Name The Following Compound:CH3-CH2-CH2-CH2-CH3 CH3 CH3

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Understanding the Compound: An Introduction

Chemistry enthusiasts and students often encounter various organic compounds with complex structures. Identifying and naming these compounds correctly is vital for understanding their properties, reactions, and applications. The compound represented by the molecular structure CH3-CH2-CH2-CH2-CH3 with attached methyl groups (CH3 CH3) is a classic example of a hydrocarbon with branching. In this article, we will explore the systematic process of naming this compound, analyze its structure in detail, and discuss its significance in organic chemistry.

Deciphering the Structural Formula

Breaking Down the Molecular Structure

The given molecular formula appears to be:

- A chain of five carbon atoms: CH3-CH2-CH2-CH2-CH3
- Additional methyl groups attached: CH3 and CH3

However, to understand the exact structure, we need to interpret how these groups are connected. Based on the notation, it suggests:

- A pentane backbone (a straight chain of five carbons)
- Methyl groups attached to the main chain

The formula as presented hints at a branched hydrocarbon rather than a simple straight chain.

Visualizing the Compound

Let's create a visual representation of the structure:

- The main chain: pentane (5 carbons)
- Attached groups: two methyl groups (CH3)

A plausible structure would be:

- A pentane chain
- Two methyl groups attached to the main chain at specific carbons

This suggests a branched alkane, possibly 2,2-dimethylpentane or 2,3-dimethylpentane, depending on the position of the methyl groups.

Identifying the Correct Compound: Structural Analysis

Determining the Correct Structure

To accurately name the compound, it’s essential to:

1. Identify the longest carbon chain
2. Number the chain to give the substituents the lowest possible numbers
3. Identify and number the substituents (methyl groups)
4. Write the name in IUPAC nomenclature

Based on the description, the compound appears to be a branched alkane with two methyl groups attached to a pentane chain.

Possible Structural Variants

Two main isomers fit this description:

- 2,2-Dimethylpentane: Both methyl groups attached to carbon 2
- 2,3-Dimethylpentane: Methyl groups attached to carbons 2 and 3

Further analysis indicates that the molecular formula matches 2,2-dimethylpentane or 2,3-dimethylpentane, but the most common and straightforward interpretation is 2,2-dimethylpentane.

Systematic Naming of the Compound

Step-by-Step Naming Process

1. Identify the longest chain: The main chain has 5 carbons (pentane).
2. Number the chain: Assign numbers from the end closest to the substituents

to give the lowest numbers to the substituents.
3. Identify substituents: Two methyl groups attached at carbon 2.
4. Combine the name: The substituents are named and numbered, then combined with the main chain.

The name for this compound is 2,2-Dimethylpentane.

Final Name: 2,2-Dimethylpentane

This name indicates a pentane chain with two methyl groups attached to the second carbon, making the compound a branched alkane.

Properties and Applications of 2,2-Dimethylpentane

Physical Properties

- Molecular Formula: C_7H_{16}
- Molecular Weight: Approximately 100.2 g/mol
- Physical State: Colorless, flammable liquid at room temperature
- Boiling Point: Around 99°C
- Density: Approximately 0.75 g/cm^3

Chemical Properties

- Hydrophobic Nature: As a hydrocarbon, it is non-polar.
- Reactivity: Mostly undergoes substitution reactions; less reactive in addition reactions.
- Stability: Relatively stable under normal conditions.

Industrial and Practical Uses

While 2,2-dimethylpentane is primarily of academic interest, related hydrocarbons are used as:

- Solvents in cleaning and extraction processes
- Fuel components in gasoline blends
- Starting materials in organic synthesis

Related Isomers and Their Significance

Understanding isomers is crucial in organic chemistry. For the molecular formula C7H16, there are numerous isomers, including:

1. Hexane derivatives with methyl substitutions
2. Heptane straight chains
3. Branched isomers like 2,3-dimethylpentane, 3-ethylpentane, etc.

Each isomer exhibits unique physical and chemical properties despite having the same molecular formula. Recognizing these differences is essential for applications in fuels, solvents, and chemical synthesis.

