

PART-II

Q2 a. what is dengue? Give a brief account of its causative agents and its symptoms.

DENGUE

Dengue is a mosquito-borne viral infection which is widespread throughout the tropics with more prevalence in areas with rainfall, and unplanned urbanization.

Dengue has 4 distinct, but closely related types - also called serotypes namely DEN-1, DEN-2, DEN-3 and DEN-4. Recovery from infection by one serotype provides lifelong immunity against only that serotype. Cross-immunity to other serotypes is partial or temporary.

Dengue has a severe type called DHF - Dengue haemorrhagic fever. It was recognized in 1950s in Philippines and Thailand. Today DHF affects Asian and Latin American countries. In these regions dengue haemorrhagic fever causes large numbers of hospitalizations and death among children and the elders.

Causative agents:

Dengue virus is transmitted by female mosquito of the species *Aedes aegypti* and rarely *Aedes albopictus*. These same mosquito species are also the ones transmitting Chikungunya, yellow fever and Zika infection - so chances of co-infection should be considered.

The primary vector - mosquito transmits the virus to humans through its bites during feeding. The mosquito lives in urban habitats and breeds mostly in man-made containers. It is a day-time feeder with peak biting periods being early in the morning and in the evening before dusk. Female *Aedes aegypti* bites multiple people during each feeding period.

The main virus DENV - dengue virus belongs to the Flaviviridae family having 4 serotypes DEN1, 2, 3, 4. In the mosquito the virus has an incubation day of 4-10 days and the infected mosquito will then transmit the virus for the rest of its life.

The main carrier and multipliers of the virus are infected and asymptomatic humans. Patients who are already infected can transmit the infection for 4-5 days till 12 via

Aedes aegypti mosquito.

Symptoms:

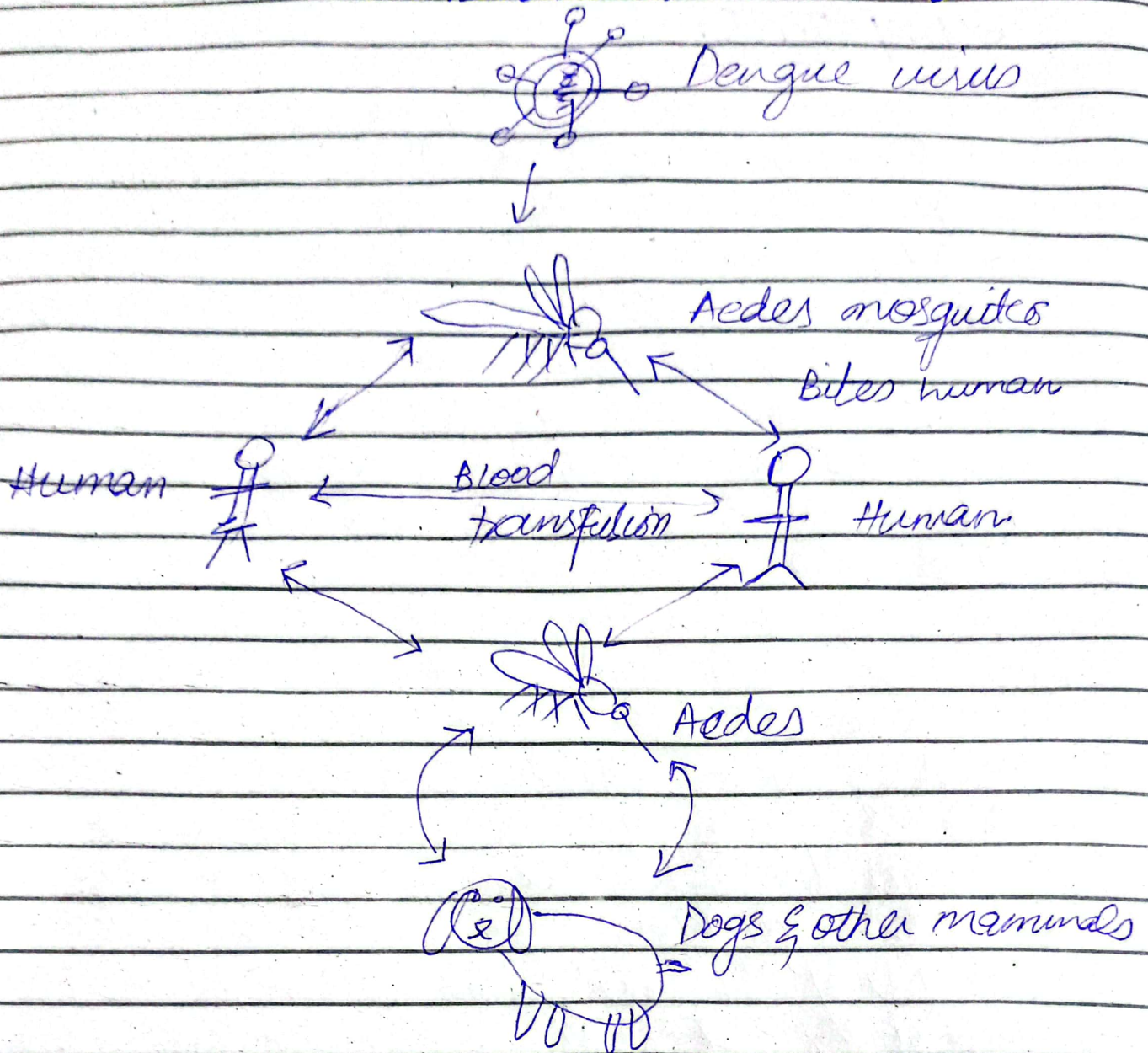
Dengue is a severe flu like illness affecting people of all ages.

