

Rabia - Nazeer

General Science and ability

SECTION-II

Qno6

(a)

A store has packets of candies in flavours apple, Cherry and Date in the ratio $3:6:2:5$. If Apple candies Date candies by 35, how many Berry candies are there.

Solution:

Apple : Berry : Cherry : Date = $3:6:2:5$

Apple = $3k$ and Date = $5k$

So Apple cannot exceed Date (since $3k < 5k$ for positive k)

$$5k - 3k = 35$$

$$2k = 35$$

$$k = 35/2$$

$$k = 17.5$$

$$\begin{aligned} \text{Berry} &= 6k = 6(17.5) \\ &= 105 \end{aligned}$$

(b)

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

Solution:

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

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

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

$$\text{Discounted price} = 200 - 50 = 150$$

$$\text{Add } 6\% \text{ tax} = 6\% \text{ of } 150$$

$$= \frac{6}{100} \times 150 = 9$$

So,

$$\text{Total amount paid} = 150 + 9 = 159\$$$

(c)

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

Solution: Distance = 36 km, Speed = 18 km/h

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

Starting time = 1 PM

Reaching = 1 + 2 hours = 3 PM

Arrival time = 3 PM

(d)

Unscramble these maths terms:

i) STSTAICITS
STATISTICS

ii) LGEBMAR
GAMBLER

(Qno 7)

(a)

Calculate the volume of a sphere with diameter 14 cm (use $\pi = 22/7$)

Solution:

Diameter = 14 cm

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

$$V = \frac{4}{3} \pi r^3$$

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

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

$$= \frac{4}{3} \times 1078 = \frac{4312}{3} = 1437.3$$

$$\text{Volume} = 1437.33 \text{ cm}^3 \text{ approximately}$$

(b)

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

Solution:

Given ratio = 1 : 2 : 3 : 4 : 5

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

Total savings = Rs 25,000

So,

$$\text{one part} = 25,000 / 15 = 1666.67$$

$$\text{Smallest share (1 part)} = \text{Rs } 1666.67$$

(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
1	1	1	1	1	1
2×3	6×3	18×3	54×3	162×3	486×3
$= 6$	$= 18$	$= 54$	$= 162$	$= 486$	$= 1458$

= All followed the same pattern so there's no error.

(d)

ii) 3, 5, 7, 11, 13, _____

This is a prime number series
so

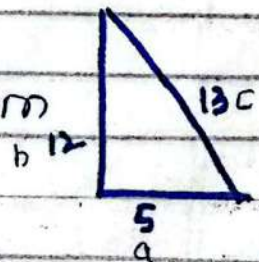
3, 5, 7, 11, 13, 17

(d)

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

Solution

$a = 5\text{cm}$, $b = 12\text{cm}$, $c = 13\text{cm}$



For right-angle triangle

$$\begin{aligned}\text{Base}^2 + \text{Perpendicular}^2 &= \text{hypotenuse}^2 \\ (5)^2 + (12)^2 &= \text{hypotenuse}^2 \\ 25 + 144 &= \text{hypotenuse}^2 \\ 169 &= \end{aligned}$$

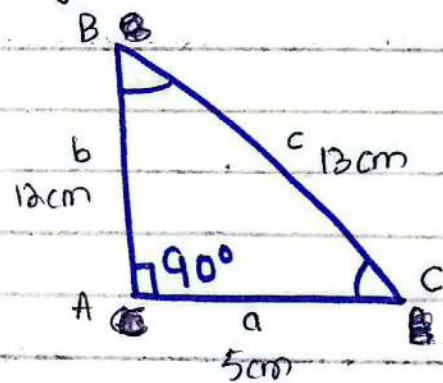
$$13^2 = \text{hypotenuse}^2$$

hence proved, it is right-angle triangle

$$\text{so } m\angle A = 90^\circ$$

$$\sin C = \frac{a}{c} = \frac{5}{13}$$

$$C = \sin^{-1}\left(\frac{5}{13}\right) \approx 22.62^\circ$$



$$B = 90^\circ - C = 90^\circ - 22.62^\circ = 67.38^\circ$$

$$A = 90^\circ, B = 67.38^\circ, C = 22.62^\circ$$



SECTION-I

Q no 3:

(a)

Why cells form organelles? Discuss Mitochondria in a human cell.

