CHAPTER-1
CARBON AND ITS COMPOUNDS

Revision Notes

Carbon and Its Properties, Homologous Series and IUPAC

Properties of Carbon

- The element carbon is a non-metal. Its symbol is C.
- Carbon is a versatile element. The percentage of carbon present in earth's crust in the form of mineral is 0.02% and in atmosphere as CO_2 is 0.03%.
- All the living things, like plants and animals are made up of carbon based compounds.
- Carbon always forms covalent bonds.
- The atomic number of carbon is 6.
- **Electronic configuration:**

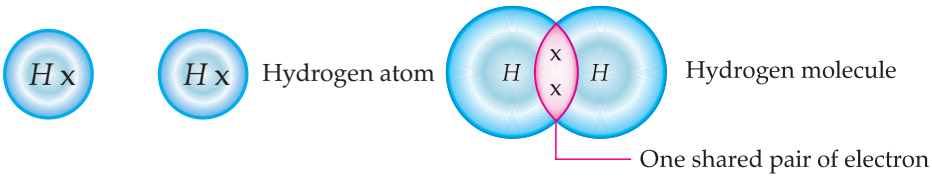
	K	L
C (6)	2	4

- It has four electrons in its outermost shell and requires 4 electrons to achieve the inert gas electronic configuration. But carbon cannot form an ionic bond.
- **How does carbon attain noble gas configuration ?**
  (i) Carbon can attain its stable noble gas configuration in two ways :
  - It may gain four electrons to form C^{4-} anion. But in that case, it would be difficult for the nucleus with six protons to hold on to ten electrons.
  - It could lose four electrons to form C^{4+} cations. But in that case, it would require huge amount of energy which is not energetically favourable.

  (ii) Thus, carbon overcomes this problem by sharing its valence electrons with other atoms of carbon or with atoms of other elements The atoms of other elements like hydrogen, oxygen, nitrogen and chlorine also form bonds by sharing of electrons.
- **Covalent Bond:** A covalent bond is formed by sharing of electrons between atoms. In a covalent bond, the shared pair of electrons belongs to the valence shell of both the atoms.
- **Conditions for formation of a covalent bond:**
  (i) The combining atoms should have 4 to 7 electrons in their valence shell.
  (ii) The combining atoms should not lose electrons easily.
  (iii) The combining atoms should not gain electrons readily.
  (iv) The difference in electronegativity of two bonded atoms should be low.
- **Properties of covalent compounds:**
  (i) Physical state: They are generally liquids or gases. Some covalent compounds may exist as solid.
  (ii) Solubility: They are generally insoluble in water and other polar solvents but soluble in organic solvents such as benzene, toluene etc.
  (iii) Melting and boiling points: They generally have low melting and boiling points.
  (iv) Electrical conductivity: Covalent compounds are generally poor conductor of electricity. This is because the electrons are shared between atoms and no charged particles are formed in these compounds.
- **Steps for writing the Lewis dot Structures of a covalent compound:**
  (i) Write the electronic configuration of all the atoms present in the molecule.
  (ii) Identify how many electrons are needed by each atom to attain noble gas configuration.
  (iii) Share the electrons between atoms in such a way that all the atoms in a molecule have noble gas configuration.
  (iv) Keep in mind that the shared electrons are counted in the valence shell of both the atoms sharing it.

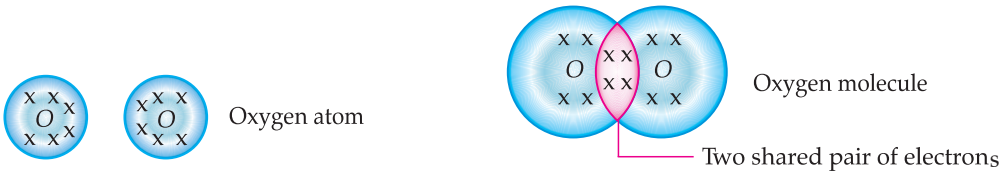
➢ **Examples:**

(i) H_2



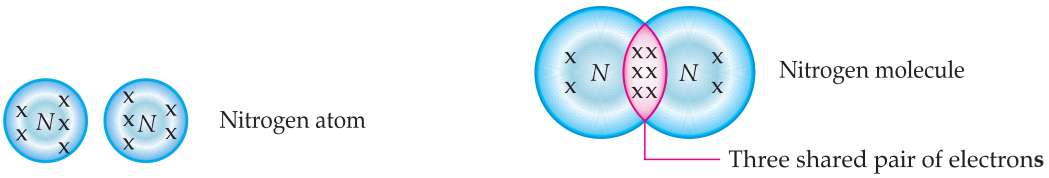
H – H: Single bond between hydrogen atoms

(ii) O_2



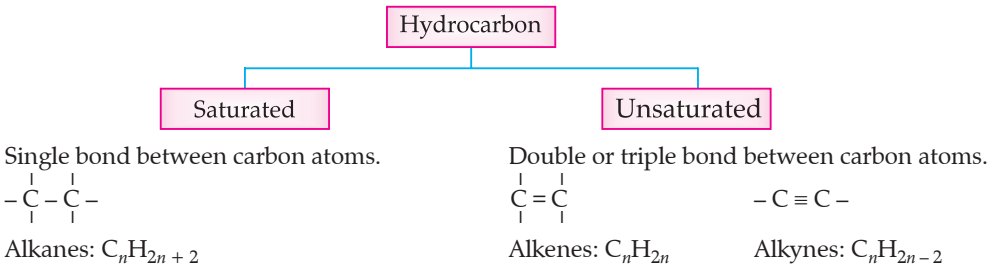
O = O: Double bond between oxygen atoms

(iii) N_2



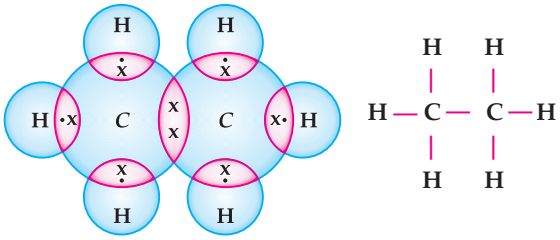
N ≡ N: Triple bond between nitrogen atoms

➢ **Hydrocarbon: Compounds made up of hydrogen and carbon are called hydrocarbon.**



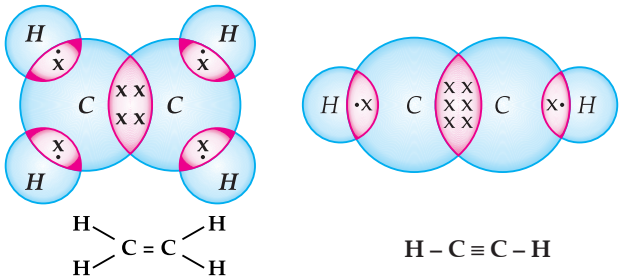
➢ **Electron dot structure of saturated hydrocarbons:**

Ethane: C_2H_6



➢ **Electron dot structure of unsaturated hydrocarbons:**

Ethene: C_2H_4 Ethyne: C_2H_2



H – C ≡ C – H

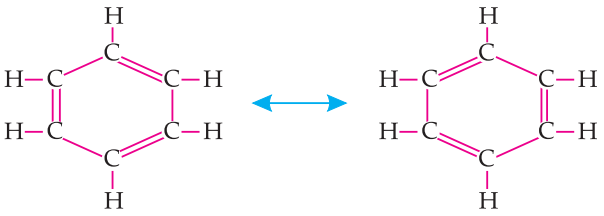
- **Cyclic or Closed Chain Hydrocarbons:** These are the hydrocarbons which have carbon - carbon closed chain.

  They are classified as:

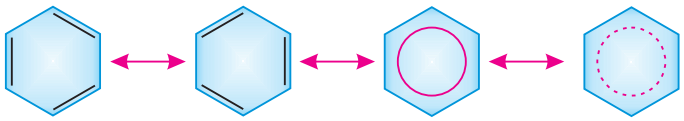
  (i) Alicyclic hydrocarbons: Alicyclic compounds are both aliphatic and cyclic compounds. These are the hydrocarbons which do not have benzene ring in their structures.

