Subject: Pharmaceutical Organic Chemistry III

Subject Code: BP401TT

Name of Chapter: Stereochemistry

Name of Topic: Stereo selective & Stereo specific reactions

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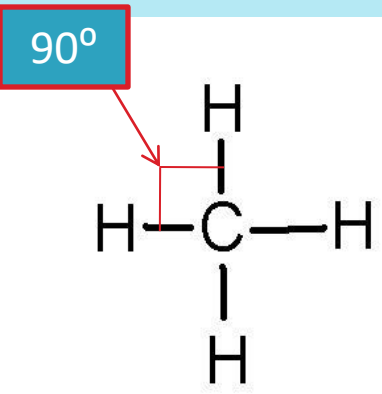
Structure of Methane

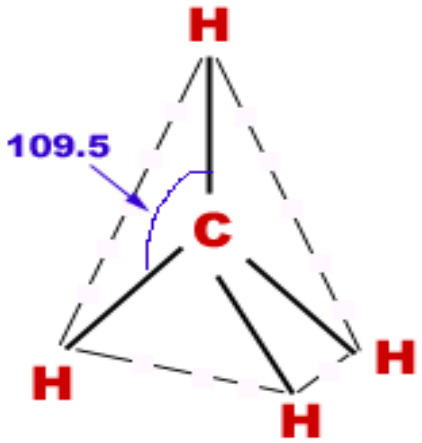


Structure of methane in 2D

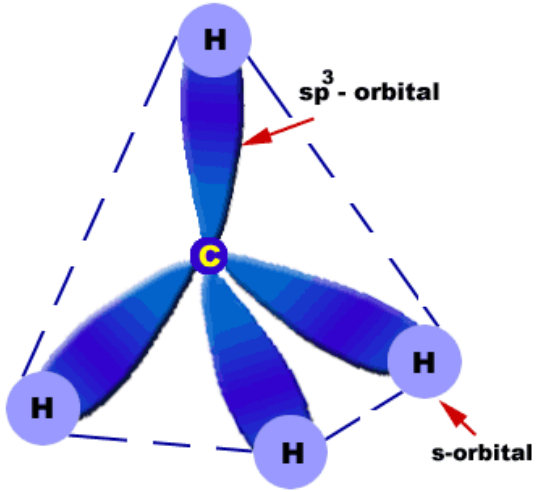
Structure of methane in 2D which shows that bond angle between H-C-H is 90°

WHICH IS WRONG

But the actual bond angle between H-C-H is 109°5’ that can be seen by observing the structure in 3D



