CSS-2025

Date ____ 20 ____
M T W T F S S

Good attempt
Work on time management

Mujaddas Mushtaq

General-Science & Ability

QNO: 1.(a)

Lipids:

Lipids are hydrophobic organic compounds made primarily of hydrogen, carbon and oxygen.

→ They are insoluble in water, but soluble in non-polar solvents like Chloroform.

→ Lipids are essential in various biological processes, including

1- energy storage
2- membrane structure
3- membrane signalling

Examples:

Examples include oils, fats, steroids and waxes.

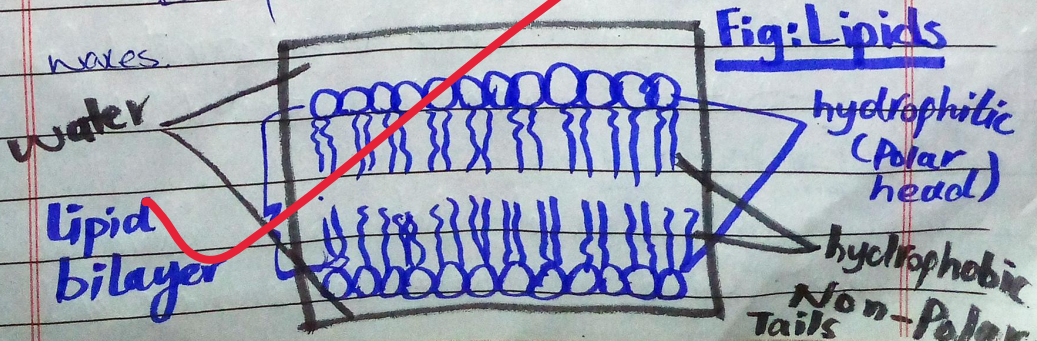
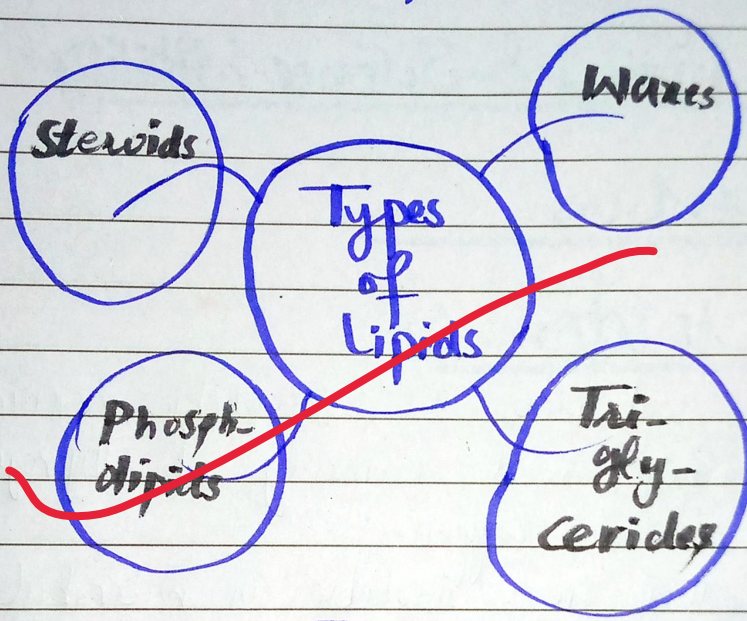


Fig: Lipids

Date ____ 20 ____
M T W T F S S

Types of Lipids:



Flowchart: Types of Lipids

(1)

Triglycerides: (Fats and oils)

Composition:

→ Glycerol bonded to three fatty acids and forms Triglycerides.

Example:

1- Olive oil which is unsaturated fat.

2- Butter which is saturated fat.

Explanation:

→ Unsaturated fats like Olive oil are liquid at room temperature and

promote heart health, while saturated fatty acids such as butter, are solid and should be consumed in moderation.

Function:

Provide long-term energy storage and insulation.

