General Instructions

1. Give numbering to headings
2. Do not write lengthy paragraphs. Write medium sized paragraphs with headings.
3. Do not use table for comparison and contrast questions.
4. Draw figures/diagram/flowchart where needed.
5. Start new question from fresh page.
6. Write out full answer in ability section.
7. Explain mathematical steps and the reasoning for better score.
8. Change colour scheme for references to give them more visibility.
9. Manage time well.
10. Wide page borders are discouraged. Should be reasonable.
11. Avoid writing wrong references.
12. Give more weightage to expressedly asked parts of the question.

19.5

Q#2 (a)

Octet rule:

The tendency of atoms to have eight electrons in the valence shell is known as the 'Octet rule' or the 'Rule of eight'.

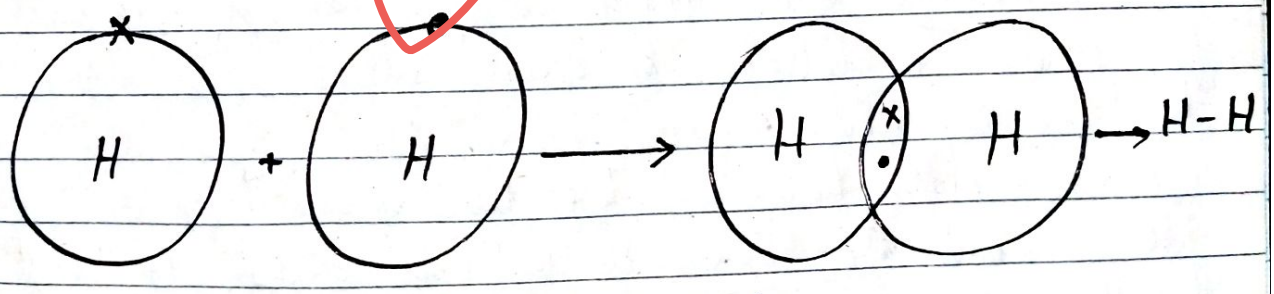
Example: Sodium with atomic number 11 will readily lose one electron to attain Neon's stable electronic configuration.

Covalent Bond

When two non-metal atoms combine, they share one, or more, pairs of electrons. A shared paired of electron called single covalent bond. A single covalent bond is represented by a single line

Example:

H-H. Hyd. gas forms the simplest covalent bond in the diatomic hydrogen molecule.



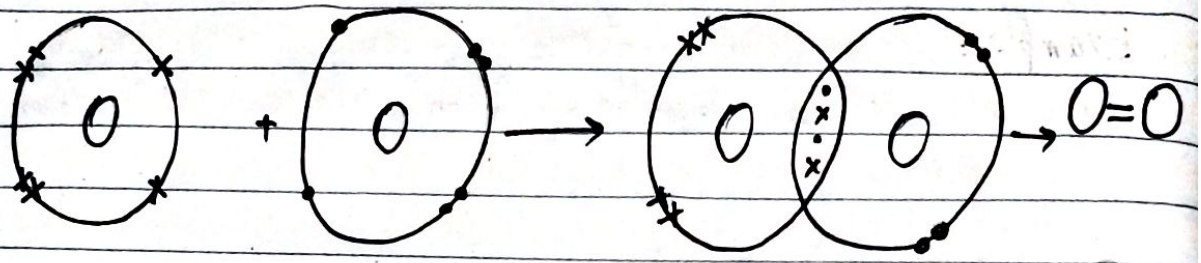
Multiple Covalent Bonds:

Some atoms can bond together by sharing two pairs

of electrons. We call this a double covalent bond. A double covalent bond is represented by a double line between the atoms.

Example.

O=O. In order to form an oxygen molecule, each oxygen atom needs to gain two electrons to complete its outer shell. So two pairs of electrons are shared and two covalent bonds are formed.



Coordinate Covalent Bond:

When shared pair of electron comes from only one atom and not one each from the two atoms involved in the bonding then it is called as coordinate covalent bond. The atoms which donates the electron to form co-ordinate covalent bond is called as the donar atom while the atom which accepts the pair of electron for bonding is called as acceptor atoms. For co-ordinate bonding we need.

