

PART II:

Q No 2:-

b. Q1- universe is expanding, how it resembles with balloon blowing in working?

- **Introduction:-** The concept of the expanding universe is one of the most significant discoveries of 20th-century cosmology, initially proposed by Georges Lemaitre and confirmed by Edwin Hubble's observations of redshift in distant galaxies. The expansion is the increase in the distance between any two distant parts of the universe over time.

- **The Balloon Analogy for the Expanding Universe:-** The expansion of the universe is often misunderstood as the expansion of matter into empty space. The balloon analogy helps visualize the correct concept: that space itself is expanding.

→ Element in Analogy	Represents	Description
1 Rubber surface of the balloon	Space-Time Fabric of the universe	The surface is the entirety of the space relevant to the analogy. As the balloon is inflated, the surface stretches.
2 Dots / coins stuck on the surface	Galaxies or clusters of galaxies	These dots represent massive objects that are not expanding themselves but are being carried apart by the expansion of the space between them.
3 Air being blown into the balloon	The driving force of Expansion (dark energy)	The action that causes the surface to stretch stretch and the dots to move apart.

- **Working Mechanism:-**

- 1 Inflation - As air is blown into the balloon, its rubber

surface stretches.

2. **Increased Distance:** An observer on any dot will see all other dots moving away from them. The further away a dot is, the faster it appears to move (representing Hubble's Law), because there is more expanding space between the observer and the distant dot.
3. **No center:** crucially, no dot is at the "center" of the surface expansion. Just as a two-dimensional observer on the surface would not find a central point, there is no centre of expansion of the three-dimensional Universe. The expansion is happening everywhere.

Part d:- Discuss working of GPS - what is fiber optic? How 2D and 3D locations are measured by satellites?

Ans:- GPS is a satellite-based navigation system that provides location and time information anywhere on Earth.

• **Components:-**

1. **Space segment:-** A constellation of about 30 Satellites orbiting the Earth.
2. **Control segment:-** Ground stations to monitor and maintain the satellites.
3. **User segment:-** GPS receivers (e.g., in a phone or car).

• **Mechanism (Trilateration):-**

1. **Signal Transmission:-** Each GPS satellite constantly broadcasts its location and the precise time the signal was sent.
2. **Time Measurement:-** The GPS receiver measures the time taken for the signal to travel from the satellite to the receiver. Since the signal travels at the speed of light, the distance to the satellite is calculated as:-

$$\text{Distance} = \text{speed of light} \times \text{Travel Time}$$

3. **Location and Determination:-**

- The distance from a single satellite places the receiver somewhere on a sphere with the satellite at its center.
- Distances from two satellites narrow the location to a circle where the two spheres intersect.
- Distances from three satellites narrow the location to two points on Earth.
- A fourth satellite is used to solve for the receiver's time error and confirm the correct location, providing a precise 3D position.

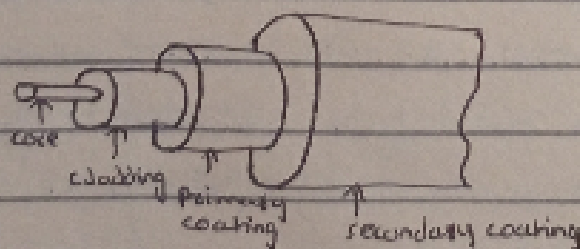
Fiber optics:

Definition:- A fiber optics is a glass or plastic filament, slightly thicker than a human hair, used to transmit data in the form of light pulses over long distances.

Working principle:-

Fiber optics cable work on the principle of "Total Internal Reflection" (TIR):-

The cable consists of a core (where light travels) and a cladding (an outer layer with a lower refractive index). Light signals entering the core strike the boundary with the cladding at a shallow angle. Because the cladding has a lower refractive index, the light is reflected back into the core, continuing its journey down the fiber with minimal loss.



