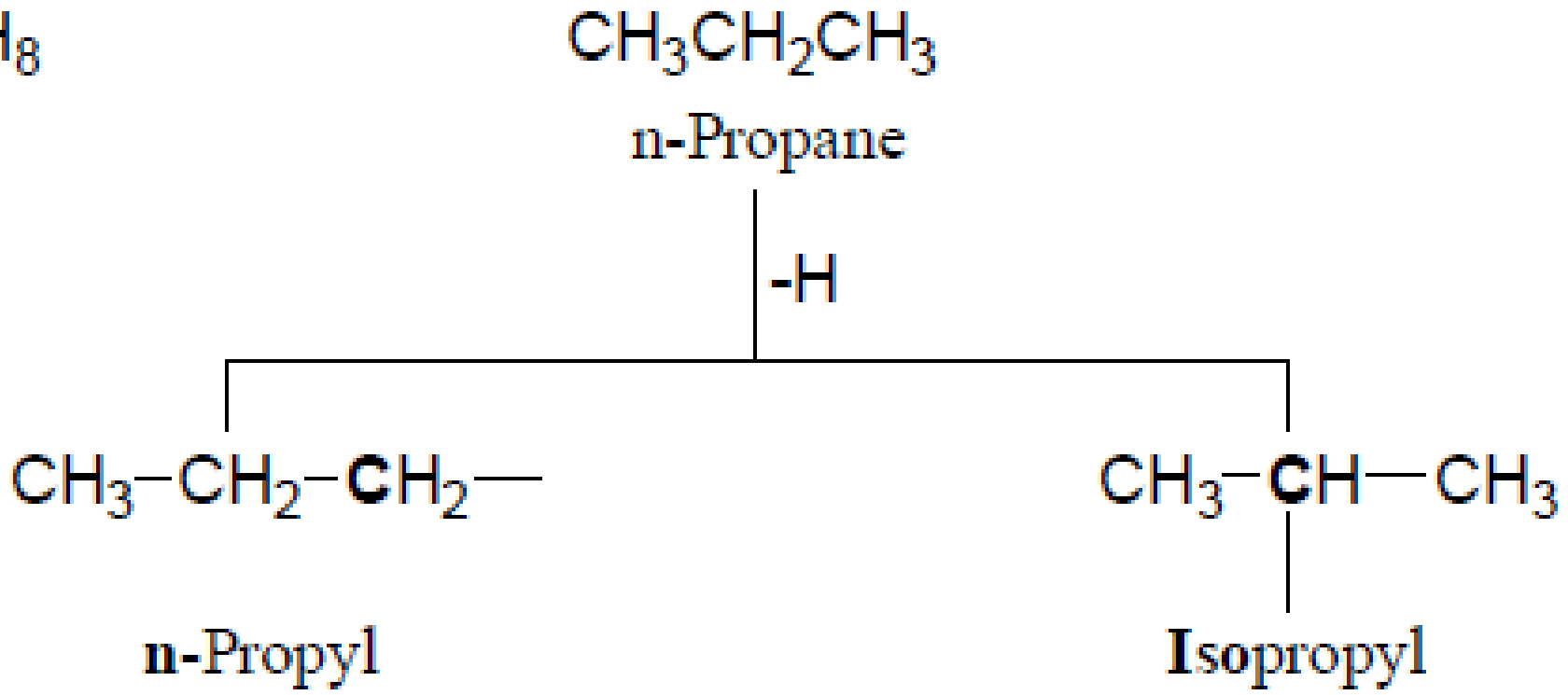
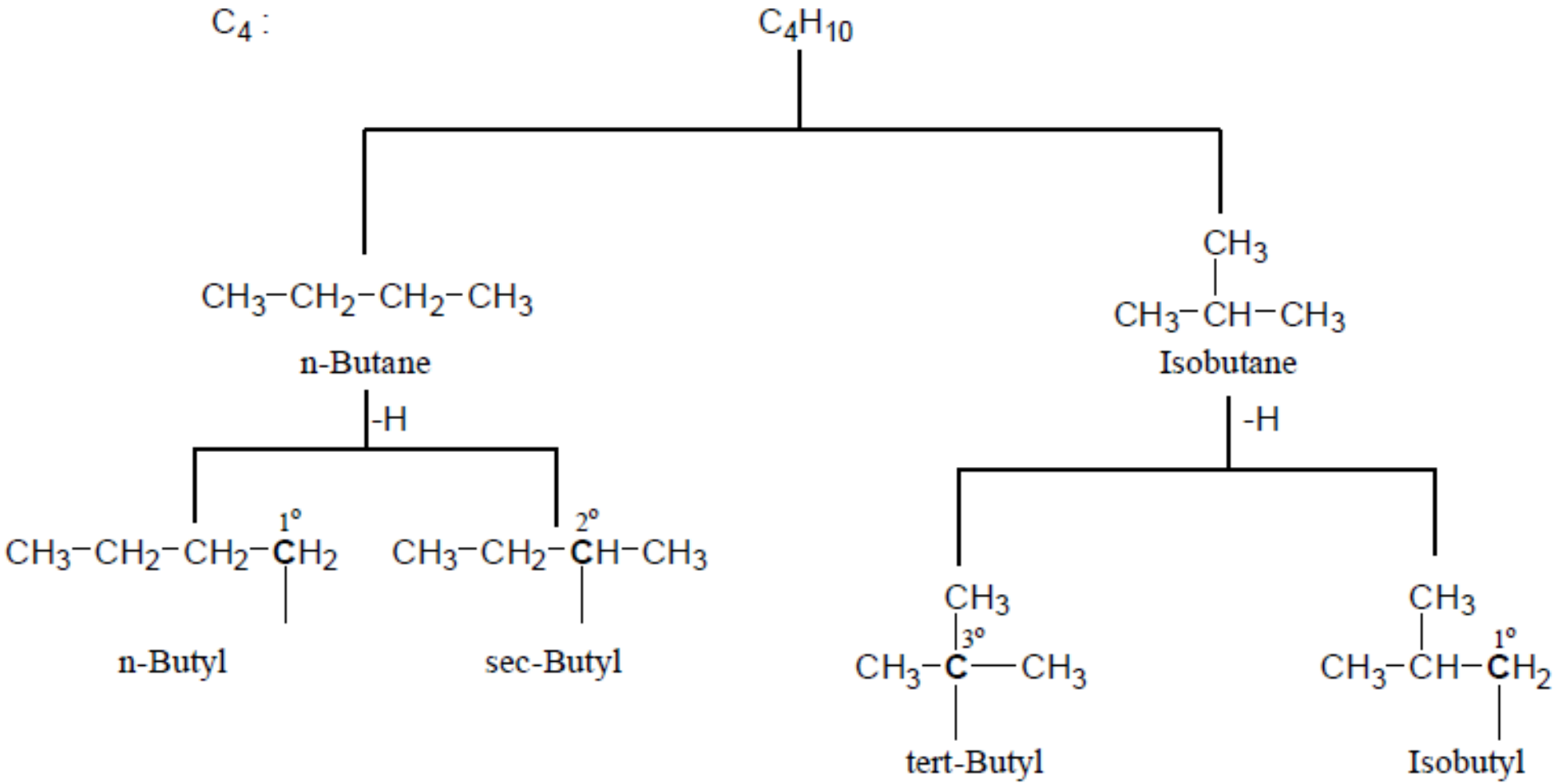
الكلية	العلوم
القسم	الكيمياء
المادة باللغة الانجليزية	Organic Chemistry
المادة باللغة العربية	الكيمياء العضوية
المرحلة الدراسية	الاولى
اسم التدريسي	محمد عدنان عبد منديل
عنوان المحاضرة باللغة الانجليزية	Nomenclature of hydrocarbons
عنوان المحاضرة باللغة العربية	تسمية الهيدروكابونات
رقم المحاضرة	السادسة
المصادر والمراجع	الكيمياء العضوية لمؤلفه (كلايدن)
	مبادي الكيمياء العضوية لمؤلفيه (موريون و بويد)

