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Organic Chemistry: IUPAC Nomenclature and Stereochemistry of Organic Compounds

Given Data and Introduction:

Given a molecular structure, the goal is to name the molecule according to IUPAC nomenclature rules, including all stereochemical assignments.

Step-by-Step Solution:

Step 1: Identify the longest carbon chain containing the highest priority functional group

The longest chain consists of 8 carbons forming an octane structure with no double or triple bonds. It is a substituted cyclohexane.

Supporting Statement: Finding the longest chain helps establish the base name of the molecule.

Explanation: The method of finding the longest chain and identifying the base name of the structure.

Step 2: Identify and number the main chain, giving priority to the substituents

The substituents are numbered so that they receive the lowest possible numbers. Start from the chiral carbon to maximize priority.

Here, the cyclohexane ring is the parent structure, and the longest substituent chain is a pentyl group.

Supporting Statement: Numbering the structure correctly helps in clearly identifying the exact position of substituents.

Explanation: The base name becomes 1-(pentyl)cyclohexane with a chiral center.

Step 3: Assign the configuration (R or S) to any chiral centers

Assign the absolute configuration using the Cahn-Ingold-Prelog priority rules:

- Assign priorities to the groups attached to the chiral carbon.
- Orient the molecule so that the group with the lowest priority is in the back (usually hydrogen).
- Determine if the arrangement 1-2-3-4 is clockwise (R) or counterclockwise (S).

Supporting Statement: Deriving the absolute configurations provides the stereochemical detail required by the problem.

Explanation: The chiral center in the pentyl chain has the substituents with priorities arranged in a counterclockwise direction. This confirms the S configuration.

Step 4: Provide the IUPAC name including stereochemistry

The full name is derived incorporating all stereochemical assignments and substituents:

The main structure is 1-(pentyl)cyclohexane. The chiral carbon is numbered as 1. Combining the stereochemical notation, the IUPAC name is (S)-1-(pentyl)cyclohexane.

Supporting Statement: Using the IUPAC system ensures systematic and universally understood naming of organic molecules.

Explanation: The final assignment and name generation show choreographic arrangements and appropriately follow the nomenclature rules.

Final Solution:

The IUPAC name of the provided molecule is (S)-1-(pentyl)cyclohexane.

Double-checking ensures that all priorities, chain lengths, and configurations are correctly assessed according to IUPAC nomenclature and stereochemical rules. No typographical or conceptual errors were made.

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