REVISION CHEAT SHEETS

1. CHEMICAL REACTIONS AND EQUATIONS

Chemical Reaction : The process in which a substance undergoes change to produce new substances with new properties are known as chemical reaction.

Chemical Equation : The qualitative representation of a chemical reaction in term of symbols and formulae, is called a chemical equation.

Balanced Chemical Equation : A chemical equation in which number of atoms of each elements on L.H.S. (i.e. reactants) and R.H.S. (i.e.products) is equal is called a balanced chemical equation.

Types of Chemical Reactions :

(i) **Combination reactions :** In which one element reacts with another to form a compound.

(ii) **Decomposition reactions :** In which a compound breaks down into simpler compounds (or substances).

(iii) **Displacement Reactions :** In which an atom, or group of atoms, present in a molecule is displaced by another atom.

(iv) **Double Displacement Reactions or Double Decomposition:** In which mutual exchange of radicals takes place are known as double decomposition reactions.

Double-displacement reactions can be classified as **precipitation, gas formation, and acid-base neutralization reactions.**

Precipitation Reactions : When two solutions are mixed together and a solid separates from the solution.

The solid part that separates from the solutions is called the precipitate.

(v) **Oxidation-Reduction Reactions :**

- **Oxidation reactions :** Oxidation involve addition of oxygen or removal of hydrogen.
- **Reduction Reactions :** Reduction involve the removal of oxygen or addition of hydrogen.

(vi) **Redox Reactions :** In which oxidation and reduction takes place simultaneously, are known as redox reactions.

(vii) **Exothermic and Endothermic Reactions :** When a chemical reaction liberates heat, than it is 'exothermic reaction' and when it absorbs the heat, than it is endothermic reaction.

Corrosion : Corrosion is the degradation of metals and generally called rust.

Randicity : An unpleasant change in the flavour and odour of a food, called rancidity.

2. ACIDS, BASES AND SALTS

Acids are sour in taste. eg. Vineger, bases are bitter in taste. e.g. milk of magnesia.

Chemical Properties of Acids :

(i) **Action on metals :** Metals react with dilute acids to form salt and hydrogen.

(ii) **Action with metal oxides (Basic oxides) :** Metal oxides are basic oxides and get neutralised when react with acids.

(iii) **Action with carbonates /bicarbonates of metals :** Acids react with carbonates and hydrogen carbonates to form salts, water and carbon dioxide gas.

Chemical Properties of Bases :

(i) **Action on metals :** Metals dissolve in base to liberate hydrogen gas.

(ii) **Action with acids :** Bases combine with acids to form salt and water only. It is a neutralisation reaction.

pH Scale : pH stands for "potential" of "hydrogen". It is the amount of hydrogen ions in a particular solution.

For acids pH < 7, For bases pH > 7, For neutral substances pH = 7

Salts : A **salt** is an ionic compound which dissociates to yield a positive ion and negative ion e.g. NaCl. Salts are formed by the reaction of acid and base which is also known as neutralisation reaction.

(i) **Sodium hydroxide (NaOH) or Caustic soda :** It is prepared by **chlor-alkali process.**

$$2NaCl\,(aq) + 2\,H_2O(l) \longrightarrow H_2(g) + Cl_2(g) + 2NaOH\,(aq)$$

(Brine)

Uses : Sodium hydroxide is widely used base in the laboratory and in manufacture of pulp and paper, textiles, drinking water, soap and detergents etc.

(ii) **Baking soda, Sodium hydrogen carbonate, ($NaHCO_3$):** It is prepared as –

$$NaCl + H_2O + CO_2 + NH_3 \longrightarrow NH_4Cl + NaHCO_3$$

Uses : Baking soda is used as a leavening agent in baking and in *soda-acid fire exinguisher.*

(iii) **Washing soda, $Na_2CO_3 . 10H_2O$, Sodium carbonate:** It is prepared as

$$Na_2CO_3 + 10H_2O \longrightarrow Na_2CO_3 . 10H_2O$$

Sodium carbonate — Hydrated sodium carbonate (Washing soda),

Uses : Sodium carbonate is used in glass, soap and paper industries and for removing permanent hardness of water.

(iv) Bleaching powder ($CaOCl_2$) :

$$2Ca(OH)_2 + 2Cl_2 \longrightarrow CaOCl_2 + CaCl_2 + 2H_2O$$

Uses : Calcium hypochlorite is used for the disinfection of drinking water or swimming pool water.

(v) Plaster of Paris, $CaSO_4$ .1/2 H_2O

$$(CaSO_4 . 2H_2O) + \text{heat} \longrightarrow (CaSO_4 . \frac{1}{2} H_2O + \frac{1}{2} H_2O$$

Uses : It is used for making moulds or casts for toys, pottery, cermics etc and in surgical bandages for setting fractured bones.

3. METALS AND NON-METALS

Metals : The elements possessing characteristic properties such as *lustre, malleability, ductility, thermal and electrical conductivity, high tensile strength* are called **metals** e.g., sodium, aluminium, iron, etc.

Non-metals : Non-metals are *brittle, non-lustrous* and are *bad conductors of heat and electricity* e.g., sulphur, oxygen etc.

