

General Science and Ability

Part II (Section I)

Q#3

a) Why cells form organelles?

Cells form organelles for proper functioning of the cell. In order to maintain internal cell processes cells divide their functions with specialized compartments. The purpose of forming organelles is to,

- divide the work load into compartments.
- perform cellular task with high efficiency.
- maintain order and organization
- to ensure specialization of function

For instance,

organelles are specified for specific function i.e lysosomes for cellular digestion, mitochondria for energy production, ribosomes for protein synthesis etc.

⇒ Mitochondria. ~~has small 2. brown~~

Mitochondria is the energy producing organelle present in both plant and animal cell. It produces energy in the form of ATP. It is also called as, "Power House Of Cell."

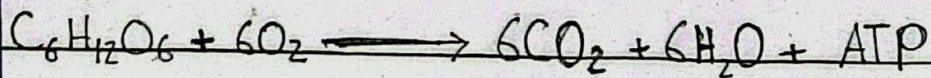
Lets discuss importance of mitochondria in human cell.

→ Structure.

- It is double membraned organelle i.e. inner and outer membrane.
- Outer membrane is a smooth structure while inner membrane comprises of various folds called "cristae". These folds increase the surface area for chemical reactions.
- Inside region is the matrix which contains enzymes, DNA etc.

→ Function.

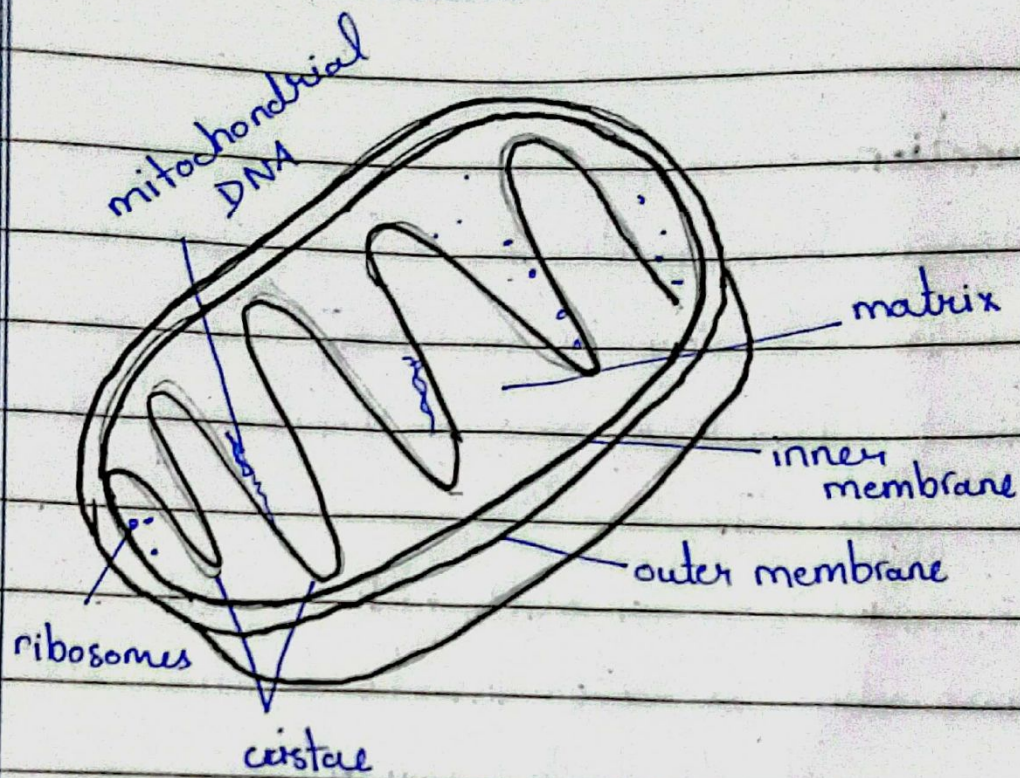
- Mitochondria meets the energy demands of the cell by producing ATP.
- Mitochondria performs cellular respiration to produce ATP.



- Mitochondria is also involved in programmed cell death → apoptosis.
- It regulates metabolism.
- It is also the storage site for calcium at cellular level.

→ Self-Replication.

- Mitochondria contains their own DNA.
So, that's why it is capable of replicating independently.
- It is a self-replicating organelle believed to evolve from free-living bacteria.



Conclusion.

- Cell forms organelles for better and improved functioning with compartmentalization. It increases efficiency, speed and specialization of cellular processes.
- Mitochondria is the power house of cell as it produces ATP by cellular respiration. Its structure is well defined to its functions.

Q#3.

b) Doping.

→ Definition.

