Lesmahagow High School

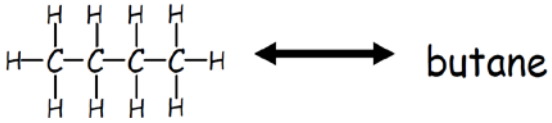
National 5 Chemistry: Unit 2

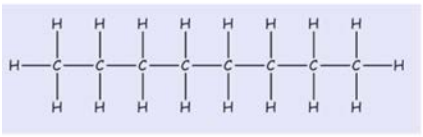
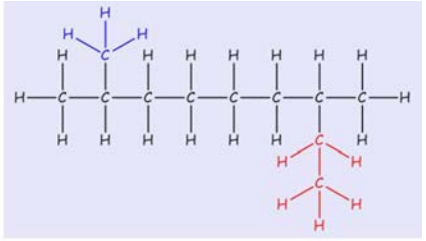
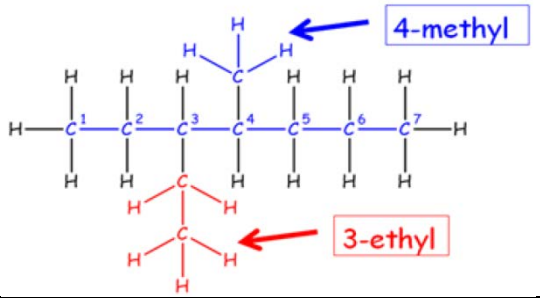
Key Area – Homologous Series

Learning Statement	Red	Amber	Green
A **homologous series** is a group of compounds with: o similar chemical properties o the same general formula o a gradual change in physical properties such as melting and boiling point.	◯	◯	◯
Examples of homologous series include groups of compounds called the **alkanes**, **cycloalkanes** and **alkenes**.	◯	◯	◯
The Alkanes The alkanes are the simplest homologous series of hydrocarbons. o The names of the first eight alkanes are:	◯	◯	◯

No. C's	1	2	3	4	5	6	7	8
Name	methane	ethane	propane	butane	pentane	hexane	heptane	octane

o You need to be able to name **and** draw the first eight alkanes.



	◯	◯	◯
o The names of the alkanes always end in …**ANE**. o The alkanes contain C-C single bonds. o The general formula for the alkanes is C_nH_{2n+2}.	◯	◯	◯
Alkanes can be **straight chained** like the above, or **branched**.  Straight chain  Branched	◯	◯	◯
Branched alkanes can be named systematically according to rules set down by the International Union of Pure and Applied Chemistry (IUPAC). o Find the longest continuous chain of carbons o Identify any branches off the longest chain, e.g. methyl or ethyl o Put the name together with the branches first and the name of the long chain last. *The longest chain should be numbered to give branches the lowest possible number.*	◯	◯	◯
e.g.  Here the longest chain is 6 carbons. There is an ethyl branch on carbon 3 and a methyl branch on carbon 4. So this is: **3-ethyl-4-methylhexane**	◯	◯	◯

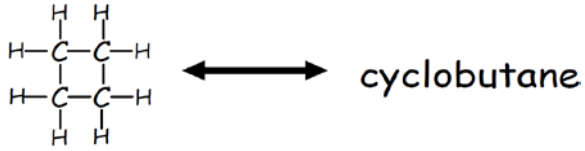
The Cycloalkanes

The cycloalkanes are a homologous series of hydrocarbons with cyclic shapes.

- The names of the first five cycloalkanes are:

No. C's	1	2	3	4	5	6	7
Name	Doesn't exist	Doesn't exist	cyclopropane	cyclobutane	cyclopentane	cyclohexane	cycloheptane

- You need to be able to draw and name the cycloalkanes.



- The names of the cycloalkanes start with **CYCLO**… and end with ….**ANE**.
- The cycloalkanes contain C-C single bonds.
- The general formula for the cycloalkanes is C_nH_{2n}.

The Alkenes

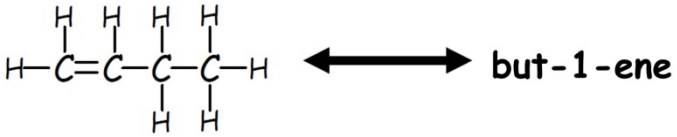
The alkenes are another homologous series of hydrocarbons.

