

Question: no 3

Answer

Cells From Organelles

Cells have organelles to perform specific functions and maintain homeostasis, much like organs in a body.

Organelles compartmentalize the cell, creating specialized environments for processes like energy production, protein synthesis, and waste disposal to occur efficiently and without interference from other cellular activities.

• Compartmentalization and Specialization

Organelles separate different biochemical reactions, preventing them from interfering with each other. For example:- the high acidity required for a lysosome to digest waste is contained within its membrane, separate from other parts of the cell.

Efficient Function:

By Specializing, Organells can achieve a high concentration of necessary enzymes and molecules for a particular task, making processes more efficient.

Efficiency:

Organells localize biochemical reactions, for example, enzymes & substrates needed for energy production are concentrated in the mitochondria, speeding up those reactions.

Specialization:

Each organelles perform a specific function or role. For example nucleus for genetic information, Golgi apparatus for protein processing, lysosomes for waste digestion.

Energy Management:

Organells like Mitochondria allow cell to produce & regulate energy with high efficiency.

Mitochondria in human cells:

- Mitochondria also known as power house of the cell. Here's a breakdown of their key roles:

Structure:

1. **Double Membrane:** outer membrane encloses the organelle: inner membrane folds into cristae to increase surface area for energy production

2. **Matrix:** The internal space that contains enzymes, mitochondrial DNA, and ribosomes

• Mitochondria in human cells

- **Energy Supply:** Many human cells (especially those with high energy demands like muscle, neurons) rely heavily on mitochondria to produce ATP. If mitochondria are impaired cells not function properly.

- **Metabolic integration:** Mitochondria like nutrient oxidation, ATP synthesis, ion homeostasis (e.g. Ca^{2+}) and also cell signaling.

AS wallace outlines, when mitochondria malfunction (due to mtDNA mutations, oxidative damage etc), this link to many pathologies including neurodegenerative, metabolic Syndrome Cancer.

Mitochondria play a key role in apoptosis (e.g. release of cytochrome activation of caspases) when cells are damaged or stressed.

(b)

Doping

In Electronics, doping is the process of intentionally adding small amounts of impurities to a pure Semiconductor (like Silicon or germanium) to change its electrical properties specifically, to increase its conductivity.

Semiconductors;

Semiconductors are extensively used in electronic circuits. As its name implies, a Semiconductor is a material that conducts current, but only partly.

The conductivity of a Semiconductor is somewhere between that of an insulator, which has almost no conductivity, and a conductor, which has almost full conductivity. Most Semiconductors are crystals made up of certain materials.

Types of Semiconductor:

1. Intrinsic Semiconductors

- Pure form : no doping

Example Pure Silicon (Si) or germanium (Ge). It has very low conductivity and charge carriers are generated only

by thermal excitation (heat)

2. Extrinsic Semiconductors

- Doping Semiconductors and have much higher conductivity than intrinsic ones. and has two types based on the dopant added.

N-Type Semiconductor

- Doped with a pentavalent element, (5 valence electrons). Such as
• Phosphorus (P), Arsenic (As)
Antimony (Sb)

Example Silicon + phosphorus $\rightarrow$ n type Semi
(extra free electrons increase conductivity)

P-type Semiconductor

- Doped with trivalent element.
(3 valence electrons) Such as

- Boron (B), Gallium (Ga)
Indium (In)

Example

Silicon + Boron $\rightarrow$ P-type Si (more holes = more conductivity)

(c) Merits Of Volcanic Eruption;

1. • Fertile Soil : Volcanic ash and lava break down over time to form mat mineral-rich soils, ideal for agriculture (e.g. in Java, Indonesia or the slopes of Mount Vesuvius in Italy).
2. Geo-thermal Energy :
Volcanically active regions can generate clean, renewable energy from geothermal sources.
3. Tourism and Economy :
Volcanoes attract tourists, supporting local economies (e.g. Mount Fuji, Japan or Yellowstone).

Demerits

1. Loss of life and Property
• Eruption can destroy towns and kill thousands e.g. Pompeii in 79 AD, Mount Pinatubo in 1991.
2. Air pollution
• Volcanic ash gases (like Sulphur dioxide) and smoke pollute the air, affecting health and air travel.
3. Damage to Agriculture ash falls can bury crops, contaminate water supplies & kill livestock.

