Question

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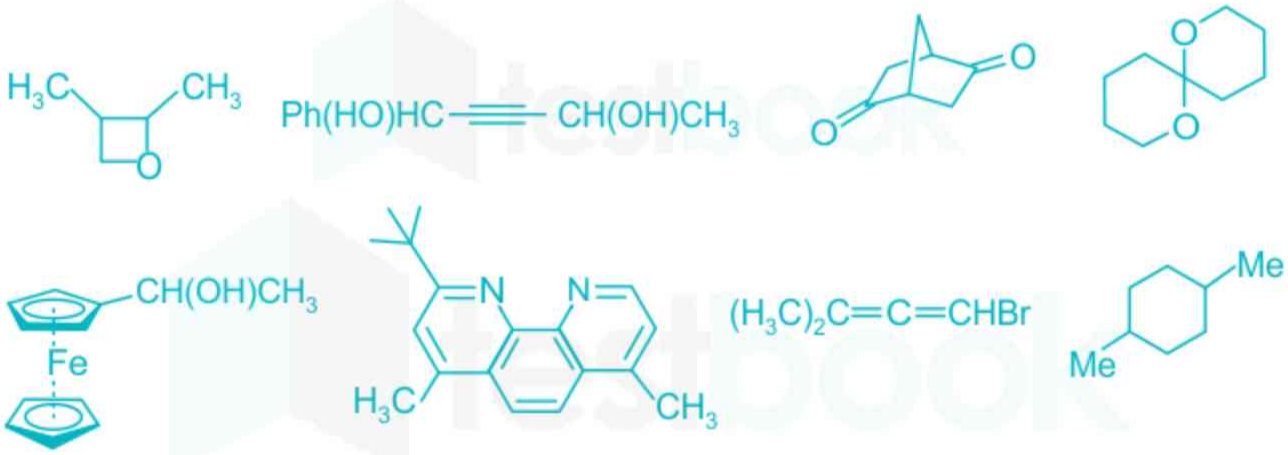
Among the following eight compounds,



the number of compound(s) which can exhibit stereoisomerism is _____.

This question was previously asked in
GATE CY 2021 Official Paper

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Answer (Detailed Solution Below) **6**

Detailed Solution

Concept:

Stereoisomerism -

- This isomerism **arises in compounds having the same chemical formula but different orientations of the atoms belonging to the molecule in three-dimensional space.**
- The compounds that exhibit stereoisomerism are often referred to as **Stereoisomers**.
- This phenomenon can be further categorized into 2 subtypes. Both these subtypes are -
  - **Optical** Isomerism
  - **Geometric** Isomerism

Geometrical isomerism:

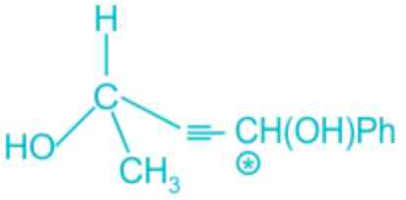
- Geometrical isomerism is shown in molecules that have a **carbon-carbon double bond C = C.**
- Geometrical isomerism is shown **only** when each carbon atom of the double bond is attached to **two different** atoms or groups.
- Compounds of the type **abC = Cad, abC = Cab, and abC = Cde** will show geometrical isomerism.
- The cause of geometrical isomerism is **restricted rotation about a C = C bond.**

Criteria to show optical isomerism-

- **Absence of centre of Symmetry** - when a line is **drawn from the centre** of a molecule towards the **corner of each atom**, it should **not** encounter similar atoms.
- **Absence of plane of symmetry** - A **real or imaginary plane**, vertical or horizontal when passed through a molecule, **bisects** it so that the one half of the molecule **should not** be the **mirror image** of the other half.
- **The presence of a Chiral centre** - An object or molecule which has **no plane of symmetry** and is **not superimposable** on its mirror image is said to be **chiral** or dissymmetric.

Explanation:

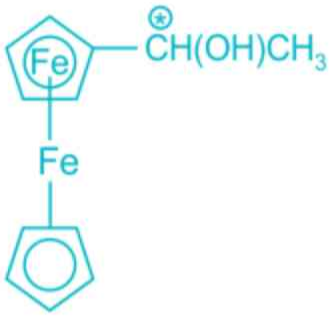
- The analysis of all the given compounds is shown below:



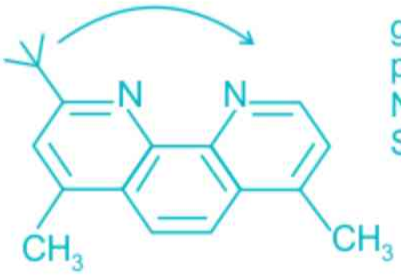
Stereoisomers possible

Optically Active

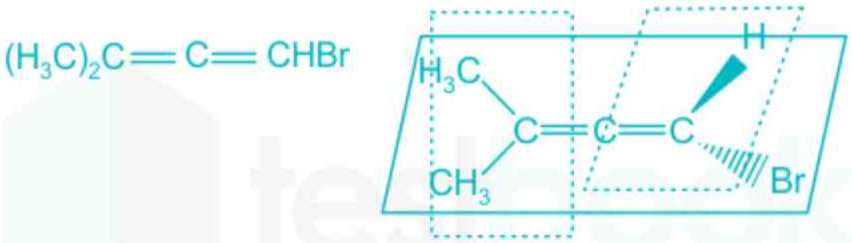
Optically Active



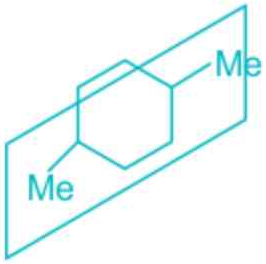
Chiral Carbon Present
Stereoisomers possible



goes out of plane,
No plane of symmetry
Stereoisomers present



Plane passes through H and Br,
Optically inactive



Plane passes through the molecules and thus is optically inactive

Hence, the total number of compounds showing **stereoisomerism is six.**