Structure of methane in 3D



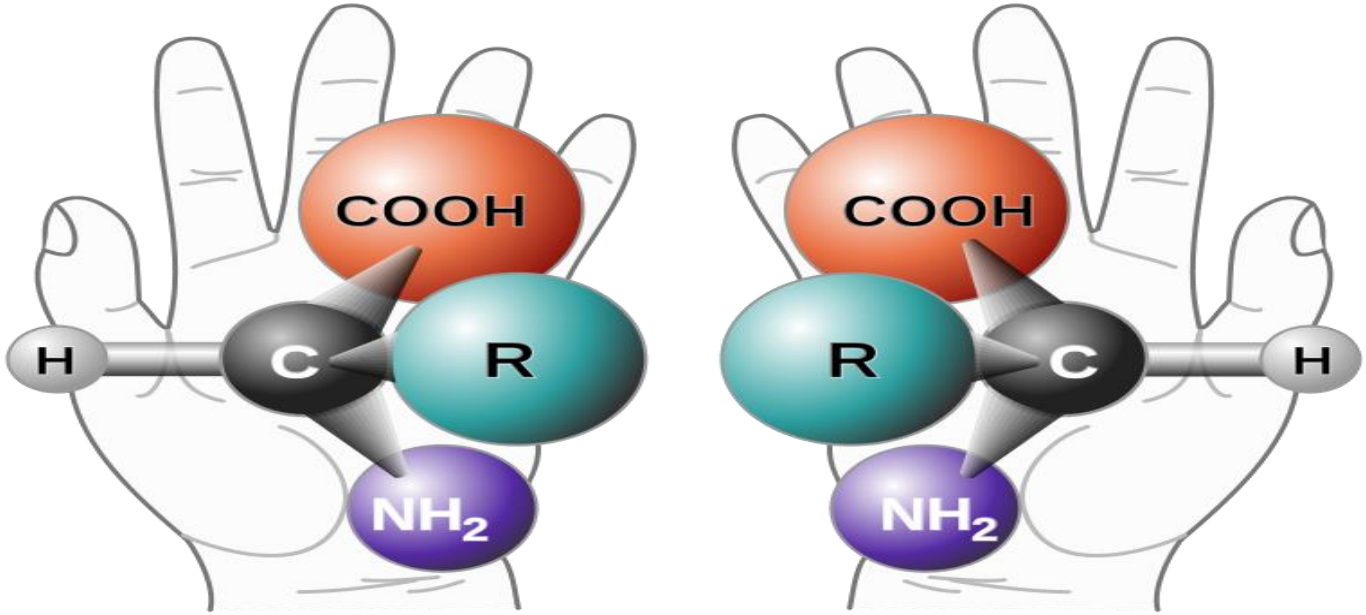
Orbital structure of methane

Stereochemistry

- The branch of science that deals with the structure of compound in 3D is known as **stereochemistry**.

- **Stereoisomers** :- Particular kind of isomers that differ from each other only in the spatial configuration of the atoms are known as Stereoisomers.

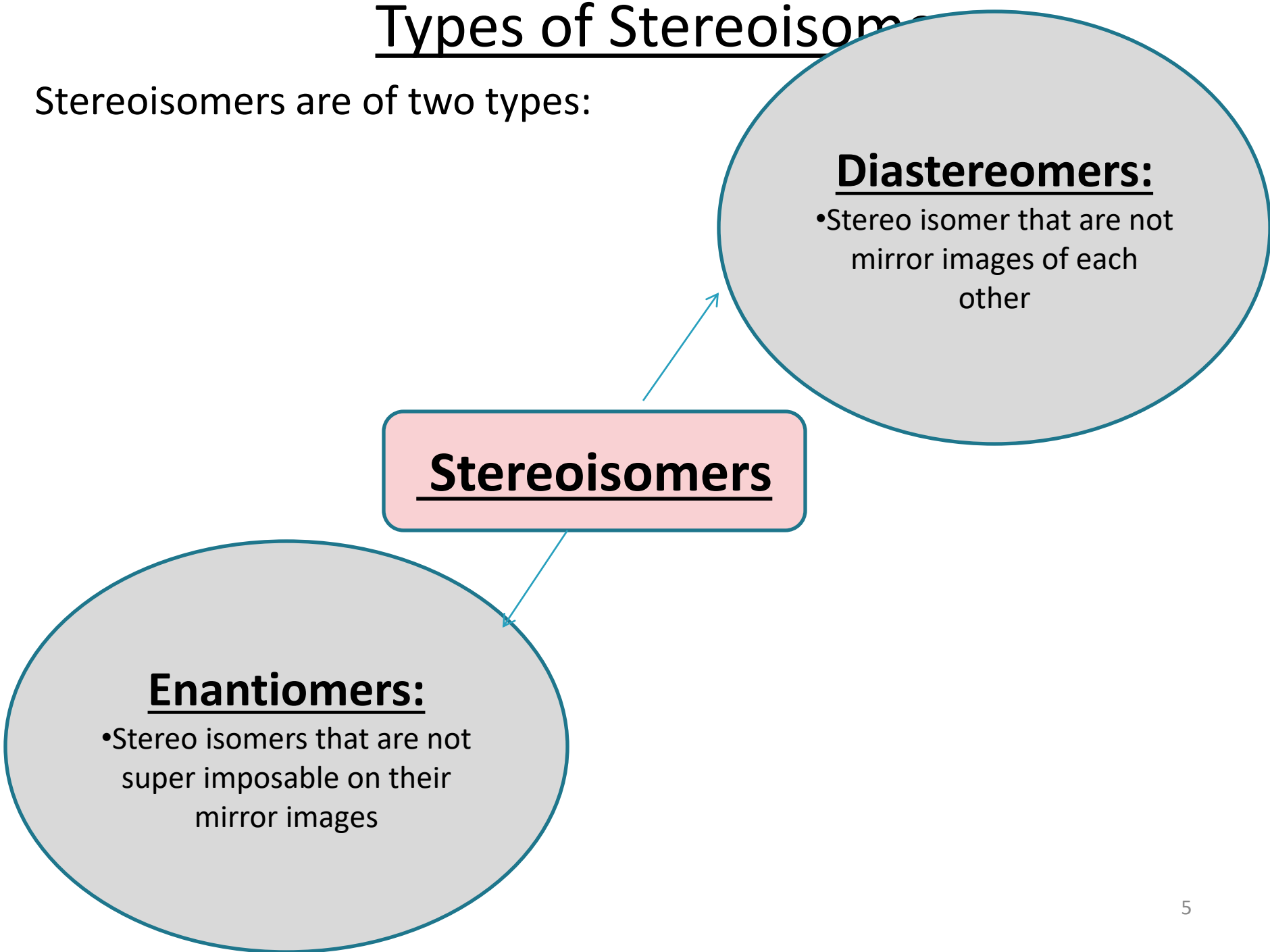
- **Chirality** :- Carbon to which four different atoms or functional groups are attached is known as chiral carbon and this phenomenon is known as chirality.



