EXPERT GUIDANCE
www.expertguidance.co.uk

New (9-1) AQA GCSE Chemistry Paper 2

Complete Revision Summary

BitPaper
Share Knowledge

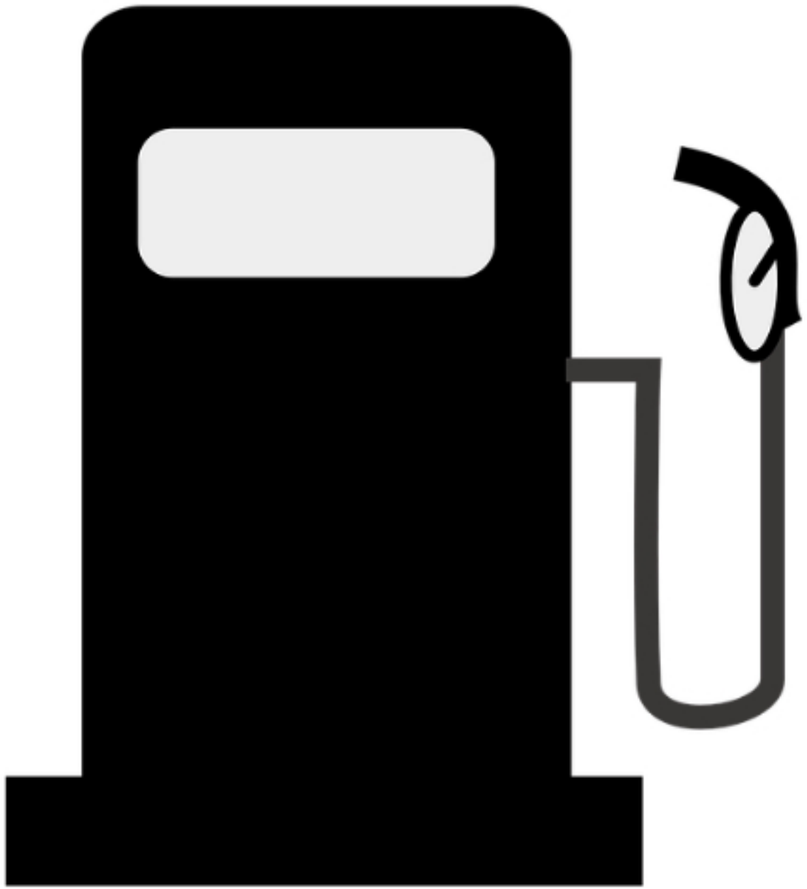
- Rates and Equilbrium
- Organic Chemistry
- Chemical Analysis
- Chemistry of the Atmosphere
- Using Resources

4.7 Organic Chemistry

- Hydrocarbons and Crude Oil
- Alkanes
- Fractional Distillation
- Properties of Hydrocarbons
- Cracking
- Alkenes
- Reaction of Alkenes
- Alcohols
- Carboxylic Acid
- Addition Polymerization
- Condensation Polymerization
- Amino Acids
- DNA

