MIND MAP OF SCIENCE
CBSE CLASS X

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MIND MAP

Chemical Reactions and Equations

Chemical Change or Chemical Reaction

These are the changes because of the alteration in chemical composition of the substance. These are irreversible in nature (in most of the case).

Chemical Equation

It is the symbolic representation of a chemical reaction, in which the reactants symbol/formula are written on the left and products symbol/ formula are written on the right. These two are separated by an arrow.

Balanced Chemical Equations

The reactions in which the total number of atoms of each element are equal on both sides of the equation are called balanced chemical equations.

Steps involved in Balancing Chemical Equation by Hit and Trial Method

***Step* I** Write unbalanced equation and enclose the formulae in brackets.
***Step* II** Make list of elements present in unbalanced or skeletal equation.
***Step* III** Balance, first, second and successive elements.
***Step* IV** Check the correctness of equation.
***Step* V** Make the equation more informatory.

5. Oxidation and Reduction Reactions

Process which involves addition of oxygen or removal of hydrogen or loss of electron is called oxidation. Reduction is the reverse of it, i.e. it involves removal of oxygen or addition of hydrogen or gain of electron.

Redox Reactions In these reactions, oxidation and reduction process occur simultaneously.

Oxidising Agent or Oxidant It is the substance that cause oxidation of other substance and itself get reduced.

Reducing Agent or Reductant It is the substance that cause reduction of other substance and itself get oxidised.

Effects of Oxidation Reactions

Corrosion It is the process of deterioration of metal surface by the action of air, water or chemical.

Rancidity It is the process of slow oxidation of oil and fats present in the food materials.

Physical Change

These are the changes in which physical properties of a substance like state, colour etc., are altered but its chemical composition remains the same. These changes are reversible in nature.

1. Combination Reactions

In these reactions, two or more reactants react together to give a single product.

2. Decomposition Reactions

In these reactions, a single reactant breaks down into two or more simpler products.

- **Thermal Decomposition** In these reactions, heat is used to decompose the substance.
- **Electrolysis** In these reactions, electricity is used to decompose the substance.
- **Photolysis** In these reactions, the substance is decomposed by using light energy.

3. Displacement Reactions

In these reactions, one element displaces the other from its salt solution.

- **Single Displacement Reactions** In these reactions, a more reactive element displaces the less reactive one from its salt solution.
- **Double Displacement Reactions** In these reactions, two different ions in the reactant molecules are displaced by each other.

4. Neutralisation Reactions

In these reactions, acids and bases react to form salt and water.

6. Exothermic and Endothermic Reactions

Reactions accompanied by the evolution of heat are called exothermic (e.g. respiration) whereas the reactions occurring by the absorption of heat are called endothermic reaction (e.g. photosynthesis).

MIND MAP

Acids, Bases and Salts

Acids

They are the substances that have sour taste and turn blue litmus red.
According to Arrhenius, these furnish H^+ ions in the aqueous solution.

Based on ionisation

Strong Acid
They ionise completely to furnish H^+ ion.
e.g. H_2SO_4, HCl etc.

Weak Acid
They ionise only partially to give less H^+ ion.
e.g. CH_3COOH etc.

Types of Acids

Based on concentration

Dilute Acid
In this acid, the concentration of acid is low.

Concentrated Acid
In this acid, the concentration of acid is high.

Properties of Acids

1. **Reaction with Metals** Hydrogen gas is released which burns with 'pop' sound.
2. **Reaction with Metal Oxides** In this reaction, salt and water are produced.
3. **Reaction with Carbonates and Hydrogen Carbonates** Carbon dioxide gas is produced, which turns lime water milky.
4. **Dilution** Acids are diluted by adding acid to water, as the reaction is highly exothermic.
5. **Electrical Conductance** These conduct electricity in aqueous solution because of presence of H^+ ion.

Bases

They are the substances that have bitter taste and turn red litmus blue.
According to Arrhenius, these furnish OH^- ions in aqueous solution.

Types of Bases

Strong Base
They ionise almost completely in aqueous solution, e.g. NaOH.

Weak Base
They ionise only partially in the aqueous solution, e.g. CuO

Alkali
Water soluble bases are called alkali. Thus, all alkalies are bases but all bases are not alkali, e.g. NaOH.

Properties of Bases

1. **Reaction with Metals** Strong bases produce hydrogen gas when react with active metals.
2. **Reaction with Non-metallic Oxides** Salt and water are the products of such reaction.
   e.g. $CO_2 + Ca(OH)_2 \longrightarrow CaCO_3 + H_2O$
3. **Dilution** it is the process of mixing of base with water and is an exothermic process.

Salts

They are the products of neutralisation reaction between acids and bases.

Common Salt : Sodium Chloride
It is obtained by the reaction of hydrochloric acid and sodium hydroxide. It is used in food and for the synthesis of industrially important chemicals like NaOH, H_2,Cl_2 etc.

Caustic Soda [Sodium Hydroxide]
It is obtained by chlor-alkali process.

$$2NaCl(aq) + 2H_2O(l) \xrightarrow[\text{current}]{\text{Electric}} 2NaOH(aq) + Cl_2(g) + H_2(g)$$
(At anode) (At cathode)

It is used for making soaps, detergents, artificial textile, fibre paper etc.

Bleaching Powder
It is used for bleaching purpose and has the formula $CaOCl_2$.

Baking Soda
It is chemically sodium hydrogen carbonate, $NaHCO_3$. It is an important constituent of baking powder.

Washing Soda
Its chemical formula is $Na_2CO_3 \cdot 10H_2O$ (hydrated sodium carbonate). It is used for cleansing purposes and to remove permanent hardness of water.

Plaster of Paris
It is chemically calcium sulphate hemihydrate, $CaSO_4 \cdot \frac{1}{2} H_2O$ and is obtained by heating gypsum ($CaSO_4 \cdot 2H_2O$) at 373 K. It is used for plastering of fractured bones.

Water of Crystallisation
Some salts in their dry state also have some fixed number of water molecules associated with them. These are called the water of crystallisation and such salts are called hydrated salt like washing soda ($Na_2CO_3 \cdot 10H_2O$), blue vitriol ($CuSO_4 \cdot 5H_2O$) etc.

MIND MAP

Metals and Non-Metals

Elements contain only one kind of atoms like Na, Mg, Cl_2, O_2 etc.
They are categorised further as metals, non-metals and metalloids.

Metals

They are electropositive in nature and have a tendency to form positive ion by losing electron(s), e.g. Cu, Fe, Au, Na etc

Physical Properties

- **Malleability** It is the property of metals to get converted into thin sheets on beating and is maximum in gold and silver.
- **Ductility** It is the property of metals due to which these can be drawn into wires. It is maximum in gold.
- **Conductivity** Metals are generally good conductors of heat and electricity because of the presence of free electrons.