Hydrocarbons

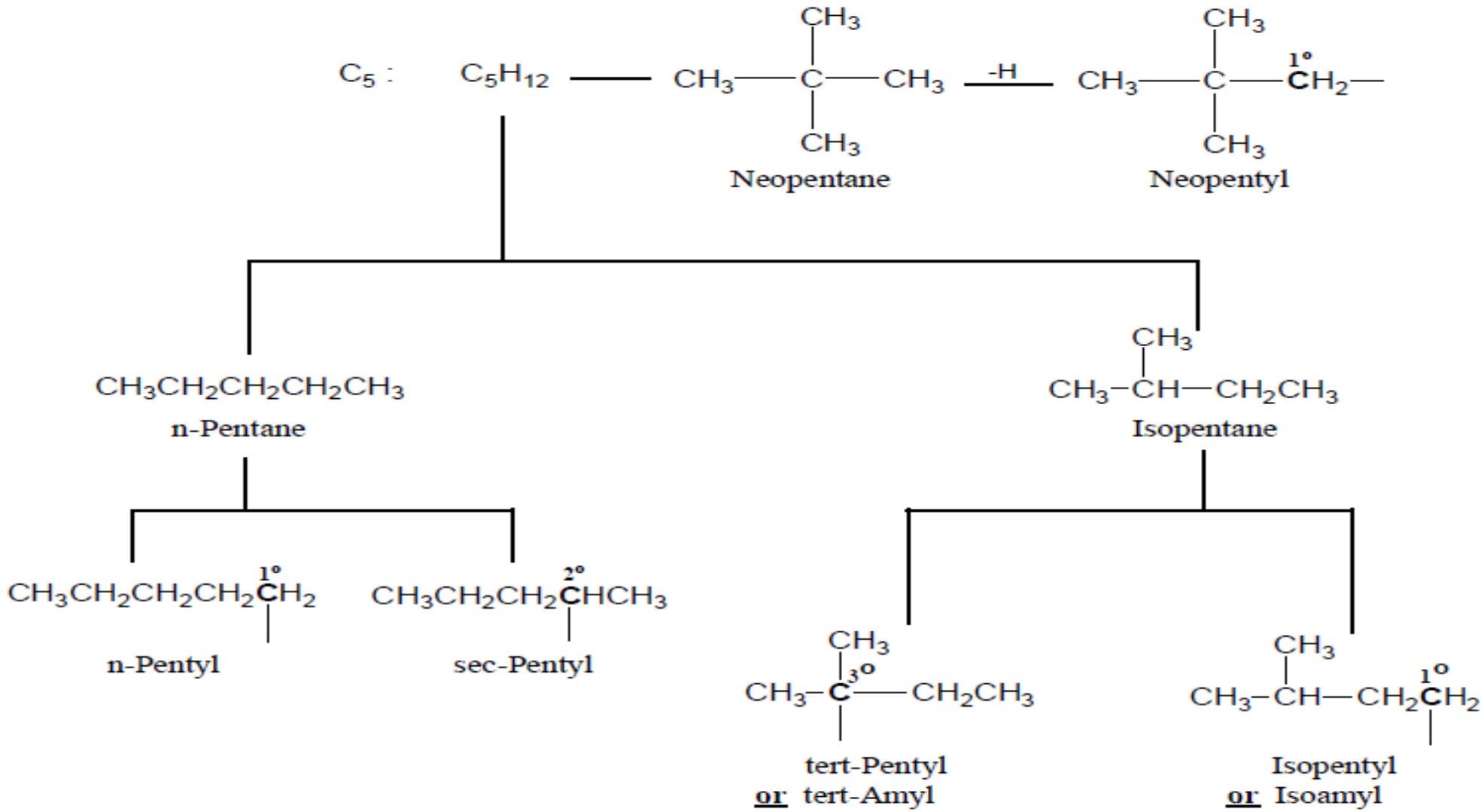
C_3 : C_3H_8



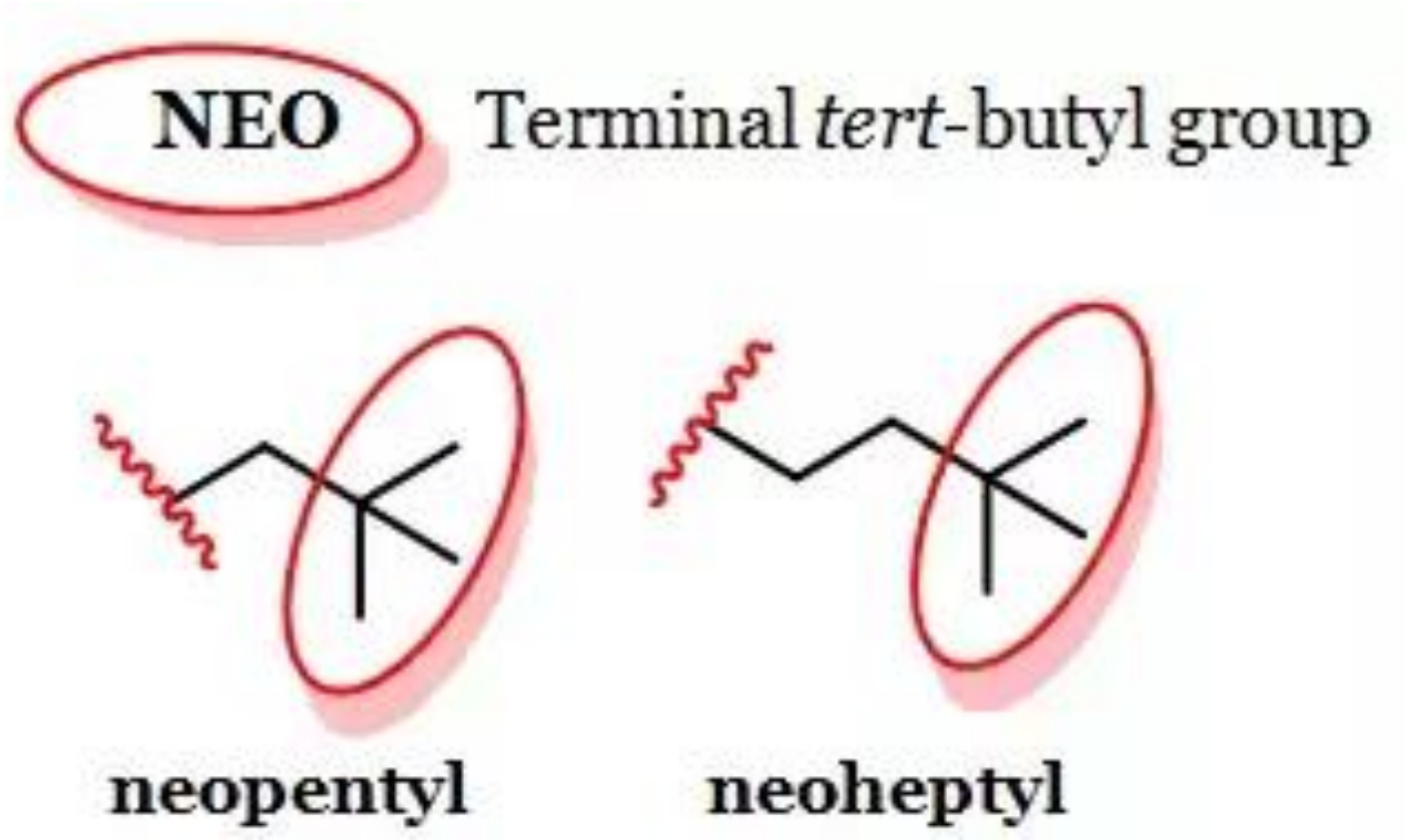
Hydrocarbons



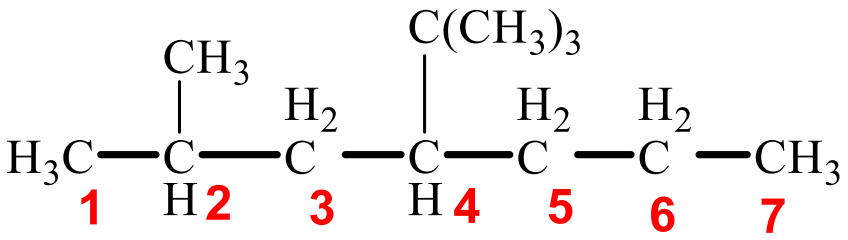
Hydrocarbons



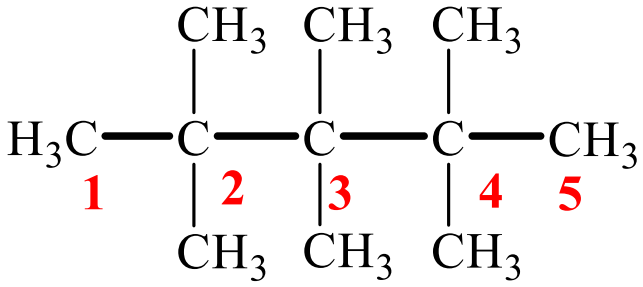
Hydrocarbons



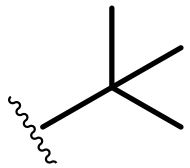
Hydrocarbons



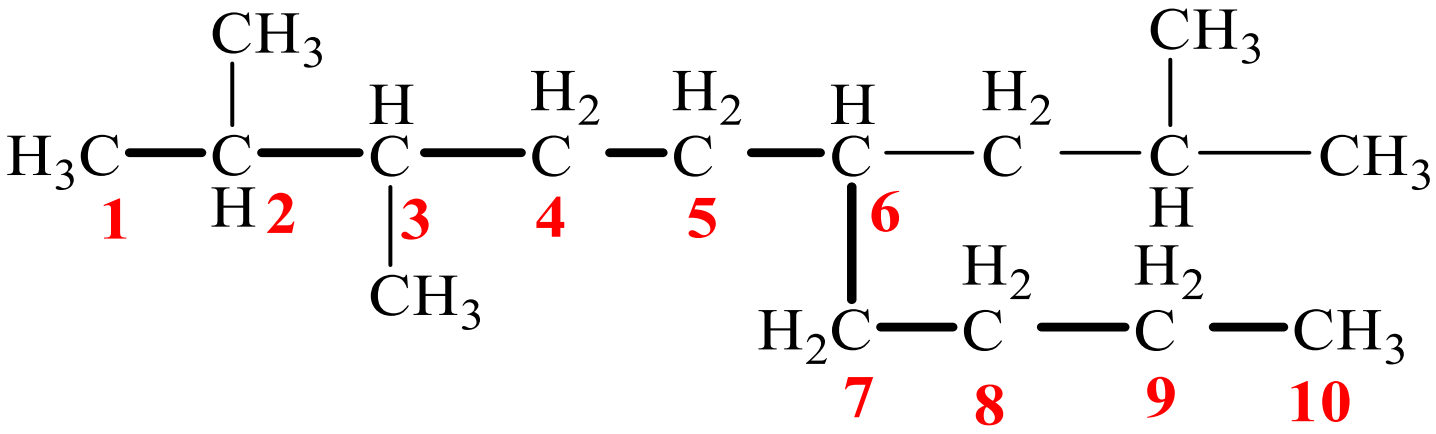
4-*tert*-butyl-2-methylheptane



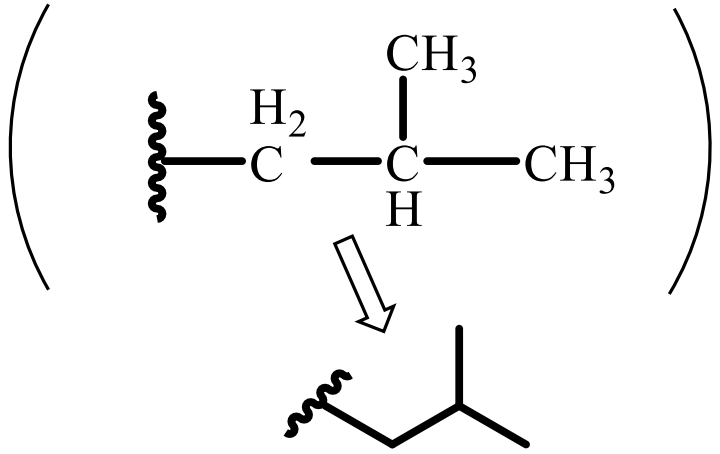
2,2,3,3,4,4-hexamethylpentane

tert-butyl $\left(C(CH_3)_3 = \right.$  $\left.\right)$

Hydrocarbons

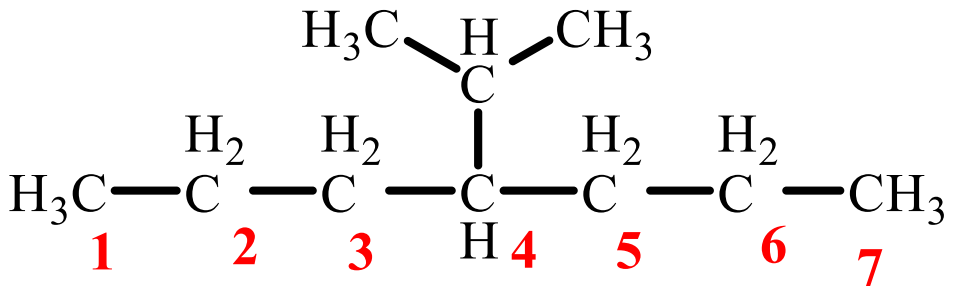


6-isobutyl-2,3-dimethyldecane

