



Edexcel GCSE Chemistry



Your notes

Hydrocarbons

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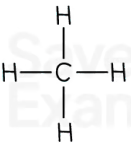
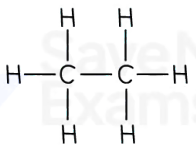
Your notes

Alkanes

Alkanes

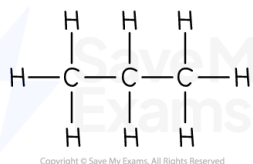
- Alkanes are a group of **saturated** hydrocarbons
 - The term saturated means that they only have single carbon-carbon bonds, there are no double bonds
- The general formula of the alkanes is C_nH_{2n+2}
- They are colourless compounds which have a gradual change in their physical properties as the number of carbon atoms in the chain increases
- Alkanes are generally unreactive compounds but they do undergo **combustion** reactions, can be **cracked** into smaller molecules and can react with **halogens** in the presence of light
- Methane is an alkane and is the major component of **natural gas**

Table of the First Four Members of the Alkane Homologous Series

Displayed formula	Name	Molecular formula
 <p>Copyright © Save My Exams. All Rights Reserved</p>	methane	CH ₄
 <p>Copyright © Save My Exams. All Rights Reserved</p>	ethane	C ₂ H ₆

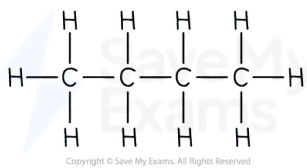


Your notes



propane

C_3H_8



butane

C_4H_{10}



Examiner Tips and Tricks

For your exam, you need to be able to name, draw and give the appropriate formula for the first **four** alkanes.



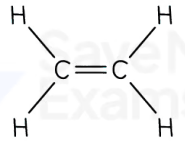
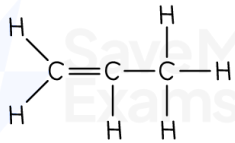
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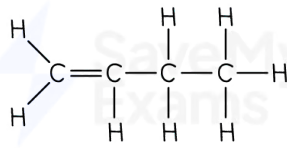
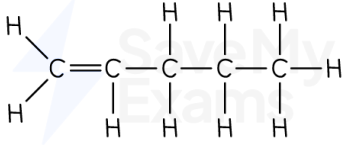
Alkenes

Alkenes

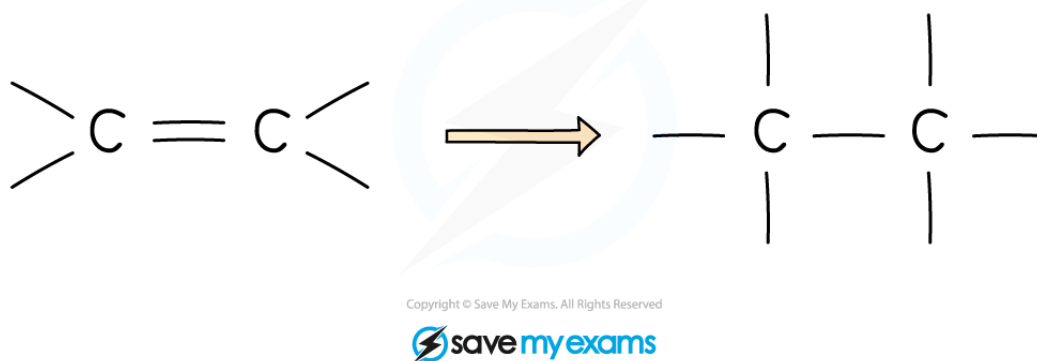
- All alkenes contain a **double carbon bond**, which is shown as two lines between two of the carbon atoms i.e. $C=C$
- All alkenes contain a double carbon bond, which is the **functional group** and is what allows alkenes to react in ways that alkanes cannot
- The names and structure of the first four alkenes are shown below
- The position of the double bond in butene can be in one of two positions
- This is shown by using the number of the carbon atom along the chain where the double bond starts