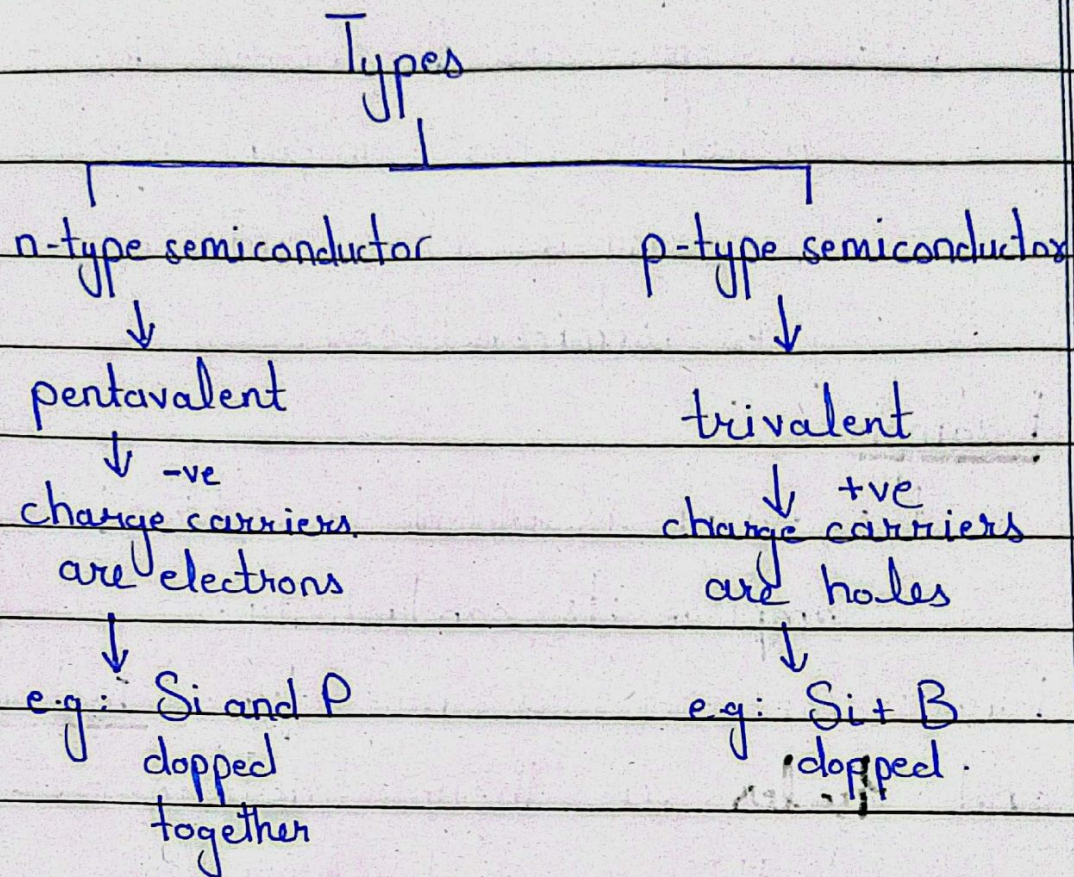
↳ Doping is the process in which a small amount of impurity is added into a pure semiconductor.

→ Example.

↳ arsenic is added to silicon to improve its conductivity.

- Pure semi-conductors have free electrons and holes in their structure. As a result they conduct electricity poorly.
- When doped with suitable impurities, their conductivity increases because the number of charge carriers increase i.e. more charge carriers, more electric conductivity.

→ Types Of Semi-conductors



1- n-type semi-conductors.

→ In n-type semi-conductors the doping element is pentavalent which means having 5 valence electrons i.e. P, As etc.

→ Majority charge carriers are electrons in this type.

→ The four electrons of impurity make covalent bond with silicon & the fifth one is free electron.

→ The benefit of n-type is that the conductivity increases because of excess electrons.

→ example: silicon is doped with phosphorus.

2. p-type semi-conductor.

→ In this type the impurity material is trivalent i.e. having 3 valence electrons.

→ Majority charge carriers are holes.

The trivalent atom forms bond with

→ 3 silicon atoms. While one bond remains incomplete creating a hole and hole acts as positive charge carrier.

→ As a result, conductivity increases due to hole movement.

→ example:

silicon doped with boron

Q #3.

c) Volcanic Eruption.

→ 1 Definition

↳ Volcanic eruption is the sudden release of magma, gases and ash from a volcanic mountain onto the earth's surface.

→ Example

↳ Mount St. Helens are the famous example of volcanic eruptions that occur in USA.

→ Merits of Volcanic Eruptions.

There are different advantages of volcanic eruptions, some of them are listed below.

- Volcanic ash and lava break down into rich minerals, creating fertile soil ideal for agriculture.
- Volcanoes bring valuable minerals like sulfur, copper, gold etc.

