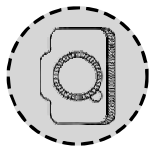
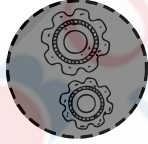


MIND MAPS

LEARNING MADE SIMPLE



Presenting words and concepts as pictures!!



anytime, as frequency as you like till it becomes a habit!



- To Unlock the imagination and come up with ideas
- To Remember facts and figures easily
- To Make clearer and better notes
- To Concentrate and save time
- To Plan with ease and ace exams

MIND MAP

AN INTERACTIVE MAGICAL TOOL

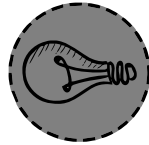
When?

What?



Learning made simple 'a winning combination'

Result



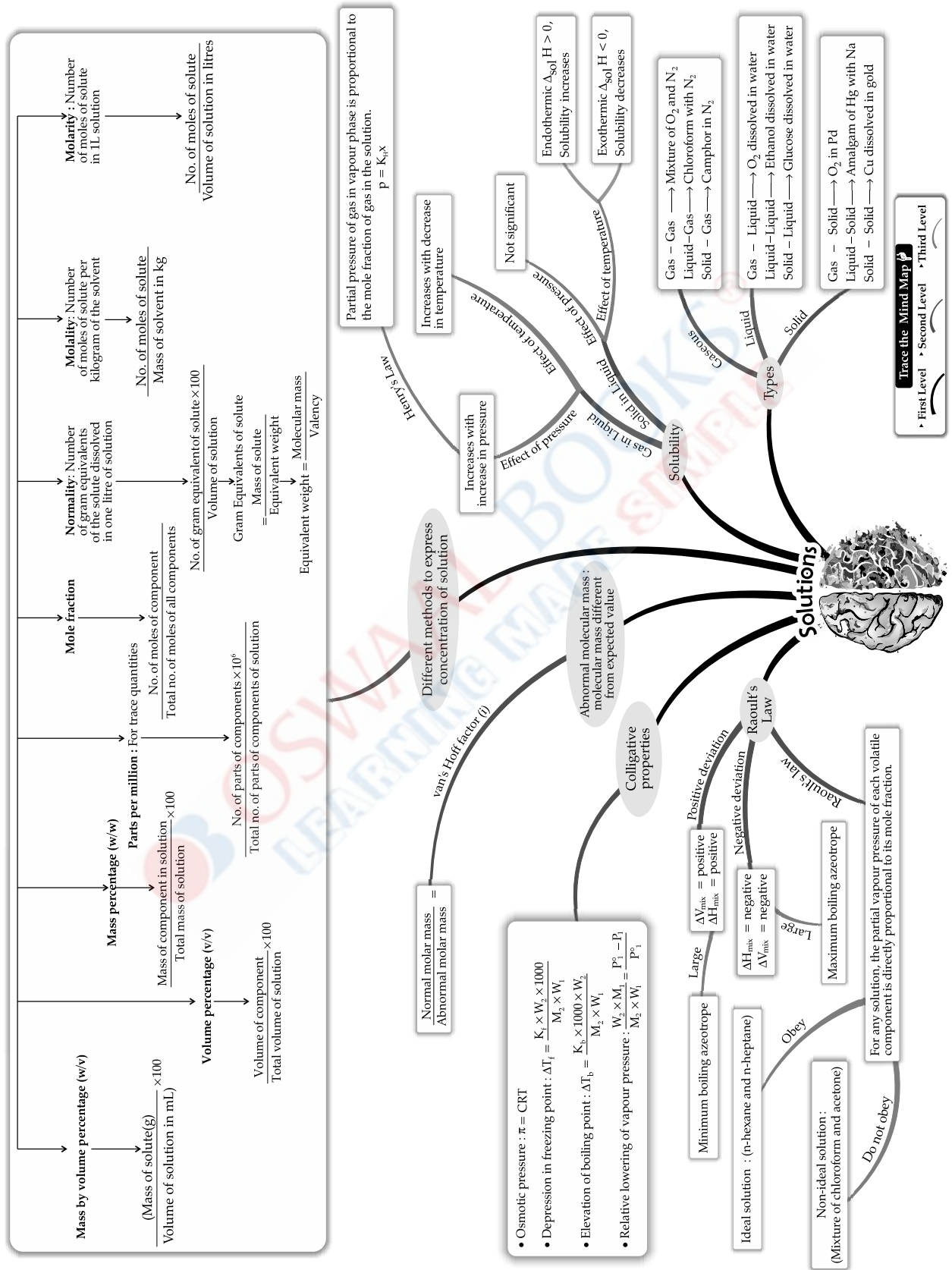
With a blank sheet of paper coloured pens and your creative imagination!

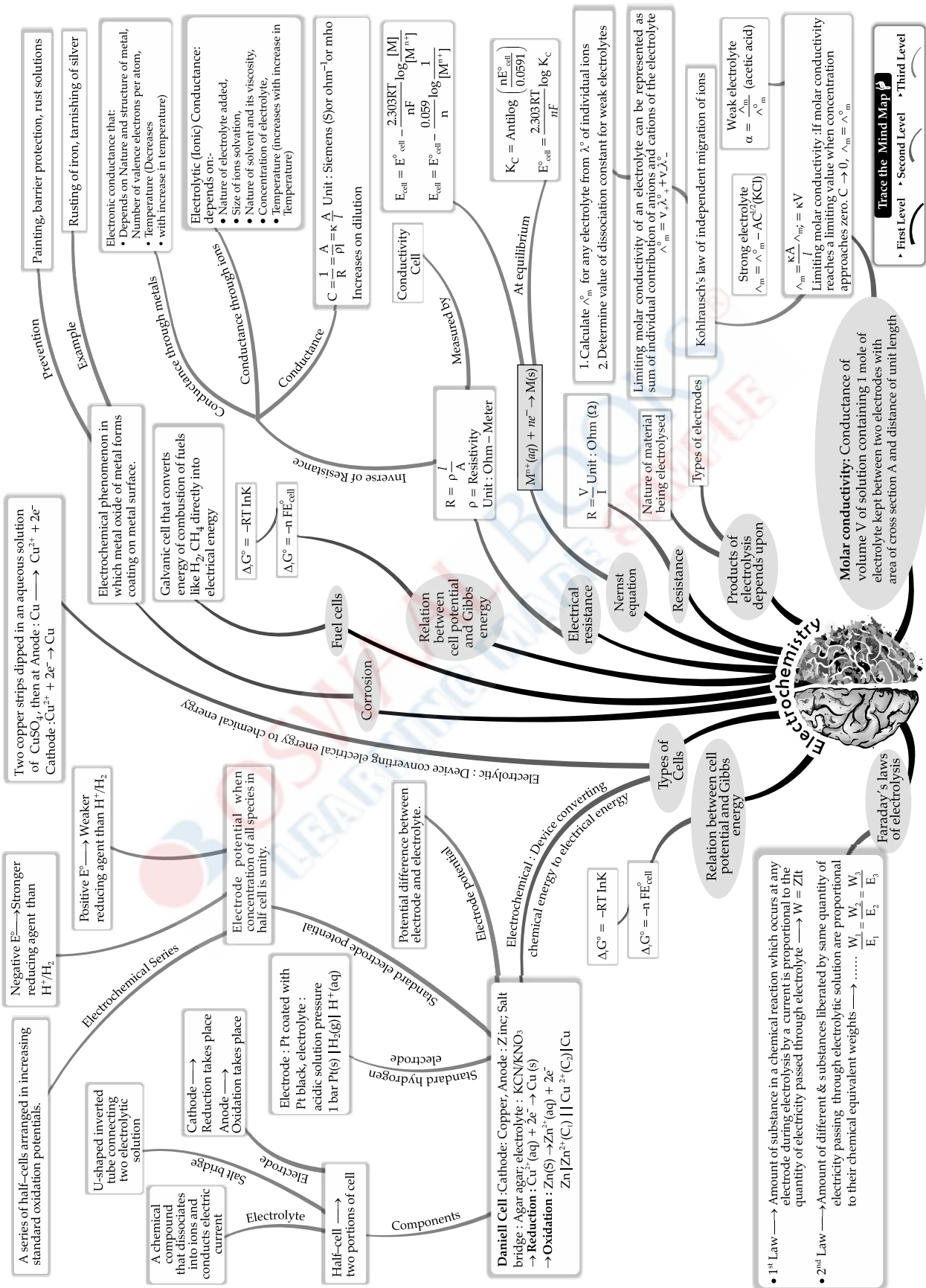
How?