Chemical Properties

- **Reaction with Water** In this reaction, metal oxide and hydrogen are obtained. Metal oxide further reacts with water to form metal hydroxide.
- **Reaction with Dilute Acids** Reactive metals generally form salt and hydrogen with HCl or H_2SO_4, but not with HNO_3.
- **Reaction with Solution of Other Metals** Reactive metals displace the less reactive metals from their salt solution.
  e.g. $A+BC \rightarrow AC+B$.
  or $Cu+AgNO_3 \rightarrow Cu(NO_3)_2^{2}+Ag$
  The order of reactivity is K>Na>>Ca>Mg>Al>Zn>Fe >Sn>H>Cu>Hg>Ag>Au.
  This series is called reactivity series.
- **Alloy formation** Alloys are homogeneous mixtures of two or more metals or a metal and a non-metal. Alloy of metal with Hg (mercury) is called amalgam.

Non-metals

They are electronegative elements, i.e. have a tendency to form anion by gaining electron(s) e.g. iodine (I_2), sulphur (S),hydrogen (H_2) etc.

Metal Extraction

Metallurgy
It is the process of extraction of metals from their ores.

Minerals
The compounds in the form of which metal occur naturally are called minerals.

Ores and Gangue
The minerals from which metal is extracted profitably are called the ores and the impurities associated with them are called gangue.

Steps of Extraction

Concentration of Ore
It is the process of removal of impurities of sand, clay etc., from the metal.

- **Metals of High Reactivity**
  - Electrolysis of molten ore
  - Pure metal
- **Metals of Medium Reactivity**
  - Carbonate ore → Calcination
  - Sulphide ore → Roasting
- **Metals of Low Reactivity**
  - Sulphide ores
  - Roasting
  - Metal
  - Refining

Oxide to metal → Reduction to metal → Purification of Metal

Metalloids

They possess the properties of metals as well as non-metals. They are very few in numbers, e.g. Ge, Ga etc.

Physical Properties

- **Metallic Lustre** Non-metals except iodine and graphite, do not possess metallic lustre.
- **Conductivity** Non-metals are generally poor conductors of heat and electricity because of the absence of free electrons.

Chemical Properties

- **Reaction with Oxygen** Non-metals also form oxides but their nature is generally acidic, (e.g. P_2O_5, SO_2 and CO_2 as they produce acid with water) or neutral, (e.g. CO, H_2O, NO_2 etc.)
- **Formation of Covalent Compounds** Non-metals react with other non-metals to form covalent compounds like H_2S,H_2O etc.

Ionic or Electrovalent Bond
The bond formed by the complete transfer of an electron from a metal atom to a non-metal atom is called ionic bond.

Properties of Ionic Compounds

- They are brittle and have high melting and boiling point.
- They are soluble in water.
- They are conductor of electricity in aqueous solution or in molten state because of the presence of free ions.

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Carbon and Its Compounds

ALLOTROPES OF CARBON

These are different forms of carbon that differ in arrangement and in number but are same chemically.

Diamond
The hardest rigid three dimensional network, which is non-conductor of electricity and used as precious stones and abrasive.

Graphite
It is an opaque substance with hexagonal planar layer structure and is a good conductor of electricity. It is used for making pencils lead and electrodes of the cells.

Fullerene
It is the recently discovered allotrope and called so because of its resemblance with framework of domeshaped halls designed by Fuller.

CATENATION

It is the self linking tendency of an element in the form of straight chains or cyclic rings. It decreases with decrease in element bond strength.

Chemical Properties
In these properties, chemical composition of the substance gets changed.

Oxidation
It is the process of intake of oxygen and removal of hydrogen. Substances which provide oxygen are called oxidising agents.

Combustion
It is the reaction in which CO_2 and H_2O are obtained by burning organic compound. Saturated hydrocarbons burns with blue flame due to their complete combustion.

Addition
In them, the reagents add completely to the substrate. *e.g.*, hydrogenation (addition of H_2) to vegetable oil to obtained ghee (hardening of oil in the presence of Ni as catalyst).

Substitution
In them, an atom or group of atoms replace another atom or group from the substrate.
It is shown by alkanes and occur in the presence of sunlight.

ORGANIC COMPOUNDS

These are the compounds of carbon except its oxides, carbonates and hydrogen carbonate salts.

Hydrocarbons
These are the compounds of carbon and hydrogen only.

Saturated Hydrocarbons
- They have only single bonds between any two atoms.
- Their general formula is C_nH_{2n+2}.

Unsaturated Hydrocarbons
- They have atleast one multiple bond between two carbon atoms along with the single bonds.

Alkenes or Olefins
- These have a C-C double bond along with single bonds.
- Their general formula is C_nH_{2n}.

Alkynes
- These have atleast one C-C triple bond along with single bonds.
- Their general formula is C_nH_{2n-2}.

Rules for Drawing Structure
1. Connect all the C atoms by single bond.
2. Satisfy the tetravalency of each C by available H atoms.
3. Satisfy the remaining valency, if any, by multiple bonds.

Rules for Nomenclature
1. Write the root word according to number of C atoms.
2. Add suffix 'ane' if all are single bonds or 'ene' for double bond and 'yne' for triple bond.
3. If functional group is present, replace 'e' of name of hydrocarbon by suffix of the group.

Fuels
They provide heat and light when burnt. These are called fossil fuels, when obtained from fossils. *e.g.*, coal, petroleum, etc.

Flame
It is the region where combustion of gases takes place.

Blue Flame
- Also called non-luminous flame.
- Obtained when oxygen is sufficient or in excess.

Yellow Flame
- Also called luminous flame.
- Obtained when oxygen is sufficient.
- Its yellow colour is because of the presence of unburnt carbon particles.

COVALENT BOND

A bond which is formed by the sharing of electrons.

Covalency
It is the number of electrons shared by an atom in bonding.

Properties of Covalent Compounds
- Weak bond
- Low melting and boiling point
- Insoluble in water
- Non-conductor of electricity

Functional Group
It is an atom or group of atoms responsible for the chemical properties of an organic compound.

Homologous Series
A series of compounds having same functional group but a difference of $—CH_2$ unit (14 unit mass) between two successive members.

Ethanol, C_2H_5OH
- It is obtained from sugar and soluble in water.
- It gives ethene on reaction with conc H_2SO_4 at 160 °C.
- It gives sodium ethoxide with Na.
- It is called denatured alcohol, if mixed with methanol, pyridine, etc.

Ethanoic Acid, CH_3COOH
- Also called acetic acid.
- Its 5-8% aqueous solution is called vinegar.
- It gives sweet smelling substance ester when treated with alcohol.
- It gives CO_2 gas with sodium carbonate and bicarbonate.

