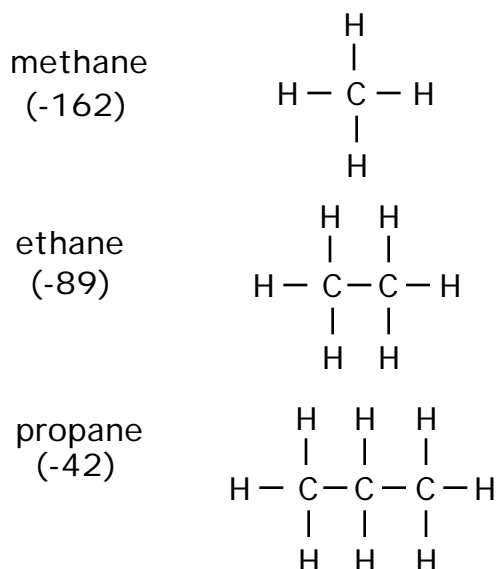


Alkanes : Notes/W.S. - 30

The alkanes are saturated hydrocarbons. This means that these molecules are composed of carbon and hydrogen atoms and that they contain the maximum number of hydrogen atoms.

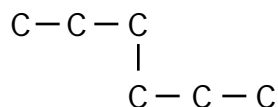
The first three alkanes are shown below. The boiling point (in °C) for each alkane is shown in brackets.

The alkanes can be separated from other substances in petroleum by the process of distillation.



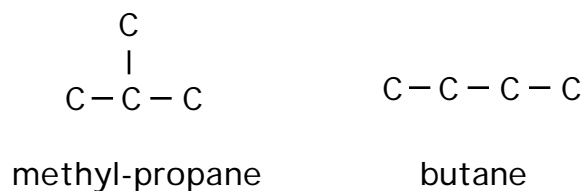
The next seven alkanes are; butane C_4H_{10} (0), pentane C_5H_{12} (36), hexane C_6H_{14} (69), heptane C_7H_{16} (98), octane C_8H_{18} (126), nonane C_9H_{20} (151), and decane $\text{C}_{10}\text{H}_{22}$ (174).

The above molecules have a carbon backbone. If this backbone is bent, the name of the alkane is the same. The alkane shown below is hexane. The hydrogen atoms are not shown for clarity.

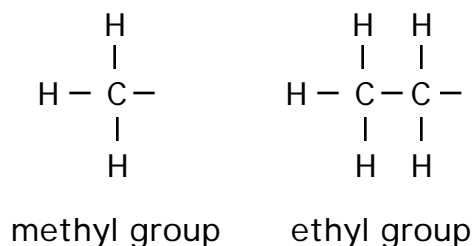


The alkanes shown above are straight chain alkanes. Many alkanes are branched-chain alkanes. Some alkanes also form rings.

The first alkane shown below is a branched alkane. It is an isomer of butane. All isomers of butane have the formula C₄H₁₀. The two isomers of butane are shown below.



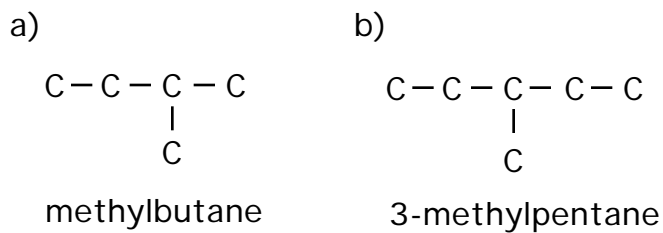
The methyl group consists of one carbon atom. The ethyl group consists of two, propyl, three, and so on. These groups are found on branched alkanes. The carbon atom of the backbone that the group is attached to, must be specified.