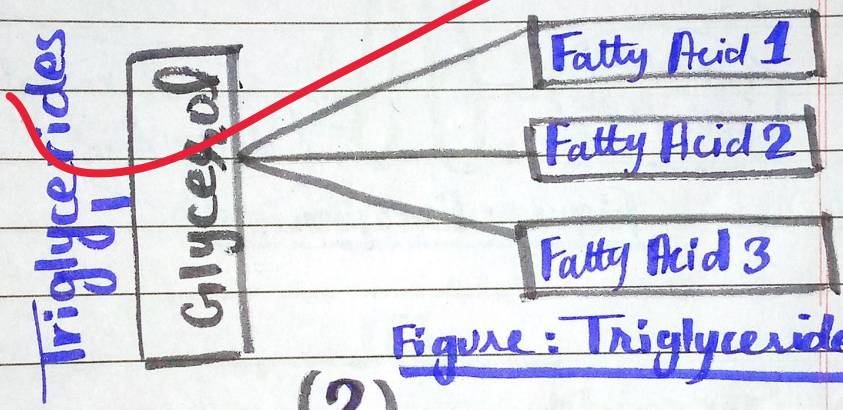


Figure: Triglycerides

(2)

Phospholipids:

Composition:

Phospholipids are formed when glycerol bonded to two fatty acids and a phosphate group.

Example:

→ Lecithin which is found in egg yolk and soyabeans.

Explanation:

Lecithin plays a critical role in forming cell membranes by creating a bilayer with hydrophilic heads

and hydrophobic tails, ensuring selective permeability.

Functions:

- Maintain structural integrity.
- Regulate transport in and out of the cells.

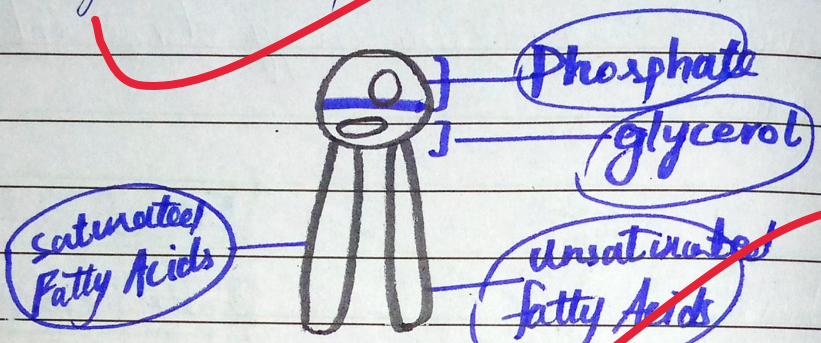


Figure: Phospholipids

(3)

Steroids:

Structure:

Four fused hydrocarbon rings formed steroids.

Example:

Chloesteral, testosterone, estrogen

Explanation:

Chloesteral stabilizes cell membranes and serves as a precursor for Vitamin D and steroid hormones. while Testosterone and estrogen regulates reproductive and metabolic

Date 20
M T W T F S S

functions

Functions:

- Hormonal regulation
- structural support in membranes

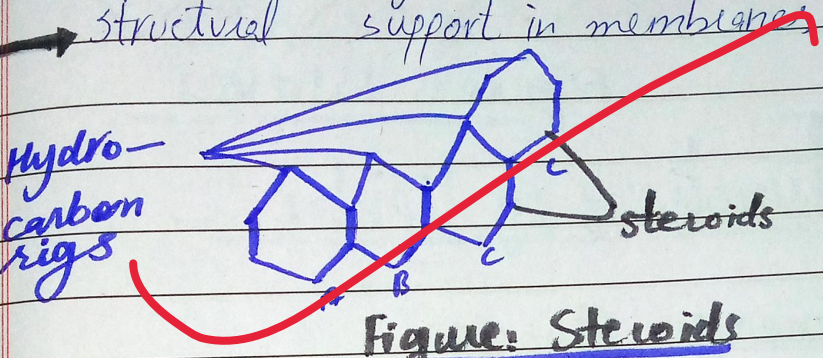


Figure: Steroids

(4)

Waxes:

Composition:

Long chain fatty acids and alcohols formed waxes.

Example:

1. Beeswax
2. Cuticle on plant leaves.

Explanation:

Beeswax is used in natural skin care, while the cuticle on leaves prevents water loss especially in arid climates.

Functions:

- Waterproofing and protection against

environmental damage.