Soaps
- These are sodium or potassium salts of long chain fatty acids ($RCOONa$) ; here $R = C_{15}H_{31}$, $C_{17}H_{35}$
- These are obtained by alkaline hydrolysis of fats and oils (saponification).
- They remove dirt and oil from clothes by Micelle formation.
- They form scum with hard water.

Detergents
- These are ammonium or sulphonate salt of long chain carboxylic acid.
- They do not form scum with hard water, so can be used with it.
- These are also called soapless soap.

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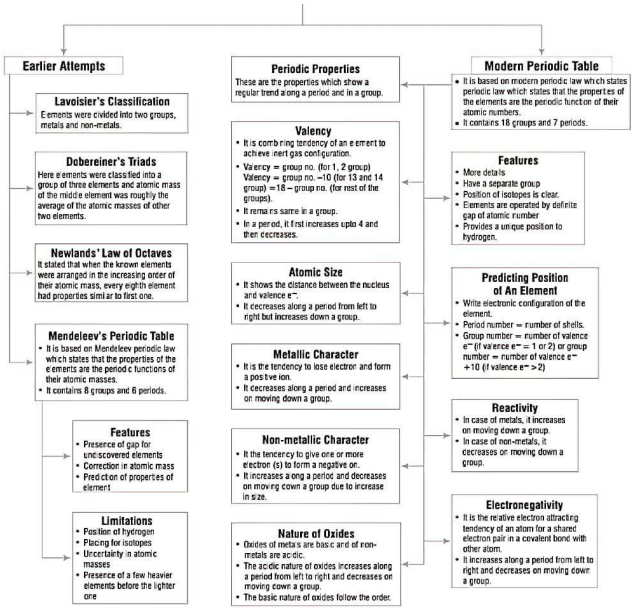
Periodic Classification of Elements



MIND MAP

Nutrition

It is a process to transfer source of energy (food) from outside to the body of living organism to obtain energy for maintaining living structures and performing basic functions of life.

Autotrophic Nutrition

It is performed by green plants and some bacteria, which manufacture their own food from inorganic sources such as carbon dioxide and water.

Photosynthesis

It is a process by which green plants synthesise organic food in form of carbohydrates in the presence of sunlight and chlorophyll by taking CO_2 and H_2O.

Site of Photosynthesis

Chloroplasts are the main sites of photosynthesis that occur in the leaf. They have a green pigment called chlorophyll that traps solar energy as photons and is essential pigment for photosynthesis.

Raw Materials for Photosynthesis

- **CO_2** It forms carbohydrates.
- **Water** It forms oxygen.

Conditions Necessary for Photosynthesis

- **Chlorophyll** It traps solar energy.
- **Sunlight** It is responsible for photolysis of water.

Events of Photosynthesis

- Absorption of light energy by chlorophyll.
- Conversion of light energy into chemical energy and splitting of water molecules into hydrogen and oxygen.
- Reduction of carbon dioxide to carbohydrates.

Mechanism of Digestion

This process involves five steps:

- **Ingestion** Taking in food into mouth.
- **Digestion** Conversion of complex food into simpler components by the action of various enzymes.
- **Absorption** Digested food is absorbed into blood.
- **Assimilation** Distribution of digested food products to cells of body and its utilisation for energy etc.
- **Egestion** Elimination of undigested food from anus to outside body.

Heterotrophic Nutrition

In heterotrophic nutrition, an organism cannot make its own food and obtain energy from organic molecules already produced by autotrophs.

Holozoic

Complex molecules are taken in and then broken down into simpler form, e.g. *Amoeba*, cow, goat, dog and humans.

Saprotrophic

They feed on dead organic matter and breakdown complex molecules outside the body, e.g. yeast and bacteria.

Parasitic

These organisms live on or inside host to obtain nutrition, e.g. ticks, lice, leech and flatworm.

Nutrition in *Amoeba*

Amoeba is an unicellular omnivore that does not have special organs for nutrition. It ingests food with pseudopodia.

Nutrition in Human Beings

The complex substances taken from outside are broken down in body by different parts of alimentary canal.

Human Digestive System

Digestion is a catabolic process. Human digestive system consists of a long tubular structure (7-8 metre) known as alimentary canal where the entire process of digestion is accomplished and its associated glands.

Alimentary Canal

It consists of following organs:

- **Mouth** It act as first part of digestive system. Tongue bears taste buds which help in tasting of food. Teeth helps in chewing of food. It leads to buccal cavity that opens into **pharynx**. The latter continues as **oesophagus**.
- **Stomach** Oesophagus connects pharynx to stomach, that stores and digest food.
- **Intestine** It is main organ of digestion and absorption.
- **Anus** End point of alimentary canal from where waste is removed out from the body.

Digestive Glands

- **Salivary glands** secrete saliva that contains enzyme salivary amylase. Help in digestion of starch.
- **Gastric glands** They are present in stomach and secrete digestive juice containing pepsin, HCl and mucus.
- **Liver** It secretes bile juice for emulsification of fats.
- **Pancreas** it secretes pancreatic juice that contains trypsin, amylase and lipase enzyme.
- **Intestinal glands** They secrete intestinal juice.

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Respiration

It is a process by which food is oxidised to release energy. For this O_2 is required from outside of the body. It is a catabolic process of biochemical oxidation of nutrients such as glucose.

Aerobic Respiration

It occurs in the presence of oxygen and releases large amount of energy. The energy released by respiration is in the form of ATP. ATP stands for Adenosine Triphosphate also known as energy currency of cell.

Anaerobic Respiration

It occurs in the absence of oxygen and releases small amount of energy.

Alcoholic Fermentation
It is incomplete breakdown of sugar into ethanol and carbon dioxide. It takes place in yeast and bacteria.

Lactic Acid Fermentation
It is incomplete breakdown of sugar into lactic acid. It takes place in some bacteria or in human muscles.

Respiration in Plants

Plants get energy through the process of respiration that is utilised in growth and life functions. Plant exchange gases through the following:

In Roots Gaseous exchange takes place by diffusion from air.

In Stems Gaseous exchange takes place by lenticels in woody plants and stomata in herbaceous plants.

In Leaves Gaseous exchange occurs through stomata.

Respiration in Animals

Animals respire through skin or constitute specific organs which make respiratory system of an organism. These organs have a structure that increases the surface area and is in contact with oxygen rich atmosphere.

Aquatic Organisms
Rate of breathing is higher in aquatic organisms as level of dissolved oxygen in water is less than level of oxygen in air. Respire through gills.

Terrestrial Organisms
They use atmospheric oxygen for respiration.

