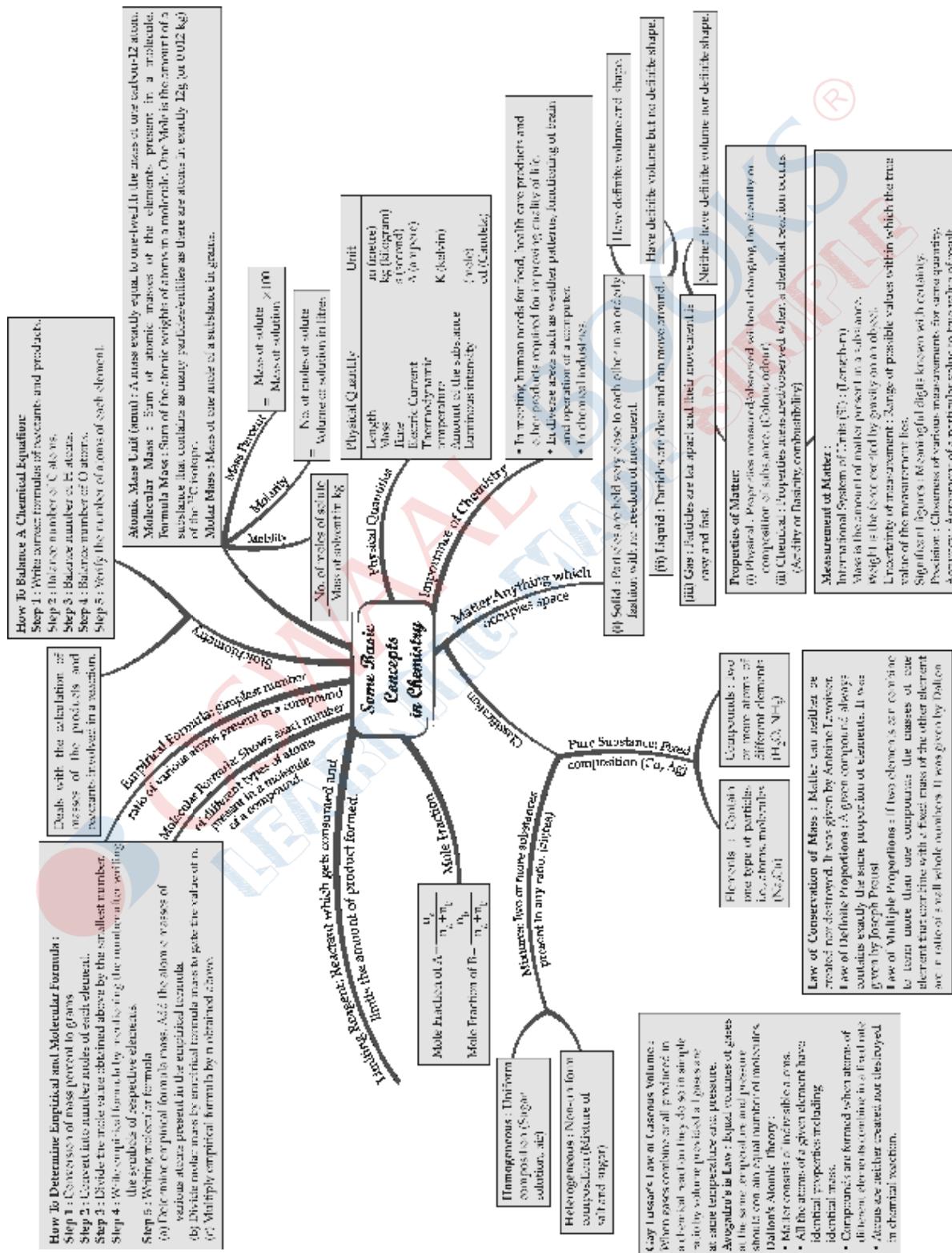


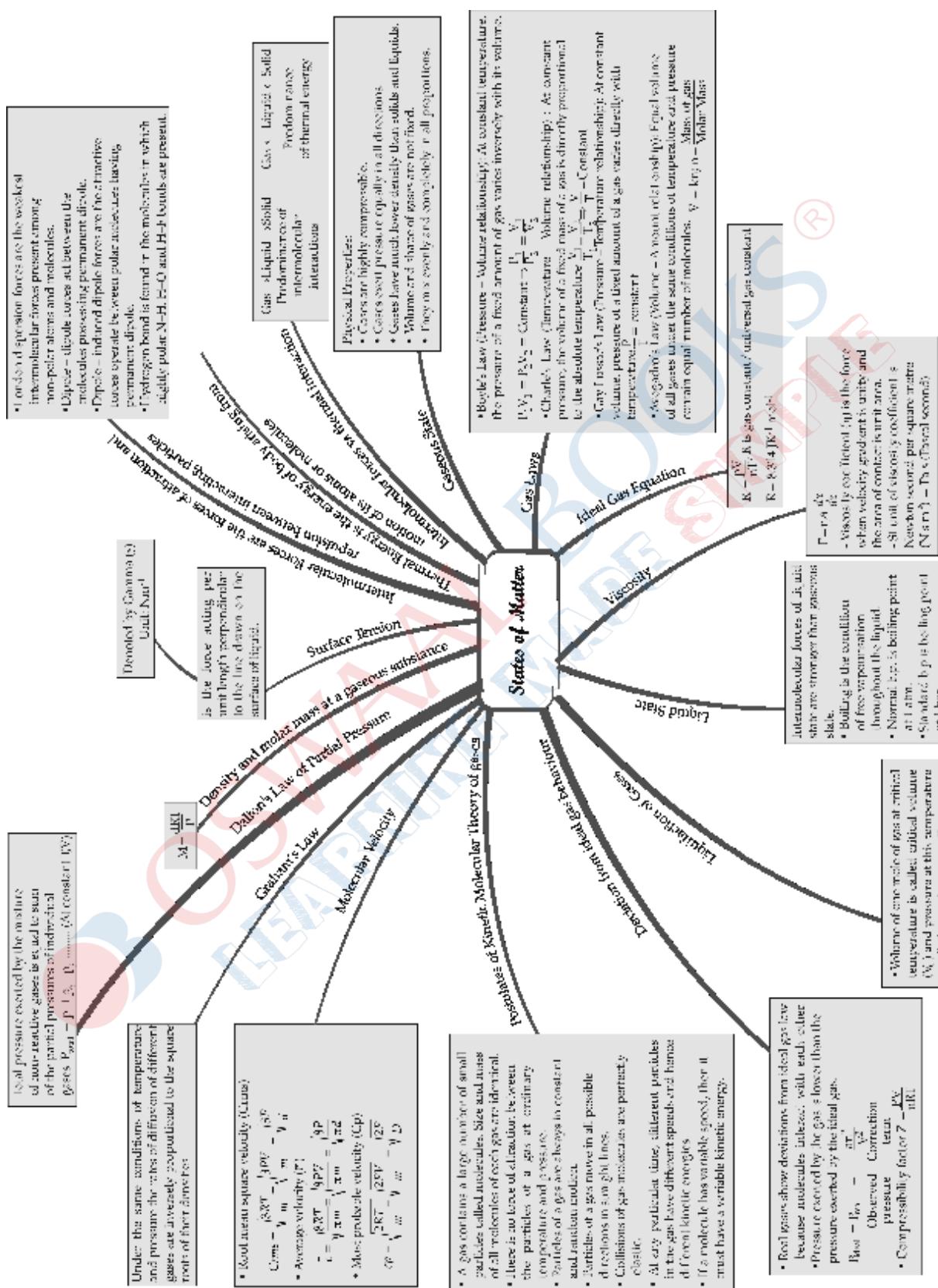
CHEMISTRY

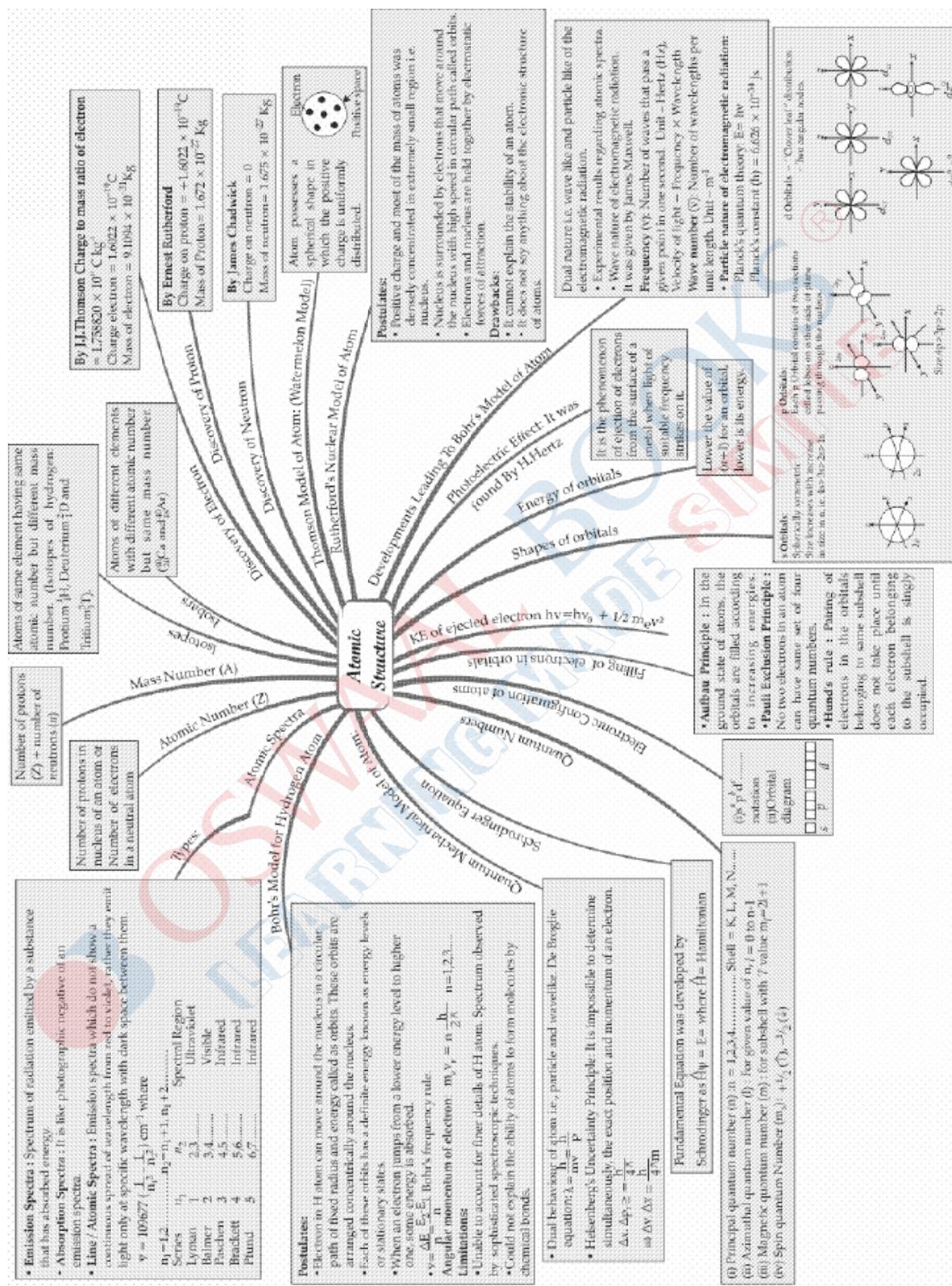
MIND MAPS

&

MNEMONICS







Types :

- (i) **Covalent Bond** : A chemical bond formed between two atoms by mutual sharing of electrons between them to complete their octet.
- (ii) **Ionic Bond** : A chemical bond formed by complete transfer of electrons from one atom to another to acquire the stable structures noble gas configuration.
- (iii) **Coordinate bond** : A chemical bond formed by donation of two electrons from one atom to another to complete their octet.

Energy required to completely separate one molecule of a solid ionic compound into gaseous constituent ions.

Postulates :

- Electrons in a molecule are present in various molecular orbitals as electrons are present in atomic orbitals.
- Atomic orbitals of comparable energies and proper symmetry combine.
- Atomic orbital is monocentric while a molecular orbital is polycentric.
- Number of molecular orbitals formed is equal to number of combining atomic orbitals.
- Bonding molecular orbital has low energy and high stability.
- Types of MO : σ (Sigma), π (Pi), δ (Delta).

Chemical Bond: Attractive forces which hold the various constituents together in different chemical species.

Molecular orbital theory

Lattice Enthalpy

Valence Shell Electron Pair Repulsion (VSEPR)

Hybridization

Chemical Bonding and Molecular Structure

Postulates :

- Shape of molecule depends upon the number of valence shell electron pairs around central atom.
- Pairs of electrons in the valence shell repel one another.
- These pairs of electrons tend to occupy such positions in space that minimize repulsion.
- The valence shell is taken as a sphere with electron pairs localising on spherical surface at maximum distance from one another.
- A multiple bond is treated as it is a single electron pair and the two or three electron pairs of a multiple bond are treated as a single super pair.
- When one or more resonance structures can represent a molecule, VSEPR model is applicable.

Decreasing order of repulsive interaction :

$$\text{Lo} > \text{Lo} > \text{bp} > \text{bp} - \text{bp}$$

Valence Bond Theory : Given by L Pauling, it explains that a covalent bond is formed between two atoms by overlap of their half-filled valence orbitals, each of which contains one unpaired electron.

Orbital Overlap Concept : Formation of a covalent bond results by pairing of electrons in valence shell with opposite spins.

Types of Overlapping :

- (i) Same (or) bond - end to end.
- (ii) Fn (n) bond - axis (or) parallel to each other.

Hybridisation : Process of intermixing of orbitals of different energies resulting in formation of new set of orbitals of equivalent energies and shape.

Types of Hybridisation - (i) sp^2 (ii) sp^3

Bonding Molecular Orbitals : Addition of atomic orbitals.

Antibonding Molecular Orbitals : Subtraction of atomic orbitals.

Postulates :

- Lewis pictured the atoms as positively charged "kernel" and the outer shell accommodates a maximum of eight electrons.
- Lewis postulated that atoms achieve the stable octet when linked by chemical bonds.
- Lewis gave following facts :
 - In the periodic table, highly electronegative halogens and highly electropositive alkali separated by noble gases.
 - Formation of a negative ion from a halogen atom and a positive ion from an alkali metal atom is associated with gain and loss of electron by respective atoms.
 - Negative and positive ions formed attain noble gas electronic configuration.
 - Negative and positive ions are stabilized by electrostatic attraction.
- Octet Rule** : Atoms can combine either by transfer of valence electrons from one atom to another or by sharing of valence electrons to complete octet in their valence shells.
- Lewis dot Structure provides a picture of bonding in molecules and ions in terms of the shared pairs of electrons and the octet rule.

How To Write A Lewis Dot Structure:

Step 1 : Add the valence electrons of the combining atoms to obtain total number of electrons.

Step 2 : Negative and positive ions are stabilized by electrostatic attraction. For cations, each positive charge means addition of one electron from total number of valence electrons.

Step 3 : Write chemical symbols of combining atoms.

Step 4 : Least electronegative atom occupies central position.

Step 5 : After accounting for shared pairs of electrons, remaining are either utilized for multiple bonding or remain as lone pairs.

Formal Charge = [Total number of valence electrons in free atom] - [Initial number of non-bonding electrons] + 1/2[total number of bonding electrons].