Cells are not homogenous ^{bags of} fluids, it is further composed of membrane-bounded and non-membrane bounded organelles for efficient functioning of the cell and orderly structure.

Organelles: Organelles are the specialized structures within a cell that performs distinct functions necessary for the cell's survival, growth, and reproduction. The term "organelle" means the little organ within the cell. They compartmentalize cellular processes, allowing different chemical reactions to occur simultaneously under optimal conditions without mutual interference. Cells form organelles due to the following reasons:

- 1) **Division of labour:** As each organelle carries its specific function - e.g.,
Mitochondria → ATP production.

- Nucleus → Genetic control
- Ribosomes → protein synthesis
- Endoplasmic reticulum → Protein processing
- Golgi Apparatus → modification and sorting
- Lysosome → Intracellular digestion
- and others.

2) compartmentalization and micro-environment:

Organelles provide compartmentalization and micro-environments. Enclosed compartments maintain distinct pH, ionic strength, and enzyme composition for particular reactions. It prevents some incompatible reactions within the same space.

3) Metabolic efficiency: Organelles enhance metabolic efficiency. As every organelle is specific in its own reaction it would cause efficiency in the cellular process and activities within the cell.

4) Protection and control: Some organelles contain digestive enzymes like lysosomes. By keeping them enclosed, cell protects itself from damage.

" Mitochondria "

Mitochondria are very important organelles. It is present only in eukaryotic cells. It is involved in the manufacturing and supply of energy to the cell. Therefore, it is also called the "**Power house of the cell**". The size of mitochondria is different in different structures.

Structure of mitochondria:

The mitochondria may be vesicle rod or filament shaped, bounded by two membranes. The outer membrane is smooth, while the inner membrane forms many foldings called "cristae". The inner surface of cristae contains knob like structure, called "F₁ particles". These F₁ particles are suspended inside the matrix.