Mechanism of Gaseous Exchange in Humans
Humans absorb oxygen from atmosphere through the process of inhalation. Exchange of oxygen and carbon dioxide occurs between blood vessels and alveoli. Carbon dioxide is exhaled from body through lungs to the atmosphere in a process called exhalation.

Respiration in Human Beings
Respiratory system in human beings provides oxygen to body and removes carbon dioxide from body. It constitutes of organs like nostrils, nasal passage, pharynx, trachea, larynx, bronchi, bronchioles, lungs, alveoli, ribs and diaphragm.

Respiratory Pigment
Haemoglobin is the respiratory pigment that carries oxygen in blood to cells of body.

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Transportation

It is a life process of carrying absorbed or made substances from one part of the body to its other parts.

Transportation in Human Beings

The transport system of human beings consists of fluid called **blood** that is pumped by **heart** through **blood vessels**. Blood transports nutrients, salts, oxygen, hormones and other substances around the body.

Blood

It is a red coloured liquid, its colour is due to the presence of red pigment called haemoglobin. It supplies O_2 and nutrients to living cells. It consist of plasma (55%) and blood corpuscles (45%). Blood corpuscles are RBCs, WBCs and platelets.

Functions of Blood

Transport of nutrients, excretory products, hormones, oxygen, carbon dioxide, regulation of pH, body temperature and protection from diseases etc.

Heart

It pumps blood. It is a muscular organ having 4 chambers-2 auricles and 2 ventricles. Left auricle and ventricle have pure blood and right auricle and ventricle contains impure blood.

Blood Vessels

Arteries are tubes which take pure blood from heart to body tissues and **veins** are the tubes that transport impure blood from body tissues to heart.
Capillaries are thin narrow tubes, which connect arteries to veins and allow exchange of materials between blood and body cells.

Flow of Blood in Humans

Humans show double circulation. It has two components, pulmonary and systemic circulation.

- The movement of blood from heart to the lungs and back to heart constitutes **pulmonary circulation.**
- The circulation of blood from heart to different parts of the body except lungs and back to heart constitutes **systemic circulation.**

Blood Pressure

The pressure at which blood is pumped around the body by heart is called blood pressure. Normal BP is 120(systolic) /80 (diastolic).

Transportation in Plants

Plants need a proper transport system to carry water and minerals from root to leaves and stored food from leaves to other parts. There are two transportation pathway, consisting of two conducting tissues.

Xylem

It transports water and minerals obtained from the soil.

Transport of Water

It occurs due to transpiration pull and root pressure.

Phloem

It transports food (like sugar) from leaves to other parts of plant and this transport is termed as translocation.

Transport of Food

Products of photosynthesis are carried from the leaves to the storage organs of roots, fruits and seeds growing parts of plant by using energy from ATP.

Transpiration

It is loss of water in the form of vapour from aerial parts of plant. It is essential for temperature regulation removing excess of water, and for transport by xylem.

Lymph

It is liquid, similar to plasma but contains less proteins. It carries digested and absorbed fat from intestine and drains excess fluid back into blood.

MIND MAP

Excretion

It is a biological process by which an organism removes harmful metabolic wastes from the body

Excretion in Human Beings

Excretory system in humans removes the nitrogen containing wastes such as urea in the form of urine through the kidney.

Excretion in Plants

Plants excrete various waste products during their life processes.

Excretory System

Ureter

They are paired, thin muscular tubes coming from each kidney and open into urinary bladder. They help in passage of urine.

Urinary Bladder

Urine is stored here temporarily.

Urethra

It is a duct which transmits urine from the urinary bladder to the exterior of the body.

Kidney

It is the main organ of excretory system. It is reddish brown and bean-shaped organ.

Functions of Kidney

- Removal of excess water and waste .
- Regulation of blood plasma concentration.
- Regulation of blood pH.

Nephron

Each kidney is made up of thousands of tiny tubules called nephron. It is the structural and functional unit of kidney.

Formation of Urine

- Ultrafiltration of blood occurs in glomerulus of Bowman's capsule.
- Selective reabsorption of useful substances occurs in tubule, forming urine.

Removal of Urine

Urine is stored in urinary bladder and pass out through urethra, under nervous control.

Gaseous Waste Products

Carbon dioxide and oxygen are excreted out through stomata and lenticels.

Liquid Waste Products

Plants get rid of excess water by transpiration through stomata.

Solid Waste Products

Some plants store waste substances in cell vacuoles and tissues with dead cells, get rid of them by dropping their leaves.

Useful Plant Wastes

Some plants wastes are useful for human beings.

Examples:

- Essential oils.
- Gums to make adhesives and resins to make glazing agents.
- Natural rubber for tyre industry and tannin for treatment of leather.

Artificial Kidney

It is a device that removes nitrogenous wastes products from blood through dialysis, in case of kidney failure.

MIND MAP

Control and Coordination

The working together of various organs of a living organism in a systematic, controlled and efficient way to produce proper response to various stimuli is known as coordination.

Coordination in Humans

Humans have nervous system and hormones to control and coordinate response to the change in environment.

Nervous System

It is a system of neurons, nerves and nervous organs which links, coordinates and controls the activities of different organs in the body.

Functions of Nervous system

- Regulates voluntary and involuntary movements.
- Collects information from outside world.
- Helps in thinking and reasoning.
- Controls reflex action of human body.

Neurons

They are structural and functional units of nervous system which detect information from environment. They are known as longest cell of body with length of 90-100 cm each. They consist of cell body, dendrites, axon and nerve endings. Neurons are of three types

- Sensory
- Motor
- Relay

Synapse

Small gap between neurons where nerve impulse passes from one neuron to another.

Reflex Action

It is a rapid, automatic response to the stimulus that is controlled through the spinal cord.

Brain

It is the main coordinating centre of the body which enables an organism to think and take decisions. It is divided into three parts, i.e. forebrain, midbrain and hindbrain. Brain and spinal cord constitute the central nervous system.

Peripheral Nervous System

Consists of all the nerves that connects different parts of body, i.e. cranial, spinal and visceral.

Coordination in Plants

Plants use electrical-chemical means to convey the information from one cell to the other. Plants cells can change their shape by changing the amount of water in them. The ability of plant to detect change and respond to it is called sensitivity of plant.

Plant Movements

Plants show two types of movements.

Tropic Movements

Movement of plant occurs in direction of stimulus, e.g. phototropism, geotropism hydrotropism and chemotropism.

Nastic Movements

Movement occurs irrespective to direction of stimuli, e.g. photonasty, thigmonasty thermonasty and seismonasty.

Animal Hormones

They transfer information in organism. They are secreted by endocrine glands and are also known as chemical messengers.