Symptoms include high grade fever $103-104^{\circ}\text{F}$ always accompanied by symptoms such as severe headaches, pain behind eyes, muscle and joint pain, nausea and vomiting, swollen glands or rash. Symptoms usually last for 2-7 days sometimes 12 days too.

Dengue usually is non lethal but can become life threatening in the case of dengue haemorrhagic fever, in which plasma leakage occurs causing fluid accumulation in lungs and abdomen, respiratory distress, organ impairment and severe bleeding from eyes, nose and mouth etc. Warning signs occur in 3-7 days after first symptoms sometimes with low grade fever 100°F and abdominal pain, vomiting, increased breathlessness and bleeding from some body orifice. Patient should be admitted then in the critical stage for at least 48 hours to avoid death.

PTD

life cycle of dengue (diagram)



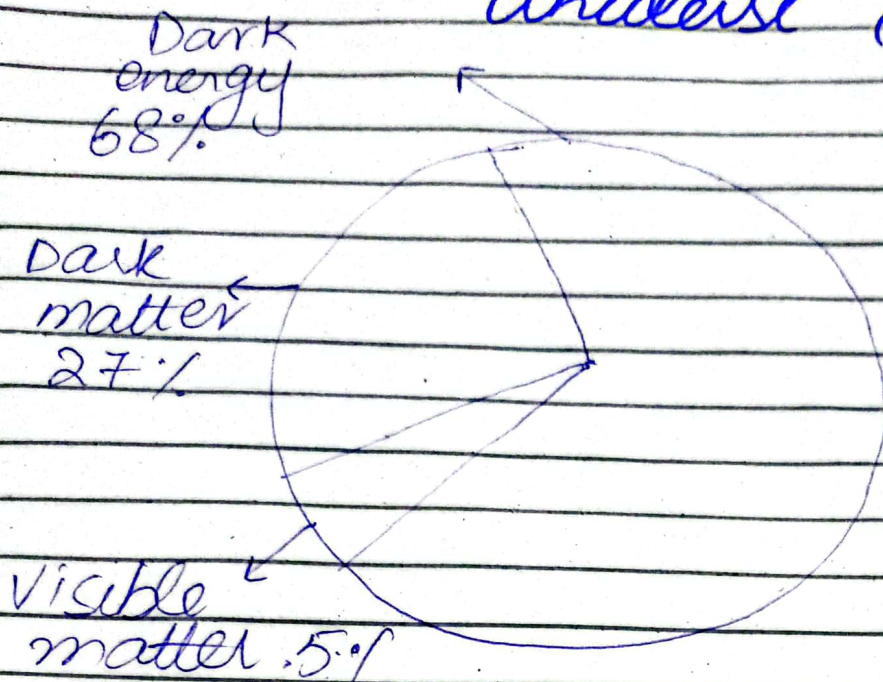
b. Explain Dark Matter and Dark Energy.

DARK MATTER

Definition:

Dark matter is a type of matter that does not emit, absorb, or reflect any electromagnetic energy.

Energy Distribution of the Universe (Diagram)



(the matter we understand. All the planets, comets, stars, galaxies, black holes and more)

or radiation, making it invisible. It can only be estimated through gravitational pulls. It is estimated to be 27% of the universe.

Proof for its existence:

Dark matter came into discussion among scientists over miscalculations in gravitational field calculations. Different phenomena prove its existence like Galaxy curves, Galaxy lensing and Background micro waves.

galaxy Rotation Curves: In the ~~1920s~~ ~~30th~~ 1930s an astronomer noted that cluster galaxies were moving faster. It could not be explained in terms of known calculations and all the visible matter. Later other astronomers came to know similar phenomenon with individual galaxies to be orbiting faster than what the calculations estimated. It indicated that maybe some other mass is present which cannot be detected with current laboratory equipment.

Gravitational lensing:

A method to detect the presence of dark matter based on Einstein's theory of relativity (bending of space time fabric) shows that gravitational field bends light from distant objects. It allows scientists to think that some object is present which emits no light.

CBMs → Background Cosmic Microwaves:

During experimentation certain Background waves were detected - sometimes called remnant radiation of Big bang. But it forces scientists

to think that there are other materials than the one which could be seen.

Theories and characteristics:

Dark Matter is composed of unknown particles that have weak interactions with ordinary matter. Some theories explaining them are as follows.

• **WIMPs** → **Weakly interacting Massive particles**: They are hypothetical particles. They "could" have mass and interact through gravity. They could only weakly interact with visible matter.

• **Axions & Sterile Neutrinos**: They are also hypothetical particles. Axions are very light particles and very little is known about them.

DARK ENERGY:



Definition:

Dark energy is a mysterious force responsible for the accelerated expansion of the universe. It is different from dark matter because it works in

opposition to gravity, causing galaxies to move away from each other at an accelerating rate. It is estimated to be 68% of universe's total energy content.

Evidence of Dark Energy:

Scientists noted that the universe is expanding and its expansion rate is increasing. They pose the question that some energy must be present which is not detectable but is definitely present. They are explained by:

• Distant Super Nova Observations:

In the end of the 20th century astronomers studying type Ia Super Nova discovered that distant galaxies were receding faster than anticipated. This indicated an accelerating expansion, contradicting that gravity alone governs cosmic movement.

Large Scale Structure of the Universe:

The distribution and growth of galaxies over time point to a force beyond gravity shaping cosmic expansion.

Theories and Characteristics.

The exact nature of dark energy remains speculative but several theories attempt to explain it.

- $\Lambda \rightarrow$ cosmological constant; proposed by Einstein proposed that a repulsive force is associated with the empty space.