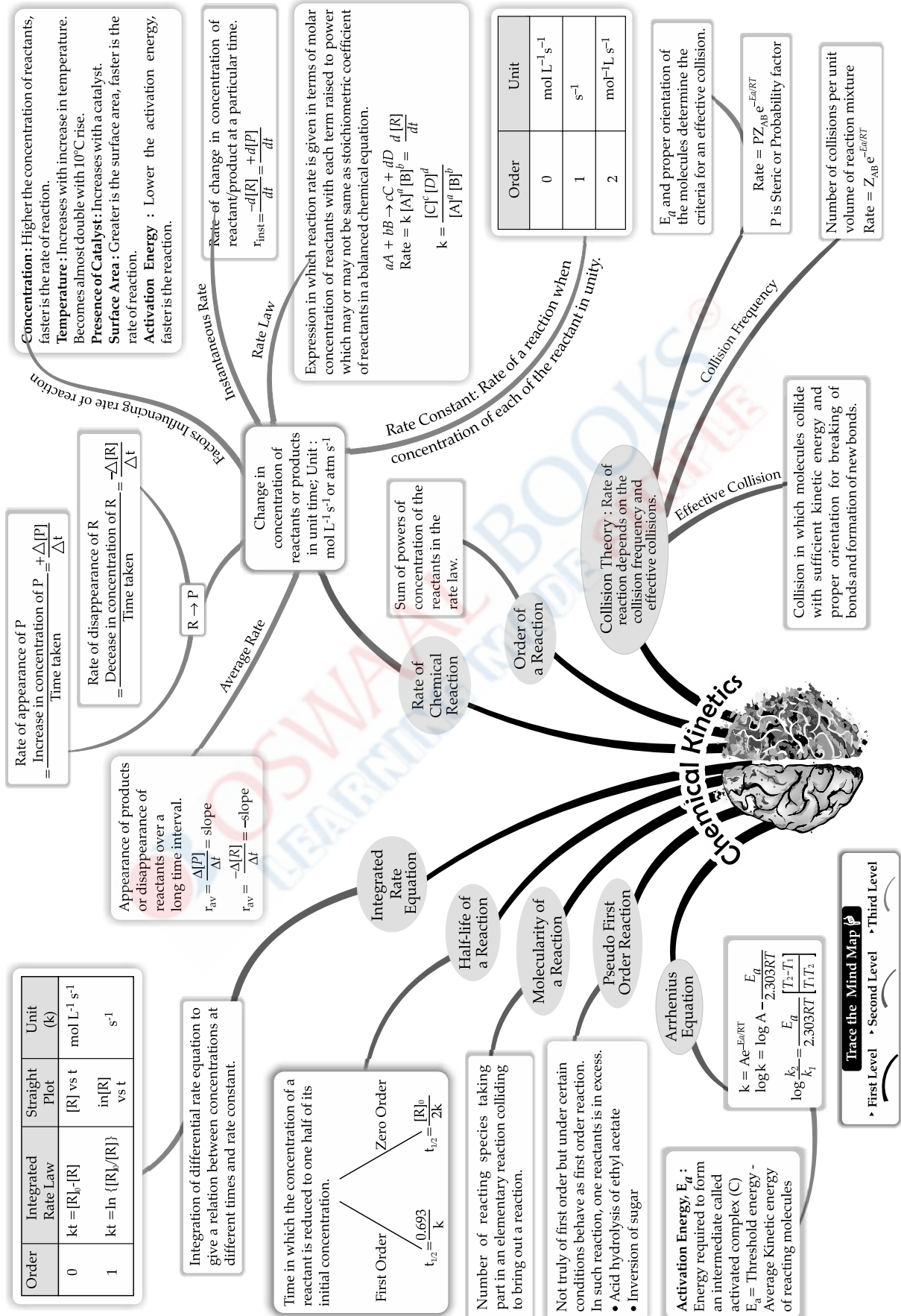
Why?

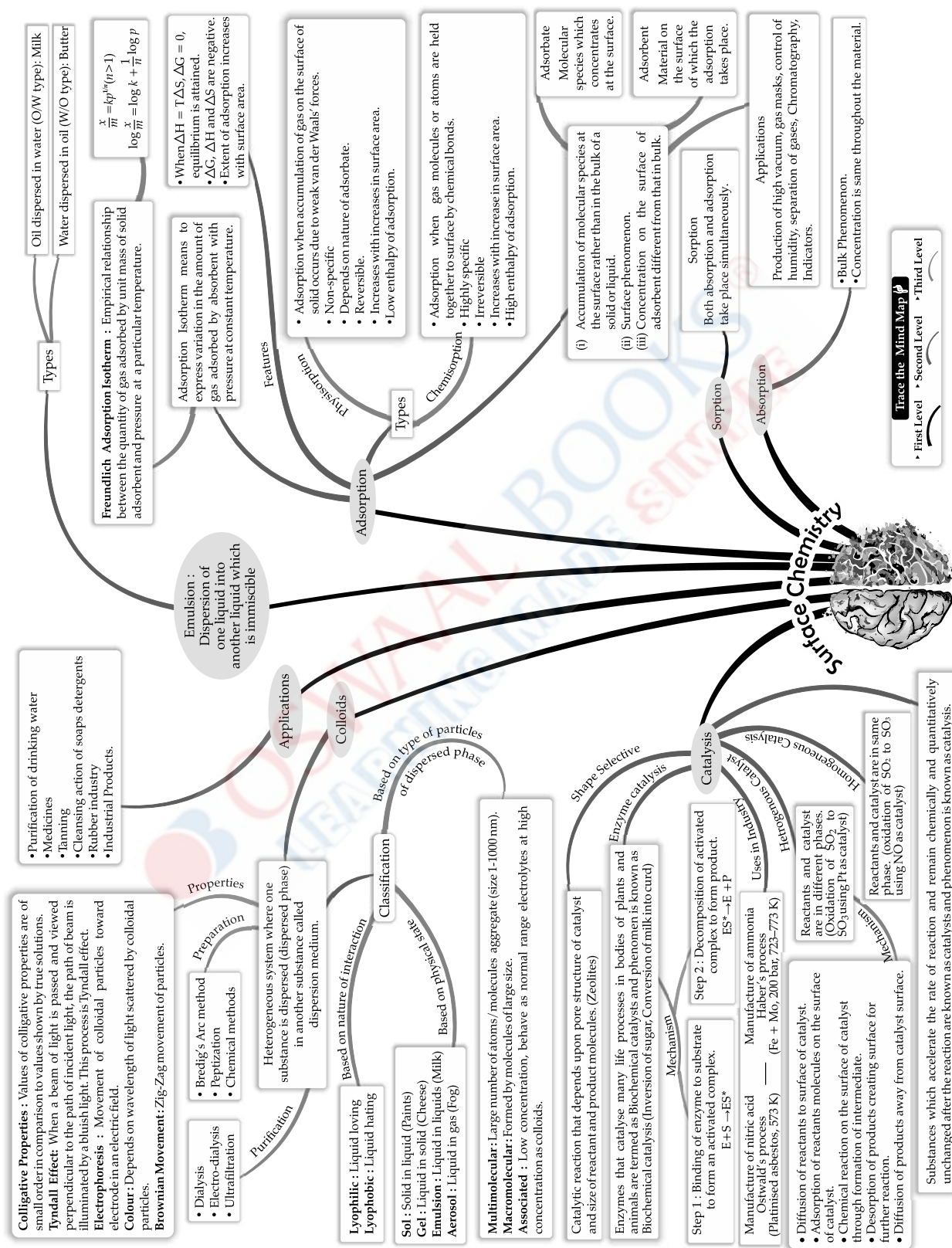
What are Associations?