  (ii) Aromatic hydrocarbons: The cyclic hydrocarbons which have benzene ring in their structures. These compounds are characterised by the presence of alternate double bonds within the ring.

- **Benzene:** It is an aromatic hydrocarbon which has the molecular formula C_6H_6. It has alternating carbon - carbon single and double bonds.



- **Benzene can also be represented as:**



- **IUPAC name of hydrocarbon consists of two parts. It involves:**

  (i) Word root: Number of carbons in the longest carbon chain.

Number of carbon atoms	Word root (Greek name)
1	Meth
2	Eth
3	Prop
4	But
5	Pent
6	Hex
7	Hept
8	Oct
9	Non
10	Dec

  (ii) Suffix: It depends on the type of carbon - carbon bond, for single bond suffix is *–ane*; for double bond, suffix is – *ene*; and for triple bond suffix is – *yne*.

- **Types of Formula for Writing Hydrocarbons:**

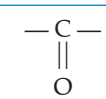
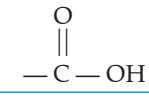
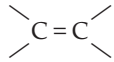
  (i) Molecular formula: It involves the actual number of each type of atom present in the compound.

  (ii) Structural formula: The actual arrangement of atoms is written in structural formula.

  (iii) Condensed formula: It is the shortened form of the structural formula.

- In hydrocarbon chain, one or more hydrogen atom is replaced by other atoms in accordance with their valencies. These are heteroatoms.

- These heteroatoms or group of atoms which make carbon compound reactive and decides its properties are called functional groups.

Heteroatom	Functional group	Formula of functional group
Cl/Br	Halo (Chloro/Bromo)	— Cl, — Br, — I
Oxygen	1. Alcohol	— OH
	2. Aldehyde	— CHO
	3. Ketone	
	4. Carboxylic acid	
Double bond	1. Alkene group	
Triple bond	2. Alkyne group	— C ≡ C —

- **Homologous Series:** A series of organic compounds in which every succeeding member differs from the previous one by – CH_2 or 14 a.m.u. is called homologous series. The molecular formula of all the members of a homologous series can be derived from a general formula.
- **Properties of a homologous series:** As the molecular mass increases in a series, physical properties of the compounds show a variation, but chemical properties which are determined by a functional group remain the same within a series.
- **Homologous series of alkanes:** General formula: C_nH_{2n+2}, where n = number of carbon atoms. CH_4, C_2H_6, C_3H_8.
- **Homologous series of alkenes:** General formula: C_nH_{2n}, where n = number of carbon atoms. C_2H_4, C_3H_6, C_4H_8.
- **Homologous series of alkynes:** General formula: C_nH_{2n-2}, where n = number of carbon atoms. C_2H_2, C_3H_4, C_4H_6.

Mnemonics

Concept: saturated and unsaturated compounds		**Concept: homologous series**
Mnemonics: Thank You DeSa		**Mnemonics: Monkeys Eat Peeled Bananas**
Interpretation:		**Interpretation:**
T: Triple bond	**Y: Alkyne**	**M: Methane (1C)**
D: Double bond	**e: Alkene**	**E: Ethane (2C)**
S: Single bond	**a: Alkane**	**P: Propane (3C)**
		B: Butane (4C)

Know the Terms

- **Catenation:** The self linking property of carbon atoms through covalent bonds to form long chains and rings is called catenation.
- **Tetravalency:** Tetravalency is the state of an atom in which there are four electrons available with the atom for covalent chemical bonding.
- **Electronegativity:** It is the ability of an atom to attract a shared pairs of electrons towards itself.
- **Isomerism:** The compounds which possess the same molecular formula but different structural formulae, are called isomers, and the phenomenon is known as isomerism. For example, butane with a molecular formula C_4H_{10} has two isomers.

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CHAPTER-2
PERIODIC CLASSIFICATION OF ELEMENTS

Revision Notes

Periodic Laws and their Limitations

- **Need for Periodic Classification:** To make the study of elements easy, elements have been divided into few groups in such a way that elements in the same group have similar properties. Now, study of a large number of elements is reduced to a few groups of elements.
- **Dobereiner's Triads:** When elements are arranged in the order of increasing atomic masses, groups of three elements (known as triads), having similar chemical properties are obtained.
- The atomic mass of the middle element of the triad was roughly the average of the atomic masses of the other two elements.

Elements	Atomic Mass
Ca	40.1
Sr	87.6
Ba	137.3

- **Limitation:** Dobereiner could identify only three triads. He was not able to prepare triads of all the known elements.
- **Newland's Law of Octaves:** John Newlands arranged the elements in the order of increasing atomic masses. It states that when the elements are arranged in increasing order of atomic masses, the properties of the eighth element are a kind of repetition of the first, just like notes of music.
- **Table showing Newland's Octaves:**

Sa (do)	re (re)	ga (mi)	ma (fa)	pa (so)	da (la)	ni (ti)
H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe
Co and Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce and La	Zr		

- **Limitations of Newland's law of octaves:**
  - **(i)** The law was applicable to elements up to calcium (Ca) only.
  - **(ii)** It contained only 56 elements. Further, it was assumed by Newlands that only 56 elements existed in nature and no more elements would be discovered in the future.
  - **(iii)** In order to fit elements into the table, Newland adjusted two elements in the same column as fluorine, chlorine and bromine which have very different properties than these elements. Iron, which resembles cobalt and nickel in properties, has been placed differently away from these elements.
- **Mendeleev's Periodic Table:** Dmitri Ivanovich Mendeleev, a Russian chemist, was the most important contributor to the early development of a periodic table of elements as in this the elements were arranged on the basis of their atomic mass and chemical properties.
- **Characteristics of Mendeleev's Periodic Table:**
  - **(i)** Mendeleev arranged all the 63 known elements in increasing order of their atomic masses.

Periodic Table of Elements

Alkali Metal | Alkaline Earth Metal | Transition Metal | Basic Metal | Semimetal | Non metal | Halogen | Noble Gas | Lanthanide | Actinide

	1 IA												13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1	1 H Hydrogen 1.0079	2 IIA																2 He Helium 4.0026
2	3 Li Lithium 6.941	4 Be Beryllium 9.0122											5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180
3	11 Na Sodium 22.990	12 Mg Magnesium 24.305	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8	9 VIII	10	11 IB	12 IIB	13 Al Aluminium 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulphur 32.065	17 Cl Chlorine 35.453	18 Ar Argon 39.948
4	19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.867	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.723	32 Ge Germanium 72.64	33 As Arsenic 74.922	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Kypton 83.798
5	37 Rb Rubidium 85.468	38 Sr Strontium 87.62	39 Y Yttrium 88.905	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybderum 95.96	43 Tc Technetium (98)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.91	46 Pd Palladium 106.42	47 Ag Silver 107.87	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.71	51 Sb Antimony 121.76	52 Te Tellurium 127.60	53 I Iodine 126.90	54 Xe Xenon 131.29
6	55 Cs Caesium 132.91	56 Ba Barium 137.33	57-71 La-Lu Lanthanide	72 Hf Hafnium 178.49	73 Ta Tantalum 180.95	74 W Tungsten 183.21	75 Re Rhenium 186.21	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.97	80 Hg Hercury 200.59	81 Tl Thallium 204.38	82 Pb Lead 207.2	83 Bi Bismuth 209.98	84 Po Polonium 208.98	85 At Astatine (210)	86 Rn Radon (222)
7	87 Fr Francium (223)	88 Ra Radium (226)	89-103 Ac-Lr Actinide	104 Rf Rutherfordium (267)	105 Db Dubnium (268)	106 Sg Seaborgium (271)	107 Bh Bohrium (272)	108 Hs Hassium (277)	109 Mt Meitnerium (276)	110 Ds Darmstadtium (281)	111 Rg Roentgenium (280)	112 Cn Copernicium (285)	113 Nh Nihonium (286)	114 Fi Flerovium (289)	115 Mc Moscovium (290)	116 Lv Livermorium (293)	117 Ts Tennessine (294)	118 Og Oganesson (294)

Lanthanide Series	58 Ce Cerium 140.12	59 Pr Praseodymium 140.91	60 Nd Neodymium 144.24	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.93	70 Yb Ytterbium 173.05	71 Lu Lutetium 174.97
Actinide Series	90 Th Thorium 232.04	91 Pa Protactinium 231.04	92 U Uranium 238.03	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No NObelium (259)	103 Lr Lawrencium (262)

(ii) The table consists of vertical columns called 'Groups' and horizontal rows called 'Periods'.

