

# 13C Carbon and its Chemistry

What are some common molecules that contain carbon?

Living organisms are made up of a great variety of molecules, but the number of different elements involved is very small. Organic chemistry is the science of molecules that contain carbon and these are the ones most important to living organisms. This investigation will introduce you to some small organic molecules.

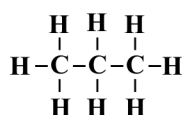
## Materials

- Periodic Table Tiles
- Reference book of organic compounds

## 1 The chemistry of carbon

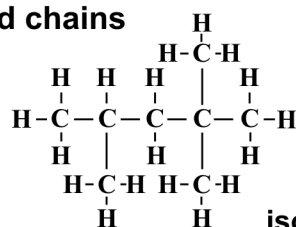
Carbon is the central element in the chemistry of living things. This is because carbon can make complex molecules. Each carbon atom can make four bonds because carbon has four electrons in the outer energy level, which can hold a total of eight. Carbon can also form double and triple bonds by sharing two or three electrons with a single atom. Because of carbon's flexible bonding ability, many molecular structures are possible.

### Straight chains



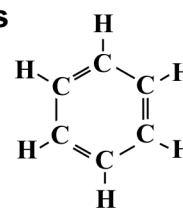
Propane  
 $\text{C}_3\text{H}_8$

### Branched chains



iso-octane  
 $\text{C}_8\text{H}_{18}$

### Rings

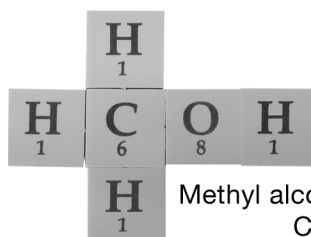


Benzene  
 $\text{C}_6\text{H}_6$

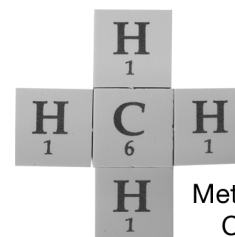
## 2 Single carbon molecules



Carbon dioxide  
 $\text{CO}_2$



Methyl alcohol (methanol)  
 $\text{CH}_3\text{OH}$



Methane  
 $\text{CH}_4$

1. Build the three carbon molecules above using the periodic table tiles.
2. Build a model of carbonic acid:  $\text{H}_2\text{CO}_3$ .

## 3 Stop and think

- a. Research and describe at least one use of methyl alcohol.

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- b. Research and describe the use and production of methane.

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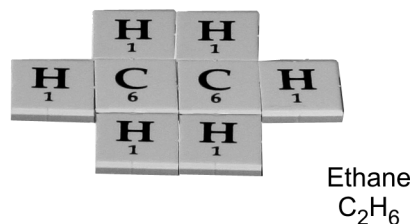
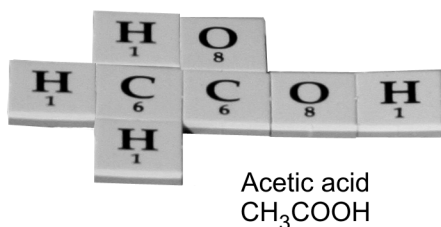
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#### 4 Molecules with two carbon atoms

Once there are two carbon atoms, the structures get more complicated. The carbon atoms may share a single, double, or triple bond between them.



1. Build the 2-carbon molecules above using the periodic table tiles.
2. Build a model of ethyl alcohol (ethanol):  $\text{C}_2\text{H}_5\text{OH}$ .  
(Hint: Each carbon atom makes 4 bonds and the oxygen atom makes two bonds)
3. Build a model of acetylene:  $\text{C}_2\text{H}_2$ .  
(Hint: there is a triple bond between the two carbon atoms)

#### 5 Stop and think

- a. Research and describe where acetic acid is found.

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- b. Research and describe at least one use of ethyl alcohol.

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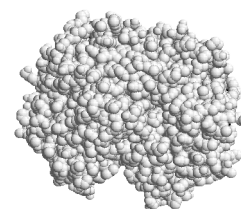
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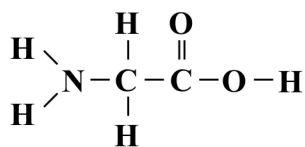
#### 6 Biological molecules

Living organisms are constructed mainly of proteins, which are very large carbon-based molecules, such as hemoglobin (right). A single protein may contain 10,000 or more atoms. Proteins themselves are constructed of simpler units called amino acids. For example, the hemoglobin molecule contains 584 amino acids.

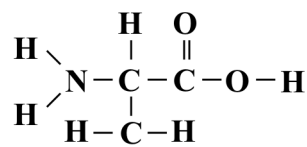


Hemoglobin molecule

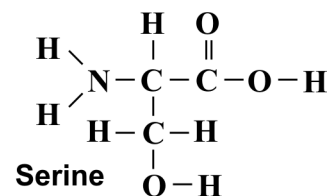
Use the periodic table tiles to build models of the three smallest amino acids.



Glycine



Alanine



Serine

## 7 Stop and think

- a. What is similar about all three amino acids?

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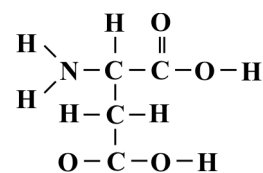
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Is this an amino acid?

- b. Is the chemical in the diagram on the right an amino acid?  
Explain why you think your answer is correct.

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