Limitations Of Octet Rule :

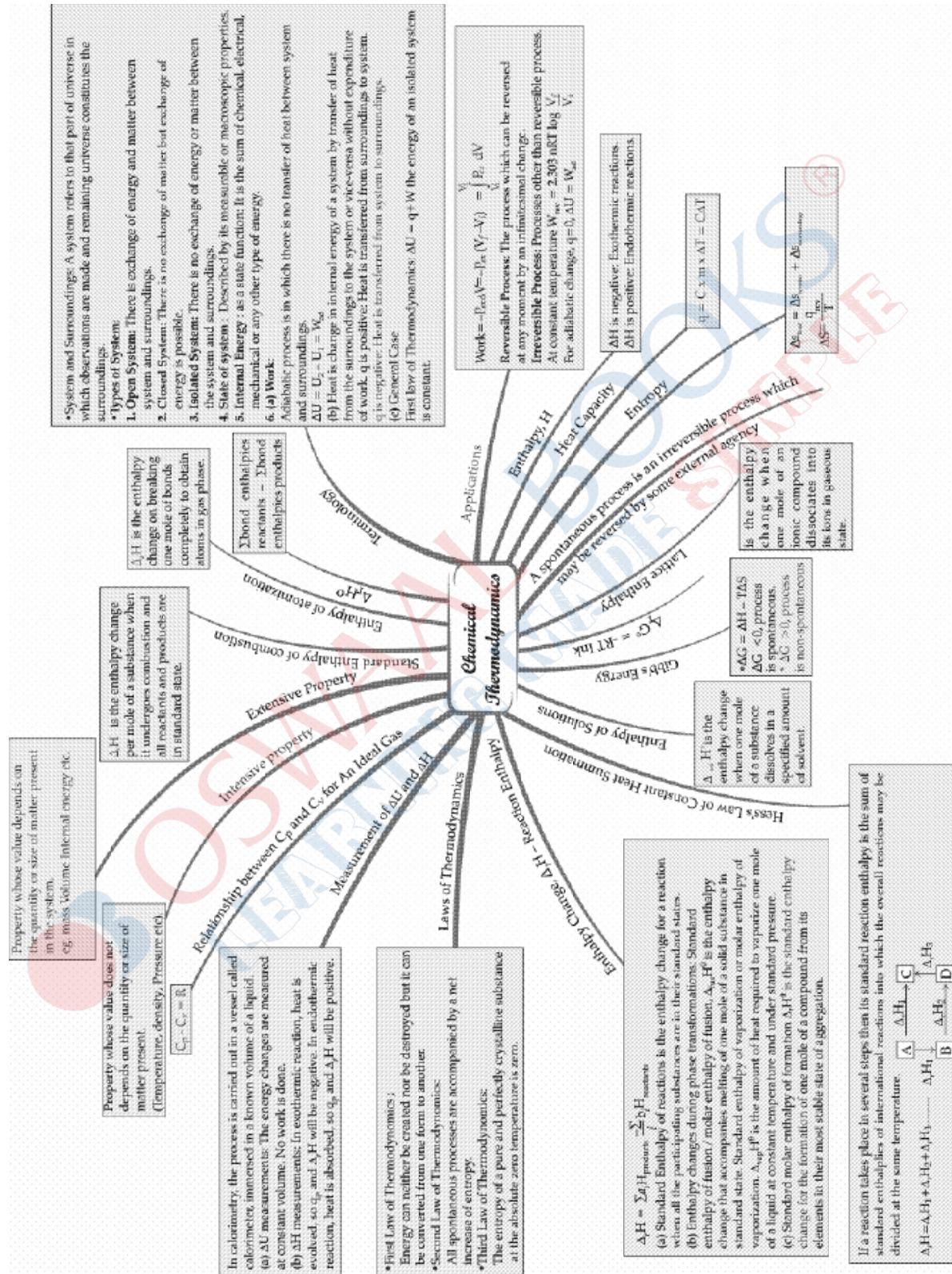
- Shows three types of exceptions i.e. incomplete octet of central atom, odd-electron molecules and expanded octet.
- Does not account for the shape of molecules.
- Fail to explain stability of molecules.
- Hydrogen Bond : formed when the negative end of one molecule attracts the positive end of other.

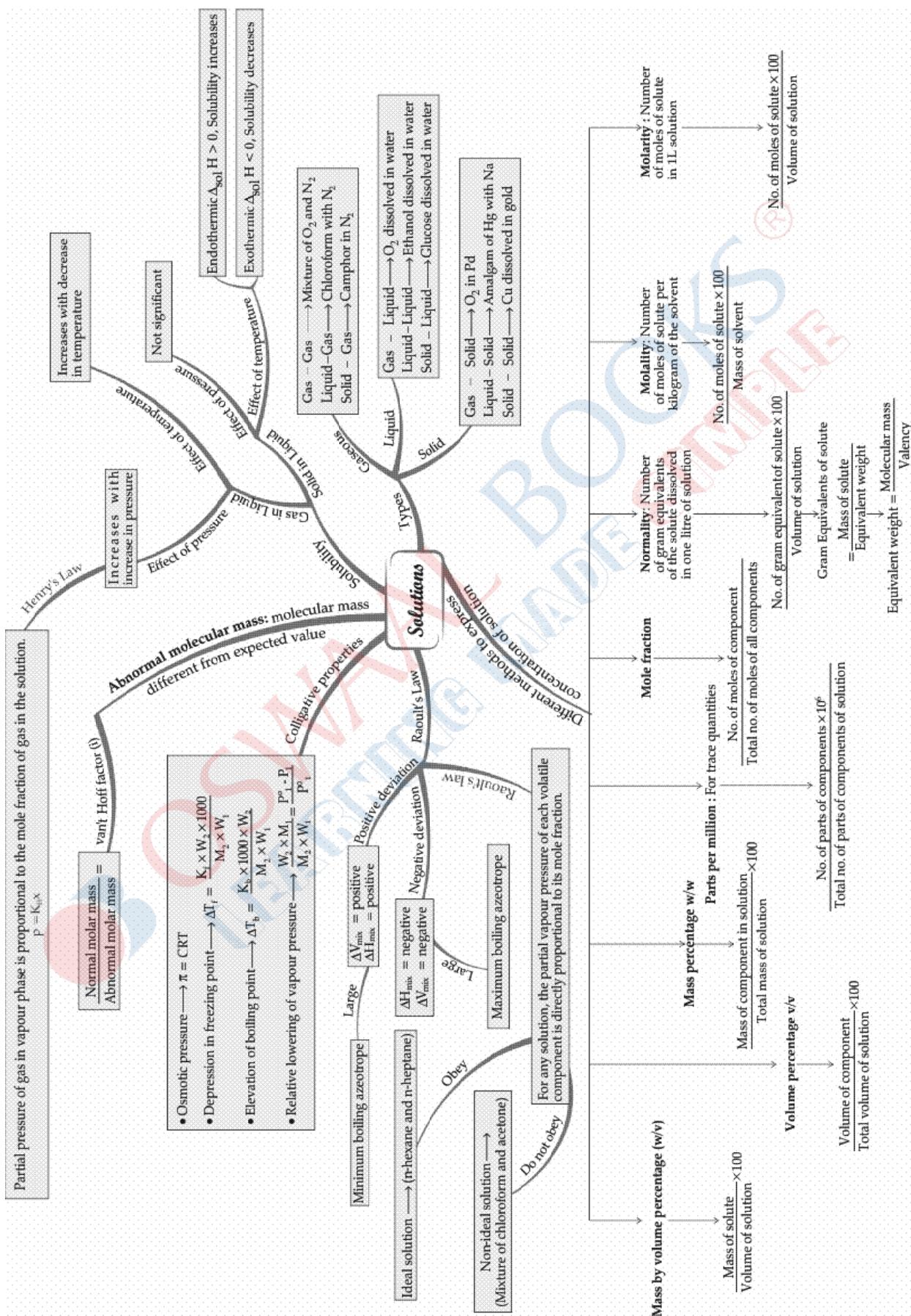
Types

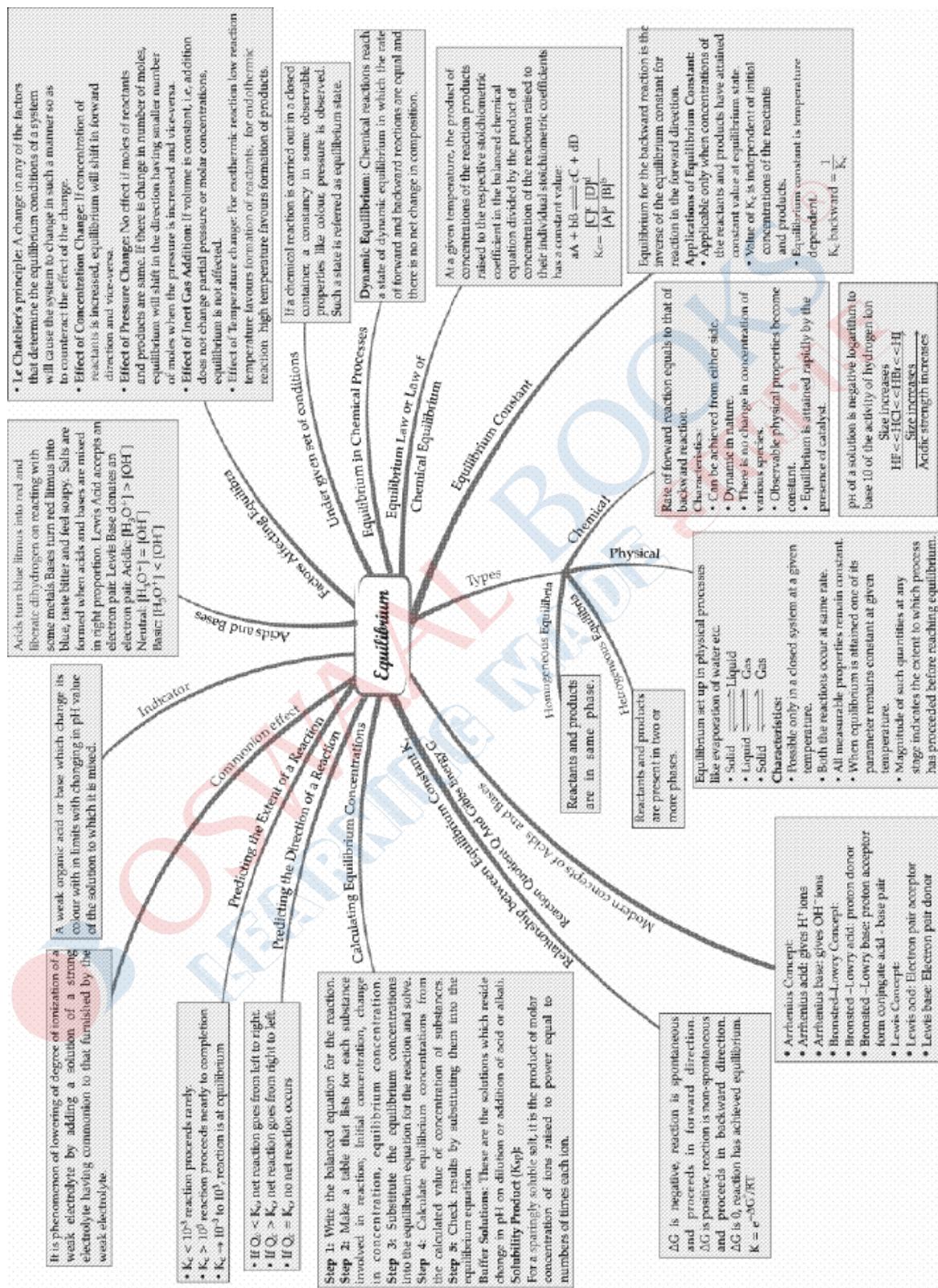
- (i) **Intermolecular** : Between two different molecules of same or different substances.
- (ii) **Intramolecular** : Between two highly electronegative atoms in the same molecule.

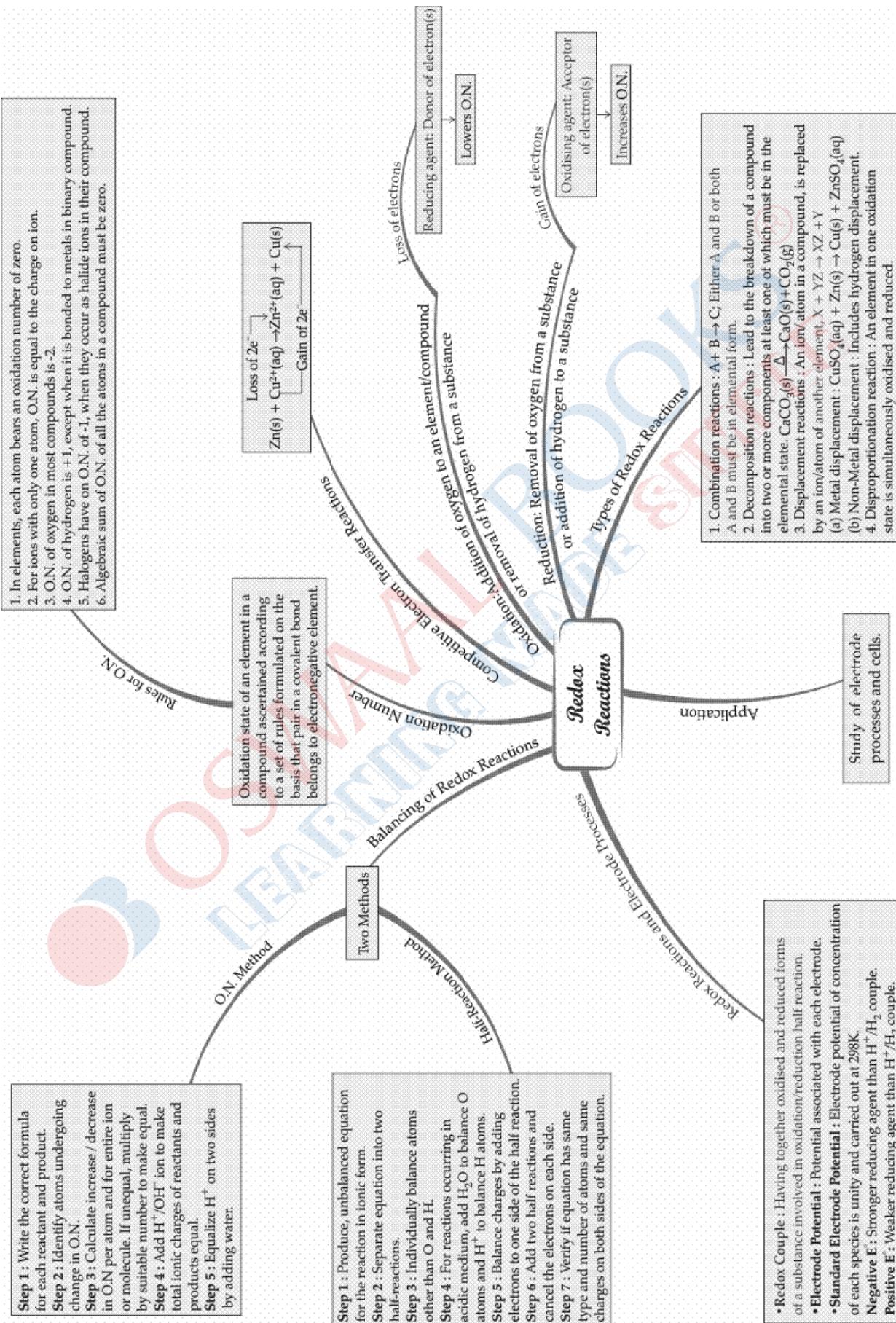
Postulates :