Plant Hormones

They are chemical substances produced naturally in plant and help to regulate growth, development and responses.
Auxin helps to grow longer.
Gibbrellins help in growth of the stem.
Cytokinins promote cell division.
Abscisic acid inhibits growth.

Endocrine glands

They include pituitary, thyroid, pancreas, adrenal glands and gonads; and secrete hormones.

Hormonal Disorders

- **Dwarfism** Hyposecretion of growth hormone.
- **Gigantism** Hypersecretion of growth hormone.
- **Diabetes** When amount of insulin secreted by the body is in less concentration.
- **Goitre** Iodine deficiency that causes less secretion of thyroxine.

Feedback Mechanism

The amount and timing of hormones released are controlled by feedback mechanism.

MIND MAP

How Do Organisms Reproduce?

Asexual Reproduction

It is the production of offspring by a single parent without the formation and fusion of gamete.
e.g. binary fission in *Amoeba*, budding in *Hydra*, spore formation in *Rhizopus*, fungus and vegetative propagation in flowering plant like rose, etc.

Fission

The splitting of a unicellular organism into two or more than two separate daughter cells.
Binary Fission Parent organism divides into two identical daughter organisms with definite orientation, e.g. *Amoeba*, *Euglena*.
Multiple Fission Parent organism divides into many identical daughter organisms e.g. *Plasmodium*.

Fragmentation

It is a form of asexual reproduction in which multicellular organisms break up into two or more small fragments or pieces, e.g. *Spirogyra*.

Regeneration

A fully differentiated organism can give rise to new individual organism from its body part, e.g. *Hydra*.

Budding

A daughter organism is formed from a small projection known as bud, which develops as an outgrowth due to repeated cell division on the parent body, e.g. yeast, *Hydra*.

Spore Formation

Living cells of spore have the ability to germinate and give rise to a new colony, e.g. *Rhizopus*.

Vegetative Propagation

New plants are obtained from a part of the parent plant without the involvement of reproductive organs.
Natural Under favourable condition, various structures take part in this type of reproduction known as natural vegetative propagation, e.g. rootbubers.
Artificial The methods such as cutting, layering and grafting are known as methods of artificial vegetative propagation in order to grow many plants like sugarcane, roses, grapes, etc.

Significance

- It is a rapid mode of multiplication.
- Cell division takes place either mitotically or amitotically.
- The new individuals produced after cell divisions are always genetically identical to their parents, e.g. clone.
- A single parent is involved, e.g. opposite sexes are not involved.
- It does not involve the fusion of gametes.

Pollination

The transfer of pollen grains from the anther of the stamen to the stigma of a flower is termed as pollination.
Self pollination In which, the pollen from the stamen of a flower is transferred to the stigma of a same flower.
Cross pollination In which, the pollen from the stamen of a flower is transferred to the stigma of a different flower.

Fertilisation

Fusion of male gamete with female gamete to form zygote.

Reproductive Health

Birth Control

Birth control barrier, hormonal, chemical and surgical method.
Barrier Condom, Diaphragm, IntraUterineContraceptive Device (IUCD)
Hormonal Oral contraceptive pills
Chemical Spermicide
Surgical Vasectomy, tubectomy.

STDs

STDs e.g. AIDS, syphilis transmitted by sexual contact with infected person.
Gonorrhoea *Neisseria gonorrhoea*
Syphilis *Treponema pallidum*
AIDS (*Acquired Immune Deficiency Syndrome*)
HIV (*Human Immunodeficiency Virus*)
Genital warts HPV (*Human Papilloma Virus*)

Tissue Culture

(*In vitro* micropropagation) Maintain tissues or organs under sterile *in vitro* to grow disease free plants, e.g. ornamental plant like orchids.

Variations

Variations are the differences found in the morphological and physiological features of an organism.
e.g. in a colony, some members get resistant against antibiotics as a result of variations.

Sexual Reproduction

It is the process of development of new individual through formation and fusion of gametes,
e.g. human, dogs, cats, frogs, etc.

In Flowering Plants

Flowering plants are generally *Angiosperms*. They carry the reproductive parts within the flower and seeds enclosed in a fruit, e.g. formation of gametes (gametogenesis).

Significance

- It is not a rapid mode of multiplication.
- Cell division involves meiosis at some stages.
- The new individuals produced after cell division exhibit variation, e.g. offspring are different from parents in eye colours, hair etc.
- It requires the involvement of two parents (a male and a female).
- It involves the formation and fusion of gametes.

In Human Beings

Puberty

Puberty is the time period when your body begins to develop and changes as you move from kid to an adult.

Male Reproductive System

Testes Paired structure lying in scrotum.
Accessory Glands Include paired seminal vesicles, prostate and urethral glands.

Female Reproductive System

Consists of a pair of ovaries along with a pair of oviduct, uterus, cervix, vagina and external genitalia.

Menstruation

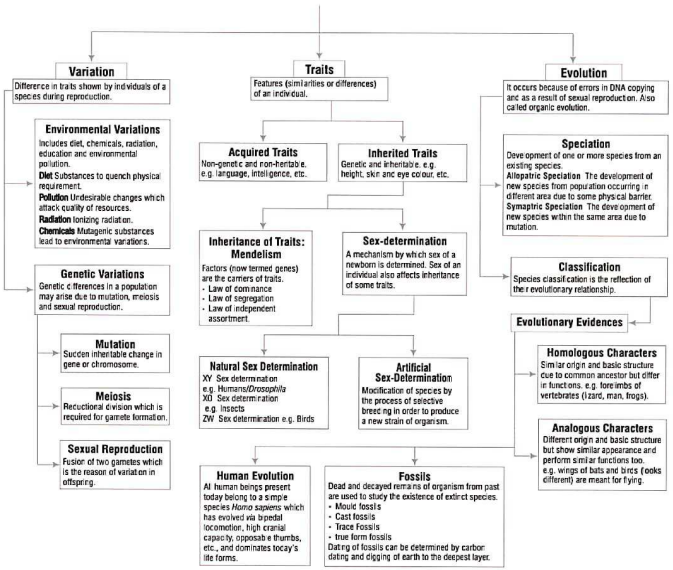
Menstrual cycle begins with puberty at the age of 11-13 years. The first menstruation is called *menarche*. The stoppage of menstruation permanently is called *menopause*. It occurs between 45-50 year.

Fertilisation

Process of fusion of sperm and egg to produce zygote.
Implantation (embedding of embryo in thick lining of uterus).
Gestation (period from development till child birth).
Parturition (strong rhythmic muscular contraction in the uterus).

MIND MAP

Heredity and Evolution



MIND MAP

Light

REFLECTION

When a light ray falls on smooth surface it bounces back in same medium, it is called reflection of light.

Laws of Reflection

- Incident ray, reflected ray and normal all lie in same plane at same point.
- Angle of incidence ($\angle i$) = angle of reflection ($\angle r$).