www.expertguidance.co.uk
mahima.laroyia@expertguidance.co.uk
+447448352272

CRUDE OIL

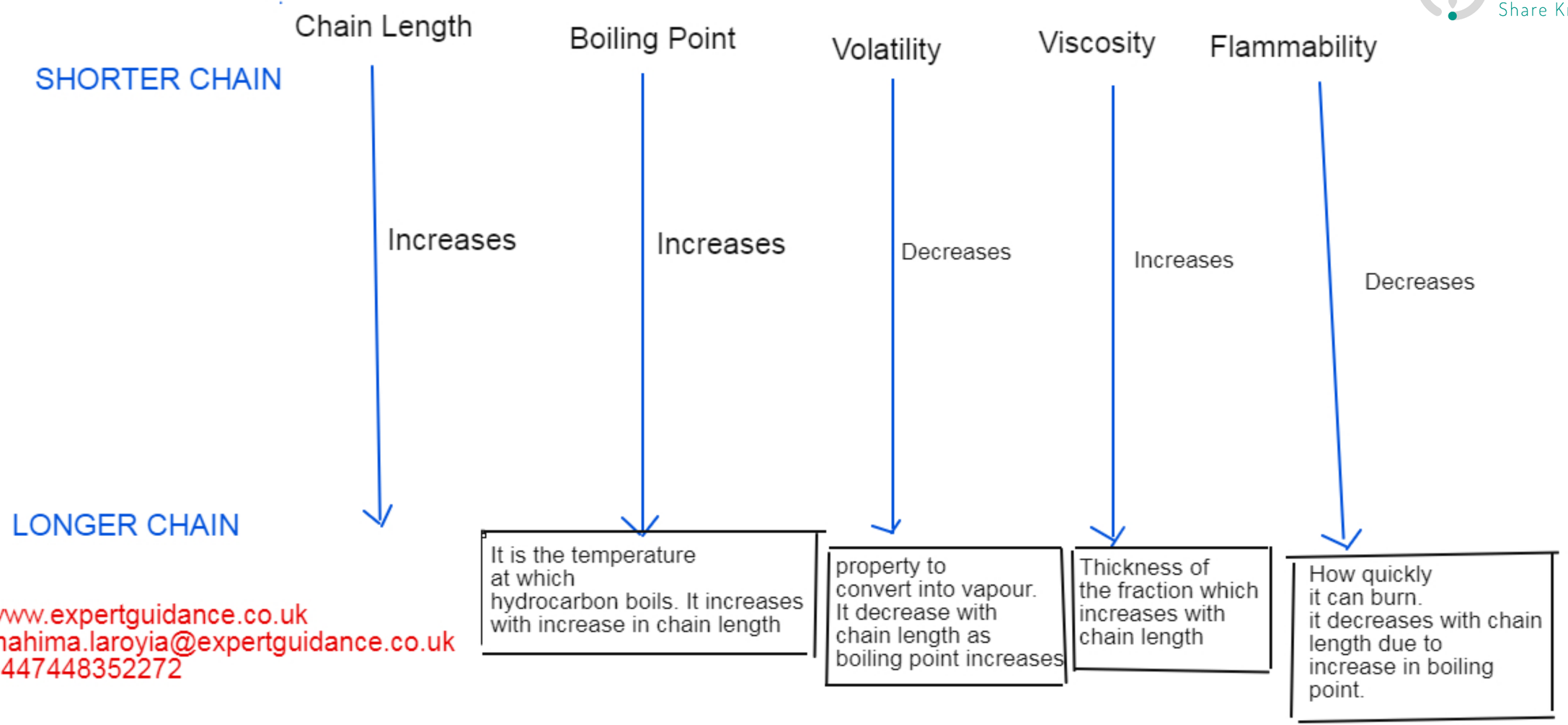


It is a black thick liquid which takes millions of years to form.

It is the mixture of hydrocarbon. Hydrocarbon are the compounds made up of carbon and hydrogen only.

The components of the crude oil are important and the crude oil is separated by the process of fractional distillation.

www.expertguidance.co.uk
mahima.laroyia@expertguidance.co.uk
+447448352272

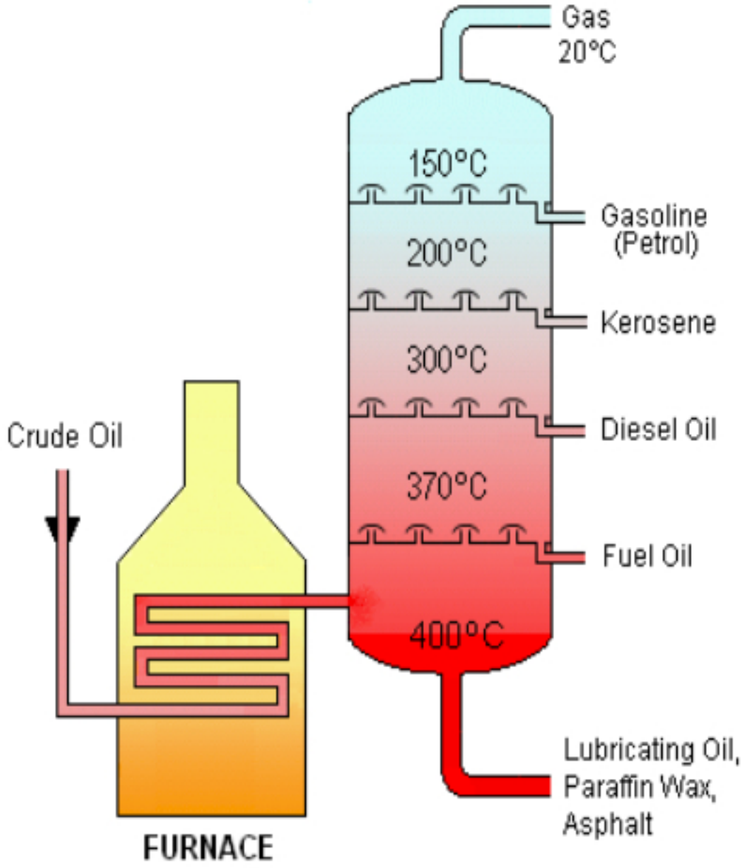


www.expertguidance.co.uk
mahima.laroyia@expertguidance.co.uk
+447448352272

FRACTIONAL DISTILLATION OF CRUDE OIL

It is separated in fractionating column with different substances of similar boiling points

separating the mixtures on the basis of boiling points.



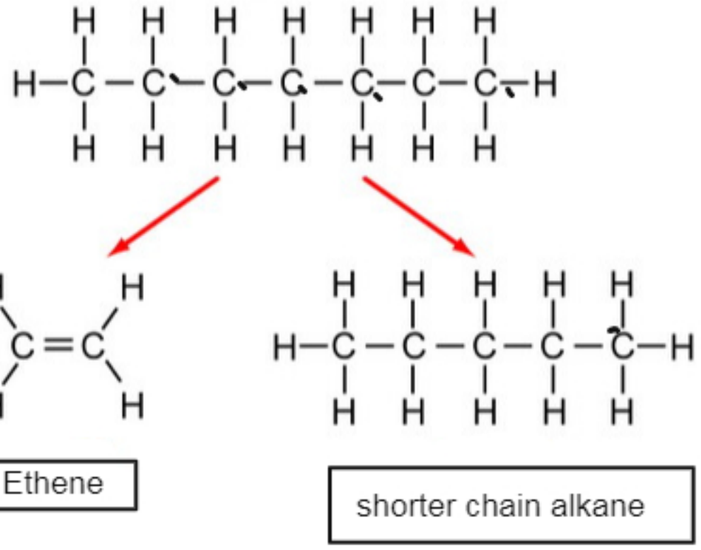
LIQUIFIED GAS	FUEL
GASOLINE/PETROL	CAR FUEL
KEROSENE	AIRCRAFT FUEL
DIESEL OIL	FUEL IN DIESEL ENGINES
RESIDUE	MAKING ROADS

L — Look
G — Great
K — Kid.
D → doing.
R → Roll.

www.expertguidance.co.uk
mahima.laroyia@expertguidance.co.uk
+447448352272

CRACKING

Hydrocarbon



Thermal decomposition of longer chain hydrocarbon into a shorter chain alkane and alkenes

