What is Organic Chemistry?
Organic chemistry is the chemistry of compounds containing carbon. Examples include carbon dioxide, carbohydrates, proteins, fats, alcohol, rubber, petrol, plastics and many more.

What are Hydrocarbons?
Hydrocarbons are organic compounds containing only hydrogen and carbon atoms. For example, the gas used in gas stoves and bunsen burners can be either propane (C₃H₈) or butane (C₄H₁₀).

Combustion of Hydrocarbons
All hydrocarbons burn ‘cleanly’ to form water and carbon dioxide in the presence of sufficient oxygen.
Complete the word and chemical equations for the combustion of propane (C₃H₈):
Propane + Oxygen → Water + ________________
C₃H₈ + O₂ → H₂O + ________________

How do Hydrogen and Carbon Atoms Bond to make Compounds?
A single bond between two atoms means that each atom shares a pair of electrons. Hydrogen atoms can only have 1 single bond with another atom at a time. Carbon atoms have 4 electrons in their outer levels. Therefore, carbon atoms can share electrons with up to 4 other atoms, that is, carbon atoms can make up to 4 single bonds with other atoms.

Methane is the smallest hydrocarbon with the chemical formula of CH₄ and the structural formula of

```
  H
 /   \
H—C—H
 |   |
  H
```
Ethane is the second smallest hydrocarbon. Its chemical formula is C\textsubscript{2}H\textsubscript{6} and its structural formula is

```
H     H
H--C--C--H
H     H
```

Propane has the chemical formula of C\textsubscript{3}H\textsubscript{8} and the structural formula of

```
H     H     H
H--C--C--C--H
H     H     H
```

Note in the structural formulae above that each carbon atom makes 4 single bonds and each hydrogen atom makes 1 single bond. These hydrocarbons are called saturated hydrocarbons because they contain only single bonds. They are also called Alkanes.

**Alkanes (Saturated Single-bonded Hydrocarbons)**

<table>
<thead>
<tr>
<th>Alkane</th>
<th>Chemical Formula</th>
<th>Structural Formula</th>
<th>Melting Point (°C)</th>
<th>Boiling Point (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>CH\textsubscript{4}</td>
<td></td>
<td>-182</td>
<td>-161</td>
</tr>
<tr>
<td>Ethane</td>
<td>C\textsubscript{2}H\textsubscript{6}</td>
<td></td>
<td>-183</td>
<td>-89</td>
</tr>
<tr>
<td>Propane</td>
<td>C\textsubscript{3}H\textsubscript{8}</td>
<td></td>
<td>-190</td>
<td>-42</td>
</tr>
<tr>
<td>Butane</td>
<td>C\textsubscript{4}H\textsubscript{10}</td>
<td></td>
<td>-138</td>
<td>-1</td>
</tr>
<tr>
<td>Pentane</td>
<td>C\textsubscript{5}H\textsubscript{12}</td>
<td></td>
<td>-130</td>
<td>36</td>
</tr>
<tr>
<td>Hexane</td>
<td>C\textsubscript{6}H\textsubscript{14}</td>
<td></td>
<td>-95</td>
<td>69</td>
</tr>
<tr>
<td>Heptane</td>
<td>C\textsubscript{7}H\textsubscript{16}</td>
<td></td>
<td>-91</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>Chemical Formula</td>
<td>Melting Point</td>
<td>Boiling Point</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>-----------------</td>
<td>---------------</td>
<td>---------------</td>
<td></td>
</tr>
<tr>
<td>Octane</td>
<td>C₈H₁₈</td>
<td>-57</td>
<td>126</td>
<td></td>
</tr>
<tr>
<td>Nonane</td>
<td>C₉H₂₀</td>
<td>-54</td>
<td>151</td>
<td></td>
</tr>
<tr>
<td>Decane</td>
<td>C₁₀H₂₂</td>
<td>-30</td>
<td>174</td>
<td></td>
</tr>
</tbody>
</table>

1. What do you notice about the naming of hydrocarbons with the number of carbon atoms greater than 4? ________________

2. How many hydrogen atoms would be in an alkane containing 12 carbon atoms? ____________________________

3. The general formula of an alkane is CₙH₂n+₂. What does this mean? ____________________________

4. Complete: The melting point of a substance is the temperature at which it changes from a solid to a liquid and vice versa. The boiling point is the temperature at which a substance changes from liquid to a ________ and vice versa.

5. What do you notice about the increase in carbon atoms in alkanes and their melting and boiling points? ________________

6. Look at the boiling points. Which alkanes are gases at the room temperature of 25°C? ____________________________

7. In the Snowy Mountains, school bunsen burners are fueled by propane not butane. Why? ________________

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Alkenes (Unsaturated Double-bonded Hydrocarbons)

Hydrocarbons with double or triple bonds are called unsaturated.

In alkenes, a double bond is one in which two pairs of electrons are shared between carbon atoms. For example, the smallest alkene is ethene with the chemical formula of C₂H₂ and the structural formula of

\[
\text{H} \quad \text{C} \equiv \text{C} \quad \text{H}
\]

Propene has the chemical formula of C₃H₆ and one possible structural formula of

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There is a double bond between carbon atoms and a single bond between the hydrogen and carbon atoms. Altogether, each carbon atom has 4 bonds (lines) from each atom and only 1 bond (line) from each hydrogen atom.

<table>
<thead>
<tr>
<th>Alkene</th>
<th>Chemical Formula</th>
<th>Structural Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethene</td>
<td>$C_2H_4$</td>
<td></td>
</tr>
<tr>
<td>Propene</td>
<td>$C_3H_6$</td>
<td></td>
</tr>
<tr>
<td>Butene</td>
<td>$C_4H_8$</td>
<td></td>
</tr>
<tr>
<td>Pentene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hexene</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Complete the chemical formulae for pentene and hexene.
2. The general formula for alkanes above was $C_nH_{2n+2}$. What do you think is the general formula for alkenes? ____________
3. Complete the structural formula for the alkenes above.
4. How many possible structural formulae are there for hexene? (Do your working on a scrap of paper. Count mirror images of each other as one possibility.) _________________

**Alkynes (Unsaturated Triple-bonded Hydrocarbons)**

Hydrocarbons with *double or triple bonds* are called *unsaturated*.

In alkynes, a triple bond is one in which three pairs of electrons are shared between carbon atoms. For example, the smallest alkyne is ethyne with the chemical formula of $C_2H_2$ and the structural formula of

\[
\begin{align*}
\text{H} & \quad \text{C} \equiv \text{C} \quad \text{H} \\
\end{align*}
\]
There is a triple bond between carbon atoms and a single bond between the hydrogen and carbon atoms. Altogether, each carbon atom has 4 bonds (lines) from each atom and only 1 bond (line) from each hydrogen atom.

1. Draw the possible structural formulae for propyne and butyne (each with 1 triple bond).

2. What is the general formula for alkynes? ________________

3. The old name for ethyne is acetylene. For what is it used? __

__________________________________________________________