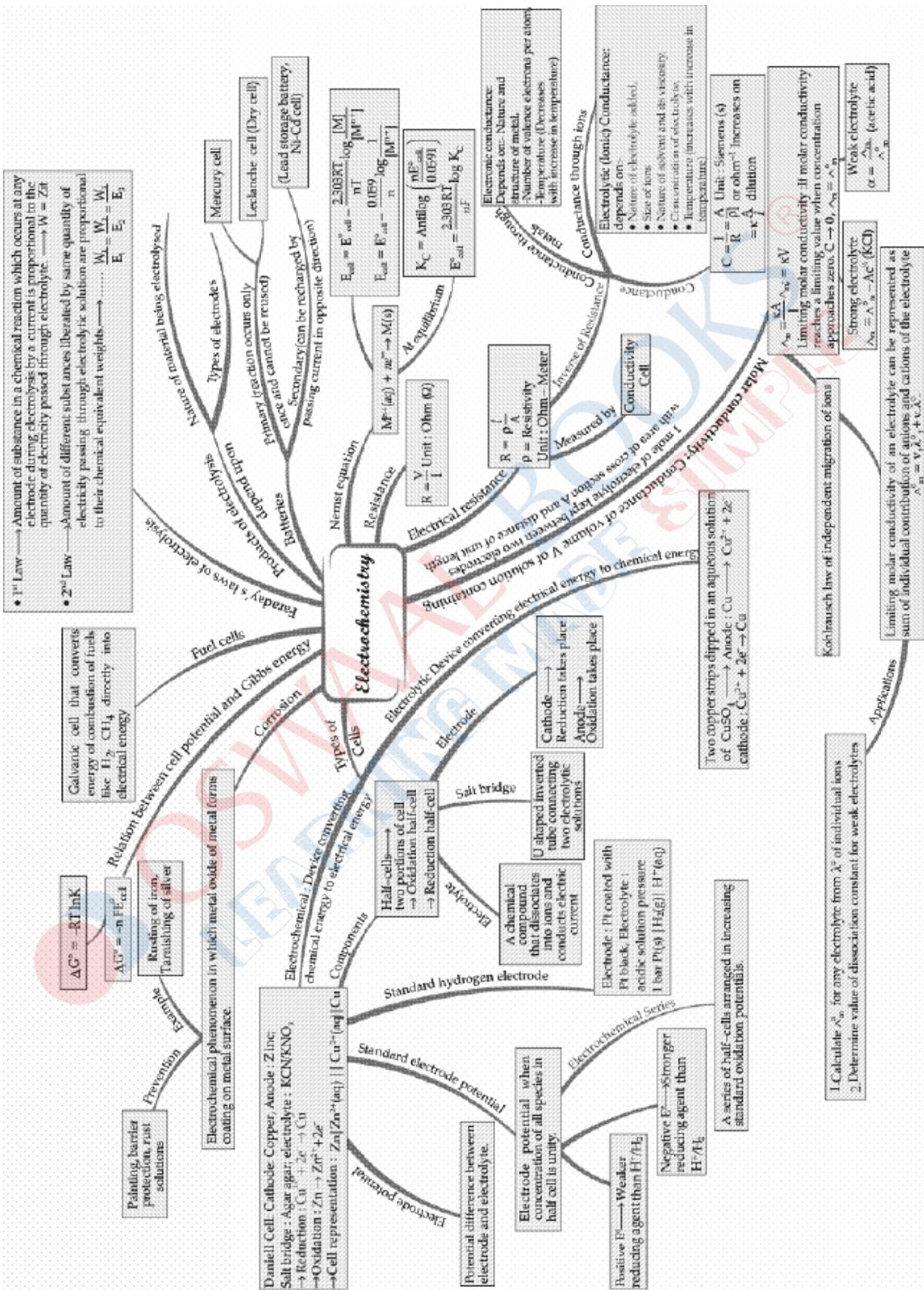
- (i) **Bond Length** : Equilibrium distance between the nuclei of two bonded atoms in molecule.
- (ii) **Bond Angle** : Angle between the orbitals containing bonding electron pairs around central atom in a molecule complex ion.
- (iii) **Bond Enthalpy** : Amount of energy required to break one mole of bonds of particular type between two atoms.
- (iv) **Bond Order** : Number of bonds between the two atoms of a molecule.
- (v) **Resonance Structures** : A set of two or more Lewis structures that collectively describe the electronic bonding in a single polyatomic species.
- (vi) **Dipole Moment** : Product of the magnitude of the charge and distance between centre of positive and negative charge ($\mu = Q \times r$)