Chemical properties of metals :

- **Reaction of metals with acids:**

$$Zn(s) + \text{dil} \cdot H_2SO_4(aq) \longrightarrow ZnSO_4(aq) + H_2(g)\uparrow$$

- **Reaction of metal, with solutions of other metal salts:**

$$Zn + CuSO_4\,(aq) \longrightarrow ZnSO_4\,(aq) + Cu(s)$$

- **Reaction with oxygen :** Metals burn in the oxygen of the air to produce a metal oxide.

Nature of Metal Oxides :

- **Action of metal oxide with water :** Oxides of some metals (i.e. Na, K, Mg etc.,) dissolve in water to yield soluble hydroxides known as **alkalies**
- **Action of metal oxide with acids :** Metal oxides react with acids to form corresponding salts and water
- The oxides which exhibit the characteristics of both acids and bases are known as **amphoteric oxides**

Activity series : The relative electron releasing tendencies of some metals are summed up in the **Activity series** also called **Reactivity series.**

Formation and Properties of Ionic Compounds :

Ionic compounds: Compounds which contain ionic bonds are called **ionic compounds** : e.g. NaCl. An **ionic bond** is formed with *transfer of electrons from metal to non-metal.*

Occurrence of metals :

Major source of metals is earth's crust. Metals exist both in *free state* or *native state* and also in *combined state*

Minerals : Elements or compound occur naturally in earth's crust are called minerals.

Ores : Minerals from which the metal can be extracted profitably and conveniently are called ores.

Gangue or Matrix : The unwanted impurities of sand and rocky materials present in the ore is known as gangue or matrix.

Metallurgy : The extraction of metals from their ores, and then refining them for use.

Corrosion of Metals : Corrosion is an oxidation reaction with atmospheric oxygen in the presence of water on the surface of a metal.

Prevention of Corrosion :

- Alloying
- Galvanizing

4. CARBON AND ITS COMPOUNDS

Bonding in Carbon : Carbon form covalent bonds. Covalent bond formation involves sharing of electrons between bonding atoms

Covalency : Number of electrons contributed by an atom for sharing is known as its covalency.

Allotropy in Carbon : The property due to which an element exists in two or more forms, is known as **"Allotropy"** and the various forms are called **"Allotropes"**. Carbon exists in two allotropic form crystalline (diamond) and amorphous (Coal).

Unique Nature of Carbon

- **Catenation :** The property of elements to form long chains or rings by self linking of their own atoms through covalent bonds is called catenation.

Saturated and Unsaturated Carbon Compounds : In saturated compounds the valencies of carbon atoms are satisfied by single bonds between them. While in the unsaturated compounds, valencies of the carbon atoms are satisfy double or triple bond.

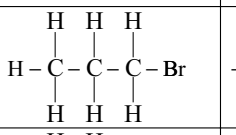
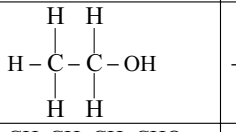
Straight chain compounds : The compounds which contain straight chain of carbon atoms e.g. (C_4H_{10})

Branched chain compounds : Compounds which are branched e.g. iso-butane (C_4H_{10})

Closed chain compounds or Ring compounds : Cyclic compounds are called closed chain or ring compounds cyclohexane (C_6H_{12})

Hydrocarbons : Compounds which contain just carbon and hydrogen are called hydrocarbons.

Functional Group : The atom or group of atoms which determine the properties of a compound is known as functional group. –OH (alcohol), –CHO (aldehyde), > C = C < (alkene), – C ≡ C – (alkyne) etc.

Functional group	Prefix / Suffix	Functional group	Example	IUPAC Name
1. Halogen	Chloro, bromo, Iodo	–Cl, – Br, – I		–Bromopropane
2.Alcohol	–ol	–OH		–ethanol
3. Aldehyde	–al	–CHO	$CH_3CH_2CH_2CHO$	–Butanal
4. Ketone	–one	–CO	CH_3COCH_3	–Propanone
5. Carboxylic acid	–oic acid	–COOH	CH_3CH_2COOH	–Propanoic acid
6. Amine	Amino	$-NH_2$	$CH_3CH_2NH_2$	–Amino ethane
7. Ester	oate –	–COOR	CH_3COOCH_3	–Methyl ethanoate
8. Double bond	ene		$CH_3 - CH = CH_2$	–Propene
9. Triple bond	yne		$CH_3 - CH_2 - C \equiv CH$	–Butyne

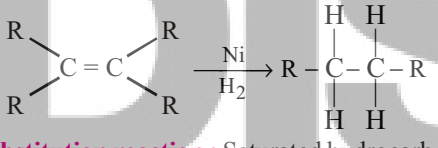
Chemical Properties of Carbon Compounds :

(i) Combustion : Carbon compound undergo combustion reaction to produce CO_2 H_2O with the evolution of heat and light.

(ii) Oxidation :

$$\underset{\text{ethanol}}{CH_3CH_2OH} \xrightarrow{\text{alk. } KMnO_4/\Delta} \underset{\text{ethanoic acid}}{CH_3COOH}$$

(iii) Addition reaction : Unsaturated hydrocarbons undergo addition reaction in presence of catalysts e.g.