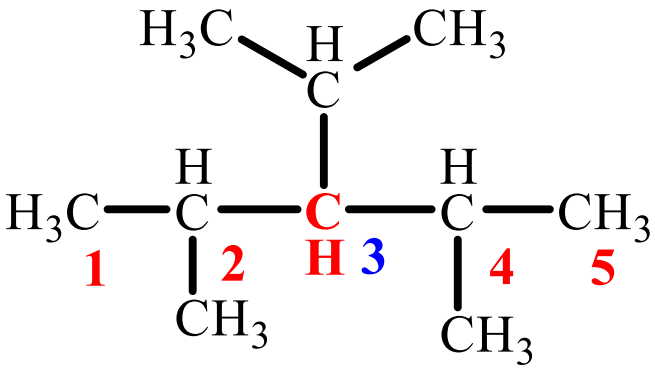


isobutyl

Hydrocarbons

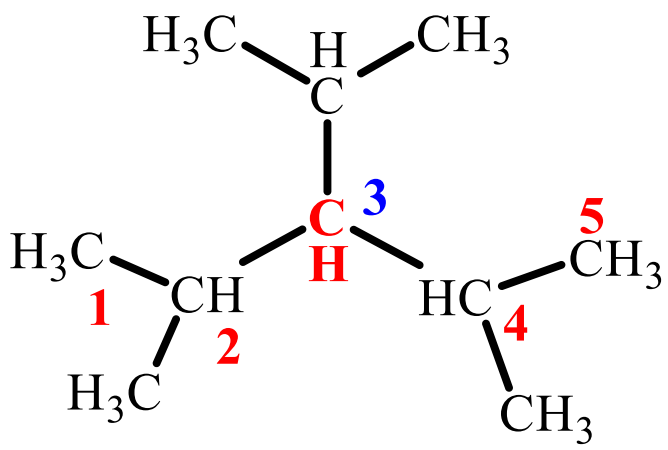


4-isopropylheptane



3-isopropyl-2,4-dimethylpentane

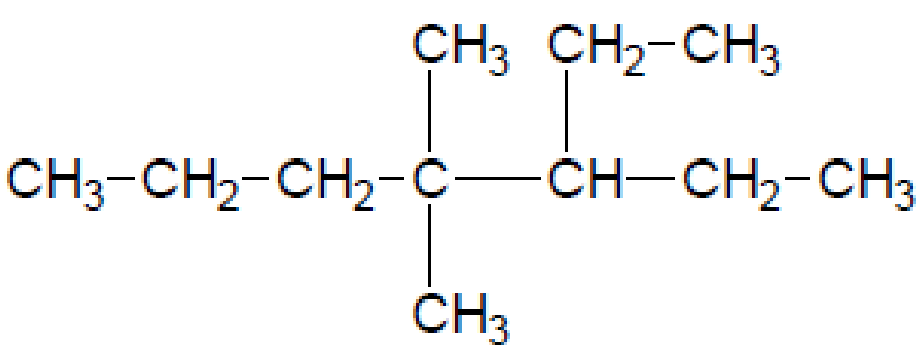
Hydrocarbons

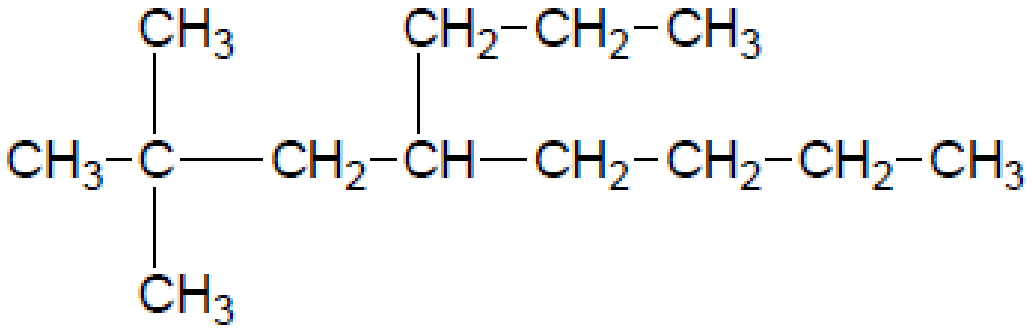


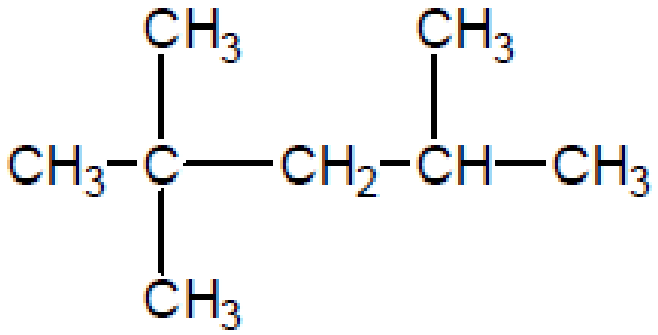
Triisopropyl methane

Hydrocarbons

Some examples







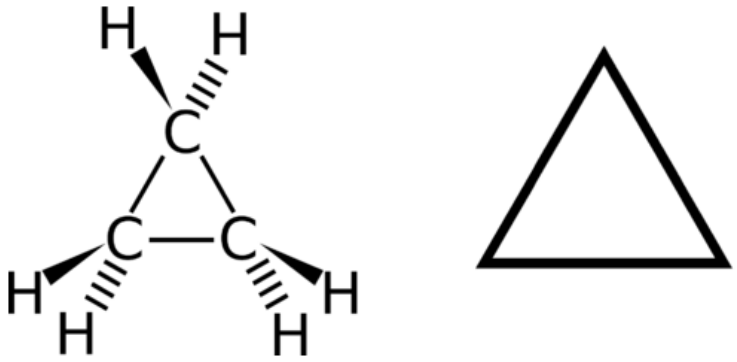
Hydrocarbons

Cyclic hydrocarbons

Have you ever grabbed a piece of meat at a barbecue that was left on the grill a bit too long? Chemically, the charred portion on grilled meat contains cyclic compounds. That is, if