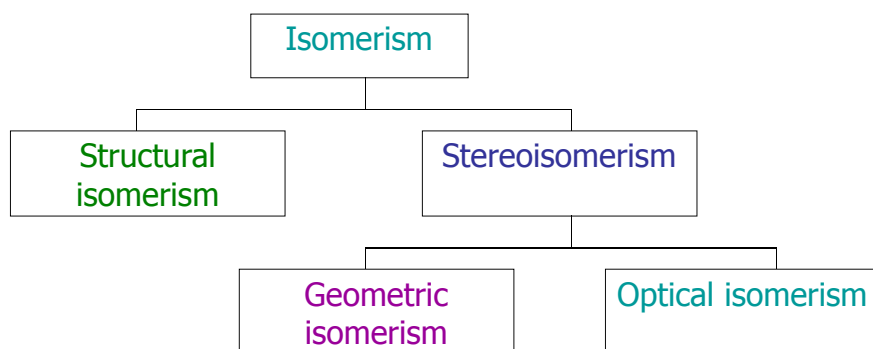


Optical Isomerism

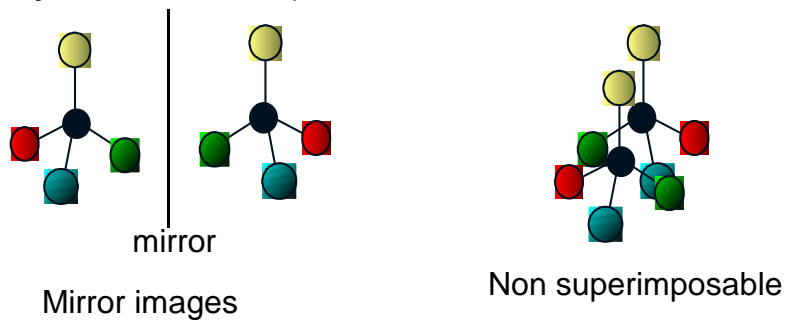
N Goalby
Chemrevise.org

Types of isomerism



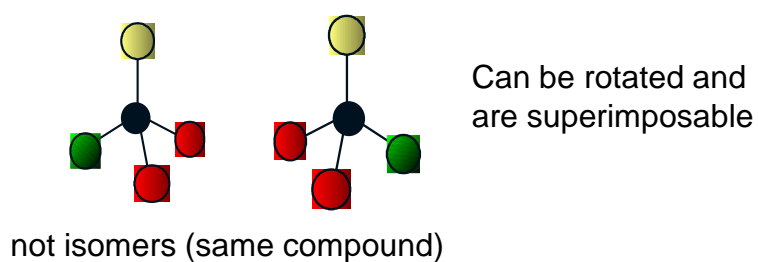
Optical Isomerism

Optical isomerism occurs in carbon compounds with 4 different groups of atoms attached to a carbon (called an **asymmetric carbon**).



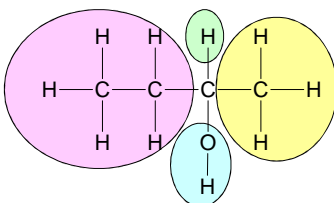
Compounds that show optical isomerism are called **chiral** compounds.

Optical Isomers

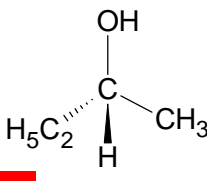


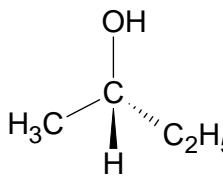
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Chiral Carbons



These four groups are arranged tetrahedrally around the carbon.



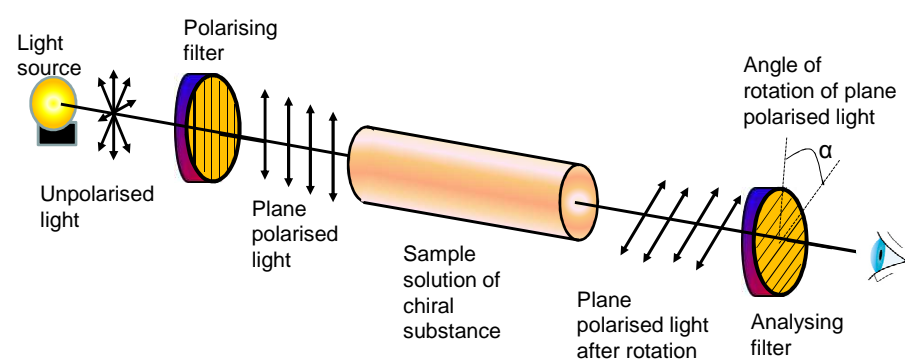


This causes two different isomers that are not superimposable to be formed. They are mirror images

key

The central **asymmetric carbon** is called the **chiral centre**.