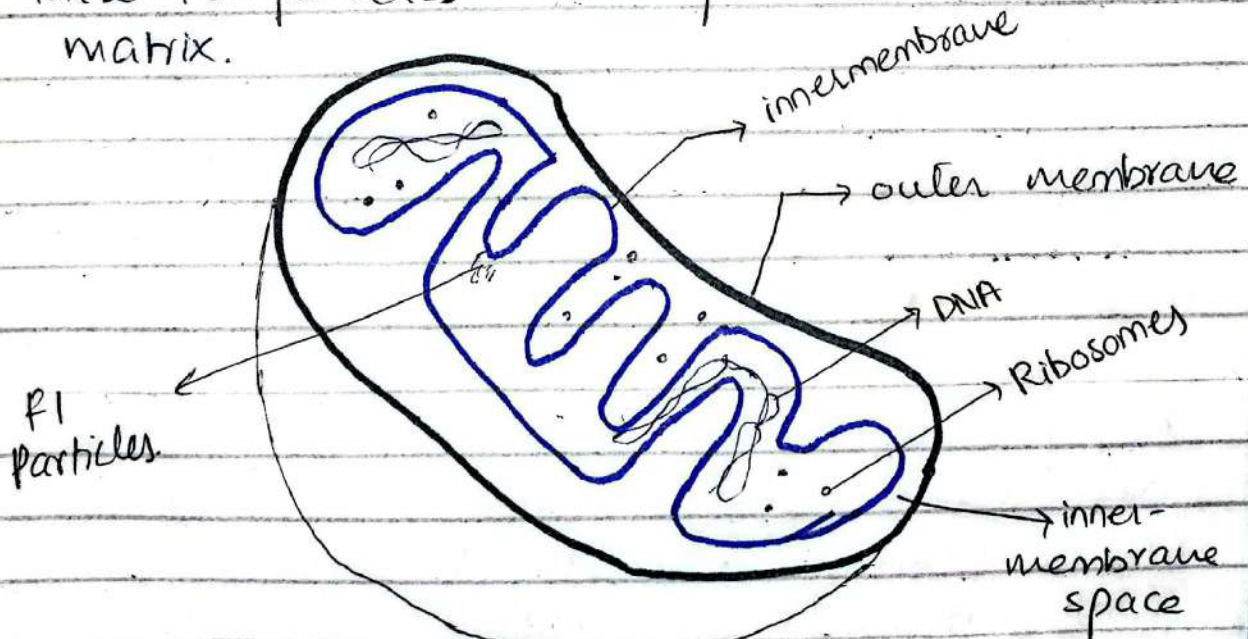


Fig: Structure of Mitochondria

Chemical composition:

The mitochondrial membranes are composed of lipids and proteins, same like other membranes. Mitochondrial matrix contains a large number of enzymes, coenzymes, organic and inorganic salts. They also contain DNA and ribosomes, so they can synthesize their own proteins.

Formation of New Mitochondria:

Mitochondria are self-replicating organelles. It means new mitochondria are formed by the division of old mitochondria.

Functions :

1) Many important metabolic processes like Krebs cycle, aerobic respiration, fatty acid metabolism etc. takes place in mitochondria.

2) The energy is transferred to energy rich compound ATP (adenosine tri-phosphate). ATP provides energy to cell on demand and ATP is broken to ADP. Then, ADP absorbs energy from mitochondria and again becomes ATP.

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Qno3 (b)

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

Doping:

Doping is the process of intentionally small amounts of impurities (dopants) to a pure semi-conductors like silicon or germanium in order to change its electrical properties. Pure semi-conductors are called intrinsic semiconductors and after doping they became extrinsic semiconductors, which have much higher conductivity.

Why doping is done?

Doping is done because in intrinsic semiconductors there are number of free electrons which means there are number of holes due to which electrical conductivity is very low at room temperature.

Impurities are added due to which the number of charge carriers i.e. electrons increases due to which the material becomes a better conductor.

Types of Semiconductors:-

There are two main types of doped Semiconductors:-

- 1) N-type Semiconductor
- 2) P-type Semiconductor

1) N-type Semiconductor:

Formation:- Doped with pentavalent impurities (elements having 5 valence electrons) such as:-

- phosphorus (P)
- Arsenic (As)
- Antimony (Sb)

In silicon (which has 4 valence electrons) when a pentavalent is added, it shares 4 of its electrons with its neighboring silicon atoms. The 5th electron is free because it is not needed for bonding. These free electrons increase electron concentration in the semiconductor.

Charge carriers:

1) Majority carriers: Electrons

2) Minority carriers: Holes

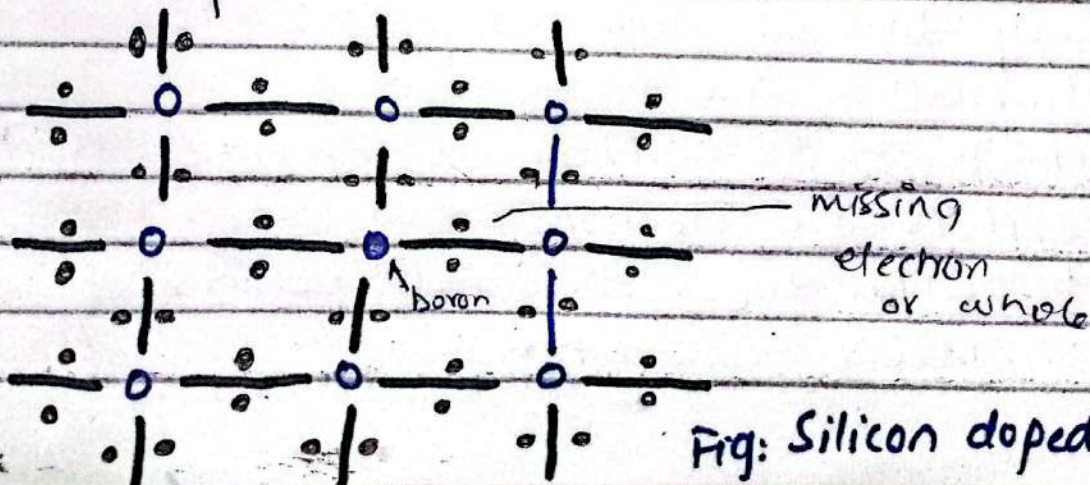


Fig: Silicon doped with boron

a) P-type Semi-conductor:

P-type occurs when dopant (such as boron) has only three electrons in the valence shell. When a small amount is incorporated into the crystal, the atom is able to bond with four silicon atoms, but it has only three electrons to offer. A hole is created. The hole behaves like a positive charge. That's why semiconductors doped in this way are called P-type-semiconductors. Like a positive charge attracts electrons. But when an electron moves into a hole, the electron leaves a new hole at its previous location.

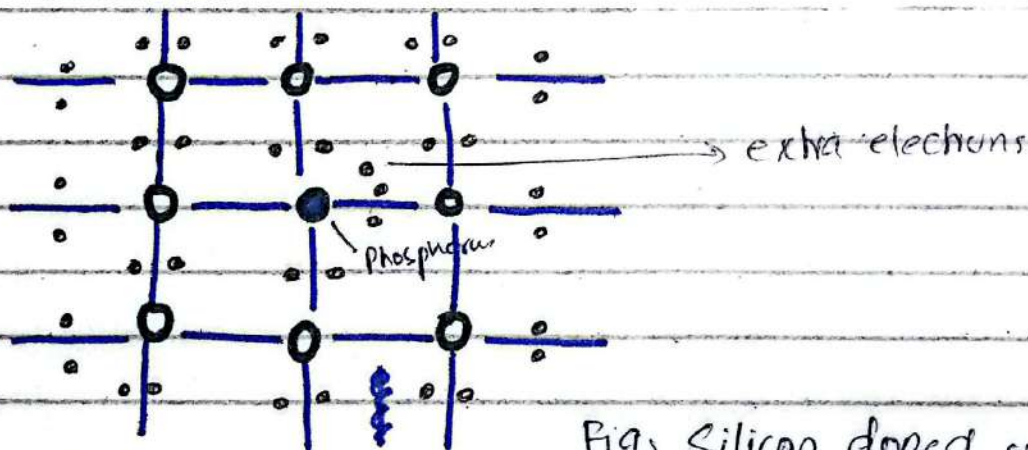


Fig. Silicon doped with phosphorus

Qno3(c): State some of the merits and Demerits of volcanic eruption

1) Merit :-

- loss of life and property. Explosions, lava flows, and ash clouds can destroy homes, infrastructure and cause fatalities.

2) Air pollution: Volcanic ash and gases like sulphur dioxide pollute the atmosphere ~~and~~ reducing air quality

3) Climate effects :-

Large eruptions can lower global temperatures by blocking sunlight

4) Destruction of vegetation and Wildlife

Lava and ash can burn forest and destroy habitats.

5) Displacement of people

Nearby residents may have to evacuate permanently due to danger zones.

B) Merits:

1) Fertile soil: Volcanic ash and lava break down over time to form rich, mineral-filled soil - ideal for agriculture e.g. in Java, Italy.

2) Mineral resources:

Volcanic regions are rich in valuable minerals such as copper, gold, and sulfur.