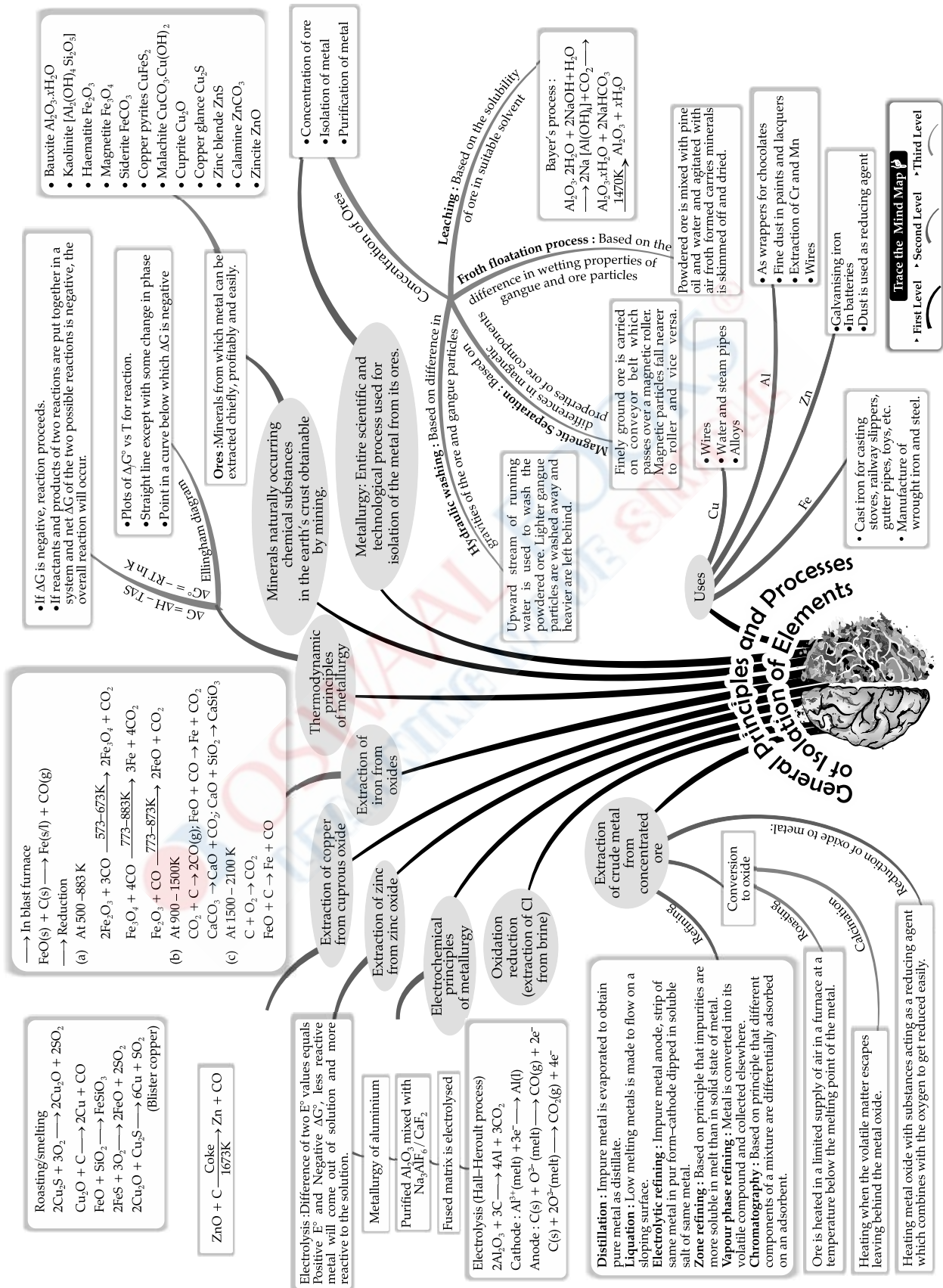
It's a technique connecting the core concept at the Centre to related concepts or ideas. Associations spreading out straight from the core concept are the First Level of Association. Then we have a Second Level of Association emitting from the first level and the chronology continues. The thickest line is the First Level of Association and the lines keep getting thinner as we move to the subsequent levels of association. This is exactly how the brain functions, therefore these Mind Maps. Associations are one powerful memory aid connecting seemingly unrelated concepts, hence strengthening memory.