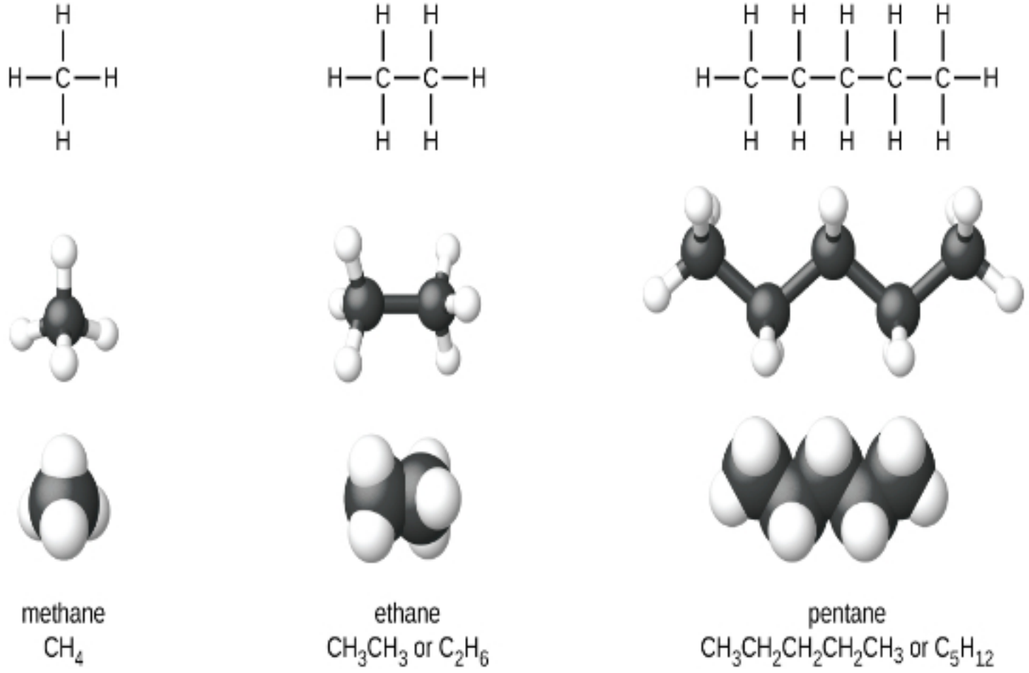
- **Thermal Cracking** — It is done at a very high temperature
- **Catalytic Cracking** — It is done using a catalyst

WHY CRACKING ?

- Shorter chain alkanes are more in demand as they are more efficient fuel which fractional distillation alone cannot meet .
- Alkenes are required for polymerization and synthesize other hydrocarbons which fractional distillation cannot meet.

www.expertguidance.co.uk
mahima.laroyia@expertguidance.co.uk
+447448352272

ALKANES



methane
CH_4

ethane
CH_3CH_3 or C_2H_6

pentane
$CH_3CH_2CH_2CH_2CH_3$ or C_5H_{12}

Saturated Hydrocarbon

- carbon carbon single bond
- made up of carbon and hydrogen only

GENERAL FORMULAE — C_nH_{2n+2}

METHANE — CH_4

ETHANE — C_2H_6

PROPANE — C_3H_8

BUTANE — C_4H_{10}

PENTANE — C_5H_{12}

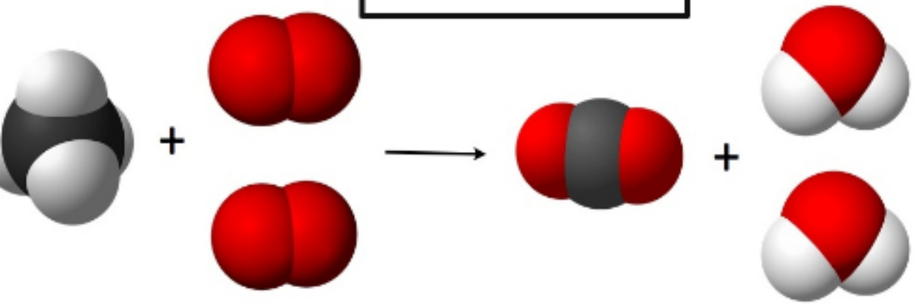
Members of the same family have similar functional group similar chemical properties and general formulae but different physical property and each members differs from successive by CH2