(iv) Substitution reaction : Saturated hydrocarbons give substitution reaction methane in presence of sunlight.

Some Important Carbon Compounds

(i) Alcohols : Compounds containing –OH group attached to a carbon atom are known as alcohols. e.g. Ethanol (C_2H_5OH)

Properties of ethanol :

- **Reaction with sodium :**

$$2C_2H_5OH + 2Na \longrightarrow \underset{\text{Sodium ethoxide}}{2C_2H_5ONa} + H_2\uparrow$$

- **Reaction with conc. H_2SO_4 :**

$$CH_3CH_2OH \xrightarrow[443\,K]{\text{conc. } H_2SO_4} C_2H_4 + H_2O$$

- **Alcohol as a fuel :** Alcohol is added to petrol upto 20% and mixture is called **"gasol"**.

(ii) Ethanoic Acid (Acetic Acid) CH_3COOH:

Ethanoic acid, known as acetic acid

Properties of Ethanoic Acids:

(i) Reaction with a base :

$$2CH_3COOH + 2NaOH \longrightarrow 2CH_3COONa + H_2O$$

(ii) Reaction with carbonates and bicarbonates :

$$2CH_3COOH + Na_2CO_3 \longrightarrow 2CH_3COONa + CO_2 + H_2O$$

$$CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2$$

(iii) Reaction with alcohol : (Esterification)

$$CH_3COOH + C_2H_5OH \longrightarrow \underset{\text{Ethl ethanoate (ester)}}{CH_3COOC_2H_5} + H_2O$$

Esters react is the presence of an acid or a base to give back the alcohol and carboxylic acid-this reaction is known as **saponification**

Soaps and Detergents :

Soaps : Soaps are sodium or potassium salts of long chain acid carboxylic acids.

Detergent : They are ammonium or sulphurate salts of long chain carboxylic acids.

5. LIFE PROCESSES

Nutrition

(i) There are different types of nutrition :

- **Autotrophic Nutrition :** Autotrophs contain chlorophyll pigment, which is capable of trapping and fixing the solar energy. This energy is utilized for synthesising food from the raw materials like carbon dioxide, water and a few minerals, *e.g.,* **Green plants, Euglena.**
- **Heterotrophic Nutrition :** A heterotrophic organism is a consumer which derives its nutrition from other organisms, *e.g.,* all animals, most **bacteria and fungi**.
- **Parasitic Nutrition :** These animals live on or inside the body of the host and obtain their food, *e.g.,* **Tapeworm, Cuscuta (amarbel),** *etc.*
- **Saprophytic Nutrition :** In this type of nutrition, animals depend on dead decaying organic matters, *e.g.,* **Fungi, bacteria**.

- **Holozoic nutrition;** It means feeding on solid food. In this type of nutrition, the complex organic food material is taken into its body by the process of ingestion, the ingested food is digested and then absorbed into the body cells of the organism, *e.g.,* **Man, cat, dog, fish**. **Amoeba**, etc.

(ii) Nutrition in Plants

- **Photosynthesis :** It is the process by which autotrophic chlorophyll, containing organisms manufacture their own energy sources (simple sugars) from intracellular chemical reaction of carbon dioxide and water in presence of sunlight and chlorophyll.

$$6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \underset{\text{(Glucose)}}{C_6H_{12}O_6} + 6H_2O + 6O_2$$

Respiration

Respiration is a complex process which includes breathing *i.e.* exchange of O_2 and CO_2 and oxidation of food to release energy.

- There are two types of respiration :
  (a) Aerobic respiration
  (b) Anaerobic respiration
- Aerobic respiration occurs in the presence of O_2. It involves two steps :
  (a) Glycolysis,
  (b) Krebs cycle.
- **Anaerobic respiration** takes place in certain bacteria and yeast which release energy in the absence of O_2.

Respiration in Animals

- Animals have specific organs for respiration like **skin, lungs, gills**.
- **Inspiration** is by which atmospheric air reaches lungs. In this volume of thorax increases and outside air reaches lungs.
- **Expiration** is the process by which foul air of lungs is released. It occurs by relaxing intercoastal muscles and diaphragm.

Transportation

(i) Transportation in Human beings

- **Transportation** is a process in which substances are absorbed in one part and move to the other parts of the body.
- **Heart** is situated in the thoracic cavity between two lungs. Heart is made up of cardiac muscles which works continously.
- Normal heart rate is 72/minute.

Double Circulation in Man: The circulatory system of man is called double circulation as the blood passes through the heart twice in one complete cycle of the body. It involves two circulations:

Pulmonary circulation:

Systemic circulation:

(ii) Transportation in Plants

- **Xylem** and **Phloem** are conducting tissues of plants. The loss of water in the form of vapours from the leaf to the atmosphere is called as **transpiration**.
- **Excretion**

(i) Excretion in Animals

- The removal of unwanted waste materials from the body is called **excretion**.
- The process of maintaining the right amount of water and proper ionic balance in the body is called as **osmoregulation**.

(ii) Excretion in Human beings

- Excretory system of human beings consists of a pair of **kidneys, a pair of ureters, urinary bladder and urethra.**
- Artificial kidney is used when natural kidneys begin malfunction or stop working.

