

GENERAL KNOWLEDGE-1

GENERAL SCIENCE AND ABILITY

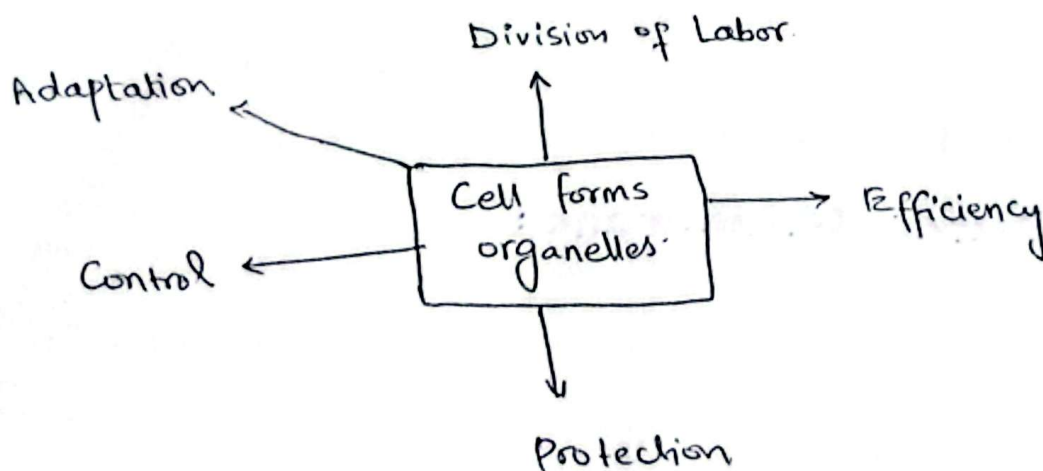
Q. No. 3

2. why cells form organelles? Discuss mitochondria in a human cell.

why cells form organelles?

Cells form organelles to perform different functions efficiently, just like a factory has separate departments for different tasks. Each organelle has a specific role that helps the cell survive, grow, and carry out life processes.

without organelles, all chemical reactions would take place in the same space, confusing and inefficient.



Mitochondria in a human cell:

Mitochondria are the "power houses" of a human cell, responsible for generating most of the chemical energy in the form of adenosine triphosphate (ATP) needed to power the cell's biochemical reactions. They are double-membraned organelles found in the cytoplasm of nearly all human cells and also play roles in other functions like cell signalling, Calcium homeostasis, and apoptosis.

Structure and function:

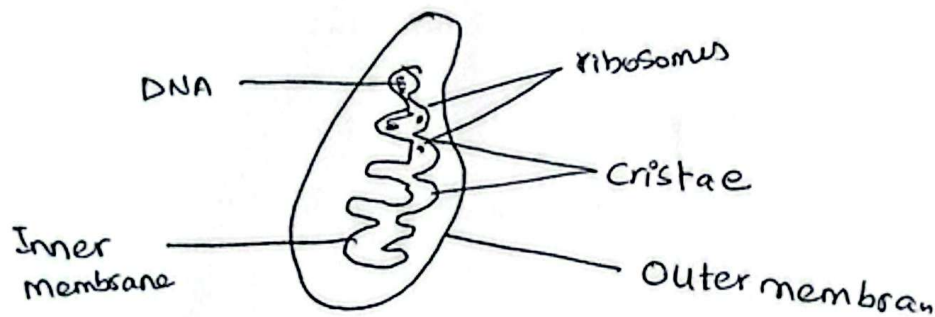


Diagram of Mitochondrion.

Each Mitochondrion is a double-membraned organelle with distinct compartment.

* Outer Membrane:

The smooth, outer boundary of the mitochondrion, it contains porins, which are channel-forming proteins that allows the passage of small molecules and ions.

* Inner membrane:

The membrane is extensively folded into structures called cristae, which increase the surface area for the production of energy. It is much less permeable than the outer membrane and houses the protein complexes of electron transport chain.