Homolgous Series

www.expertguidance.co.uk
mahima.laroyia@expertguidar
+447448352272

COMBUSTION

COMPLETE



$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

FUEL IS COMPLETELY BURNED

PRODUCES CARBON DIOXIDE AND WATER

IT IS NOT TOXIC

INCOMPLETE

$CH_4 + O_2 \rightarrow CO + 2H_2O$

FUEL IS PARTIALLY BURNED DUE TO LIMITED SUPPLY OF OXYGEN

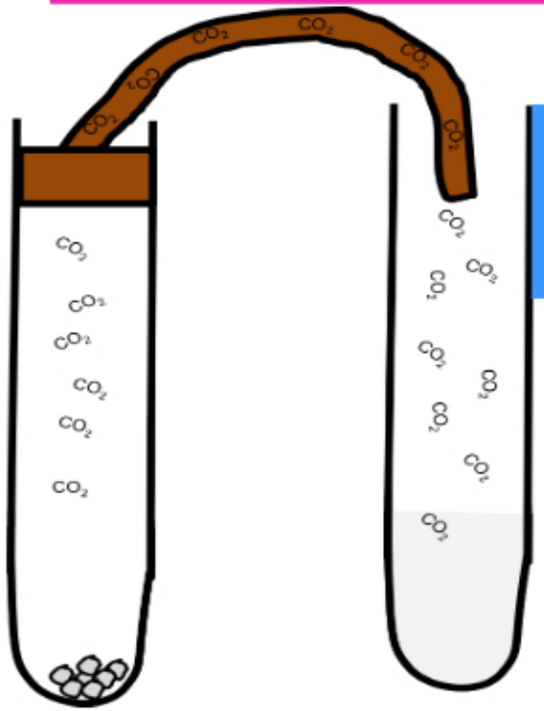
PRODUCES CARBON MONOXIDE AND WATER

CARBON MONOXIDE IS TOXIC AS IT DECREASES THE OXYGEN CARRYING CAPACITY OF RED BLOOD CELLS

www.expertguidance.co.uk
mahima.laroyia@expertguidance.co.uk
+447448352272

PRODUCTS OF COMBUSTION

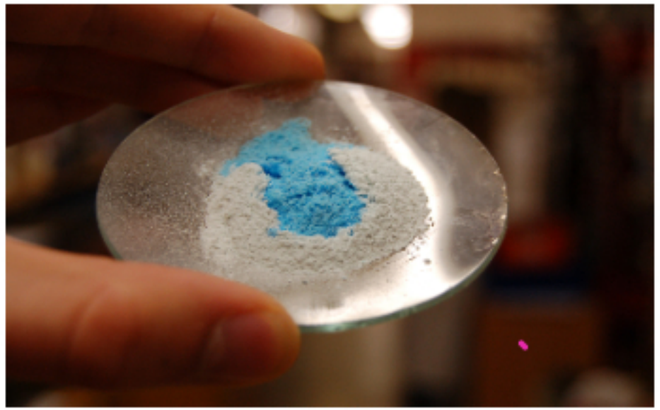
Carbon Dioxide Test



Limewater Test.

Carbon Dioxide will turn limewater milky

Water Test



Anhdrous copper sulphate test

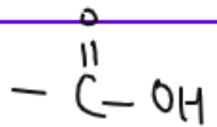
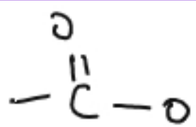
Water will turn anhydrous white copper sulphate crystals to blue.

blue cobalt chloride paper test

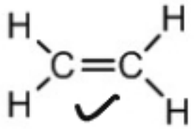
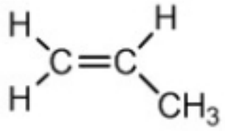
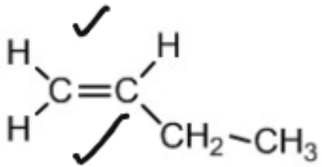
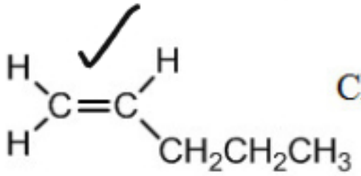
Cobalt chloride blue paper will turn pink in the presence of water

FUNCTIONAL GROUPS

Groups of atoms that give special properties and reactions to the organic molecule

	Functional Group	Examples	Formation
ALKENES		Ethene, propene, butene, pentene	Cracking of crude oil
ALCOHOLS		methanol, ethanol, propanol, butanol, pentanol	Reaction of alkene with water
CARBOXYLIC ACID		methanoic acid, ethanoic acid, propanoic acid, butanoic acid.	Oxidation of alcohols
ESTERS		methyl ethanoate, ethyl ethanoate	Reaction of alcohols and carboxylic acid

ALKENES

IUPAC Name	Molecular Formula	Structural Formula	Condensed Formula
Ethene	C_2H_4		$CH_2=CH_2$
Propene	C_3H_6		$CH_2=CHCH_3$
1-Butene	C_4H_8		$CH_2=CHCH_2CH_3$
1-Pentene	C_5H_{10}		$CH_2=CHCH_2CH_2CH_3$

Unsaturated Hydrocarbon

Compounds which have carbon carbon double bond

Compounds made up of carbon and hydrogen only

GENERAL FORMAULE

C_nH_{2n}

Useful to make polymers, alkanes, alcohols

www.expertguidance.co.uk
mahima.laroyia@expertguidance.co.uk
+447448352272

MANUFACTURE OF ETHANOL

	FERMENTATION	HYDRATION OF ETHENE
REACTION	Glucose $\xrightarrow{\text{yeast}}$ Ethanol + carbon dioxide $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$	Ethene + Steam $\rightarrow$ Ethanol $C_2H_4 + H_2O \rightarrow CH_3CH_2OH$
REACTION CONDITIONS	Gentle temperature and pressure. Anaerobic conditions	Nickel catalyst and high temperature and pressure
ADVANTAGES	Uses renewable resources like sugarcane. Less dependent on fossil fuels and due to less energy requirements do not harm the environment.	It is a continous process. It is rapid more efficient and have 100% atom economy. Produces more pure ethanol
DISADVANTAGES	It is a batch process. The ethanol has to be distilled from time to time as high concentration will kill the yeast. The reaction is slow and produces impure ethanol. Also the atom economy is not 100%	Requires ethene which is dependent on crude oil. Uses non renewable resources.

www.expertguidance.co.uk
mahima.laroyia@expertguidance.co.uk
+447448352272

REACTIONS OF ALKENES

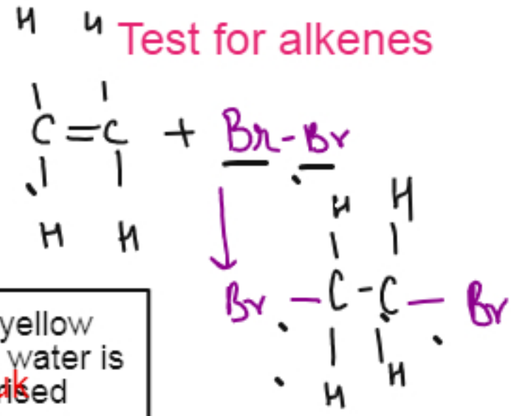
COMBUSTION

- INCOMPLETE
- COMPLETE

ADDITION REACTIONS

HALOGENS

Test for alkenes

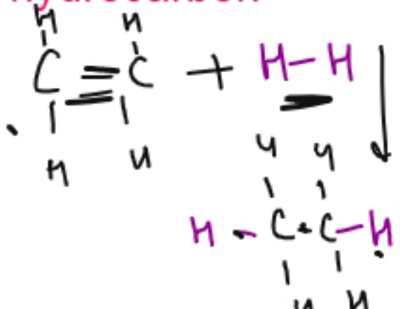


Orange yellow bromine water is decolourised

HYDROGEN

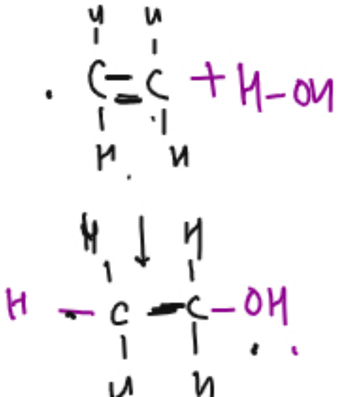
converts unsaturated hydrocarbon to saturated hydrocarbon