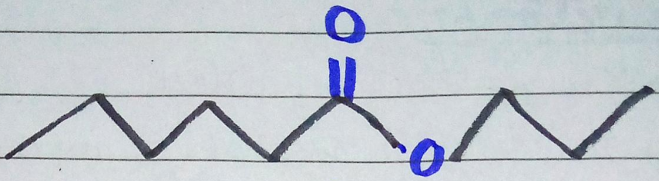


Figure: Waxes

Functions of lipids:

(1)

Energy Storage:

Lipids store energy efficiently, providing more than twice the energy per gram compared to carbohydrates.

Example: (9kcal/g Vs 4kcal/g)

Whale Blubber store energy and insulates marine mammals in cold waters.

Explanation:

The energy-dense nature of lipids is crucial for organisms requiring high energy like migratory Birds.

(2)

Structural Role:

Phospolipids form the bilayer of cell membranes

Example: Fluid mosaic model of

the plasma membrane.

Date 20
M T W T F S S

Explanation:

The flexibility of lipid bilayers allows cells to adapt and survive in varying environments.

(3)

Insulation and Protection:

Example:

Adipose tissue in humans cushions internal organs and insulates against cold.

Explanation:

Fats deposits protect vital organs like the kidneys from mechanical shocks.

(4)

Signalling Molecules:

Example:

Eicosanoids, derived from arachidonic acid, are involved in inflammation and immune responses.

Explanation:

Prostaglandins regulate fever and pain responses, demonstrating the role of lipids.

Date 20
M T W T F S S

(4)

Waterproofing:

Example:

Birds secret oils from uropygial glands to waterproof feathers.

Explanation:

This prevents water logging and helps birds maintain flight efficiency during rain.

Lipids have many functions which are applicable in our daily life by using olive oil, cholesterol, and beeswax. Recent Researches and Developments, such as the role of lipids in nanotechnology as drug delivery systems.

Q NO: 2(b)

Energy Conservation and its Sustainble Use :-

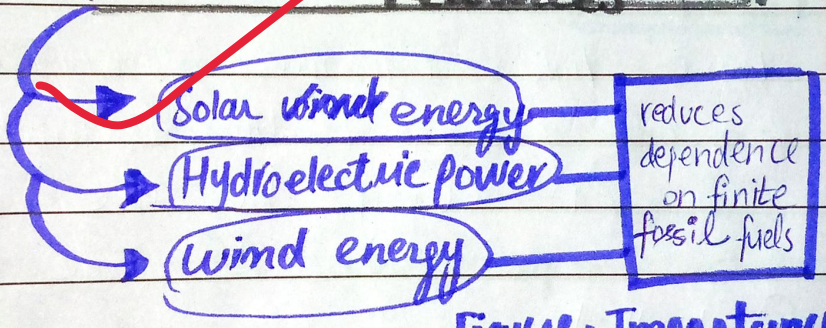
Energy Conservation refers to the practice of using energy

Date 20
M T W T F S S

efficiciently to seduce the waste. While Sustainble use ensures that energy resources are managed responsibly to meet the current and future needs.

Here are the Some Key Measures:-

1-Use of Renewable Energy Sources:



Figure; Importance of fossil fuels

Example:

The widespread adoption of solar panels in residential and commercial buildings.

→ The International Renewable Energy Agency (IRENA) reported a 17% increase in global renewable energy capacity in 2023.

Date ____ 20 ____
M T W T F S S

2 - Energy-Efficient Technologies:

Incorporating energy-efficient technologies

- Led Lights
- Energy-Star rated devices
- Energy devices

→ It reduces energy consumption.

Example:

LED lights consume up to 75% less energy than traditional incandescant bulbs. A study by the U.S Department of Energy found that energy-efficient appliances could save consumers $500 annually.

3 - Building Insulation and Design:

- **Proper Insulation** → minimize energy loss.
- **Sustainable architecture** → uses natural lightening and ventilation

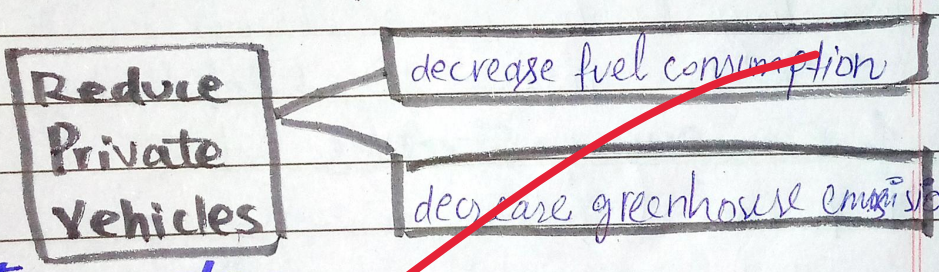
Date 20
M T W T F S S

Example:

Proper and Passive Solar homes that maintains comfortable temperatures year-round.