(iii) The elements with similar physical and chemical properties came under same groups.

- **Mendeleev's Periodic Law:** The properties of elements are the periodic functions of their atomic masses.
- **Merits of Mendeleev's Periodic Table:**

(i) Mendeleev left some blank spaces for undiscovered elements.

(ii) Mendeleev predicted the discovery of some elements and named them as eka- boron, eka- aluminium and eka- silicon.

(iii) Noble gases discovered later could be placed without disturbing the existing order.

- **Limitations of Mendeleev's periodic table:**

(i) **Position of Hydrogen:** He could not assign a correct position to hydrogen as hydrogen resembles alkali metals as well as halogens.

(ii) **Position of Isotopes :** Isotopes are placed in same position though they have different atomic masses.

(iii) Separation of chemically similar elements while dissimilar elements are placed in the same group.

- **Modern Periodic Table:** Henry Moseley gave a new property of elements, 'atomic numbers' and this was adopted as the basis of Modern Periodic Table.
- **Modern Periodic Law:** Properties of elements are the periodic functions of their atomic numbers.

Periodic Elements and Periodic Properties

- **Position of elements in modern periodic table:**

(i) The Modern Periodic Table consists of 18 groups and 7 periods.

(ii) Elements present in any one group have the same number of valence electrons. Also, the number of shells increases as we go down the group.

(iii) Elements present in any one period, contain the same number of shells. On moving from left to right with increase in atomic number by one unit, the valence shell electron increases by one unit.

(iv)

Period	**Shells**
1	K
2	K, L
3	K, L, M.....so on.

- **Trends in the Modern Periodic Table:**

(i) **Periodicity in Properties:** The properties of elements depend upon the electronic configuration which changes along a period and down a group in the periodic table. The periodicity properties *i.e.*, repetition of properties after a regular interval is due to similarity in electronic configuration.

(ii) **Tendency to lose or gain electron:** Chemical reactivity of an element depends upon the ability of its atoms to donate or accept electrons.

(iii) **Variations of tendency to lose electron down the group:** Tendency to lose electron goes on increasing down the group.

Reason: It is due to the increase in the distance between the valence electrons and the nucleus as the atomic size increases down the group, the force of attraction between the nucleus and the valence electrons decreases, therefore, tendency to lose electron also increases down the group.

(iv) **Variation of tendency to lose electron along a period:** It goes on decreasing generally along a period from left to right with decrease in atomic size.

Reason: Due to decrease in the atomic size, the force of attraction between the valence electrons and the nucleus increases and therefore, electrons cannot be removed easily.

(v) **Variation of tendency to gain electron down the group:** It goes on decreasing down the group in general.

Reason: Due to increase in atomic size, the force of attraction between the nucleus and the electron decreases.

(vi) **Variation of tendency to gain electron along a period:** It increases left to right in a period.

Reason: It is due to decrease in the atomic size which leads to an increase in the force of attraction between the nucleus and the electron. Thus, tendency to gain electrons increases across the period.

- **Metallic and non-metallic character:** Group 1 to 12 are metals. Group 13 to 18 comprises non-metals, metalloids and metals.
- **Properties of Metals:**

(i) They are malleable.

(ii) They are ductile.

(iii) They are good conductors of heat and electricity.

(iv) They have generally 1 to 3 valence electrons.

(v) They have the same or less number of electrons in their outermost shell than the number of shells.

(vi) They are mostly solids.

➢ **Properties of Non-metals:**

(i) They exist in solid, liquid or gaseous state.

(ii) Non-metals are generally brittle.

(iii) They are non-conductors.

(iv) They have 4 to 8 valence electrons.

➢ **Atomic radii increases down the group.**

Atomic number	Elements	Symbols	Electronic configuration	Valence electrons	Valency
1	Hydrogen	H	(1)	1	1
2	Helium	He	(2)	2	0
3	Lithium	Li	(2, 1)	1	1
4	Beryllium	Be	(2, 2)	2	2
5	Boron	B	(2, 3)	3	3
6	Carbon	C	(2, 4)	4	4
7	Nitrogen	N	(2, 5)	5	3
8	Oxygen	O	(2, 6)	6	2
9	Fluorine	F	(2, 7)	7	1
10	Neon	Ne	(2, 8)	8	0
11	Sodium	Na	(2, 8, 1)	1	1
12	Magnesium	Mg	(2, 8, 2)	2	2
13	Aluminium	Al	(2, 8, 3)	3	3
14	Silicon	Si	(2, 8, 4)	4	4
15	Phosphorus	P	(2, 8, 5)	5	3
16	Sulphur	S	(2, 8, 6)	6	2
17	Chlorine	Cl	(2, 8, 7)	7	1
18	Argon	Ar	(2, 8, 8)	8	0
19	Potassium	K	(2, 8, 8, 1)	1	1
20	Calcium	Ca	(2, 8, 8, 2)	2	2

Mnemonics

Concept: First 20 atomic number

Mnemonics:
Hi Helen, Listen B.B.C. News On Friday N(e)ight
Senior Maggie Always Sings Pop Songs. Casted All People Came

Interpretation: Hydrogen, Helium, Lithium, Beryllium, Boron, Carbon, Nitrogen, Oxygen, Fluorine, Neon, Sodium, Magnesium, Aluminium, Silicon, Phosphorus, Sulphur, Chlorine, Argon, Potassium, Calcium.

Concept: Trends in Atomic Radii:	Concept: Gradation in Properties
Mnemonics: Display Pic (DP)	Mnemonics: Dear God IskoPoocho: EA IP EN
Interpretation: Decreases across a Period	Interpretation: Decrease in groups Increase in periods In case of: Electron Affinity, Ionization Potential And Electro Negativity

Know the Terms

- **Groups:** The 18 vertical columns in modern periodic table are known as groups.
- **Periods:** 7 horizontal rows in modern periodic table are called periods.
- **Periodicity:** When the elements are arranged in order of increasing atomic numbers, elements with similar chemical properties are repeated at definite intervals. This is known as periodicity.
- **Atomic Radius:** Atomic radius is defined as the distance from the centre of the nucleus of an atom to the outermost shell of electrons.
- **Covalent Radii:** It is defined as half of the distance between the centre of nuclei of two atoms (bond length) bonded by a single covalent bond *e.g.*, bond length in case of H—H is 74 pm.

  Covalent radius: It can be measured in case of diatomic molecules of non-metals.
- **Metallic Radii:** It is defined as half of the internuclear distance between the two metal ions in a metallic crystal.
- **Metalloids:** Those elements which resemble both metals and non-metals are called metalloids. They are also called semi-metals. *e.g.*, Boron, Silicon, Germanium, Arsenic, Antimony, Tellurium and Polonium.
- **Isotopes:** Elements which have same atomic number but different mass number are called isotopes.

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THEME: THE WORLD OF THE LIVING
UNIT II: WORLD OF LIVING

CHAPTER-3
HOW DO ORGANISMS REPRODUCE?

Revision Notes

Asexual Reproduction and Vegetative Propagation

Introduction

- Reproduction is the process by which living organisms produce new individuals similar to themselves. It ensures continuity of life on earth.
- Nucleus of the cell contains DNA (Deoxyribose Nucleic Acid), which is the hereditary material.
- DNA replicates and forms new cells causing variation. So, these new cells will be similar but may not be identical to original cell.
- Variations are useful for the survival of the individual and species over time. It is the base of evolution.