Ni at 600°C



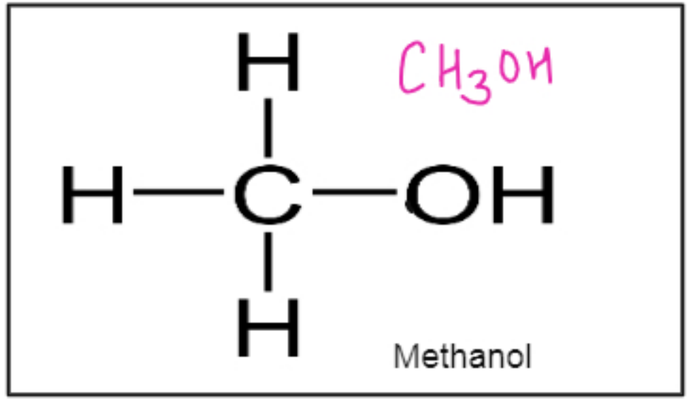
WATER

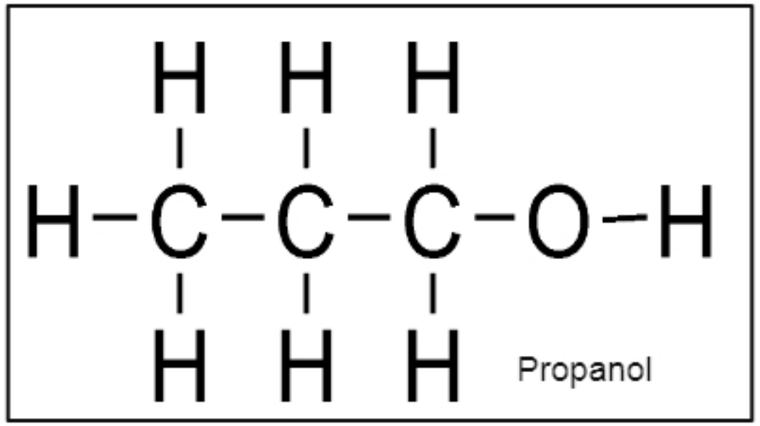
produces ethanol



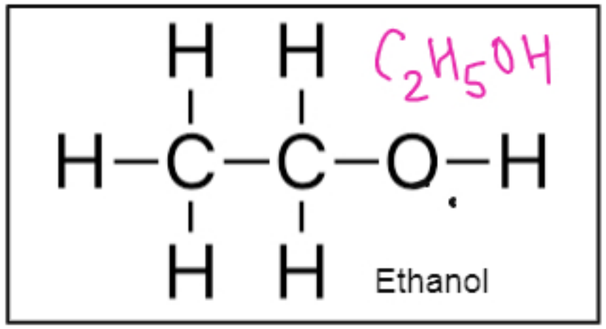
www.expertguidance.co.uk
mahima.laroyia@expertguidance.co.uk
+447448352272

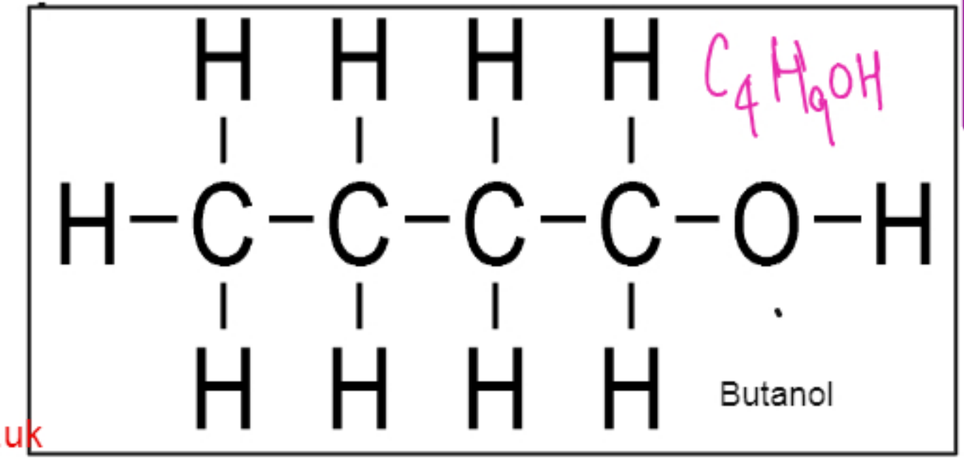
ALCOHOLS





Have functional Group -OH





General Formulae

$C_nH_{2n+1}OH$

Formed by replacing hydrogen of alkane with OH group

Used as fuel, solvents, spirits

www.expertguidance.co.uk
mahima.laroyia@expertguidance.co.uk
+447448352272

REACTIONS OF ALCOHOLS

COMBUSTION

It can undergo complete or incomplete combustion. Complete combustion produces carbon dioxe and water.

Ethanol + Oxygen = Carbon dioxide + water

$C_2H_5OH + O_2 \longrightarrow CO_2 + H_2O$

Incomplete combustion produces carbon dioxide and water.
Ethanol + Oxygen = Carbon monoxide + water

$C_2H_5OH + O_2 \longrightarrow CO + H_2O$

OXIDATION

Alcohols are oxidised to carboxylic acid in the presence of oxidising agent.