(Fiber optics structure)

Now 2D and 3D Locations are measured by satellites:-

1. 2D location (Latitude and Longitude):-

To calculate a 2D position (location on the ground), the GPS receiver needs signals from at least three satellites. This provides the latitude and longitude coordinates.

2. 3D location (Latitude, Longitude, Altitude):-

To calculate a 3D position, the GPS receiver needs signals from a minimum of four satellites. The fourth satellite is essential because it allows the receiver to determine the correct altitude (height above sea level) and correct for any small timing errors in the receiver's clock, thus providing a precise position in three dimensions.

Q 2:

Part a: Data is the new oil. "Do you agree ---?"

Ans: Yes, I agree that "Data is the new oil".
Because data, like oil, is a valuable resource that drives growth and innovation in today's world. However, data needs to be refined and processed to extract meaningful insights, just as crude oil requires refining to be useful. Data powers decision-making, business strategies, and technological advancements.

Example:-

- 1) Online shopping.
- 2) Health care.
- 3) Social Media.

Part c:- what do you mean by a balanced ---?

Ans:-

- **Balance Diet:-** A balanced diet is a diet that includes a variety of different foods in the right proportions to provide all the essential nutrients the body needs for healthy functioning. It typically involves consuming foods from five main groups: vegetables, fruits, grains, protein sources, and dairy or alternatives, along with adequate water. A balanced diet ensures the right amounts of carbohydrates, proteins, fats, vitamins, minerals, and fiber, supporting overall health.

- **Deficiency of vitamins:-**

Deficiency of vitamins causes specific imbalances in the human body.

- Vitamin A deficiency can lead to vision problems such as night blindness and impair immune function.
- Vitamin D deficiency results in bone disorders like rickets in children and osteomalacia or osteoporosis in adults due to poor calcium absorption.

- Vitamin E deficiency may cause neurological problems due to poor nerve conduction and muscle weakness.

Thus, a balanced diet containing adequate vitamins A, D, and E is vital to prevent these imbalances and maintain overall health.

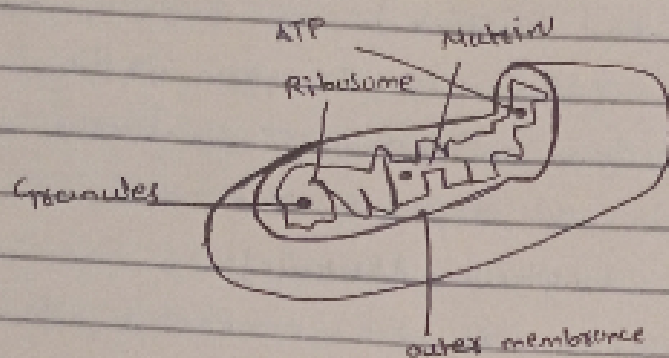
QNo 3:-

Part A: Why cells form organelles? Discuss mitochondria in a human cell?

Ans:- cells form organelles to compartmentalize different biochemical processes, allowing greater efficiency, specialization, and regulation inside the cell. organelles provide distinct environments tailored for specific functions, minimizing interference and enhancing metabolic control.

Mitochondria in a human cell:-

Mitochondria are key organelles in human cell, known as the "powerhouses of the cell". They produce energy by converting nutrients into adenosine triphosphate (ATP), the energy currency for cellular activities. Mitochondria have a double membrane; the inner membrane is folded into cristae to increase surface area for energy production. Remarkably, mitochondria have their own DNA (mtDNA), allowing some genetic independence and enabling ~~from~~ them to reproduce within the cell.



Part d:-

Q:- what is dengue? Discuss symptomatology, causative agents and remedies.

Dengue:- Dengue is a viral infection transmitted primarily by *Aedes aegypti* and *Aedes albopictus* mosquitoes. The causative agent is the dengue virus (DENV), which has four serotypes.

Symptomatology:-

- Sudden high fever
- severe headaches.
- Muscle and joint pains
- Rash
- Nausea and vomiting
- Fatigue.