Types of Reproduction

(a) Asexual Reproduction
- A single individual give rise to new individual.
- Gametes are not formed.
- New individual is identical to parent.
- Adopted by lower organisms.

(b) Sexual Reproduction
- Two individuals *i.e.*, one male and one female are needed to give rise to new individual.
- Gametes are formed.
- New individual is genetically similar but not identical to parents.
- It is useful to generate more variations in species.
- Adopted by higher organisms.

➢ **Asexual reproduction** takes place through fission, fragmentation, regeneration, budding, vegetative propagation, and spore formation. These modes of reproduction depend on the body design of the organisms.

(a) Fission: It is of two types - binary fission and multiple fission.

(i) Binary fission: It is the division of one cell into two similar or identical cells. The nucleus first divides amitotically into two, followed by the division of the cytoplasm. The cell finally splits into two daughter cells. *e.g.*, *Amoeba*

(ii) Multiple fission: In multiple fission, many individuals are formed from a single individual. *e.g.*, *Plasmodium.* The nucleus divides repeatedly, producing many nuclei and many daughter cells are formed.

(b) Fragmentation: It takes place in multicellular organisms with simple body organisation such as in *Spirogyra*. In this, the body breaks up into two or more small pieces of fragments upon maturation. These fragments grow into new individuals.

(c) Regeneration: It is the ability of a fully differentiated organism to give rise to new individual organisms from its body parts. Small cut or broken parts of the organism's body grow or regenerate into separate individuals. **For example:** *Planaria* and *Hydra*.

(d) Budding: In budding, a small part of the body of the parent grows out as a bud which then detaches and becomes a new organism. *Hydra* reproduces by budding using the regenerative cells.

(e) Vegetative Propagation: In many plants, new plants develops from vegetative parts of plant body such as stem, roots, leaves, etc.

Methods of vegetative propagation:

(i) Natural methods are:
- **(a)** By roots: *e.g.*, Dahlia, sweet potato.
- **(b)** By stems: *e.g.*, Potato, ginger.
- **(c)** By leaves: *e.g.*, *Bryophyllum* (leaf margins bear buds which develop into plants).

(ii) Artificial methods:
- **(a)** Grafting: *e.g.*, Mango
- **(b)** Cutting: *e.g.*, Rose
- **(c)** Layering: *e.g.*, Jasmine
- **(d)** Tissue culture: *e.g.*, Ornamental plants, orchid.

(f) Spore Formation: Spores are small bulb like structures which are covered by thick walls. Under favourable conditions, they germinate and produce new organisms.

Sexual Reproduction in Plants

Parts of Flower

➢ Flowers are main reproductive part of a plant. The main parts of a flower are: sepals, petals, stamens and carpels.

➢ Stamens and carpels are the reproductive parts of a flower which contain the germ cells. The male organ of a flower called '**stamen**' makes the male gamete which are present in the pollen grain. The female organ of a flower called '**carpel**' makes the female gamete, which are present in ovules of the plant.

➢ Flowers may be unisexual (*e.g.* papaya and watermelon) or bisexual (*e.g. Hibiscus* and mustard).

➢ **Pollination:** It is the transfer of pollen grain from the anther of a stamen to the stigma of a carpel. Pollination is of two types: self pollination and cross pollination.

- The transfer of pollens takes place by agent like wind, water or animals.
- After pollination, a pollen tube grows out of pollen grains, through which male germ cell reaches the ovary and fuses with the female germ cell.
- Fertilisation is the process of fusion of male and female gamete to produce zygote. It occurs inside the ovary.
- After fertilisation, ovary develops into fruit whereas ovules into the seed.
- **Double fertilisation:** It is a characteristic feature of flowering plants. In this process, out of the two sperm nuclei, one sperm nucleus fuses with the egg nucleus to form an embryo (process is called **syngamy**) and another fuses with the secondary nucleus to form an endosperm (process is called **triple fusion**).
- Because two kinds of fusion syngamy and triple fusion take place, the process is known as **double fertilisation**.

Reproduction in Human Beings

- Humans have sexual mode of reproduction.
- It needs sexual maturation, which is the period of life when production of germ cells *i.e.*, ova (female) and sperm (male) start in the body. This period of sexual maturity is called **puberty**.
- **Changes at Puberty are:**
  - **(a) Common in male and female**
    - Thick hair growth in armpits and genital area.
    - Skin becomes oily, may result in pimples.
  - **(b) In girls:**
    - Breast size begins to increase.
    - Girls begin to menstruate.
  - **(c) In boys:**
    - Thick hair grows on face.
    - Voice begins to crack.
    - These changes signals that sexual maturity is taking place.
- **Male Reproductive System**
  - **(a) Testes:** A pair of testes are located inside scrotum which is present outside the abdominal cavity. Scrotum has a relatively lower temperature needed for the production of sperms.
    Functions of testes:
    - Produce male germ cells *i.e.*, sperms are formed here.
    - Testes release male sex hormone (testosterone). Its function is to:
      (i) Regulate production of sperms.
      (ii) Bring changes at puberty.
  - **(b) Vas deferens:** It passes sperms from testes towards the urethra.
  - **(c) Urethra:** It is a common passage for both sperms and urine. Its outer covering is called **penis**. It is like a fibromuscular long tube which travels through penis.
  - **(d) Associated glands:** Seminal vesicles and prostate gland add their secretion to the sperms. This fluid provide nourishment to sperms and make their transport easy. Sperm along with secretion of glands form semen.
- **Female Reproductive System**
  - **(a) Ovary:** A pair of ovary is located in both sides of abdomen.
    - Female germ cells *i.e.*, eggs are produced here.
    - At the time of birth of a girl, thousands of immature eggs are present in the ovary.
    - At the onset of puberty, some of these eggs start maturing.
  - **(b) Oviduct or Fallopian tube**
    - Receives the egg produced by the ovary and transfer it to the uterus.
    - Fertilisation *i.e.*, fusion of gametes takes place here.
  - **(c) Uterus:** It is a bag-like structure where development of the foetus takes place.
    - Uterus opens into vagina through cervix.
    - The embryo moves down to reach the uterus. The embedding of the embryo in the thick inner lining of the uterus is called **implantation**.
- The time period from the development of foetus inside the uterus till birth is called **gestation period**. The act of giving birth to the fully developed foetus at the end of gestation period is termed as **parturition**.
- The breakdown and removal of the inner, thick and soft lining of the uterus along with its blood vessels in the form of vaginal bleeding is called **menstrual flow** or **menstruation**.

- Reproductive health is all those aspects of general health which help a person to lead a normal, safe and satisfying reproductive life.
- **Sexually Transmitted Diseases (STDs)** are the diseases which spread by sexual contact from an infected person to a healthy person. Some common STDs are Gonorrhoea, syphilis, trichomoniasis, AIDS.
- There are different methods which are developed to prevent and control pregnancy such as mechanical methods, chemical methods, oral pills and surgical methods.
- **Contraception:** It is the avoidance of pregnancy, which can be achieved by preventing the fertilisation of ova.
- **Methods of contraception**
  - **(a) Physical barrier**
    - To prevent union of egg and sperm.
    - Use of condoms, cervical caps and diaphragm.
  - **(b) Chemical methods**
    - Use of oral pills.
    - These change hormonal balance of body so that eggs are not released.
    - May have side effects.
  - **(c) Intrauterine contraceptive device (IUDs)**
    - Copper-T or loop is placed in uterus to prevent pregnancy.
  - **(d) Surgical methods**
    - In males the vas deferens is blocked to prevent sperm transfer called **vasectomy**.
    - In females, the fallopian tube is blocked to prevent egg transfer called **tubectomy**.