(iii) Excretion in Plants

- Oxygen is bye product of photosynthesis in plants.
- Plants get rid of excess of water by transpiration.
- Waste products may be stored in leaves that fall off. Many waste products are stored as resins and gums in plants.

6. CONTROL AND COORDINATION

Human Nervous System :

It comprises neurons, nerves, nervous organs which control the activities of different organs of the body.

- **Neuron** is the structural and functional unit of nervous system. Neuron (or nerve cell) has three components.
  (i) Cell body (or Cyton)
  (ii) Axon and
  (iii)Dendrites
- **Reflex Actions :** It is rapid, automatic, definite response to stimulus by an organ without involving brain for its initiation. The pathway which is followed by this is called **reflex arc**.
- **Human Nervous System :** Nervous system of man consists of three parts –
  (i) Central Nervous System, which includes **brain** and **spinal cord**.

(ii) Peripheral Nervous System, comprises of nerves arising from brain and spinal cord.

(iii)Autonomic Nervous System.

- Brain is divided into three parts –

(a) Forebrain : (i) Olfactory lobes; (ii) Cerebrum

(b) Midbrain : (i) Crura Ceribri; (ii) Carpora Quadrigemina

(c) Hind brain : (i) Cerebellum; (ii) Medulla oblongata; (iii) Pons

Co-ordination in Plants

- The plants coordinate their behaviour against environmental changes by using hormones.
- Plants show two types of movements :

(i) Movement dependent on growth

(ii) Movement independent on growth

- **Immediate Response to Stimulus :**
- The plant movements made in response to external stimuli fall into two main categories :

(i) Tropism and (ii) Nastic

Tropisms (Tropic movements) :

- A growth movement of a plant part in response to an external stimulus in which the direction of stimulus determines the direction of response is called tropism.

Nastic (Nastic movements) :

The main difference between tropic and nastic movements is that tropic movement is a directional movement of a plant part but nastic movement is not a directional movement of the plant part with respect to the stimulus.

Thigmonasty :

- It is the non-directional movement of a plant part in response to the touch of an object. *e.g.*- *Mimosa pudica* (Chui-mui)

Photonasty :

- The non-directional movement of a plant part (usually petals of flowers) in response to light is called photonasty.

Hormones in Plants

- **Auxins :** It stimulates growth, phototropism, geotropism. 2, 4 - D is used to avoid pre-harvest fruit in oranges, apples, used as weedicide. Auxins prevent potato sprouting.
- **Gibberellins :** These can increase the height of plant, can induce parthenocarpy, stimulate flowering.
- **Cytokinins :** Promote cell division, inhibit or delay ageing, organ formation.
- **Ethylene :** It's a gaseous plant hormone, used in artificial ripening of fruits, promote ageing in plants, breaks dormancy of several organs.
- **Abscisic Acid (A. B. A) :** Also known as stress hormone. It is a growth inhibitor, inhibit the process of flowering, seed development.

Hormones in Animals

- Hormones are the substances which help in control and coordination of the body activities.
- Exocrine glands are **mammary glands, salivary gland, sweat gland**.
- Endocrine glands are **pituitary, thyroid, adrenal**.
- **Pancreas**, **testes** and **ovary** are endocrine as well as exocrine gland.

7. HOW DO ORGANISMS REPRODUCE?

The production of new organisms from the existing organisms of the same species is known as **reproduction**.

Asexual Reproduction : Modes of asexual reproduction used are binary fission, multiple fission, Budding, spore formation, regeneration, vegetative propagation, tissue culture, fragmentation

Sexual Reproduction : In sexual reproduction, a male gamete (germ cells) fuses with a female gamete to form a new cell called '**zygote**'. This zygote then grows and develop into a new organism in due course of time.

- When male gamete and female gamete fuse, they form a zygote and the process is known as **fertilization**.
- Fertilization is of two types :- External fertilization and Internal fertilization.

Sexual Reproduction in Flowering Plants : Flower is meant essentially for sexual reproduction.

- Pollination is the process in which pollen grains are transferred from the anther to stigma of the carpel. It is of two types self-pollination and cross-pollination.
- In the fertilization process **primary endospermic nucleus** is formed.
- After the fertilization process, **ovary developes into the fruit whereas ovules into the seed.**

Reproduction in Human Being : The sex organ in males are testes and ova in females.

- Male reproductive system consist of accessory duct and external genetilia.
- Female reproductive part consist of a pair of ovaries, a pair of fallopian tube, uterus, vagina, external genitalia, mammary glands and accessory glands.
- Fertilization process occurs in **fallopian tube**. In this process zygote is formed. In this process umbilical cord is produced which is attached to foetus.
- After the age of 45-50 years menses stop and process is called **menopause**.
- Fertility control can be done chemically, mechanically or surgically.