Methanol $\xrightarrow{[O]}$ Methanoic Acid

Ethanol $\xrightarrow{[O]}$ Ethanoic Acid

Oxidising agent used is acidified potassium dichromate solution

METAL

Alcohols react with

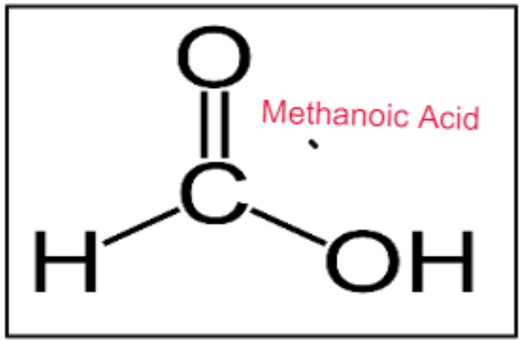
metals to form salt and

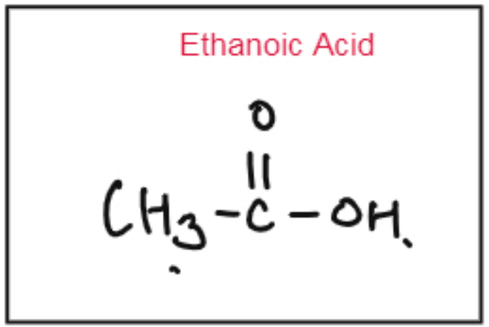
hydrogen.

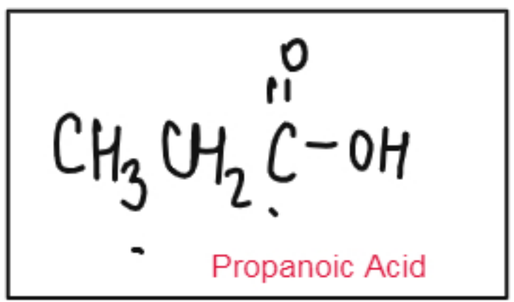
$2C_2H_5OH + 2Ca \rightarrow 2C_2H_5OCa + H_2$

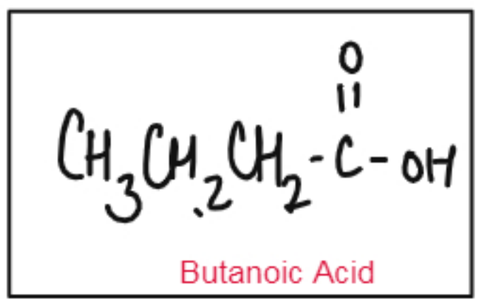
www.expertguidance.co.uk
mahima.laroyia@expertguidance.co.uk

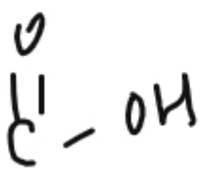
CARBOXYLIC ACID











www.expertguidance.co.uk
mahima.laroyia@expertguidance.co.uk
+447448352272

Weak Acids

Carboxylic Acids are weak acids as they are partially dissociated in water to release H+ ions.

$$CH_3COOH \rightleftharpoons CH_3COO^- + H^+$$

Metal oxides and Metal hydroxide

Carboxylic Acid reacts with metal oxides and metal hydroxide to form salt and water.

$$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$$

Metal carbonate

Carboxylic Acid reacts with metal carbonate to form salt, water and carbon dioxide.

$$CH_3COOH + Li_2CO_3 \rightarrow CH_3COOLi + CO_2 + H_2O$$

ESTERS

Fruity smelling compounds

Used in the manufacture of perfumes, foods and cosmetics.

CARBOXYLIC ACID + ALCOHOLS ⟶ ESTERS + WATER

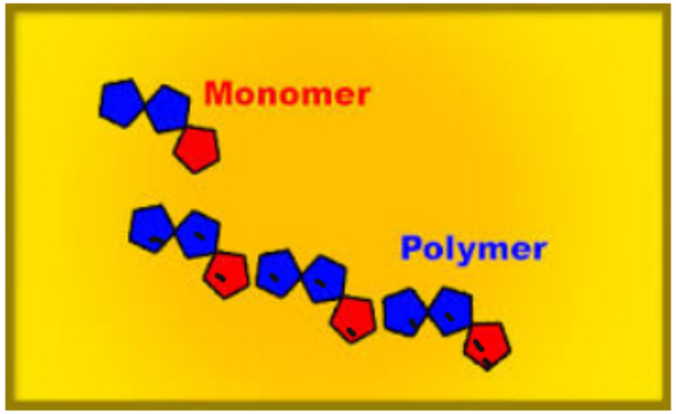
Alkyl alkanoate

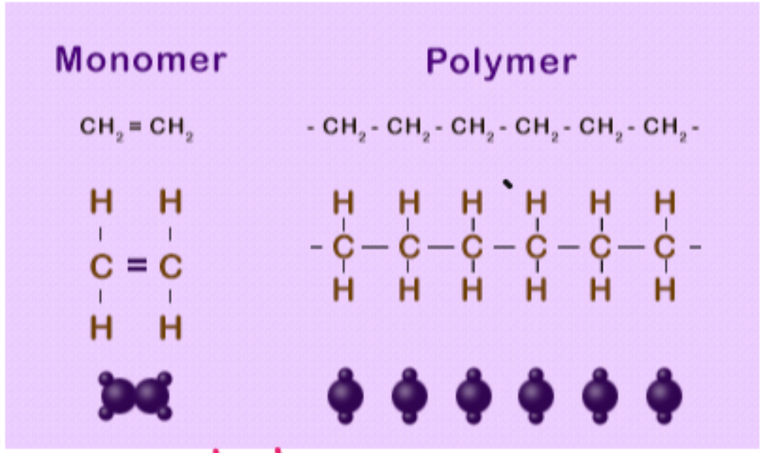
Methanoic Acid + Methanol ⟶ Methyl methanoate + Water