Mirror

It is a smooth reflecting surface whose one side is polished.

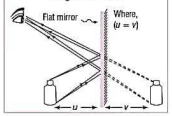
Plane Mirror

Whose reflecting surface is plane.
Focal length = infinity (∞)

Nature of Image

- Always forms virtual image
- Object distance (u) is always equal to the image distance (v).
- Always erect image is formed behind the mirror.
- Magnification (m) of the plane mirror is +1, which means the size of object is equal to size of image.

Image Formation



Convex Mirror

Whose reflecting surface is curved outward. Also called diverging mirror
Focal length = positive
Magnification (m) = positive

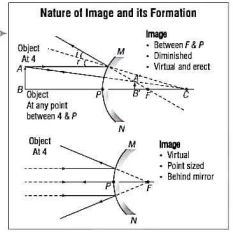
Spherical Mirror

Whose reflecting surface is curved.

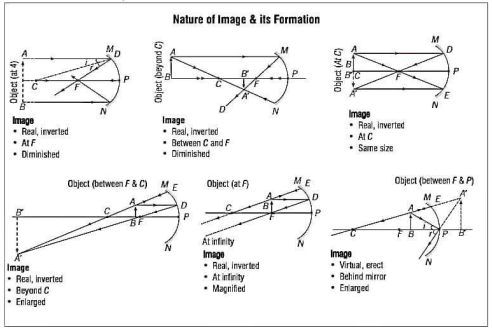
Concave Mirror

Whose reflecting surface is curved inward.
Also called converging mirror
Focal length = negative
Magnification (m) = – ve or + ve

Nature of Image and its Formation



Nature of Image & its Formation



REFRACTION

When light rays travel from one medium to other, either they bend towards the normal or away from the normal, it is called refraction of light.

Laws of Refraction

- Incident ray, refracted ray and normal all lie in the same plane, at a same point.
- Ratio of sine of angle i and sine of angle r is a constant called refractive index.
  i.e., $\frac{\sin i}{\sin r}$ = constant = μ
- It is also called Snell's law .

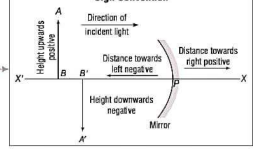
Lens

A piece of glass or other transparent material with curved sides for concentrating or dispersing light rays, used single (in magnifying glass) or with other lens (in a telescope) is called lens.

Concave Lens

- It is also called diverging lens.
- Focal length = – ve
- Magnification (m) = + ve

Sign Convention



Convex Lens

- It is also called converging lens.
- Focal length = + ve
- Magnification (m) = – ve or + ve

Image Formation & its Nature

Object (at infinity)

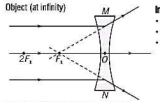


Image
- At focus
- Virtual, erect
- Point sized

Object (any point between ∞ and O)

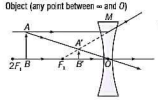


Image
- Between F_1 and O
- Virtual, erect
- Diminished

Image Formation & its Nature

Object (∞)

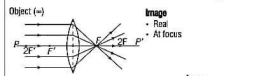


Image
- Real
- At focus

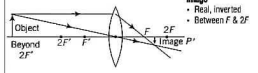


Image
- Real, inverted
- Between F & 2F

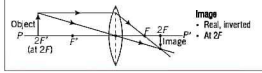


Image
- Real, inverted
- At 2F

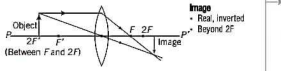


Image
- Real, inverted
- Beyond 2F

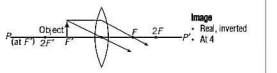


Image
- Real, inverted
- At 4

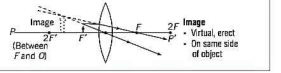


Image
- Virtual, erect
- On same side of object

Power of Lens (P)

If is defined as the reciprocal of focal length in metre.

i.e. Power (P) = $\frac{1}{f}$ (meter)

SI unit of Power = dioptre (D)

For convex lens, P = + ve	For concave lens, P = – ve

MIND MAP

Human Eye and The Colourful World

HUMAN EYE

Structure and Function

Cornea
It is a transparent membrane covering in front of eye.
Function Maximum refraction of light takes place.

Lens
It is a transparent living material.
Function Focus image on retina.

Iris
It is a muscular diaphragm.
Function Controls size of pupil.

Pupil
It is a small hole between iris.
Function Regulates entry of light.

Ciliary Muscle
It is a muscle which hold the eye lens.
Function Helps in accommodation.

Retina
It has rod and cone cells.
Function Image formation takes place.

Optic Nerve
It is made up of nerve optical fibre.
Function Transmits visual information to brain.

Aqueous Humour
The liquid between cornea and eye lens.
Function Helps to refract light to be focused on retina, maintains intraocular pressure.

Defects of Vision

Myopia
(Short sightedness) In this, a person is not able to see distant objects, but can see nearby objects.
Image formed before retina and corrected by concave lens.

Hypermetropia
(Long sightedness) In this, a person is not able to see nearby objects.
Image is formed behind retina and corrected by convex lens.

Presbyopia
It is due to old age mostly farsightedness.
Corrected by bifocal lens

Astigmatism
In this defect, a person can't identify vertical and horizontal lines.
Corrected by cylindrical lens.

Colour Blindness
It is a genetic defect.
Persons cannot identify colours.
It can't be corrected.

Vitreous Humour
The liquid between eye lens and retina.
Function Provides the eye its form and shape.

REFRACTION

Prism

Angle of Deviation
It is the angle between incident and emergent ray.
It depends on angle of prism, angle of incidence and angle of emergence.

Dispersion
It is a phenomenon of splitting of light into its constituent colours.
Cause of dispersion is due to different velocities of light in same medium.
Red light deviates least.
Violet light deviates maximum.

Rainbow
It is natural dispersion of light formed by the rain drop, when sunlight falls on it.
Rainbow is formed due to refraction, dispersion and total internal reflection of light.

Applications
Sky appears blue due to large scattering of blue colour in comparison with others.
Tyndal effect - The effect by which if light ray is passed through colloidal solution, formation of tyndal cone takes place.

Atmosphere

Atmospheric Refraction
Refraction of light due to multiple layers of atmosphere is called atmospheric refraction.

Applications

- Stars seem higher than they actually are due to atmospheric refraction.
- Twinkling of stars is due to atmospheric refraction.
- We see the sun for few minutes even after it has actually set.
- The sun appears oval (or flattened) at sunset and sunrise but appears circular at noon.

SCATTERING OF LIGHT

Reflection of light from an object in all directions is called scattering of light.

Conditions for Scattering

- Small particle scatters shorter wavelength.
- Large particle scatters longer wavelength.

