

## STUDY GUIDE FOR MODULE NO. 4

## HYDROCARBON CHAINS AND RINGS



## MODULE OVERVIEW

Many hydrocarbons occur in nature. In addition to making up fossil fuels, they are present in trees and plants, as, for example, in the form of pigments called carotenes that occur in carrots and green leaves. More than 98 percent of natural crude rubber is a hydrocarbon polymer, a chainlike molecule consisting of many units linked together. The structures and chemistry of individual hydrocarbons depend in large part on the types of chemical bonds that link together the atoms of their constituent molecules.

Nineteenth-century chemists classified hydrocarbons as either aliphatic or aromatic on the basis of their sources and properties. Aliphatic (from Greek *alephos*, "fat") described hydrocarbons derived by chemical degradation of fats or oils. Aromatic hydrocarbons constituted a group of related substances obtained by chemical degradation of certain pleasant-smelling plant extracts. The terms *aliphatic* and *aromatic* are retained in modern terminology, but the compounds they describe are distinguished on the basis of structure rather than origin.



## MODULE LEARNING OBJECTIVES

At the end of the unit, the student should be able to:

1. Identify the structures and homologous members of alkene, alkane and alkyne families
2. Describe the structure of benzene and the substituted aromatics
3. Name the organic compounds using IUPAC
4. Differentiate the types of structural compounds



## LESSON 1: HYDROCARBONS: REPRESENTATIVE ALKANES, ALKENES, ALKYNES, AND AROMATIC COMPOUNDS

**HYDROCARBONS**

The simplest organic compounds are those composed of only two elements: carbon and hydrogen. These compounds are called hydrocarbons. Hydrocarbons themselves are separated into two types: aliphatic hydrocarbons and aromatic hydrocarbons. Aliphatic hydrocarbons are hydrocarbons based on chains of C atoms. There are three types of aliphatic hydrocarbons. Alkanes are aliphatic hydrocarbons with only single covalent bonds. Alkenes are aliphatic hydrocarbons that contain at least one C=C double bond, and alkynes are aliphatic hydrocarbons that contain a C-C triple bond. Occasionally, we find an aliphatic hydrocarbon with a ring of C atoms; these hydrocarbons are called cycloalkanes (or cycloalkenes or cycloalkynes).

The general molecular formulas and molecular structures of the alkanes, alkenes, and alkynes:

| Group   | General Molecular Formula | Example Compound | Molecular Structure |
|---------|---------------------------|------------------|---------------------|
| Alkanes | $C_nH_{2n+2}$             | Ethane           |                     |
| Alkenes | $C_nH_{2n}$               | Ethene           |                     |
| Alkynes | $C_nH_{2n-2}$             | Ethyne           |                     |

# Hydrocarbons Alkanes Study Guide Answers

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