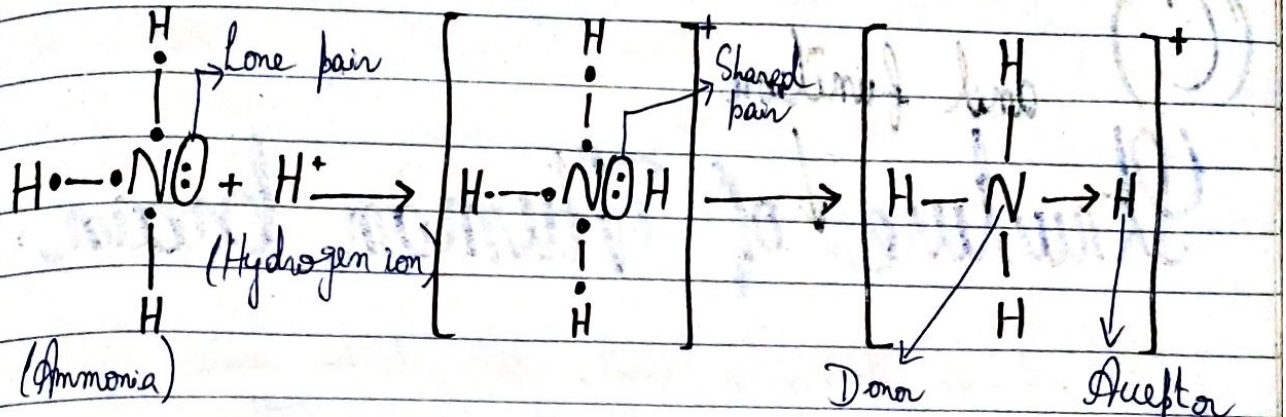
a) One atom having a lone pair of electrons

b) a second atom having an unfilled orbital to accept the lone pair.

Thus coordinate bond can also be explained as the bond formed between the donar and acceptor atoms. A

coordinate bond is represented by an arrow (→) starting from the donor atom and ending in the acceptor atom.

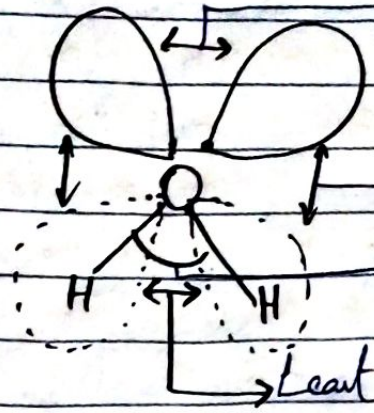
In ammonia, the nitrogen atom has a lone pair of electrons after completing its outer shell. It donates this lone pair to the hydrogen ion. Thus, the nitrogen atom becomes the donor. The hydrogen atom becomes the acceptor. The linkage between N and H atoms is called coordinate bond. It is represented by an arrow →.



(B)

Why water molecule is angular in structure:

Because Water has two bonding pairs of electrons and two lone pairs of electrons. The greatest electron pair repulsion is between the two lone pairs. This results in the bonds being pushed even closer together. The shape of the water molecule is a nonlinear V shape. The H-O-H bond angle is 104.5°.



(C) and function

Structure of Human brain:

The human brain is made of three main parts: the forebrain, mid brain and hindbrain. The forbrain consist of the cerebrum, thalamus and hypothalamus. The mid brain consist of the tectum and tegmentum. The hindbrain is made of the cerebellum, pons and medulla. Often the midbrain, pons, and medulla are refered together as the brainstem.

The cerebrum is responsible for higher cognitive functions and is divided into four lobes: frontal, parietal temporal and occipital. The cerebellum controls movement and balance with the brainstem regulates essential functions like breathing and heart rate. These structures work together to facilitate various bodily functions and cognitive processes.

(1)

Cell Structure:

Cell is the base structural unit of all living organisms, including humans. Cells word derived from the Latin word "cellula" which means "a little room". Cells have some common structures and components.

1. **Cell Membrane**: Thin semi-permeable barrier surrounds the cell.

2- **Cytoplasm**: The gel-like substance that fills the cell.

3- **Nucleus**: The cell's control center

4- **Mitochondria**: Often called the "powerhouses" of the cell

5- **Endoplasmic Reticulum**: A network of membranes involved in protein and lip.

And many other important compenent like Golgi Apparatus, Ribsoromes, Lysosomes, Vacuoles, Cytoskeleton, Centrioles, Cell Wall and Chloroplasts are present. These structures work together to enable various cellular functions and processes, allowing cells to carry out essential tasks necessary for

the survival and functioning of organisms.

Functions of Nucleus:

Diagram?

1- It controls all the activities of the cells.
2- It controls the transfer of hereditary characters from parents to offspring.
3- The three types of RNAs, i.e. mRNA, tRNA, rRNA are synthesized in the nucleus. These RNAs are involved in the synthesis of proteins.

Functions of Mitochondria:

Many important metabolic proceses take place in mitochondria. These are Kerbs cycle, aerobic respiration, fatty acid metabolism, etc. Energy is released from organic food during these metabolic processes. This energy is transfered to energy rich compound ATP. ATP provides energy to cell on demands and ATP is broken to ADP. This ADP absorbs energy from mitochondria and again becomes ATP.

Functions of Vacuoles:

1- They expands the plant cells and do not dilute its cytoplasm.
2- They store water, cell products a metabolic intermedies.

3- They cause turgor in plant cell. This turgor provides support to individual plant cells. It creates rigidity in leaves and young parts of the plants.

Q# 3

(a)

Polio:

Poliomyelitis (polio) is a highly infectious viral disease, which mainly affects young children.