- Heat of the volcanoes can be used to produce geothermal electricity.
- Volcanoes also attract tourists giving economic benefits
- Volcanic eruptions form new islands and mountain ranges.

→ Example

- ↳ Famous Hawaiian Island formed because of volcanic eruption
- ↳ Indonesia producing geo-thermal energy from volcanoes.

⇒ Demerits of Volcanic Eruption.

These are the some drastic demerits of volcanic eruption.

- Explosive volcanic eruptions can cause great destruction of homes, crops and infrastructure.
- Volcanic eruption causes air pollution

- Volcanic eruption release sulfur dioxide which further results in acid rain.
- Volcanic eruptions can cause great climatic changes.
- Ash and gases can cause acute respiratory problems, skin irritations etc.

Example

↳ Philippines suffered great acid rains due to volcanic eruptions.

↳ Volcanic eruption in 1991, made the global temperature to drop by 0.5°C .

Q#3

d) Dengue.

- Dengue is a viral infection.
- Dengue transmitted to humans through the bite of infected female *Aedes* mosquito.
- It is also known as "breakbone fever".
- It is common in rainy seasons.

→ Symptoms.

Following are the significant symptoms of dengue.

- High fever
- Severe headache
- Muscle, joint pain
- Nausea and vomiting
- Skin rashes
- Pain behind eyes.

Severe symptoms may include bleeding gums, low platelet etc.

→ Causative Agent.

- Dengue virus is the causative agent (DENV)
- It has four main types, (DENV-1, DENV-2, DENV-3 and DENV-4)

→ Remedies.

- Take plenty of water & fluids to prevent dehydration.
- Use paracetamol, avoid aspirin
- Use mosquito repellants
- Complete rest.
- Eat citrus fruits
- Complete medical checkup and platelets monitoring.

⇒ To prevent dengue
wear long sleeves, remove standing water, anti-dengue awareness, destroy breeding sites etc

Q # 4.

b) Ribosomes.

Ribosomes are tiny round organelles found in cytoplasm or attached to endoplasmic reticulum. They are involved in protein synthesis. They are known as "Protein Factories".

- They are made of rRNA and proteins.
- They have two subunits.

- small subunit (reads genetic code)
- large subunit (forms protein chain)

→ Role in protein synthesis

Protein Synthesis by ribosomes involve 4 steps.

↳ Initiation

↳ Elongation

↳ Peptide bond formation

↳ Termination

1. mRNA attachment → initiation

In this process,

↳ mRNA attaches to the small ribosomal subunit

↳ the AUG (start codon) signals ribosome to begin synthesis

2. tRNA binding → elongation

In this step,

↳ tRNA brings specific amino acid molecules

↳ the ribosome matches the codon on mRNA sequence with the anticodon on tRNA, ensuring the correct amino acid order

3. Peptide bond formation

This step involves

↳ formation of polypeptide chain by large subunit of ribosome

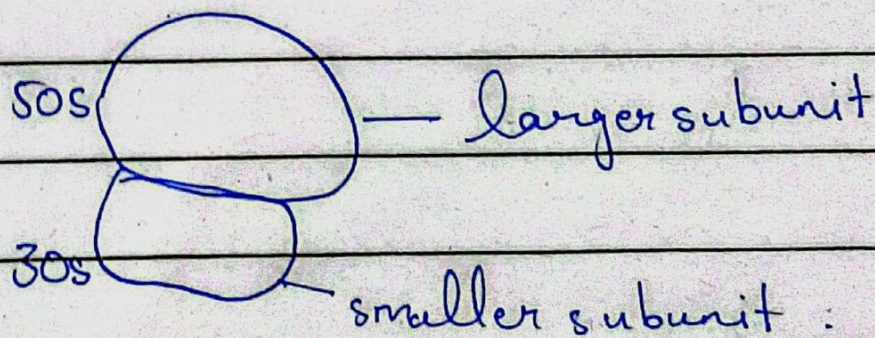
4. termination.

In this final step

↳ when ribosome reaches a stop codon (UAA, UAG, UGA)
protein synthesis stops

↳ the formed protein is released & ribosome & mRNA get detached.

→ Ribosomes act as a site where amino acids are assembled and proteins are formed resultantly.



70S prokaryotic ribosome.
(eukaryotic ribosome is 80S)

Q#4

c) Solid Waste Management

Definition.

↳ It refers to the collection, treatment and disposal of solid material or waste material discarded by the society.

→ The purpose of solid waste management is to reduce pollution and protect public health by promoting recycling and reuse.

→ Methods.

Solid waste management involves,

- Open Dumping
- Landfilling
- Incineration
- Compositing
- Recycling
- Pyrolysis etc.