Mnemonics

Concept: Vegetative Reproduction

Mnemonics: Positive Example Based Learning

Interpretation:
P - Potato
E - Eyes
B - Bryophyllum
L - Leaf buds

Concept: Reproductive parts of Flower

Mnemonics: Stamina of MEN, Pistil vali MAA

Interpretation:
Stamen : Male part of a Flower
Pistil/Stigma : Female part of flower

Concept: Parts of Male Reproductive System

Mnemonics: SEVEn UP

Interpretation:
S- Seminiferous tubules
E- Epididymis
V- Vas deferens
E- Ejaculatory duct
U - Urethra
P - Penis

Concept: Accessory glands in Males

Mnemonics: Saint Peters

Interpretation:
Seminal vesicle, Prostate gland

Concept: Accessory Ducts in Females

Mnemonics: Our United Villages

Interpretation:
Oviduct, Uterus, Vagina

Concept: Birth Control Methods

Mnemonics: Swiss National Bank's Indian OffiCe

Interpretation:
Surgical, Natural, Barrier, IUD, Oral contraceptive

Concept: Barrier Methods

Mnemonics: CDC Volunteered Student's Junior Fellowship

Interpretation:
Condoms, Diaphragm, Cervical caps, vaults, Spermicidal creams, jellies, foams

Know the Terms

- **Vegetative method:** It is a method in which new plants are obtained from the vegetative parts of old plants such as stem, roots and leaves, without help of any reproductive organs.
- **Tissue culture:** It is the production or propagation of new plants from isolated plant cells or small pieces of plant tissue in a nutrient medium. This technique is also known as **micro propagation**, and in vitro culture because it takes place outside the body of the parent plant in a test tube in an artificial environment.
- **Sexual reproduction:** It is the process in which two sexes male and female are involved. The male sexual unit is known as **male gamete** or **sperm** while female sexual unit is termed as **female gamete** or **ovum**.
- **Zygote:** The cell which is formed by the fusion of a male gamete and female gamete is called **zygote**, *i.e.,* it is a '**fertilized ovum**' or '**fertilized egg**.'
- **Embryo:** It is the stage of development between the zygote or fertilized egg and the newly formed offspring.

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CHAPTER-4
HEREDITY AND EVOLUTION

Revision Notes

Heredity and Mendel's Contribution

Introduction

- Variations arise usually during the process of sexual reproduction. They may be few in asexual reproduction, but many in case of sexual reproduction.
- The minor variations arising during sexual reproduction are caused by slight inaccuracies in DNA copying. In sexual reproduction, variations are also caused by crossing over during meiosis.
- Beneficial variations help the species to survive better in the environment.
- Nature selects the beneficial variations thereby leading to evolution.
- Sexual reproduction produces offspring with similar body design of the parents. However, the offsprings are not identical and show a great deal of variation from the parents.
- **Importance of Variation:**

(i) Depending upon the nature of variations, different individuals would have different kinds of advantages. *e.g.,* Bacteria that can withstand heat will survive better in a heat wave.

(ii) Main advantage of variation to species is that it increases the chances of its survival in a changing environment.

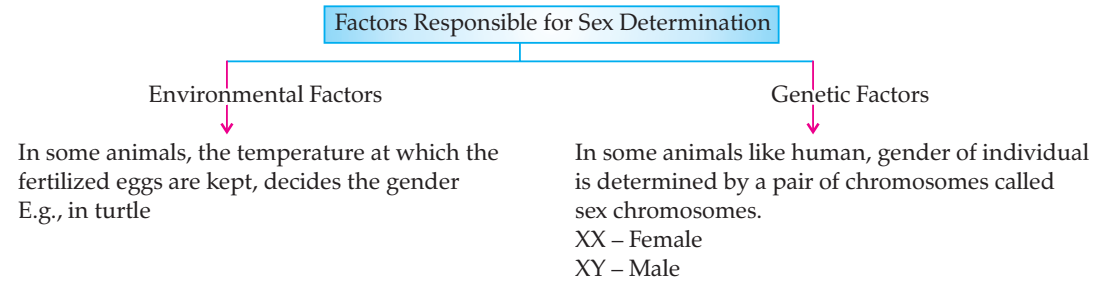
Mendel and His Work on Inheritance

- **Gregor Johann Mendel (1822-1884):** Started his experiments on plant breeding and hybridization. He proposed the laws of inheritance in living organisms.
- Mendel is known as the **Father of Genetics.**
- Plant selected by Mendel was *Pisum sativum* (garden pea). Mendel used a number of varieties of garden pea to study the inheritance of seven pairs of contrasting characters.

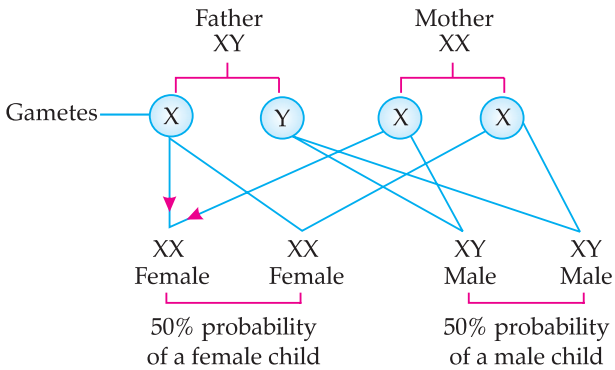
- Seven pairs of contrasting characters in garden pea, selected by Mendel were:

Character	Dominant Trait	Recessive Trait
Flower colour	Violet	White
Flower position	Axial	Terminal
Seed colour	Yellow	Green
Seed shape	Round	Wrinkled
Pod shape	Inflated	Constricted
Pod colour	Green	Yellow
Height of plant	Tall	Dwarf/Short

- Mendel conducted a series of experiments in which he crossed the pollinated plants to study one character (at a time).
- In case of monohybrid cross with pure line breeding varieties of plants, the phenotypic ratio obtained in F_2 generation was 3: 1.
- In case of dihybrid cross *i.e.*, involving two pairs of contrasting characters, the phenotypic ratio obtained in F_2 generation was 9: 3: 3: 1.
- Mendel concluded that out of any pair of contrasting characters, one is dominant *i.e.*, it makes its appearance in the hybrid while the other is recessive *i.e.*, the manifestation of the other is masked.
- The homozygous dominant trait is denoted by two capital letters whereas the homozygous recessive trait is denoted by two small letters.
- The factors or genes controlling a particular trait separate from each other during gamete formation. Hence, gamete is always pure as far as contrasting characters are considered. Each gamete will possess only one gene set.
- In crossing, if two or more traits are involved, their genes assort independently, irrespective of the combinations present in the parents.
- Genes carry information for producing proteins, which in turn control the various body characteristics.
- For a particular trait, the offspring receives one allele from the father and one allele from the mother.
- The combination of the male and female germ cells gives a diploid zygote. Thus, the normal diploid number of chromosomes in the offspring is restored.
- Different mechanisms are used for sex determination in different species.



- **Sex Chromosomes:** In human beings, there are 23 pairs of chromosomes. Out of these, 22 chromosomes pairs are called **autosomes** and the last pair of chromosome which helps in deciding sex of the individual is called **sex chromosome**.
- **Sex determination in human beings:**



Know the Terms

- **F_1 generations:** The generations resulting immediately from a cross of the first set of parents (parental generation).
- **F_2 generations:** Offsprings resulting from a cross of the members of F_1 generation.
- **Dominant:** The gene which expresses itself in F_1 hybrid generation is known as dominant gene.
- **Recessive:** The gene which is unable to express itself in presence of the dominant gene.
- **Genotype:** It is the genetic constitution of an organism which determines the phenotypic characters.
- **Phenotype:** It is the outward appearance of an individual.
- **Progeny:** The offspring produced as a result of reproduction of the parents.
- **Dominant trait:** A genetic trait is considered dominant if it is expressed in a person who has only one copy of that gene *i.e.* a trait which phenotypically expressed in heterozygote.
- **Recessive trait:** A genetic trait is considered recessive if it is expressed only when two copies of the recessive gene are present.
- **Homozygous:** Having two identical alleles of the same gene.
- **Heterozygous:** Having dissimilar alleles at corresponding chromosomal loci.
- **Monohybrid cross:** A type of cross in which only one pair of contrasting characters are considered.
- **Dihybrid cross:** A type of cross in which the inheritance of two pairs of contrasted characters is considered.
- **Allele:** Either of a pair (or series) of alternative forms of a gene that can occupy the same locus on a particular homologous pair of chromosome and that control the same character.
- **Somatic cells:** All cells forming the body of an organism, except the reproductive cells.
- **Sex chromosomes:** Either of a pair of chromosomes, usually designated X or Y, in the germ cells of most animals, that combine to determine the sex and sex-linked characteristics of an individual.
- **Gene:** A segment of DNA that is involved in producing a polypeptide chain and forms the basic unit of heredity.
- **Trait:** A trait is a distinct variant of a phenotypic character of an organism that may be inherited or environmentally determined.
- **Haploid cell:** Cell that has only one complete set of chromosomes.
- **Diploid cell:** Cell that has two sets of chromosomes, one of paternal origin, the other of maternal origin.