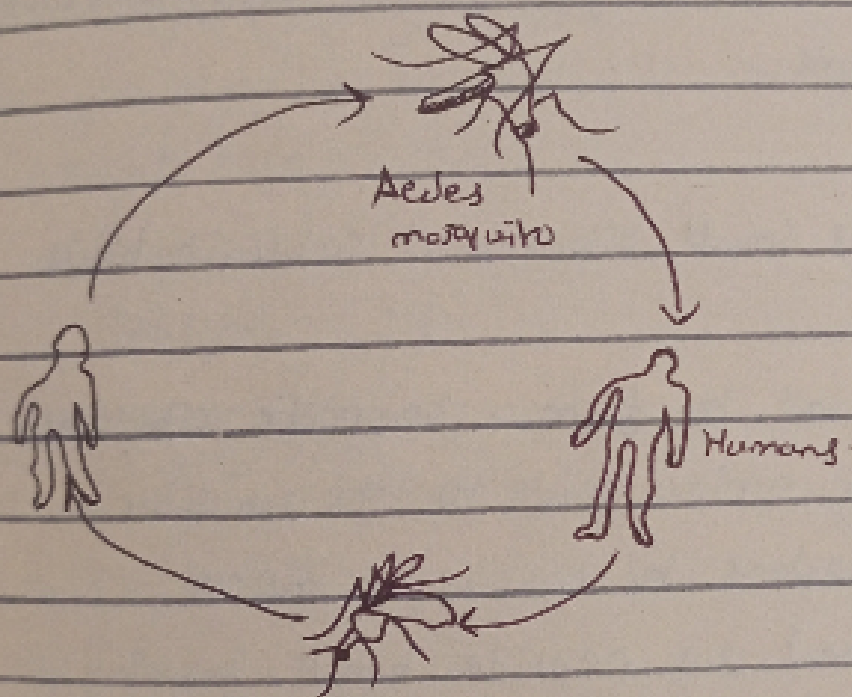
Symptoms typically appear 2-10 days after a mosquito bite and usually resolve within a week. Severe forms can cause bleeding, plasma leakage, and even death.

Remedies and Management:-

- No specific antiviral treatment exists.
- Rest and hydration are crucial.
- Use paracetamol to reduce fever and pain.
- Avoid non-steroidal anti-inflammatory drugs (NSAIDs) like aspirin or ibuprofen, which increase bleeding risk.
- Seek medical help if symptoms worsen.

Prevention:-

- Avoid mosquito bites by wearing protective clothing and using mosquito repellents containing DEET or similar.
- Remove standing water where mosquitoes breed.
- Use window screens and mosquito nets.



and maintain overall health.

Q No 3:-

Part b:- What is doping? ---?

Doping:- Doping is the intentional introduction of impurities into a pure semiconductor material to alter its electrical properties and increase its conductivity. This process creates free charge carriers, either electrons or holes, enabling semiconductors to be used in electronic devices.

There are two main types of semiconductors:-

1) Intrinsic semiconductor:-

These are pure semiconductors without any significant impurities. Their conductivity depends on the temperature and is relatively low.

Example: Silicon and Germanium are common examples.

2) Extrinsic semiconductor:-

These are doped semiconductors containing impurities. They are two types.

1) N types: Doped with elements that provide extra electrons. (Negative charge carriers).

2) P types:

Doped with elements that create holes (positive charge carriers) by accepting electrons.