Reproductive Health

Measures to control over population

- **Mechanical barrier method:-** They prevent contraception by preventing either sperms from entering uterus or preventing implantation if fertilization has occurred.
- **Hormonal method:** They are used by women for suppressing the production of ovum. *i.e.*, oral pills, Implants morning after pills.
- **Chemical contraception: –** They are creams, jellies and foaming tables which are placed in vagina for killing the sperms at the time of coitus.
- **Surgical techniques:–**

  (i) Vasectomy – removing or tying of vas deferens

  (ii) Tubectomy – removal or tying of fallopian tube

Sexually Transmitted Diseases (STDs)

The sexually transmitted diseases are also called **venereal diseases** (VDs). Some 30 different types of STDs are known. For example: Gonorrhoea, Syphilis, Trichomonas, Genital warts, AIDS.

8. HEREDITY

The transmission of characters from parent to their offsprings is known as **heredity**.

- Variation in sexually reproducing organisms are caused due to the following factors like environment, crossing over and recombination of genes and mutation.
- The first study of inheritance was done by Gregor Mendel on garden pea.
- Paired condition of chromosomes is known as **diploid**.
- Unpaired condition of chromosomes is known as **haploid**.

Mendel's laws of inheritance are

(i) Law of Dominance

(ii) Law of Segregation (Law of purity of gametes)

(iii) Law of Independent Assortment

Genotype is the composition of genes present in an organism and the characteristic which is visible in an organism is called its **phenotype**.

DNA (Deoxyribo Nucleic Acid), RNA (Ribo Nucleic Acid) is the genetic material in all organisms. DNA is the source of making protein in a cell. The section of DNA that provides information for one protein is called **gene**.

Physical and Chemical Basis of Heredity

Mendel (1866) said that heredity was controlled by particles, called germinal units, or factors.

- Sex determination is the process by which the sex of a person is determined.

  All human chromosomes are not paired. 22 pairs are called **autosomes**. Women have a perfect pair of sex chromosomes XX. But men have a mismatched pair XY.

9. LIGHT–REFLECTION AND REFRACTION

Ray of Light : A line drawn in the direction of propagation of light is called a ray of light.

Beam of Light : A group of rays of light emitted by a source of light is called a beam of light.

Reflection of Light : The phenomena of sending the light back in the same medium by a surface.

Laws of Reflection :

(i) The incident ray, the reflected ray and the normal at the point of incidence, all lie in a same plane.

(ii) The angle of incidence is always equal to the angle of reflection, $\angle i = \angle i$.

Image : When light rays meet or appear to meet after reflection from a mirror,then it is called an **image**.

(i) Real Image : It is a kind of image which is formed by actual intersection of light rays after reflection.

(ii) Virtual Image : It is a kind of image which is formed by producing the reflected rays backward after reflection.

Plane Mirror : A piece of glass whose one side is polished.

Spherical Mirrors : It is part of hollow glass sphere whose one surface is polished. Types of spherical mirror.

(i) Concave Mirror : It is a spherical mirror whose outer surface is polished and inner or concave side is reflecting surface.

(ii) Convex Mirror : It is a spherical mirror whose inner surface is polished and outer or convex side is the reflecting surface.

Uses of Concave Mirror : It is used as a shaving mirror, dentist mirror, in solar heating devices like solar cooker, in floodlight, etc.

Uses of Convex Mirror : It is used as rear view mirror in automobiles, security checking purposes etc.

Principal Focus (f) :A point on the principal axis of a spherical mirror where the rays of light parallel to the principal axis meet or appear to meet after reflection from the mirror.

Focal Length (f) : The distance between the pole (P) and principal focus(F) of a spherical mirror is called the focal length of the mirror.

Radius of Curvature (R) : It is the radius of the sphere of which mirror is a part. $R = 2f$

Image formation by a concave mirror for different positions of the object

Position of the object	Position of the image	Relative size of the image	Nature of the image
At infinity	At the focus F	Highly -diminished, point-sized	Real and inverted
Beyond C	Between F and C	Diminished	Real and inverted
At C	At C	Same size	Real and inverted
B/W C and F	Beyond C	Enlarged	Real and inverted
At F	At infinity	Highly enlarged	Real and inverted
B/W P and F	Behind the mirror	Enlarged	Virtual and erect

Image formation by a convex mirror for different positions of the object

Position of the object	Position of the image	Relative size of the image	Nature of the image
Anywhere between pole (P) and infinity (∞)	Between P and F back of the mirror	Small	Virtual and erect
At infinity	At F	Very small in size	Virtual and erect

Mirror Formula : It is a relation between distance of object, (u) distance of image from the pole of the mirror (v) and it's focal length, (f)

i.e., $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$

Magnification : $m = \frac{\text{height of image (I)}}{\text{height of object (O)}}$

Refraction of Light : The bending of ray of light when it passes from one medium to another.

Laws of Refraction :

(i) The incident ray, the refracted ray and the normal at the point of incidence all lie in the same plane.

(ii) When a ray of light undergoes refraction then the ratio of sine of angle of incidence to the sine of angle of refraction is constant. *i.e.*, $\frac{\sin i}{\sin r} = n_{21}$

It is also known as **Snell's law.**

Refractive Index : The refractive index of medium 2 with respect to medium 1 is given by

$$n_{21} = \frac{\text{Speed of light in medium 1}}{\text{Speed of light in medium 2}} = \frac{v_1}{v_2}$$

Refraction by spherical lenses : Lens is a transparent medium which is formed by joining two pieces of spherical glass. There are two types of lenses.