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THEME: NATURAL PHENOMENA
UNIT IV: EFFECTS OF CURRENT

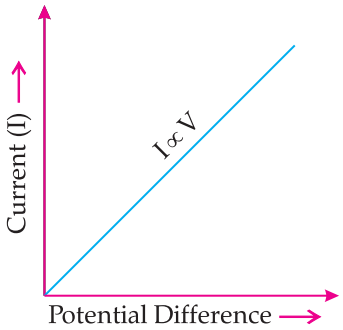
CHAPTER-5
ELECTRICITY

Revision Notes

Ohm's Law

- **Ohm's Law:** The current through a conductor between two points is directly proportional to the voltage across the two points provided external conditions remain constant.
  (i) Mathematical expression for Ohm's law:
  $I \propto V$
  $V = IR$ (Where R = Resistance)

(ii) *V-I* graph for Ohm's law:



- **Resistance (*R*):** It is the property of a conductor to resist the flow of charges through it.
  (i) S.I. unit of resistance is Ohm (Ω).
  (ii) 1 ohm = $\frac{1 \text{ volt}}{1 \text{ ampere}}$
  (iii) Mathematically, $R = \rho \frac{l}{A}$
  where, ρ = Resistivity of material
  l = Length of conductor
  A = Cross- section area of material
- When potential difference is 1 V and current through the circuit is 1 A, then resistance is 1 Ω.
- **Rheostat:** Rheostat is a variable resistor used to regulate current without changing the source of voltage.
- **Factors on which the Resistance of a Conductor depends:** Resistance of a uniform metallic conductor is,
  (i) directly proportional to the length of conductor.
  (ii) inversely proportional to the area of cross-section.
  (iii) directly proportional to the temperature.
  (iv) depends on nature of the material.
- **Resistivity (ρ):** It is defined as the resistance offered by a cube of a material of side 1 m when current flows perpendicular to its opposite faces.
  (i) Its S.I. unit is ohm-metre (Ωm).
  (ii) Resistivity does not change with change in length or area of cross-section but it changes with change in temperature.
  (iii) Range of resistivity of metals and alloys is 10^{-8} to 10^{-6} Ωm.
  (iv) Range of resistivity of insulators is 10^{12} to 10^{17} Ωm.
  (v) Resistivity of alloy is generally higher than that of its constituent metals.
  (vi) Alloys do not oxidize (burn) readily at high temperature, so they are commonly used in electrical heating devices.
  (vii) Copper and aluminium are used for electrical transmission lines as they have low resistivity.

Resistance in Series and Parallel Combination, Electric Power and Heating Effect

- **Resistances in series:** When two or more resistances are connected end to end so that same current flows through each one of them in turn, they are said to be connected in series. Here, the total resistance is equal to the sum of the individual resistances.

$$R_s = R_1 + R_2 + R_3 + ...$$

- **Resistances in parallel:** When two or more resistances are connected across two points so that each one of them provides a separate path for current, they are said to be connected in parallel. Here, the reciprocal of their combined resistance is equal to the sum of the reciprocals of the individual resistances.

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

- **Heating effect of current** : When an electric current is passed through a conductor, heat is produced in it. This is known as heating effect of current.
- **Joule's law of heating:** It states that the heat produced in a conductor is directly proportional to **(i)** the square of the current *I* through it, **(ii)** its resistance *R* and **(iii)** the time *t*, for which current is passed.

Mathematically, it can be expressed as :

$$H = I^2 Rt \text{ joule} = \frac{I^2 Rt}{4.18} \text{cal}$$

Or

$$H = VIt \text{ joule} = \frac{VIt}{4.18} \text{cal}$$

- **Practical application of the heating effect of electric current:** It is utilised in the electrical heating appliances such as electric iron, room heaters, water heaters etc. The electric heating is also used to produce light as in an electric-bulb.
- **Electric energy:** It is the total work done in maintaining an electric current in an electric circuit for a given time.
  Electric energy, $W = VIt = I^2Rt$ joule
- **Electric Fuse:** It is a safety device that protects our electrical appliances in case of short circuit or overloading.
  (i) Fuse is made up of pure tin or alloy of copper and tin.
  (ii) Fuse is always connected in series with live wire.
  (iii) Fuse has low melting point.
  (iv) Current capacity of fuse is slightly higher than that of the appliance.
- **Electric Power:** The rate at which electric energy is consumed or dissipated in an electric circuit is known as Electric Power.

$$P = VI$$

$$P = I^2R = \frac{V^2}{R}$$

- **Watt:** It is the SI unit of power. The power of an appliance is 1 watt if one ampere of current flows through it on applying a potential difference of 1 volt across its ends.

$$1 \text{ watt} = \frac{1 \text{ joule}}{1 \text{ second}} = 1 \text{ volt} \times 1 \text{ ampere}$$

Or

$$1 \text{ W} = 1 \text{Js}^{-1} = 1 \text{VA}$$

$$1 \text{ kilowatt} = 1000 \text{ W}$$

- **Kilowatt hour:** It is the commercial unit of electrical energy. One kilowatt hour is the electrical energy consumed by an appliance of 1000 watts when used for one hour.

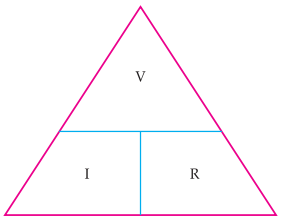
$$1 \text{ kilowatt hour (kWh)} = 3{\cdot}6 \times 10^6 \text{ J}$$

- **Power rating:** The power rating of an appliance is the electric energy consumed per second by the appliance when connected across the marked voltage of the mains.
- **Efficiency of an electrical device:** It is the ratio of the output power to the input power.

$$\text{Efficiency, } \eta = \frac{\text{Output power}}{\text{Input power}}$$

Mnemonics

Concept: Ohm's Law



Interpretation:
To find V=Multiply I and R
To find I=Divide V by R
To find R=Divide V by I

Concept: Connection of ammeter and voltmeter
Mnemonics: Am Sleeping Very Patiently
Interpretation: **Ammeter is connected in Series** **Voltmeter is connected in Parallel**

Concept: Formula of power	
Mnemonics: Twinkle Twinkle Little Star Power equals I squared R	
Interpretation: **$P = I^2 R$**	

Know the Terms

- **Ohm:** It is the SI unit of resistance. A conductor has a resistance of one ohm if a current of one ampere flows through it on applying a potential difference of 1 volt across its ends.

$$1 \text{ ohm} = \frac{1 \text{volt}}{1 \text{ ampere}} \quad \text{or} \quad 1\,\Omega = \frac{1\text{V}}{1\text{ A}}$$

- **Resistor:** A conductor which has some appreciable resistance is called a 'resistor'.
- **Semiconductors:** Materials having resistivity between that of an insulator and a conductor are called semiconductors. They are used in making integrated circuits.
- **Superconductors:** These are certain materials that lose their resistivity at low temperature. Such materials are called as superconductors. The phenomenon of complete loss of resistivity by substances below a certain temperature is called superconductivity.
- **Fuse Wire:** The wire which melts, breaks the circuit and prevents the damage of various appliances in the household connections. It is connected in series with live line and its thickness determines the maximum current that can be drawn. It is made of an alloy of aluminium, copper, iron and lead.