Comparison of Key Isomers

Isomer Name	Structural Features	Boiling Point (°C)	Melting Point (°C)
n-Pentane	Straight chain, no branches	36.1	-130.0
2,2-Dimethylpentane	Branched at carbon 2	99.0	-60.0
2,3-Dimethylpentane	Branches at carbons 2 and 3	86.4	-50.0
3-Ethylpentane	Ethyl group at carbon 3	86.0	-50.0

Understanding these differences aids chemists in selecting the appropriate compound for specific applications.

Conclusion: The Importance of Proper Nomenclature

Accurate naming of organic compounds like 2,2-dimethylpentane is fundamental in chemistry. It enables clear communication, facilitates research, and ensures proper identification for practical applications. Recognizing structural features from the molecular formula and applying systematic nomenclature principles allow chemists to identify and work with diverse compounds effectively.

In summary, the compound represented by CH3-CH2-CH2-CH2-CH3 with attached methyl groups is systematically named 2,2-dimethylpentane. Its structure, properties, and related isomers exemplify the importance of understanding organic chemistry nomenclature and structural analysis. Whether used for academic purposes or industrial applications, mastering these concepts is essential for anyone involved in the field of chemistry.

Frequently Asked Questions

What is the IUPAC name of the compound with the structure CH3-CH2-CH2-CH2-CH3 and CH3 CH3?

The compound is pentane, with the structure CH3-CH2-CH2-CH2-CH3.

Is the compound CH3-CH2-CH2-CH2-CH3 considered a saturated hydrocarbon?

Yes, pentane is a saturated hydrocarbon as it contains only single bonds.

What are the common uses or applications of pentane?

Pentane is commonly used as a solvent, in foam production, and as a blowing agent in the manufacturing of polystyrene foam.

How many carbon atoms are present in the given compound?

There are five carbon atoms in the compound, making it a pentane derivative.

What is the molecular formula of the compound shown?

The molecular formula is C5H12.

Does the compound exhibit any isomerism?

Yes, pentane has structural isomers such as 2-methylbutane and 2,2-dimethylpropane.

What is the physical state of pentane at room temperature?

Pentane is a colorless, flammable liquid at room temperature.

Can the compound CH3-CH2-CH2-CH2-CH3 undergo combustion?

Yes, as a hydrocarbon, it readily undergoes combustion producing carbon dioxide and water.

Is the compound nonpolar or polar?

Pentane is a nonpolar molecule due to its symmetrical hydrocarbon structure.

Additional Resources

Name The Following Compound: CH3-CH2-CH2-CH2-CH3 CH3 CH3

Introduction

In the realm of organic chemistry, the nomenclature and structural identification of compounds form the backbone of understanding chemical behavior, reactivity, and applications. One such fundamental task involves determining the correct IUPAC name of a given chemical structure. The compound in question, denoted by the formula CH3-CH2-CH2-CH2-CH3 CH3 CH3, presents an intriguing case that warrants a detailed analytical approach. This article aims to thoroughly dissect this compound's structure, interpret its components, and arrive at its systematic name, contributing valuable insights for chemists, students, and researchers alike.

Deciphering the Structural Formula

At first glance, the notation CH3-CH2-CH2-CH2-CH3 CH3 CH3 appears to be a concatenation of molecular fragments. To accurately interpret this, it is essential to parse the formula carefully, considering possible structural configurations.

Parsing the Formula

- Main Chain: The sequence CH3-CH2-CH2-CH2-CH3 suggests a linear alkane chain. Counting the carbons:

- CH3: 1 carbon
- CH2: 4 times, each with 1 carbon
- Total carbons in this segment: 1 + 4 = 5

- Additional Groups: The CH3 CH3 appended after the main chain indicates two methyl groups.

Given the concatenation, the overall structure appears to be a pentane backbone with two methyl groups attached, but their exact points of attachment need clarification.

Structural Interpretation and Possible Configurations

Step 1: Recognize the Main Chain

The initial segment CH3-CH2-CH2-CH2-CH3 explicitly indicates a pentane backbone (a five-carbon saturated hydrocarbon). This is a straightforward

linear alkane, commonly called n-pentane.

Step 2: Interpret the Additional Methyl Groups

Post the main chain, the notation CH3 CH3 suggests two methyl groups. The key question is: are these attached to the main chain, or are they separate entities? Given the standard notation, it is reasonable to interpret the compound as a pentane chain with two methyl substituents attached at specific positions.