* Matrix:

The innermost compartment enclosed by the inner membrane. It contains hundred of enzymes, mitochondrial DNA (mtDNA), and ribosome.

Functions:

Some important functions of mitochondria are the following:

* Energy Production:

Convert nutrients and oxygen into ATP, the cell's primary energy currency, through cellular respiration.

* Metabolism:

Involved in various metabolic pathways, including beta oxidation and the Krebs cycle.

* Cell Signalling:

Play a role in communication between cells

* Other functions:

Involved in heat generation, cell growth, and maintenance of lipid membranes.

b. What is doping? Discuss different types of Semiconductors.

Doping :

Doping is the process of introducing a small amount of foreign atoms (dopants) into the crystal lattice of a pure semiconductor, like silicon or Germanium.

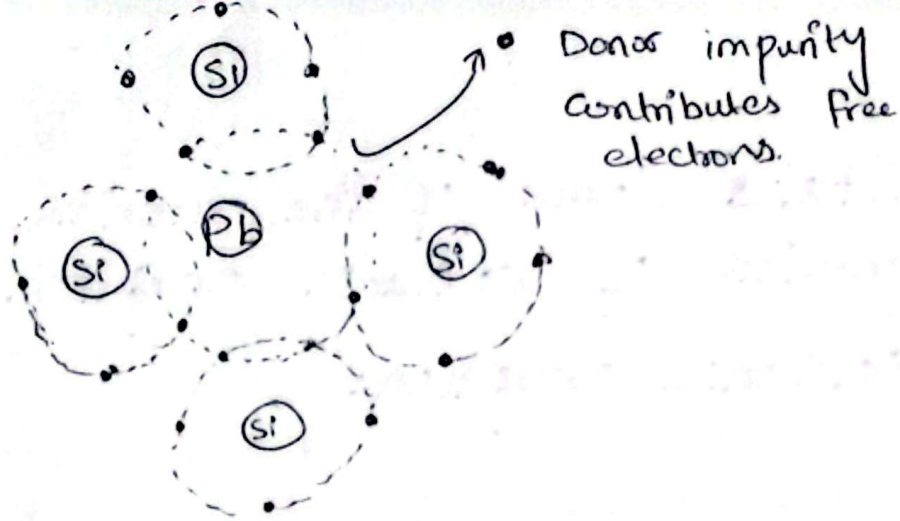
This is done to increase the material's electrical conductivity by adding more charge carriers, which can be either extra electrons or holes. This process changes the conductivity and behavior of the semiconductor, making it suitable for various electronic applications.

Types of Semiconductors:

- i. N-Type Semiconductors.
- ii. P-Type Semiconductors.

i. N-Type Semiconductors:

N-Type Semiconductors are created by doping with donor impurities (like phosphorus), these have an excess of free electrons, making them more conductive.

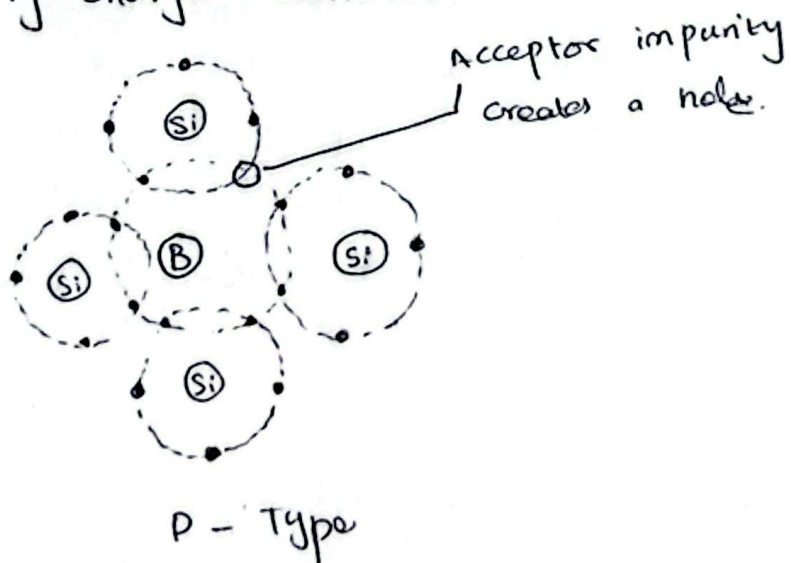


ii. P - type semiconductors:

An element with three valence electrons is used such as Boron, which is added to silicon.

Carriers: The dopant atom has one less electron, creating an empty space or "hole" in the crystal lattice. This hole can be filled by an electron from a neighboring atom, causing the hole to move.

There is an excess of holes, making holes the majority charge carriers.



C. States Some of the merits and demerits of volcanic eruption.

Volcanic eruption:

A volcanic eruption is the release of gases, rock fragments, and molten lava from inside the Earth through a vent on its surface. Magma, which is hot, liquid rock, rises from beneath the Earth's (surface) crust and collects in chambers.

Merits of Volcanic Eruption:

Some of merits of volcanic eruption are following:

i. Soil fertility and agriculture:

Volcanic ash and lava weather into mineral rich soils (high in phosphorus, potassium, trace elements) that support productive agriculture (e.g. coffee, grapes)

ii. Mineral and Geothermal resources:

Concentration of valuable ore deposits associated with magmatic and hydrothermal processes. Geothermal energy potential enables renewable electricity and heating (Iceland, New Zealand, Indonesia)

iii. Economic and Cultural benefits:

Volcanoes, lava flow, hot springs, and unique landscapes attract tourists and support local economies.

iv. Climate regulation:

Large explosive eruptions inject aerosols into the stratosphere that can

temporary cool global temperatures for 1-3 years, influencing climate patterns (e.g 1991 Mount Pinatubo)

De-merits of volcanic Eruptions:

Some of demerits of volcanic eruption are as follows,

i. Human hazards and mortality:

Volcanic gases cause immediate deaths, injuries and destruction of settlements and infrastructure.

ii. Environmental and Agricultural damages.

Thick ash layer can bury crops, smother vegetation, contaminate water supplies, and render soils temporarily infertile and weathering occurs.

iii. Climates Impacts:

Strong eruptions can cause short-term global cooling, disrupting agriculture and weather patterns.

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d. What is dengue? Discuss Symptomology, Causative agents and Remedies.

Dengue:

Dengue is a viral disease transmitted by infected mosquitoes, Primarily Aedes. Dengue is mainly due to mosquitoes.

Symptomology:

Key symptoms include high fever, severe headache, pain behind the eyes, muscles and joint pain, nausea vomiting and rash.

Causative agents:

The disease is caused by any of the four related dengue viruses; dengue virus 1, 2, 3 and 4. The virus is transmitted to humans through the bite of an infected mosquito, most commonly the *Aedes aegypti* mosquito.

Remedies:

Following are the some important remedies for dengue.

- i. **Supportive Care:** There is no specific antiviral treatment for dengue, so care focus on managing symptoms.
- ii. **Hydration:** Drink plenty of fluids to prevent dehydration.
- iii. **Medication to avoid:** Don't take non-steroid anti-inflammatory drugs such as Ibuprofen, aspirin, or naproxin, as they can increase the risk of bleeding.
- iv. **Rest:** Get plenty of rest to allow the body to recover.



Q.No.4

a. Write a note on plant Kingdom "Chlorophyll"
Plant Kingdom "Chlorophyll":

The "chlorophyll class" in the plant kingdom refers primarily to Chlorophyceae, which are characterized by their chlorophyll a and b pigments, stored food as starch, and cellulose cell walls. These are predominantly freshwater organisms that reproduce vegetatively.

