

General Science & Ability

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RWP-OB-74

Section-I

Q:1

(a)

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

Organelles In a Cell:

- There are numerous organelles in a cell i.e. ribosomes, golgi apparatus, nucleus, mitochondria, SER, RER etc. All these organelles perform their own specific designated function and assist cell to function normally.

Example:

nucleus: stores DNA and reads its sequence to form mRNA by a process called transcription

ribosomes: This mRNA travels outside nucleus, attaches to ribosomes in cytoplasm and ribosomes help to form proteins by process called translation

- Hence, all organelles of the cell work in a close, coordinated system, to ensure the functionality and survival of cell.

- Damage to any 1 organelle disrupts the normal functioning of entire cell, which eventually dies.

Mitochondria:

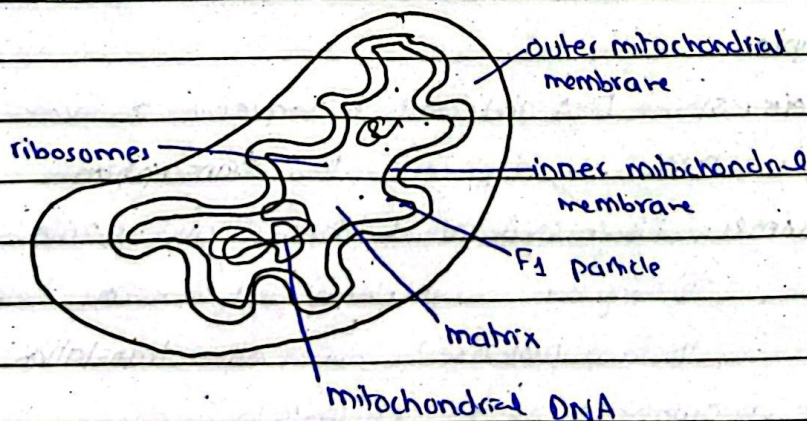
Mitochondria is a double-membrane organelle present in cytoplasm of cell.

function:

- (1): Mitochondria is called as the "power house of cell"
- (2): Processes like aerobic respiration, kreb's cycle and fatty acid metabolism take place in mitochondria and result in production of ATP (Adenosine Triphosphate)
- ATP is also called as energy currency of cell.

Structure:

- (1): Mitochondria consists of double membranes i.e. outer mitochondrial membrane (smooth) and inner mitochondrial membrane (infoldings)
- (2): It consists of an inner matrix which contains enzymes and many organic salts.
- (3): Mitochondria has its own DNA and ribosomes in matrix



• Replication of Mitochondria:

Since mitochondria has its own DNA, it is self-replicating organelle. Old mitochondria replicate into new mitochondria.

(b)

What is doping? Discuss different types of Semi-conductors?

Doping

- Definition:

Doping is the process of deliberately adding impurities into a ^{Semi}conductor to increase its electrical conductivity.

- Used In:

Doping is used in devices such as:

- 1) transmitters
- 2) Diode

- Example:

- (1) In silicon semi-conductors (N-type) phosphorus is added, which gives free floating electron and increases conductivity.
- (2) In silicon semi-conductors (P-type) Boron is added, which results in creation of a hole, increasing conductivity.

Types Of Semi-conductors

- Following are the two major types of semi-conductors:

- (1): N-type semiconductor:

In an N-type semiconductor, a phosphorus atom having 5 valence electrons is added. Since, 4 of phosphorus's valence electrons can form bond

With neighbouring valence electrons, 1 electron remains free of any bonding. This free electron helps increase conductivity of semiconductor.

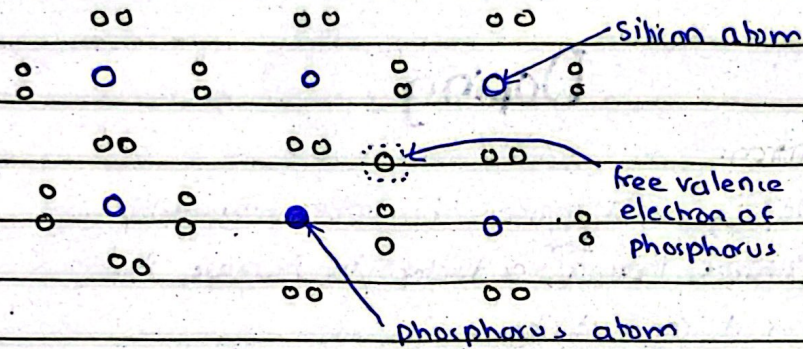


fig: Silicon-phosphorus semiconductor
(N-type)

(2): P-type semiconductor:

In a P-type semiconductor, a Boron atom having 3 valence electrons is added. 3 of its valence electrons form a bond with neighbouring atom's valence electrons, but in the place of 4th electron a hole is created. This hole acts as a positive charge, attracting other negatively charged electrons toward itself.