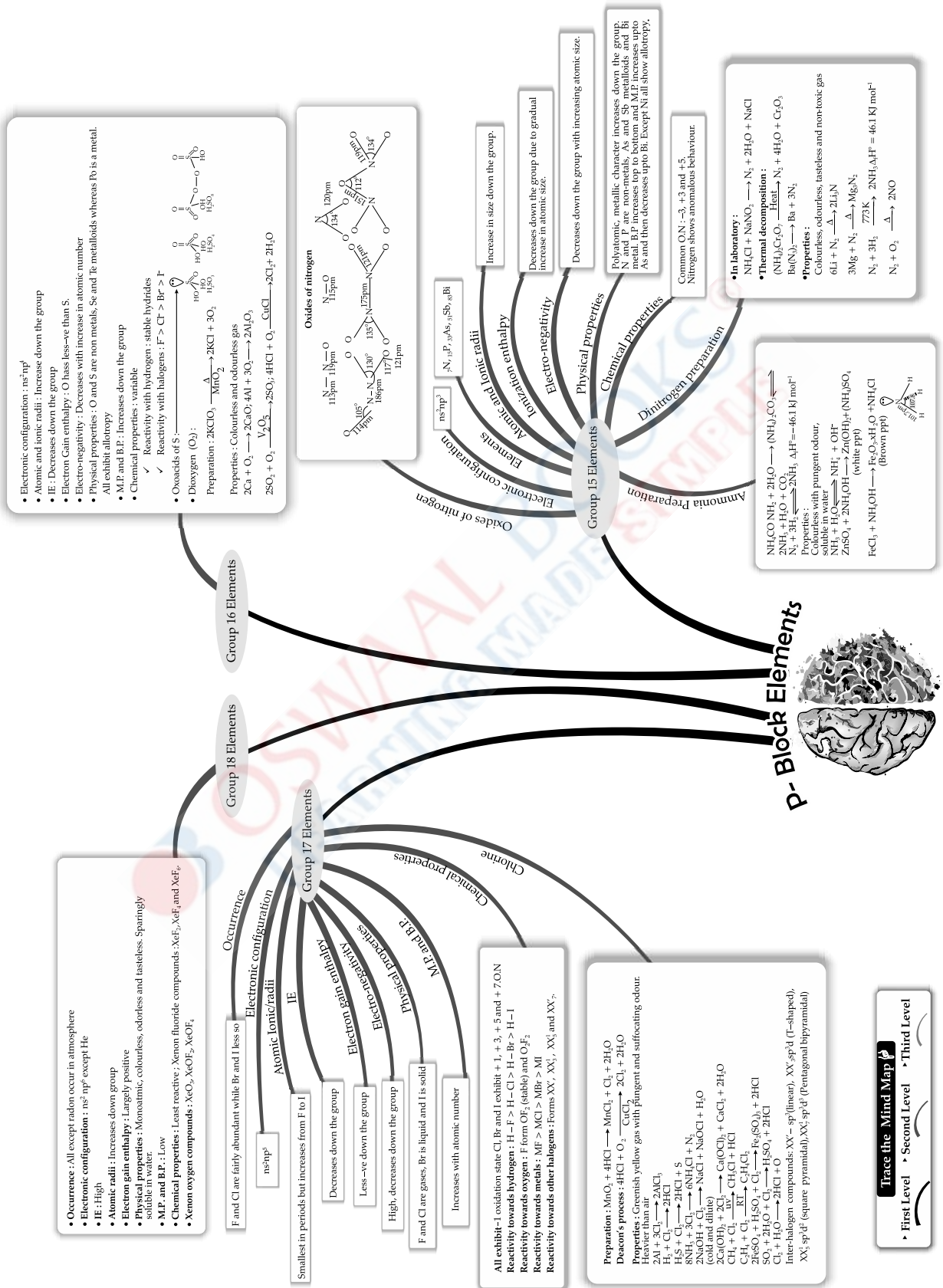


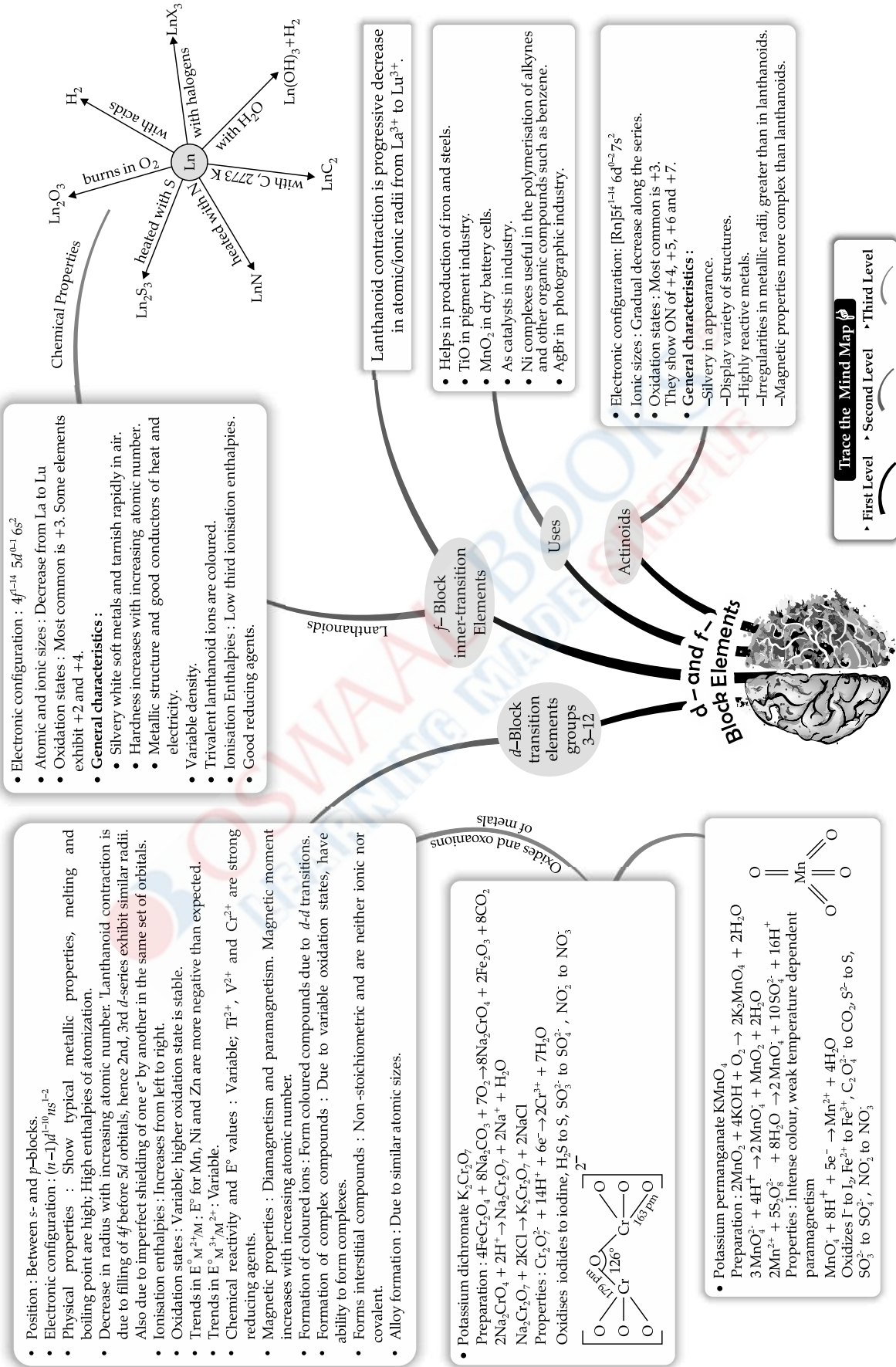


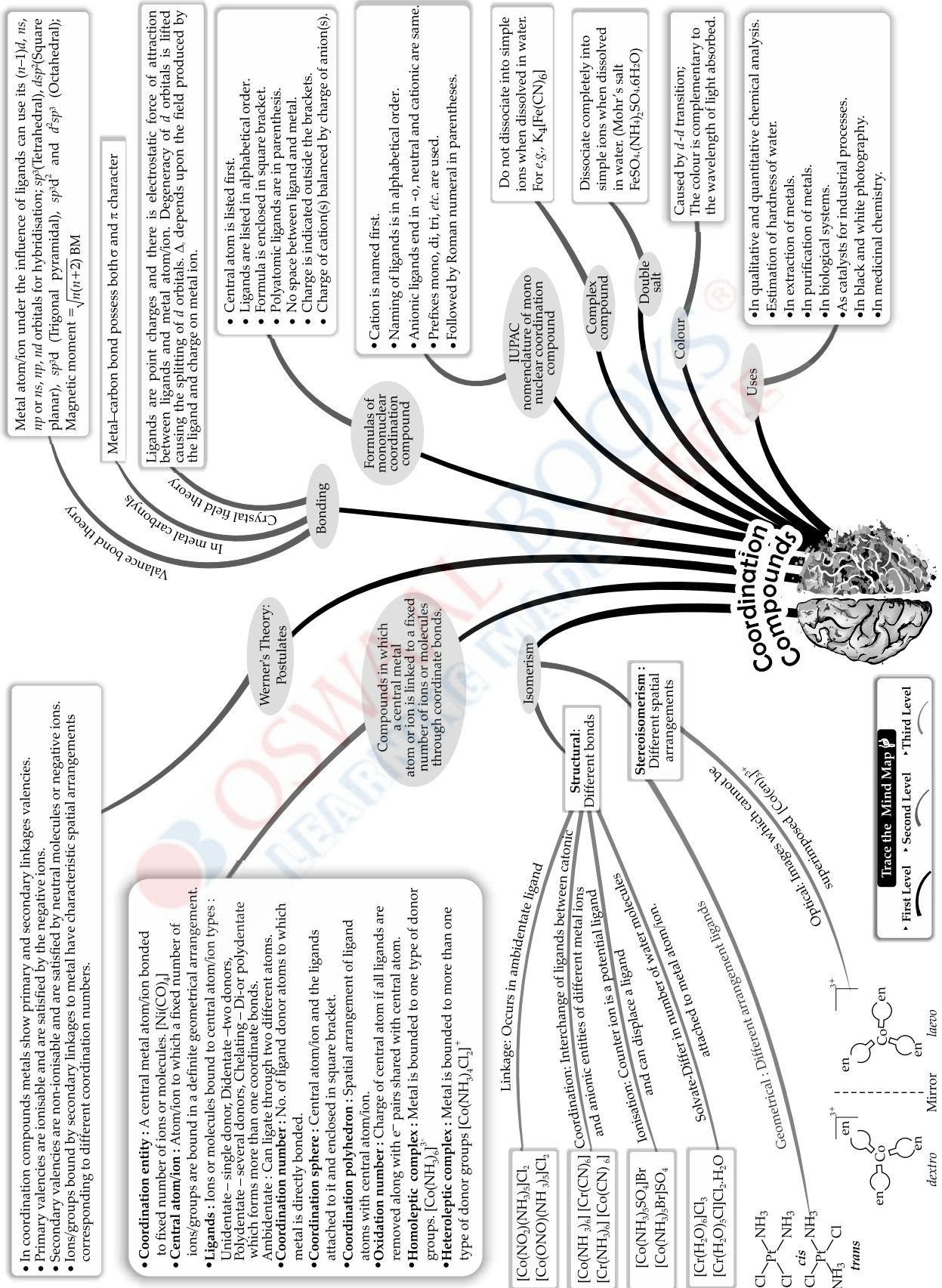












=>Preparation

- From alcohol : $R-OH + HCl \xrightarrow{ZnCl_2} R-Cl + H_2O$
 $3R-OH + PX_3 \rightarrow 3R-X + H_3PO_3$
 $ROH + PCl_5 \rightarrow R-Cl + POCl_3 + HCl$
- From hydrocarbons :
 (a) By free radical halogenation
 $CH_3CH_2CH_2CH_3 \xrightarrow{Cl_2/h\nu} CH_3CH_2CH_2CH_2Cl + CH_3CH_2CH(Cl)CH_3$
 (b) By electrophilic substitution
 $CH_3CH_2CH_2CH_3 + X_2 \xrightarrow{Dark} CH_3CH_2CH(X)CH_3$
 (c) Sandmeyer's reaction
 $Ph-NH_2 \xrightarrow{NaNO_2 + HX} Ph-N_2X \xrightarrow{Cu_2X_2} Ph-X + N_2$
 (d) From alkenes
 $C=C + HX \rightarrow C-C$
 $H_2C=CH_2 + Br_2 \xrightarrow{CCl_4} BrCH_2-CH_2Br$

=>Properties

- Halogen exchange :**
 $R-X + NaI \rightarrow R-I + NaX$
- Physical :** Colourless, volatile, sweet smell.
 Lower members are gases at room temperature while higher are solids.
- Chemical :**
 (a) Nucleophilic substitution
 $Nu^- + \overset{\delta+}{C}-\overset{\delta-}{X} \rightarrow [C-Nu]^\ddagger \rightarrow C-Nu + X^-$
 For S_N2 reaction: Tertiary, Secondary, Primary
 For S_N1 reaction: Tertiary, Secondary, Primary
 (b) Elimination reaction
 $B^- + \overset{\delta+}{C}-\overset{\delta-}{C}-H \rightarrow C=C + B-H + X^-$
 B = Base; X = Leaving group
 (c) Reaction with metals
 $CH_3CH_2Br + Mg \rightarrow CH_3CH_2MgBr$
 Wurtz reaction : $2RX + 2Na \xrightarrow{Dry\ ether} RR + 2NaX$

Trace the Mind Map
 • First Level • Second Level • Third Level

No. of halogen atoms

- C_2H_5X Monohaloalkane
- CH_2X-CH_2X Dihaloalkane
- $CH_2X-CH_2X-CH_2X$ Trihaloalkane

