

13.4 Isomerism: structural isomerism and stereoisomerism

Name: _____ Class: _____ Date: _____

Total: 12 marks

KEY WORDS isomerism 异构 • structural 结构 • stereoisomerism 立体异构
• structural isomerism 结构异构 • chiral 手性

Objective

Build the skills to answer exam questions on **isomerism** 异构 — **structural** 结构 isomerism (chain, positional, functional group) and **stereoisomerism** 立体异构 (cis/trans and optical).

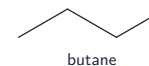
You must be able to:

- describe structural isomerism and its three kinds
- explain cis/trans isomerism in terms of restricted rotation at a C=C bond
- identify chiral centres and the geometrical isomerism in a given structure

1 Worked examples

■ Structural isomerism

chain

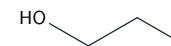


butane

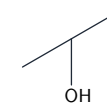


2-methylpropane

positional

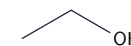


propan-1-ol



propan-2-ol

functional



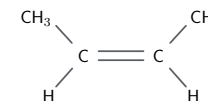
ethanol (alcohol)



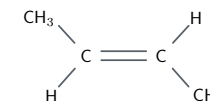
methoxymethane (ether)

Chain, positional and functional-group isomerism — same molecular formula, different structure

■ Stereoisomerism

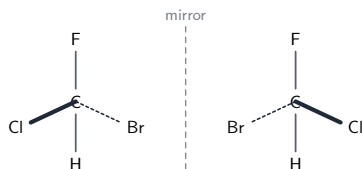


cis: both CH₃ on the same side



trans: CH₃ on opposite sides

Cis/trans isomerism at a C=C: the π bond stops rotation, fixing groups on the same (cis) or opposite (trans) side



enantiomers: mirror images that cannot be superimposed
(the central carbon has 4 different groups)

A **chiral centre** 手性中心 (*carbon with four different groups*) gives two mirror-image **enantiomers** 对映体

2 Practice

2.1 Name the three kinds of structural isomerism. [3]

2.2 State what is meant by a **chiral centre**. [1]

3 Exam-style questions

3.1 Cis/trans isomerism is possible because: [1]

- | | |
|---|---|
| A | B |
| C | D |
- A** single bonds cannot rotate
B the π bond in $C=C$ prevents rotation
C the molecule is ionic
D the carbons are sp^3 hybridised

3.2 Which compound has a chiral centre? [1]

- | | |
|---|---|
| A | B |
| C | D |
- A** $CH_3CH_2CH_3$
B $CH_3CHBrCH_2CH_3$
C CH_3CH_2OH
D CH_2Cl_2

3.3 (a) Draw the cis and trans isomers of but-2-ene, $CH_3CH=CHCH_3$. [2]

(b) Explain why but-2-ene shows cis/trans isomerism but but-1-ene does not. [2]

3.4 2-hydroxypropanoic acid is $CH_3CH(OH)COOH$. State, with a reason, whether it has a chiral centre. [2]