→ When electrons jump from their respective position to this hole, a subsequent hole is created in the place of that electron. Hence, this phenomenon and movement of electrons helps conduct electricity.

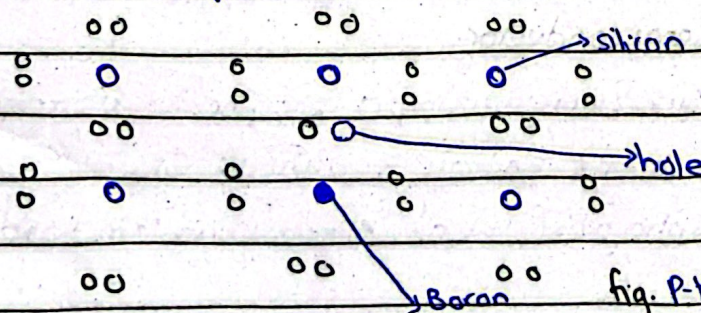


fig. P-type semiconductor

(1)

State some merits and demerits of volcanic eruptions.

Volcanic Eruptions

- The release of magma in the form of lava from earth's crust, to the surface of earth is called volcanic eruption.

• Merits of Volcanic Eruptions:

(1): Nutrient-rich soil:

The lava released from volcanic eruption when passes over soil/ground, enriches it. The lava is rich in nutrients, i.e. phosphorous. Once lava cools down, this excess phosphorous enriches the soil, resulting in growth of plants and microbes.

(2): Renewable energy:

Thermal energy obtained from volcanic eruptions can be used as a renewable source of energy. Many countries including Iceland and New Zealand are using volcanic thermal energy for production of energy which is being supplied to houses.

(3): Minerals and rare-rocks:

Volcanic eruptions bring several rare earth minerals and rocks along with them on the surface of earth from earth's crust. Further mining can also help extract more minerals and rocks of high value.

(4): Tourist attraction:

Volcanic eruption sites have become a major tourist attraction over the years, which can also help generate revenue.

• Demerits of Volcanic Eruptions:-

(1) Destruction of Property, Plants:

Volcanic eruptions damage everything in its path, resulting in huge economic losses. Houses, cars, critical infrastructure, Plants, trees, habitats of organisms all are destroyed because of extremely hot lava.

(2): Trigger other natural disasters:

Volcanic eruptions sometimes trigger other serious natural disasters i.e earthquakes, land sliding etc which further damage life and property.

(3): Atmospheric pollution:

Sulphur oxide and various oxides of carbon and nitrogen and other harmful chemicals which when released from volcanic eruptions become a part of atmosphere, resulting in change in weather patterns, global warming and immense air pollution.

(4): Changes in weather patterns:

Harmful gases released from volcanic eruptions form a layer in atmosphere, blocking access of sunlight to surface of earth resulting in a temporary cold temperature. Furthermore, these gases mix with water vapours and result in acid rain further damaging life and property and incurs economic losses.

(d)

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

Dengue

- Dengue is a mosquito-borne viral disease which infects many people every year, and in serious cases it might also cause death of infected person.

Causative Agent:

- Dengue spreads through an infected female mosquito *Aedes Aegypti*, which acts as a vector of dengue virus.
- When dengue virus infects *Aedes Aegypti* mosquito, it takes an incubation period (4-10 days) in the mosquito body, after which the mosquito becomes infectious for lifetime.
- When this infected mosquito bites a healthy person, she transmits dengue virus into the blood of person infecting the person.

^

- Transmission: A healthy mosquito biting a dengue infected person, also becomes dengue infected, thus transmitting the disease to other healthy individuals.

Symptoms:

- Mild symptoms of dengue infection include:

- 1) Fever
- 2) Pain in joints, muscles, behind the eyes
- 3) Vomiting and nausea

4) Severe Weakness

5) Headache

• Dengue infection can progress to a life-threatening stage as well, the symptoms of which are:

1) Breathing problems

2) Plasma leakage

3) Severe Blood loss

4) Organ Impairment

Remedies:

(1): Immediate remedy of dengue disease is to cure individual symptoms with medicines i.e. fever with paracetamol or other fever controlling medicine, body aches with pain killer medicine.

(2): Special attention should be paid to the diet of patient, since dengue infection causes severe weakness in body.

(3): In late 2015 and early 2016, a dengue vaccine by the name of dengvaxia was also introduced, which can be administered to individuals of 9-49 years; and has proved successful.

Q: 2

(a)

Write a note on kingdom "Chlorophyll".