(i) **Convex Lens :** It is a lens which is thicker at the centre and thinner at the edges.

(ii) **Concave Lens :** It is a lens which is thinner at the centre and thicker at the edges.

Terms related to a lens

(i) **Optical Centre of Lens :** It is the centre of the lens through which light can pass without any deviation.

(ii) **Principal Axis :** It is the line passing through optical centre and is perpendicular to the line joining its edges.

(iii) **Principal Focus :** It is a point on the principal axis where all light rays which are parallel to principal axis either converge or appear to diverge from, after refraction.

Nature, position and relative size of the image formed by a convex lens for various positions of the object

Position of the object	Position of the image	Relative size of the image	Nature of the image
At infinity	At focus F_2	Highly -diminished, point-sized	Real and inverted
Beyond $2F_1$	Between F_2 and $2F_2$	Diminished	Real and inverted
At $2F_1$	At $2F_2$	Same size	Real and inverted
Between F_1 and $2F_1$	Beyond $2F_2$	Enlarged	Real and inverted
At Focus F_1	At infinity	Infinitely large or highly enlarged	Real and inverted
Between F_1 and Optical centre O	On the same side of the lens as the object	Enlarged	Virtual and erect

Nature, position and relative size of the image formed by a concave lens for various position of the object

Position of the object	Position of the image	Relative size of the image	Nature of the image
At infinity	At focus F_1	Highly -diminished, point-sized	Virtual and erect
Between infinity and and Optical centre O of the lens	Between F1 and Optical centre O	Diminished	Virtual and erect

Lens formula : $\frac{1}{f}=\frac{1}{v}-\frac{1}{u}$

Magnification : Magnification, ratio of height of image to the height of object. i.e., $m=\frac{h_2}{h_1}$

Also, $\frac{h_2}{h_1}=\frac{v}{u}$

Power of a lens (P) : It is the reciprocal of focal length (in metre) i.e., $P=\frac{1}{f(\text{in metre})}$

S.I. unit of power of lens is 'dioptre' (D) : One dioptre is the power of a lens whose focal length is 1m.

Power of a combination of two or more lenses : Power of combined lenses is equal to the sum of the powers of individual lenses i.e., $P = P_1 + P_2 + P_3 + ...$

10. HUMAN EYE AND COLOURFUL WORLD

The **Human Eye** is a natural optical instrument which is used to see the objects. It is like a camera which has lens and screen system.

Parts of human eye

(i) **Retina :** It is a light sensitive screen inside the eye on which image is formed. It contains rods and cones.

(ii) **Cornea :** Thin membrane which covers the eye ball. It acts like a lens which refracts the light entering the eye.

(iii) **Aqueous humour :** It is fluid which fills the space between cornea and eye lens.

(iv) **Eye lens :** It is a Convex lens made of transparent and flexible jelly like material. Its curvature can be adjusted with the help of ciliary muscles.

(v) **Pupil :** It is a hole in the middle of iris through which light enters the eye. It appears black because light falling on it goes into the eye and does not come back.

(vi) **Ciliary muscles :** These are the muscles which are attached to eye lens and can modify the shape of eye lens which leads to the variation in focal lengths.

(vii) **Iris :** It controls the amount of light entering the eye by changing the size of pupil.

(viii) **Optical nerve :** These are the nerves which take the image to the brain in the form of electrical signals.

Accomodation power : The ability of eye to change the focal length of eye lens with the help of ciliary muscles to get the clear view of nearby objects (about 25 cm) and distant objects (at infinity).

Colour blindness : Some people do not possess some cone cells that respond to certain specific colours due to genetic disorder.

Eye defects

(i) **Myopia (Short sightedness) :** Person can see near objects clearly but cannot see the distant objects clearly. Myopia is due to

- excessive curvature of cornea.
- elongation of eye ball.

Corrected by using concave lens of suitable forcal length.

(ii) **Hypermetropia (Long sightedness) :** Person can see distant objects properly but cannot see the nearby objects clearly. It happens due to

- decrease in power of eye lens i.e., increase in focal length of eye lens.
- shortening of eye ball.

Corrected by using convex lens of suitable focal length.

(iii) **Astigmatism :** Person cannot see (focus) simultaneously horizontal and vertical lines both.

Corrected by using cylindrical lens.

Dispersion of white light by a glass prism : The phenomenon of splitting of white light into its seven constituent colours when it passes through a glass prism. The various colours seen are Violet, Indigo, Blue, Green, Yellow, Orange and Red. The sequence of colours remember as VIBGYOR. The band of seven colours is called spectrum.

Composition of white light : White light consists of seven colours i.e., violet, indigo, blue, green, yellow, orange, red.

Recombination of light : Newton found that when an inverted prism be placed in the path of dispersed light then after passing through prism, they recombine to form white light.

Formation of rainbow : The water droplets act like small prisms. They refract and disperse the incident sunlight, then reflect it internally, and finally refract it again when it comes out of the raindrop. Due to the dispersion of light and internal reflection, different colours reach the observer's eye. as a band of VIBGYOR.

Atmospheric Refraction : The refraction of light caused by the earth's atmosphere (having air layers of varying optical densities) is called atmospheric refraction.