Part c:- Merits and Demerit of volcanic Eruption:

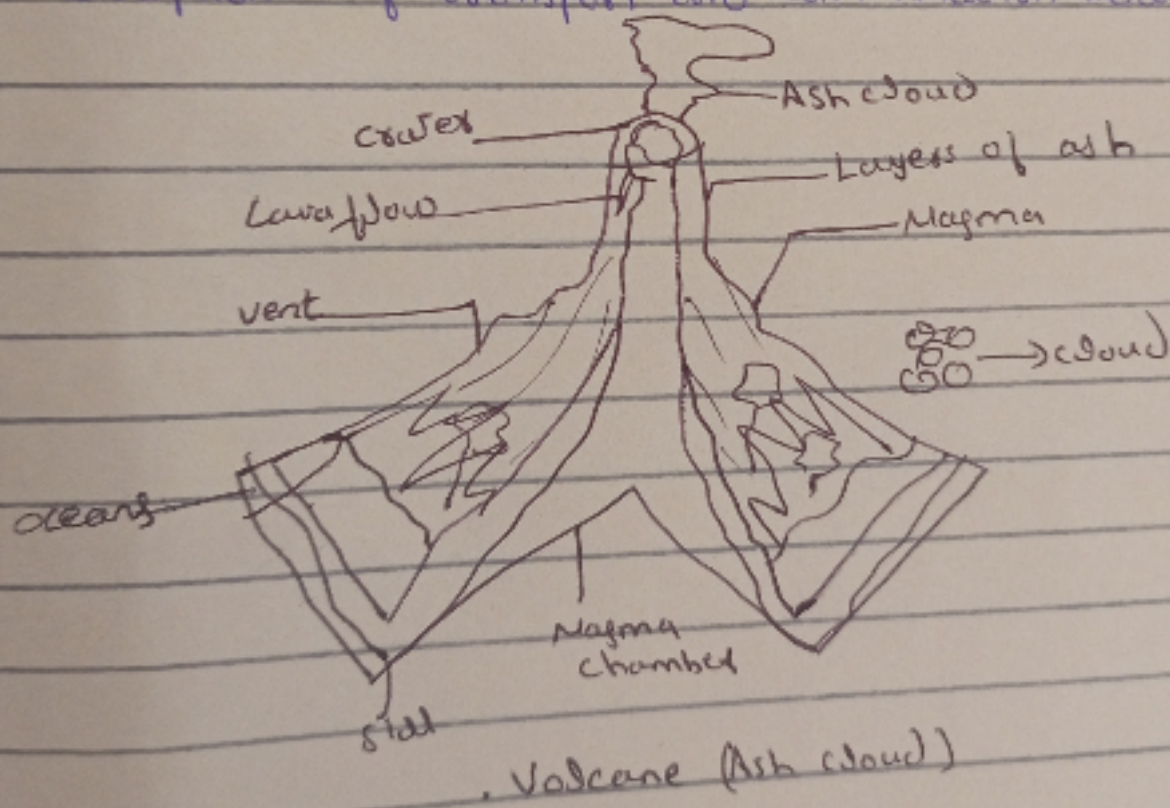
1) Merits:

- volcanoes ~~are~~ ash enriched soil fertility by

- by adding minerals beneficial for agriculture.
- The formation of new landforms and geothermal energy sources.
- Attraction of tourism, boosting the local economy.

• Demerits:

- It causes destruction of habitats, property, and loss of human lives.
- Air pollution and respiratory problems due to volcanic gases and ash.
- Disruption of transport and communication networks.



Section II:-

Q No 6:-

Part a:- A store has packets — — — — — measures?

Given:

• Flavours in the ratio: Apple : Berry : cherry

• Date = 3 : 12 : 5 : 1

• Apple candies exceed Date candies by 8.

Let the number of parts be multiplied by x , so

• Apple = $3x$

• Berry = $12x$

• cherry = $5x$

• Date = $1x$

Now, Apple - Date = 8

$$\Rightarrow 3x - x = 8$$

$$\Rightarrow 2x = 8$$

$$\Rightarrow x = 4$$

Now, Berry candies = $12x \Rightarrow 12 \times 4 \Rightarrow 48$

So 48 Berry candies.

Part b:- A camera priced — — — — — paid?

Ans: A camera priced at 200%. (likely means 200% of base price), Then gets 25% of, and then has 5% tax.