(d) Dengue

Dengue is a mosquito-borne viral disease that has rapidly spread in all regions in recent years. Dengue virus is transmitted by Female mosquitoes mainly of the Species *Aedes aegypti* and, to a lesser extent, *Ae. albopictus*. The mosquito also transmits Chikungunya, Yellow Fever & Zika-infection.

Symptoms:

Dengue Fever is a Severe, Flu-like illness that affects infants, young children & adults, but seldom cause death. Dengue should be suspected when a high fever $40^{\circ}\text{C}/104^{\circ}\text{F}$ is accompanied by 2 of the following symptoms: Severe headache,

Pain behind the eyes, muscle and joints Pain, nausea, Vomiting

Swollen glands or rash. Symptoms usually last for 2-7 days after an incubation period of 4-6 days the bite from an infected mosquito.

Causative Agents of Dengue

1 Pathogen:

dengue virus is a causative agent.
It belongs to the Flavivirus genus
There are 4 main types

DENV-1, DENV-2, DENV-3, DENV-4

2 Vector (Carrier)

Dengue virus is transmitted to humans
through the bite of an infected
mosquito

• Primary vector

• Aedes aegypti mosquito

Secondary vector: Aedes albopictus
less common

Remedies:

- Rest Get plenty of rest to help your body recover
- Hydration: Drink a lot of fluids like water or electrolyte drinks to prevent dehydration.
- Pain & Fever relief: Take acetaminophen Paracetamol to manage fever and pain

Q8
(A)

$$\sqrt{(7)^2 + (24)^2}$$

$$= \sqrt{49 + 576}$$

The total distance from
one loop is
 $7 + 24 + 25 = 56 \text{ km}$

Step 2

Since the hiker completes one loop
the distance covered is 56 km

Step-3

$$10 + 5 = 15 \text{ km}$$

Step 4

The total distance walked is the
Sum of the distance walked in one
loop and the additional distance
walked

$$56 + 15 = 71 \text{ km}$$

Step 5

Let's assume the hiker starts at the
origin (0,0) After one loop the hiker
will be back at the starting point (0,0)
Then the hiker walks 10 km straight
let's assume it's along the x-axis
and reaches (10,0) After turning 90
degree, the hiker walks 5 km (let's

assume it's long then y -axis) and
reaches $(10, 5)$

Step-6

$$\sqrt{(10-0)^2 + (5-0)^2} =$$

The final answer is

$$\text{Total distance} = 71 \text{ km}$$

$$\text{Distance From Start} = 5\sqrt{5} \text{ km}$$

Q No: 8

(b)

Step 1: Express each Siblings,
Share in terms of one variable
The relationships between the Siblings
Share are given as

$$A = \frac{1}{2} B$$

$$B = 3C$$

$$C = 4D$$

$$D = 2E$$

$$E = F$$

we can express, all Shares in terms
of F

$$E = F, \text{ Then } D = 2E = 2F$$

$$C = 4D \text{ then } C = 4(2F) = 8F$$

$$B = 3C \text{ then } B = 3(8F) = 24F$$

$$A = \frac{1}{2} B \text{ then } A = \frac{1}{2} (24F) =$$

$$12F$$

Step 2

$$A + B + C + D + E + F = 9000$$

$$12F + 24F + 8F + 2F + F + F = 9000$$

$$48F = 9000$$

$$F = \frac{9000}{48} = 187.5$$

$$F = \text{Rs } 187.50$$

$$E = F = \text{Rs } 187.50$$

$$D = 2F = 2(187.5) = \text{Rs } 375.00$$

$$C = 8F = 8(187.5) = 1500.00$$

$$B = 24F = 24(187.5) = \text{Rs } 4500.00$$

$$A = 12F = 12(187.5) = \text{Rs } 2250.00$$

Q_{No} 8
(C)

Formula

Total Surface area of a rectangular box is

$$TSA = 2(Lw + lh + wh)$$

$$TSA = 2(8m)(6m) + (8m)(4m) + (6m)(4m)$$

$$TSA = 2(48m^2 + 32m^2 + 24m^2)$$

$$TSA = 2(104m^2)$$

$$TSA = 208 m^2$$

Step 2

Formula of volume

$$V = lwh$$

$$V = (8m)(6m)(4m)$$

$$V = 192 m^3$$

Qno8(d)

The family initially has 8 members, with equal number of men and women.
This means there are 4 men and 4 women.

