Carbon Chemistry: On Line Lab

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Carbon Chemistry

How can models of carbon compounds be built?

Organic chemistry is the study of the compounds of carbon. Carbon compounds contain carbon and one or more other elements, such as hydrogen, oxygen, nitrogen, or sulfur. A molecular formula for a compound indicates what elements make up the compound and how many atoms of each element are present in a molecule of the compound. For instance, the molecular formula for methane is CH4. This means each methane molecule is made up of 1 carbon atom and 4 hydrogen atoms. A compound like methane that is made up of only carbon and hydrogen atoms is called a hydrocarbon. Straight-chain hydrocarbons are so called because the carbon molecules are bonded together side by side in a line, or "chain."

The outermost electrons in an atom form covalent bonds with outermost electrons in other atoms. A single covalent bond is formed when two atoms share the same electron.

A carbon atom has four outermost electrons, each of which will form a covalent bond with either another carbon atom or an atom of another element such as hydrogen. A hydrogen atom has one electron, and so will form one covalent bond.

There are three groups or series of straight-chain hydrocarbons. The alkane series consists of hydrocarbons that have single covalent bonds between each of their carbon atoms. An alkene series hydrocarbon has a double covalent bond (two covalent bonds) between at least two of its carbon atoms. A double bond counts as two bonds, so a carbon atom that has a double bond has only two remaining electrons available to form covalent bonds. An alkyne series hydrocarbon has a triple bond (three covalent bonds) between at least two of its carbon atoms. A triple bond counts as three bonds, so a carbon atom that has a triple bond will have only one electron available to form a covalent bond.

Like a molecular formula, a structural formula indicates the number and kinds of atoms that make up a molecule of a compound. Additionally, it describes the arrangement of the atoms in the molecule. For an example of the structural formula for methane, click the formula button.

Notice that the number of carbon and hydrogen atoms is the same as that given by the molecular formula CH4. The dashes between the letters represent the single covalent bonds between the atoms. In a structural formula, bonds connect two atoms; they do not attach to other bonds.

Procedure:

1. Click the Video button to watch the demonstration.

2. Click the Chemistry button to learn about the structure of basic hydrocarbon molecules. Click the forward and back arrows to page through the information. Click the Close button to return to the activity screen.

3. Click the Molecule menu and select a molecule.

4. Build a structural model of the molecule you chose by clicking atoms and covalent bonds and dragging them to the work area.

5. Click the Check button to check your model.

6. Once your model is correct, record your findings in the Table.

7. Click the Reset button when you want to clear the work area. Build structural models of five different molecules.

8. Complete the Journal questions.

Notes from on-line lab Video:

_____
_____
_____
_____

Notes/drawings from Chemistry section from on-line lab:

_____
_____
_____

Build a molecule. Draw 5 examples here

1	2	3
4	5	Extra credit drawing

Complete these questions:

1. Which of these can form when carbon bonds?
A) double bonds B) branched chains C) rings D) all of these

2. A simple hydrocarbon contains molecules of _____ and _____.
A) carbon, nitrogen B) hydrogen, chlorine C) hydrogen, carbon D) carbon, helium

3. Saturated hydrocarbons contain _____ covalent bonds.
A) four B) double C) triple D) single

4. Which suffix ending is given to compounds in which carbon atoms are joined by double bonds?
A) ine B) ane C) yne D) ene

5. Which group contains a covalently bonded hydrogen and oxygen atom?
A) amino B) carboxyl C) hydroxyl D) protein

Carbon Molecules with Trix

Part 1: Do Pentane & Hexane Have Isomers?

Purpose: To model the structure of isomers

Procedure:

1. Use: colored Trix for carbon and hydrogen and toothpicks for covalent bonds.

Try to made a model of pentane: C_5H_{12}.

Remember each carbon atom MUST have 4 bonds, while hydrogen can only have 1.

Draw some of your models here:

How many different models (isomers) could you build? _____

2. Try to made a model of hexane: C_6H_{14}.

Remember each carbon atom MUST have 4 bonds, while hydrogen can only have 1.

Draw all of your models here: (not all the boxes may be filled)

How many different models (isomers) could you build? _____

Part 2: Can you make new models from your hexane structures?

Purpose: To model the relationship between a hydrocarbon and a substituted hydrocarbon

Procedure:

1. Using your straight chain model of hexane, remove a hydrogen trix and replace it with another colored Trix. This can represent an alcohol (OH), carboxyl (COOH) or an amine (NH_3). This simulates what happens when a lipid, carbohydrate or nucleic acid are formed.

Draw some of your straight line models here and label what they are :

Conclusion questions:

1. What did you learn about isomers, that you didn't understand before?

_____
_____
_____
_____
_____

2. Would the substitution of a colored trix with a marshmallow significantly change the properties of the compound? What kinds of changes would you predict?

_____
_____
_____
_____
_____

Journal Questions For Both Labs:

What are organic compounds? _____
_____
_____

What are hydrocarbons? _____
_____
_____

What are covalent bonds? _____
_____
_____

In the computer lab which (if any) of the molecules you built were Alkanes? Alkenes? Alkynes?_____
_____
_____
_____

What is the difference between saturated and unsaturated hydrocarbons?

_____
_____
_____

What is the difference between a molecular formula and a structural formula?

_____
_____
_____