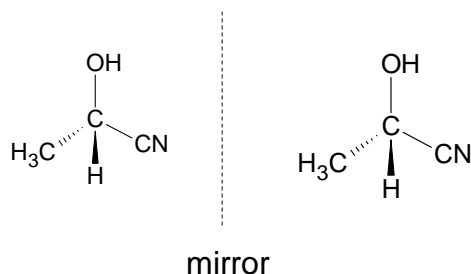
Optical isomers have similar physical and chemical properties, but they rotate plane polarised light in different directions.



One optical isomer will rotate light clockwise and the other isomer will rotate light in an anti-clockwise direction.

key

These stereoisomers are called **enantiomers**.



One optical isomer will rotate plane-polarised light clockwise (+)(called *dextrorotatory*). The other will rotate it anticlockwise(-)(called *laevorotatory*).

A mixture of **equal amounts of the two optical isomers** will not rotate plane-polarised light. The mixture is called a **racemic mixture** or a **racemate**

key

Method for using polarimeter

Brief method

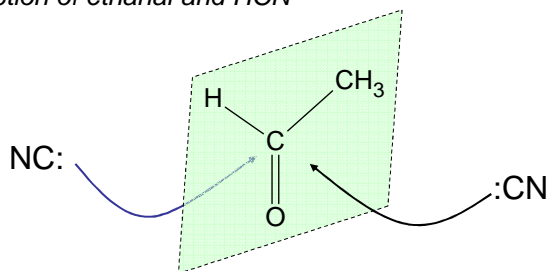
- first put water in sample tube and rotate analyser to block out light
- replace water with sample. If the sample is chiral light will be seen
- rotate analyser again to block out light. The amount the analyser is rotated is the amount the light has been rotated.

Chemical Reactions and Optical Isomers

Formation of a racemate:

A racemate will often be formed in a reaction when a trigonal planar reactant or intermediate is approached from both sides by an attacking species