Features of Chlorophyceae:

* Pigments:

They contain chlorophyll a and b, along with other pigments like β carotene and xanthophyll, which give them green color.

* Photosynthesis:

They are autotrophs producing their own food through photosynthesis, using sunlight, CO_2 and water.

* Storage:

The primary food reserve is starch.

* Cell structure:

Their cell walls are made of cellulose.

* Habitat:

Most species are found in freshwater environments.

* Reproduction:

They can reproduce through various methods:

- * vegetative : Fragmentation
- * Sexual :
- * Asexual,

b. Describe role of ribosomes in Protein Synthesis.

Ribosomes:

Ribosomes are like the construction sites of the cell where proteins are made. They read messenger RNA sequences and assemble amino acids into polypeptide chains, which fold into proteins.

- 1. mRNA binding:** The ribosome binds to the mRNA, which carries the genetic code from DNA.
- 2. tRNA selection:** Transfer tRNA molecules bring amino acids to the ribosomes, matching the mRNA codes.
- 3. Peptide bond formation:** The ribosome links amino acids together, forming a growing polypeptide chain.
- 4. Translation completes:** The process ends when a stop codon is reached, releasing the completed protein.

Ribosomes are essential for translating ~~acquiring~~ genetic information into proteins, playing a central role in protein synthesis.



C. Discuss different methods of solid waste management:

Solid waste management:

Solid waste management involves several methods to handle waste effectively. Here are some key approaches.

i. Land filling:

Waste is buried in a designated area, but this can lead to environmental issues like leachate and methane production.

ii. Incineration:

Waste is burned, reducing volume, but potentially producing air pollutants.

iii. Recycling:

Materials are collected, processed, and reused, conserving resources and reducing landfill waste.

iv. Composting:

Organic waste is broken down into nutrient-rich soil amendments.

v. Waste to Energy:

Waste is used to generate electricity or heat.

Effective management often involves a combination of these methods, considering environmental, economic, and social factors.

d. Define the terms :

i. Bio fuel:

A fuel produced from organic matter or biological material, such as plants, algae, or agricultural wastes, used as an alternate to fossil fuels.

ii. Adulteration:

The act of intentionally adding inferior or harmful substances to a product, often food, or fuel, to increase profit or deceive consumers.

iii. Hydrosphere:

The region of the earth where water is present, including oceans, lakes, rivers, ground water and atmospheric water vapors.

iv. Troposphere:

The lowest layer of the Earth's atmosphere, extending upto about 12 km altitude, where weather occurs and temperature decreases with altitude.

v. Isotopes:

Atoms of the same chemical element with the same number of protons, but different number of neutrons, resulting in different atomic masses.

like ${}^1_1\text{H}$, ${}^2_1\text{H}$ and ${}^3_1\text{H}$ etc

⑦

Q. 6.

- a. A store has packets of candies in flavors. Apple, Berry, Cherry and Date in ratio 3:6:2:5. If Apple candies exceed Date candies by 35, how many Berry candies are there.

Soln

Given that
 By ratio $\frac{3x}{5x} = \frac{35}{25}$ (x is the common multiplier)
 Base on data

$$\text{Apple candies} = 3x$$

$$\text{Date candies} = 5x$$

$$3x - 5x = 35$$

$$2x = 35$$

$$x = \frac{35}{2} = 17.5$$

$$\text{Berry candies} = 6x$$

$$= 6(17.5)$$

$$= 105 \text{ candies}$$

The number of berry candies is 105

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- b. A camera priced at 200\$ gets 25% off plus 6% tax. Calculate the total amount paid.

