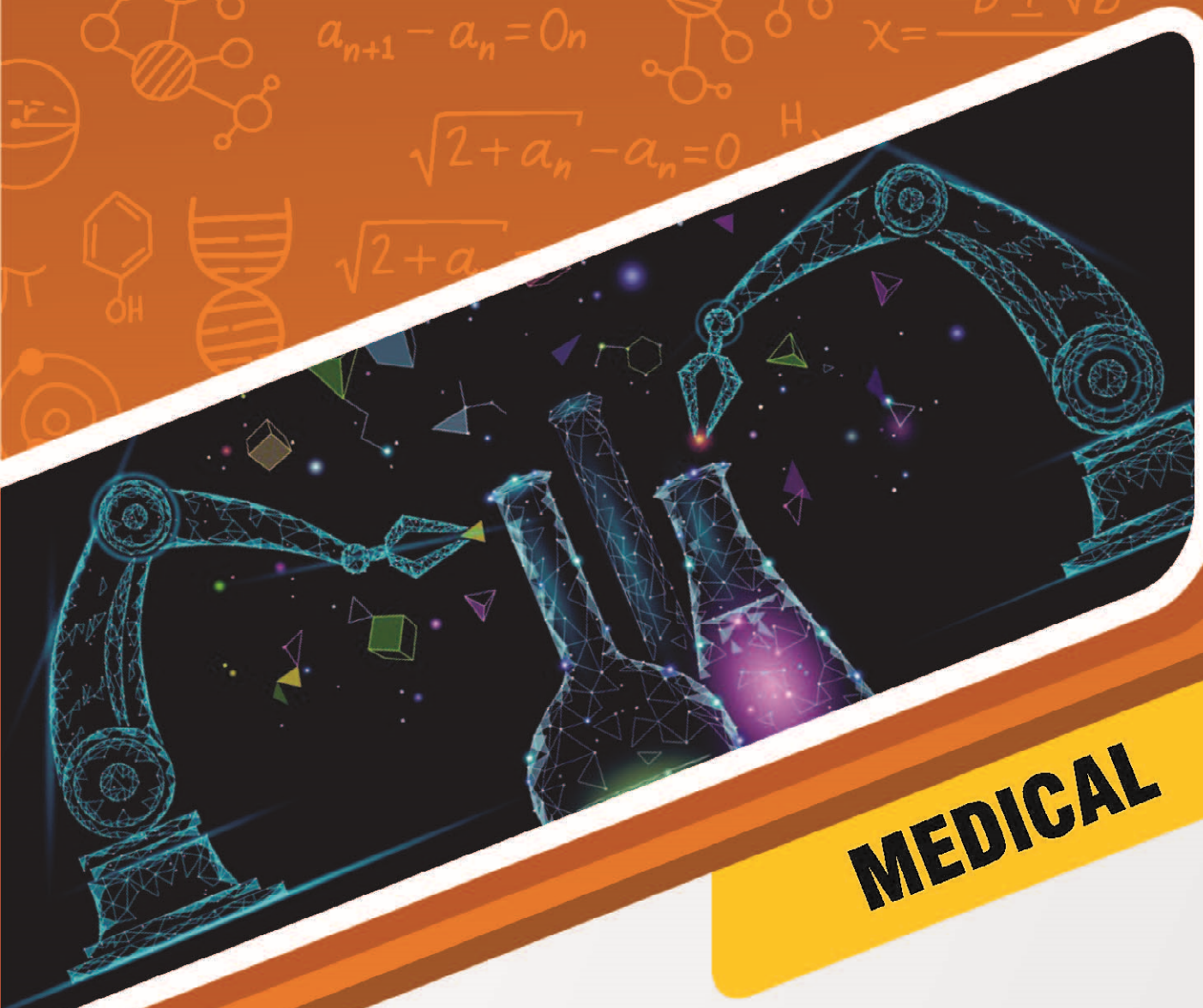
CHEMISTRY



MEDICAL

ISOMERISM

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CONTENT

ISOMERISM

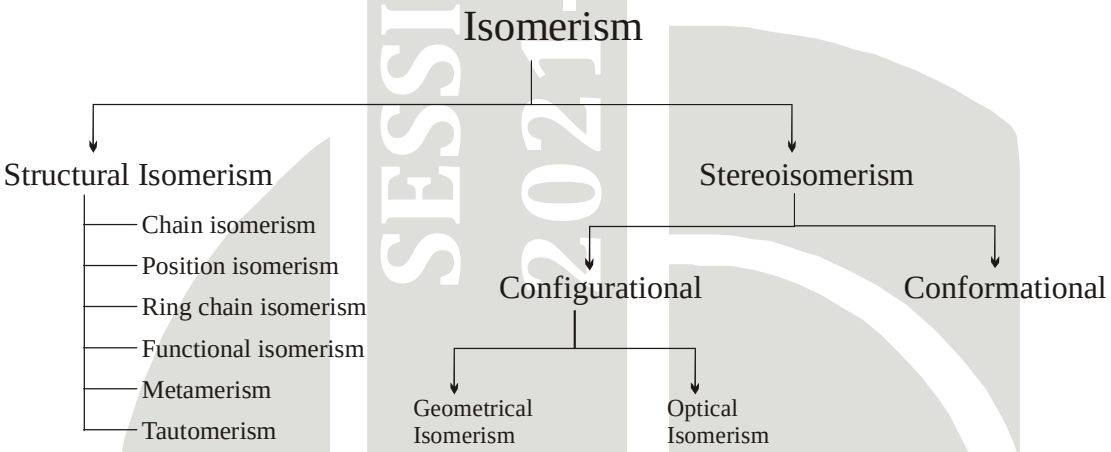
ISOMERISM

INTRODUCTION

(i) The compound which have the same molecular formula but differ in physical and chemical properties are called as Isomer and the phenomenon is called Isomerism.