Vacuum Energy and Quantum Fluctuations.

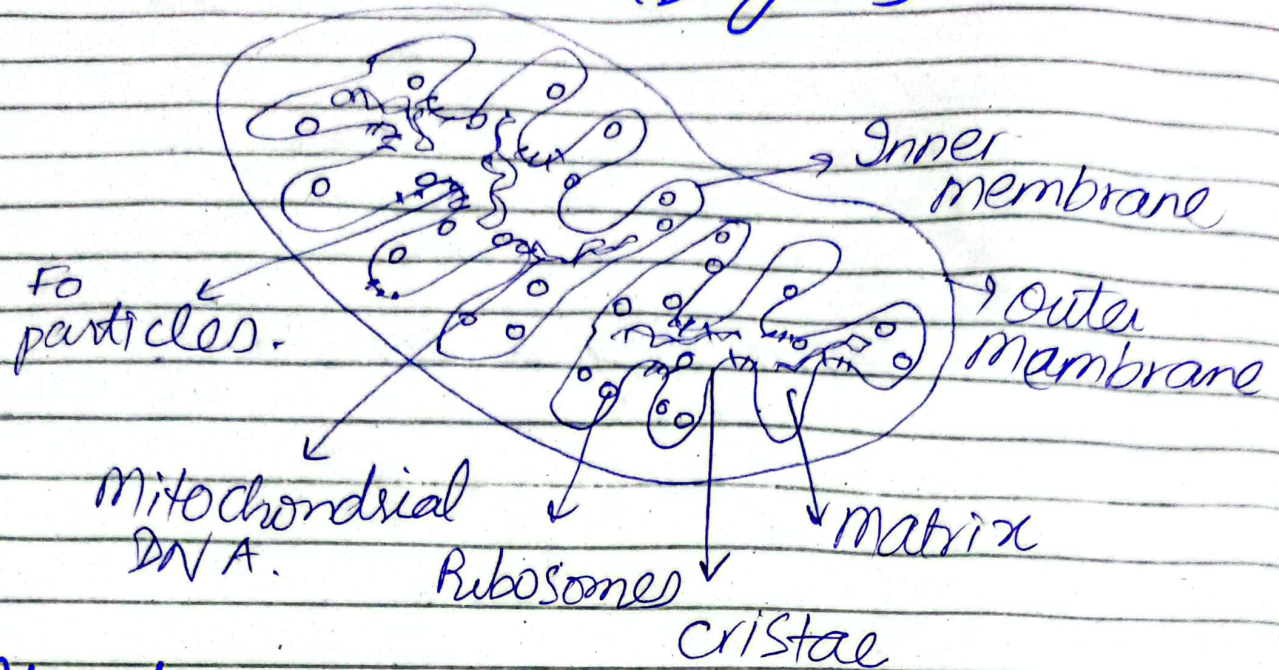
This states that vacuum of space itself has an energy density that contributed to cosmic expansion.

- c. Discuss structure and function of mitochondria. How is it the powerhouse?

MITOCHONDRIA:

Mitochondria are double-membraned organelles found in the cytoplasm of eukaryotic cells. Often referred to as the powerhouse of the cell due to their critical role in producing energy through cellular respiration.

Structure of mitochondria (Diagram)



Structure:



The mitochondria are vesicle or rod or filament shaped structures. They are bounded by two membranes. The outer membrane is smooth and the inner membrane forms infoldings called cristae. The outer membrane contains channels called porins that allow passage of ions and the inner membrane has F_0/F_1 complexes. The inter membrane space is the area between the two membranes and it plays a role in ATP generation. The matrix is the most inner compartment containing enzymes, mitochondrial DNA & ribosomes.

Function:

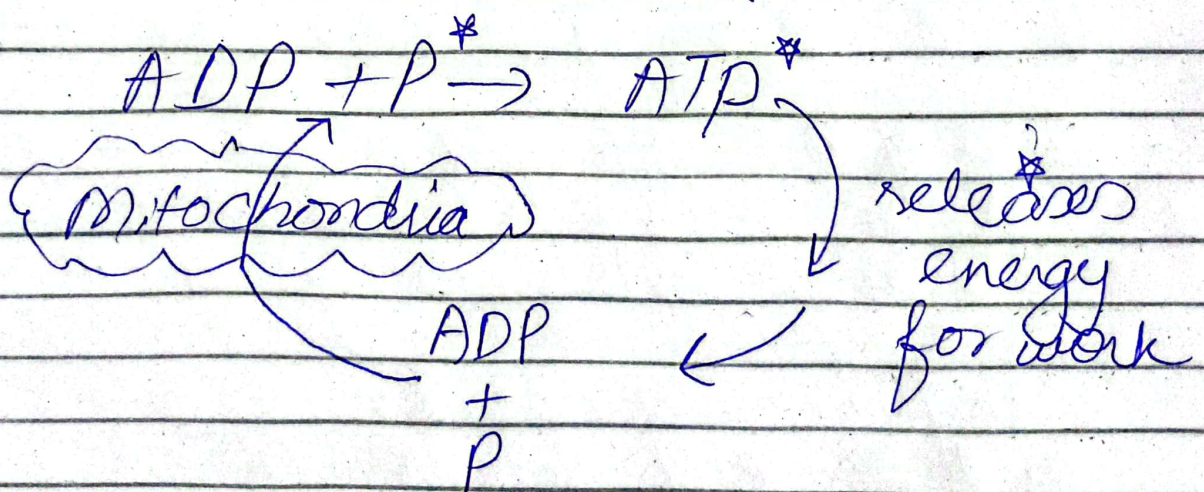
The primary function of mitochondria is to generate

ATP through aerobic respiration through several steps including glycolysis, Krebs cycle, electron transport chain, chemiosmosis and ATP synthesis.

