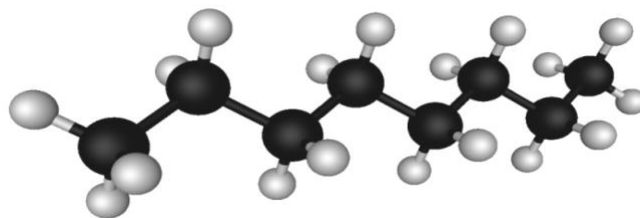


Name: _____



Introduction to Organic Chemistry: Hydrocarbons

Why?

Organic molecules all contain carbon. This POGIL explores an introduction to the most basic organic molecules, hydrocarbons, their structure, and how to name them. These skills are necessary to decoding ingredient labels and more complex organic compounds.

Learning Objectives:

- Identify a hydrocarbon and classify it as an alkane, alkene, or alkyne
- Name hydrocarbons following the IUPAC naming system and using Tables P and Q from the Regents Chemistry Reference Tables.

Model 1: Table P

Table P from the Regents Chemistry Reference Tables.

This table is used to determine the prefix for hydrocarbons as well as other organic molecules.

Hydrocarbons are molecules formed with hydrogen and carbon atoms only.

Key Questions:

1.) Which two elements must a molecule contain to be classified as a hydrocarbon? _____ and _____

2.) What information does Table P from the Regents Reference Table provide?

3.) How many carbons does a hydrocarbon chain that contains the prefix “but-” have? _____

4.) What prefix is used when a hydrocarbon chain contains 5 carbons? _____

5.) A hydrocarbon that can be found in grill gas tanks is called propane. How many carbons does this molecule have? _____

6.) A hydrocarbon used in the manufacturing of certain plastics is hexene. How many carbons does this molecule have? _____

**Table P
Organic Prefixes**

Prefix	Number of Carbon Atoms
meth-	1
eth-	2
prop-	3
but-	4
pent-	5
hex-	6
hept-	7
oct-	8
non-	9
dec-	10

Model 2: Table Q

Table Q from the Regents Chemistry Reference Tables. Recall that a **line** between two atoms indicates a **pair of shared electrons** in a **covalent bond**.

Key Questions:

7.) What are the **three classifications** (names) in this homologous series of hydrocarbons?

Do not use the names from the example.

8).How many **pairs of electrons** are **shared between** the atoms of **carbon** in the structural formula of **ethane**?
(Make sure you read this carefully!!!) _____

9).How many **pairs of electrons** are **shared between** the atoms of **carbon** in **ethene**? _____

10).How many **pairs of electrons** are **shared between** the atoms of carbon in **ethyne**? _____

11.) Write a complete sentence in which you relate the type of bond between carbons in a molecule (single, double, or triple) to the type of hydrocarbon.

12). What does **n** represent in the general formula? _____

13). If $n = 3$ in an **alkane**, how many **hydrogens** would it have? _____

14). If $n = 3$ in an **alkene**, how many **hydrogens** would it have? _____

15). If $n = 3$ in an **alkyne**, how many **hydrogens** would it have? _____

16). If a hydrocarbon has a molecular formula of C_4H_{10} , would it be an **alkane, alkene** or **alkyne**? _____

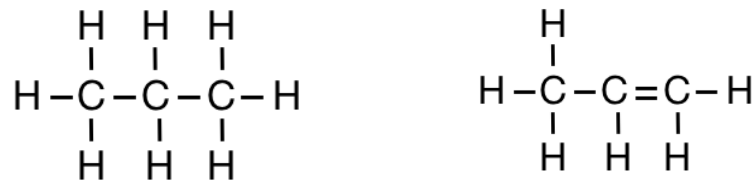
17.) If a hydrocarbon has a molecular formula of C_5H_8 , would it be an **alkane, alkene, or alkyne**? _____

Table Q
Homologous Series of Hydrocarbons

Name	General Formula	Examples	
		Name	Structural Formula
alkanes	C_nH_{2n+2}	ethane	<pre> H H H-C-C-H H H</pre>
alkenes	C_nH_{2n}	ethene	<pre> H H \ / C=C / \ H H</pre>
alkynes	C_nH_{2n-2}	ethyne	$H-C\equiv C-H$

Note: n = number of carbon atoms

Model 3: Structural formulas of two hydrocarbons



Key Questions:

18). What information does a structural formula provide?

19). How many carbons and hydrogens does the molecule on the left have?

20). How many carbons and hydrogens does the molecule on the right have?

21). For the molecule on the left, record the molecular formula and identify the homologous series it can be classified as

Molecular formula: _____ Homologous series: _____

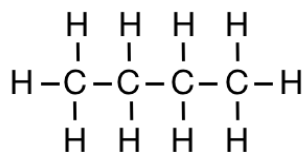
22). For the molecule on the right, record the molecular formula and identify the homologous series it can be classified as

Molecular formula: _____ Homologous series: _____

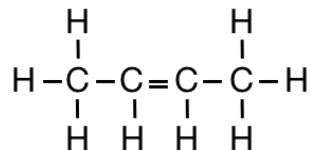
23). In terms of bonds between carbons, what is different between the two hydrocarbons in Model 3?

24). Besides the difference in the number of hydrogens, what would be different between a 4 carbon alkane and a 4 carbon alkyne? HINT: Look at the examples in Table Q in Model 2.

Model 5: Structural formula of butane and 2-butene



Butane



2-Butene

Key Questions:

28.) Note 2 differences between the structural diagrams for butane and 2-butene.

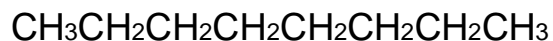
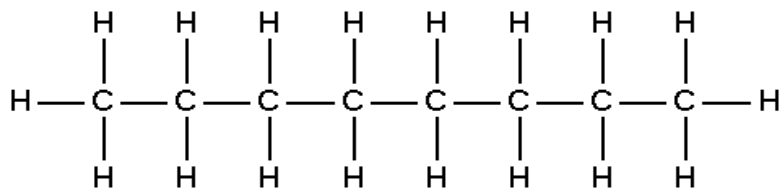
29.) What does the ending -ene tell you about the hydrocarbon on the right?

30.) In the diagram on the right, number the carbons starting from the left with number 1. What does the 2 in 2-butene tell you about location of the double bond in the hydrocarbon?

31.) Draw **2-pentyne** below. Draw all of the carbons first, connecting them with the appropriate type of bond. Be sure that when you add the hydrogens that there are **only 4 bonds** on each carbon.

32.) Draw **3-heptene** below.

Model 6: Structural formula of a hydrocarbon along with its corresponding condensed structural formula.



- 33.) What is the **name** of the molecule shown in Model 6? _____
- 34.) Starting from the left hand side, how many **hydrogens** are on the **first carbon** in the structural formula?

- 35.) How many **hydrogens** are on the **second carbon** in the structural formula? _____
- 36.) **Compare** the **structural formula** with the **condensed structural formula**. What connections can you make?
- 37.) Draw **heptane** in the space below.
- 38.) Write the **condensed structural formula** of **heptane**.