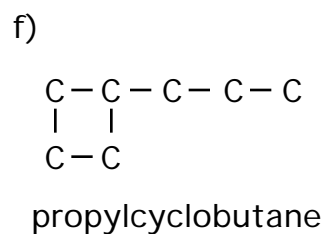
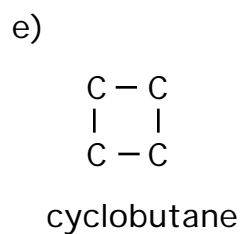
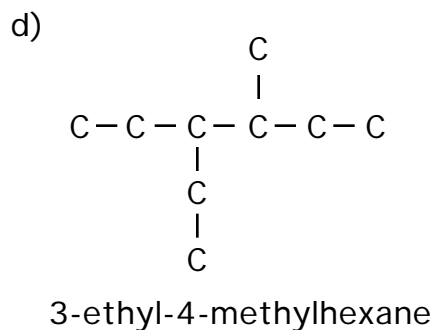
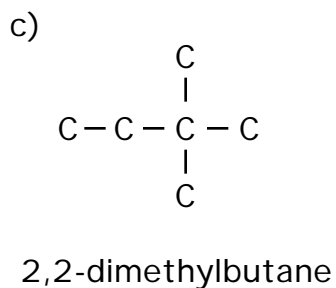


The naming system that is commonly used is the IUPAC system. It was developed by the International Union of Pure and Applied Chemists.

The IUPAC System

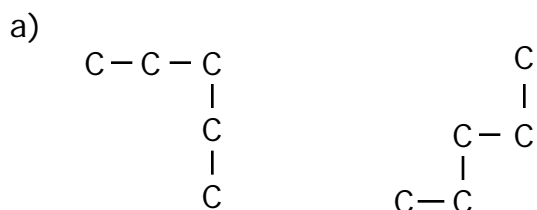
Several examples of alkanes, with their names, are given below. Hydrogen atoms are not shown for clarity. Note: In example a), it is not necessary to use 2-methylbutane to name the compound.

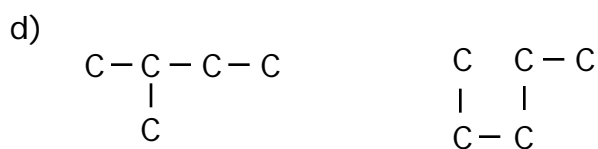
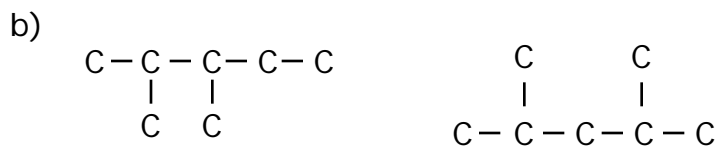




Problems:

- 1) Petroleum is a mixture of many different alkanes. How are these different alkanes separated?
- 2) The general formula for an alkane is C_nH_{2n+2} . What is the formula for dodecane? (its backbone has 12 carbon atoms)
- 3) Estimate the boiling point of undecane, which has the formula $C_{11}H_{24}$.
- 4) At room temperature ($20.^{\circ}\text{C}$), an alkane can be a gas, a liquid, or a solid. Give the state of the following alkanes at room temperature; a) propane, b) octadecane ($C_{18}H_{38}$, melting point is 28°C), c) pentane.
- 5) Are the following pairs of alkanes identical or isomers?

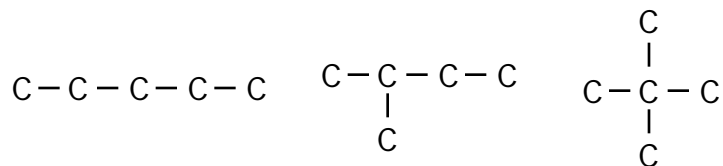




6) Draw the three isomers of C₅H₁₂.

7) Draw the five isomers of C₆H₁₄.

Answers: 1) The alkanes are separated by distillation. This is the separation of the components of a mixture based on differences in the boiling points of the components. 2) C₁₂H₂₆, 3) It is 196°C, 4) gas, solid, liquid., 5) a) identical, b) isomer, c) identical, d) isomer, 6)



7)