Energy is released from organic food during these metabolic processes. The energy is transferred to ADP converting it to ATP.

Power house of the cell:

Mitochondria are known as the cell's power house because they generate most of the cell's supply of ATP which powers various cellular activity including muscle contraction, protein synthesis and cell division. Without ATP cellular dysfunction and cell death occurs.



d. What are covalent bonds? Explain types along with elaborate structures.

COVALENT BOND:

Covalent bonds are a type of chemical bond where two atoms share one or more pairs of electrons. These bonds form between non metal atoms with similar electronegativities and help create stable compounds and molecules. Covalent bonding results in the formation of molecules that can exist as solids, liquids or gases depending on the forces between the molecules.

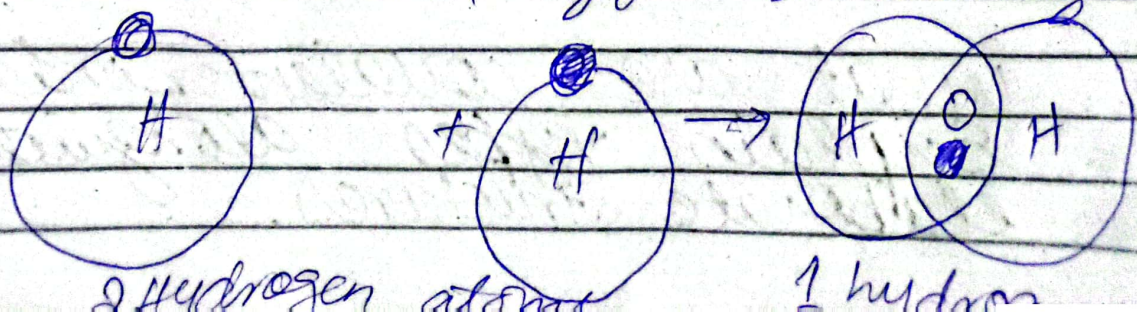
Types of Covalent bonds:

1. Single covalent bond:

Definition: A single covalent bond forms when two atoms share one pair of electrons.

Example: Hydrogen molecule H_2
- Each hydrogen atom shares one electron creating H-H

They are generally less strong and have longer bond lengths.

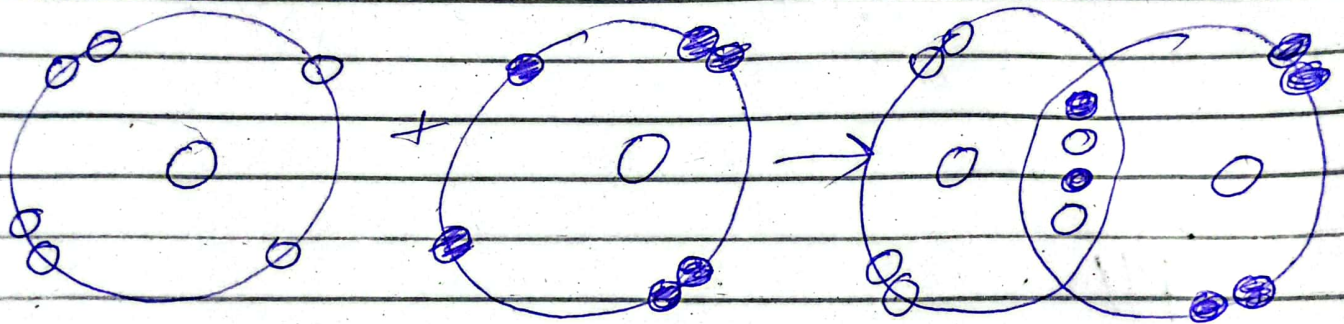


2. Double covalent Bond.

Definition: A double covalent bond forms when two atoms share two pairs of electrons.

Example: Oxygen molecule (O_2)
Each oxygen atom shares two electrons with the other forming a double bond ($O=O$)

They are stronger and have shorter bond lengths than single bonds



(2, 6)

2 oxygen atoms \rightarrow one oxygen molecule

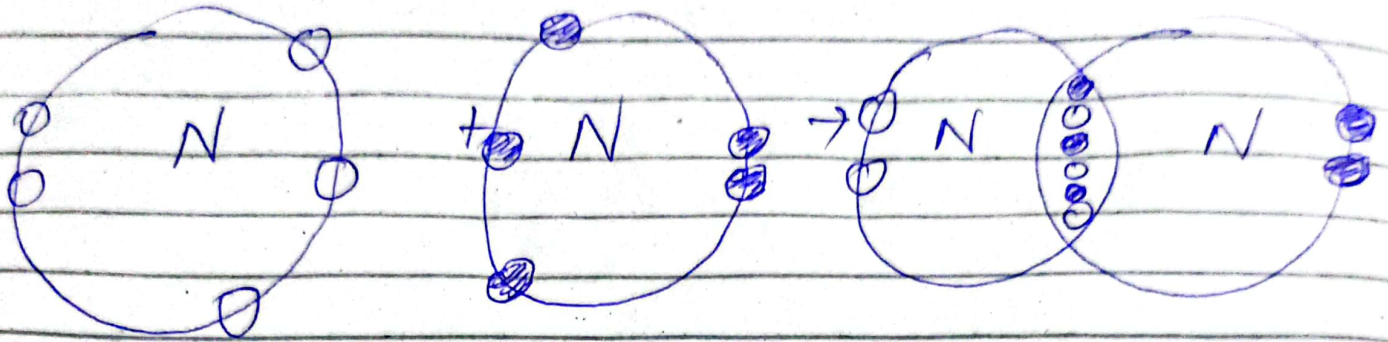
3. Triple covalent Bond.