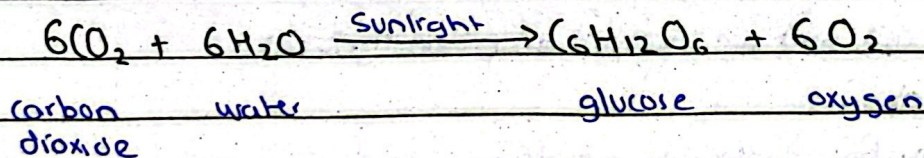
Chlorophyll:

→ Chlorophyll is a green pigment in plants, and is the characteristic feature of plants.

Function:

(1): Photosynthesis:

- The most important function of chlorophyll is that it absorbs sunlight and converts carbon dioxide and water into carbohydrate (glucose) and oxygen.
- This glucose acts as a source of food for plants.



(2): Green color of Plants:

The green pigment i.e. chlorophyll is what makes plants appear green and is a defining feature of plants.

(3): Production of Oxygen:

By the process of photosynthesis, chlorophyll helps release oxygen into environment, which is necessary to sustain life on earth.

(4): Carbon Sink:

Plants, because of chlorophyll's photosynthetic ability are able to absorb excess atmospheric carbon help

control global warming and pollution.

Types of Chlorophyll:

Chlorophyll a and b: most common in plants and found most common in nature.

Chlorophyll c: found in marine algae.

Chlorophyll d: found in cyanobacteria.

Chlorophyll e: found in golden algae, and is very rare.

(b)

Describe role of ribosomes in protein synthesis.

Ribosomes

Definition:

Ribosomes are granular, small organelles present in cell and are involved in protein synthesis.

Location:

1) Free floating in cytoplasm

2) Attached to Rough endoplasmic Reticulum (RER)

Structure:

Ribosomes consist of a:

1) Smaller subunit (40s)

2) Larger subunit (60s)

Role of Ribosomes In Protein Synthesis:

messenger RNA (mRNA) attaches to the cytoplasmic ribosomes.

Ribosomes clump the mRNA and travel through entire mRNA strand and decode mRNA's message.

By reading mRNA in the form of codons, ribosomes attach supplementary tRNA anticodons to mRNA.

This process results in creation of a long polypeptide chain, which folds into a complex structure and form protein.

This process is known as translation.

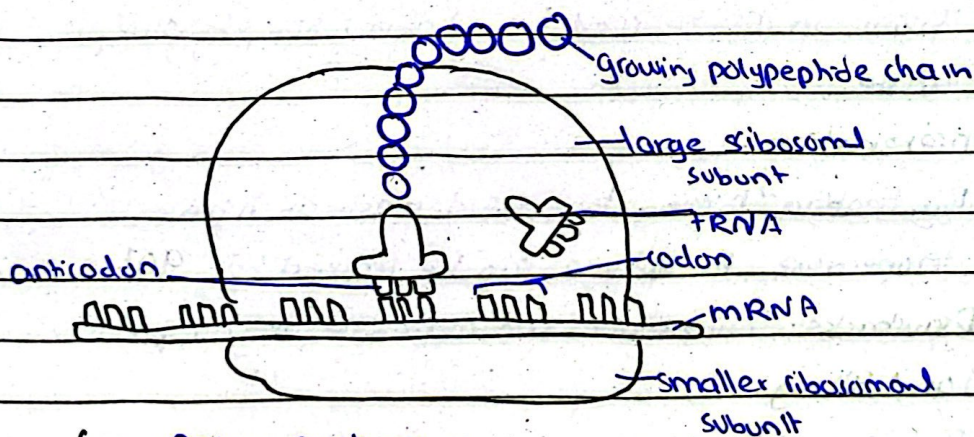


fig. Protein Synthesis

(c) Solid Waste Management

Solid waste consists of our everyday generated waste in the form of discarded food, bottles, plastics, papers etc. The proper management of this solid waste is crucial to ensure environmental protection and cleanliness.

Methods Of Solid Waste Management

(1): Recycle, Reuse, Reduce:

- Recycle all the solid waste, which could be used again in numerous other forms eg recycle paper into bags.
- Reuse all solid items by converting it into other useable forms i.e. reuse a bottle to plant a seed.
- Reduce the use of solid items which are non-recyclable to reduce the load on environment.

(2): Composite method:

- By allowing microorganisms to degrade and eliminate solid waste from environment.
- Worms can also be used for biodegradation of solid waste.

(3): Incineration:

- By heating/burning the solid waste at high temperature, its volume can be reduced by 90%.

Drawbacks: Incineration can contribute to air pollution.

(4): Land filling:

- By dumping solid waste deep within ground, so that it may be degraded by microbes over long period of time.

Drawbacks: it can cause pollution of soil and underground water in the long run.

(d)

Define the terms

(i): **Biofuel:**

Definition: The production of environment friendly fuel from biomass i.e. degraded plants, animals waste.

Such a fuel is called biofuel.

Advantage: It is a sustainable source of energy and is a renewable energy source, being used by many countries, eg. European countries use biodiesel in their vehicles.

