

## 12.2: Hydrocarbons

### Learning Objectives

- Understand the difference between saturated and unsaturated hydrocarbons.

**Hydrocarbons** are compounds that contain only carbon and hydrogen. Even though they are composed of only two types of atoms, there is a wide variety of hydrocarbons because they may consist of varying lengths of chains, branched chains, and rings of carbon atoms, or combinations of these structures. In addition, hydrocarbons may differ in the types of carbon-carbon bonds present in their molecules.

Many hydrocarbons are found in plants, animals, and their fossils; other hydrocarbons have been prepared in the laboratory. We use hydrocarbons every day, mainly as fuels, such as natural gas, acetylene, propane, butane, and the principal components of gasoline, diesel fuel, and heating oil. The familiar plastics polyethylene, polypropylene, and polystyrene are also hydrocarbons. We can distinguish several types of hydrocarbons by differences in the bonding between carbon atoms.

### Classes of Hydrocarbons

You have probably heard the terms saturated and unsaturated (as in monounsaturated or polyunsaturated) applied to different types of fats. It turns out these terms are derived from vocabulary used in organic chemistry. Hydrocarbons may also be classified as saturated or unsaturated. Their classification is based upon the number of bonds between carbon atoms.

- Saturated hydrocarbons have only single bonds between carbon atoms, so the carbon atoms are bonded to as many hydrogen atoms as possible. In other words, they are saturated with hydrogen atoms.
- Unsaturated hydrocarbons have at least one double or triple bond between carbon atoms, so the carbon atoms are not bonded to as many hydrogen atoms as possible. In other words, they are unsaturated with hydrogen atoms.

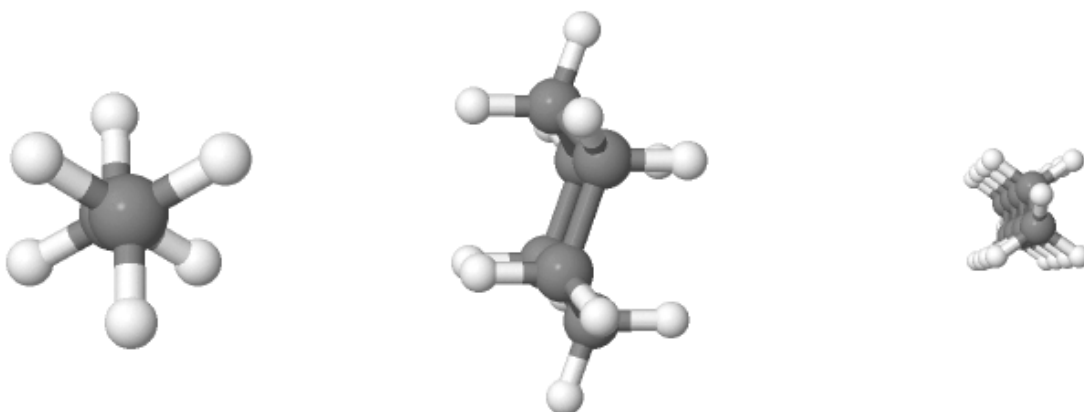




Figure 12.2.1: Row 1: saturated hydrocarbons – ethane, cyclohexane, and octane. Row 2: unsaturated hydrocarbons – trans-2-butene, acetylene, and naphthalene.

In the case of fats, a saturated fat is one in which all of the carbon-to-carbon bonds are single bonds – it is saturated with hydrogen atoms. A monounsaturated fat contains one carbon-to-carbon double bond, while a polyunsaturated fat contains many carbon-to-carbon double bonds. Though a hydrocarbon may also be considered unsaturated if it contains a carbon-to-carbon triple bond, fats will only contain carbon-to-carbon single bonds or double bonds.

### Sources of Hydrocarbons

The main source of hydrocarbons is fossil fuels – coal, petroleum, and natural gas. Fossil fuels formed over hundreds of millions of years, as dead organisms were covered with sediments and placed under great pressure. Giant ferns in ancient swamps eventually turned into coal deposits. Dead organisms in ancient seas gradually formed deposits of petroleum and natural gas. Fossil fuels are usually retrieved from depths of hundreds (coal) to thousands (petroleum and natural gas) of feet.



Figure 12.2.2: First aid to the injured in an anthracite coal mine. Postcard copyright 1914 by J.W. Evans. (Janet Lindenmuth via Flickr)

### Summary

- Hydrocarbons are compounds containing only carbon and hydrogen. If all carbon-to-carbon bonds are single bonds, the hydrocarbon is saturated. If the compound contains carbon-to-carbon double or triple bonds, the hydrocarbon is unsaturated.
- The primary source of hydrocarbons is fossil fuels.

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