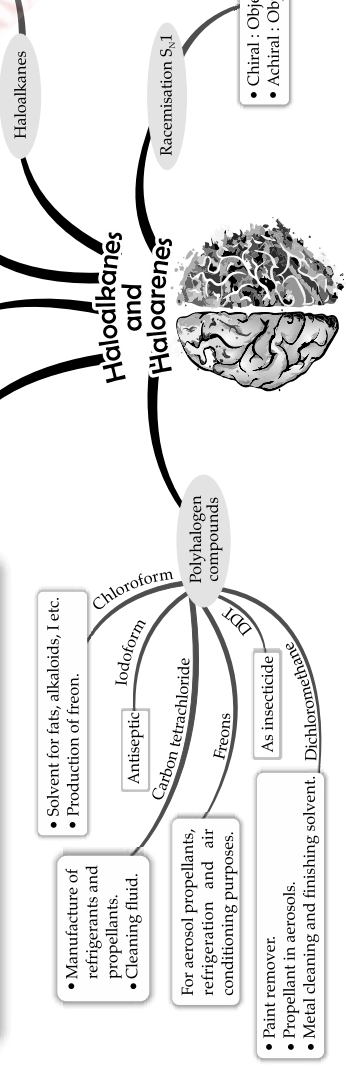
Compounds containing sp^2 C-X bond

- (a) Alkyl halides
 $R-C-X$
- (b) Allylic halides
 $CH_2=CH-CH_2-X$
- (c) Benzylic halides
 $Ph-CH_2-X$
- (d) Aryl halides
 $Ph-X$

Nomenclature
 Common name : Alkyl group followed by halides. Dihalogen derivatives, prefixes *o*-, *m*-, *p*- are used.
 IUPAC name : Numerals are used.
 Nature of C-X bond : Carbon-halogen bond is polarized.
 $\overset{\delta+}{C}-\overset{\delta-}{X}$

Reactions :

- (i) Nucleophilic substitution
 (a) Resonance effect
 $Ph-Cl \leftrightarrow Ph^{\ominus}-Cl^{\oplus}$
- (ii) Hybridisation of C in C-X bond :
 Haloalkane sp^3 ; Haloalkene sp^2
- (iii) Phenyl cation unstabilised by resonance
 Ph^{\oplus}
- (iv) Electrophilic substitution
 (i) $NaOH, 623K, 300atm$
 $Ph-Cl \xrightarrow{(i) H^+} Ph-OH$
 $Ph-Cl \xrightarrow{(i) NaOH, 443K} Ph-NO_2$
 (ii) NO_2
 $Ph-Cl \xrightarrow{Anhyd. FeCl_3} Ph-Cl_2$
 $Ph-Cl \xrightarrow{HNO_3, conc. H_2SO_4} Ph-NO_2$
 $Ph-Cl \xrightarrow{H_2SO_4, \Delta} Ph-SO_3H$
 Friedel-Crafts reaction
 $Ph-Cl + CH_3Cl \xrightarrow{Anhyd. AlCl_3} Ph-CH_3$
 $Ph-Cl + H_3C-CO-Cl \xrightarrow{Anhyd. AlCl_3} Ph-CO-CH_3$
- (v) Reaction with metals
 Wurtz-Fittig reaction
 $Ph-X + 2Na + RX \xrightarrow{Ether} Ph-Ph + 2NaX$
 Fittig reaction
 $2Ph-X + 2Na \xrightarrow{Ether} Ph-Ph + 2NaX$



Chiral : Objects which are non-superimposable.
 Achiral : Objects which are superimposable.

(i) Physical • Boiling point increases with increase in the number of C atoms.
• Solubility decreases with increase in size of alkyl/aryl groups.

(ii) Chemical : $2R-O-H + 2Na \rightarrow 2R-O-Na + H_2$; Acidity – primary > secondary > tertiary

$Ar/RO-H + R'-COOH \xrightarrow{H^+} Ar/ROCOR' + H_2O$; $ROH + HX \rightarrow R-X + H_2O$

$C_6H_5OH \xrightarrow{H_2SO_4, 443 K} CH_2 = CH_2 + H_2O$; $RCH_2OH \xrightarrow{Oxidation} R-C(=O)-H \rightarrow R-C(=O)-R$

Phenols

$Dil. HNO_3 \rightarrow$ 4-nitrophenol + 2,4-dinitrophenol

$Conc. HNO_3 \rightarrow$ 2,4,6-trinitrophenol

$Br_2, CS_2, 273K \rightarrow$ 2,4-dibromophenol

$3Br_2 \rightarrow$ 2,4,6-tribromophenol

$Zn \rightarrow$ 2,4-dibromophenol

Kolbe's reaction : $Phenol \xrightarrow{NaOH} NaOAr \xrightarrow{CO_2} NaOArCO_2Na \xrightarrow{H^+} HOArCO_2H$

Reimer Tiemann reaction : $Phenol \xrightarrow{CHCl_3, NaOH} NaOAr \xrightarrow{CHCl_3, NaOH} NaOArCH_2CO_2Na \xrightarrow{H^+} HOArCH_2CHO$

(i) Physical :

- C-O bonds are polar
- Boiling points comparable to those of alkanes.
- Solubility in water as alcohols.

(ii) Chemical : $R-O-R + HX \xrightarrow{Etanoic acid} RX + R-OH$

Friedel-Crafts reaction :

$Phenol + CH_3Cl \xrightarrow{Anhyd. AlCl_3, CS_2} p\text{-methoxytoluene}$

$Phenol + CH_3COCl \xrightarrow{Anhyd. AlCl_3} p\text{-methoxyacetophenone}$

Alcohols, Phenols And Ethers

Alcohols

Classification : Mono, Di, Tri, or polyhydric

Properties

Nomenclature : Structures of functional groups

Preparation

Ethers

Phenols

Alcohols

Ethers

Phenols

Commercially important alcohols

(i) Containing $C_{sp^3}-OH$ bond
 $-CH_2OH > CHOH > COH$
(1°) (2°) (3°)

(ii) Containing $C_{sp^2}-OH$ bond
Vinylic alcohol : $CH_2 = CH-OH$ Phenols

(i) Simple/symmetrical : Alkyl or aryl attached to oxygen atom same.
(ii) Mixed/unsymmetrical : Two groups are different.

Common name : Alkyl group + ol; IUPAC name : substituting 'e' of alkane with suffix 'ol'

Common name : Terms ortho, meta and para are used. IUPAC name : Dihydroxy derivatives as 1,2-, 1,3- and 1,4-benzenediol

Common name : Alkyl/aryl groups in alphabetical order followed by ether. IUPAC name : In alkyl/aryl group 'e' replaced by oxy followed by parent hydrocarbon.

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

1. From alkenes :- (i) By acid catalysed hydration
 $>C=C< + H_2O \xrightarrow{H^+} >C-C(OH)<$

(ii) By hydroboration - oxidation
 $CH_3-CH=CH_2 + (H-BH_2)_2 \xrightarrow{H} CH_3-CH_2-CH_2-OH$
 $3CH_3-CH_2-CH_2-OH + B(OH)_3 \xrightarrow{H_2O} 3H_3BO_3 + 3CH_3-CH_2-CH_2-OH$

2. From carbonyl compounds :

(i) By reduction of aldehydes and ketones
 $RCHO + H_2 \xrightarrow{Pd} RCH_2OH$; $RCHO + H_2 \xrightarrow{NaBH_4} R-CH_2-OH$

(ii) By reduction of carboxylic acids and esters
 $RCOOH \xrightarrow{LiAlH_4} RCH_2OH$; $RCOOR' \xrightarrow{LiAlH_4} RCH_2OH + ROH$

3. From Grignard reagent
 $>C=O + R-MgX \rightarrow [>C(OMgX)R] \xrightarrow{H_2O} >C(OH)R$

1. By dehydration of alcohols
 $CH_3CH_2OH \xrightarrow{H_2SO_4, 413 K} C_2H_5OC_2H_5$

2. Williamson synthesis
 $RX + R'ONa \rightarrow R-O-R' + NaX$

$Phenol + NaOH \rightarrow NaOPh + H_2O$
 $NaOPh + RX \rightarrow PhOR + NaX$

1. From haloarenes
 $Ar-Cl + NaOH \xrightarrow{623K, 300atm} Ar-ONa + NaCl$

2. From benzene sulphonic acid
 $Ph-SO_3H + NaOH \xrightarrow{H^+} Ph-ONa + NaSO_3^-$

3. From diazonium salts
 $Ph-N_2^+Cl^- + H_2O \xrightarrow{Warm} Ph-OH + N_2 + HCl$

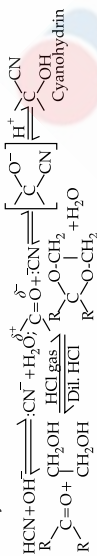
4. From Cumene
 $Ph-CH(CH_3)-CO-OH \xrightarrow{H^+} Ph-CH(CH_3)-COCH_3 + H_2O$

Trace the Mind Map

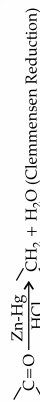
- First Level → Second Level → Third Level

ALDEHYDES AND KETONES:

(i) **Physical:** Boiling points are higher than hydrocarbons and ethers of comparable molecular masses and lower than alcohols of similar molecular masses due to absence of intermolecular hydrogen bonding.
 (ii) **Chemical:** **Nucleophilic addition reactions:** Aldehydes are more reactive than ketones due to steric and electronic reasons.

