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GENERAL SCIENCE AND ABILITY

PART - II

SECTION - I

Q NO. 3

a. ORGANELLES

Organelles are **specialized subunits within a cell** that are enclosed by **membranes** (in eukaryotic cells) and perform **specific functions** necessary for cell's survival and proper functioning

Miniature Organ Inside the Cell

Each organelle works like a miniature organ within the cell. For example

- The **nucleus** control cell activities and contain genetic material
- The **mitochondria** produces energy

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Why Cells Form Organelles?

Cell form organelles to **compartmen-talize specific functions, increasing efficiency** and **organization**. This division of labor allows cells to carry out complex processes necessary for life.

- **Compartmentalization increases efficiency**

Placing enzymes and substrates toge-ther raises local concentration and accelerates reaction rates.

- **Seperation of incompatible chemistries**

Many cellular reactions require different conditions (pH, redox state, ion concentration) Organelles allow processes to occur seperately from processes that would be damaged by them.

- **Evolutionary advantage**

Specialization allow multicellular complexity and division of labor within cells, bringing new metabolic capacities into **eukaryotic cells.**

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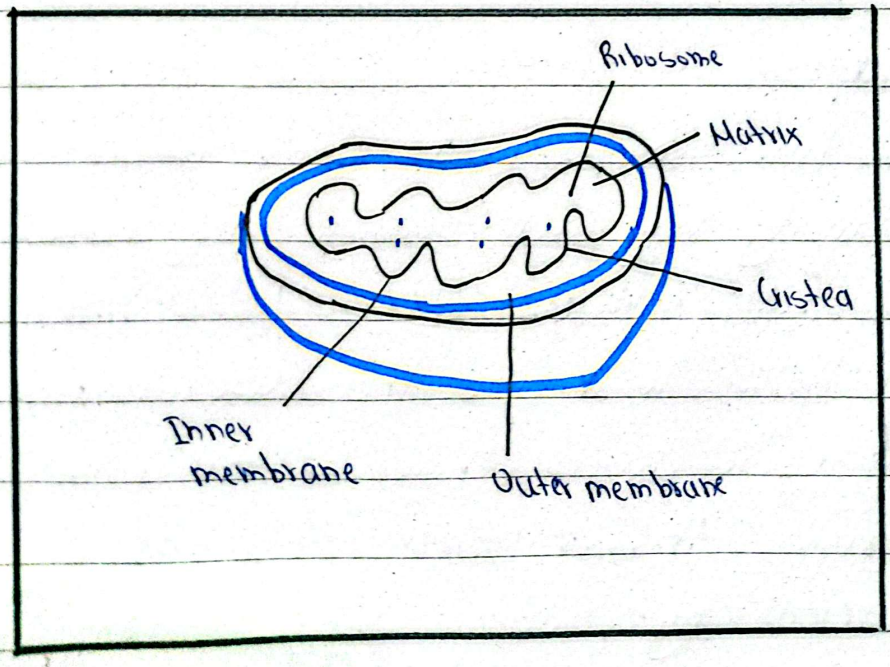
MITOCHONDRIA

Mitochondria, often referred to as the **powerhouses** of the cell are **double membraned organelles** found in cytoplasm of most eukaryotic cells, including human cells.

• Primary Function of Mitochondria

Their primary function is to produce **Adenosine Triphosphate** (ATP), the cell's main energy currency through a process called **cellular respiration**. This involves breakdown of glucose and other nutrients in the form of oxygen.



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Mitochondria have a unique structure having an outer membrane, an inner membrane folded into **cristea** (increasing chemical surface area for chemical reaction), and their own DNA (mtDNA), seperates from cell's nucleus.

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b. What is doping? Discuss different types of semi-conductors.

DOPING:-

Doping is the process of **initially introducing impurities** into an **extremely pure** semiconductor material to alter its electrical properties.

Purpose of Doping

Pure semiconductor don't conduct electricity very well because they have **few free charge carriers (electrons or holes)**. To make them useful in electronic devices, there is need to increase **the number of charge carriers** by adding controlled impurities.

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This process creates either an excess or a deficiency of electrons, transforming the semiconductors into either p-type (positive) or n(negative) material.

N-TYPE SEMICONDUCTOR	P-TYPE SEMICONDUCTOR
Doping Element	
N-type semiconductors are pentavalent (5 valence electrons)	P-type semiconductors are trivalent (3 valence e')
Example of Dopant	
Phosphorous and Arsenic are used as dopants.	Boron and Gallium are used as dopant
Majority Charge Carriers	
Electrons	Holes
Conductivity	
Extra electrons from dopant increase conductivity	Deficiency of electrons (holes) increases conductivity

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TYPES OF SEMICONDUCTORS

1. Elemental Semiconductors

Pure elements like silicon and germanium are intrinsic semiconductors. They have four valence electrons, allowing them to form **covalent bonds** with neighbouring atoms.