Table Showing the Formulae and Structures of the Alkenes

Displayed formula	Name	Molecular formula
 <p>Copyright © Save My Exams. All Rights Reserved</p>	ethene	C_2H_4
 <p>Copyright © Save My Exams. All Rights Reserved</p>	propene	C_3H_6

 <small>Copyright © Save My Exams. All Rights Reserved</small>	but-1-ene	C ₄ H ₈
 <small>Copyright © Save My Exams. All Rights Reserved</small>	pent-1-ene	C ₅ H ₁₀

- Compounds that have a C=C double bond are also called unsaturated compounds
- That means they can **make more bonds** with other atoms by opening up the C=C bond and allowing incoming atoms to form another single bond with each carbon atom of the functional group
- Each of these carbon atoms now forms 4 single bonds instead of 1 double and 2 single bonds
- This makes them much more reactive than alkanes



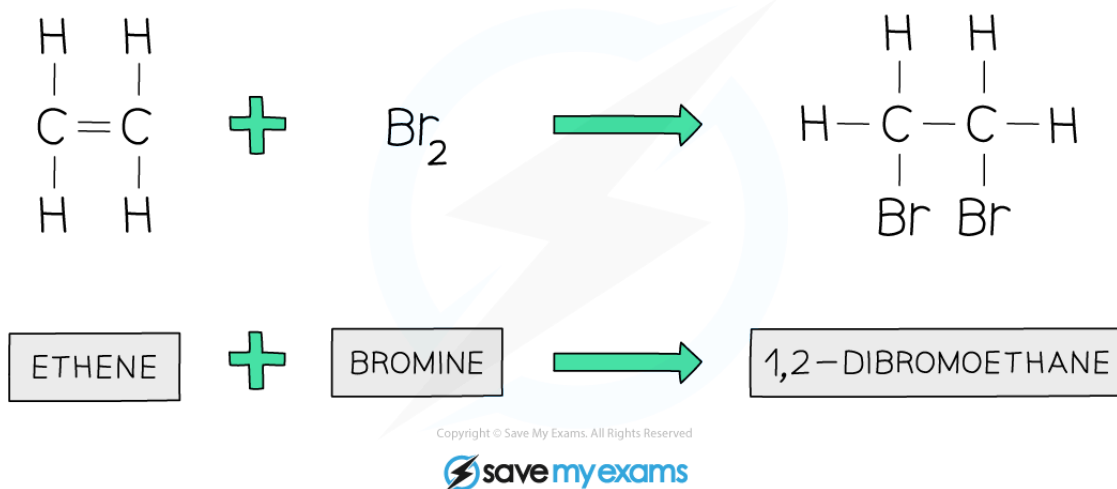
A carbon-carbon double can break and form a single bond, allowing more atoms to attach to the carbon atoms

Bromine & Alkenes



Your notes

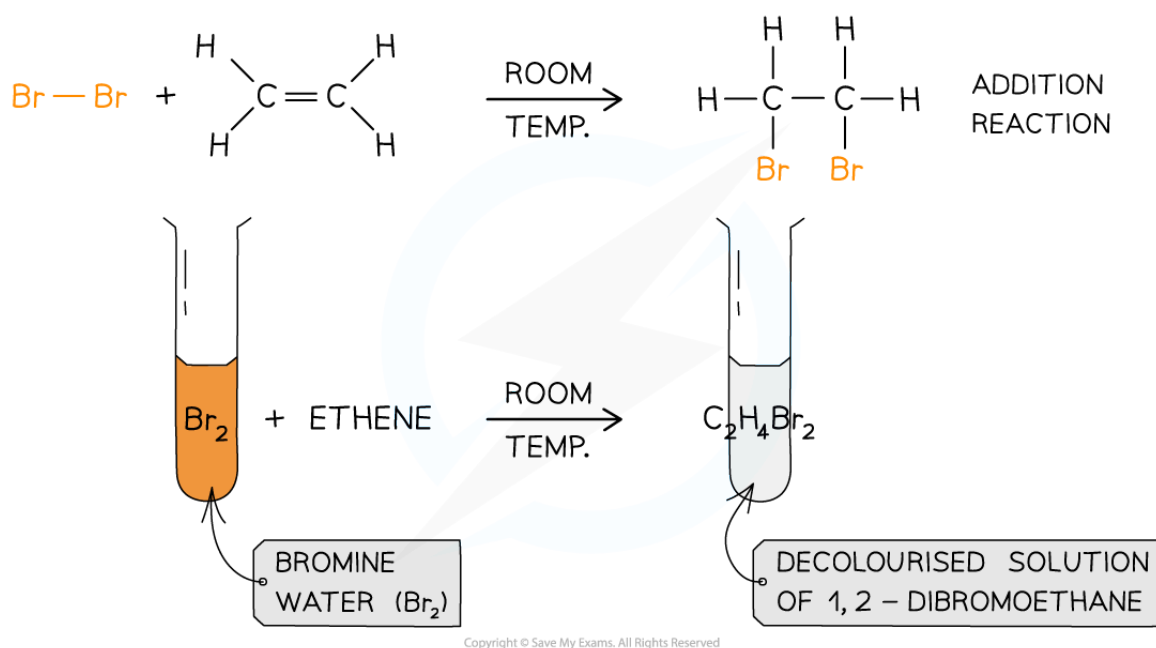
- Alkenes undergo addition reactions in which atoms of a simple molecule **add across** the C=C double bond
- The reaction between bromine and ethene is an example of an addition reaction
- The same process works for any **halogen** and **any alkene** in which the halogen atoms always add to the carbon atoms across the C=C double bond