Definition: A triple covalent bond forms when two atoms share three pairs of electrons.

Example: Nitrogen molecule (N_2)
or Carbon dioxide (CO_2)²

- Each Nitrogen atom shares three electrons with the other, resulting in a triple bond (N≡N)

They are the strongest and have the shortest bond lengths among covalent bonds



2 Nitrogen atoms (2,5)

Nitrogen molecule

Q4

a. What is noise pollution?
Give its harmful effects and ways to curb.

NOISE POLLUTION

Noise pollution is the presence of excessive or harmful levels of unwanted sound in the environment, typically generated by human activities like traffic, industrial processes, construction,

and urban development. Unlike other types of pollution, noise doesn't accumulate in the environment, but it can have significant immediate and long-term effects on both human health and wildlife.

Harmful Effects of Noise Pollution:

It can have numerous detrimental effects impacting both physical and mental health as well as disrupting ecosystems.

Harmful effects on Humans:

They include hearing loss, cardiovascular issues such as palpitation, sleep disturbances, headaches and migraines and mental health impacts such as anxiety, stress and irritability.

Effects on wildlife:

Many animals rely on sound communication, navigation and hunting, so it causes disturbances in communication. It disrupts the migration mating and feeding behaviors which can reduce population sizes.

~~Noise pollution~~
Noise pollution can change natural behaviors in animals, leading to imbalances in ecosystems. For example predator-prey relationships and plant-pollinator interaction.

Ways to curb Noise Pollution:

To reduce the effects of noise pollution, various strategies can be implemented at individual, community and government levels.

Urban Planning and Zoning

Installing sound barriers such as walls and green belts around highways, industrial areas and ~~industrial areas~~ residential zones helps reduce noise transmission.

Creating buffer zones with limited or no human activity around sensitive areas like wild life habitat, hospital, schools can minimize noise pollution.

Also techniques like soundproof buildings near noisy areas can reduce indoor noise levels.

Regulating Noise Sources

Restricting heavy traffic,
implementing speed limits
and encouraging the use of
electric vehicles can be useful
in reducing noise pollution.

Industrial regulations
such as requiring industries
and construction sites to install
noise reducing machinery and
following noise limits can curb
loud noises.

Apart from that limiting
loud activities such as loudspeaker
use at night helps in reducing
noise levels.

Public Awareness and Education

Awareness campaigns including
educating the public about the
harms of noise pollution can
reduce behaviors like honking,
loud music etc. is an effective
way of curbing noise pollution.

Technological Solutions

Noise cancelling devices, earplugs
can help protect individuals
from direct noise exposure.

Introduction of Green
technology in industry can significantly
reduce noise output.

the body's ability to absorb nutrients from food is essential for maintaining a healthy immune system. This is why it's important to eat a variety of fruits and vegetables, which are rich in antioxidants and other nutrients that help to boost the immune system.

Another important factor is the amount of sleep you get. Lack of sleep can weaken the immune system, making you more susceptible to illness. Aim for 7-9 hours of sleep per night to keep your immune system strong.

Stress is another enemy of a strong immune system. Chronic stress can suppress the immune system, making it harder for your body to fight off infections. Find ways to manage stress, such as exercise, meditation, or talking to a friend.

What makes a plate of food balanced?

A balanced diet is one that provides your body with all the nutrients it needs to function properly. This includes a variety of fruits, vegetables, whole grains, and lean proteins. It also means eating in moderation and avoiding too much sugar, salt, and fat. A balanced diet is the foundation for a healthy immune system.

and health.

→ Fruits and vegetables:

(50% of the plate)

→ Whole grains like brown rice, quinoa, oats, wheat are 25% of plate.

