energy.

Types of chlorophyll

There are several forms of chlorophyll, but the main types found in plants are

- 1 Chlorophyll a - the primary pigment that directly

participates in photosynthesis, gives plants their characteristic green colour

2. Chlorophyll - b : an accessory pigment that absorbs light different wavelengths and transfers energy to chlorophyll 'a' for efficient photosynthesis

Functions

1. Photosynthesis

Chlorophyll absorbs sunlight (mainly blue and red light) and converts it into chemical energy stored in glucose, releasing oxygen as a by-product

2. Energy Conversion

It initiates the light-dependent reactions of photosynthesis by exciting electrons, which drives the formation of ATP and NADPH - the cell's energy molecules

3. Plant Growth and Metabolism

The energy captured through chlorophyll supports growth, reproduction, and nutrient synthesis in plants

Ecological Importance

1. Chlorophyll based photosynthesis is the foundation of the food chain, sustaining nearly all life on Earth
2. It also helps in carbon dioxide absorption and oxygen production, maintaining the planet's ecological balance

b- Describe the role of ribosomes in protein synthesis

Answer Role of Ribosomes in Protein Synthesis

Ribosomes are small, dense, ribonucleoprotein particles found either free in the cytoplasm or attached to the rough endoplasmic reticulum (RER) of both prokaryotic and eukaryotic cells. They are often called the 'protein factories' of the cell because they are the sites where proteins are synthesized.

Structure

Ribosomes consist of two subunits; a large subunit and a small subunit made up of ribosomal RNA (rRNA) and proteins.

In prokaryotes, they are 70S (50S + 30S), while in eukaryotes, they are 80S (60S + 40S).

Role in Protein Synthesis

Protein synthesis (translation) occurs in three main stages, and ribosomes play a vital role in each.

1. Initiation

The small ribosomal subunit binds to the messenger RNA (mRNA) at the start codon (AUG).

The initiator tRNA carrying the amino acid methionine pairs with the start codon.

The large subunit then joins to form a complete ribosome, ready for translation.

2 Elongation

Ribosomes provide binding sites (A, P and E sites) for transfer RNA (tRNA)

tRNA molecules bring specific amino acids to the ribosomes according to the codons on mRNA

The rRNA catalyzes peptide bond formation between amino acids, elongating the polypeptide chain.

3 Termination

When the ribosome reaches a stop codon, no tRNA matches it.

The polypeptide chain is released, and the ribosomal subunits separate for reuse in another round of translation.

Function

- Decodes mRNA to determine the correct amino acid sequence
- Forms peptide bonds between amino acids
- Ensure accurate and efficient protein formation

C- Discuss different methods of Solid Waste Management

Answer: Methods of Solid Waste Management

Solid Waste Management (SWM) refers to the collection, treatment and disposal of solid materials that are discarded by society. Its main goal is to reduce environmental pollution, protect public health, and promote resource recovery. Effective waste management integrates scientific, economic and environmental approaches.

① Open Dumping:

Waste is dumped in open lands, low-lying areas or outskirts of cities

Advantage: Cheap and easy to implement

Disadvantages: Causes foul odour, groundwater contamination, spread of diseases, and air pollution due to burning.

Example Common in developing countries due to lack of infrastructure

② Landfilling:

Waste is buried in specially designed ~~areas~~ sites with protective liners and drainage system

Types:

→ Sanitary landfills (scientifically engineered)

→ Controlled landfills (partially managed)

Advantage: Simple and cost-effective for large-scale waste.

Disadvantage: Requires large land areas, may produce leachate and methane gas

③ Incineration (Thermal treatment)

Waste is burned at a high temperature (upto 1200°C) to reduce volume and generate energy

Advantages: → Reduces waste by volume 80-90%.

→ Can produce electricity and heat

(Waste-to-energy process)

Disadvantages: → Expensive to maintain.

→ Emits toxic gases if not properly managed

④ Compositing (Biological Method)

Organic waste (food, leaves, paper) is decomposed by microorganisms into humus-like compost.

Advantages: → Produces natural fertilizer for soil enrichment
→ Reduces waste going to landfills.

Disadvantages → Requires proper segregation of organic waste.

→ Time consuming and odor issues if unmanaged

⑤ Recycling

Recovery and Reprocessing of materials (like paper, plastic, metal, glass) into new products

Advantages → Saves energy and raw materials.
→ Reduces environmental pollution.