you looked at the chemical produced from cooking your meat beyond well-done, you would see that its chemical structure contains **cyclic hydrocarbons**.

Hydrocarbons

A **cyclic hydrocarbon** is a hydrocarbon in which the carbon chain joins to itself in a ring. Many organic compounds found in nature or created in a laboratory contain rings of carbon atoms with distinguishing chemical properties; these compounds are known as cycloalkanes. A cycloalkane is a cyclic hydrocarbon in which all of the carbon-carbon bonds are single bonds. Such other alkanes, cycloalkanes are saturated compounds, they have the general formula C_nH_{2n}. The simplest cycloalkane is cyclopropane, a three-carbon ring.

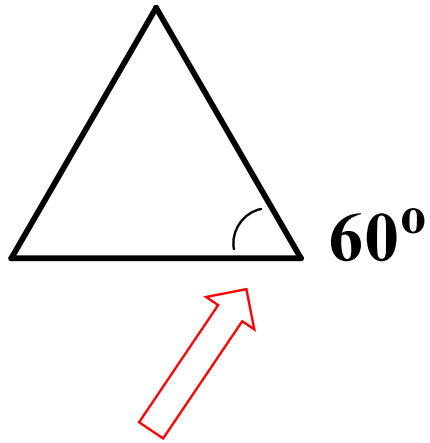


Cyclopropane is the simplest cycloalkane. Its highly strained geometry makes it rather unstable and highly reactive

Hydrocarbons

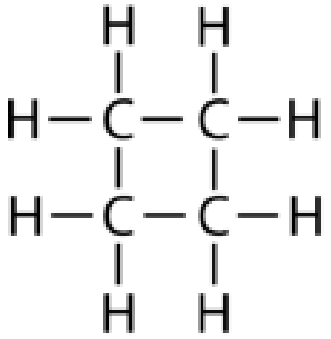
Cyclic hydrocarbons

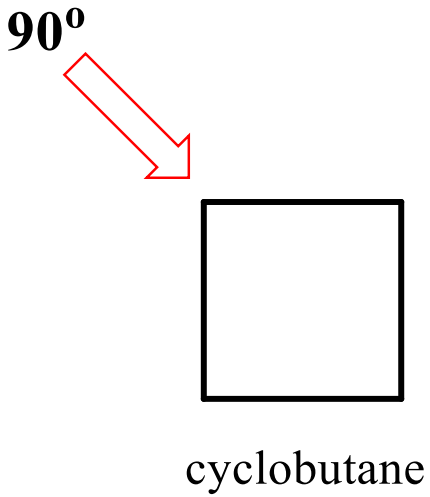
The carbon atoms in cycloalkanes are still sp^3 hybridized, with an ideal bond angle of 109.5^o. However, an examination of the cyclopropane structure shows that the triangular structure results in a C–C–C bond angle of 60^o.