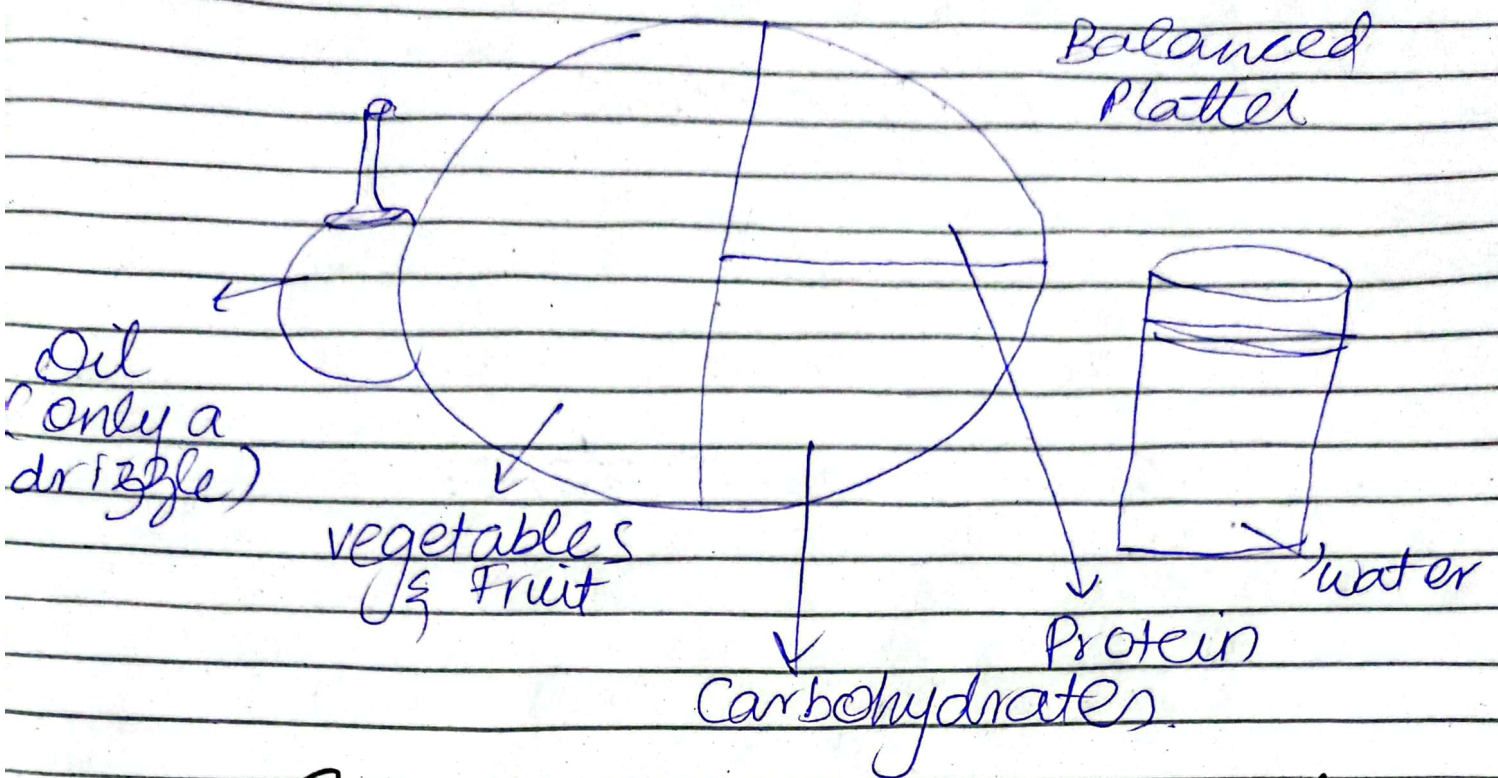
→ Proteins include lean proteins such as poultry, fish, beans, legumes, eggs etc. They contribute 25% of the plate.

→ Healthy fats should be in small portions such as olive oil, avocado oils.

→ Dairy and Dairy Alternatives are optional food items like a glass of milk, cheese or yogurt on the side provide protein and calcium.

→ Hydration is least talked about when mentioning a healthy platter. Though it is not on the platter but no meal should be taken without water.

P.T.O



c. Elaborate drinking water quality and standards.

DRINKING WATER QUALITY & STANDARDS

Ensuring the quality of drinking water is crucial for public health.

WHO guidelines for drinking water quality is an international reference point. The standards of different countries vary slightly. Pakistan Environmental Protection Agency finalised National Standards for quality drinking water in June 2008. According to these standards the water should be safe and free of chemicals and

micro organisms

Key parameters

Drinking water quality is based on several parameters, divided into physical, chemical and microbiological categories.

Physical Parameters: include taste color, odor, and appearance. Pure water should be colourless. Colours in water can indicate presence of metals or organic material. A measure of water's clarity is called turbidity. High turbidity can harbor pathogens. Drinking water should be free from any unpleasant odors and tastes.

Chemical Parameters:

Chemical parameters both naturally occurring and man-made can be harmful if consumed in large quantities. One way of measuring it is by seeing pH levels. Water should have a pH of 6.5-8.5 to be safe. Hardness of water due to dissolved calcium and magnesium can pose health risks. The presence of heavy metals such as arsenic, lead and mercury can

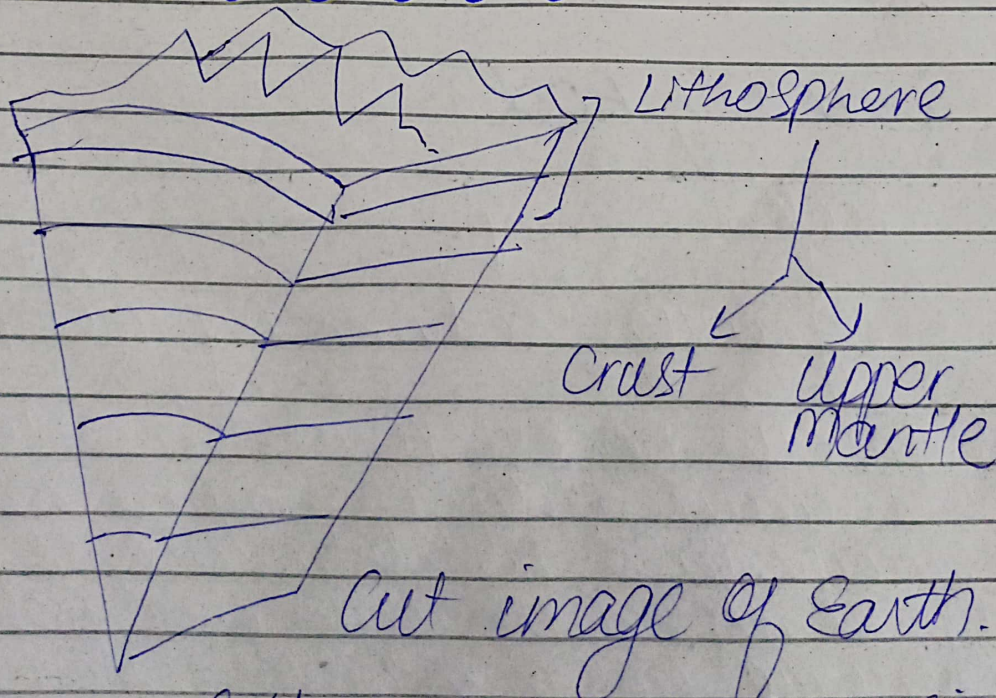
be brain damaging so they are kept in ~~trace~~ minute amounts.