2. Compound Semiconductors

They are made up of **compounds of two or more elements** such as **gallium arsenide (GaAs)** and **cadmium selenide (CdSe)**. They have wider bandgaps and higher electron mobility

3. Organic Semiconductors

These are **carbon based materials** with semi conductor properties. They are light weight, flexible, and can be produced using low cost methods. They are used in **solar cells** and **organic light emitting diodes (OLEDS)**

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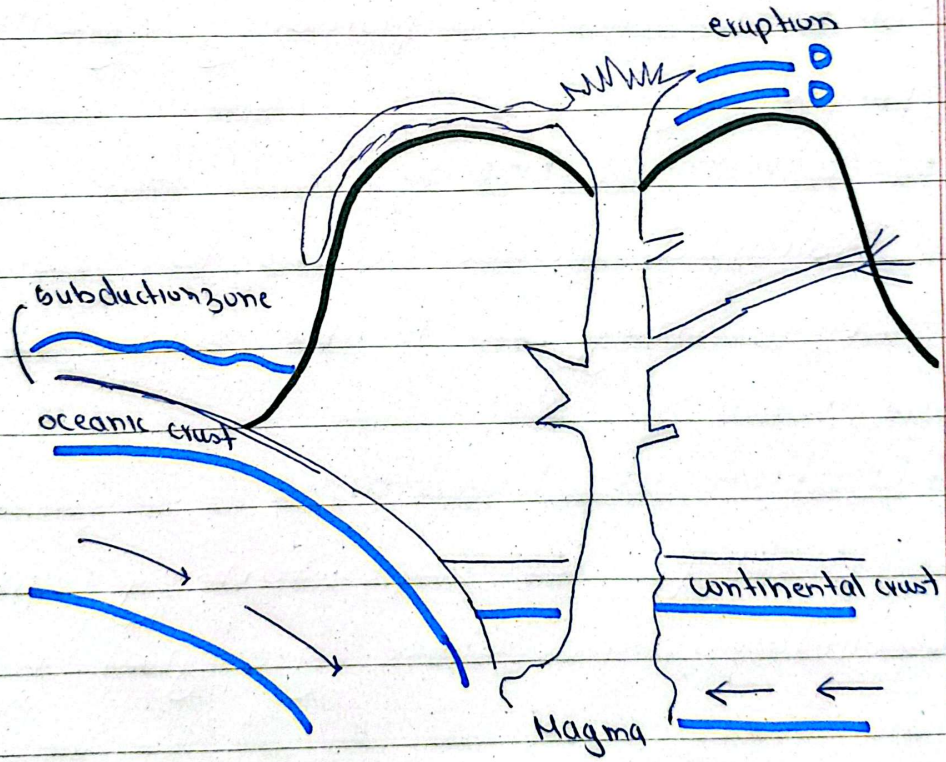
c. State some of the merits and demerits of volcanic eruption.

VOLCANIC ERUPTION

A volcanic eruption is a natural event in which magma (molten rock beneath the Earth's surface) along with gases, ash and rock fragments is forcefully expelled from a volcano through opening called **vents** or **craters**.



How it happens?

Inside the Earth, molten rock called **magma** forms due to high temperature

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and pressure. This magma rises upward because it is less dense than the surrounding solid rock. When the pressure builds up beneath the surface, it eventually becomes **too great to be contained.** The magma bursts out through cracks or vents — this is **eruption.**

MERITS OF VOLCANIC ERUPTIONS

- **Soil Fertility**

Volcanic ash is rich in minerals, enriching soil and promoting agricultural productivity.

- **Geothermal Energy**

Volcanoes provide access to geothermal energy — a reliable source of power.

- **Creation of Landforms**

It shapes landscapes, forming islands, mountains, and other geological features.

DEMERITS OF VOLCANIC ERUPTIONS

- **Loss of Life and Property**

It can cause loss of life,

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destruction of infrastructure, and displacement of communities.

- **Climate Impact**

Large eruptions can inject massive amount of gas, and ash into the atmosphere temporarily cooling the planet and affecting global climate pattern.

- **Ashfall and Pyroclastic flows**

Ashfall can damage crops, contaminate water sources and cause respiratory problems. Pyroclastic flows made of gases and volcanic fragments are dangerous and destructive.