$$\begin{aligned}\text{Men Consumption} &= 4 \times 72 \text{ kg} = 288 \text{ kg} \\ \text{Women Cons:} & 4 \times 50 \text{ kg} = 200 \text{ kg} \\ \text{total}\end{aligned}$$

$$288 \text{ kg} + 200 \text{ kg} = 488 \text{ kg}$$

After Amna joined

$$9 \times 67 \text{ kg} = 603 \text{ kg}$$

$$603 \text{ kg} - 488 \text{ kg} = 115 \text{ kg}$$

Question no: 4 (A)

Plant Kingdom (Kingdom Plantae)

- The Plant Kingdom Scientifically referred to as Kingdom Plantae comprises, multicellular, eukaryotic, and predominantly autotrophic organisms. These organisms are characterized as
 - The presence of cell walls composed of cellulose
 - The ability to perform photosynthesis
 - A life cycle exhibiting alternation of generations.

Chlorophyll

Chlorophyll is a green pigment essential for the process of photosynthesis, it is located in the chloroplasts of plant cells, specifically embedded in the thylakoid membranes. Chlorophyll absorbs light energy, primarily in the red and blue regions of the light spectrum, while reflecting green light which gives plants their characteristic color.

There are several types of Chlorophyll

• Chlorophyll - a

The primary pigment directly involved in the light reactions

• Chlorophyll - b

an accessory pigment that helps capture additional light energy. Chlorophyll plays a critical role in enabling plants to convert solar energy into chemical energy supporting not only plant life but also all life forms that depend on plants for food and oxygen. Chlorophyll absorbs sunlight and uses its energy to

1/ Split water molecules (H_2O) into hydrogen and oxygen

2/ Convert carbon dioxide (CO_2) and hydrogen into glucose

3/ Release oxygen (O_2) as a by product

(b) Role Of Ribosomes In Photosynthesis;

Ribosomes do not participate in the light dependent or light - independent reactions of photosynthesis, but they play an essential supporting role in enabling photosynthesis by producing the proteins and enzymes required for the process.

Key Functions

1. Protein Synthesis.

Ribosomes are responsible for synthesizing proteins by translating messenger RNA (mRNA) into polypeptide chains. Photosynthesis produces and ribosomes produce

- photosynthetic enzymes (e.g. Rubisco)
- protein components of photosynthesis Systems I and II
- Electron transport chain proteins
- ATP synthase subunits

2. Located in Chloroplast:

Chloroplast contains own

their DNA and 70S ribosomes (Similar to prokaryotic ribosomes). These chloroplast ribosomes synthesize some of the key proteins involved in photosynthesis inside the organelle itself, while other proteins are made by cytoplasmic ribosomes and imported into the chloroplast.

3/

Maintaining Photosynthetic Machinery;

Since protein degrades over time, ribosomes are continually needed to repair and replace photosynthetic proteins, ensuring that the process remains efficient.

Q No: 4 (c)