• Microbiological Parameters:

They are a primary concern as they can cause immediate health issues. *E. coli* and other coliform bacteria can cause infections such as cholera, typhoid, and dysentery. Safe drinking water should have no detectable bacteria per 100 ml sample. Many standards require chlorination or UV treatments.

d. Elaborate Lithosphere. What are rocks and minerals?

LITHOSPHERE



The lithosphere is the rigid outermost shell of the Earth. It

includes the crust and the uppermost part of the mantle forming a solid layer of approximately 100km thick. The lithosphere is divided into several tectonic plates which float on the semi-fluid asthenosphere. The movement of these plates cause earthquakes and mountain formation.

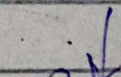
Rocks and Minerals: Composition of Lithosphere

Rocks:

nm Rocks are naturally occurring solid substances composed of one or more minerals.

Types of Rocks:

Rocks



Igneous

Sedimentary

Metamorphic

Igneous Rocks: Formed from the solidification of magma or lava. They could be intrusive (forming beneath Earth's surface e.g. granite) & extrusive (forming on the surface e.g. basalt).

Sedimentary Rocks: Formed by the accumulation and compression of sediments like sand, silt and organic matter over time. Examples include sandstone, limestone and shale.

Metamorphic Rocks: Formed when existing rocks undergo transformation due to high pressure, temperature or chemical processes. Examples include marble (from limestone) and schist (from shale).

MINERALS:

Minerals are naturally occurring inorganic substances with a specific chemical composition and a crystalline structure. Minerals are the basic components of rocks and are classified based on chemical and physical properties.

Properties of minerals:

Hardness: ^{is} Measured by Mohs hardness scale and is defined as the difficulty with which a smooth surface of a mineral be scratched.

Colour: Minerals derive their colour from the presence of a particular element within the crystal.

Lustre: It is the property that indicates how much the surface of a mineral reflects light.

crystal habit: It describes the favoured growth pattern of crystals.

Cleavage and fracture: It refers to the splitting of crystal along a smooth plane.

Q6

a. Determine the value of k . if the arithmetic mean of 9, 8, 10, k , 12 is 15.

Make equation

Arithmetic Mean (average)

$$\text{Mean} = \frac{\text{Sum of all numbers}}{\text{Total no. of values}}$$

$$15 = \frac{9 + 8 + 10 + k + 12}{5}$$

$$15 = \frac{39 + k}{5}$$

$$15 \times 5 = \frac{39 + k}{5} \times 5$$

$$75 = 39 + k$$

$$75 - 39 = \cancel{39} + k - \cancel{39}$$

$$\boxed{36 = k} \quad \text{Answer.}$$

b. A mixture contains sugar solution and colored water in the ratio of 4:3. If 10 litres of colored water is mixed in the mixture, the ratio becomes 4:5. Find the initial quantity of sugar solution in the given mixture.

Make equation.

$$\text{Mixture} = \text{sugar} : \text{color}$$

$$= 4 : 3$$

So,

$$\text{sugar sol} = 4x$$

$$\text{colour sol} = 3x$$

10 litre of water colored added.
The coloured water becomes

$$\Rightarrow 3x + 10 \text{ litres}$$

The new ratio becomes 4:5

$$\text{So, } 4x : 3x + 10 = 4 : 5$$

$$\frac{4x}{3x+10} = \frac{4}{5}$$

Cross multiply

$$4x \times 5 = (3x+10) \times 4$$

$$20x = 12x + 40$$

$$20x - 12x = 12x + 40 - 12x$$

$$8x = 40$$

$$\frac{8x}{8} = \frac{40}{8}$$

$$x = 5$$

Initial quantity of sugar sol = $4x$

$x = 5$ So $4x = 4 \times 5 = 20$ litres

c. what will be the answer.
volume of a football with
a radius of 12cm?