Student Sign _____

Class: _____

Session: _____

Teacher Sign _____

Date: _____

Name	Mechanism	Merit	Demerit
→ Open Dumping	Waste is dumped in open land areas	simple and cheap	bad odors, harmful to environment, soil pollution
→ Land filling	Waste is buried under the soil	Controlled & hygienic	Requires large area of land
→ Incineration	Waste is burned properly in incinerators	Produces energy	Causes air pollution
→ Compositing	Decomposition of organic waste	Produces natural fertilizer	Slow process, time taking
→ Recycling	Reusing the waste material	Economic friendly	Needs segregation
→ Pyrolysis	Thermal breakdown of waste to fuel	Energy recovery	Expensive

Q # 4

d) i) Biofuels.

↳ Biofuel is the renewable fuel produced by biological sources such as plants, animals waste or micro-organisms

- It is eco-friendly.

→ Forexample

↳ Ethanol is made from corn & sugarcane

ii) Adulteration

↳ Mixing of harmful substance into food, fuel or other products.

- It reduces quality of product.

→ Forexample

Adding water in milk

iii) Hydrosphere.

↳ All the water present on or near the Earth surface is called hydrosphere

→ Foreexample

↳ water bodies like river, lakes, oceans, underground water, glacier etc are hydrosphere.

(iv) Troposphere.

↳ It is the lowest region or layer of the Earth's atmosphere where weather changes occur.

→ Rain, winds, clouds happen in troposphere. It extends 8-15 km above Earth's surface.

(v) Isotopes.

↳ Isotopes are atoms of the same element that have same number of protons but different neutron number.

→ Foreexample,

Isotopes of hydrogen are Protium (${}^1_1\text{H}$), Deuterium (${}^2_1\text{H}$), Tritium (${}^3_1\text{H}$)

(Section II)

Q# 7 (a)

→ Given Data:

$$\text{Diameter} = 14 \text{ cm}$$

$$\text{Volume} = ?$$

$$r = \frac{D}{2} = \frac{14}{2} = 7 \text{ cm.}$$

$$\pi = \frac{22}{7}$$

→ To find:

$$\text{Volume} = ?$$

→ Solution.

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

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

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

$$V = 1437.33 \text{ cm}^3$$

Q.# 7 (b) .

Total saving = Rs. 25,000

Ratio = 1 : 2 : 3 : 4 : 5

Let Shares $\rightarrow 1x, 2x, 3x, 4x, 5x$

Smallest share = ?

$$\begin{aligned}\text{Total share} &= 1x + 2x + 3x + 4x + 5x \\ &= 15x\end{aligned}$$

$$15x = 25,000$$

$$x = \frac{25,000}{15}$$

$$x = 1666.6$$

Smallest share will be $1x = \text{Rs. } 1666.6$

→ Q# 7(c)

(i) 2, 6, 18, 54, 162, 486
3x 3x 3x 3x 3x

No error.

(ii) 3, 5, 7, 11, 13, 17
series of prime numbers.

→ Q# 7(d)

$$a = 5 \text{ cm}$$

$$b = 12 \text{ cm}$$

$$c = 13 \text{ cm}$$

It will be a right angle triangle
Proof:

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

$$25 + 144 = 169$$

$$169 = 169$$

So, the angle opposite to hypotenuse
will be 90°

Q#6 (a).

Ratio of apple : berry : cherry : date.
3 : 6 : 2 : 5

Apple exceeds by 25.
dates

Let common factor x

$$\text{apple} = 3x$$

$$\text{berry} = 6x$$

$$\text{cherry} = 2x$$

$$\text{date} = 5x$$

$$\text{Apple} = \text{Date} + 35$$

$$3x = 5x + 35$$

$$3x - 5x = 35$$

$$-2x = 35$$

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

$$x = -17.5$$

$$\text{Berry } 6x = 6x = 6(17.5) = \boxed{105}$$

Q# 6 (b).

$$\text{Original price} = \$200$$

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

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

$$\begin{aligned} 25\% \text{ discount} &= 200 \times 25\% \\ &= 200 \times \frac{25}{100} \end{aligned}$$

$$= \$50$$

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

$$\begin{aligned} 6\% \text{ tax} &= 150 \times 6\% \\ &= 150 \times \frac{6}{100} \\ &= \$9 \end{aligned}$$

$$\text{Final price} = 150 + 9$$

$$= \$159$$

Q#6 (c).

Distance = 36 km.

Speed = 12 km/hr

Start time = 1:00 pm.

$$\text{Time} = \frac{D}{S}$$

$$= \frac{36}{12}$$

= 2 hours.

Start time = 1:00 pm

= 1 + 2 hrs

Final time = 3:00 pm.

Q#6 (d).

(i) STSTAICTS → STATISTICS

(ii) LGEBMAR → ALGEBRA