→ The Global Alliance for Buildings and Construction emphasized that improved building design could cut global energy demand **by 30%.**

4- Promoting Public Transport and Carpooling:



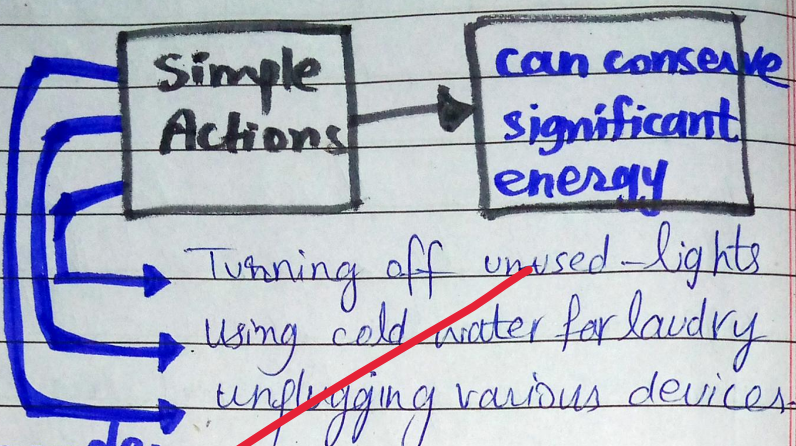
Example:

Rapid Transit Systems like the **Metro Bus in Lahore** encourage Public Transportation.

→ The International Energy Agency **(IEA)** highlighted that public transit reduces urban energy consumption by **40%.**

Date 20
M T W T F S S

5_ Behavioural Changes:



Example:

Japan's **"Cool Biz"** campaign encourages less air conditioning by promoting lightweight clothing in Summer.

→ A report by **McKinsey & Company** states that behavioural changes could cut global energy use by **20%**.

6_ Sustainable Industrial Practices :

Industries can adopt cleaner production technologies and recycle waste energy.

Examples:

Using heat recovery systems in power plants to improve efficiency.

Explanation:

According to the **World**

Date 20
M T W T F S S

Resources Institute, efficient industrial processes could save $60 billion annually in energy cost.

1— Government Policies and Incentives:

Governments can encourage energy conservation through subsidies, tax rebates, and strict regulations.

Example:

Germany's energiewende policy promotes renewable energy and efficiency.

→ The European union achieved a **23% reduction** in energy consumption **from 2005 to 2020** due to such policies.

Q NO: 2(C)

Hydrogen Bonding:

Hydrogen Bonding is a type of weak chemical interactions that occurs with when

Date ____ 20 ____
M T W T F S S

a hydrogen atom covalently bonded to a highly electronegative atom like — (Nitrogen, Oxygen or Flouine) interacting with another electronegative atom nearby.

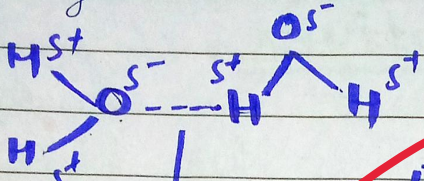


Figure: Hydrogen Bonding

Characteristics of Hydrogen Bonding:

1- **Strength:** Stronger than van-der-Waals forces but weaker than covalent or ionic bonds

2- **Directionality:** Hydrogen Bonds are directional, often forming at specific angles.

3- **Importance:** crucial for biological structures and properties of water, DNA, and Proteins

Types of Hydrogen Bonding:

1 — Intermolecular : Between

the molecules e.g between Water Molecules

2- Intramolecular: Within the same molecules. e.g Proteins and DNA - double Helixes.