Causes:

There are three types of poliovirus: type 1, type 2, and type 3. All three types can cause polio but they are slightly different genetically. In most cases, polio infection results in mild or no symptoms. However, in some instances, the virus can enter the bloodstream and attack the motor neurons in the spinal cord and brainstem leading to muscle weakness, paralysis, and potentially lifelong disabilities.

Symptoms:

Polio is a highly infectious disease caused by a

virus. It invades the nervous system, and can cause total paralysis in a matter of hours. Initial symptoms are fever, fatigue, headache, vomiting, and stiffness in the neck and pain in the limbs. One in 200 infections leads to irreversible paralysis. Among those paralyzed, 5% to 10% die when their breathing muscles become immobilized. Polio mainly affects children under 5 years of age

Difference between IPV and OPV

IPV (inactivated Poliovirus Vaccine)	OPV (Oral Poliovirus Vaccine)
IPV is also known as the "killed" polio vaccine.	OPV is also known as the "live" polio vaccine.
It is made from inactivated poliovirus, so it cannot cause polio.	It contains weakened (attenuated) but live poliovirus.
IPV is usually administered as an injection into the muscle.	OPV is administered orally usually as drops given by mouth.

(b)

The nervous system is divided into 2 main parts.

1) Central Nervous System (CNS)
2) Peripheral Nervous System (PNS)

Central Nervous System

This includes the brain and spinal cord. The CNS is responsible for processing and integrating sensory information, coordinating motor activities, and performing higher cognitive functions like thinking, memory, and decision-making.

Alzheimer's disease

Alzheimer's disease is a progressive and irreversible neurological disorder that primarily affects memory, thinking, and behavior. It is the most common cause of dementia, a term used to describe a group of cognitive impairments that interfere with daily functioning and quality of life. Alzheimer's disease typically develops slowly over time and worsens as it progresses.

Key characteristics of Alzheimer's disease include: Memory loss, cognitive decline, language impairment, Mood and behavioral changes, Disorientation and confusion, Loss of ability to perform

everyday tasks, Progressive nature.

The cause of Alzheimer's disease involves the accumulation of abnormal protein aggregates in the brain, particularly beta-amyloid plaques and tau tangles. These aggregates disrupt communication between nerve cells and lead to cell death, contributing to the cognitive decline and functional impairments seen in the disease.

(C)

Carbohydrates:

Structure:

Carbohydrates are organic compounds made up of C, H, O atoms. They serve as a primary source of energy for living organisms and play essential roles in various biological process. Carbohydrates have the general formula $(CH_2O)_n$, where "n" represents the number of carbon atom. The hydrogen : Oxygen ratio is usually 2 : 1.

Clarification:

Carbohydrates can be clarified into 3 main groups based on their chemical composition.

1- Monosaccharides:

These are the simplest carbohydrates and cannot

be further broken down into smaller units. Examples include glucose, fructose and galactose.

2. Disaccharides:

There are composed of two monosaccharide units linked together. Example include sucrose (glucose + fructose) etc.

3- Polysaccharides

There are complex carbohydrates made up of multiple monosaccharide units e.g: Starch, cellulose.

Functions:

a. Carbohydrates are chief energy source, in many animals; they are instant source of energy. Glucose is broken down by glycolysis / Kreb's cycle to yield ATP.

b. Glucose is stored as glycogen in animals and starch in plants.

c. Stored carbohydrates acts as energy source instead of proteins.

d. Carbohydrates are rich in fibre content help to prevent constipation.

d)

Preservatives in Food:

Preservatives are substances added to food products to extend their shelf life by inhibiting the growth of microorganisms such as bacteria, yeasts and molds. They play a crucial role in preventing spoilage, maintaining product quality, and ensuring food safety. Here are some reasons for the importance of preservatives.

a) Microbial Growth prevention: Preservatives help prevent the growth of harmful microorganisms that can cause foodborne illnesses, spoilage and deterioration of food quality.

b) Global Distribution: In a highly interconnected world, food products often travel long distances before reaching consumers. Preservatives help maintain the freshness and safety of food during transportation and storage.

c) Variety and Convenience: Preservatives enable a wider variety of food options and convenience foods by extending their shelf life, reducing food waste, and allowing consumers to access foods that may not be locally produced.

d) Economic Benefits: Reducing spoilage and food waste due to longer shelf life can result in economic savings for both manufacturers and consumers.

Antioxidants in Food:

Antioxidants are compounds that help prevent or slow down the oxidative damage caused by free radicals in the body. In food, antioxidants play an important role in maintaining the quality and nutritional value of products.

a) Preventing Oxidation: Oxidation in foods can lead to the development of off-flavors, color changes, and nutrient degradation. Antioxidants help prevent or delay these undesirable changes, thereby maintaining the sensory and nutritional qualities of the food.

b) Nutrient Retention: Antioxidants can help preserve the nutritional content of foods by protecting vitamins, minerals, and other nutrients from degradation due to oxidation.

c) Increasing Shelf Life: Antioxidants contribute to extending the shelf life of products by slowing down the oxidative processes that lead to spoilage.