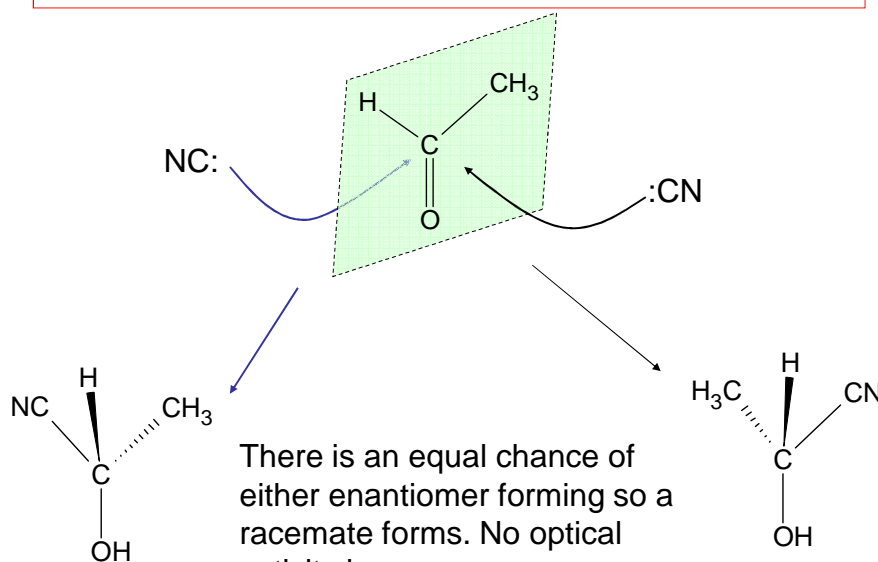
e.g. the reaction of ethanal and HCN



The carbonyl group is planar and can be attacked from both sides

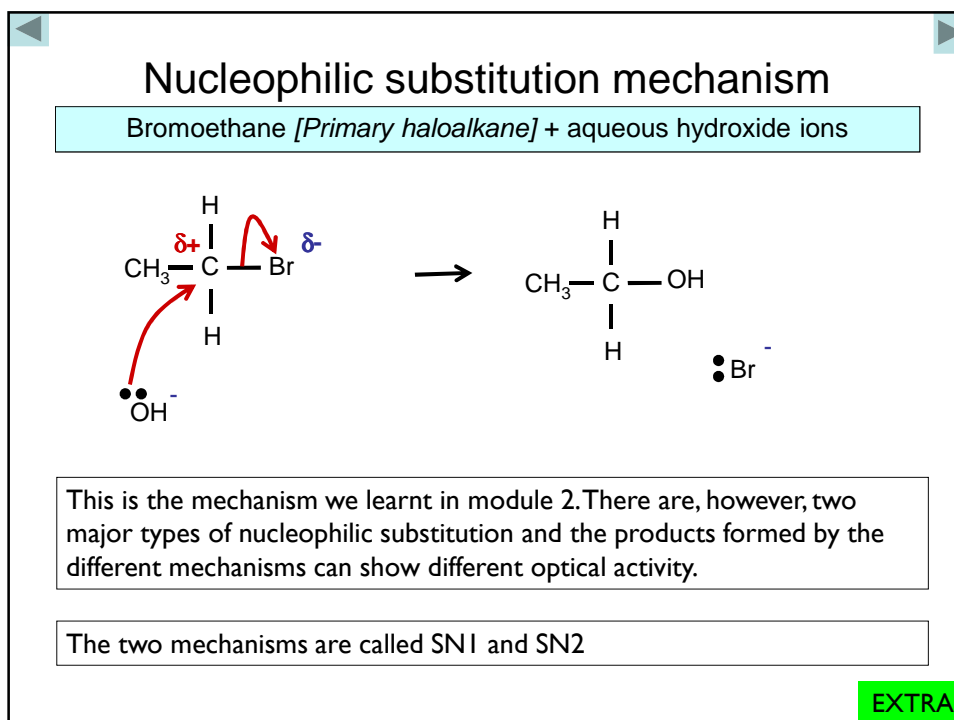
