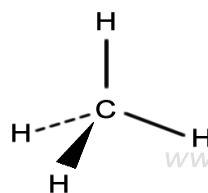


Alkanes

Family: Alkanes

- Alkanes: Hydrocarbons (compounds with only hydrogen and carbons) that contain only single bonds
- Simplest alkane is methane.

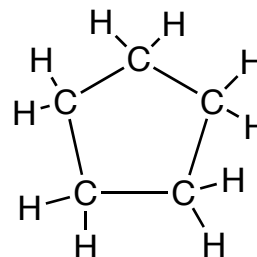
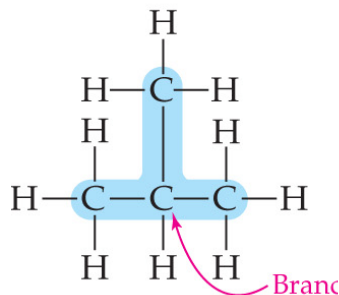
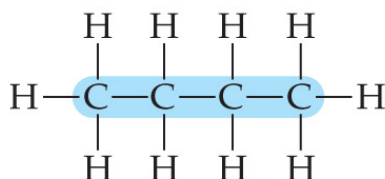


Sketched 3-D Structural Formula of Methane



"Ball and Stick" Model of 3-D Structure of Methane

- Except in the case of methane, each C must be bound to another C.
- Can be open-chain or cyclic. If open-chain (general formula C_nH_{2n+2}), can be straight-chain or branched-chain.