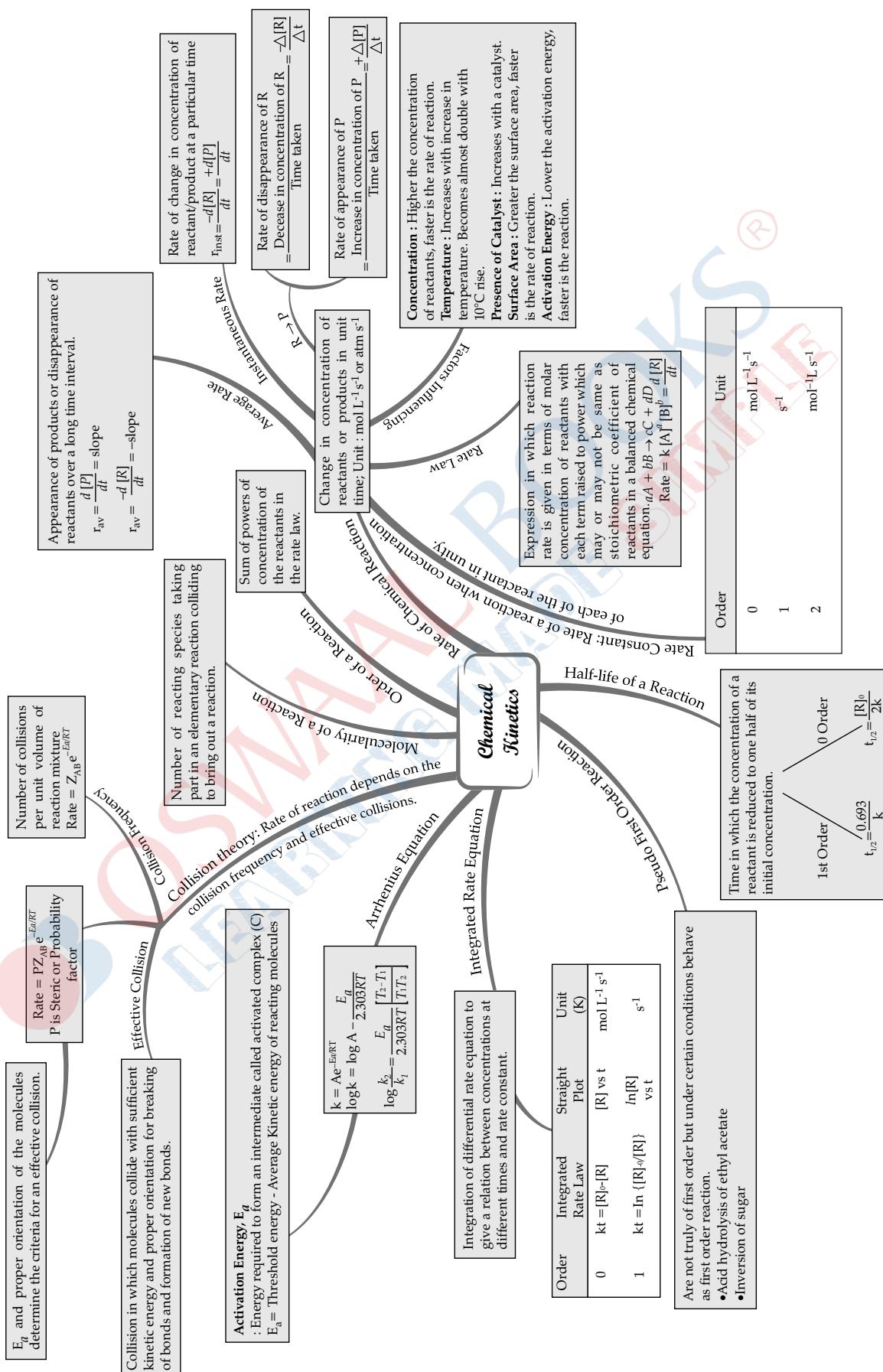


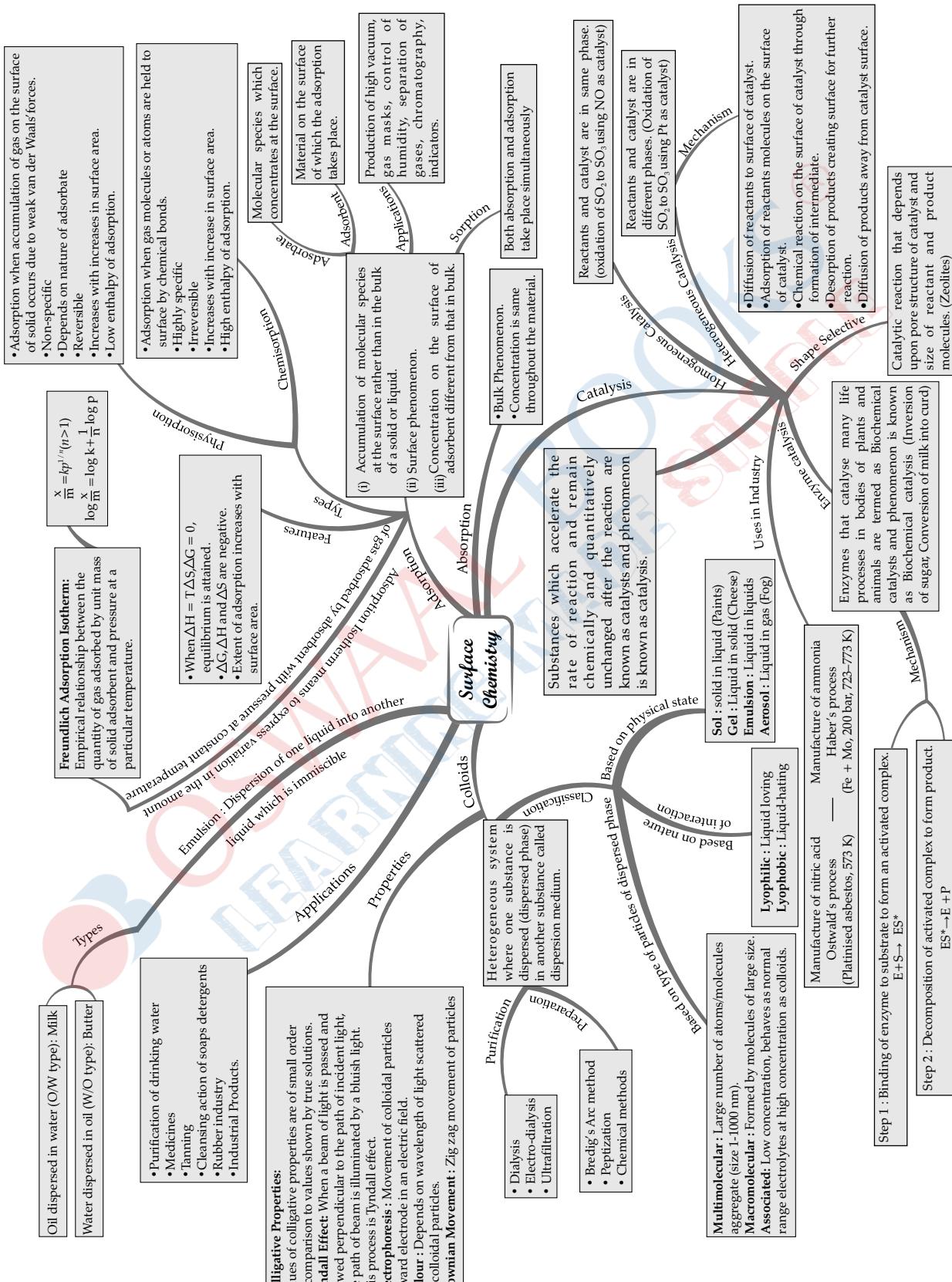


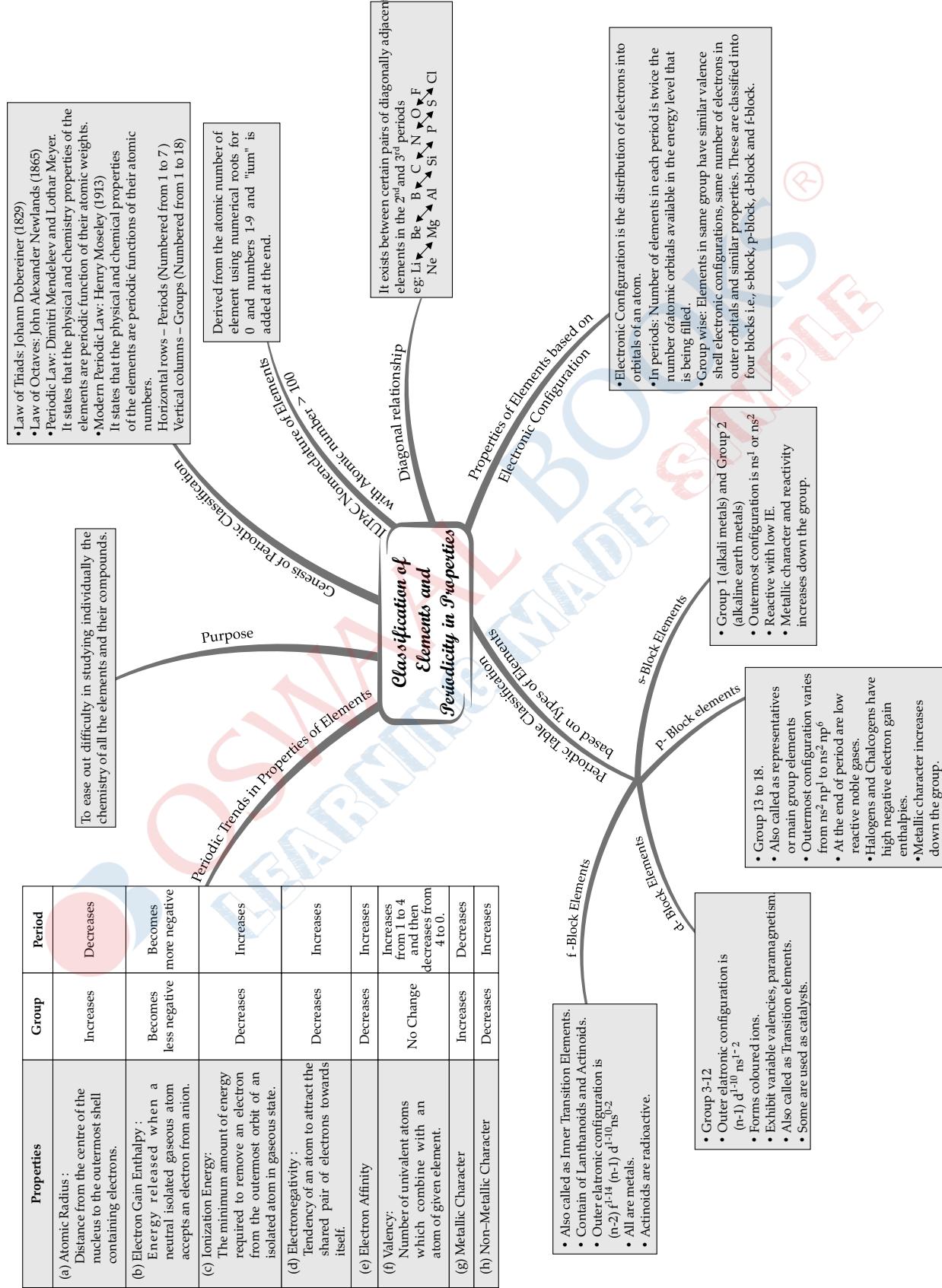


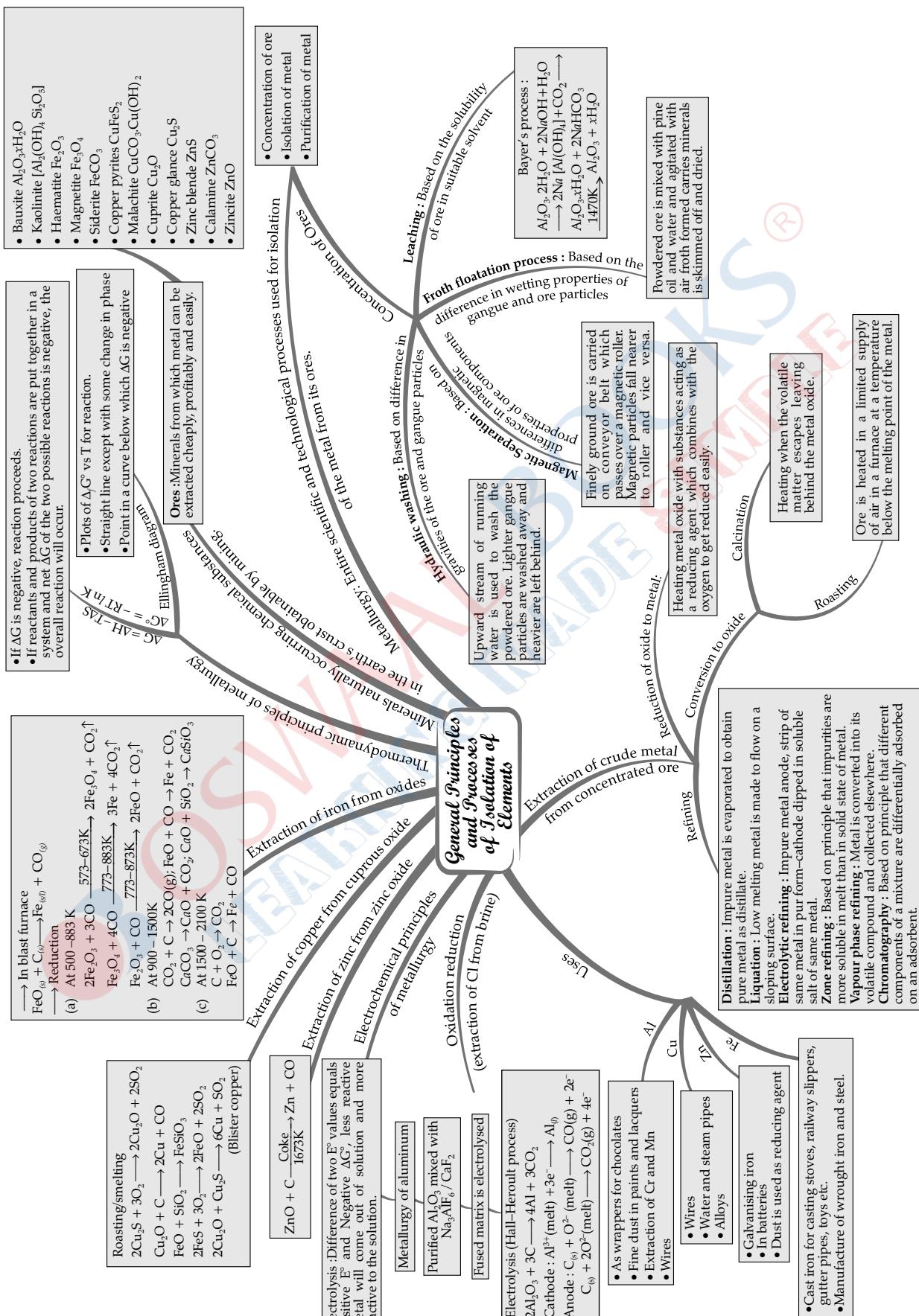


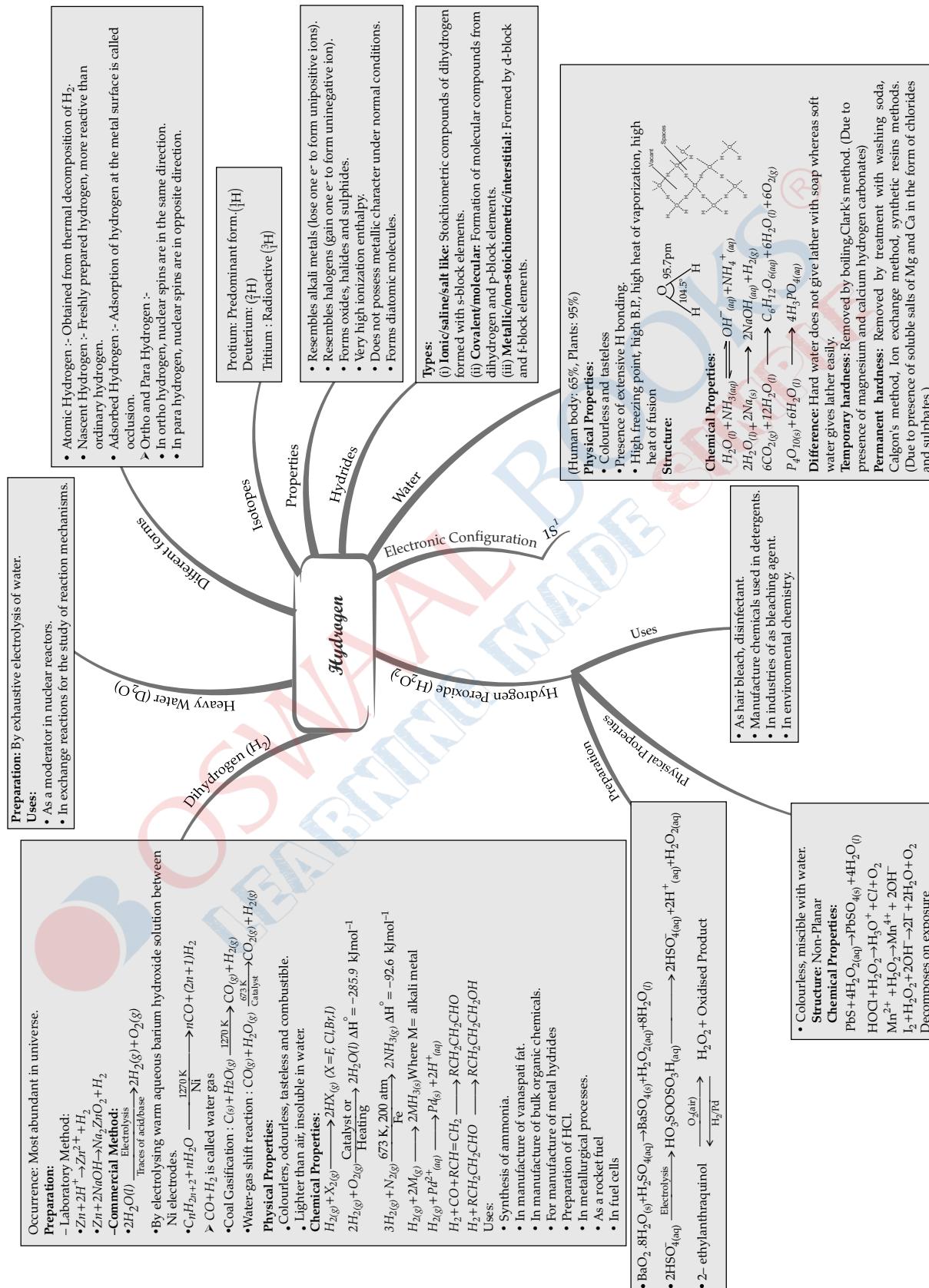


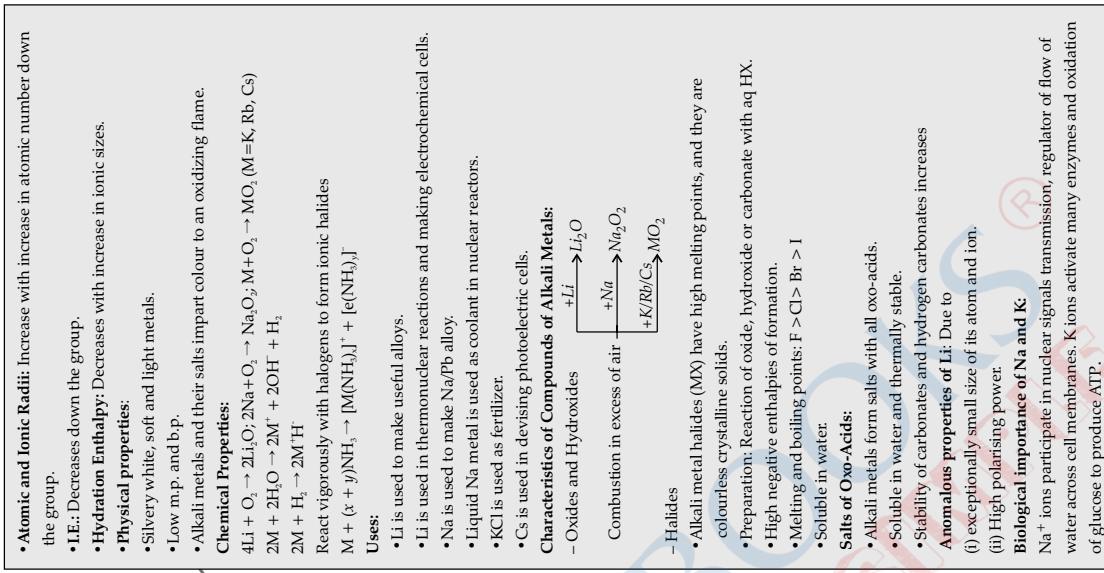
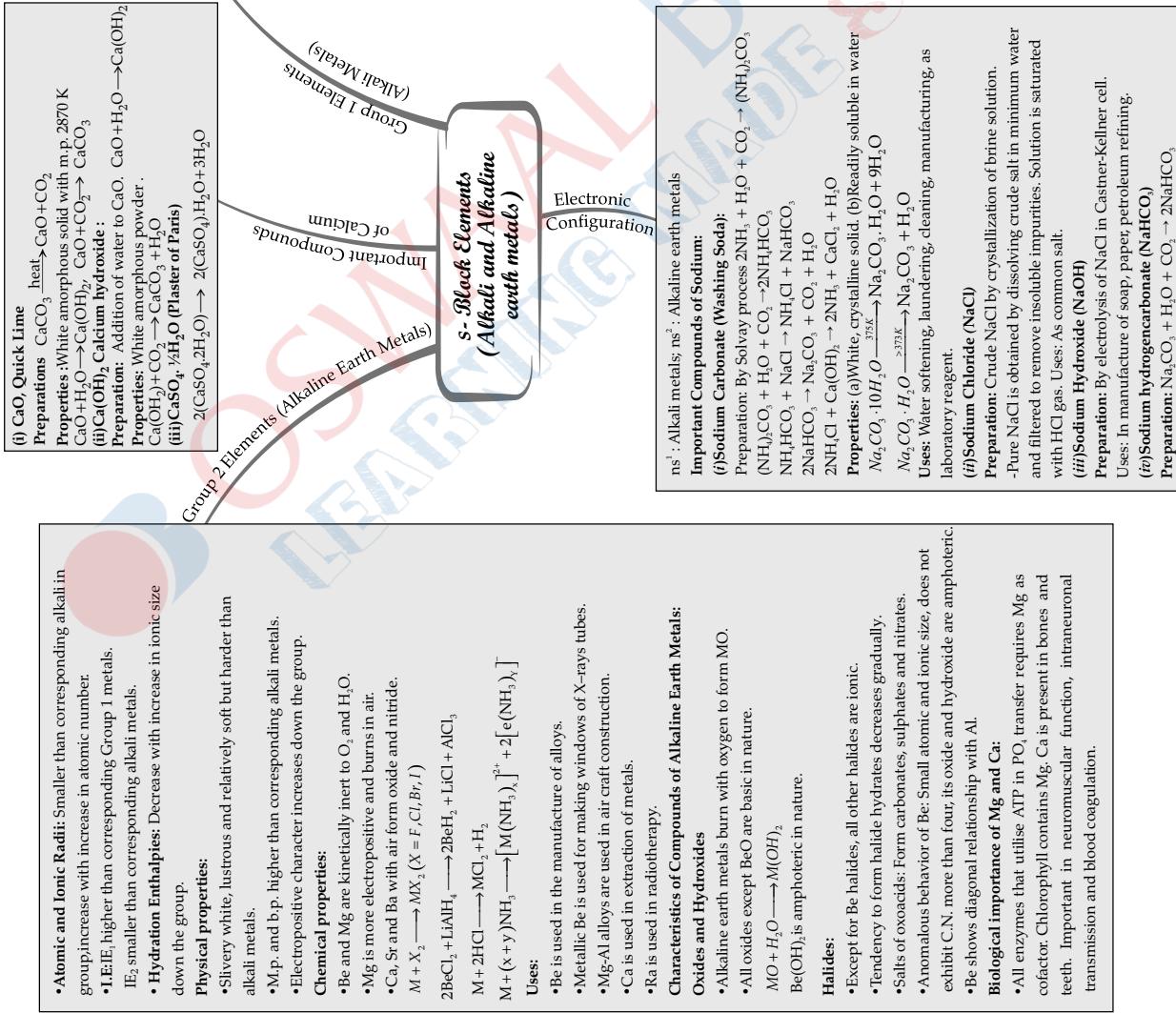