MIND MAP

Electricity

Important Source of Energy

Electric Circuit

- A closed and continuous path through which electric current flows.
- Components of electric circuit are cell/battery, bulb, switch/key, fuse, connecting wire, ammeter, voltmeter, rheostat, galvanometer etc.

Electric Charge

It is a physical quantity of matter which causes it to experience a force when placed near other electrically charged matter.

- A body is negatively charged if it gains electrons.
- A body is positively charged if it loses electrons.
- Its SI unit is coulomb.
- It is a scalar quantity.
- Charges are conserved and quantised.

Electric Current

- Rate of flow of electric charges through a conductor.
- $I = \frac{Q}{t}$ or 1 A = 1 C/s.
- Its SI unit is ampere.
- It is a scalar quantity.
- Measured by ammeter

$1\ mA = 10^{-3}\ A$, $1\ \mu A = 10^{-6}\ A$

Potential Difference

It is work done per unit charge in moving a unit positive charge between two points.

- $V = \frac{V_A - V_B}{Q} = \frac{W}{Q}$ or 1V = 1 J/C
- Its SI unit is volt.
- It is a scalar quantity.
- Measured by voltmeter
- $1mV = 10^{-3}$ V, $1\ \mu V = 10^{-6}$ V
- $1kV = 10^{3}$ V, $1\ MV = 10^{6}$ V

Ohm's Law

The current passing through a conductor is directly proportional to the potential difference across its ends, such that the physical conditions like temperature, density etc., remain unchanged.

$V \propto I$

or $V = RI$

Electric Power

- Rate at which electric energy is dissipated or consumed in an electric circuit.
- $P = VI = I^2R = V^2/R$
- Its SI unit is watt.
- $1W = 1\ J/s$, $1kW = 10^3\ W$
- Commercial unit of electric energy is kWh.
- $1\ kWh = 3.6 \times 10^6\ J$

Joule's Law of Heating

The heat produced in a conductor is directly proportional to the (i) Square of the current (I), (ii) Resistance (R) of the conductor and (iii) the time (t) for which the current is passed.

$H \propto I^2 \propto R \propto t$

$H = I^2RT$

- Its SI unit is Joule.

Resistance

Property of a conductor due to which it opposes the flow of current through it.

- $R = \frac{V}{I}$ or $1\Omega = 1\ V/A$
- Its SI unit is ohm.
- It is a scalar quantity.
- $1\ k\Omega = 10^3\ \Omega$, $1\ m\Omega = 10^{-3}\ \Omega$

Factors Affecting Resistance

- Length of the conductor
- Area of cross-section
- Nature of material
- Effect of temperature
- $R = \frac{\rho l}{A}$ (where, ρ is resistivity of conductor)

Resistance in Series

- Maximum effective resistance.
- Two or more resistors are connected end to end.
- Current remains constant but voltage varies.

$V = V_1 + V_2 + V_3$

$R = R_1 + R_2 + R_3$

Resistance in Parallel

- Minimum effective resistance.
- Two or more resistors are connected simultaneously between two points.
- Voltage remains constant but current varies.

$I = I_1 + I_2 + I_3$

$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

Practical Applications

- Electric bulb (to produce light)
- Electric fuse that protects circuits and appliances.
- Electrical heating appliances.

Resistivity

It refers to resistance of a conductor of unit length and cross-sectional area.

- It depends on the nature of the substance and temperature.
- Its SI unit is Ohm-metre (Ω-m).

MIND MAP

Magnetic Effects of Electric Current

An electric current flowing in a wire produces magnetic field around it.

Magnetic Field

- It is a space surrouncing a magnet in which a magnetic force is exertec.
- It has magnitude as well as direction.
- Magnetic force may be attractive or repulsive in nature.
- Its SI unit is tesla or weber/m^2.
- 1 T = 1 N/A-m = 10^4 gauss

Magnetic Field Lines

A pattern of continuous curves in a magnetic field such that the tangent at any point gives the direction of magnetic field at that point.

Field lines come out of North poles and goes into South pole. No two field lines intersect each other.

Circular Loop

Magnetic field lines are represented by concentric circles that appear as straight lines near the centre of loop. Magnetic field produced at the centre of loop.

- Directly on the current, directly on the number of turns and inversely on the radius of coil.

Solenoid

Magnetic field produced is similar to the magnetic field produced by a bar magnet.

- Depends on the number of turns per unit length and current passing through it.

Pattern due to Straight Conductor

Magnetic field lines are represented by concentric circles and become larger as the distance increases.

- Depends directly on the length of wire, directly on the current passing through the wire and inversely on the distance from the wire.

Force on a Current-Carrying Conductor

- A magnet exerts a mechanical force on a current-carrying concuctor.
- Force acting on the conductor is perpendicular to the direction of magnetic field.

Fleming's Left Hand Rule

If the forefinger, thumb and middle finger of left-hand are stretched mutually perpendicular, then forefinger points along the direction of magnetic field.

Electric Motor

- It is a device which converts electrical energy into mechanical energy.
- Usec in electric fans, machines etc.

Domestic Electric Circuit

- It uses parallel connections at various electrical point at 220 V, 50 Hz power.
- Short-circuit occurs when two wires touch each other cue to fault in the appliance.
- Overloacing occurs due to accidental rise in supply voltage and connecting many cevices to one socket.
- Fuse is a safety cevice having short length of thin wire made of tin (25%) and leac (75%) alloy having low melting point arounc 200°C.

Electromagnet

Soft iron is used for making electromagnet or temporary magnet. It works on the magnetic effect of current. It is used in electric bell, telephone etc.

Right Hand Thumb Rule

This rule is usec to find the direction of magnetic field due to a straight current-carrying wire.

It states that if we consicer ourselves winding a cork screw in the direction of current, then the direction of rotation of the cork screw is the direction of the magnetic lines.

Electromagnetic Induction

It is a phenomenon of induction of emf in a coil when there is a change in magnetic flux linked with coil.

Fleming's Right-Hand Rule

If the thumb, forefinger and the middle finger of your right-hand are at right angle to one another in such a way that the forefinger points in the direction of magnetic field and the middle finger points the direction of induced current then the thumb gives the direction of motion of conductor.

Electric Generator

Converts mechanical energy into electrical energy.

Magnetic Flux

Product of magnetic field and the area through which magnetic field passes.

DC and AC Current

- If current flows in one direction then it is called Direct Current (DC).
- If the current reverses direction after equal intervals of time then it is called Alternating Current (AC).
- AC produced in Incia reverses its direction every 1/100 second.
- AC can be transmitted over long distances without much loss of electrical energy.

MIND MAP

Sources of Energy

Provide adequate amount of energy in a convenient form over a long period of time.