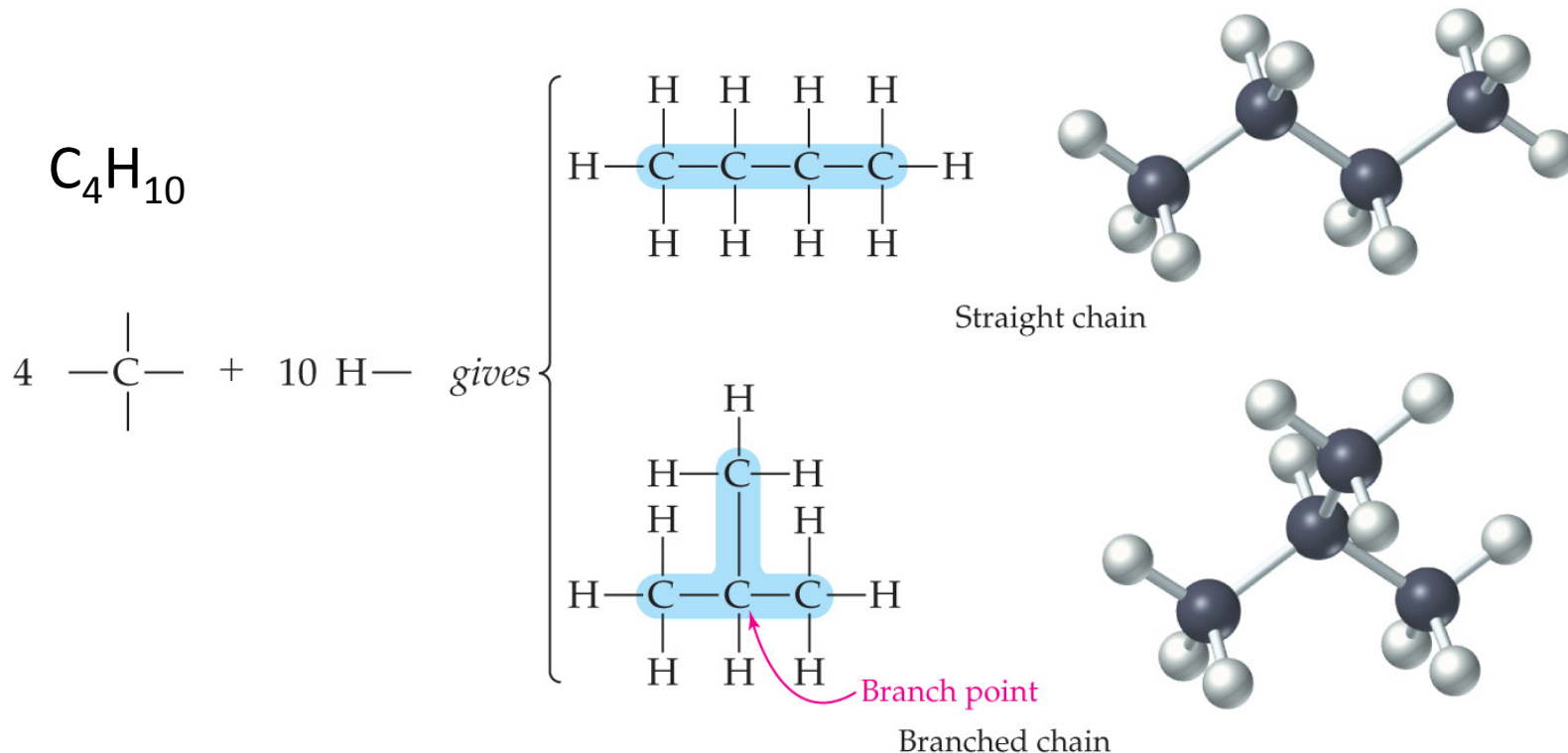


Isomers

- **Isomers:** Compounds that have the same molecular formula but different arrangement of atoms in space
- There are several different types of isomers.

Constitutional Isomers

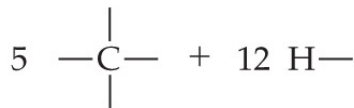
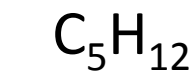
Constitutional Isomers: same molecular formula, but different atom-atom connections



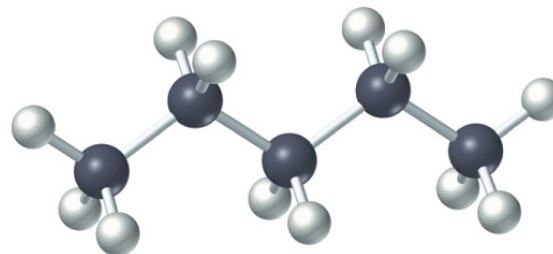
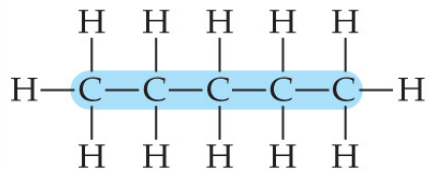
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- Completely different compounds, with different structures, physical properties (melting pt, boiling pt)

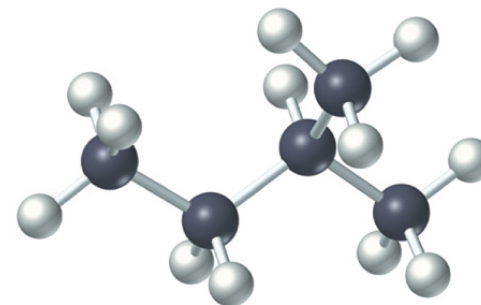
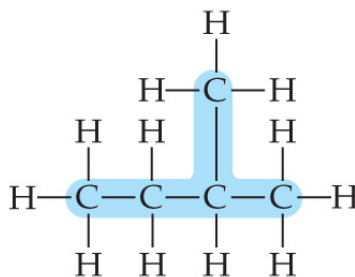
Constitutional Isomers



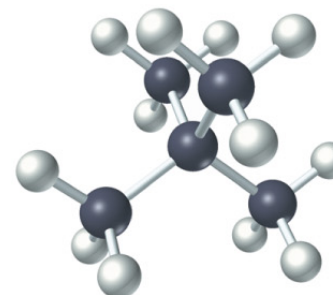
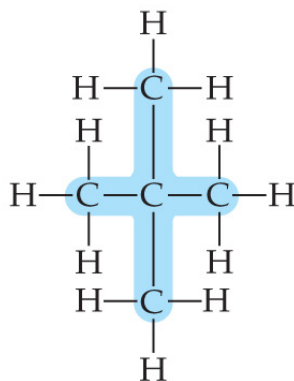
gives