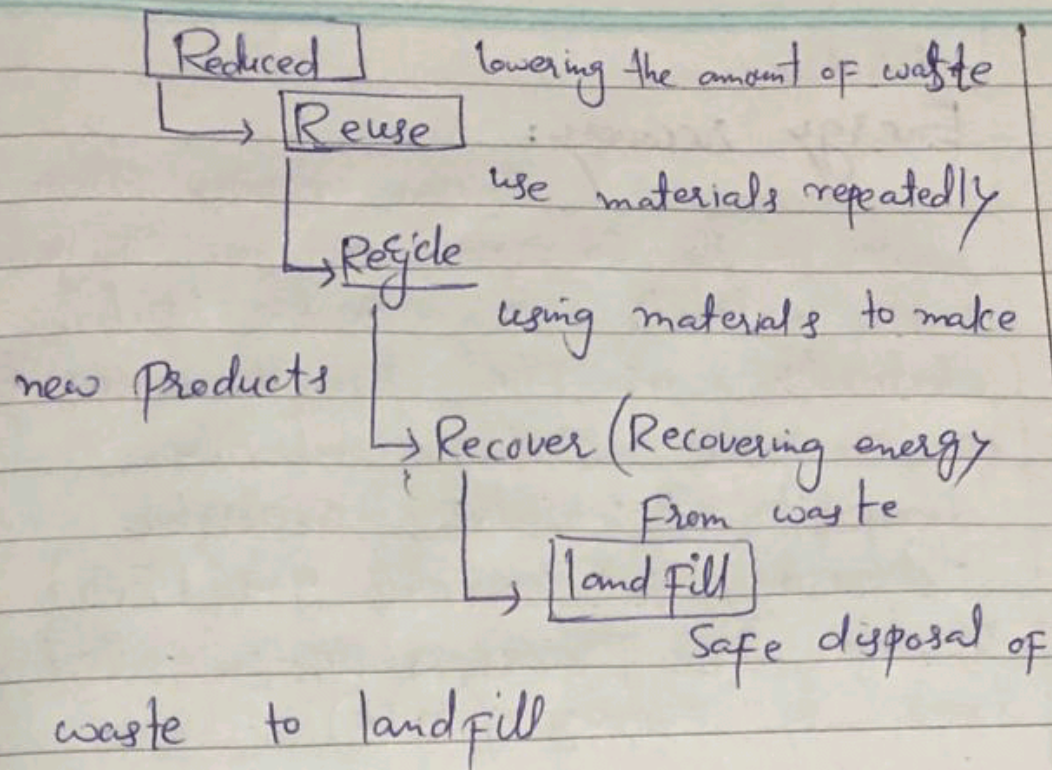
Solid waste Management

"Solid wastes" are the discarded leftovers of our advanced Consumer Society.

The growing Mountain of Garbage and trash represents not only an attitude of indifference towards valuable natural resources, but also a Serious economic & public health Problem.

(Jimmy Carter)

Any refuse or waste material, including Semi Solid Sludge, produced from domestic, Commercial or industrial premises or processes including mining and agricultural operations and water treatment plants. Solid waste management refers to the Systematic management of the generation, Collection, transfer, treatment, recycling, recovery and disposal of Solid waste.



Recycling: Recycling is a series of activities that includes collecting used, reused, or unused items that would otherwise be considered waste; sorting and processing the recyclable products into raw materials, and manufacturing the recycled raw material into new products.

Composting: Composting of food scraps, yard trimmings, and other organic materials to form compost. Benefit of recycling include preventing the emission of many greenhouse gases, and water pollutions, saving energy, supply valuable raw materials to

industry.

Energy recovery:

Energy recovery from waste is the conversion of non-recyclable waste materials into useable heat, electricity, or fuel through a variety of processes including combustion, gasification, pyrolyzation, anaerobic digestion, and landfill gas (LFG) recovery. This process is often called waste to energy (WTE).

Treatment and Disposal:

Prior to disposal, treatment can help reduce the volume and toxicity of waste. Treatments can be physical (e.g. shredding), chemical (e.g. incineration) and biological (e.g. anaerobic digestion). Landfills are the most common form of waste disposal and are an important

- A landfill is a carefully designed structure built into or on top of the ground, in which trash is separated from the area around

it. landfills contains garbage and
serve to prevent contamination between
the waste and the surrounding
environment, especially ground water.

Question 4 (d)

(i) Biofuels

Bioenergy is energy derived from biofuels. Biofuels are fuels produced directly or indirectly from organic material biomass, including plant material and animal waste. Overall bioenergy covers approximately 10% of the total world energy demand. Traditional unprocessed biomass such as fuelwood, charcoal and animal dung accounts for most of this represents the main source of energy for a large number of people in developing countries for cooking and heating used.

(iii) Hydrosphere

Hydrosphere is the total amount of water on a planet. The hydrosphere includes water that is on the surface of the planet, underground, and in the air. A planet's hydrosphere can be liquid, vapour, or ice. On Earth, liquid water exists on the surface in the form of oceans, lakes and rivers.

It also exists below ground as ground water, in wells and aquifers. Water vapour is most visible as clouds and fog. The frozen part of earth hydrosphere is made of ice: glaciers, ice caps and ice bergs. The frozen parts of hydrosphere has its own name Cryosphere.

(ii) Adulteration:

The act of making food or drugs worse in quality by adding something to them. The adulteration of poultry is considered a serious problem.

(iv) Troposphere:

The lowest region of atmosphere, extending from the earth's surface to a height of about 6-10 km (the lowest boundary of the Stratosphere).

(v) Isotopes

Isotopes are atoms of the same chemical elements that have the same number of protons but different number of neutrons.