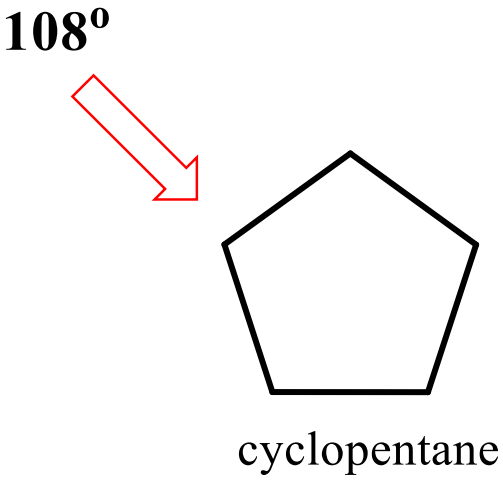


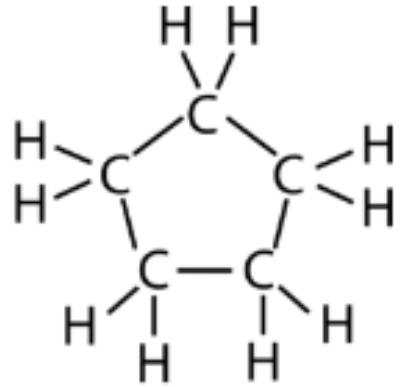
Hydrocarbons

This deviation from the ideal angle is called ring strain and makes cyclopropane a fairly unstable and reactive molecule. Ring strain is decreased for cyclobutane, with a bond angle of 90°, but is still significant. Cyclopentane has a bond angle of about 108°. This minimal ring strain for cyclopentane makes it a more stable compound.

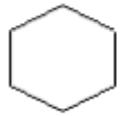






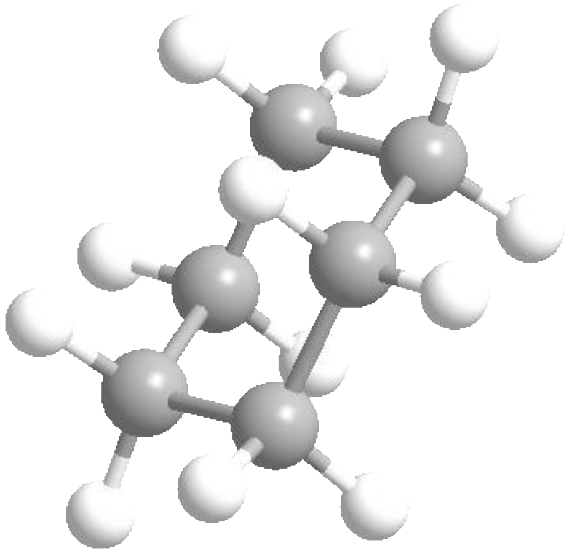


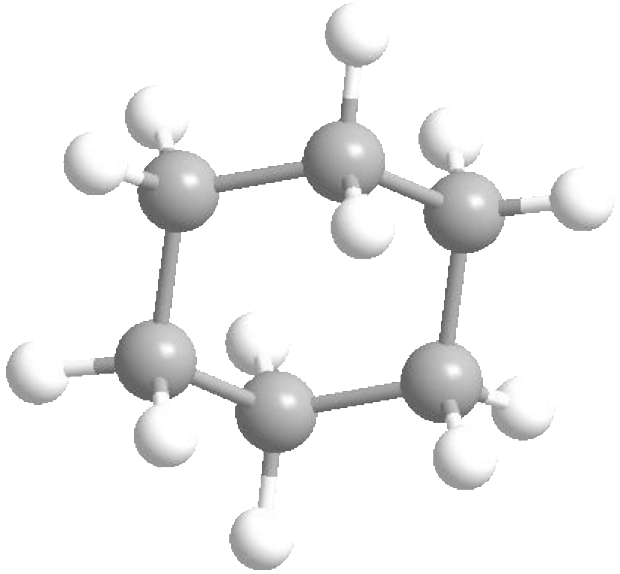
Hydrocarbons

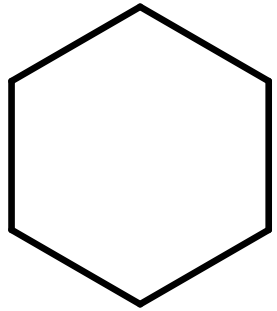
Cycloalkane	Molecular Formula	Basic Structure
Cyclopropane	C_3H_6	
Cyclobutane	C_4H_8	
Cyclopentane	C_5H_{10}	
Cyclohexane	C_6H_{12}	
Cycloheptane	C_7H_{14}	
Cyclooctane	C_8H_{16}	
Cyclononane	C_9H_{18}	
Cyclodecane	$C_{10}H_{20}$	

Hydrocarbons

The general formula as said for a cycloalkane is C_nH_{2n}. Cyclic compounds are not all flat molecules. All of the cycloalkanes, from cyclopentane upwards, exist as "puckered rings". Cyclohexane, for example, has a ring structure that looks like this:







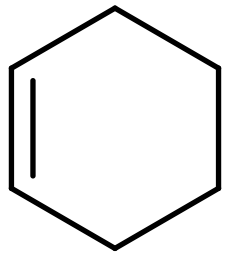
Hydrocarbons

All three of the depictions of cyclohexane are somewhat misleading, because the molecule is not planar. In order to reduce the ring strain and attain a bond angle of approximately 109.5°, the molecule is puckered. The puckering of the ring means that every other carbon atom is above and below the plane. The figure below shows two possibilities for the puckered cyclohexane molecule. Each of the structures is called a conformation. The conformation on the left is called the **chair** conformation, while the one on the right is called the **boat** conformation.

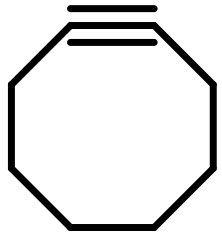
Hydrocarbons

While both conformations reduce the ring strain compared to a planar molecule, the chair is preferred. This is because the chair conformation results in fewer repulsive interactions between the hydrogen atoms.