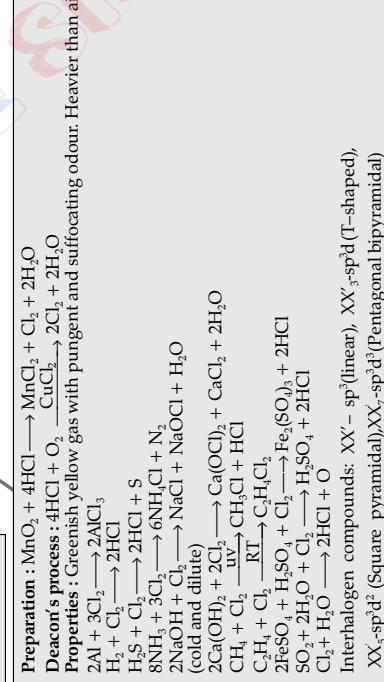
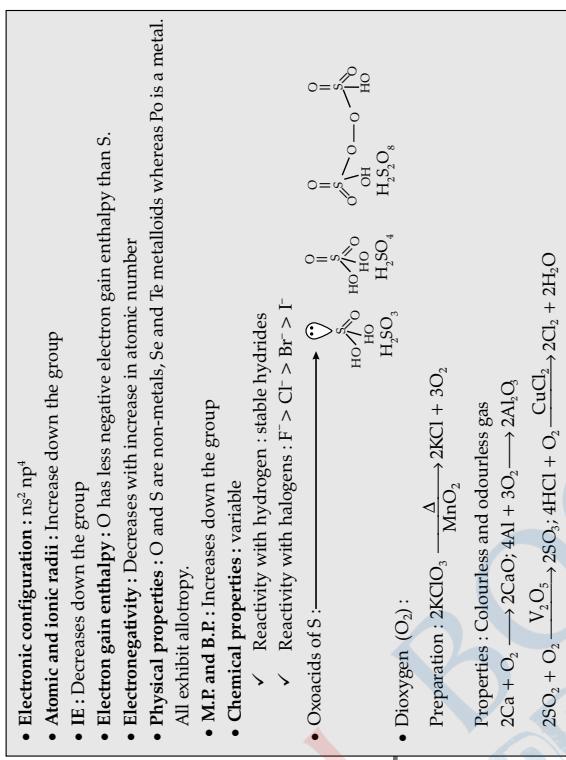
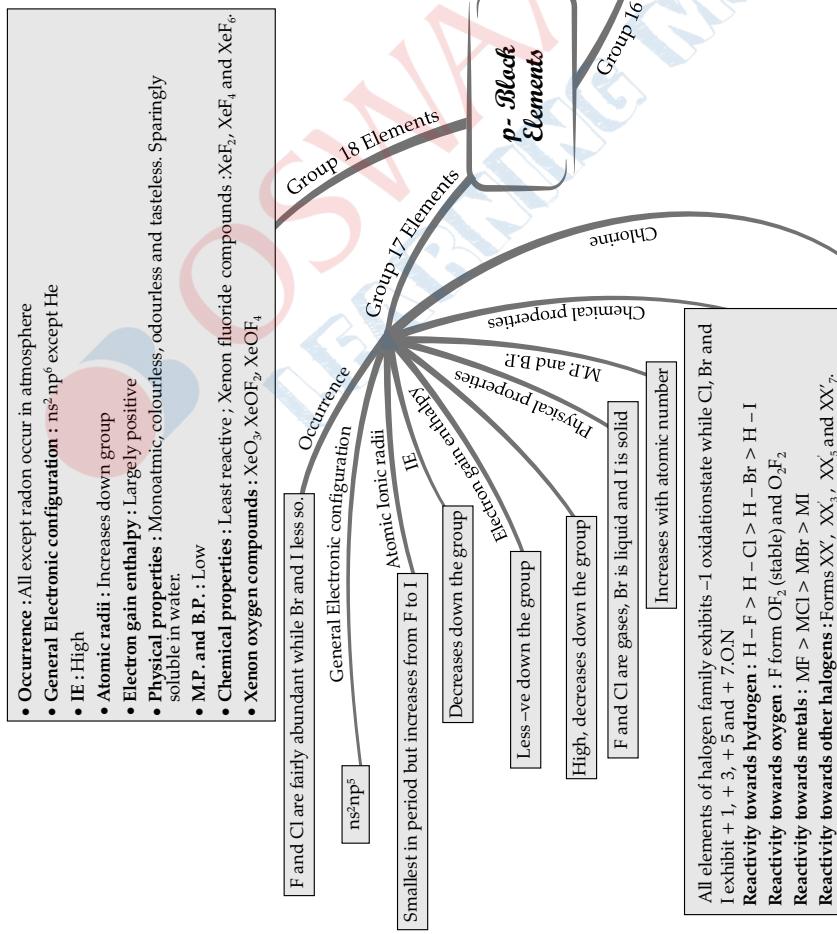