Non-renewable Sources of Energy

Energy sources that once depleted cannot be regenerated. e.g. fossil fuels.

Conventional Sources
Sources of energy which are exhaustible and formed in nature after long period.

Fossil Fuels
Natural fuels such as coal, petroleum and natural gas formed from remains of prehistoric plants and animals.

Thermal Power Plants
Fuel is burnt to produce heat energy required to make steam which runs the turbine to generate electricity.

Hydro Power Plant
Power plant which converts the potential energy of flowing water into electricity.

Improvement in Technology
Using conventional sources of energy.

Animal Product
Cow-dung is decomposed in absence of oxygen to produce bio-gas. Bio-gas burns without smoke, leaves no residue and slurry is used as manure.

Wind Energy
Energy possessed by the wind due to its high speed. It is an environment-friendly.

Windmill
Machine which works with the energy of blowing air or wind.

Wind Generator
Complete set up, i.e. wind turbine generating electricity by using wind energy.

Wind Energy Farm
- Used for commercial purpose.
- A number of windmills are erected over a large area.

Bio-mass
Waste material of living things (cattle-dung) and dead parts of plants and animals.

Plant Products
Burning wood in a limited supply of oxygen, charcoal is produced.

Environmental Consequences
- Burning of fossil fuels causes air pollution.
- Cutting down of trees from the forest leads to deforestation.
- Greenhouse effect is resulting in global warming.

Renewable Sources of Energy

Sources of energy which are being produced continuously in nature and are inexhaustible.
e.g. solar energy, nuclear energy, energy from sea etc.

Non-conventional Sources
Energy sources which do not deplete and are scarcely used by the population.

Solar Energy
The energy obtained from the Sun in the form of ultraviolet rays, infrared rays, visible light etc.
- Solar Cooker
- Solar Cells
- Solar Panels

Nuclear Energy
Energy released by bombarding the nucleus of a heavy atom with low energy neutrons.

Nuclear Fusion
The process in which two nuclei of light elements combine to form a heavy nucleus.

Nuclear Fission
The process in which the nearby nucleus of a radioactive atom splits into smaller nuclei when bombarded with low energy neutrons, e.g. uranium-235.

Geothermal Energy
Internal heat of earth harnessed to generate electricity.

Energy from Sea
Energy obtained from the sea.
Tidal Energy Energy obtained due to difference in sea levels due to high and low tides.
Wave Energy Energy trapped from strong waves.
Ocean Thermal Energy Energy obtained from the difference between temperatures of water at surface and depths.

MIND MAP

Our Environment

Ecosystem

It was introduced by Tansley in 1935. All the interacting organisms in an area together with the non-living components of the environment.

Types of Ecosystem

Natural
Naturally existing without human support.
- Terrestrial (desert, forest, etc).
- Aquatic (ponds, lakes, estuaries, etc).

Artificial
Created and maintained by humans.
The largest man-made ecosystem is agroecosystem.
e.g., aquariums, parks, botanical gardens, etc.

Components of Ecosystem

Biotic Components
Include all the living organisms present in the ecosystem.
Also include mainly three categories of organisms
- **Producers** (make their own food) *e.g.*, plants.
- **Consumers** (depend on producers for their nutritional requirements)*e.g.*, grazing animals, humans.
- **Decomposers** organisms of decay, feed on decaying and dead matter, *e.g.*, bacteria fungi.

Abiotic Components
Non-living features of ecosystem on which an organism depends. It includes physical factors as light, temperature, wind, etc.

Food Chain

Link of organisms through which energy is transferred in the form of food.
Unidirectional flow from one organism to another.

Energy Flow

Food chain shows how food and energy passes from one organism to another in a habitat.

Trophic Level

The transfer of food or energy in the various steps in the food chain forms trophic level.
- Only 10% energy is available to the next trophic level in chain.
- Producers occupy first trophic level.
- Primary Consumers occupy second trophic level.
- Secondary consumers occupy third trophic level.

Food Web

Network of various food chains being inter connected at various trophic levels.

Human Impact on Environment

Waste Substances

The left over or discarded substance. It can be in the solid, liquid or gaseous forms.

Biodegradable Substances
- These can be broken down into simple harmless forms naturally by action of microorganisms.
- Polute environment when present in huge quantities.
e.g., Livestock waste, left over food articles, etc.

Non-biodegradable Substances
- These cannot be broken down into simpler harmless forms by microorganisms.
- Polute the environment majorly. *e.g.*, plastic, heavy metals etc.

Biological Magnification

Phenomenon of progressive increase in the concentration of toxicant at each successive trophic level.
e.g., Pesticides like DDT, sprinkled on plants enters the body of human beings through the food chain.

Ozone Depletion

Formation of ozone
Ozone (O_3) is a molecule formed by three atoms of oxygen.

$$O_2 \xrightarrow{UV} O + O$$

$$O + O_2 \longrightarrow O_3 \text{ (Ozone)}$$

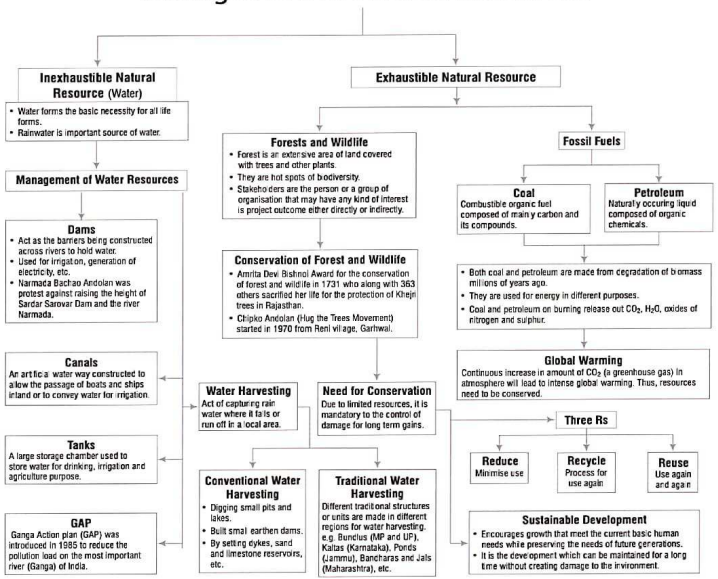
It shields the surface of the earth from UV rays of the Sun.
Use of CFCs have led to the deletion of ozone layer.

Garbage Management

- The household waste is called garbage.
- The waste should be disposed off in a scientific way by segregating waste into biodegradable, non-biodegradable materials, etc.
- Methods include
  Recycling
  Composting
  Incineration
  Landfills
  Sewage treatment
  Biogas production.

MIND MAP

Management of Natural Resources



From:- Rajesh.N.Nagure