Chirality in amino acids

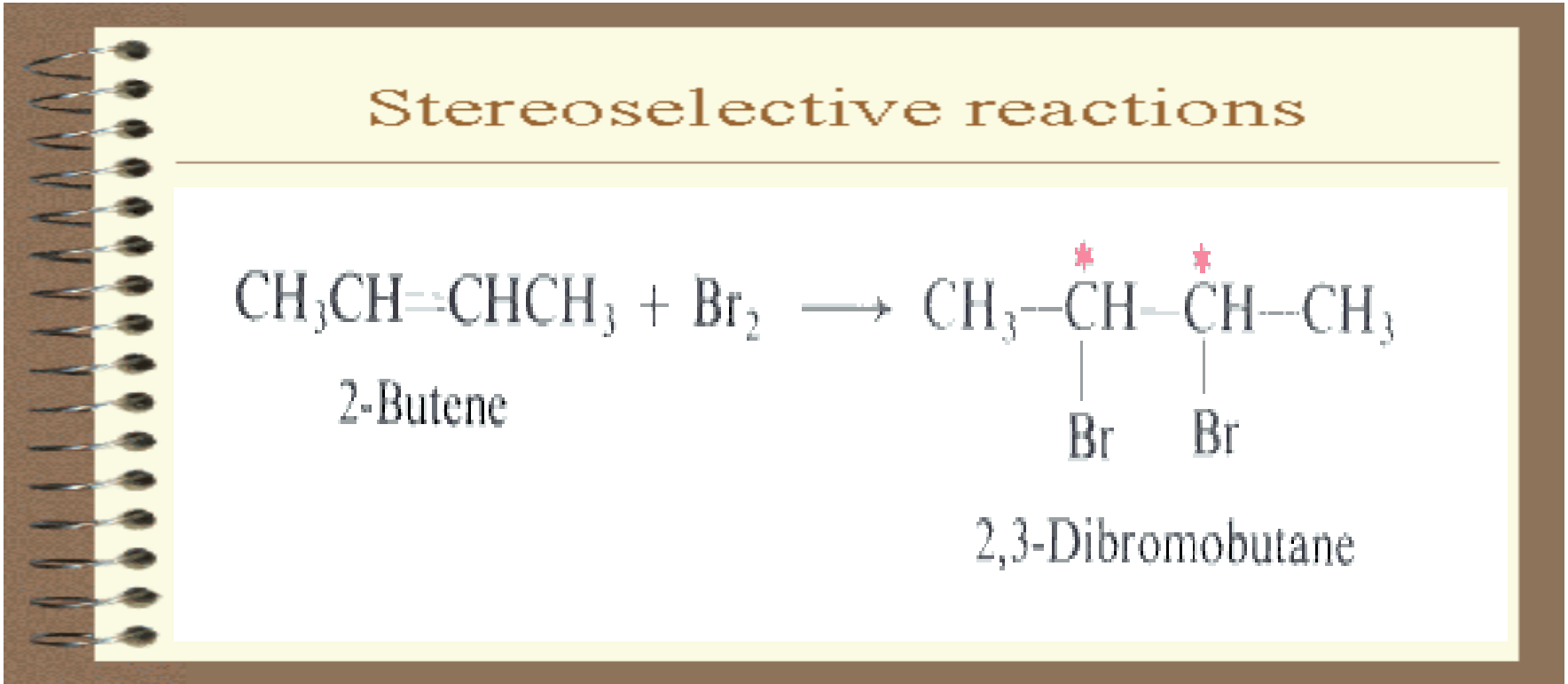
Types of Stereoisom

- Stereoisomers are of two types:

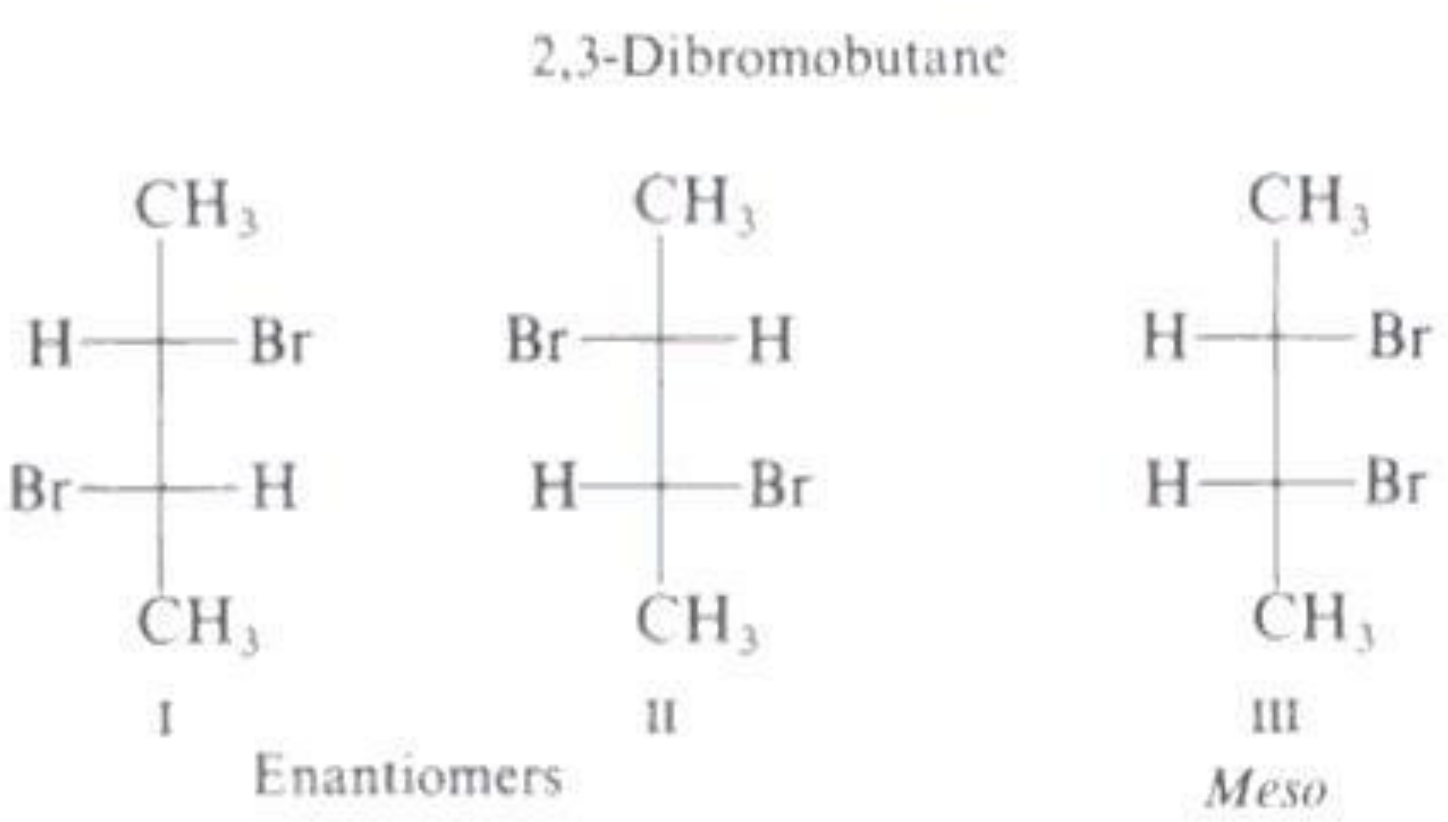


Stereo selective reactions

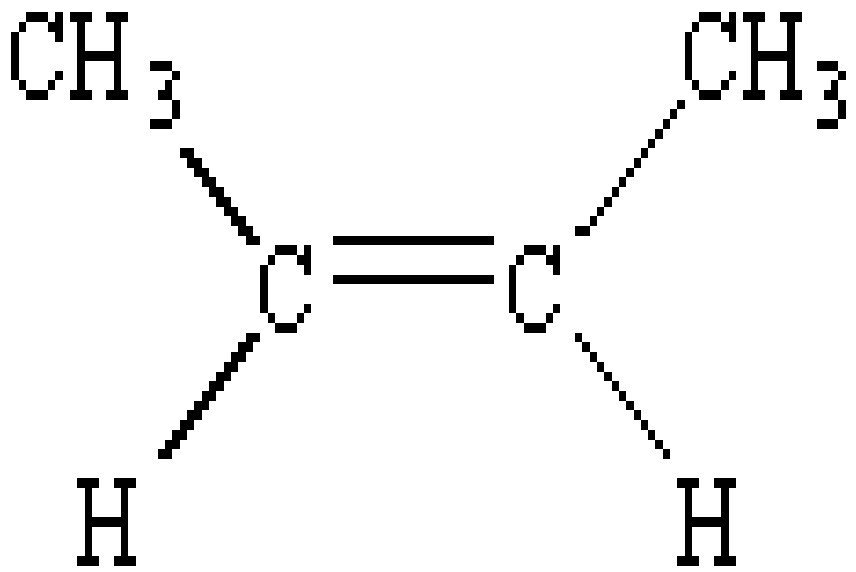
- A reaction that gives one stereo isomer out of several possible diastereomers is known as a stereo selective reaction.