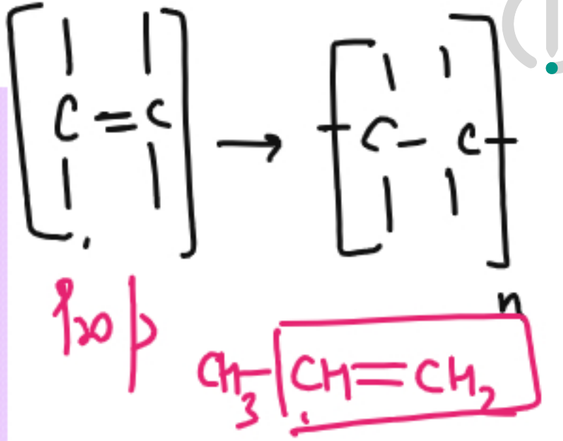
Ethanol + Methanoic Acid ⟶ Ethylmethanoate + Water.

www.expertguidance.co.uk
mahima.laroyia@expertguidance.co.uk
+447448352272

ADDITION POLYMERIZATION

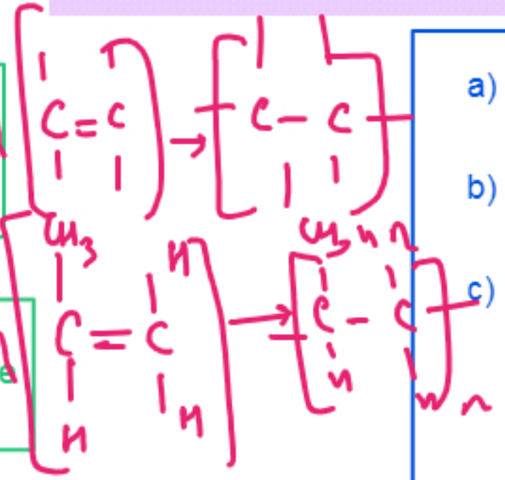






The individuals unit that polymerizes to form a polymers is known as a monomers. Eg Ethene

The structure formed by the polymerization of the monomer is a polymers. eg Polyethene



ADDITION POLYMERS

a) Formed by addition reaction.

b) Require only one monomer generally an alkene

c) Nothing is lost in the reaction.

eg Polyethene, polypropene

www.expertguidance.co.uk
mahima.larovia@expertguidance.co.uk

CONDENSATION POLYMERS

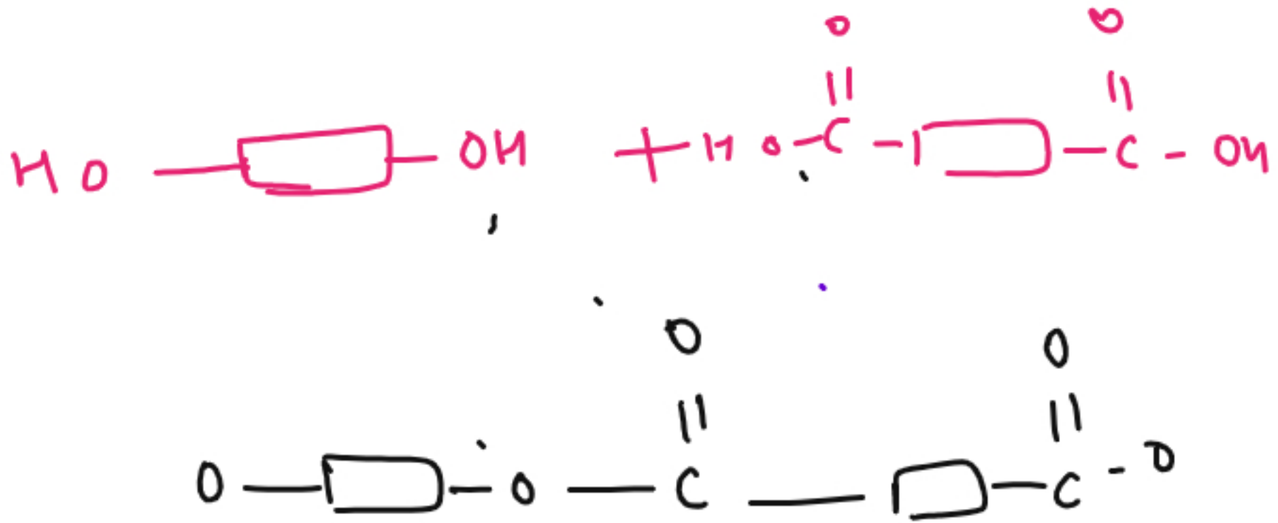
a) Requires two monomers

b) Requires two functional group

c) Formed by condensation reaction.

