

Structural isomers

Chain isomers



Answer all the questions below then check your answers

1. Define the term structural isomer.
2. Hexane has the molecular formula C_6H_{14} .
 - (a) What is meant by a chain isomer?
 - (b) State how many chain isomers hexane has.
3. The condensed formula of a hydrocarbon is $CH_3CH(CH_3)CH_2CH_2CH_3$.
 - (a) State the molecular formula of this compound.
 - (b) Give the systematic name of this compound.
4. Explain why 4-methylpentane is not an acceptable name for a structural isomer of hexane.
5. Give the systematic name of the hydrocarbon shown by the condensed formula $CH_3C(CH_3)_2CH_2CH_3$.

6. Two hydrocarbons both have the molecular formula C_7H_{16} .

One is heptane and the other is 2-methylhexane.

Explain why these compounds are chain isomers.

7. State two rules that must be followed when naming branched-chain alkanes.

8. The hydrocarbon 2,3-dimethylbutane has the molecular formula C_6H_{14} .

Explain why it is a chain isomer of hexane.

Answers

1. Define the term structural isomer.

Answer:

Structural isomers are molecules that have the same molecular formula but different structural formulae.

2. Hexane has the molecular formula C_6H_{14} .

(a) What is meant by a chain isomer?

(b) State how many chain isomers hexane has.

Answer:

(a) Chain isomers are structural isomers that have the same molecular formula but differ in the arrangement of the carbon atoms in the main chain.

(b) Hexane has five chain isomers.

3. The condensed formula of a hydrocarbon is $CH_3CH(CH_3)CH_2CH_2CH_3$.

(a) State the molecular formula of this compound.

(b) Give the systematic name of this compound.

Answer:

(a) C_6H_{14}

(b) 2-methylpentane.

4. Explain why 4-methylpentane is not an acceptable name for a structural isomer of hexane.

Answer:

Numbering the carbon chain from the opposite end gives the substituent the lowest possible number. Therefore, the correct name is 2-methylpentane, not 4-methylpentane.

5. Give the systematic name of the hydrocarbon shown by the condensed formula $\text{CH}_3\text{C}(\text{CH}_3)_2\text{CH}_2\text{CH}_3$.

Answer:

2,2-dimethylbutane.

6. Two hydrocarbons both have the molecular formula C_7H_{16} .

One is heptane and the other is 2-methylhexane.

Explain why these compounds are chain isomers.

Answer:

They have the same molecular formula but different arrangements of the carbon atoms in the main chain. Heptane has a straight carbon chain, whereas 2-methylhexane has a branched carbon chain.

7. State two rules that must be followed when naming branched-chain alkanes.

Answer:

- The longest continuous carbon chain must be identified first.
- Substituents must be given the lowest possible numbers.

8. The hydrocarbon 2,3-dimethylbutane has the molecular formula C_6H_{14} .

Explain why it is a chain isomer of hexane.

Answer:

Both compounds have the same molecular formula but different carbon skeletons. Hexane has a straight chain, whereas 2,3-dimethylbutane has a branched chain.