Larger cycloalkanes also exist, but are less common. Cyclic hydrocarbons may also be unsaturated. A **cycloalkene** is a cyclic hydrocarbon with at least one carbon-carbon double bond. A **cycloalkyne** is a cyclic hydrocarbon with at least one carbon-carbon triple bond. Shown below are the simplified structural formulas for cyclohexene (left) and cyclooctyne (right).



cyclohexene



cyclooctyne

Hydrocarbons

Nomenclature of cyclic alkanes

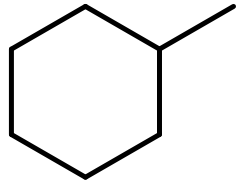
IUPAC Rules for Nomenclature

- Determine the cycloalkane to use as the parent chain. The parent chain is the one with the highest number of carbon atoms. If there are two cycloalkanes, use the cycloalkane with the higher number of carbons as the parent chain.
- If there is an alkyl straight chain that has a greater number of carbons than the cycloalkane, then the alkyl chain must be used as the primary parent chain. Cycloalkane acting as a substituent to an alkyl chain has an ending "-yl" and, therefore, must be named as a cycloalkyl.

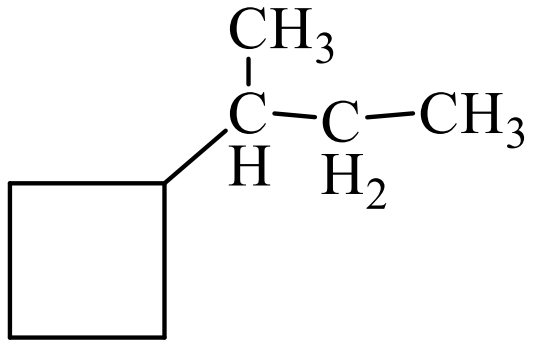
Hydrocarbons

Cycloalkane	**Cycloalkyl**
cyclopropane	cyclopropyl
cyclobutane	cyclobutyl
cyclopentane	cyclopentyl
cyclohexane	cyclohexyl
cycloheptane	cycloheptyl
cyclooctane	cyclooctyl
Cyclononane	cyclononanyl
cyclodecane	cyclodecanyl

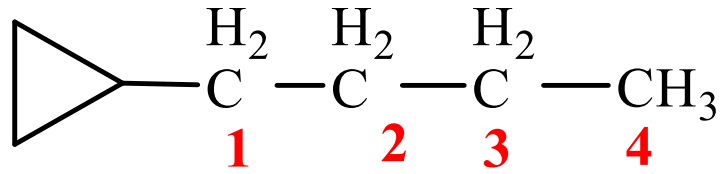
Hydrocarbons



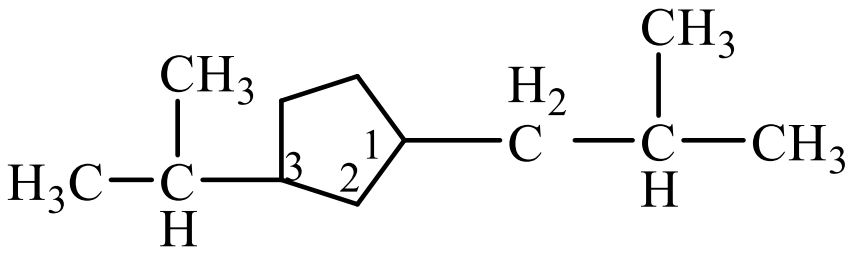
Methylcyclohexane



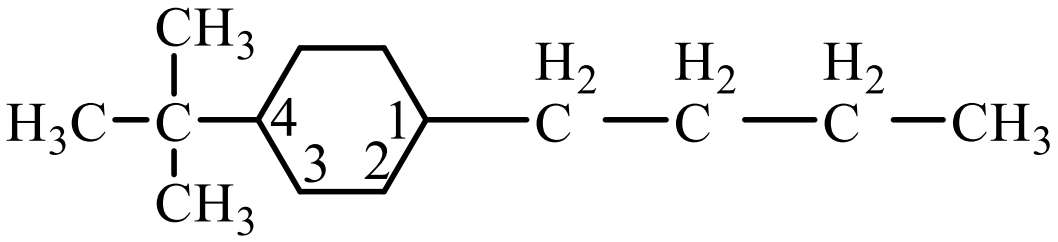
sec-butylcyclobutane



1-Cyclopropane butane



1-isobutyl-3-isopropylcyclopentane



1-*n*-Butyl-4-*tert*-butyl cyclohexane

Hydrocarbons

Summary

- A cyclic hydrocarbon is a hydrocarbon in which the carbon chain joins to itself in a ring.
- A cycloalkane is a cyclic hydrocarbon in which all of the carbon-carbon bonds are single bonds. (Like other alkanes, cycloalkanes are saturated compounds).
- A cycloalkene is a cyclic hydrocarbon with at least one carbon-carbon double bond.
- A cycloalkyne is a cyclic hydrocarbon with at least one carbon-carbon triple bond.
- Names and structures of typical cyclic hydrocarbons are given.

Thank you for attention