Soln

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

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

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

$$\begin{aligned}\text{Discount Amount} &= \text{Discount \%} \times \text{Price of Camo} \\ &= 25\% \times 200 \$ \\ &= \frac{25}{100} \times 200 \$ \\ &= 50 \$\end{aligned}$$

$$\begin{aligned}\text{Price after Discount} &= 200 \$ - 50 \$ \\ &= 150 \$\end{aligned}$$

$$\begin{aligned}\text{Tax} &= \text{Tax \%} \times \text{Price} \\ &= 6\% \times 150 \$ \\ &= \frac{6}{100} \times 150 \$\end{aligned}$$

$$\text{Tax} = 9 \$$$

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

$$\boxed{\text{Total Amount Paid} = 159 \$}$$

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C. A bicycle covers 36 km at 18 km/hr starting at 1 pm. what time does it reach?

Soln:

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

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

$$\begin{aligned}\text{Time taken} &= \text{Distance} / \text{speed} \\ &= \frac{36 \text{ km}}{18 \text{ km/hr}}\end{aligned}$$

$$\boxed{\text{Time taken} = 2 \text{ hr}}$$

The bicycle starts at 4 pm so it will reach the destination at $4\text{pm} + 2\text{hours} = \boxed{3\text{pm}}$

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d. Unscramble these math terms:

i. STSTAICITS
 ↳ STATISTICS

ii. LGEBMAR
 ALGEBRA

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Q No 7

a. Calculate the volume of a sphere with diameter 14 cm. ($\pi = \frac{22}{7}$ use)

Soln: Given diameter = 14 cm

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

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

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

$$= \frac{4}{3} \times \frac{22}{7} \times \overset{49}{\cancel{343}}$$

$$= \frac{4 \times 22 \times 49}{3}$$

$$= \frac{4312}{3}$$

$$\begin{array}{r} 88 \times \\ 49 \\ \hline 792 \\ 352 \times \\ \hline 3 \overline{) 4312} \quad (1437.3 \\ \underline{3} \\ 13 \\ \underline{12} \\ 11 \\ \underline{9} \\ 22 \\ \underline{21} \\ 10 \\ \underline{9} \end{array}$$

Volume of sphere = 1437.33cm^3

b. Five friends's total savings = 25,000 Rs,
ratio 1:2:3:4:5 Find the smallest share.

Solve

The ratio of Savings = 1:2:3:4:5

$$\begin{aligned}\text{Sum of ratios} &= 1+2+3+4+5 \\ &= 15\end{aligned}$$

$$\text{Total savings} = 25,000 \text{ Rs.}$$

$$\text{Smallest share ratio} = 1$$

$$\text{Smallest share} = \frac{1}{15} \times \frac{1666.67}{25,000}$$

Smallest Share	=	1666.67 Rs
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c. Spot the error / Complete the series:

i. 2, 6, 18, 54, 162, 486 (which number doesn't fit)

2, 6, 18, 54, 162, 486, ...

this is geometric progression with a common ratio of 3.

$$2 \times 3 = 6$$

$$6 \times 3 = 18$$

$$18 \times 3 = 54$$

$$54 \times 3 = 162$$

$$162 \times 3 = 486.$$

All numbers are in pattern, there's no number that doesn't fit.

ii. 3, 5, 7, 11, 13, ~~13~~, —

This is a sequence of prime numbers :
Next prime number after 13 is 17.

So the completed series is : 3, 5, 7, 11, 13, 17.

★ ★

d. A triangle with sides 5cm, 12cm, 13cm.
Find all three angles.

Soln

Given sides : $a = 5\text{cm}$

$b = 12\text{cm}$

$c = 13\text{cm}$

$$\text{Since } (5)^2 + (12)^2 = 13^2$$

$$25 + 144 = 169$$

So this is a right-angle triangle

opposite the 13 cm side = 90°

using trigonometry.

$$\begin{aligned} A &= \arcsin(5/13) \\ &= 22.62^\circ \end{aligned}$$

$$\begin{aligned} \text{So } B &= 90^\circ - 22.62^\circ \\ &= 67.38^\circ \end{aligned}$$

The angles are approximately

$$A \approx 22.62^\circ$$

$$B = 67.38^\circ$$

$$C = 90^\circ$$