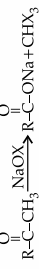


Reduction: (a) To alcohols - aldehydes and ketones reduce to primary and secondary alcohols respectively by NaBH_4 or LiAlH_4 .
 (b) To hydrocarbons -

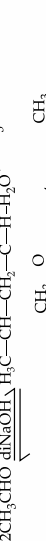
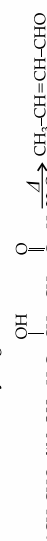


Oxidation: $\text{RCHO} \xrightarrow{[\text{O}]} \text{R-COOH}$ Silver mirror
Tollen's test: $\text{RCHO} + 2[\text{Ag}(\text{NH}_3)_2]^+ + 3\text{OH}^- \rightarrow \text{RCOO}^- + 2\text{Ag}\downarrow + 2\text{H}_2\text{O} + 4\text{NH}_3$
Fehling's test: $\text{RCHO} + 2\text{Cu}^{2+} + 5\text{OH}^- \rightarrow \text{RCOO}^- + \text{Cu}_2\text{O}\downarrow + 3\text{H}_2\text{O}$ Red brown ppt

Haloform reaction:



Reactions due to α -hydrogen:



Cannizzaro reaction: $2\text{HCHO} + \text{conc KOH} \rightarrow \text{CH}_3\text{OH} + \text{HCOOK}$

Electrophilic substitution reaction:

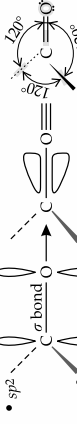


Carboxylic acids:

(i) **Physical:** Higher boiling points than aldehydes, ketones or alcohols. Solubility decreases with increasing number of C atoms.
 (ii) **Chemical:** $2\text{RCOOH} + 2\text{Na} \rightarrow 2\text{RCOONa} + \text{H}_2$
 Forms corresponding anhydride on heating with mineral acids
 $\text{RCOOH} + \text{R}'\text{OH} \xrightarrow{\text{H}^+} \text{RCOOR}' + \text{H}_2\text{O}$
 $\text{RCOOH} + \text{PCl}_5 \rightarrow \text{RCOCl} + \text{POCl}_3 + \text{HCl}$
 $\text{CH}_3\text{COOH} + \text{NH}_3 \rightleftharpoons \text{CH}_3\text{COO}^- + \text{NH}_4^+ \xrightarrow{-\text{H}_2\text{O}} \text{CH}_3\text{CONH}_2$
 $\text{RCOOH} \xrightarrow{\text{B}_2\text{H}_6, \text{H}_2\text{O}^+} \text{RCH}_2\text{OH}$
 $\text{RCOONa} \xrightarrow{\text{Heat, NaOH \& CaO}} \text{R-H} + \text{Na}_2\text{CO}_3$
 $\text{RCH}_2\text{COOH} \xrightarrow{\text{X}_2/\text{Red P, H}_2\text{O}} \text{R}-\text{CH}_2-\text{COOH} \text{ (HVZ reaction)}$ (X = Cl, Br)

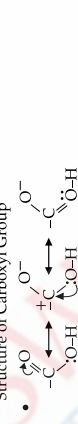
1. Aldehydes and Ketones

Common names:
 • Replace corresponding carboxylic acids with aldehyde.
 • Alkyl phenyl ketones by adding acyl group as prefix to phenone.
 IUPAC names:
 • Replacing -e with -al and -one as required.
 • Structure of Carbonyl group



2. Carboxylic Acids

Common names: end with -ic with -oic acid.
 IUPAC names: replace -e in the corresponding alkane with -oic acid.



3. USES

- (a) **Carboxylic acids**
- Methanoic acid in rubber, textile, dyeing, leather industries.
 - Ethanoic acid as solvent.
 - Higher fatty acids in manufacture of soaps and detergents.
- (b) **Aldehydes of ketones**
- As solvents.
 - Starting materials and reagents for synthesis of products.

ALDEHYDES:

- 1. From acyl chloride**
 $\text{R-COCl} \xrightarrow{\text{H}_2} \text{R-CHO}$
 $\text{R-COCl} \xrightarrow{\text{Pd-BaSO}_4} \text{R-CHO}$
- 2. From nitriles and esters: Stephen reaction**
 $\text{RCN} + 5\text{SnCl}_2 + \text{HCl} \rightarrow \text{RCH}=\text{NH} \xrightarrow{\text{H}_3\text{O}^+} \text{R-CHO}$
- 3. From hydrocarbons: Etard reaction**
 $\text{C}_6\text{H}_5\text{CH}_3 + \text{CrO}_2\text{Cl}_2 \xrightarrow{\text{CS}_2} \text{C}_6\text{H}_5\text{COCl} \xrightarrow{\text{H}_3\text{O}^+} \text{C}_6\text{H}_5\text{CHO}$
 $\text{C}_6\text{H}_5\text{CH}_3 \xrightarrow{\text{Cl}_2/h\nu} \text{C}_6\text{H}_5\text{CH}_2\text{Cl} \xrightarrow{\text{H}_2\text{O, 373K}} \text{C}_6\text{H}_5\text{CHO}$

Gattermann - Koch reaction
 $\text{C}_6\text{H}_6 \xrightarrow{\text{CO, HCl, Anhyd. AlCl}_3} \text{C}_6\text{H}_5\text{CHO}$

KETONES:

- 1. From acyl chloride**
 $2\text{R-Mg-X} + \text{CdCl}_2 \rightarrow \text{R}_2\text{C=Cd} + 2\text{Mg(X)Cl}$
 $\text{R}_2\text{C=Cd} \xrightarrow{\text{O}} \text{R}_2\text{C=O}$
- 2. From nitriles**
 $\text{CH}_3\text{CH}_2\text{CN} + \text{C}_6\text{H}_5\text{MgBr} \xrightarrow{\text{Ether}} \text{CH}_3\text{CH}_2\text{C}(\text{C}_6\text{H}_5)_2 \xrightarrow{\text{H}_3\text{O}^+} \text{C}_6\text{H}_5\text{C}(\text{C}_6\text{H}_5)\text{C}_6\text{H}_5$
- 3. From benzene or substituted benzenes**
 $\text{C}_6\text{H}_6 \xrightarrow{\text{Ar/R-CO-Cl, Anhyd. AlCl}_3} \text{C}_6\text{H}_5\text{C(=O)Ar/R}$

Carboxylic Acids:

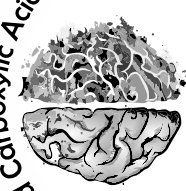
- 1. From primary alcohols and aldehydes** RCH_2OH alk. $\text{KMnO}_4 \xrightarrow{\text{H}_3\text{O}^+} \text{RCOOH}$
- 2. From alkyl benzenes**
 $\text{C}_6\text{H}_5\text{CH}_3 \xrightarrow{\text{KMnO}_4/\text{KOH}} \text{C}_6\text{H}_5\text{COOH}$
 $\text{C}_6\text{H}_5\text{CH}_2\text{COOH} \xrightarrow{\text{H}_3\text{O}^+} \text{C}_6\text{H}_5\text{COOH}$
- 3. From nitriles and amides** $\text{R-CN} \xrightarrow{\text{H}^+/\text{OH}^-} \text{R-C(=O)-NH}_2 \xrightarrow{\text{H}^+/\text{OH}^-} \text{R-COOH}$
- 4. From Grignard reagents** $\text{R-Mg-X} + \text{CO}_2 \rightarrow \text{R-C(=O)-O}^- \text{Mg}^+ \xrightarrow{\text{H}_3\text{O}^+} \text{RCOOH}$
- 5. From acyl halides and anhydrides**
 $\text{RCOCl} \xrightarrow{\text{OH}^-/\text{H}_2\text{O}} \text{RCOO}^- + \text{Cl}^- \xrightarrow{\text{H}_3\text{O}^+} \text{RCOOH}$
 $\text{C}_6\text{H}_5\text{COOCOCH}_3 \xrightarrow{\text{H}_2\text{O}} \text{C}_6\text{H}_5\text{COOH} + \text{CH}_3\text{COOH}$
- 6. From esters**
 $\text{C}_6\text{H}_5\text{COOC}_2\text{H}_5 \xrightarrow{\text{H}_3\text{O}^+} \text{C}_6\text{H}_5\text{COOH} + \text{C}_2\text{H}_5\text{OH}$
 $\text{CH}_3\text{CH}_2\text{COOC}_2\text{H}_5 \xrightarrow{\text{NaOH}} \text{CH}_3\text{CH}_2\text{COONa} + \text{C}_2\text{H}_5\text{OH}$
 $\text{CH}_3\text{CH}_2\text{COOH} \xrightarrow{\text{H}_3\text{O}^+} \text{CH}_3\text{CH}_2\text{COOH}$