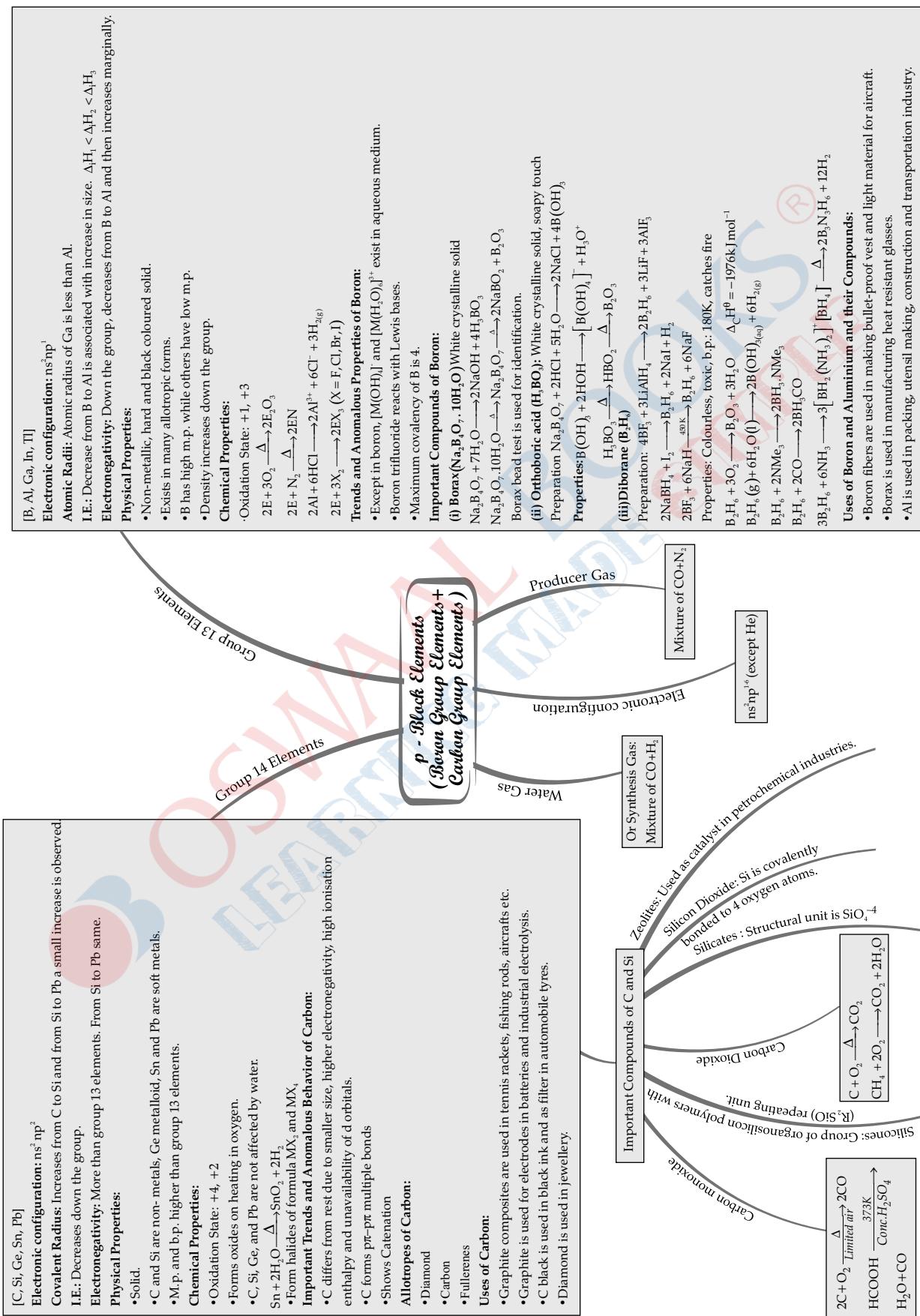


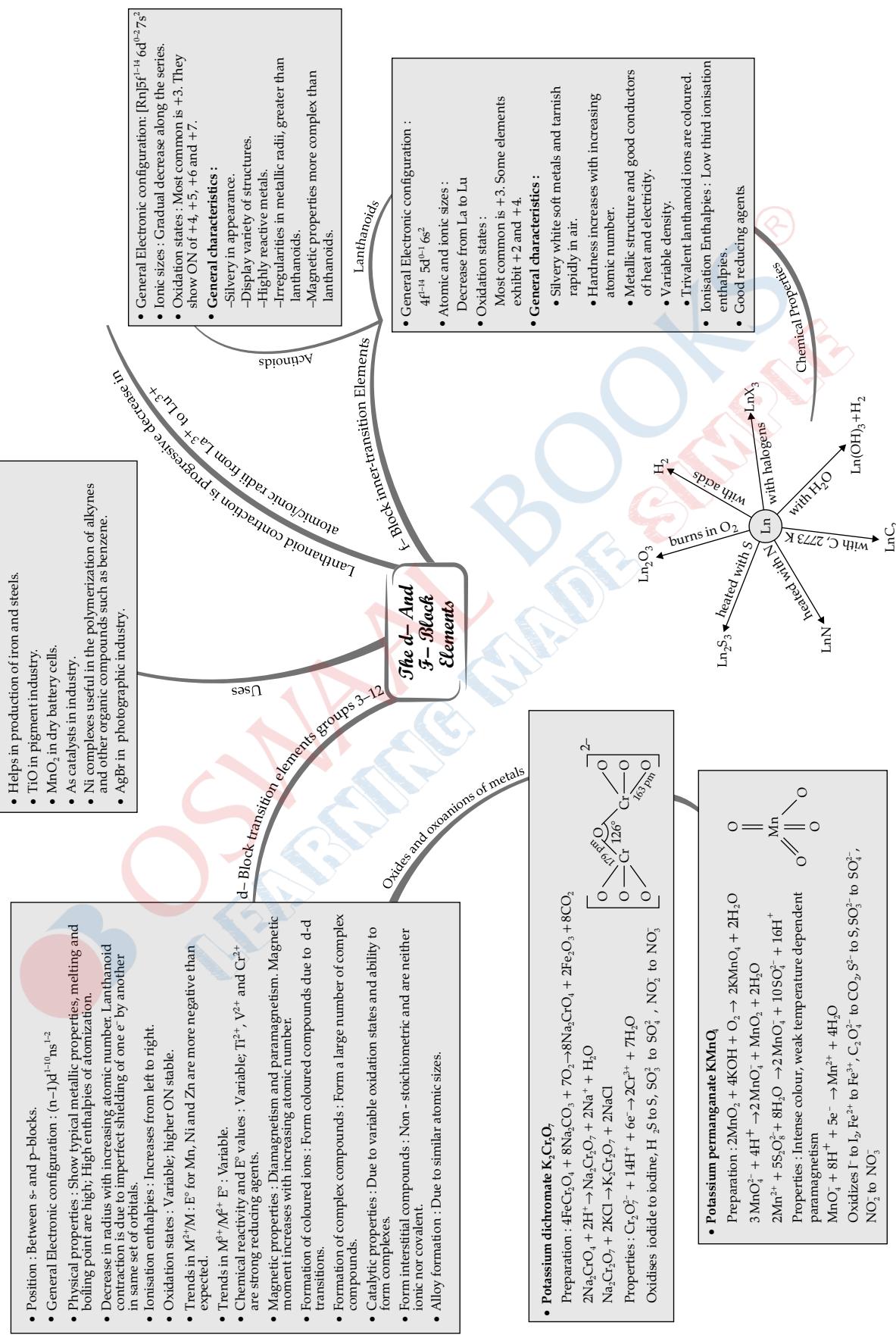


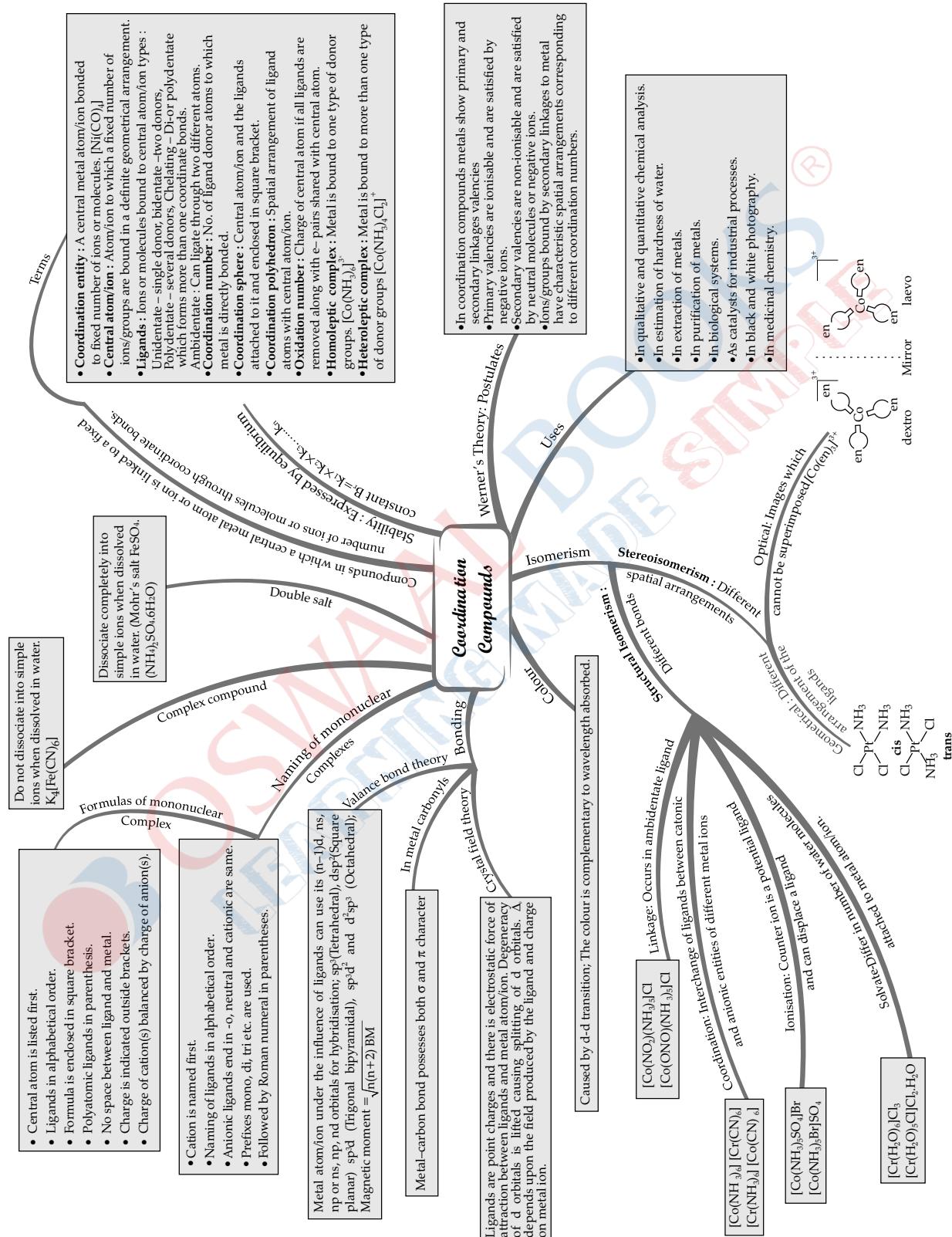


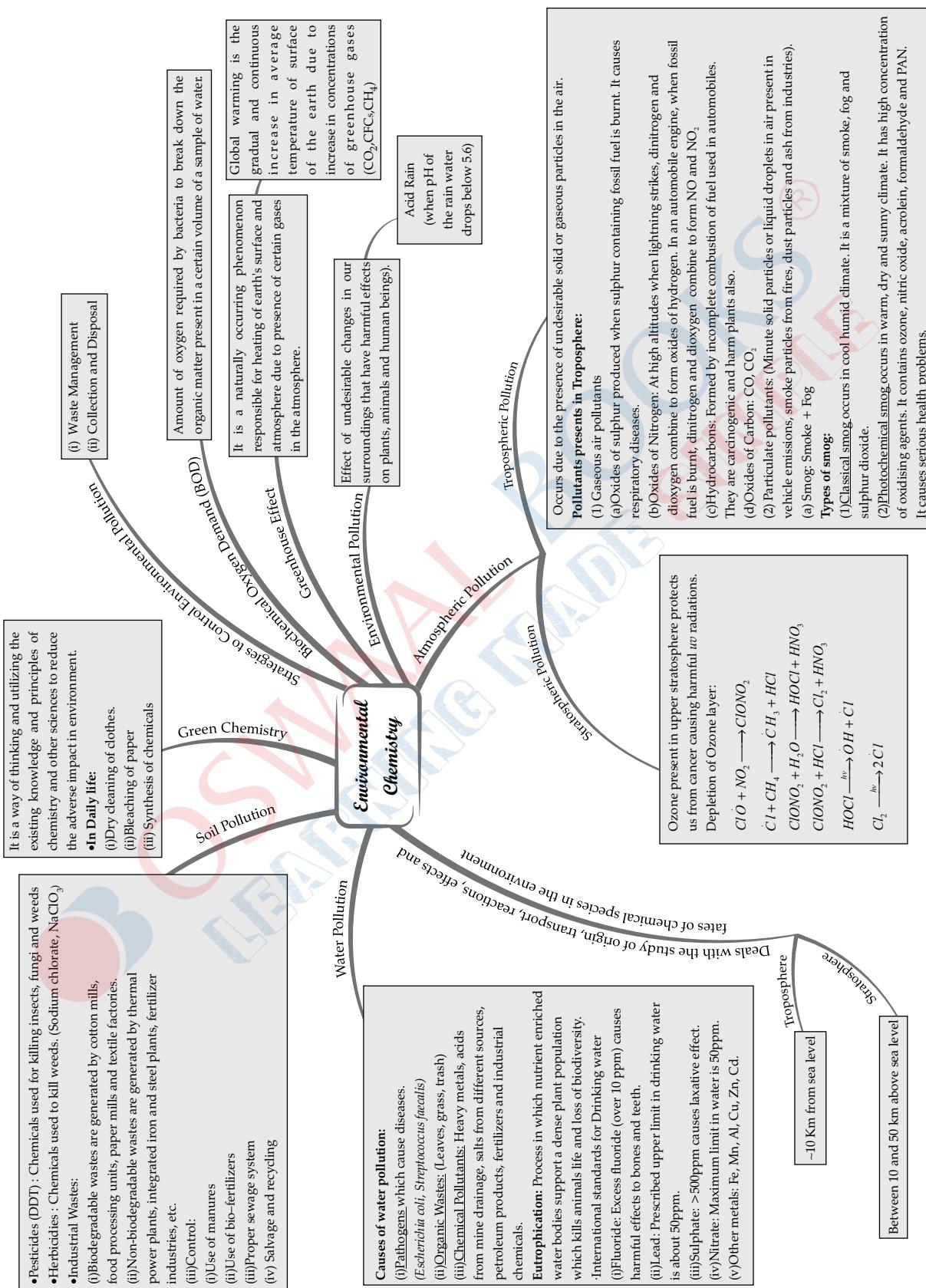


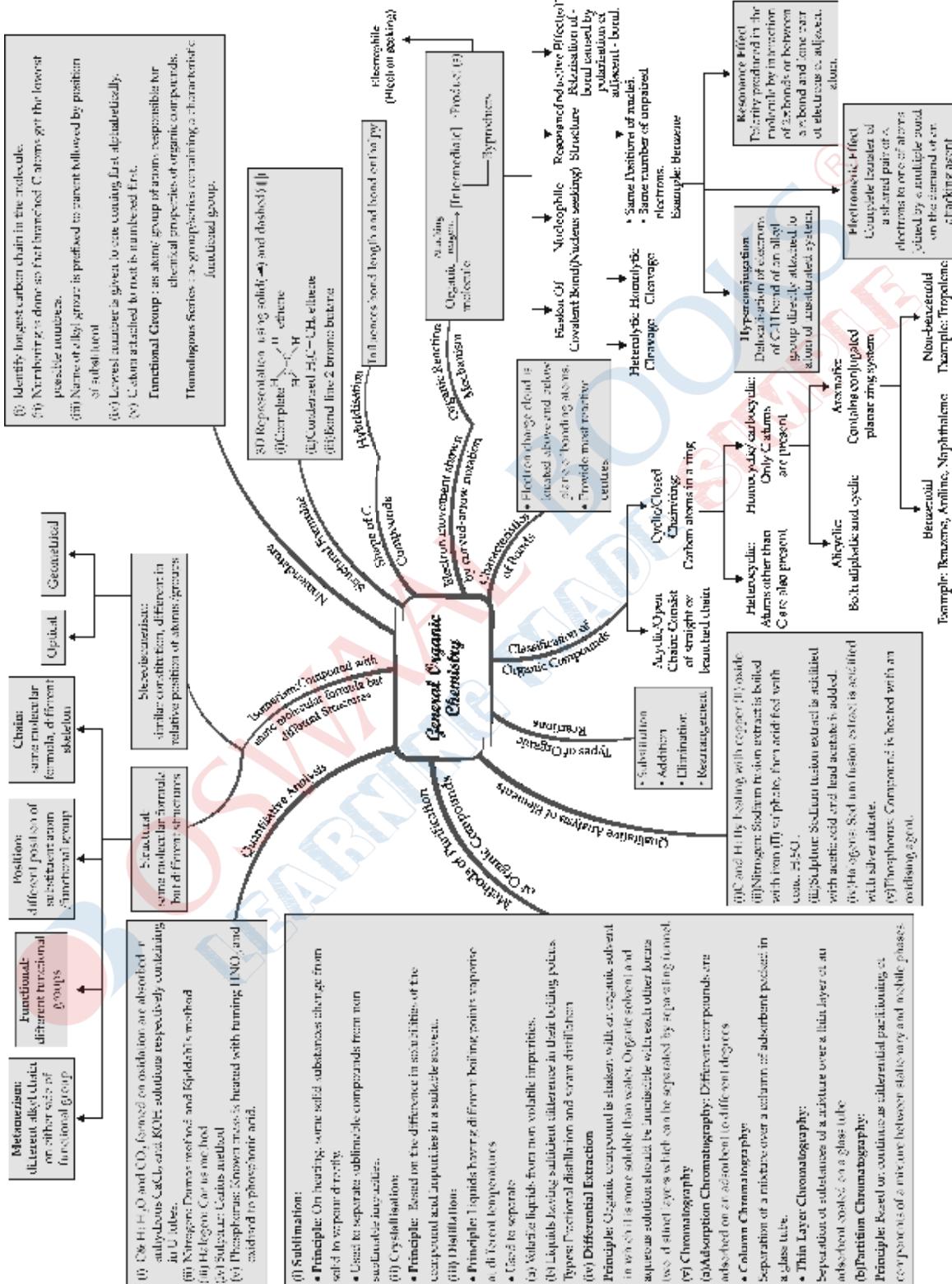


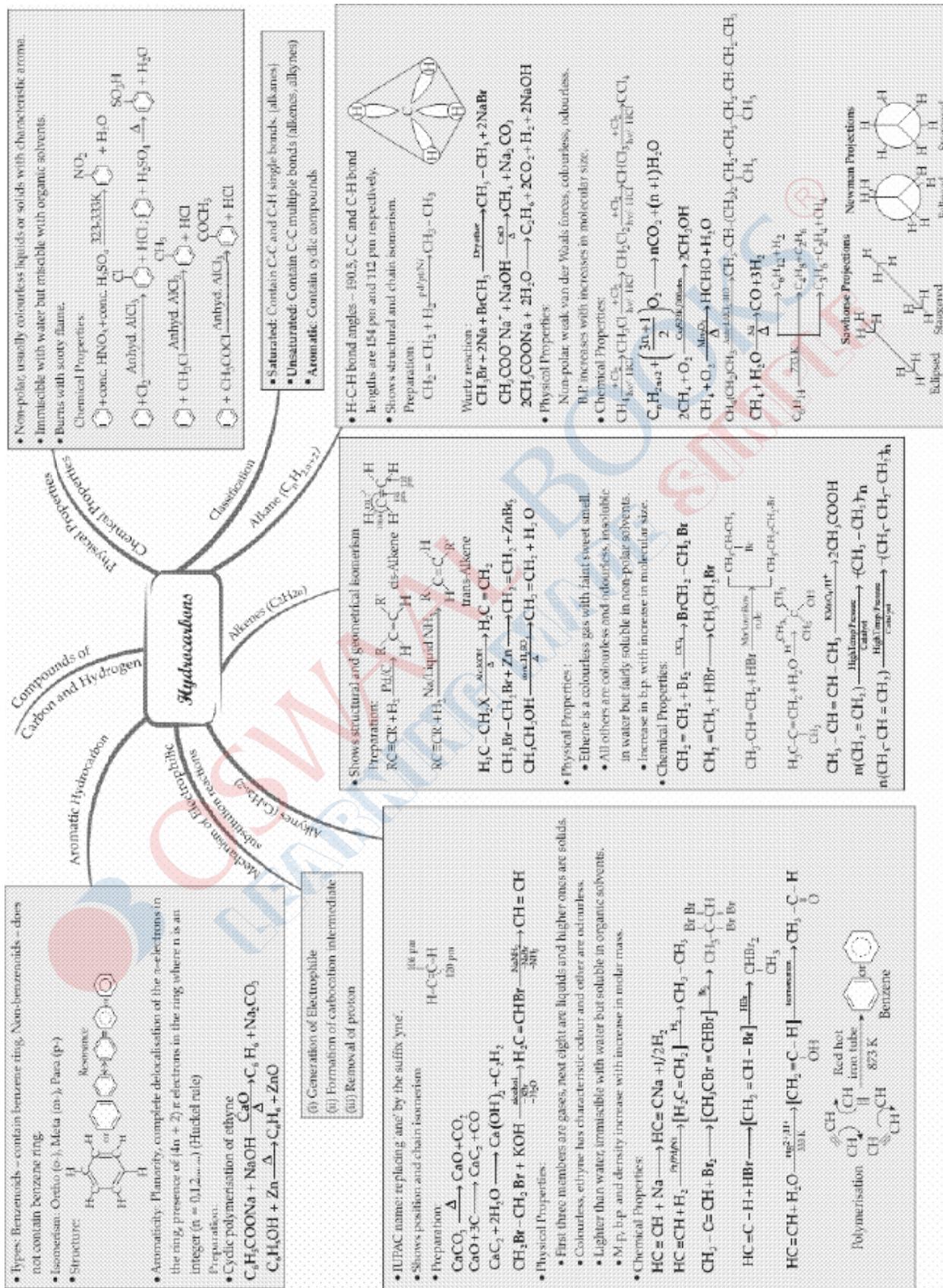


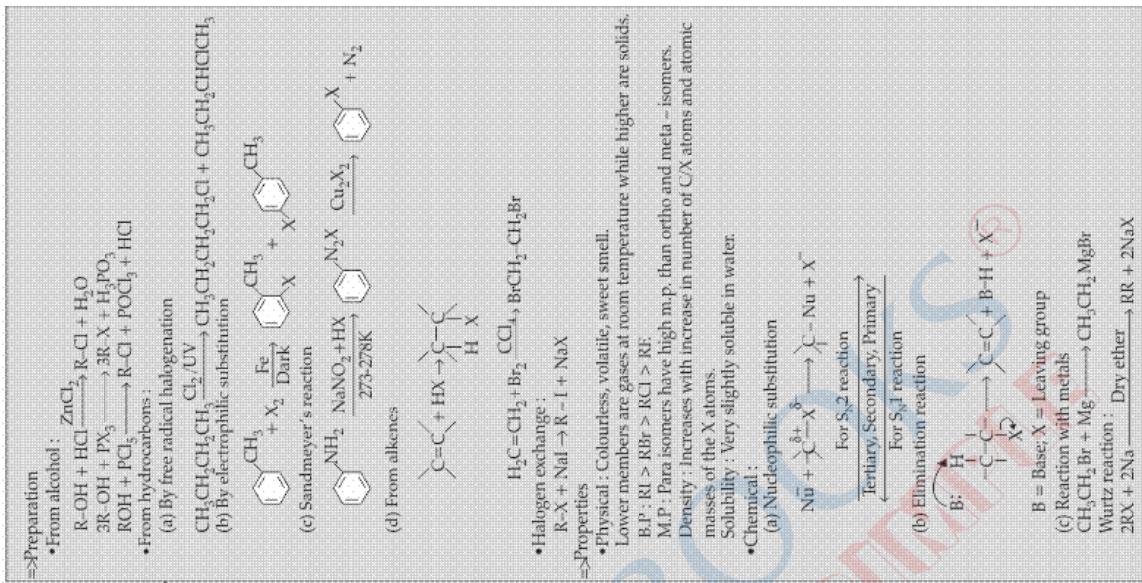
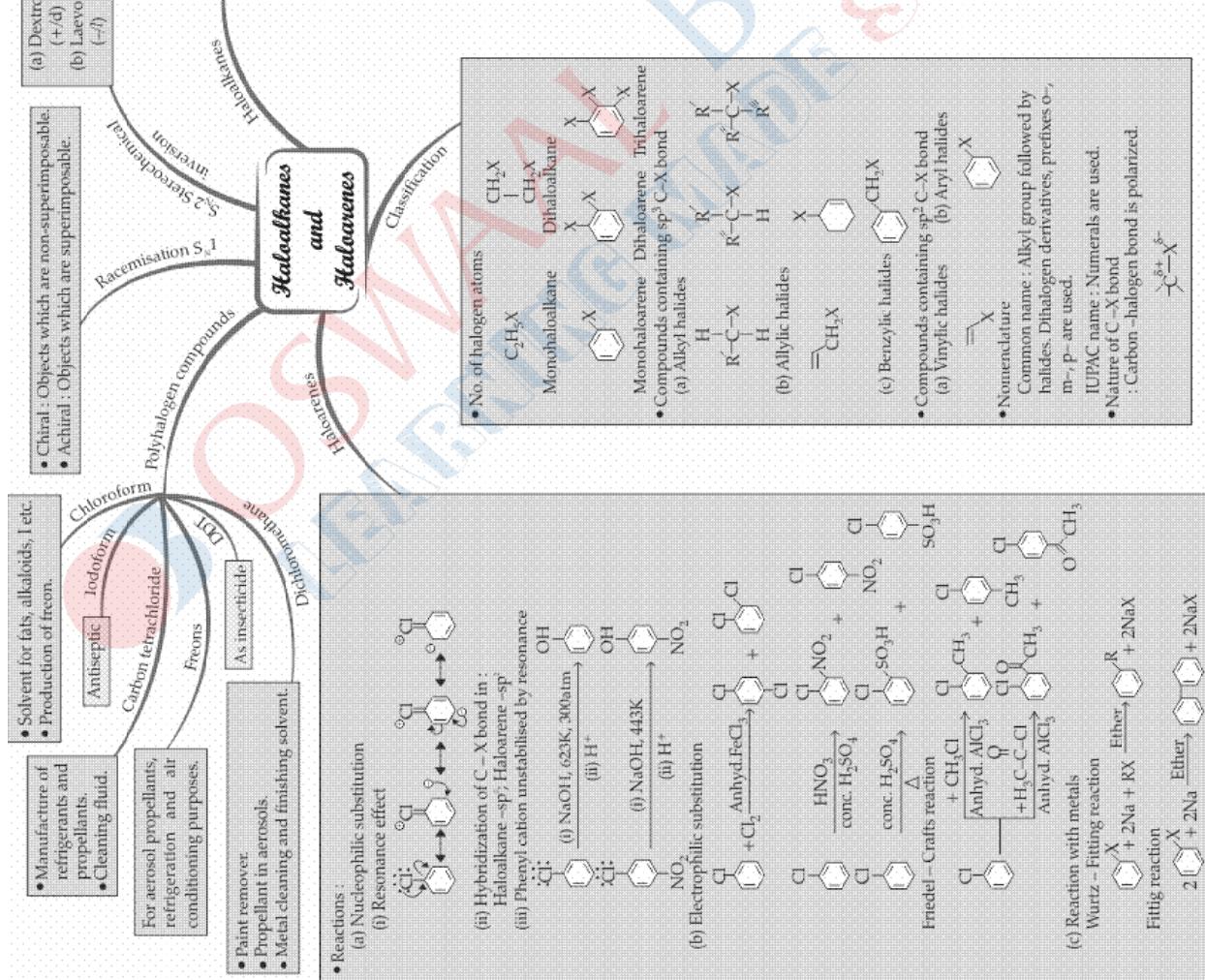












(i) Containing $\text{C}=\text{O}$ & OH bond
 $\text{--CH}_2\text{CH}=\text{C}(\text{OH})\text{COH}$ (2)

(ii) Containing $\text{C}(=\text{O})\text{OH}$ bond
 Vinylic alcohol :
 $\text{CH}_2=\text{CH}-\text{COH}$ Phenols

(iii) Simple symmetrical : Alkyl or aryl attached to O_2 are same.