Twinkling of stars is due to atmospheric refraction

Scattering of light : According to Rayleigh's law of scattering, amount of scattered light $\propto \frac{1}{(\text{wavelength})^4}$ so that the wavelength of violet, blue and indigo is small as compared to the rest of the colours. So **sky appears blue.**

The **duration of day becomes approximately 4 minutes shorter if there is no atmosphere on earth :** Actual sun rise happens when it is below the horizon in the morning. The rays of light from the sun below the horizon reach our eyes because of refraction of light.Similarly, the sun can be seen about few minutes after the actual sun set. Thus the duration of day time will increase by 4 minutes.

12. ELECTRICITY

Electric current : - Electric current is the rate of flow of charge.

If a net charge Q flows across any cross-section of a conductor in time t, then the current I, through the cross-section $I = \frac{Q}{t}$

The **SI unit** of electric charge is coulomb (C), which is equivalent to charge of 6×10^{18} electrons and of electric current is ampere (A)

Electric circuit : A continuous and closed path of an electric current made of electrical elements like cell, switch etc.

Electric potential : When a unit test charge is brought inside the field, some work is done because the unit positive charge experiences a force which becomes more and more when the test charge moves near to the given charge. This amount of work done is known as electric potential. i.e., $V = \frac{W_{ext}}{q_0}$

Electric potential difference is the difference between electric potentials of two distinct points inside an electric field. When a unit positive test charge moves from A to B, some work is done. This amount of work done is known as *potential difference* i.e., $V_B - V_A = \frac{W_{ext}}{q_0}$

The **S.I. unit** of potential and potential difference is volt.

Ohm's law: According to Ohm's Law, Electric current is directly proportional to the potential difference between the two ends of a conductor provided physical conditions such as temperature remain unchanged i.e.

$I \propto V$ or $V \propto I$ or $V = RI$

Here R is a constant called **resistance** of the wire.

Resistance: The opposition to the flow of free electrons due to the collisions is called resistance. More is the collision suffered more is the resistance.

The **S.I unit** of resistance of ohm (Ω)

Factors affecting resistance of a conductor

Resistance of a conductor depends on **length of wire** and **area of cross-section** i.e.

$R \propto L$; $R \propto \frac{1}{A}$ i.e., $R \propto \frac{L}{A} \Rightarrow R = \frac{\rho L}{A}$

ρ is a constant. This constant of proportionality is known as **resistivity or specific resistance**, which is represented by ρ (rho).

Resistance also depends on **nature of material**, **temperature**

Therefore, $\rho = \frac{RL}{A}$

Resistivity of a conductor is measured in 'ohm meter' or 'Ω m'.

Resistance of alloys: It is found practically that the resistance of alloys is more than the resistance of its constituent metals. It means alloys have higher resistivity than their constituent metals e.g., nichrome which is an alloy of nickel and chromium has very high resistivity than its constituent metals i.e., Nickel and Chromium.

Resistance of a system of resistors :

Resistances can be connected in two ways :

(i) Combination of resistances in series : - When two or more resistances are connected end to end, they are said to be in series. When two or more resistances are connected in series, then current flowing in the circuit remains same.

$V = V_1 + V_2 + V_3 + ...$

$R = R_1 + R_2 + R_3 + ...$

(ii) Combination of resistances in parallel : - If two or more resistances are connected to the same end, they are said to be in parallel.

Potential remain same.

$I = I_1 + I_2 + I_3 + ...$

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

Heating Effect of Electric Current : When the electric current is passed through a conductor then conductor gets heated, this effect is known as the heating effect of current.

Practical applications of heating effect of current

(i) Electric heater, electric iron and water heater, etc. work on the principle of the heating effect of current.

(ii) Electric bulb glows when electric current flows through the filament of the bulb.

(iii) Electric fuse in the electric circuit melts when large current flows in the circuit.

Joule's Law of Heating Effect: It states that the amount of heat produced in a conductor is

(i) directly proportional to the square of current passing through it, i.e., $H \propto I^2$ ...(i)

(ii) directly propotional to the resistance of conductor,
i.e., $H \propto R$ ...(ii)

(iii) directly proportional to the time for which current passed, i.e., $H \propto t$ ...(iii)

Combining (i), (ii) and (iii). $H \propto I^2 Rt$.

Here, constant of proportionality is 1.

$\therefore \quad H = I^2Rt$ joule

Electric Power : The rate at which electric energy is consumed is called electric power.

$$\text{Power} = \frac{\text{Work}}{\text{Time}} \quad \Rightarrow P = \frac{W}{t} = I^2R = VI = \frac{V^2}{R}$$

where P is the power, I is current flowing, V is the potential difference and R is the resistance. It is measured in 'watt'.

Electric energy is measured in **Kilowatt hour (kwh)**. It is called Board of trade unit **(B.O.T.U)**

1 kwh = 1000 watt × 3600 second $= 3.6 \times 10^6$ joule.

12. MAGNETIC EFFECTS OF ELECTRIC CURRENT

In 1820, **Hans Christian Oersted** discovered that a compass needle got deflected when an electric current passed through a metallic wire placed nearby. This observation relates electricity and magnetism.