- The names of the first seven alkenes are:

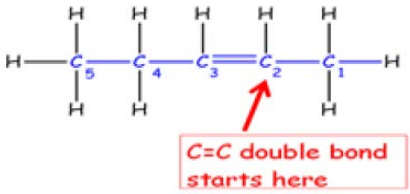
No. C's	1	2	3	4	5	6	7	8
Name	Doesn't exist	ethene	propene	butene*	pentene*	hexene*	heptene*	octene*

*Names should have numbers to show the position of C=C

- You need to be able to name and draw the alkenes.



- The names of the alkenes always end in …**ENE**.
- The name of alkenes sometimes has a number in it, e.g. pent-1-ene. The number tells us where the C=C is.

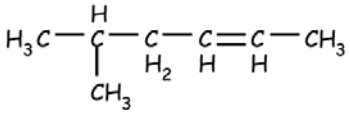


This would be:

pent-2-ene

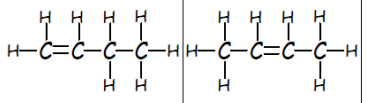
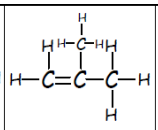
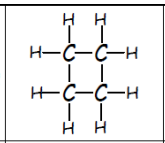
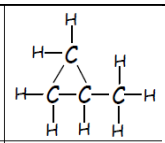
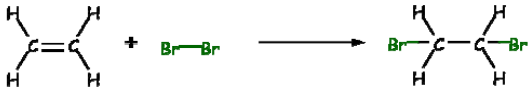
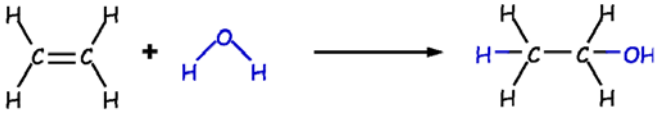
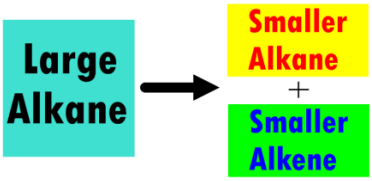
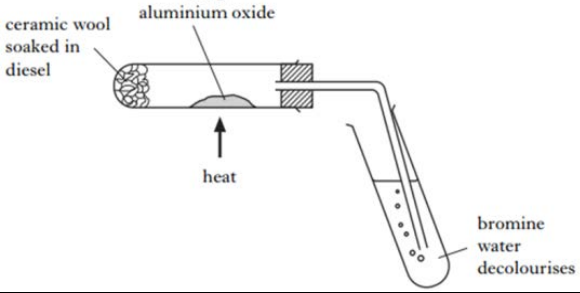
- Alkenes contain at least one C=C double bond. This is called the functional group, which means it is the part of the molecule that reacts.
- The general formula for the alkenes is C_nH_{2n}.

Alkenes can also be straight chain or branched. Branched alkenes are named in the same way we named branched alkanes. The position of the C=C double bond is numbered first and then the branches are numbered in this case however. For example:



5-methylhex-2-ene

An **isomer** is when you have compounds that have the same molecular formula but a different structural formula.

 C_4H_8	C_4H_8	 C_4H_8	 C_4H_8	 C_4H_8	◯	◯	◯
Saturated hydrocarbons contain only C-C single bonds. o The alkanes are saturated hydrocarbons. o The cycloalkanes are saturated hydrocarbons.					◯	◯	◯
Unsaturated hydrocarbons contain C=C double bonds. o The alkenes are unsaturated hydrocarbons.					◯	◯	◯
The bromine solution test can be used to distinguish between saturated and unsaturated hydrocarbons. o Unsaturated hydrocarbons immediately decolourise bromine solution. o Saturated hydrocarbons do not immediately decolourise bromine solution.					◯	◯	◯
When an unsaturated hydrocarbon, such as an alkene, reacts with bromine solution a reaction called **ADDITION** has occurred.  Ethene + Bromine → Dibromoethane C_2H_4 + Br_2 → $C_2H_4Br_2$					◯	◯	◯
The addition of hydrogen to an alkene is called **HYDROGENATION**. Adding hydrogen to an alkene forms an alkane.  Ethene + Hydrogen → Ethane C_2H_4 + H_2 → C_2H_6					◯	◯	◯
The addition of water to an alkene is called **HYDRATION**.  Ethene + Water → Ethanol C_2H_4 + H_2O → C_2H_5OH					◯	◯	◯
Cracking is when you take a large alkane and break it down into a smaller alkane and a smaller alkene.  The following apparatus can be used to carry out cracking in a laboratory.  The aluminium oxide is a catalyst in this reaction. When carrying out the experiment, the delivery tube must be removed from the bromine before you stop heating to prevent **suckback**.					◯ ◯ ◯	◯ ◯ ◯	◯ ◯ ◯