Types:

1) Bioethanol: extracted from plant starch and sugar

2) Biodiesel: made of vegetable oil and animal fat.

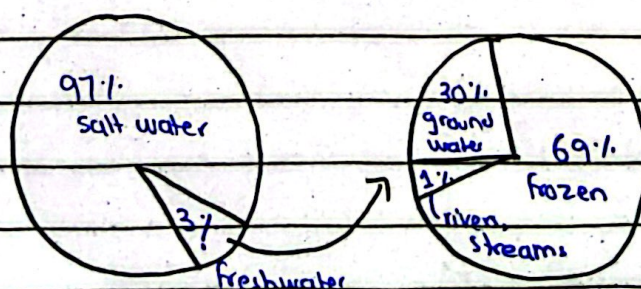
(ii): **Adulteration:**

Definition: Addition of impurity or any substance which renders the quality of food and lowers its nutrient content.

Example: Water in milk

(iii): **Hydrosphere:**

Definition: The total amount of water on the surface of Earth, collectively, is called as hydrosphere.



(iv): Troposphere:

- definition: The layer of atmosphere which extends from surface of earth upto 12 km above the surface of earth is called troposphere.
 - Most weather patterns (precipitation etc) occur in troposphere
 - most commercial flights also travel through troposphere.
- Temperature: As the troposphere extends upwards, its temperature decreases upto -53°C .

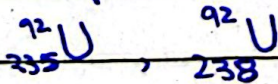
(v): Isotopes:

Definition: Atoms of an element having same atomic number but different mass number are called isotopes.

Example:

- The 3 isotopes of carbon are:
C-12, C-13, C-14

- Isotopes of uranium are:



Section-II

Q:3

(a)

Calculate volume of sphere, diameter = 14cm

(use $\pi = 22/7$)

diameter = 14cm

$$\text{radius} = \frac{d}{2} = \frac{14}{2} = 7\text{cm}$$

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

$$= \frac{4}{3} \left(\frac{22}{7} \right) (7)^3$$

$$= 88 \times 343$$

$$= 1437.3$$

(b)

Five friends' total savings = 25,000 Rs, ratio

1:2:3:4:5. Find smallest share.

$$\text{Sum of ratio} = 1+2+3+4+5 = 15 \text{ (SR)}$$

let 5 friends be, A, B, C, D, E.

share of A:

$$= \frac{\text{Total} \times \text{ratio of A}}{\text{SR}}$$

$$= \frac{25,000 \times 1}{15}$$

$$= 1666$$

share of B:

$$= \frac{\text{Total} \times \text{ratio of B}}{\text{SR}}$$

$$= \frac{25,000 \times 2}{15}$$

$$= 3333$$

DATE: ___/___/___

DAY: ___/___/___

Share of C:

$$= \frac{25000}{15} \times 3$$

$$= 5000$$

Share of E:

$$= \frac{25000}{15} \times 5$$

$$= 8333$$

Share of D:

$$= \frac{25000}{15} \times 4$$

$$= 6666$$

Ans: Smallest share is 1666 of friend A.

(C)

Spot the error / complete the Series

i): 2, 6, 18, 54, 162, 486 (which doesn't fit?)

$$2 \times 3 = 6$$

$$6 \times 3 = 18$$

$$18 \times 3 = 54$$

$$54 \times 3 = 162$$

$$162 \times 3 = 486$$

common ratio = 3

Answer: All numbers fit, none is wrong.

ii): 3, 5, 7, 11, 13, ___

- These are prime numbers $\rightarrow$ divisible by 1 or themselves
- next is 17:

Hence:

3, 5, 7, 11, 13, 17

(d)

A triangle with sides 5 cm, 12 cm, 13 cm.

Find all 3 angles.

type of triangle =

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

$$= 169$$

$$13^2 = 169$$

Hence:

$$5^2 + 12^2 = 13^2$$

This is a right angle triangle hence one angle must be 90° for side 13 cm.

other angles can be:

$$\frac{5}{13} \quad \text{and} \quad \frac{12}{13}$$

Q4

(a)

A store has packet of candies in flavor ratio: 3:6:2:5.

let candies,

$$\text{apple} = 3u \quad \text{cherry} = 2u$$

$$\text{Berry} = 6u \quad \text{Date} = 5u$$

condition:

$$3u - 5u = 35$$

$$-2u = 35$$

$$u = 17.5$$

$$\text{Berry} = 6u = 6 \times 17.5$$

$$= 105$$

DATE: / / DAY: / /

(b)

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

$$\text{Discount} = \$50$$

$$= 200 - 50 = 150$$

add tax:

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

total =

$$150 + 9 = 159 \$$$

(c)

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

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

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

$$\text{Start time} = 1:00 \text{ pm}$$

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

(d)

Unscramble math terms

STSTAICITS → STATISTICS

LGE BMAR → ALGEBRA