Nomenclature, Structure and Uses

Preparation

Properties

Aldehydes, Ketones and Carboxylic Acids



Trace the Mind Map
 • First Level • Second Level • Third Level

Structure

Classification

$$\text{NH}_3 \rightarrow \text{RNH}_2 \rightarrow \text{R}_2\text{NH} \rightarrow \text{R}_3\text{N}^+$$

Nomenclature

Common name : Aliphatic amine is named by prefixing alkyl group to amine. In secondary and tertiary amines prefix di- or tri- is put before name of alkyl group.
IUPAC name : replacement of 'e' of alkane by the word amine. Suffix 'yl' of arene is replaced by amine.

Derivatives of ammonia obtained by replacement of one, two or all the three H-atoms by alkyl and/or aryl groups

Preparation

Diazonium Salts (RN₂X)

Preparation :
 $\text{C}_6\text{H}_5\text{NH}_2 + \text{NaNO}_2 + 2\text{HCl} \xrightarrow{273-278\text{K}} \text{C}_6\text{H}_5\text{N}_2^+\text{Cl}^- + \text{NaCl} + 2\text{H}_2\text{O}$
Physical properties : Colourless crystalline solid, soluble in water, stable in cold but reacts with water on warming.
Chemical properties :

(i) Sandmeyer reaction: $\text{ArN}_2^+\text{X}^- \xrightarrow{\text{Cu}_2\text{Cl}_2/\text{HCl}} \text{ArCl} + \text{N}_2$
 $\xrightarrow{\text{Cu}_2\text{Br}_2/\text{HBr}} \text{ArBr} + \text{N}_2$
 $\xrightarrow{\text{CuCN/KCN}} \text{ArCN} + \text{N}_2$

Gattermann reaction :
 $\text{ArN}_2^+\text{X}^- \xrightarrow{\text{Cu/HCl}} \text{ArCl} + \text{N}_2 + \text{CuX}$
 $\xrightarrow{\text{Cu/HBr}} \text{ArBr} + \text{N}_2 + \text{CuX}$

(ii) $\text{ArN}_2^+\text{Cl}^- + \text{KI} \rightarrow \text{ArI} + \text{KCl} + \text{N}_2$
 (iii) $\text{ArN}_2^+\text{Cl}^- + \text{HBF}_4 \rightarrow \text{ArN}_2^+\text{BF}_4^- \xrightarrow{\Delta} \text{ArF} + \text{BF}_3 + \text{N}_2$
 (iv) $\text{ArN}_2^+\text{Cl}^- + \text{H}_3\text{PO}_2 + \text{H}_2\text{O} \rightarrow \text{ArH} + \text{N}_2 + \text{H}_3\text{PO}_3 + \text{HCl}$
 (v) $\text{ArN}_2^+\text{Cl}^- + \text{H}_2\text{O} \rightarrow \text{ArOH} + \text{N}_2 + \text{HCl}$

(vi) Coupling reaction :

$$\text{C}_6\text{H}_5\text{N}_2^+\text{Cl}^- + \text{H}-\text{C}_6\text{H}_4-\text{OH} \rightarrow \text{H}-\text{C}_6\text{H}_4-\text{OH}-\text{N}=\text{N}-\text{C}_6\text{H}_5 + \text{Cl}^- + \text{H}_2\text{O}$$

(Orange dye)

$$\text{C}_6\text{H}_5\text{N}_2^+\text{Cl}^- + \text{H}-\text{C}_6\text{H}_4-\text{NH}_2 \rightarrow \text{H}-\text{C}_6\text{H}_4-\text{NH}-\text{N}=\text{N}-\text{C}_6\text{H}_5 + \text{Cl}^- + \text{H}_2\text{O}$$

(Yellow dye)

Organic Compounds Containing Nitrogen

Physical properties

Importance of diazonium salts in synthesis of aromatic compounds

Chemical properties

In preparation of substituted aromatic compounds which cannot be prepared by direct substitution in benzene/substituted benzene.

- Lower aliphatic amines are gases. Primary amines with three or more C atoms are liquid and higher ones are solid.
- Arylamines are colourless but get coloured on storage.
- Lower aliphatic amines are soluble in water, while higher are insoluble.
- Primary and secondary amines form intermolecular association.
- Boiling point : Primary > Secondary > Tertiary

(i) Basic character of amines

- React with acids to form salts: $\text{R}-\text{NH}_2 + \text{HX} \rightleftharpoons \text{R}-\text{NH}_3^+\text{X}^-$ (salt)
- React with base to regenerate parent amines: $\text{RN}^+\text{H}_3\text{X}^- + \text{OH}^- \rightarrow \text{RNH}_2 + \text{H}_2\text{O} + \text{X}^-$
- Order of stability of ions: $1^\circ > 2^\circ > 3^\circ$

(ii) $\text{C}_2\text{H}_5-\text{NH}-\text{CH}_3-\text{Cl} \xrightarrow[\text{Base}]{\text{C}_2\text{H}_5\text{N}^+-\text{C}(\text{CH}_3)_2+\text{HCl}} \text{C}_2\text{H}_5\text{N}^+-\text{C}(\text{CH}_3)_2+\text{HCl}$

(iii) **Carbonylamine reaction :** $\text{R}-\text{NH}_2 + \text{CHCl}_3 + 3\text{KOH} \xrightarrow{\Delta} \text{R}-\text{NC} + 3\text{KCl} + 3\text{H}_2\text{O}$

(iv) **With nitrous acid**
 $\text{RNH}_2 + \text{HNO}_2 \xrightarrow{\text{NaNO}_2 + \text{HCl}} [\text{R}-\text{N}_2\text{Cl}] \xrightarrow{\text{H}_2\text{O}} \text{ROH} + \text{N}_2 + \text{HCl}$
 $\text{C}_6\text{H}_5\text{NH}_2 \xrightarrow[273-278\text{K}]{\text{NaNO}_2 + \text{HCl}} \text{C}_6\text{H}_5\text{N}_2\text{Cl} + \text{NaCl} + 2\text{H}_2\text{O}$

(v) $\text{C}_6\text{H}_5\text{NH}_2 + \text{H}_2\text{N}-\text{C}_6\text{H}_5 \xrightarrow{\text{Br}_2/\text{H}_2\text{O}} \text{C}_6\text{H}_5\text{NH}-\text{C}_6\text{H}_5 + \text{HCl}$

(vi) **Electrophilic substitution reactions**

$$\text{C}_6\text{H}_5\text{NH}_2 + 3\text{Br}_2 \xrightarrow{\text{Br}_2/\text{H}_2\text{O}} \text{C}_6\text{H}_2(\text{Br})_3\text{NH}_2 + 3\text{HBr}$$

$\text{C}_6\text{H}_5\text{NH}_2 + \text{HNO}_2/\text{H}_2\text{SO}_4 \xrightarrow{288\text{K}} \text{C}_6\text{H}_4(\text{NO})\text{NH}_2 + \text{H}_2\text{O}$ (47%)

$\text{C}_6\text{H}_5\text{NH}_2 + \text{HNO}_2/\text{H}_2\text{SO}_4 \xrightarrow{453-473\text{K}} \text{C}_6\text{H}_4(\text{NO}_2)\text{NH}_2 + \text{H}_2\text{O}$ (51%)

$\text{C}_6\text{H}_5\text{NH}_2 + \text{H}_2\text{SO}_4 \rightleftharpoons \text{C}_6\text{H}_5\text{NH}_3^+\text{HSO}_4^-$ (2%)

Trace the Mind Map

• First Level → Second Level → Third Level

Optically active polyhydroxy aldehydes or ketones or compounds which produce units with specific functional groups on hydrolysis.