Straight chain



Branched chain

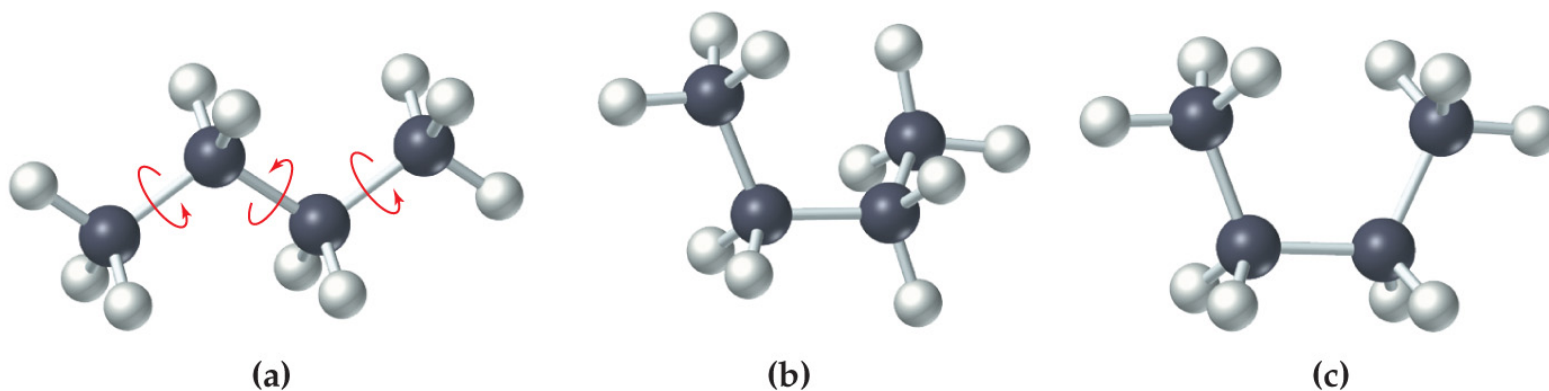


Branched chain

Ex Probs

Conformational Isomers

Conformational Isomers (Conformers): same molecular formula and same atom-atom connections, but different 3D geometries due to rotation about a bond



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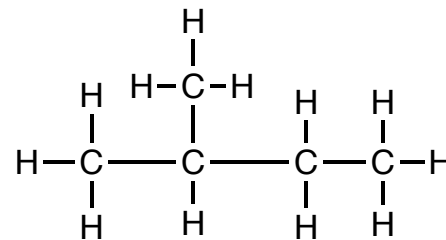
- Identical compound with same physical properties; can't be separated
- Most molecules in the sample have the least crowded, extended conformation.

Drawing Organic Structures

Different Types of Structural Formulas

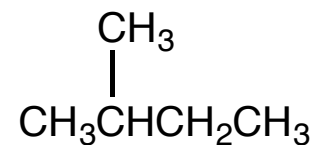
1. Full

- All atoms and bonds are shown.



2. Condensed

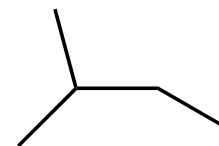
- C-C and C-H bonds are not shown (unless branched).



3. Line

- Each C-C bond is represented as a line.
Every vertex and open end represents a C.

Cs and Hs are not shown. (Any atoms other than C or H must be shown.)

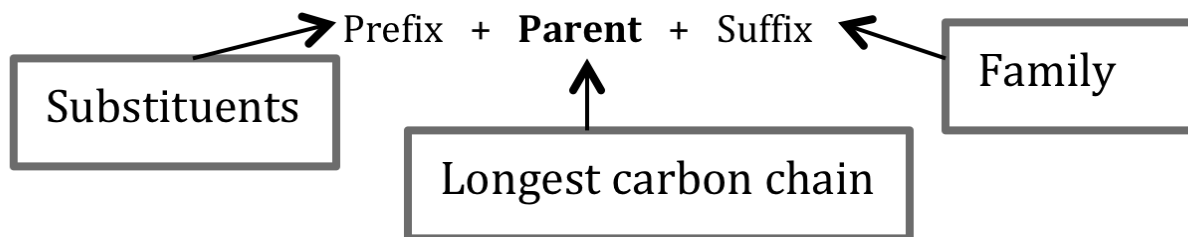


Chemical Nomenclature

1. IUPAC System (International Union of Pure and Applied Chemistry)
2. Common

IUPAC Nomenclature for Alkanes

Refer to *Handout: Naming Organic Molecules*.