Examples with Structures:

1- Hydrogen Bonding in Water (H_2O):

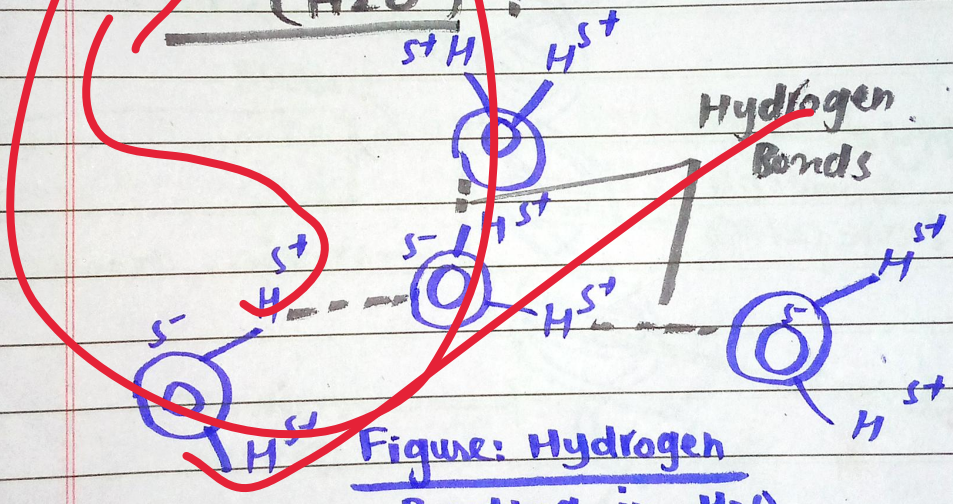


Figure: Hydrogen Bonding in H_2O

(a) Structure:

Each water molecule has two hydrogen δ^+ atoms covalently bonded to an oxygen atom. The oxygen atom's lone pairs δ^+ form Hydrogen Bonds with hydrogen atoms of neighbouring molecules.

Date 20
M T W T F S S

Significance:-

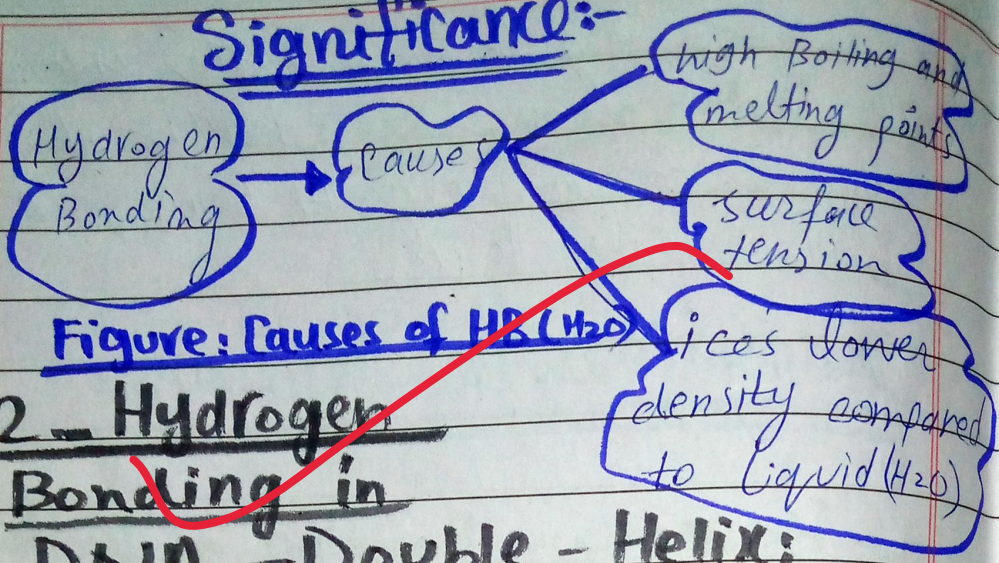


Figure: Causes of HB (H_2O)

2_ Hydrogen Bonding in DNA – Double - Helix:

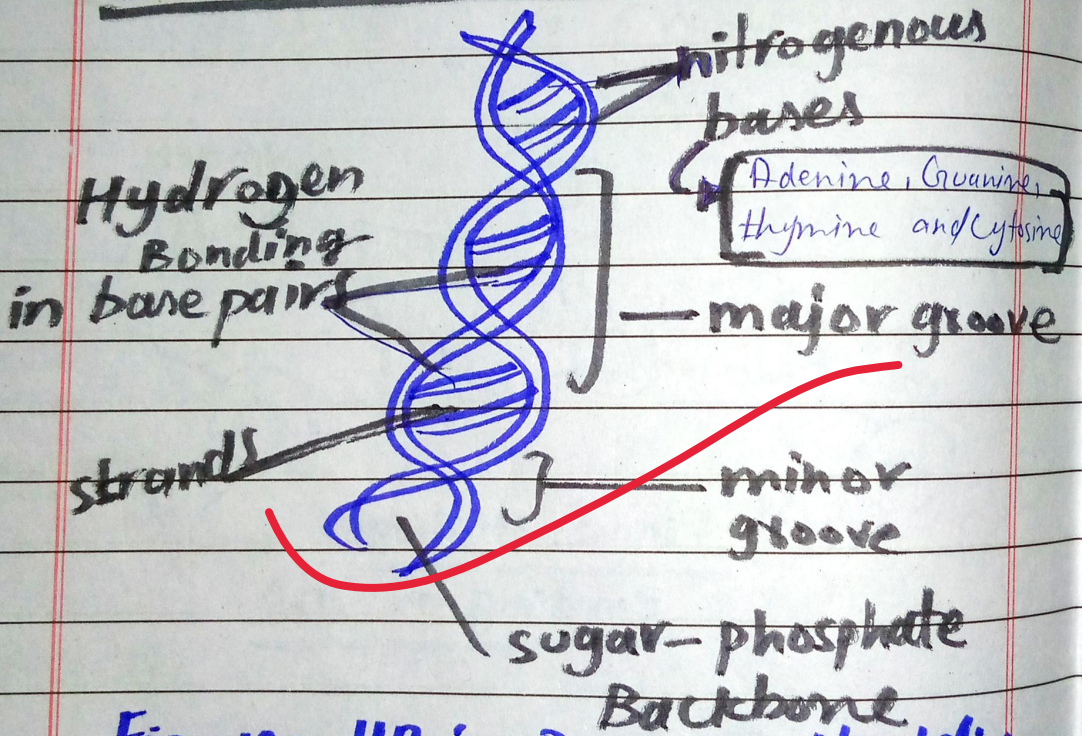


Figure: HB in DNA Double Helix

Structure:

In DNA, Hydrogen Bonds are formed between nitrogenous bases adenine (A) pairs with thymine (T) via two hydrogen bonds, and

Date 20
M T W T F S S

Cytosine (C) pairs with Guanine (G) via three Hydrogen Bonds.

∴ (A = T , C ≡ G)

Significance:

Hydrogen Bonds provide stability to the DNA Double helix. while allowing it to unzip during replication and duplication and transcription.

3 Hydrogen Bonding in Ammonia (NH_3):

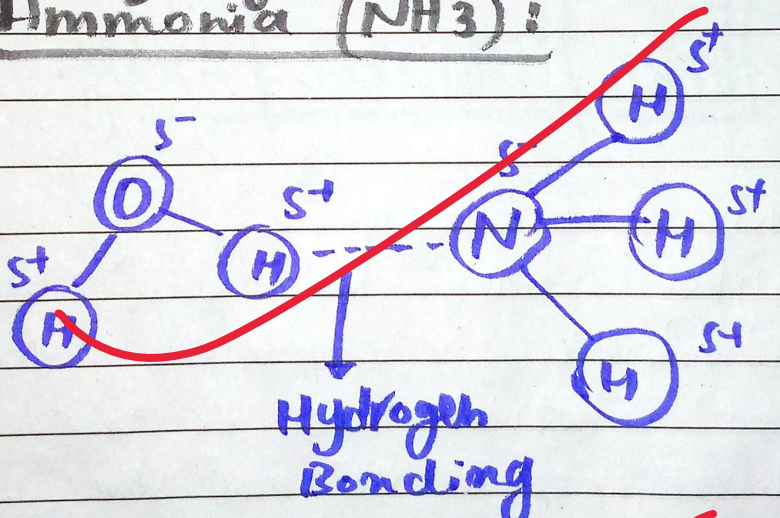


Figure: HB in NH_3

Structure:

Ammonia molecules (NH_3) interact ~~with~~ through the hydrogen Bonds between the nitrogen atom of one molecule and the hydrogen

Date ____ 20 ____
M T W T F S S

atom of another molecule.