- 3) Geothermal Energy: Heat from volcanic activity can be used to generate geothermal electricity e.g in Iceland.
- 4) Tourism: Volcanic landscapes attract tourists, boosting the local economy. e.g Mount Fuji, Hawaii
- 5) New Land Formation:
Eruptions can create new islands or expand landmasses e.g Iceland, Hawaii
-

Qno 3 (d):

* Dengue: Dengue is a viral infection transmitted to humans through the bite of infected female Aedes mosquito primarily Aedes aegypti and Aedes albopictus. It is also called "breakbone fever" because it causes severe joint and muscle pain. It is common in tropical and sub-tropical regions including Pakistan, Southeast Asia, and Latin America.

* Causative agent:

- 1, pathogen: Dengue Virus
- 2, Type: RNA virus

• Family: Flaviviridae

• ~~Ser~~ Serotypes: - There are four main types of the dengue virus,

- 1) DENV-1
- 2) DENV-2
- 3) DENV-3
- 4) DENV-4

* Symptoms:

Symptoms usually appear 4-10 days after the mosquito bite and can last about 2-weeks.

A. Mild Dengue Fever:

- Sudden high fever
- Severe Headache
- Pain behind the eyes
- Muscles and Joint pain
- Nausea and Vomiting
- Skin rash.
- Fatigue and weakness.

2) Severe Dengue (Dengue Hemorrhagic Fever)

- * Bleeding under the skin
- * Nosebleeds or gum bleeding
- * Abdominal pain
- * Persistent vomiting
- * Difficulty breathing

- organ Failure (extreme cases)

* Remedies and Treatment:

There is no specific treatment but care is crucial.

A) Medical management:

- Hydration
- Paracetamol
- Hospitalization (severe cases)

B) Preventive measures

- Mosquito control
- Personal protection
- community awareness
- Vaccination

Q no 4 :

(a)

Plant Kingdom "Chlorophyll"

Chlorophyll is a green pigment found mainly in the chloroplast of plants, algae and some bacteria. It plays a crucial role in photosynthesis, the process by which plants prepare food using sunlight, water and carbon dioxide.

2, Functions of chlorophyll.

i) Absorption of light energy:

It absorbs ^{light} mainly in the blue and red regions of the spectrum and reflects green light, which gives plants that green colour.

a) Conversion of energy:

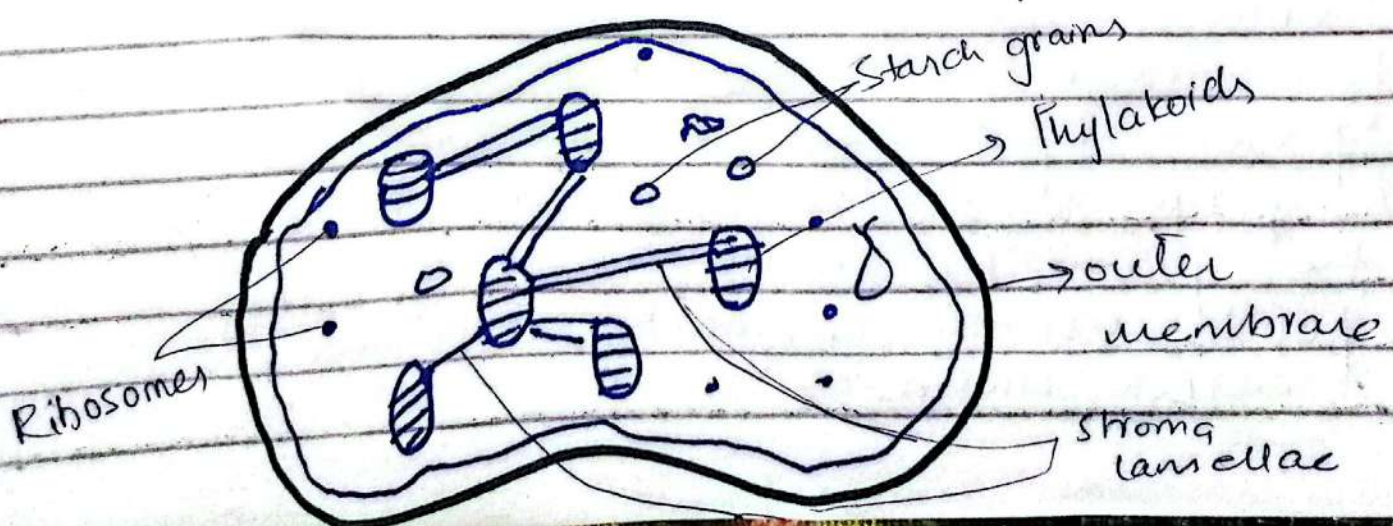
Chlorophyll converts light energy into chemical energy (ATP and NADPH) during photosynthesis.

