Systematic Nomenclature (IUPAC System)

Prefix-Parent-Suffix

Parent - number of carbons
Prefix - substituents
Suffix - functional groups

Naming Alkanes

General Formula: \( C_nH(2n+2) \)
suffix: -ane

Parent Names:
1. \( CH_4 \) Methane \( CH_4 \)
2. \( CH_3CH_3 \) Ethane \( C_2H_6 \)
3. \( CH_3CH_2CH_3 \) Propane \( C_3H_8 \)
4. \( CH_3(CH_2)2CH_3 \) Butane \( C_4H_{10} \)
5. \( CH_3(CH_2)3CH_3 \) Pentane \( C_5H_{12} \)
6. \( CH_3(CH_2)4CH_3 \) Hexane \( C_6H_{14} \)
7. \( CH_3(CH_2)5CH_3 \) Heptane \( C_7H_{16} \)
8. \( CH_3(CH_2)6CH_3 \) Octane \( C_8H_{18} \)
9. \( CH_3(CH_2)7CH_3 \) Nonane \( C_9H_{20} \)
10. \( CH_3(CH_2)8CH_3 \) Decane \( C_{10}H_{22} \)

Alkyl Substituents

R = Rest of the molecule

1. \( CH_3-R \) Methyl
2. \( CH_3CH_2-R \) Ethyl
3. \( CH_3CH_2CH_2-R \) Propyl
4. \( CH_3(CH_2)2CH_2-R \) Butyl
5. \( CH_3(CH_2)3CH_2-R \) Pentyl
6. \( CH_3(CH_2)4CH_2-R \) Hexyl
7. \( CH_3(CH_2)5CH_2-R \) Heptyl
8. \( CH_3(CH_2)6CH_2-R \) Octyl
9. \( CH_3(CH_2)7CH_2-R \) Nonyl
10. \( CH_3(CH_2)8CH_2-R \) Decyl
Rules for Systematic Nomenclature of Alkanes

1. Find the parent chain
   a. Identify the longest continuous carbon chain as the parent chain.

   
   
   7 carbons = hept-

   b. If more than one different chains are of equal length (number of carbons), choose the one with the greater number of branch points (substituents) as the parent.

   
   2 branch pts.

   1 branch pt.

2. Numbering the carbons of the parent chain
   a. Number the carbon atoms of the parent chain so that any branch points have the lowest possible number

   
   branch pts. at carbons 3 and 4

   branch pts. at carbons 4 and 5
b. If there is branching equidistant from both ends of the parent chain, number so the second branch point has the lowest number.

branch pts. at carbons 3, 6, 7
branch pts. at carbons 3, 4, 7

3. Substituents
a. Identify and number the substituents and list them in alphabetical order.

Parent C-9 = nonane
3-ethyl
4-methyl
7-methyl
3-ethyl-4,7-dimethylnonane

b. If there are two substituents on the same carbon, assign them the same number.

4. Write out the name
a. Write out the name as a single word:
   hyphens (-) separate prefixes
   commas (,) separate numbers
b. Substituents are listed in alphabetical order
   If two or more identical substituents are present use the prefixes:
      di- for two
      tri- for three
      tetra- for four
   note: these prefixes (di-, tri-, tetra-, etc.) are not used for alphabetizing purposes.
5. *Complex Substituents (substituents with branching)*
   
a. Named by applying the four previous rules with some modification
b. Number the complex substituent separately from the parent. Begin numbering at the point of attachment to the parent chain.
c. Complex substituents are set off by parenthesis.

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CH₃—CH—CH₂—CH—CH₂—CH—CH₂—CH₂—CH₂—CH₃
  1                3  4  5               7  8  9  10

CH—CH₂—CH₃
  1

CH₃
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2,6-dimethyl-4-(1-methylpropyl)decane

**Nonsystematic (trivial) Names:**

**3-carbons:**

- **Isopropyl**
  
  (1-methylethyl)

**4-Carbons:**

- **sec-butyl**
  
  (1-methylpropyl)

- **Isobutyl**
  
  (2-methylpropyl)

- **tert-butyl**
  
  (1,1-dimethylpropyl)

**5-Carbons:**

- **Isopentyl**, **isoamyl**
  
  (3-methylbutyl)

- **neopentyl**
  
  (2,2-dimethylpropyl)

- **tert-pentyl**, **tert-amyl**
  
  (1,1-dimethylpropyl)

**Alphabetizing trivial names:**

Iso- and neo are part of the alkyl group name and are used for alphabetizing.
sec- and tert- are not included in the alphabetical order.