Disadvantages → Needs public cooperation and sorting systems

→ not all materials are recyclable

Conclusion.

An integrated solid waste management system combining reduction, reuse, recycling, composting and energy recovery is essential for sustainable development

d- Define the terms

Answer: Biofuels:

Biofuel is a renewable energy source derived from biological materials such as plants, animals, waste, or agricultural essentials. Example include ethanol

(from sugarcane) and bio diesel (from vegetable oil). Biofuels are used as alternatives to fossil fuels to reduce carbon emissions and energy dependence.

2 Adulteration:

Adulteration refers to the intentional addition or mixing of inferior, harmful or unauthorized substances into food, fuel or other products to increase profit. It reduces quality and can pose serious health risks to consumers.

Example: Mixing water in milk or cheap oil in ghee.

3 Hydrosphere:

The hydrosphere comprises all the water present on Earth, including oceans, rivers, lakes, glaciers, groundwater and water vapour in the atmosphere. It plays a crucial role in the water cycle, climate regulation and supporting life on the planet.

4 Troposphere:

The troposphere is the lowest layer of Earth's atmosphere, extending from the Earth's surface up to about 8-18 km. It contains most of the atmospheric gases, clouds and weather phenomena like rain and storms. The temperature decreases with altitude in this layer.

5 Isotopes:

Isotopes are atoms of the same element that have the same number of protons but different numbers of neutrons in their nuclei. Hence, they have identical chemical properties but different atomic masses.

Date: _____

Example. Hydrogen has three isotopes
Protium (^1H), Deuterium (^2H), Tritium (^3H)

SECTION - II

a- Ratio (Apple : Berry : Cherry : Date) = 3 : 6 : 2 : 5

The difference b/w Apple and Date = 35

$$\text{Apple} = 3k, \text{ Date} = 5k$$

$$|3k - 5k| = 2k = 35 \Rightarrow k = 35/2$$

$$k = 17.5$$

$$\text{Berry } 6k = 6 \times 17.5 = 105$$

Answer [105 Berry Candies]

b-

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

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

$$\text{Discount amount} = 0.25 \times 200 = 50 \$$$

Price after discount

$$= 200 - 50$$

$$= 150 \$$$

$$\text{Tax} = 6\% \text{ on discounted price} = 0.06 \times 150$$

$$= 9 \$$$

$$\text{Total paid} = 150 + 9$$

Answer [= 159 \$]

Date: _____

c-

$$\text{Distance} = 36 \text{ km}$$

$$\text{Speed} = 18 \text{ km/h}$$

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

start at 1:00 pm → arrival at 3:00 pm

Answer 3:00 pm

d-

→ STATISTICS

→ ALGEBRA

QUESTION # 7

a

Volume of a sphere

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

$$\text{Use } V = \frac{4}{3} \pi r^3 \text{ . With } \pi = \frac{22}{7}$$

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

$$\Rightarrow \frac{4}{3} \times \frac{22}{7} \times 343$$

$$\Rightarrow \frac{4 \times 22 \times 249}{3}$$

$$\Rightarrow \frac{4312}{3} \text{ cm}^3$$

Date: _____

b- Five friends saving in ratio $1:2:3:4:5$
total Rs 25000

Sum of ratio parts = $1+2+3+4+5 = 15$

Smallest share = $\frac{1}{15} \times 25000$

$$\rightarrow \frac{25000}{15}$$

$$\Rightarrow 1666 \text{ Rs}$$

c

i- 2, 6, 18, 54, 162, 486

each term is previous $\times 3$

Geometric progression is $\boxed{3}$

ii- 3, 5, 7, 11, 13

prime numbers in ascending order.

The next number is $\boxed{17}$

d-

Triangle with sides 5cm, 12cm, 13cm
find angles

$$5^2 + 12^2 = 25 + 144 = 169 = 13^2$$

(Hyp = 13) so angle is 90°

let θ be angle opposite 5 $\Rightarrow \sin \theta = \frac{5}{13}$ or $\tan \theta = \frac{5}{12}$

$$\theta = \frac{5}{13}; \theta = \frac{5}{12}$$

The angle are $22.6, 67.3, 90^\circ$ **Answer**