(ii) The term 'isomer' was given by Berzellius.

(iii) The isomer was derived from Greek word meaning 'equal or like part' (isos= equal; meros = parts)



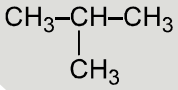
(I) **Structural Isomerism / Constitutional Isomerism** :

Structural isomers possess the same molecular formula but different connectivity of atoms. The term constitutional isomerism is a more modern term of structural isomerism. It is sub-classified into following types.

(i) Chain Isomerism : The different arrangement of carbon atoms gives rise to chain isomerism. Chain isomers possess different lengths of carbon chains (straight or branched). Such isomerism is shown by each and every family of organic compounds.

Butane : C_4H_{10}

$CH_3 - CH_2 - CH_2 - CH_3$ n- butane

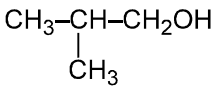


iso butane

n-butane has the chain of four carbon while isobutane has three. Hence they are chain isomers.

Butyl alcohol : C_4H_9OH

$CH_3 - CH_2 - CH_2 - CH_2OH$ n-Butyl alcohol



Isobutyl alcohol

These two butyl alcohols are chain isomers.

(ii) Position Isomerism -Position isomerism is shown by the compounds in which there is difference in the position of attachment of functional group, multiple bond or substituent along the same chain length of carbon atoms -

(i) The same molecular formula

(ii) The same length of carbon chain

(iii) The same functional group.

Example :

(a) $CH_3-CH_2-CH_2Cl$ and $CH_3-\underset{\underset{Cl}{|}}{CH}-CH_3$

1- Chloropropane 2- Chloropropane

(b) $CH_3-CH_2-CH_2OH$ and $CH_3-\underset{\underset{OH}{|}}{CH}-CH_3$

1 - propanol 2 - Propanol

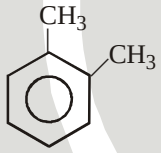
(c) $CH_3-CH_2-CH_2-NH_2$ and $CH_3-\underset{\underset{NH_2}{|}}{CH}-CH_3$

n-Propylamine Isopropylamine

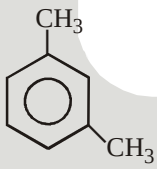
(d) $CH_3-CH_2-CH=CH_2$ and $CH_3-CH=CH-CH_3$

1-Butene 2-Butene

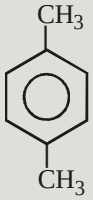
(e)



o-xylene



m-xylene



p-xylene

(iii) Ring chain isomerism –

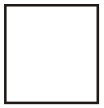
Such isomerism arises because of the difference of carbon-chain or ring.

For example :

(i)  $CH_3CH=CH_2$

Cyclopropane Propene

Cyclopropane and propene are ring chain isomers.

(ii) $CH_3-CH_2-CH=CH_2$ 

Cyclobutane

Cyclobutane is the ring-chain isomer of 1-butene.

Note: Acyclic Alkanes do not exhibit ring-chain isomerism.

(iv) Functional group isomerism :

Compounds with the same molecular formula but differing in the type of functional group they possess are classed as functional isomers and isomerism between them is known as functional isomerism. For example:

(a) $CH_3 - CH_2 - OH$ and $CH_3 - O - CH_3$

Ethyl alcohol (Alcohol) — Dimethyl ether (Ether)

(b) $CH_3 - CH_2 - COOH$ and $CH_3-\overset{\overset{O}{\|}}{C}-O-CH_3$

Propanoic acid (Acid) — Methyl acetate (Ester)

(c) $CH_3 - CH_2 - CH_2 - NH_2$ 1° amine

$CH_3 - CH_2 - NH - CH_3$ 2° amine

$CH_3 - \underset{\underset{CH_3}{|}}{N} - CH_3$ 3° amine

(d) Alkyne and Alkadienes

C_4H_6

$CH \equiv C - CH_2 - CH_3$ 1-Butyne

$CH_2 = CH - CH = CH_2$ 1,3-Butadiene

(v) Metamers : This type of Isomerism arises due to unequal distribution of alkyl substituents around a polyvalent functional group.

Some example of Polyvalent functional groups.

–O– Ether

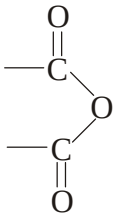
$-\overset{\overset{O}{\|}}{C}-$ Ketone

$-\underset{|}{N}-$ tert.amine

–S– Thioether

$-\overset{\overset{S}{\|}}{C}-$ Thioketone

– COO – Ester



acid anhydride