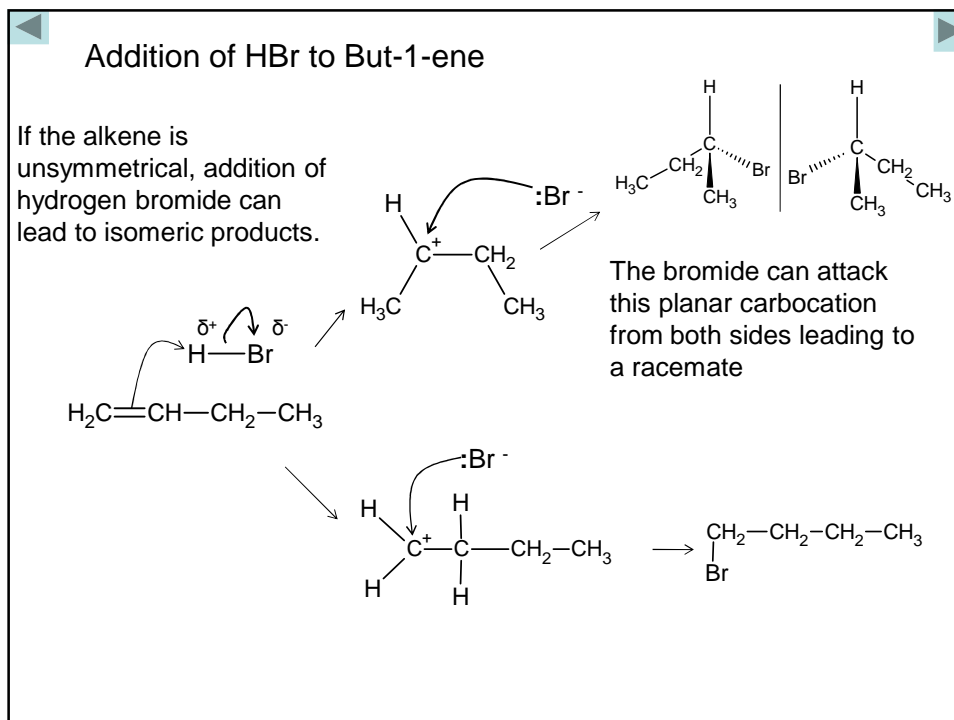
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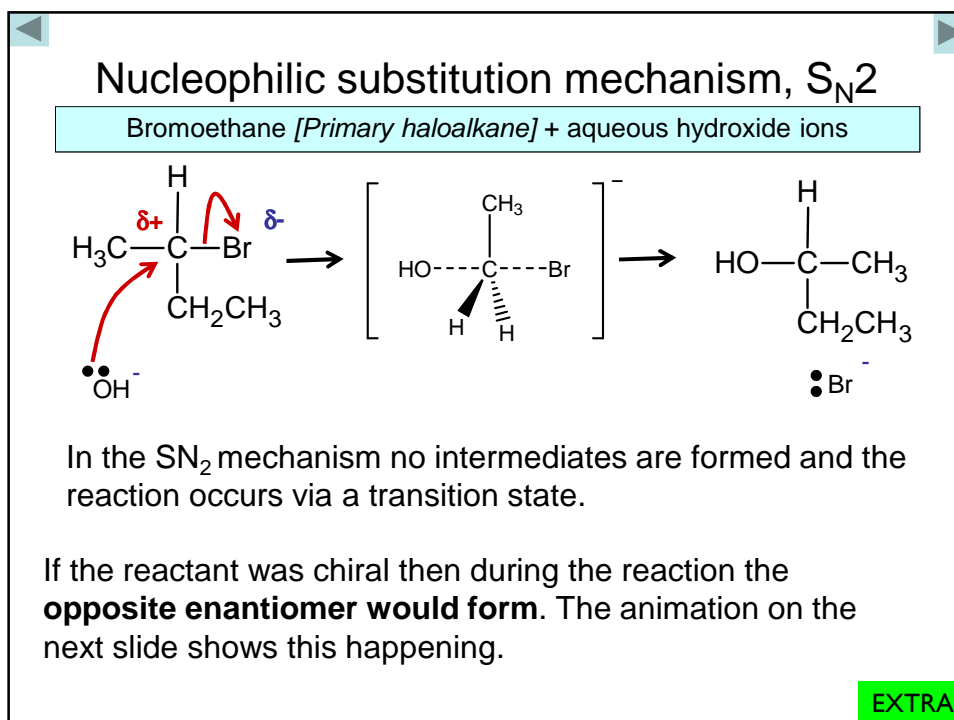
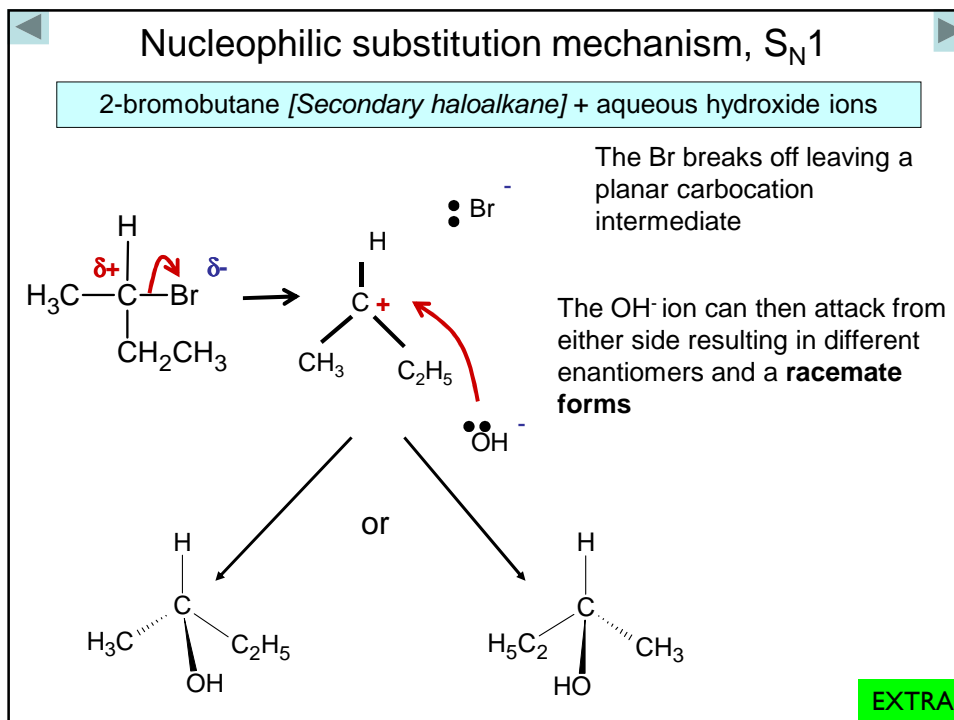
Chemical Reactions and Optical Isomers