Classification:

(I) **Monosaccharides:** (Aldehyde group – aldose, keto group – ketose)

Glucose : Preparation : $C_6H_{12}O_{11} + H_2O \xrightarrow{H^+} C_6H_{12}O_6 + C_6H_{12}O_6$
 Sucrose Fructose

(a) **From sucrose:** $C_{12}H_{22}O_{11} + H_2O \xrightarrow{H^+} C_6H_{12}O_6 + C_6H_{12}O_6$
 Glucose Fructose

(b) **From starch:** $(C_6H_{10}O_5)_n + nH_2O \xrightarrow{H^+, 393K; 2-3 \text{ atm}} nC_6H_{12}O_6$

Structure:

$\begin{matrix} \text{CHO} \\ | \\ (\text{CHOH})_4 \\ | \\ \text{CH}_2\text{OH} \end{matrix}$ $\xrightarrow{\text{H}^+/\text{A}}$ $\begin{matrix} \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3 \\ | \\ \text{CH}=\text{N}-\text{OH} \\ | \\ (\text{CHOH})_4 \\ | \\ \text{CH}_2\text{OH} \end{matrix}$

$\begin{matrix} \text{CHO} \\ | \\ (\text{CHOH})_4 \\ | \\ \text{CH}_2\text{OH} \end{matrix}$ $\xrightarrow{\text{NH}_2\text{OH}}$ $\begin{matrix} \text{CH}=\text{CN} \\ | \\ (\text{CHOH})_4 \\ | \\ \text{CH}_2\text{OH} \end{matrix}$

$\begin{matrix} \text{CHO} \\ | \\ (\text{CHOH})_4 \\ | \\ \text{CH}_2\text{OH} \end{matrix}$ $\xrightarrow{\text{HCN}}$ $\begin{matrix} \text{COOH} \\ | \\ (\text{CHOH})_4 \\ | \\ \text{CH}_2\text{OH} \end{matrix}$

$\begin{matrix} \text{CHO} \\ | \\ (\text{CHOH})_4 \\ | \\ \text{CH}_2\text{OH} \end{matrix}$ $\xrightarrow{\text{Br}_2/\text{Water}}$ $\begin{matrix} \text{CHO} \\ | \\ (\text{CHOH})_3 \\ | \\ \text{CO}-\text{C}-\text{CH}_3 \\ | \\ \text{CH}_2-\text{O}-\text{C}-\text{CH}_3 \end{matrix}$

$\begin{matrix} \text{CHO} \\ | \\ (\text{CHOH})_4 \\ | \\ \text{CH}_2\text{OH} \end{matrix}$ $\xrightarrow{\text{Acetic anhydride}}$ $\begin{matrix} \text{CHO} \\ | \\ (\text{CHOH})_3 \\ | \\ \text{CO}-\text{O}-\text{C}-\text{CH}_3 \\ | \\ \text{CH}_2-\text{O}-\text{C}-\text{CH}_3 \end{matrix}$

$\begin{matrix} \text{CHO} \\ | \\ (\text{CHOH})_4 \\ | \\ \text{CH}_2\text{OH} \end{matrix}$ $\xrightarrow{\text{Oxidation}}$ $\begin{matrix} \text{COOH} \\ | \\ (\text{CHOH})_4 \\ | \\ \text{COOH} \end{matrix}$

Cyclic Structures

$\begin{matrix} \text{CH}_2\text{OH} \\ | \\ \text{H} \\ | \\ \text{H} \\ | \\ \text{H} \\ | \\ \text{H} \\ | \\ \text{H} \\ | \\ \text{H} \end{matrix}$ $\begin{matrix} \text{OH} \\ | \\ \text{OH} \\ | \\ \text{OH} \\ | \\ \text{OH} \\ | \\ \text{OH} \\ | \\ \text{OH} \end{matrix}$

$\alpha\text{-D-(+)-Glucopyranose}$

$\begin{matrix} \text{CH}_2\text{OH} \\ | \\ \text{H} \\ | \\ \text{H} \\ | \\ \text{H} \\ | \\ \text{H} \\ | \\ \text{H} \end{matrix}$ $\begin{matrix} \text{OH} \\ | \\ \text{OH} \\ | \\ \text{OH} \\ | \\ \text{OH} \\ | \\ \text{OH} \\ | \\ \text{OH} \end{matrix}$

$\beta\text{-D-(+)-Fructofuranose}$

Structure of Fructose

$\begin{matrix} \text{HOH}_2\text{C} \\ | \\ \text{H} \\ | \\ \text{H} \\ | \\ \text{H} \\ | \\ \text{H} \end{matrix}$ $\begin{matrix} \text{OH} \\ | \\ \text{OH} \\ | \\ \text{OH} \\ | \\ \text{OH} \\ | \\ \text{OH} \end{matrix}$

$\alpha\text{-D-(+)-fructofuranose}$

$\begin{matrix} \text{HOH}_2\text{C} \\ | \\ \text{H} \\ | \\ \text{H} \\ | \\ \text{H} \\ | \\ \text{H} \end{matrix}$ $\begin{matrix} \text{OH} \\ | \\ \text{OH} \\ | \\ \text{OH} \\ | \\ \text{OH} \\ | \\ \text{OH} \end{matrix}$

$\beta\text{-D-(+)-fructofuranose}$

Structure of Fructose

$\begin{matrix} \text{HOH}_2\text{C} \\ | \\ \text{H} \\ | \\ \text{H} \\ | \\ \text{H} \\ | \\ \text{H} \end{matrix}$ $\begin{matrix} \text{OH} \\ | \\ \text{OH} \\ | \\ \text{OH} \\ | \\ \text{OH} \\ | \\ \text{OH} \end{matrix}$

$\alpha\text{-D-(+)-fructofuranose}$

Structure of Fructose

$\begin{matrix} \text{HOH}_2\text{C} \\ | \\ \text{H} \\ | \\ \text{H} \\ | \\ \text{H} \\ | \\ \text{H} \end{matrix}$ $\begin{matrix} \text{OH} \\ | \\ \text{OH} \\ | \\ \text{OH} \\ | \\ \text{OH} \\ | \\ \text{OH} \end{matrix}$

$\beta\text{-D-(+)-fructofuranose}$

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

(III) Polysaccharides: Large number of monosaccharides units joined by glycosidic linkages. e.g.

(a) Starch : Polymer of α -glucose with two components amylose and amylopectin

(b) Cellulose

(c) Glycogen

Importance:

- Form a major portion of food.
- As storage molecules.
- Cellulose forms cell wall of bacteria and plants.
- Raw materials for industries like textiles, paper, lacquers and breweries.

Enzymes

DNA Fingerprinting: Unique sequence of bases on DNA.

Global proteins specific for particular reaction and for particular substrate. Mechanism : Reduces the magnitude of activation energy

A sequence of bases on DNA unique for a person and information regarding this is called DNA fingerprinting. It is same for every cell and cannot be altered by any known treatment. DNA fingerprinting is now used

- (i) in forensic laboratories for identification of criminals.
- (ii) to determine paternity of an individual.
- (iii) to identify the dead bodies in any accident by comparing the DNA's of parents or children.
- (iv) to identify racial groups to rewrite biological evolution.

(Polymers of 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

Structure : $\text{H}_2\text{N} - \text{CH}_2 - \text{CO}-\text{NH} - \text{CH}(\text{COOH}) - \text{CH}_3$

Denaturation of protein :

When a protein in its native form is subjected to physical change, globules unfold, helix get uncoiled and protein loses its biological activity.

Organic compounds required in diet in small amounts to perform specific biological functions for maintenance and growth.

Classification:

- (i) **Fat soluble:** Soluble in fats and oils but insoluble in water. (Vitamins A,D,E and K)
- (ii) **Water soluble:** B group and vitamin C are soluble in water.

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 $\beta\text{-D-2-deoxyribose}$ whereas in RNA is $\beta\text{-D-ribose}$. DNA contains A,G,C,T whereas RNA has A,G,C,U.

Structure: –

Nucleotide: Formed by attachment of a base to 1' of sugar

Nucleoside: Formed by link to phosphoric acid at 5' of sugar.

$\begin{matrix} \text{Base} \\ | \\ \text{Base} \\ | \\ \text{Base} \\ | \\ \text{Base} \end{matrix}$ $\begin{matrix} \text{Phosphate} \\ | \\ \text{Phosphate} \\ | \\ \text{Phosphate} \\ | \\ \text{Phosphate} \end{matrix}$ $\begin{matrix} \text{Sugar} \\ | \\ \text{Sugar} \\ | \\ \text{Sugar} \\ | \\ \text{Sugar} \end{matrix}$

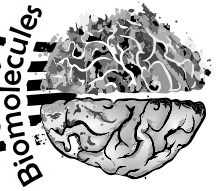
Types of RNA : m-RNA, t-RNA, r-RNA

Biological Functions:

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

Trace the Mind Map

• First Level • Second Level • Third Level



Carbohydrates

Proteins

Vitamins

Nucleic Acids

Biomolecules