- Reaction of 2-Butene with bromine gives 2,3-Dibromobutane



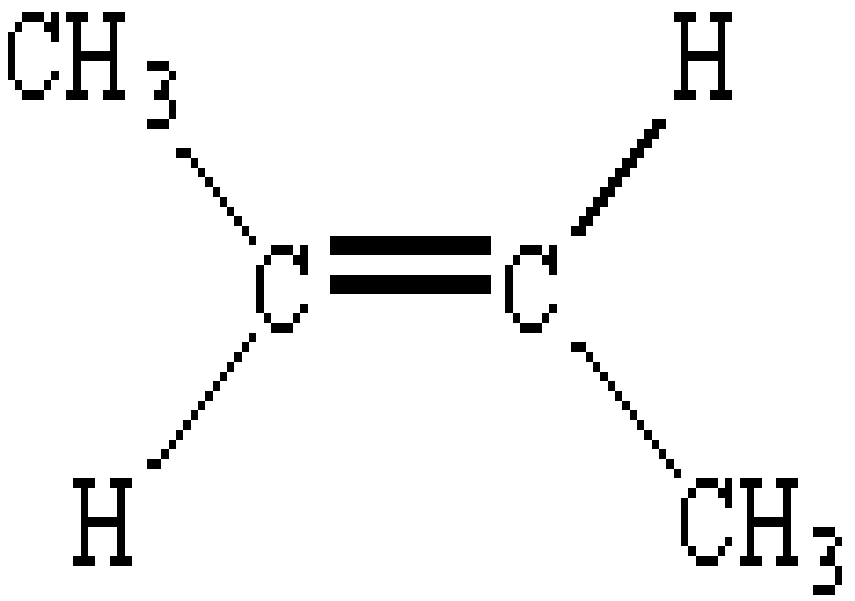
- Product can exist as a pair of enantiomers (I & II) or a meso compound (III).



Also the reactants exist as stereoisomers:
A pair of geometric isomers: *cis* & *trans*