1. Name parent+suffix: longest carbon chain + family suffix (-ane).
2. Number carbons in parent chain: Begin numbering from end that meets specified criteria (Begin at end nearer to branch point. Then give smallest #s possible to substituents).
3. Name prefix: substituent position #s and names (group repeated substituents together using di-, tri-, etc).
4. Write full name, listing substituents in alphabetical order (ignore di-, tetra- in alphabetizing).

Name Format: #-substituent-#-substituentparentsuffix

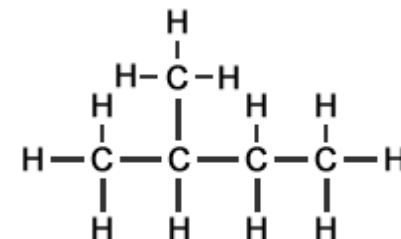
Names of Parent Alkanes

TABLE 12.2 Names of Straight-Chain Alkanes

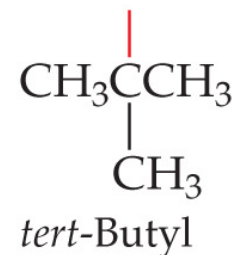
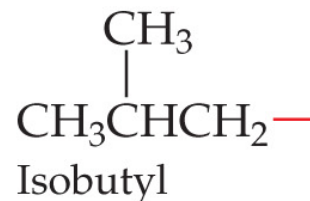
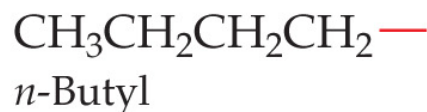
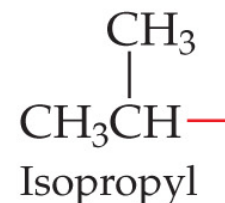
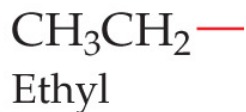
Number of Carbons	Structure	Name
1	CH ₄	<i>Methane</i>
2	CH ₃ CH ₃	<i>Ethane</i>
3	CH ₃ CH ₂ CH ₃	<i>Propane</i>
4	CH ₃ CH ₂ CH ₂ CH ₃	<i>Butane</i>
5	CH ₃ CH ₂ CH ₂ CH ₂ CH ₃	<i>Pentane</i>
6	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃	<i>Hexane</i>
7	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃	<i>Heptane</i>
8	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃	<i>Octane</i>
9	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃	<i>Nonane</i>
10	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃	<i>Decane</i>

Names of Alkyl Substituents

- Substituent: An atom or group of atoms attached to a parent compound
- Alkyl substituent: An alkane-derived substituent (To name, change *-ane* to *-yl*).

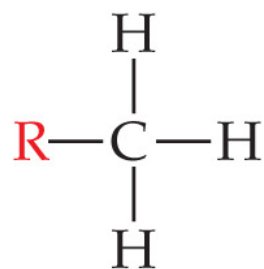


Some Common Alkyl Groups*



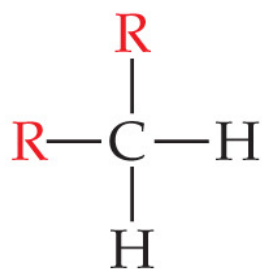
* The red bond shows the connection to the rest of the molecule.

Four Substitution Patterns of Carbon

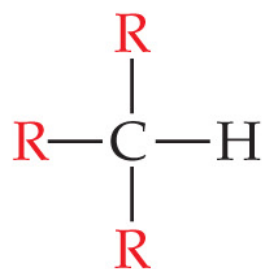


Primary carbon (1°) has one other carbon attached.

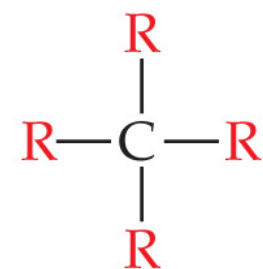
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Secondary carbon (2°) has two other carbons attached.



Tertiary carbon (3°) has three other carbons attached.



Quaternary carbon (4°) has four other carbons attached.

Ex Probs