

Chemistry 3.5

Advanced Organic Chemistry

Isomers

Isomers

- Isomers are molecules that have the **same atom composition** but **arranged differently** either **by different bonding order** or **different positions in space**
- There are two types of isomers
 - **Structural isomers**
 - **Stereo-isomers**
 - **Geometric isomers**
 - **Optical isomers**

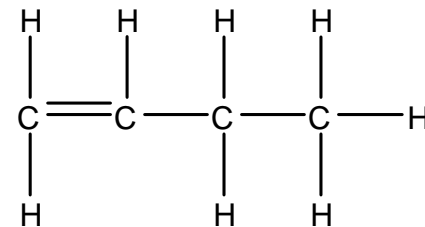
Structural isomers

- Structural isomers have same atom composition but arranged in different orders.
- In other words, they have the same molecular formula but with different structure.

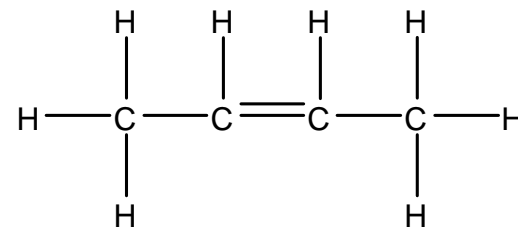
Examples

But-1-ene, but-2-ene and 2-methylprop-1-ene

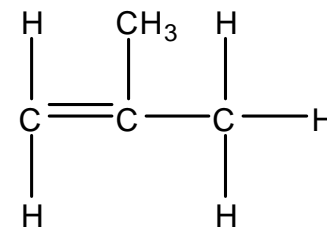
All have the molecular formula of C_4H_8 but they all have different structure



but-1-ene



but-2-ene



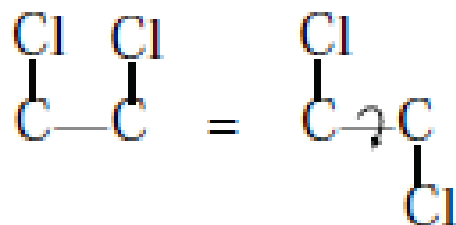
2-methylprop-1-ene

Stereoisomer

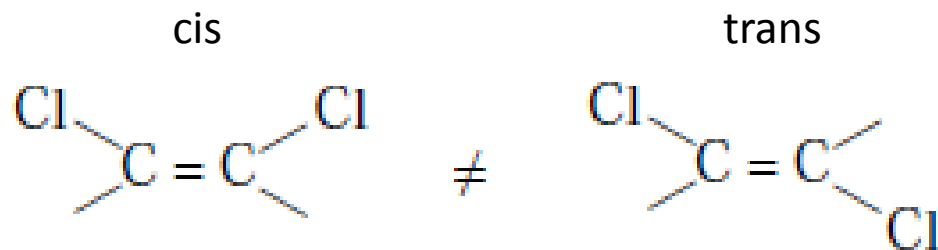
- **Stereoisomers** have atoms arranged in the **same order**, but in **different position in space**.
- There are two form of stereoisomerism
 - **Geometric** (*cis or trans*)
 - **Optical**

Geometric isomers

- Geometric isomers are caused by **rigidity** of **double bond**. While **C – C** bond will **rotate** freely, the **C = C** bond does **not rotate**.



The C—C bond will rotate easily: one compound.



The C=C bond does not rotate, so these two compounds are different.

Optical isomers

- Whenever four different groups are attached to a single carbon atom, they can be attached in two different way which are mirror images of each other
- These two configurations are not **superimposable**.
- The **pair** of configuration is called **enantiomer**
- A carbon atom with four different groups is called **chiral** carbon or **asymmetric** carbon

Try it...

Properties

- Their physical properties are mostly the same, except for one:

The two isomers will rotate plane-polarised light in opposite directions

- Many hormones and enzymes found in biological system contain chiral carbon, therefore, one enantiomer can be active in the biological system while the other does not

Drawing enantiomers

1. Identify the chiral carbon
2. Draw a straight line directly above
 - Straight line = parallel to the page
3. Draw another straight line around 109° either on the left or right
4. On the other side draw a wedge and staircase on the other side
5. Place the groups

C.

6. Draw the mirror image