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CHAPTER-6
MAGNETIC EFFECTS OF ELECTRIC CURRENT

Revision Notes

Magnetic Field

Magnet:

- The black ore of iron (Fe_3O_4) called magnetite, capable of attracting similar pieces of iron is called lodestone. They are naturally existing magnets used by human to find the directions.
- There are two poles of a magnet namely North pole and South pole. Like poles repel each other, while unlike poles attract each other.
- H.C. Oersted, a Danish physicist first noticed the magnetic effect of electric current. According to him, a needle kept near the wire carrying current will deflect due to the magnetic field produced. Any change in the direction of current will show variation in the deflection.
- Magnet is any substance that attracts iron or iron-like substances.
- **Properties of magnet**

(i) Every magnet has two poles *i.e.*, North and South.

(ii) Like poles repel each other.

(iii) Unlike poles attract each other.

(iv) A freely suspended bar magnet aligns itself in nearly north-south direction, with its north pole towards north direction.

- The substances which are attracted by a magnet are called **magnetic substances**. **Examples:** Iron, nickel, cobalt, steel etc. The substances which are not attracted by a magnet are called **non-magnetic substances. Examples:** wood, glass, copper, aluminium, brass, paper etc.
- **Magnetic Field:** The area around a magnet in which its magnetic force can be experienced.

(i) Its SI unit is Tesla (T).

(ii) Magnetic field has both magnitude and direction.

(ii) Magnetic field can be described with help of a magnetic compass.

- **Magnetic needle:** The needle of a magnetic compass is a freely suspended bar magnet.
- **Characteristics of Field Lines**

(i) Field lines arise from North pole and end into South pole of the magnet.

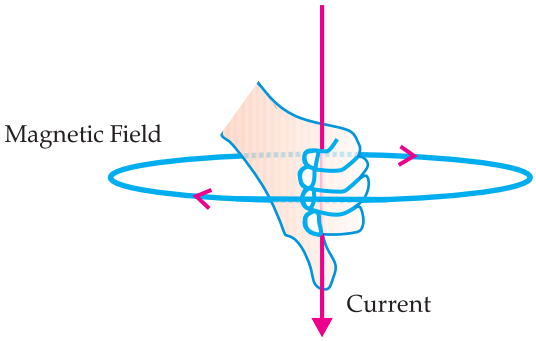
(ii) Field lines are closed curves.

(iii) Field lines never intersect each other as for two lines to intersect, there must be two directions of magnetic field at a point, which is not possible.

(iv) Direction of field lines inside a magnet is from South to North.

(v) The relative strength of magnetic field is shown by degree of closeness of field lines. Field lines are closer in stronger magnetic field.

- **Right Hand Thumb Rule:** Imagine you are holding a current carrying straight conductor in your right hand such that the thumb is pointing towards the direction of current. Then the fingers wrapped around the conductor give the direction of magnetic field.



- **Magnetic Field Due to Current through a Straight Conductor**

- It can be represented by concentric circles at every point on conductor.
- Direction can be given by right hand thumb rule or compass.
- Circles are closer near the conductor.
- Magnetic field ∝ Strength of current
- Magnetic field $\propto \frac{1}{\text{Distance from the conductor}}$

- **Magnetic Field Due to Current through a Circular Loop**

- It can be represented by concentric circles at every point.
- Circles become larger and larger as we move away.
- Every point on wire carrying current would give rise to magnetic field appearing as straight line at centre of the loop.
- The direction of magnetic field inside the loop is same.

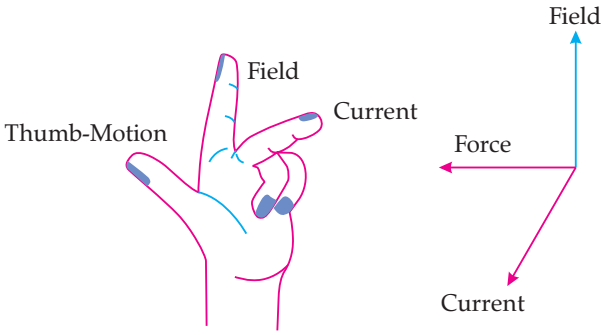
- **Factors affecting magnetic field of a circular current carrying conductor**

(i) Magnetic field ∝ Current passing through the conductor

(ii) Magnetic field $\propto \frac{1}{\text{Distance from conductor}}$

(iii) Magnetic field ∝ No. of turns in the coil

- Magnetic field is additive in nature *i.e.*, magnetic field of one loop adds up to magnetic field to another loop. This is because the current in each circular turn has some direction.
- A coil of large number of turns closely wound on a hollow cylinder of insulated material or otherwise is called a **solenoid**. The end of the solenoid having clockwise current will act as south while on the other hand having anti-clockwise current will act as north pole. Thus, a solenoid acts as a normal magnet.
- **Permanent magnets:** They are made of carbon steel, chromium steel, tungsten steel and some alloys like Alnico and Nipermag. Alnico is an alloy of aluminium, nickel and cobalt. Nipermag is an alloy of iron that contains nickel, aluminium and titanium.
- When a material is placed inside a coil carrying current, it will get magnetised. A bunch of nails or an iron rod placed along the axis of the coil can be magnetised by the current when allowed to pass through the coil. Such magnets are called electromagnets.
- **Ampere** suggested that when a current I passes through a conductor of length l placed in a perpendicular magnetic field B, then the force experienced is given by $F = IBl \sin\theta$, where θ is the angle between the length of the conductor and magnetic field.
- **Fleming's Left Hand Rule:** Stretch the thumb, forefinger and middle finger of your left hand such that they are mutually perpendicular. If fore finger points in the direction of magnetic field, middle finger in the direction of current then thumb will point in the direction of motion or force.

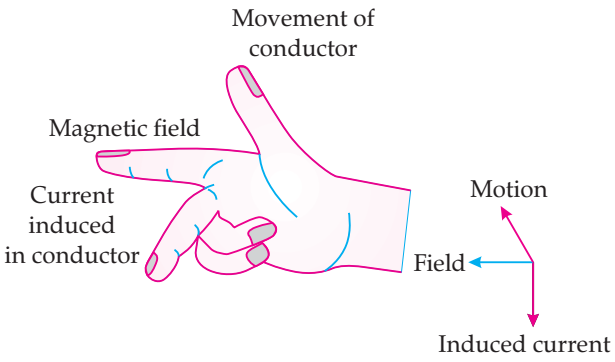


Electric Motor

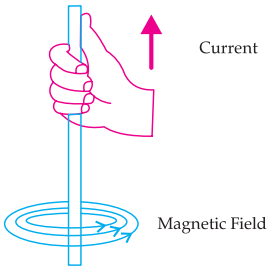
- **Electric motor:** It is a device used to convert electrical energy to mechanical energy. It works on the principle that force experienced by a current carrying conductor in a magnetic field.
- **Faraday's Law:** The rate at which the magnetic flux linked with a coil changes, produces the induced emf or current. More the rate, more the current and vice-versa.

$$e_{emf} = -\frac{d\phi}{dt}$$

- **Fleming's Right Hand Rule:** Hold the thumb, the forefinger and the middle finger of right hand at right angles to each other. If the fore finger is in the direction of magnetic field and the thumb points in the direction of motion of conductor, then the direction of induced current is indicated by middle finger.