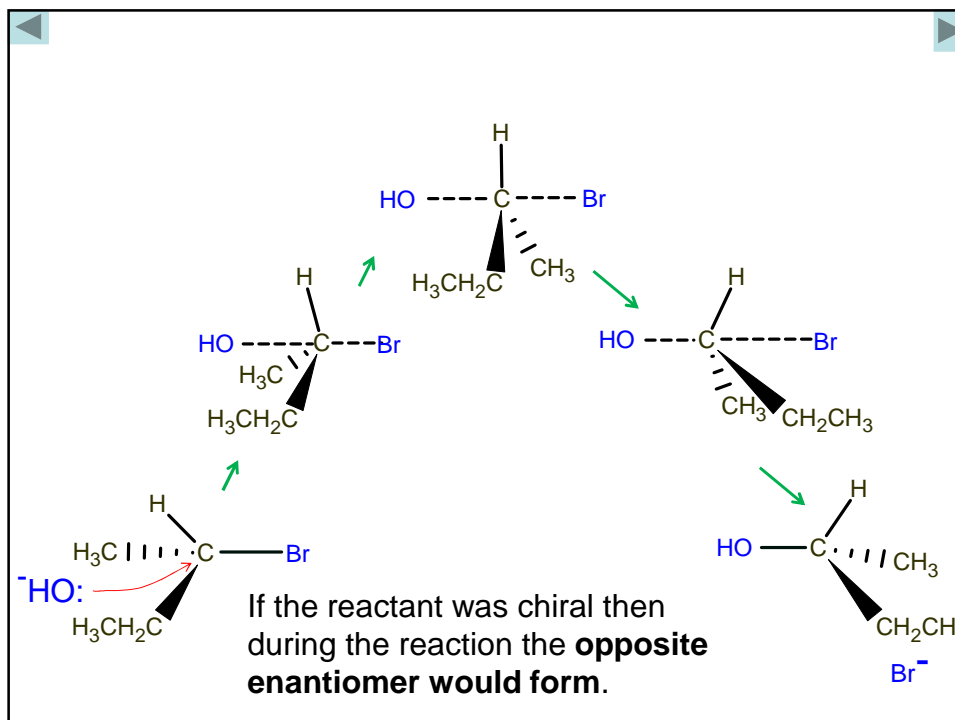


There is an equal chance of either enantiomer forming so a racemate forms. No optical activity is seen

key



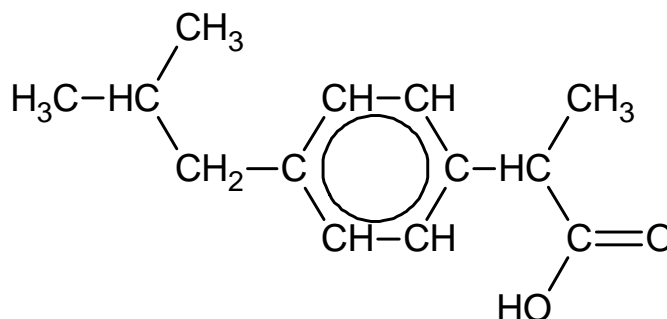




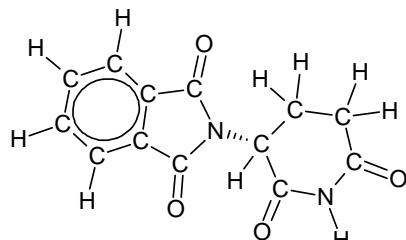
Ibuprofen

Drug action and optical isomers

Drug action may be determined by the stereochemistry of the molecule. Different optical isomers may have very different effects

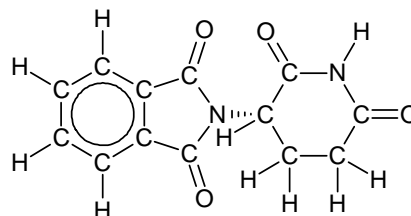


Thalidomide



Where is Chiral carbon?

R thalidomide (dangerous drug)



S thalidomide (effective drug)

One enantiomer of thalidomide causes birth defects in unborn children whilst the other had useful sedative problems. Unfortunately it was given in a racemic mixture when first used.