Bromine atoms add across the C=C in the addition reaction of ethene and bromine

Distinguishing between an alkane and an alkene

- Halogens can be used to test if a molecule is **unsaturated** (i.e. contains a double bond)
- Br₂(aq) is an orange-yellow solution, called **bromine water**
- The unknown compound is **shaken** with the bromine water
- If the compound is unsaturated, an addition reaction will take place and the coloured solution will decolourise



 Your notes

The bromine water test for alkenes



Examiner Tips and Tricks

You should be able to state the result of the bromine water test for other simple alkenes and deduce the structure of the product given the starting alkene.



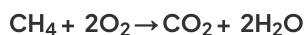
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Combustion of Hydrocarbons

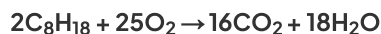
Combustion of Hydrocarbons

Combustion of alkanes

- Alkanes and alkenes undergo combustion in the presence of air
- Complete combustion occurs to form water and carbon dioxide gas
- For example, the simplest alkane, methane burns as follows:



- Gasoline is largely composed of isomers of octane, C_8H_{18} , which requires large amounts of oxygen to combust fully



- The efficiency of car engines does not usually enable all the gasoline to burn, so car exhaust will contain small amounts of unburnt hydrocarbons as well as other products such as carbon monoxide and soot which lead to environmental problems
- The carbon dioxide produced is a major contributor to global warming and the replacement of combustion engines with electric vehicles is a major on-going challenge for all countries
- Methane, the main component of natural gas, is the fuel used in Bunsen burners which can control the degree of combustion and hotness of the flames:

Combustion of Methane in a Bunsen Burner

POSITION OF COLLAR	FLAME	USED FOR
CLOSED	SHIMMERING AND BRIGHT YELLOW FLAME	THIS IS THE SAFETY FLAME AND IS GENERALLY NOT USED
HALF - CLOSED	STEADY BLUE FLAME	GENTLE HEATING E.G. SOLUTIONS IN A BOILING TUBE WHICH IS MOVED INTO AND OUT OF FLAME
FULLY OPEN	NOISY, ROARING BLUE FLAME	HOTTEST FLAME, USED IN THERMAL DECOMPOSITION REACTIONS, OXIDATION, DEHYDRATION



Your notes

Combustion of alkenes

- These compounds undergo complete and incomplete combustion, but because of the higher carbon to hydrogen ratio they tend to undergo incomplete combustion, producing a smoky flame in air
- Complete combustion occurs when there is **excess oxygen** so water and carbon dioxide form e.g:



butene + oxygen → carbon dioxide + water



Examiner Tips and Tricks

Combustion and burning are the same thing - an exothermic reaction with oxygen that produces the oxides of elements.