(iv) Mixed unsymmetrical : Two groups are different.

Common name : Alkyl group + oil. IUPAC name : substituting 'e' of alane with suffix 'ol'.
 Common name : Alkyl groups in alphabetical order followed by either IUPAC name. In alkylaryl group 'e' replaced by 'o' followed by parent hydrocarbon.

Common name : Alkyl groups in alphabetical order followed by either IUPAC name. In alkylaryl group 'e' replaced as 1,2-, 1,3- and 1,4- benzene-ol.

Oxygen of -OH group is attached to C by a σ bond formed by the overlap of sp^2 orbital of C with a sp^3 orbital of oxygen pair.
 • In ethers, tetrahedral arrangement for four electron pairs.

1. From alkenes :- i) By acid catalysed hydration
 $\text{C}=\text{C} \xrightarrow{\text{H}_2\text{O}, \text{H}^+} \text{C}-\text{C}$
 ii) By hydroboration - oxidation
 $\text{CH}_2=\text{CH}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_3 \xrightarrow{\text{BH}_3, \text{DIBAH}} \text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_3$

2. From carbonyl compounds :-
 i) By reduction of aldehydes and ketones
 $\text{RCHO} + \text{H}_2/\text{Pt} \rightarrow \text{RCH}_2-\text{H}$ or $\text{RCH}_2-\text{HCl} \rightarrow \text{RCH}_2-\text{OH}$

ii) By reduction of carboxylic acids and esters OH
 $\text{RCOOH} \xrightarrow{\text{LiAlD}_5} \text{RCH}_2-\text{OH}$ or $\text{RCH}_2-\text{OD} \xrightarrow{\text{LiAlD}_5} \text{RCH}_2-\text{OH}$

3. From Grignard reagent
 $\text{C}=\text{O}+\text{R} \xrightarrow{\text{MgX}_2} \text{C}-\text{OR} \xrightarrow{\text{H}_2\text{O}} \text{C}-\text{OH}+\text{MgX}_2$

1. From halocarbons
 $\text{C}_6\text{H}_5\text{Cl} + \text{NaOH} \xrightarrow{\text{H}_2\text{O}} \text{C}_6\text{H}_5\text{OH} + \text{NaCl}$

2. From benzene sulphonic acid
 $\text{C}_6\text{H}_6 + \text{SO}_3\text{Cl} \xrightarrow{\text{H}_2\text{O}} \text{C}_6\text{H}_5\text{SO}_3\text{H} + \text{NaCl}$

3. From diazonium salts
 $\text{C}_6\text{H}_5\text{NH}_2 + \text{NaNO}_2 \xrightarrow{\text{H}_2\text{O}} \text{C}_6\text{H}_5\text{NO}_2 + \text{N}_2 + \text{H}_2\text{O}$

4. From Cumene
 $\text{CH}_3-\text{C}_6\text{H}_5-\text{CH}_2-\text{OH} \xrightarrow{\text{H}^+} \text{C}_6\text{H}_5-\text{CH}_2-\text{COCH}_3 + \text{H}_2\text{O}$

1. By dehydration of alcohols
 $\text{CH}_3\text{CH}_2\text{OH} \xrightarrow[\text{413 K}]{\text{H}_2\text{SO}_4} \text{C}_2\text{H}_5\text{OCH}_3$

2. Williamson synthesis
 $\text{RX} + \text{KONa} \longrightarrow \text{R-O-R} + \text{NaX}$

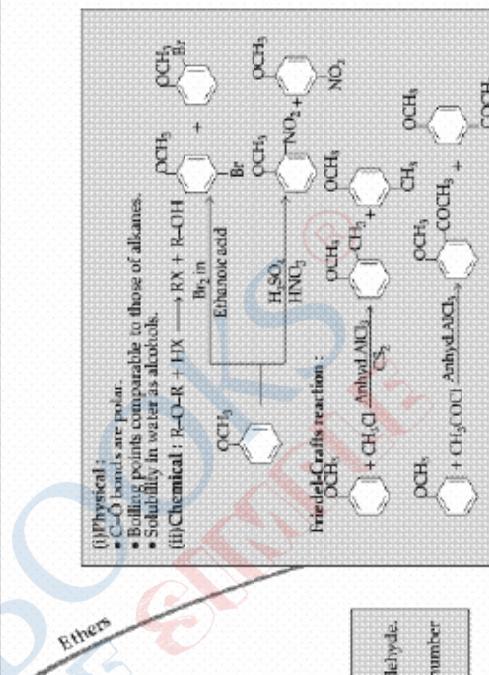
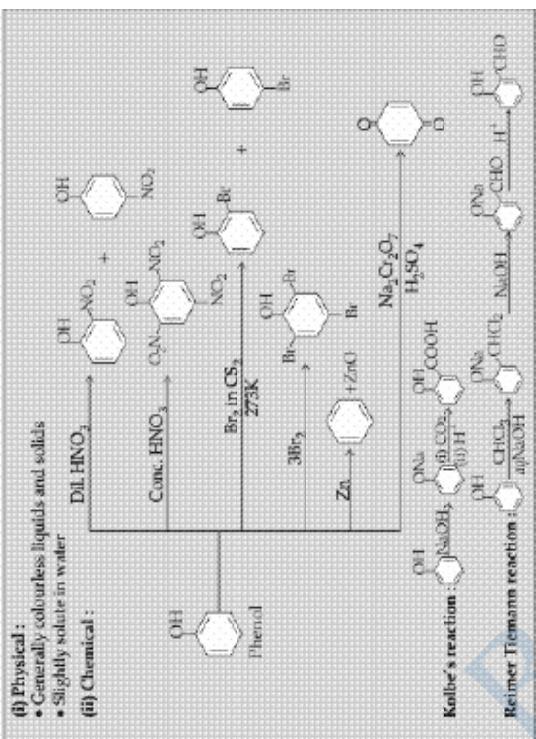
3. From $\text{R}-\text{O}-\text{R}'$
 $\text{R}-\text{O}-\text{R}' + \text{NaOH} \longrightarrow \text{R}-\text{OH} + \text{R}'-\text{OH} + \text{NaX}$

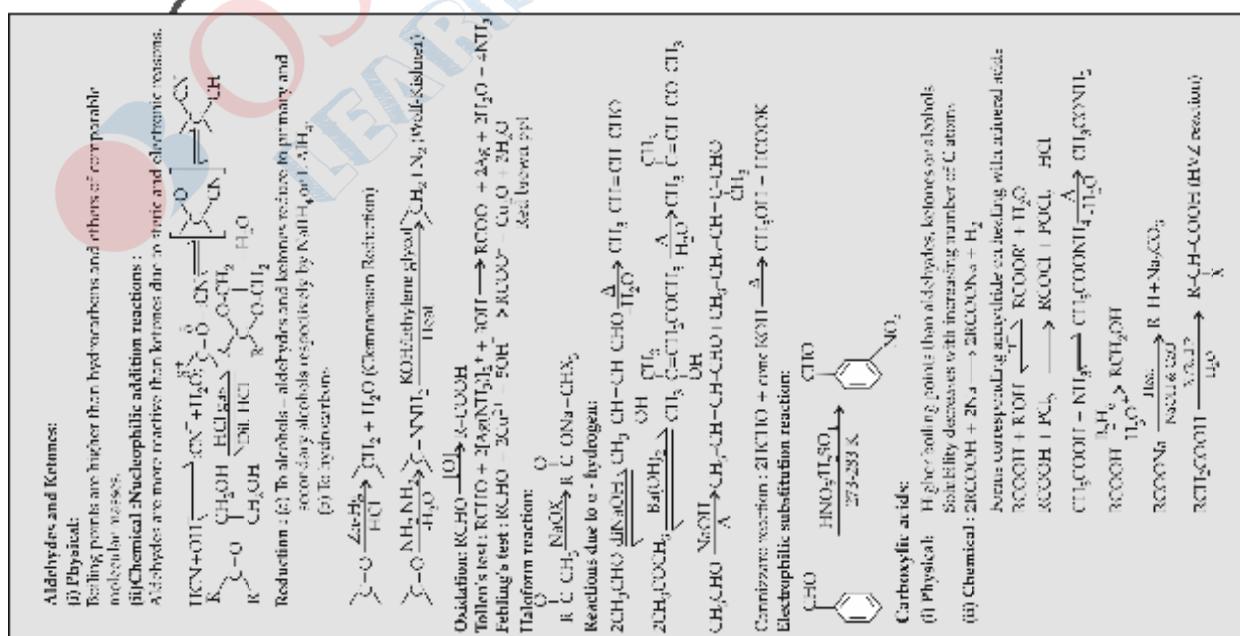
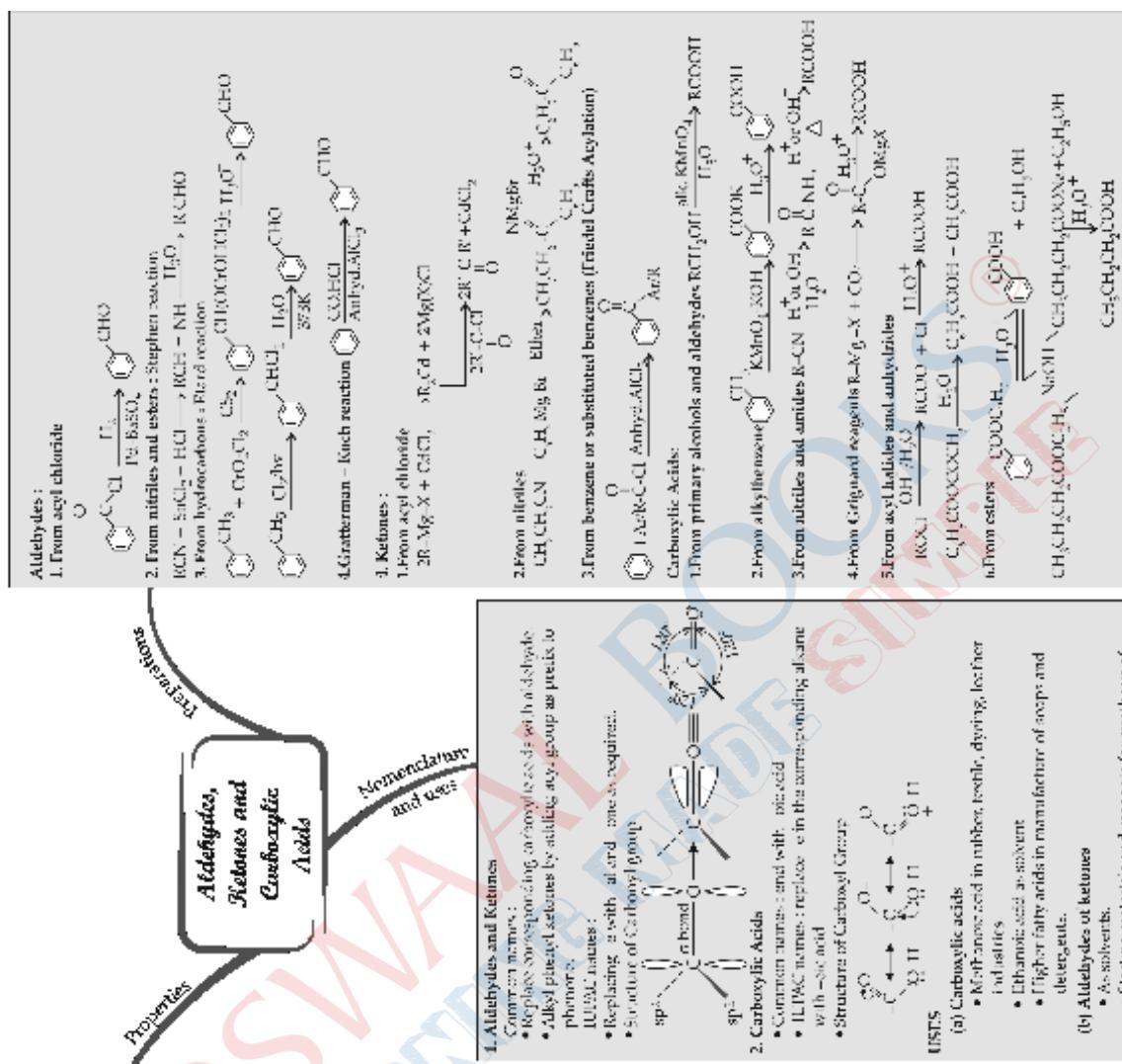
4. From $\text{R}-\text{O}-\text{R}'$
 $\text{R}-\text{O}-\text{R}' + \text{CH}_3\text{COCl} \xrightarrow{\text{Anhyd. NaCl}} \text{R}-\text{OCOCH}_3 + \text{R}'-\text{OH} + \text{CH}_3\text{COCl}$