Magnetic field: Every magnet has a region around it in which it's force (attraction or repulsion) can be experienced by a magnetic material like iron cobalt, nickel etc. This region is known as magnetic field.

Magnetic lines of force (or magnetic field lines): The path (straight or curved) along which unit north pole moves in a magnetic field (if it is free to do so) is called magnetic lines of force. They are imaginary lines.

Properties of magnetic lines of force :

(i) Two field lines never intersect each other.

(ii) All field lines are closed curves.

(iii) Inside the magnet, direction of magnetic field lines is from south pole to north pole while outside the magnet from north pole to south pole.

Right Hand Thumb Rule : If we imagine that we are holding a wire carrying current and thumb is stretched in the direction of current (I) then the direction in which fingers will be wrapped gives the direction of magnetic lines of force.

It means if the current is flowing in the upward direction then the direction of magnetic lines of force will be anticlockwise and if current is flowing in the downward direction then the direction of field will be clockwise.

Factors on which strength of magnetic field around a straight wire carrying current depends:

(i) Strength of this magnetic field depends on current i.e., it is directly propotional to the current flowing through the conductor.

(ii) Distance from the wire : Strength of the Magnetic Field is inversely proportional to the distance from the wire carrying current.

Solenoid: A solenoid is a coil of many turns of an insulated wire closely wound in the shape of a tight spring.

Factors on which magnetic field due to a solenoid depends :

(i) The number of turns of the wire forming a solenoid. i.e., $B \alpha n$

(ii) The strength of current. i.e., $B \alpha I$

(iii) Nature of material inside the solenoid
i.e., $B \alpha \mu$ (where μ is permeability of material).

Electromagnet : It is a piece of magnetic material like soft iron or hard steel which is placed inside a solenoid through which current is flowing.

Uses of electromagnets :

(i) to lift heavy iron pieces.

(ii) in many devices like electric bell, electric horn, telephone reciever etc.

Force exerted on a wire carrying current placed in a magnetic field :

It was discovered that when a magnetic needle is placed near a conductor carrying current, it shows deflection i.e. a force exerted on it.

Fleming's Left hand Rule : According to this rule stretch thumb, fore finger and central finger of left hand in such a way that these fingers are perpendicular to each other. If fore finger is placed in the direction of Magnetic Field (B) and middle finger in direction of current (I), then thumb will point towards the direction of force (F).

Household Circuit : We receive supply of electric power through mains. One of the wires in the supply has red insulation called **live wire**. Another wire with black insulation is called **neutral wire**. Potential difference between them is 220 volt.

Short circuit: It occurs when the insulation of wires get damaged and live and neutral wires touch each other.

Fuse: Fuse is a safety device having a very thin wire which is made up of either tin or alloy of tin and lead (or tin and copper). This wire has low melting point so it melts and breaks the circuit easily if the current in the circuit exceeds it's safety valve, due to short circuit or overloading.

13. OUR ENVIRONMENT

Introduction

- The environment includes our physical surroundings like air (or atmosphere), water bodies, soil (land) and all the organisms such as plants, animals, human beings and micro-organisms like bacteria and fungi (called decomposers).

- The waste materials produced by the various activities of man and animals are poisonous to some extent and can be divided into two main groups :

(i) **Biodegradable wastes,** and

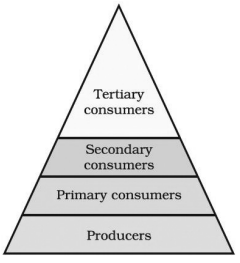
(ii) **Non-biodegradable wastes**.

Ecosystem

- An **ecosystem** is a self-contained unit of living things (plants, animals and decomposers), and their non-living environment (soil, air and water). *e.g.* a forest, a pond, a lake, a greenland etc.
- There are two components of an ecosystem : **biotic component** and **abiotic component**.
- **Biotic component :** It includes three types of organisms:
- **Producer, Consumer and decomposer**
- **Abiotic component**
- Consumers can be further divided into three groups : herbivores, carnivores and **omnivores**.

Food Chains and Webs

- The sequence of living organisms in a community in which one organism consumes another organism to transfer food energy, is called a **food chain**.
- A food chain is unidirection where transfer of energy takes place in only one direction.
- The various steps in a food chain at which the transfer of food (or energy) takes place are called trophic levels.



Trophic Levels

- The inter-connected food chains operating in an ecosystem which establish a network of relationships between various species, is called a **food web**.

Ozone Layer formation and importance

- **Ozone (O_3)** is a molecule formed by three atoms of oxygen. Ozone, is a deadly poison. It shields the surface of the earth from ultraviolet (UV) radiation from the Sun. This radiation is highly damaging to organisms.
- The deplation of ozone layer is due to **CFC (chloro fluorocarbons).**
- The increase in concentration of harmful chemical substances like pesticides in the body of living organisms at each trophic level of a food chain is called biological magnification.
- The disposal of waste should be done in a scientific way. There are different methods of waste disposal. The method to be used depends on the nature of the waste. Some of the important modes of waste disposal are :
  (i) Recycling (ii) Preparation of compost
  (iii)Incineration (iv) Landfill
  (v) Sewage treatment