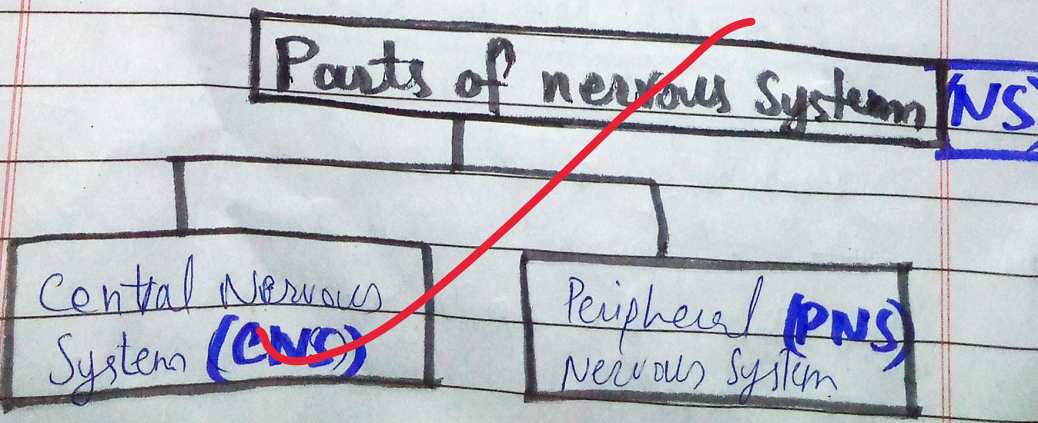
Significance:

Hydrogen Bonding in Ammonia (NH_3) contributes to Ammonia's high solubility in water.

Q No: 2(d)

The Nervous System of The Human Body:

The nervous system of Body is a highly complex network of cells responsible for coordinating the body's activities and responses to internal and external stimuli.



Date 20
M T W T F S S

1_ Central Nervous System (CNS):

It is the control center of the Body.

a) Brain: Central Nervous System (CNS) (Brain)

- **Cerebrum:** controls voluntary actions, reasoning, emotions and memory.
- **Cerebellum:** Maintains Balance and coordinates Muscle Movement.
- **Brainstem:** Regulates vital functions like Heartbeat, digestion and Breathing.

b) Spinal Cord:

Structure:

A long cylindrical structure of nerve tissue running through vertebral column.

Functions:

- Transmits signals between the Body and Brain.
- Controls reflex actions through Reflex arc.

2- Peripheral Nervous System of Brain: (PNS)

The Peripheral Nervous System of Brain (PNS) connects to the (CNS) central nervous system to the rest of the Body.

Parts of PNS:

It is further divided into two parts

1- Somatic Nervous System (SNS)
2- Autonomic Nervous System (ANS)

(a) Somatic Nervous System:

Functions:

Control voluntary movements by transmitting signals to skeletal muscles

Example:

1- Lifting your hand while touching hot things.
2- Walking - steps up or down.

(b) Autonomic Nervous System (ANS):

Functions:

Regulates involuntary actions

Date 20
M T W T F S S

like heart beat, digestion and glandular Activities

Autonomic Nervous System

Sympathetic (NS)
- It activates "fight" or "flight" response during stress
- **Ex:** Increased heart rate and dilated pupils in danger

Parasympathetic (NS)
- Promotes "rest and digest" activities
- **Ex:** Slowing rate of heart and stimulating digestion.

Types of Nerves in the (PNS):

1- Sensory Nerves (Afferent):

- Transmit sensory information from the body to CNS.
- **Example:** feeling heat from the stove.

2- Motor Nerves (Efferent):

- Transmit motor commands from the CNS to muscles and glands
- **Example:** Moving your hand.

away from the stove.

3- Neurons: The Functional units of the Nervous System:-

Structure of Neurons:

(a) Cell Body (Soma):
contains the nucleus and the organelles.

(b) Dendrites:
Receive signals from other neurons.

(c) Axon:
Transmit impulses to other neurons or effectors.

(d) Synapse:
A junction where signals are transmitted between neurons using neurotransmitte

Types of Neurons:

(a) Sensor Neurons:
Carry signals from sensory organs to the CNS.

Date ____ 20____
M T W T F S S

(b) Motor Neurons:

Carry signals from the CNS to the muscles or glands.

(c) Interneurons:

Connect sensory and motor neurons within the CNS.