3) Production of Glucose and Oxygen:

It helps produce glucose and release oxygen as a byproduct, which is essential for life.

Structure:

The chloroplast has four main components: envelop, stroma, Thylakoid, and Granum.



Types:

- 1) Chlorophyll a: Primary pigment, essential for Photosynthesis.
- 2) Chlorophyll b, c, d, and e: Accessory pigment that assist in capturing more light energy

Qno 4 (b)

Role of Ribosomes in Protein Synthesis

* Ribosomes:

Ribosomes are small, spherical organelles found in the cytoplasm or attached to the endoplasmic reticulum (rough RER). They are also known as the "protein factories" of the cell.

* Role in Protein Synthesis

1) Site of Translation:

Ribosomes read the mRNA sequence and translate it into specific amino acid chain

a) Binding of tRNA

tRNA carries amino acid to the ribosomes, matching its anticodon with code on mRNA

3) Formation of peptide bonds

Ribosomes help form peptide bonds between amino acids, producing a complete protein chain

4) Completion and Release:

Once the full sequence is read, the newly formed protein detaches and folds into its functional shape

Qno 4 (c) Methods of Solid Waste Management

Solid waste Management is the process of collecting, treating, and disposing of solid waste in an environment friendly way

Main Methods:

1) **Landfilling**: waste is buried in the ground in a controlled manner. It is common but may cause groundwater pollution if not managed properly

2) **Incineration**: It is process of burning waste at high temperatures to reduce volume and destroy pathogens. It produces energy and also releases harmful gases

3) **Recycling**: It is the process of reprocessing of materials like paper, glass, and metals into new products. It produces pollution and conserve resources. It is three steps process.

4) **Composting**: It is the process in which the biodegradable waste decomposes naturally to produce organic fertilizers. It is eco-friendly and improves soil quality.

5) **Waste-to-Energy**:

It is the process of converting non-recyclable waste into energy (heat and electricity) through combustion or biogas.

6) **Source reduction**:

Reducing waste generation at the source e.g. using reusable products, less packaging.

Qno 4 (d)

(i) **Biofuel**:

Biofuels are the fuels derived from the organic matter for example plants, animals and microorganisms.

For Example: Ethanol, Biodiesel, biogas
They are renewable, and reduce dependence on fossil fuels.

ii) Adulteration.

Adulteration is the addition of harmful or inferior substances to food, drink, or other products to increase profit.

e.g. mixing water into milk.

It is dangerous and harmful for human health.

iii) Hydrosphere:

The hydrosphere includes all the water on the earth e.g. in oceans, rivers, lakes, glaciers, underground water and even water vapours.

It covers about 71% of the Earth's surface.

iv) Troposphere:

It is the lowest layer of the earth's atmosphere extending up to about 8-15 km from the Earth's surface. It contains most of the atmospheric gases and weather phenomena. The temperature decreases with altitude in this layer.

ii) Isotopes:

Isotopes are the atoms of the same element that have the same number of protons and different number of neutrons

e.g carbon have isotopes C-12 and C-14.