(d)

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

DENGUE

Dengue is a mosquito-borne viral infection caused by the dengue virus. It is transmitted primarily

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primarily by **Aedes aegypti mosquito** which is active during the day.

Symptomology

Dengue is manifested in various ways, ranging from **mild flu like symptoms** to severe and potentially life threatening conditions.

Classic Dengue Fever shows **sudden high fever** (upto 104°F), severe headache, pain behind the eyes, muscles and joint pain, nausea, and vomiting, mild bleeding from **gums and nose**

Causative Agent

Causative agent of dengue is **Dengu Virus (DENV)**. There are four main stereotypes attached - **DENV 1 DENV-2, DENV-3,** and **DENV-4.**

Mode of Transmission

Spread to human through the bite of infected **female Aedes**

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mosquito mainly Aegypti and Aedes albopictus.

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(d)

HYDROMETER

An instrument that is used to measure **specific gravity (relative density)** of liquids as compared to water. It is commonly used to determine the concentration of solution, such as in battery acids or alcohol.

EPICENTRE

The underground point where the earthquake originates. It is point on the Earth's surface directly above focus. At this point the seismic waves from earth quake are typically the strongest

EYE WALL OF CYCLONE

It is the ring of thunderstorms

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surrounding the eye (the calm centre) of cyclone or hurricane. It is the most intense part of a storm, with strongest wind and heaviest rainfall.

DEEP FOCUS

It refers to an earthquake that originates at a depth greater than 300 km before the Earth's surface.

LIGHT YEAR

It is the distance that light travels in one year in a vacuum, approximately 9.46 trillion km. It is used to measure vast distances in space.

(ii)

CAUSES OF POPULATION EXPLOSION IN PAKISTAN

1. High Birth Rate.

- Traditional families prefer large families.

- Lack of family planning and nited access to contraceptives.

ecluing Death Rate

- Improvement in health care and sanitation reduces mortality ates.
- Better access to medical facilities and vaccinations

Poverty and Illiteracy

- Limited education results in oor family planning. Children are seen as economic assets in labor intensive families.

Lack of Government Policies

- Inadequate implementation of population control programs.

MEASURES

d Awareness

cation among em to take

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informed decisions.

- Awareness campaigns about family planning will raise awareness among local public.

2. Easy Access to Contraceptive

- There is need to easy access of contraceptives and reproductive health services.

3. Economic Incentives

Government should introduce policies that will benefit small families such as tax benefits or subsidies.

(b)

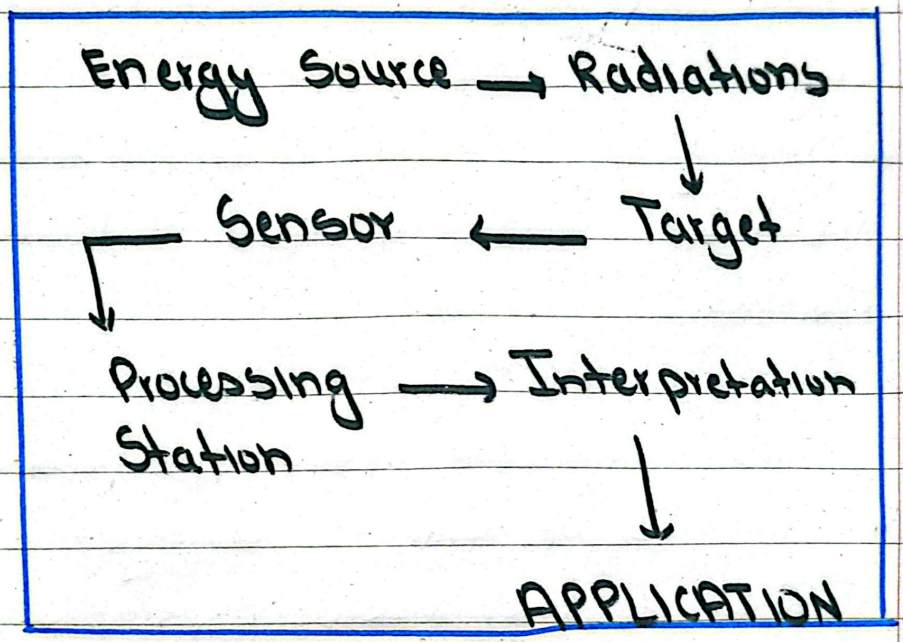
What is Remote Sensing? Discuss the role of GIS in environmental science.

REMOTE SENSING

It is the art and science of **obtaining data** about an area, an object or phenomena without

coming into direct contact with it, usually by using **sensors** mounted on the satellites, aircrafts or drones.