Let assume the base price is \$100.

• 200% of base price = \$200 (this is mep or listed price).

• 25% discount $\rightarrow 25\%$ of 200 = 50

• So, selling price after discount = \$200 - 50 = \$150

• 5% tax on \$150 = $0.05 \times 150 \Rightarrow 7.5$

• Final amount = \$150 + \$7.5 = \$157.50

So Answer \$157.50

Part c:-

... .. the series.

part c:- A bicycle - - - - - reach?

Ans:

Given:-

• Distance = 36km

• speed = 18km/h

• Start time = 1:00 pm

Formula:-

$$\text{Time} = \text{Distance} / \text{speed}$$

To find:-

$$\text{Time} = ?$$

So:-

$$\text{Time} = \frac{36\text{km}}{18\text{km/h}} \Rightarrow 2 \text{ hours}$$

Step 2:- Add the travel time to the start time.

• The bicycle starts at 1:00 pm.

• Travel time = 2 hours

• 1:00 pm + 2 hours = 3:00 pm

So the bicycle will reach its destination at 3:00 pm.

Q No 7

part a:- calculate volume of - - - - - ?

Ans The formula of the volume of sphere is:-

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

so with a diameter of 14cm, the radius (r) is 7cm.

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

So

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

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

$$V = \frac{4}{3} \times 22 \times 49 \text{ cm}^3$$

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

Part b:- Five friends - - - - ?

Ans. The Total Savings of the five friends is Rs 25,000, and the ratio of their savings is -

$$1:2:3:4:5$$

1) Find the total no of parts in the ratio:

$$1+2+3+4+5 = 15 \text{ parts.}$$

2) Calculate the Value of one part:

$$\text{Rs. } 25,000 = 1666.666 \dots \text{ Rs}$$

3) Find the ¹⁵ smallest share (which corresponds to 1 part):

$$1 \times 1666.666 \dots \text{ Rs} \approx 1666.67 \text{ Rs}$$

Part c:- Spot the error - - - - ?

(i) 2, 6, 18, 54, 162, 486 (which number does not fit)

This is a geometric progression where each term is the previous term multiplied by 3 (the common ratio)

$$\bullet 2 \times 3 = 6$$

$$\bullet 18 \times 3 = 54$$

$$\bullet 6 \times 3 = 18$$

$$\bullet 54 \times 3 = 162$$

Error: No Number doesn't fit. This series is perfectly consistent.

(ii) 3, 5, 7, 11, 13 - - - -

This is the sequence of the first five prime numbers (Number greater than 1 with no positive divisors other than 1 and itself)

So the Next prime number after 13 is 17.

$$3, 5, 7, 11, 13, 17$$

Part d:- A triangle - - - - ?

Ans. The sides are 5cm, 12cm, and 13cm.

1) check for a Right-angled Triangle:

Using pythagorean theorem:

$$a^2 + b^2 = c^2$$

$$\text{so } 5^2 + 12^2 = 25 + 144 = 169$$

$$13^2 = 169$$

$$169 = 169$$

Since $5^2 + 12^2 = 13^2$, the triangle is a right-angled triangle, and the angle opposite the longest side (13cm) is 90° .

2) Find the other two angles.

Let 'A' be the angle opposite 5cm, and 'B' be the the angle opposite 12cm.

$$\text{Angle } C = 90^\circ$$

$$\bullet \sin(A) = \frac{\text{opposite}}{\text{Hypotenuse}} = \frac{5}{13}$$

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

$$\bullet \text{Angle } B = 90^\circ - A \Rightarrow 90^\circ - 22.62^\circ \approx 67.38^\circ$$

So the three angles are approximately:

$$\bullet 22.62^\circ \text{ (opposite 5cm)}$$

$$\bullet 67.38^\circ \text{ (" 12cm)}$$

$$\bullet 90^\circ \text{ (" 13cm)}$$