

ISOMERISM

When the same molecular formulae represents two or more compounds which differ in their physical and chemical properties, then such compounds are called isomers and the phenomenon is called isomerism.

Structural Isomerism When the same molecular formula represents two or more compounds which differ in the arrangement of atoms within the molecule, then such compounds are called structural isomers and the phenomenon is called structural isomerism.

How many isomers are possible for pentane? Draw their structural arrangement and name them.

Conformational Isomerism

Different spatial arrangements of atoms or groups that can be converted into one another by rotation around carbon-carbon single bonds

are called conformational isomers or conformations, this phenomenon is also referred to conformational isomerism.

What are the conformers of Ethane?

Which is more stable and why?

Is it possible to separate the two isomers?

How can they be represented?

What do you understand by Boat form and Chair form of cyclohexane, which is more stable and why?

What is the difference between staggered and eclipsed forms?

Stereoisomerism.

When the same molecular formula represents two or more compounds which differ in spatial arrangements of atoms or groups, then such compounds are called stereo isomers. The phenomenon is known as stereo isomerism.

What is optical activity?

When plane polarised light is passed through a substance, it may or may not rotate the plane of the polarised light the substance which does not rotate the plane of the polarised light is known as optically inactive compound, while a substance which rotates the plane of the polarised light is known as the optically active substance, this property of a substance to rotate the plane of the polarised light is known as OPTICAL ACTIVITY.

The substance which rotates the plane of the polarised light towards right is called Dextrorotatory and the one which rotates the plane of the plane polarised light towards the left is called Laevorotatory.

What are the causes for optical activity?

Optical activity is shown by compounds containing a Chiral or Asymmetrical carbon atom.

Chiral Structure.

An object or structure which has no plane of symmetry and is not superimposable on its mirror image is said to be chiral or dissymmetric, Or carbon atom in which all its four valencies are satisfied by four different atoms or groups is also said to be a chiral.

What are Enantiomers?

When the same molecular formula represents two compounds which are related to each other as object and mirror image or which have similar chemical and physical properties but differ in their action towards plane polarised light, then they are known as optical isomers or Enantiomers.

Which of the following are expected to be optically active?

- (i) 2-propanol (ii) 3-chloropentane (iii) 2-chlorobutane.
(iv) n-butanol (v) 4-hydroxyheptane (vi) 2-hydroxypropanoic acid
(vii) 3-chlorohexane.

[iii, vi, vii]

Racemic Mixture

An optically inactive mixture of equal parts of enantiomers is called a racemic modification, racemic mixture, or dl-mixture.

A mixture of two enantiomers in equal proportions (1:1 ratio) is optically

inactive. The dextro-rotatory property of one isomer is compensated by the laevo-rotatory property of the other isomer. This is called external compensation.

Resolution.

The separation of a racemic mixture into constituent enantiomers is termed Resolution.

Geometrical Isomerism.

When the same molecular formula represents two compounds which differ in the spatial arrangement of atoms or groups around carbon-carbon double bond, then such isomers are called geometrical isomers.

Geometrical isomerism is due to the restricted rotation about a carbon-carbon double bond.

What is Cis-Trans isomerism. Which is more stable? Give suitable examples.

Arenes

Aromatic compounds are otherwise known as arenes. Examples of arenes are Benzene, Naphthalene, Anthracene etc. Benzene does not give addition reactions like alkenes even though it contains three double bonds. In benzene the carbon atom undergoes sp^2 hybridisation this is confirmed by the bond angle of 120° . Three sigma bonds two with the neighbouring carbon atom and one with a hydrogen, are formed by each carbon, all in the same plane of the sigma bonds. All the six pi orbitals together form a pi bond above and below the plane of the carbon skeleton, accommodating all six electrons. A delocalised pi-bond is formed i.e. a pi-bond which is spread over all the carbon atoms. The same conclusion can be arrived at by using the concept of resonance. The actual structure of benzene can be considered as a resonance hybrid of the different canonical forms (Kekule structures). Hence we can also account for the bond length of benzene which is 1.39 Å

Conditions for aromaticity

- i. Aromatic compounds must be cyclic compounds having planar rings.
- ii. These compounds must have cyclic delocalised pi-electron cloud lying above and below the plane of the ring.

Isomerism in Arenes

All mono substituted benzene have only a single isomers, disubstituted benzene show position isomerism. They are Ortho, Meta and Para isomers. e.g. the three different isomers of Xylene [Dimethylbenzene] are ortho-xylene, meta-xylene and para-xylene. Why does benzene give substitution reactions? The carbon-carbon bond length in benzene is 1.39 Å Explain.