d) A small molecule of water is lot

e) Example : Nylon a polyester



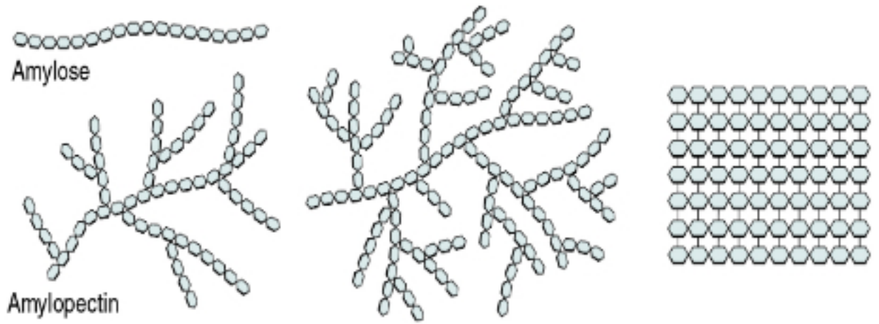
Polyester

www.expertguidance.co.uk
mahima.laroyia@expertguidance.co.uk
+447448352272

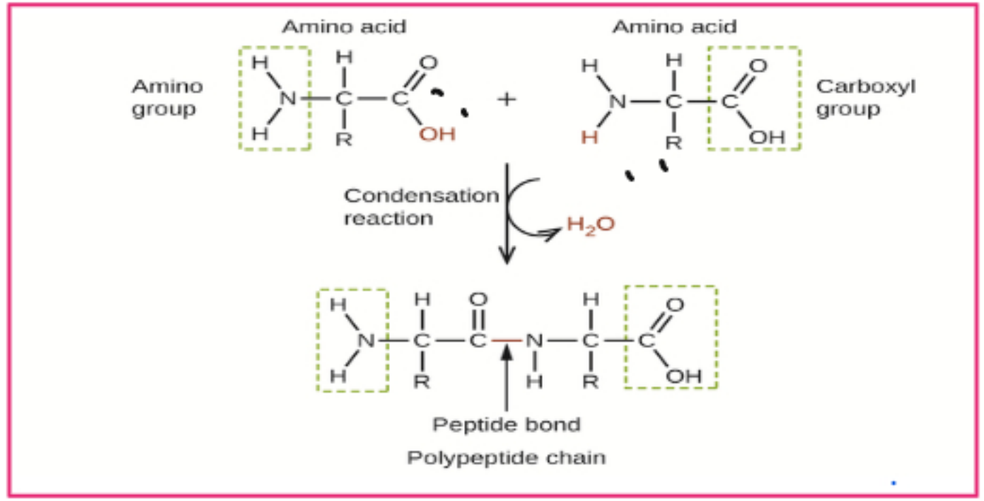
NATURAL POLYMERS

a) They are found naturally

b) All the complex biomolecules are polymers

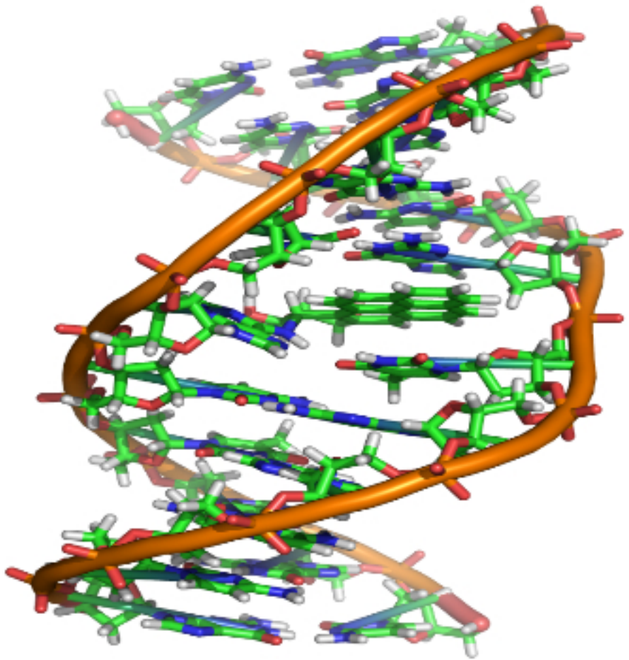


Monomer	Polymer
Glucose	Starch
Proteins	Amino Acid
Nucleotide	DNA



www.expertguidance.co.uk
mahima.laroyia@expertguidance.co.uk
+447448352272

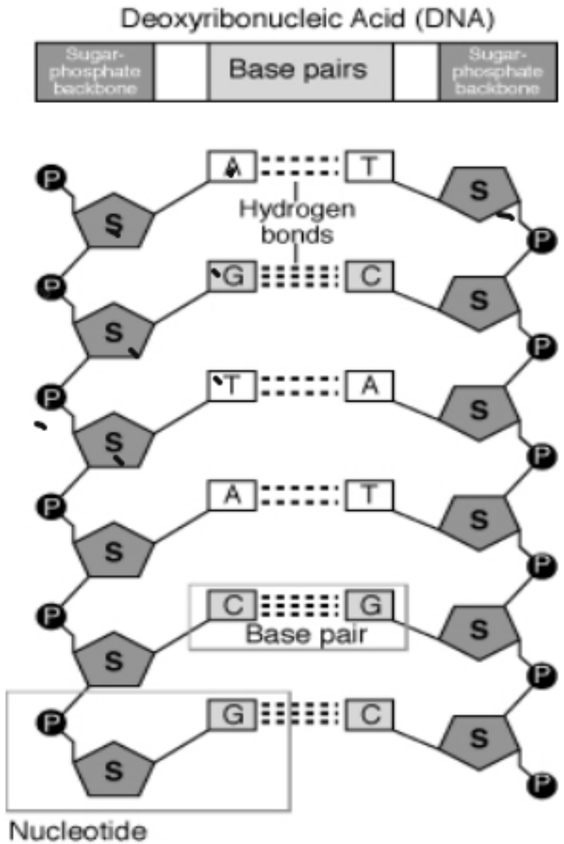
DNA



a) DNA Is polynucleotide

b) Nucleotide =
Phosphate + Sugar + Nitrogenous Bases

c) There are four bases present in the DNA
Adenine
Thymine
Guanin
Cytosine



www.expertguidance.co.uk
mahima.laroyia@expertguidance.co.uk
+447448352272

KEY TERMS

- Hydrocarbon
- Crude Oil
- Fractional Distillation
- Alkanes
- Saturated hydrocarbon
- Unsaturated hydrocarbon
- General Formula
- Viscosity
- Flammable
- Volatility
- Fractions
- Complete Combustion
- Incomplete Combustion
- Cracking
- Thermal Decomposition
- Alkenes
- Functional Group
- Homologous Series
- Addition Reactions
- Alcohols
- Carboxylic Acid
- Esters
- Fermentation
- Weak Acid
- Monomers
- Polymers
- Addition Polymerization
- Condensation Polymerization
- Monosaccharide
- Polysaccharide
- Starch
- Cellulose
- Proteins
- DNA

www.expertguidance.co.uk
mahima.laroyia@expertguidance.co.uk
+447448352272

EXPERT GUIDANCE
www.expertguidance.co.uk

NEXT STEP

- CHECK SPECIFICATION
- EXAM QUESTIONS ON THIS TOPIC

www.expertguidance.co.uk
mahima.laroyia@expertguidance.co.uk
+447448352272