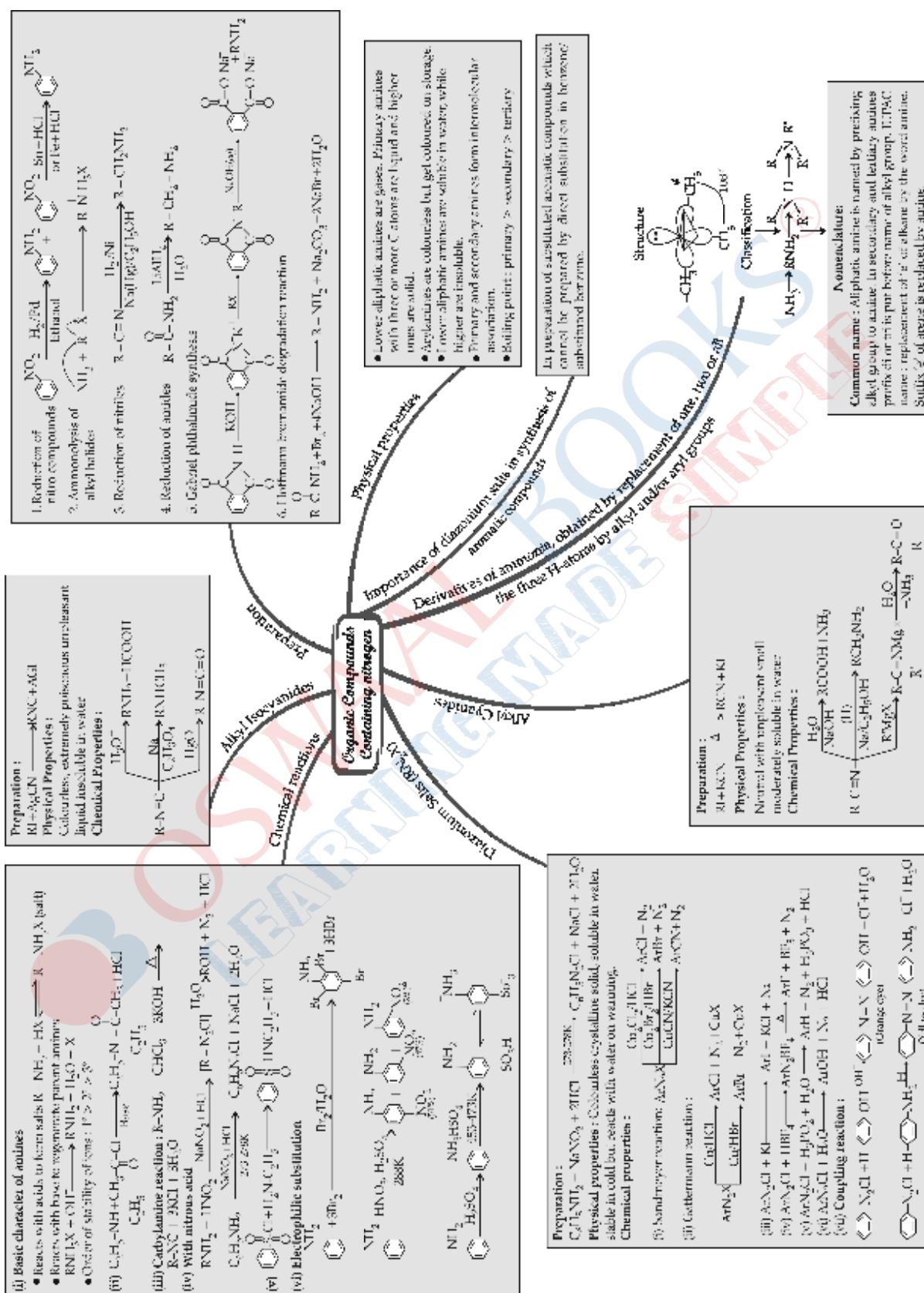
• Methanol (Wood spirit) :-
 Used as solvent in paint, varnishes and making formaldehyde, i.e.,

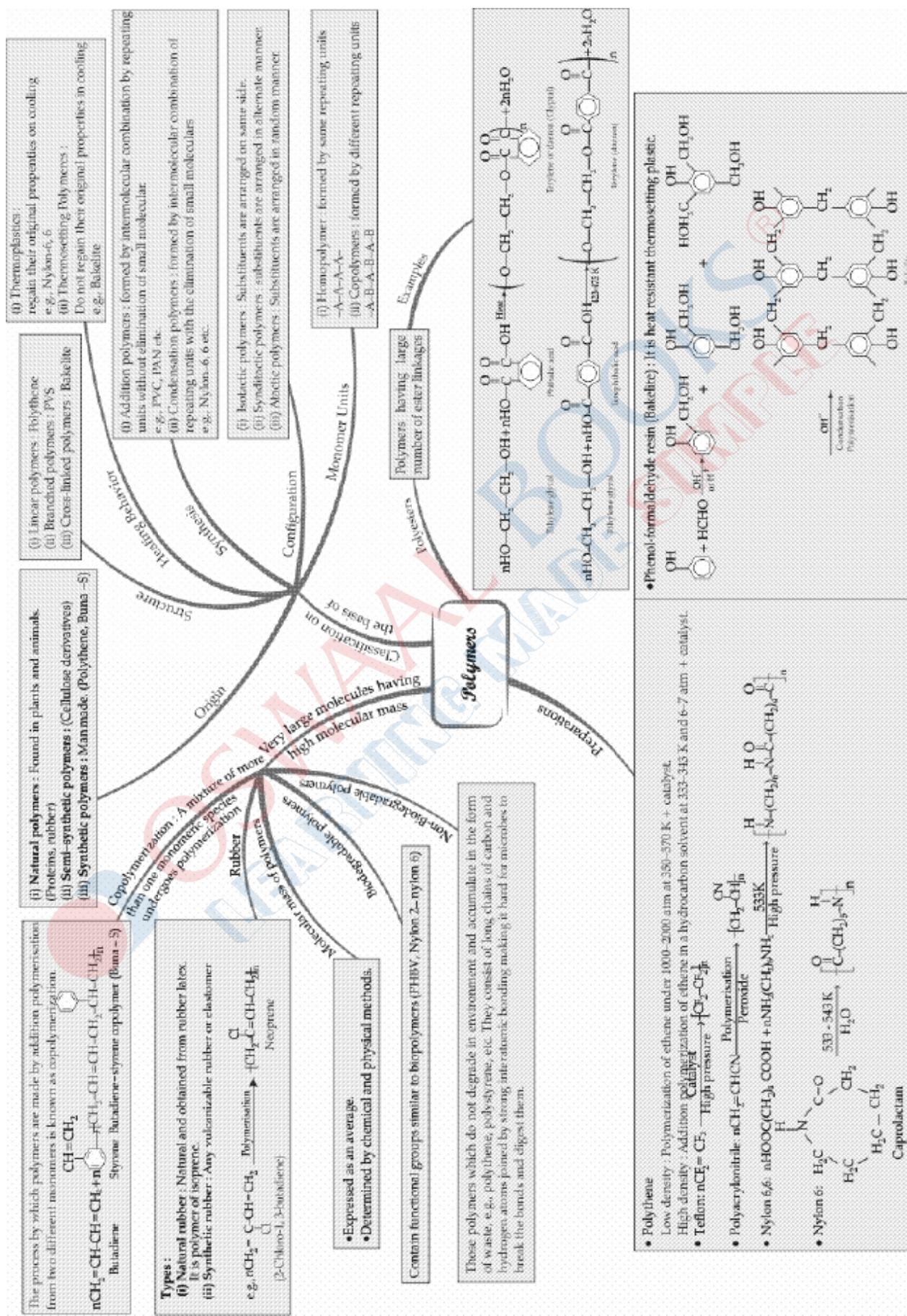
• Ethanol :

Used as solvent in paint industry and preparation of a number of carbon compounds.









Carbohydrates

- (Polymers of α -amino acids)
- Amino acids contain $-\text{NH}_2$ and $-\text{COOH}$ group.

Classification:

- On the basis of relative number of $-\text{NH}_2$ and $-\text{COOH}$ group:
 - (i) Neutral : Equal number of $-\text{NH}_2$ and $-\text{COOH}$ group.
 - (ii) Basic : More number of $-\text{NH}_2$ than $-\text{COOH}$ group.
 - (iii) Acidic : More number of $-\text{COOH}$ than $-\text{NH}_2$ group.
- On the basis of place of synthesis:
 - (i) Essential – cannot be synthesized in the body.
 - (ii) Non-essential – synthesized in the body.
- On the basis of shape:
 - (i) Fibrous : Fibre-like structure
 - (ii) Globular : Spherical
 - (iii) Peptide linkage : $\text{Structure : H}_2\text{N}-\text{CH}_2-\text{[CO-NH]}-\text{CH-COOH}$
- Denaturation of proteins :**
When a protein in its native form is subjected to physical change, globules unfold, helix get uncold and protein loses its biological activity.

Biomolecules

**Chemical substances produced by ductless gland called endocrine gland.
e.g., Adrenalin, thyroxine etc.**

Hormones

Vitamins

Nucleic Acids

DNA Fingerprinting: Unique sequence of bases on DNA

Enzymes

Importance:

- Form a major portion of food.
- As storage molecules.
- Cellulose forms cell wall of bacteria and plants.
- Starch : Polymer of α -glucose with two components amylose and amylopectin
- Glycogen

Disaccharides : Linkage between 2 monosaccharides. Glycosidic linkage (Sucrose, maltose)

Poly saccharides : Large number of monosaccharides units joined by glycosidic linkages.

- (a) Starch : Polymer of α -glucose
- (b) Cellulose
- (c) Glycogen

Chromosomes : Particles in nucleus responsible for heredity. Chromosomes are made up of proteins and nucleic acid.

Two types : Deoxyribonucleic acid (DNA), Ribonucleic acid (RNA)

Composition : In DNA, sugar is β -D-2-deoxyribose whereas in RNA is β -D-ribose. DNA contains A,G,C,T whereas RNA has A,G,C,U.

Structure :-

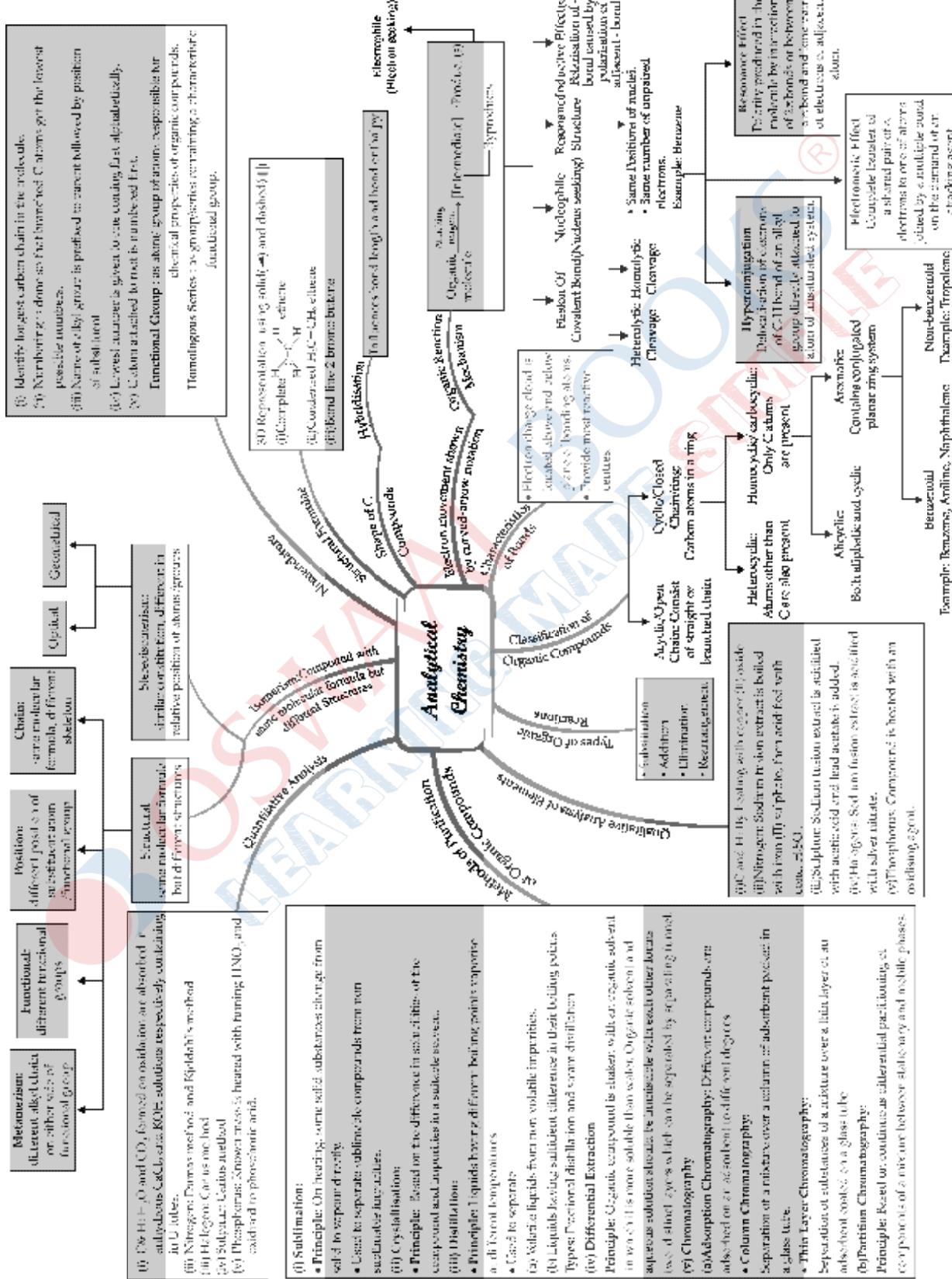
- Nucleoside : Formed by attachment of a base to 1' of sugar
- Nucleotide : Formed by link to phosphoric acid at 5' of sugar

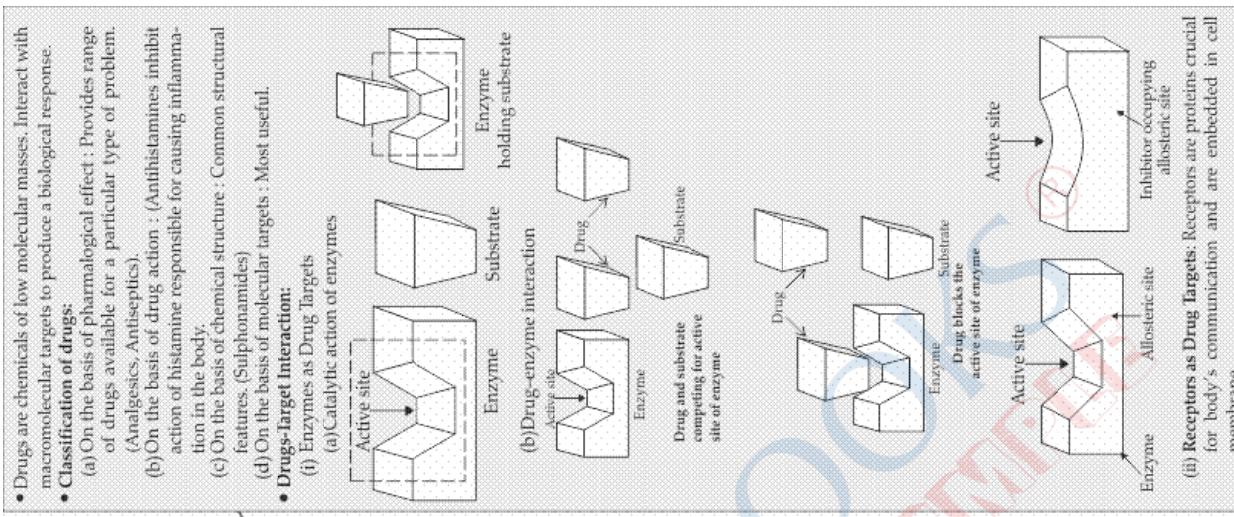
Base Base
—Sugar—Phosphate—[Sugar—Phosphate]—Sugar—

Types of RNA : m-RNA, r-RNA, t-RNA

Biological Functions :

- Chemical basis of heredity.
- Responsible for identity of different species of organisms.
- Nucleic acids are responsible for protein synthesis in cell.





Purpose:

- For their preservation
- Enhancing their appeal
- Adding nutritive value

(a) **Artificial Sweetening Agents :** Natural sweeteners (sucrose), artificial sweeteners (Aspartame, Saccharin)

(b) **Food Preservatives :** Prevent spoilage of food due to microbial growth. (Table salt, sugar)