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

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

$$r^3 = 12 \times 12 \times 12 = 1728$$

$$V = \frac{4 \times (3.1416) \times 1728}{3}$$

Multiply simply

$$V = \frac{4 \times 1728 \times (3.1416)}{3}$$

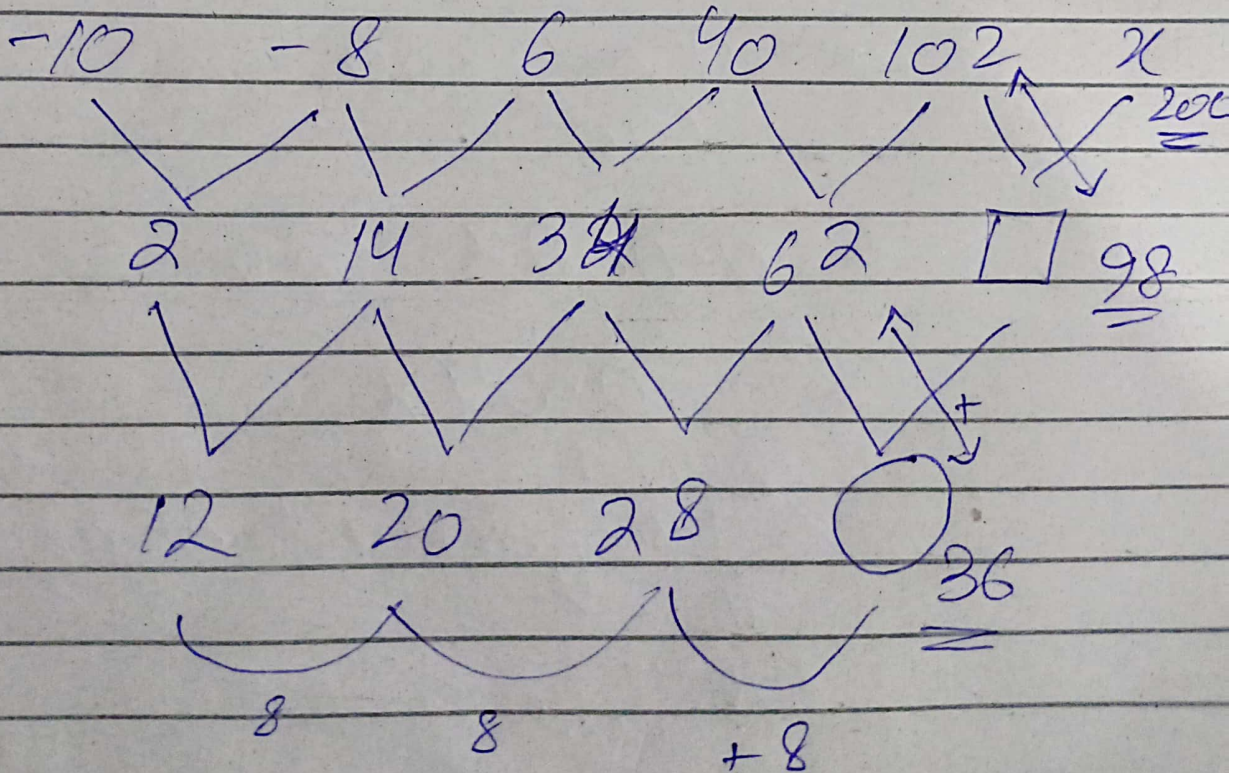
$$V = \frac{6912 \times (3.1416)}{3}$$

$$V = 2304 \times 3.1416$$

$$V = 7238.23 \text{ cm}^3 \text{ / Answer.}$$

d. Given a series $-10, -8, 6, 40, 102, x$

Find value



$$\boxed{? = 200} \text{ Answer}$$

Q7

a- If 20% of $x = y$

what is the value of $y\%$ of 20 in terms of x ?

$$\frac{20}{100} \times x = y \Rightarrow 0.2 \times x = y$$

$$\frac{y}{100} \times 20 = ?$$

$$y \text{ in terms of } x \Rightarrow y = 0.2x$$

$$\text{So, } \frac{y}{100} \times 20$$

$$= \frac{0.2x}{100} \times 20$$

$$= 0.002x \times 20$$

$$= 0.04x$$

$$\Rightarrow y\% \text{ of } 20 \text{ in terms of } x = \boxed{0.04x}$$

Answer.

b. P and Q have an average monthly salary of Rs 5050. Q and R have an average monthly income of 6250 Rs while P and R have of Rs 5200. Find the monthly salary of P

$$P \ \& \ Q \xrightarrow{\text{avg}} \text{Rs } 5050$$

$$Q \ \& \ R \xrightarrow{\text{avg}} \text{Rs } 6250$$

$$P \ \& \ R \xrightarrow{\text{avg}} \text{Rs } 5200$$

Monthly salaries of :

$$\begin{array}{l} P \rightarrow p \\ Q \rightarrow q \\ R \rightarrow r \end{array}$$

Fill in:

$$\star \quad \frac{p+q}{2} = 5050$$

$$p+q = 5050 \times 2$$

$$(p+q = 10100) \text{ --- i}$$

$$\star \quad \frac{q+r}{2} = 6250$$

$$(q+r = 12500) \text{ --- ii}$$

$$\star \quad \frac{p+r}{2} = 5200 \Rightarrow (p+r = 10400) \text{ --- iii}$$

- i $p+q = 10100$
- ii $q+r = 12500$
- iii $p+r = 10400$

Find $p \rightarrow$ cancel other values

$$(p+q) + (p+r) - (q+r) = 10100 + 10400 - 12500$$

$$p + \cancel{q} + p + \cancel{r} - \cancel{q} - \cancel{r} = 8050$$

$$\frac{2p}{2} = \frac{8050}{2}$$

$$p = 4025 \quad \text{Answer.}$$

c. Two coins are tossed 500 times and we get

Two heads \rightarrow 105 times

One head \rightarrow 275 times

No head \rightarrow 120 times

Find the probability of each event to occur

$$\text{Probability event} = \frac{\text{No. of required event}}{\text{Total number of event}}$$

total trials are 500

$$* P \text{ Two heads} = \frac{105}{500} = 0.21$$

$$P \text{ One head} = \frac{275}{500} = 0.55$$

$$P \text{ No head} = \frac{120}{500} = 0.24$$

$$P \text{ Probability of Two heads} = 0.21$$

$$" \quad " \quad 1 \text{ head} = 0.55$$

$$" \quad " \quad \text{no head} = 0.24$$

d. Jamie's dad is 4 times ^{answer} older than Jamie.

In 14 years time Jamie's dad will be twice the age of Jamie. What is the sum of Jamie's age now and Jamie's dad's age now?

$$\begin{aligned} \text{Jamie's age} &\rightarrow x \\ \text{Jamie's dad} &\rightarrow 4x \end{aligned}$$

In 14 years

$$\text{Jamie's age} \rightarrow x + 14$$

$$\text{Jamie's dad} \rightarrow 4x + 14$$

Now Jamie's dad is twice as old as Jamie.

$$\text{So, } [4x + 14] = \underline{2} (x + 14)$$

$$4x + 14 = 2x + 28$$

$$4x - 2x = 28 - 14$$

$$2x = 14$$

$$x = 7$$

Answer,

So Jamie + dad age.

$$7 + 28 = 35 \text{ Answer.}$$