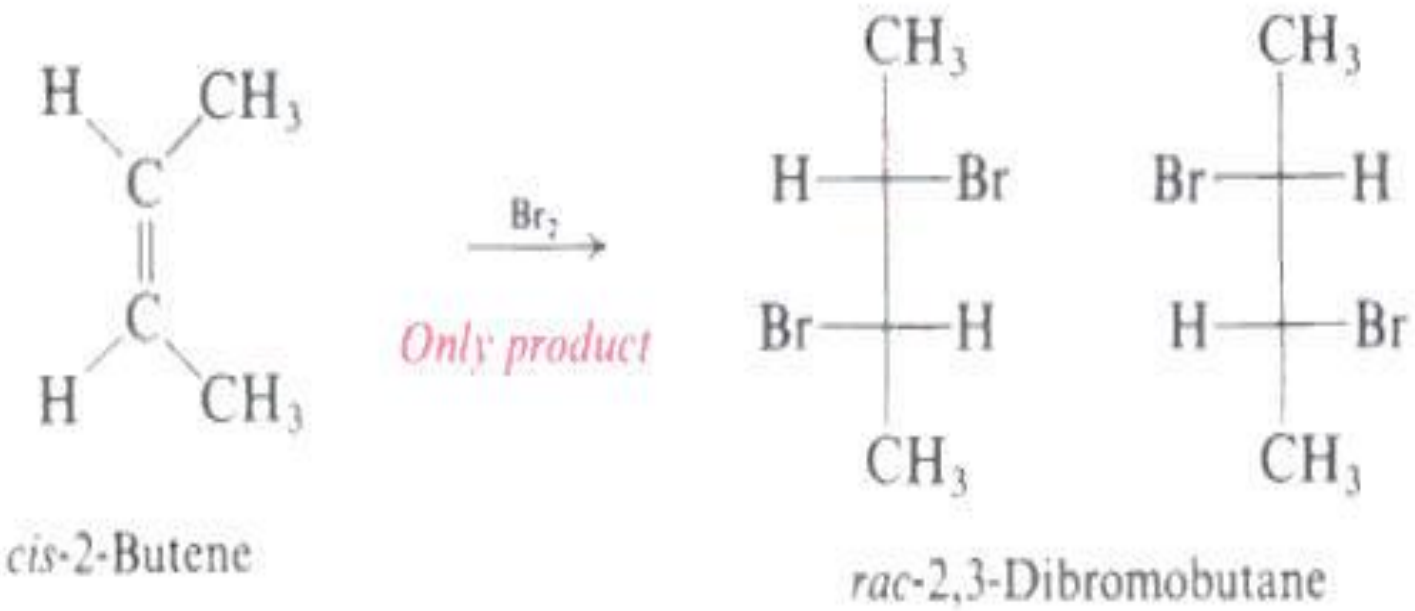
cis-2-Butene



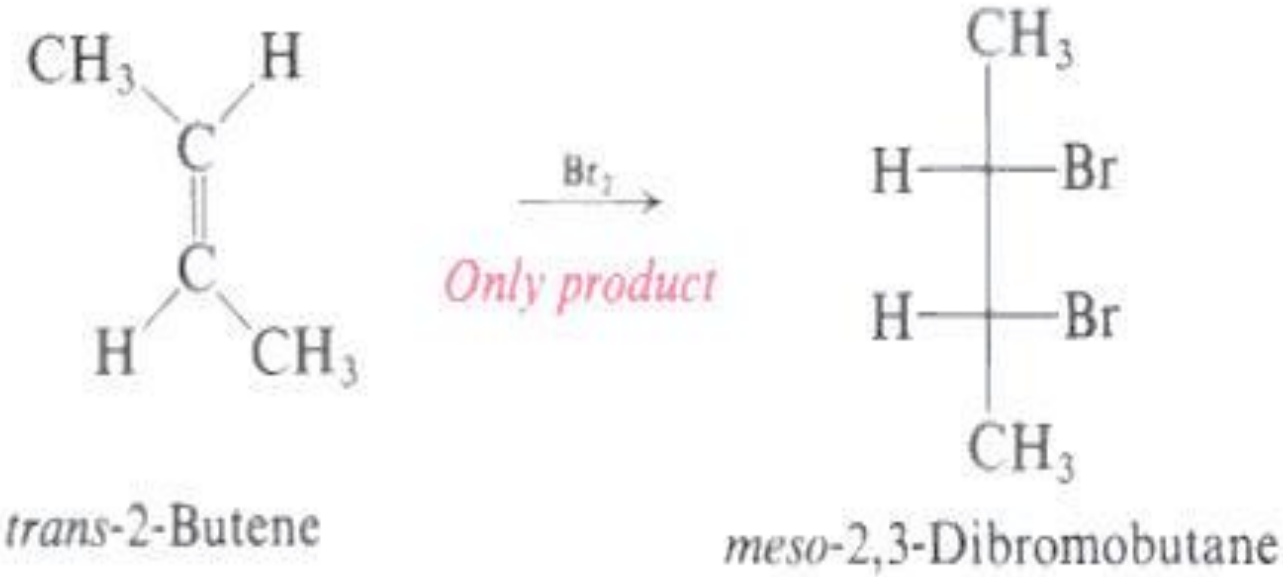
trans-2-Butene

Stereo specific reactions

- A reaction in which stereo chemically different molecules react differently is called a stereo specific reaction
- Example: Reaction with *cis*-2-Butene gives racemic mixture of 2,3-Dibromobutane (A pair of enantiomer).