However, the notation as written is somewhat ambiguous. It might also be interpreted as a dimethylpentane, i.e., a pentane chain with two methyl groups attached as substituents, making the molecule a dimethylpentane.

Step 3: Structural Options

- Option 1: The structure is 2,2-dimethylpentane – two methyl groups attached to the second carbon of pentane.
- Option 2: The structure is 2,3-dimethylpentane – methyl groups attached at the second and third carbons.
- Option 3: The structure is 2,2,3-trimethylpentane – three methyl groups attached at positions 2 and 3.

Given the notation CH3-CH2-CH2-CH2-CH3 CH3 CH3, the most straightforward interpretation is that the compound is 2,2-dimethylpentane – a pentane with two methyl groups attached to the second carbon, forming a branched alkane.

Structural Elucidation: The IUPAC Name

Based on above interpretation, the most probable structure is 2,2-dimethylpentane.

Confirming the Structure

- The main chain: pentane (5 carbons).
- Two methyl substituents attached to carbon 2 of the main chain.
- The molecule is saturated, containing only single bonds.

Thus, the compound's IUPAC name is:

2,2-Dimethylpentane

Deeper Dive: Understanding the Nomenclature and Structural Variants

Why 2,2-Dimethylpentane?

- The methyl groups are attached at the same carbon (carbon 2), leading to a

branched structure.
- The name follows IUPAC rules: the longest chain (pentane) is identified first, then the substituents are named and numbered based on their positions.

Alternative Names and Isomers

The compound 2,2-dimethylpentane has several structural isomers:

Isomer Name	Structural Description	Number of Carbons	Branching Site(s)
n-Pentane	Linear chain	5	None
2-Methylpentane	Methyl at C2	5	C2
3-Methylpentane	Methyl at C3	5	C3
2,2-Dimethylpentane	Two methyls at C2	5	C2
2,3-Dimethylpentane	Methyls at C2 and C3	5	C2, C3
2,2,3-Trimethylpentane	Three methyl groups (two at C2, one at C3)	5	C2, C3

The exact structure depends on the placement of methyl groups, but the notation strongly suggests 2,2-dimethylpentane.

Structural Formula and Visualization

To better understand, here's the structural formula:

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CH3
|
CH3-CH-CH2-CH3
|
CH3
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- The main chain: CH3-CH-CH2-CH3 (pentane backbone).
- Two methyl groups attached to carbon 2 of main chain.

Physical and Chemical Properties

Understanding the properties of 2,2-dimethylpentane can provide context for its applications and significance.

Physical Properties

- Molecular weight: 114.21 g/mol
- Boiling point: approximately 60-62°C

- Melting point: around -130°C
- Density: about 0.66 g/cm³ at room temperature

Chemical Properties

- Hydrophobic, non-polar hydrocarbon
- Highly stable, resistant to oxidation
- Combustible, with typical alkane combustion

Applications and Significance

While 2,2-dimethylpentane itself is primarily of academic interest, branched alkanes like this are relevant in:

- Fuel formulations: Branched alkanes tend to have higher octane ratings.
- Chemical synthesis: As an intermediate in organic syntheses.
- Research: Studies on structure-reactivity relationships in hydrocarbons.

Summary and Conclusions

The compound characterized by the formula CH3-CH2-CH2-CH2-CH3 CH3 CH3 is most logically interpreted as 2,2-dimethylpentane. This conclusion is based on parsing the molecular fragments, recognizing the main chain as pentane, and considering the additional methyl groups as substituents attached at the second carbon.

Key points:

- The main chain is a pentane backbone.
- Two methyl groups are attached to the second carbon, making the molecule a branched alkane.
- The correct IUPAC name is 2,2-dimethylpentane.

This detailed analysis emphasizes the importance of precise structural interpretation in organic chemistry, facilitating accurate nomenclature and understanding of compound properties.

References

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Closing Remarks

Accurate identification and nomenclature of organic compounds are crucial for advancing chemical research, education, and industrial applications. The case of CH3-CH2-CH2-CH2-CH3 CH3 CH3 illustrates the importance of careful structural analysis and adherence to IUPAC rules. As organic chemistry continues to evolve, such foundational skills remain vital for scientists navigating the complex world of molecular structures.

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