BASIC PRINCIPLE



Different objects reflect the radiations (radiations have specific wavelengths). These reflections can be recorded through sensors and information can be obtain about that object.

ROLE IN ENVIRONMENTAL SCIENCES

1. Monitor Natural Resources

GIS assist in mapping and

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managing natural processes like water, minerals, forests and ensuring their sustainable use.

2. Accessing Environmental Hazards

GIS supports risk assessment, early warning systems, response planning for natural disasters like floods earth quakes and wild fires.

3. Climate Change Analysis

GIS is used to model and predict the impacts of climate change - such as sea-level rise, temperature changes and shift in ecosystems.

4. Oceanography

It helps to monitor **oil spills, tracking ocean currents** and areas of **filth** concentration.

5. Geology

It is used in mineral exploration.

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(c)

The Atmosphere is the blanket of Earth. Justify with your opinion.

Atmosphere performs several functions that protect and sustain life on Earth.

1. Temperature Regulation

The atmosphere traps heat from the sun through greenlight effect, keeping Earth's surface warm enough to support life. Without it the temperature would drastically fluctuates between day and night.

2. Protection from Solar Radiatio
ns

The ozone layer in the stratosph
ere absorbs harmful ultraviolet radiation from the sun, shielding living organisms from DNA damage and skin cancer.

3. Shield Against Meteors

The atmosphere burns up

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most meteor and space debris before they reach the Earth's surface acting as a protective shield.

4. Breathable Air

The atmosphere facilitates weather patterns, distributing heat and moisture around the globe, which is essential for agriculture and ecosystem.

SECTION II

Q.No.6

(a)

Ratio = Apple : Berry : Cherry : Date

3 : 6 : 2 : 5

Let x be the common ratio factor

Apple = 3x

Berry = 6x

Cherry = 2x

Date = 5x

If Apple candies exceed Date candies by 35

$$3x - 5x = -35$$

$$-2x = -35$$

$$\boxed{x = 17.5}$$

Now to find the number of Berry candies

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

$$\boxed{\text{Berry candies} = 105}$$

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(b)

Given,

Price = $200

Discount = 25% off

Sales Tax = 6%

Step 1 = Apply the Discount

$$25\% \text{ of } 200 = 200 \times \frac{25^{1}}{100_{4}} = 50$$

So discounted price = 200 − 50

= 150

Step 2 = Add the 6% tax

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

Total paid amount = 150 + 9

$$= 159$$

(c)

Given

Distance = 36 km

Speed = 18 km/h

Start time = 1 PM

Step 1 – Find Time taken

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

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$= \frac{36}{18} = 2$ hours

Step 2 - Add time to start time

1 PM + 2 hours = 3PM

The bicycle reaches at 3PM.

(d)

STSTAICITS

STATISTICS

LGEBHAR

ALGEBRA

QNO.7

(a) Volume of Sphere

Volume of Sphere (diameter = 14 cm, so radius r = 7cm)

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

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

$\because 7^3 = 343$

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

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

$= \frac{4312}{3} \text{ cm}^3$

$V = \frac{4312}{3} \text{ cm}^3 \approx 1437.33 \text{ cm}^3$

(b)

Five friends total saving = 25000 Rs

Ratio = 1:2:3:4:5

Find the smallest share = ?

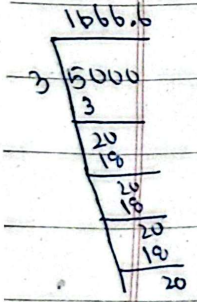
Total parts = 1+2+3+4+5

= 15

One part = 25000 ÷ 15

$= \frac{5000}{3}$

= 1666.67 Rs



So smallest share is 1666.67 Rs.

(c)

Series

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

2x3 = 6

6 x 3 = 18

18 x 3 = 54

54 x 3 = 162

162 x 3 = 486

All numbers fit, none is out of place.

(iii) Series 3, 5, 7, 11, 13, ___

These are all prime numbers After 13 next prime no. is 17

Series = 3, 5, 7, 11, 13, 17

(d)

Triangle with sides 5, 12, 13

Find all three angles

a = 5cm

b = 12cm

c = 13cm

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\cos B = \frac{a^2 + c^2 - b^2}{2ac}$$

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

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Find angles

$$\cos A = \frac{12^2 + 13^2 - 5^2}{2 \times 12 \times 13}$$

$$= \frac{144 + 169 - 25}{312}$$

$$= \frac{288}{312} = \frac{144}{156} = \frac{72}{78}$$

$$= \frac{36}{39} = \frac{12}{13} = 0.92$$