Mnemonics

Concept: Right Hand Thumb Rule	Concept: Direction of field lines
Mnemonics: When current move upwards, wrap magnetic field	**Mnemonics: O Maria Mr. Fox is moving from North to South**
Interpretation: 	**Interpretation:** **Outside** **Magnet** **Magnetic** **Field** **North** **South**

Know the Terms

- **Magnetic field lines:** Magnetic line of force are imaginary lines representing the direction of magnetic field such that the tangent at any point gives the direction of the field at that point.
- **Magnetic field:** The area around a magnet in which its effect can be experienced is called magnetic field.
- **Magnetic effects of current:** When electric current flows through a conductor, a magnetic field is produced around it. This is called magnetic effects of current.
- **Electromagnet:** An electromagnet is a solenoid coil that attains magnetism due to the flow of current. It works on the principle of magnetic effect of current.
- **Electromagnetic induction:** The production of electric current due to relative motion between a conductor and a magnetic field is called electromagnetic induction. Electric current produced due to this phenomenon is called induced current.
- **Magnetic flux:** It is defined as the product of the magnetic field and the area through which magnetic field passes perpendicularly. Magnetic flux, $\phi = nBA$, when field passes perpendicular to the plane of the coil. It is measured in weber. If B and A are at angle θ, $\phi = nBA \cos\theta$, where n is the number of turns.

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CHAPTER-7
OUR ENVIRONMENT

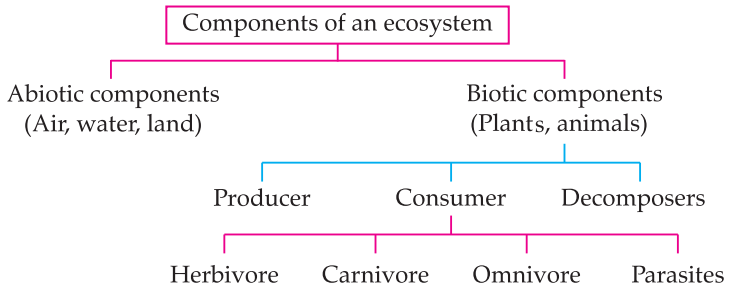
Revision Notes

Ecosystem and Food Chain

- Everything that surrounds us is environment. It includes both living (biotic) and non-living (abiotic) components.
- Interaction between these biotic and abiotic components forms an ecosystem.
- In an ecosystem, living components depend on each other for their food which gives rise to food chains and food webs in nature.
- Human activities lead to environmental problems such as depletion of ozone layer and production of huge amount of garbage.
- **Ecosystem:** All the interacting organisms in an area together with the non-living constituents of the environment form an ecosystem. *e.g.*, forest, pond etc.
- **Types of Ecosystem**: It is of two types:

  (a) Natural Ecosystem: The ecosystem which exists in nature on its own. *e.g.*, forest, lake, ocean, etc.

  (b) Artificial Ecosystem: Man-made ecosystem is called artificial ecosystem. *e.g.*, crop field, aquarium, garden, etc.



- Herbivores, carnivores, omnivores and parasites are the various type of consumers.
- **Consumers** are those organisms which depend upon the producers for food, either directly or indirectly by feeding on other consumers for their sustenance. They are also called *heterotrophs*.
- **Parasites** are those organisms that live outside (ectoparasites) or inside (endoparasites) the body of another organisms, *i.e.*, host *e.g.*, parasites of human include fleas and lice.
- **Decomposers** are those micro-organisms that obtain energy from the chemical break down of dead organisms or animals or plant wastes. Decomposers break down the complex organic substances into simple inorganic substances that go into the soil and are used up again by the plants.
- **Food chain** is the sequence of organisms through which food energy flows in an ecosystem. It is a succession of organisms that eat other organisms and may, in turn, be eaten themselves. **Examples:**

Grass	→	Grasshopper	→	Frog	→	Snake	→	Eagle
(Producer)		(Herbivore)		(Carnivore)		(Carnivore)		(Top Carnivore)

- **Trophic Levels** are the various steps or levels in the food chain where transfer of food or energy takes place. Producers are the first trophic level, herbivores are the second trophic level, carnivores or secondary consumers are the third trophic level and large carnivores or tertiary consumers are the fourth trophic level.
- **Food Web** is the network of various food chains which are interconnected at various trophic levels. Since an organism can occupy position in more than one food chain, in a food web it occupies more than one trophic level. It represents the feeding relationship within the community.

- **Energy Flow:** The flow of energy through different steps in the food chain is unidirectional. This means that the energy that is captured by the autotrophs does not revert back to the solar input and the energy which passes to the herbivores does not come back to autotrophs.
- **10 Percent Law**: It states that only 10 per cent of food energy is transferred from one trophic level to the next level. The remaining 90 per cent energy is used in life processes (digestion, growth, reproduction, etc.) by the present trophic level.
- Due to this gradual decrease in energy, food chains contain 3 - 4 trophic levels.
- **Biological Magnification:** The concentration of harmful chemicals goes on increasing with every next trophic level in a food chain. This is called as *biological magnification*.
- Maximum concentration of such chemicals get accumulated in human bodies as human occupy the top level in any food chain.

Biodegradable and Non-Biodegradable Substances and Global Warming

- **Waste Materials:** Improvements in lifestyle have resulted in accumulation of large amounts of waste materials.
- **Garbage contains following type of materials:**
  - **(a) Biodegradable Wastes:** Substances which can be decomposed by the action of micro-organisms are called as biodegradable wastes. *e.g.*, fruit and vegetable peels, cotton, jute, dung, paper, etc.
  - **(b) Non-biodegradable Wastes:** Substances which cannot be decomposed by the action of micro-organisms are called as non-biodegradable wastes. *e.g.*, plastic, polythene, metals, synthetic fibres, radioactive wastes, pesticides, etc.
- **Methods of Waste Disposal:**
  - **(a) Biogas Plant:** Biodegradable waste can be used in biogas plant to produce biogas and manure.
  - **(b) Sewage Treatment Plant:** The drain water can be cleaned in sewage treatment plant before adding it to rivers.
  - **(c) Land Fillings:** The wastes are buried in low lying areas and are compacted by rolling with bulldozers.
  - **(d) Composting:** Organic wastes are filled in a compost pit and covered with a layer of soil. After about three months garbage changes to manure.
  - **(e) Recycling:** Non-biodegradable waste are recycled to make new items.
  - **(f) Reuse:** It is a conventional technique to use an item again *e.g.*, newspaper for making envelops.
- Ozone (O_3) is not the isotope of oxygen. It is a molecule formed by three atoms of oxygen. Ozone performs an essential function of shielding the surface of the earth from ultraviolet radiation of the sun.

$$O_2 \xrightarrow{UV} 2O$$

$$O_2 + O \longrightarrow \underset{\text{Ozone}}{O_3}$$

- Ozone layer is a layer of the earth's atmosphere in which most of the atmosphere's ozone is concentrated.
- Ozone layer protects the earth from harmful UV radiations.
- **There are several reasons for depletion of the ozone layer :**
- (a) The foremost is the use of chlorofluorocarbons (CFCs). (b) The other factor responsible for ozone destruction is the pollutant nitrogen monoxide (NO).
- When the harmful chemicals like chlorofluorocarbons (CFCs) are released into the air, it accumulates in the upper atmosphere and reacts with ozone resulting in reduction in thickness of the ozone layer.
- Thus, the ozone layer in the atmosphere becomes thinner and gets depleted allowing more ultraviolet rays to pass through it. This phenomenon is referred as the Ozone hole.
- The Antarctic hole in ozone layer is caused due to chlorine molecules present in chlorofluorocarbons (CFCs), that are used by human beings.

Mnemonics

Concept: Major components of environment

Mnemonics: WASAP

Interpretation:

W - Water
A - Air
S - Soil
A - Animals
P - Plants

Know the Terms

- **Environment:** It is the sum total of all biotic and abiotic components occurring naturally.
- **Biodegradable substances:** Substances which are broken down into simpler, harmless substances in nature in due course of time by the biological processes such as action of micro-organisms.
- **Non–biodegradable substances:** Substances which cannot be broken down into simpler, harmless substances in nature. These substances may be in solid, liquid or gaseous form and may be inert and accumulate in the environment or may concentrate in the food chain and harm the organisms.

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