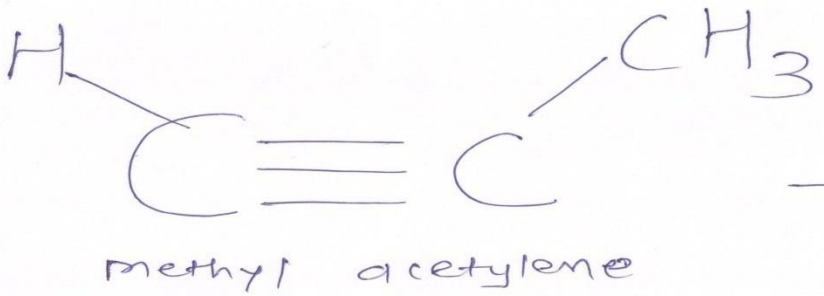


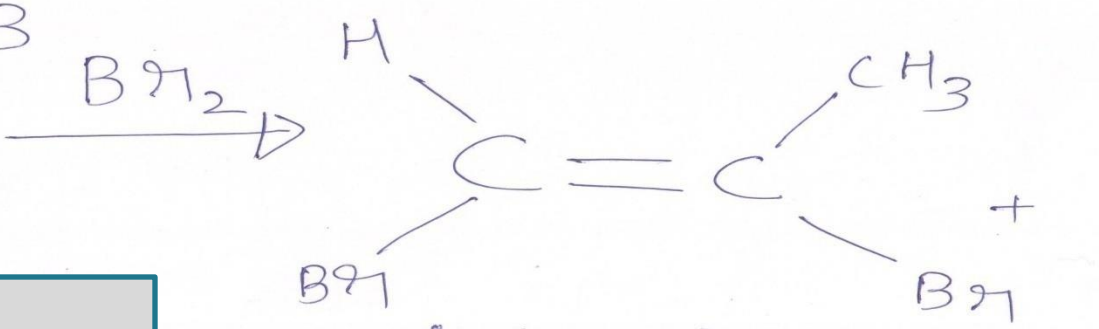
Whereas Reaction with *trans*-2-Butene gives meso 2,3-Dibromobutane (only one product meso compound)

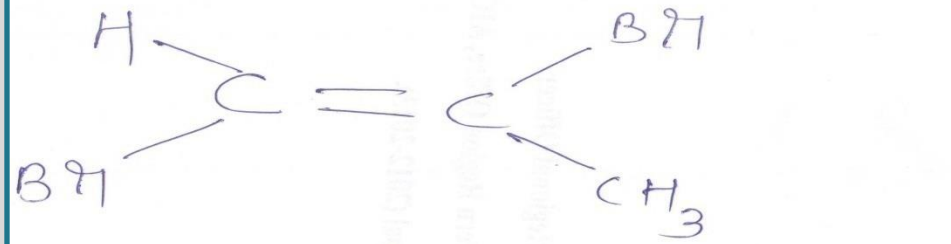


- In both the above reaction, *cis* & *trans*-2-Butene are stereo chemically different molecules. Both of them react in different pattern. So this type of reaction is known as stereo specific reaction.
- Hence addition of bromine to 2-Butene is both stereo selective as well as stereo specific.

Addition of Bromine to Methyl acytelene







- This reaction gives a pair of geometric isomer (i.e. *cis* & *trans*). So this reaction is stereo selective in nature.

- But Methyl acytelene has no any stereo isomer. So it can't be stereo specific.

Conclusion

- If a reaction is carried out on a compound that has no stereo isomer then it can’t be stereo specific but it is stereo selective.

- Further all the stereo specific reactions are stereo selective but it is not necessary that all the stereo selective reactions are stereo specific.

THANK YOU