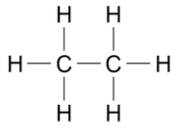
AQA Chemistry GCSE Student Progress

Unit 4.7 - Organic Chemistry

4.7.1. Carbon Compounds as Fuels and Feedstock

4.7.1.1. Crude Oil, Hydrocarbons and Alkanes

a	I know that crude oil is a finite resource found in rocks and that it is the remains of an ancient biomass consisting mainly of plankton that was buried in mud.			
b	I know that crude oil is a mixture of a very large number of compounds and that most of the compounds in crude oil are hydrocarbons, which are molecules made up of hydrogen and carbon atoms only.			
c	I know that most of the hydrocarbons in crude oil are hydrocarbons called alkanes and that the first four members of the alkanes are methane, ethane, propane and butane.			
d	I know that the general formula for the homologous series of alkanes is $C_nH_{2n+2.}$			
e	I know that alkane molecules can be represented in the following forms: C_2H_6 or 			
f	I can recognise substances as alkanes given their formulae in the forms shown above.			

4.7.1.2. Fractional Distillation and Petrochemicals

a	I know that the many hydrocarbons in crude oil may be separated into fractions, each of which contains molecules with a similar number of carbon atoms, by fractional distillation.			
b	I can explain how fractional distillation works in terms of evaporation and condensation.			
c	I know that the fractions can be processed to produce fuels and feedstock for the petrochemical industry.			
d	I know that many of the fuels on which we depend for our modern lifestyle (such as petrol, diesel oil, kerosene, heavy fuel oil and liquefied petroleum gases) are produced from crude oil.			
e	I know that many useful materials on which modern life depends (such as solvents, lubricants, polymers, and detergents) are produced by the petrochemical industry.			
f	I know that the vast array of natural and synthetic carbon compounds occur due to the ability of carbon atoms to form families of similar compounds.			

4.7.1.3. Properties of Hydrocarbons

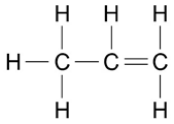
a	I know how some properties of hydrocarbons depend on the size of their molecules, including boiling point, viscosity and flammability and that these properties influence how hydrocarbons are used as fuels.			
b	I can recall how boiling point, viscosity and flammability change with increasing molecular size.			
c	I know that the combustion of hydrocarbon fuels releases energy.			
d	I know that during combustion, the carbon and hydrogen in the fuels are oxidised and that the complete combustion of a hydrocarbon produces carbon dioxide and water.			
e	I can write balanced equations for the complete combustion of hydrocarbons (with a given formula).			
f	I can describe trends in properties of hydrocarbons (limited to boiling points, viscosity and flammability).			

4.7.1.4. Cracking and Alkenes

a	I know that hydrocarbons can be broken down (cracked) to produce smaller, more useful molecules.			
b	I can describe in general terms the conditions used for catalytic cracking.			
c	I can describe in general terms the conditions used for steam cracking.			
d	I know that the products of cracking include alkanes and another type of hydrocarbon called alkenes.			
e	I know that alkenes are more reactive than alkanes and react with bromine water, which is used as a test for alkenes.			
f	I can recall the colour change when bromine water reacts with an alkene.			
g	I know that there is a high demand for fuels with small molecules and so some of the products of cracking are useful as fuels.			
h	I know that alkenes are used to produce polymers and as starting materials for the production of many other chemicals.			
i	I can balance chemical equations as examples of cracking given the formulae of the reactants and products.			
j	I can give examples to illustrate the usefulness of cracking and I can explain how modern life depends on the uses of hydrocarbons.			

4.7.2. Reactions of Alkenes and Alcohols (Chemistry Only)

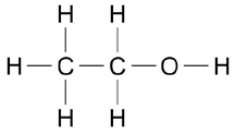
4.7.2.1. Structure and Formulae of Alkenes (Chemistry Only)

a	I know that alkenes are hydrocarbons with a double carbon-carbon bond.			
b	I know that the first four members of the homologous series of alkenes are ethene, propene, butene and pentene.			
c	I know that the general formula for the homologous series of alkenes is C_nH_{2n}.			
d	I know that alkene molecules can be represented in the following forms: C_3H_6 or  and I can recognise substances that are alkenes from their names or from given formulae in these forms.			
e	I know that alkene molecules are unsaturated because they contain two fewer hydrogen atoms than the alkane with the same number of carbon atoms.			

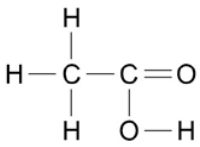
4.7.2.2. Reactions of Alkenes (Chemistry Only)

a	I know that alkenes are hydrocarbons with the functional group C=C and it is the reactions of the functional groups that determine the reactions of organic compounds.			
b	I know that alkenes react with oxygen in combustion reactions in the same way as other hydrocarbons, but they tend to burn in air with smoky flames because of incomplete combustion.			
c	I know that alkenes react with hydrogen, water and the halogens, by the addition of atoms across the carbon-carbon double bond so that the double bond becomes a single carbon-carbon bond.			
d	I can describe the reactions and conditions for the addition of hydrogen, water and halogens to alkenes.			
e	I can draw fully displayed structural formulae of the first four members of the alkenes and the products of their addition reactions with hydrogen, water, chlorine, bromine and iodine.			

4.7.2.3. Alcohols (Chemistry Only)

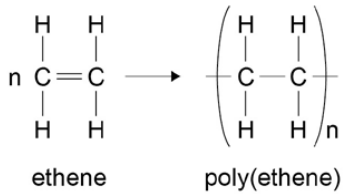
a	I know that alcohols contain the functional group –OH.			
b	I know that methanol, ethanol, propanol and butanol are the first four members of a homologous series of alcohols and I can recall the main uses of these alcohols.			
c	I know that alcohols can be represented in the following forms: CH_3CH_2OH or  and I can recognise alcohols from their names or from given formulae.			
d	I can describe what happens when any of the first four alcohols react with sodium, burn in air, are added to water, or react with an oxidising agent.			
e	I know that aqueous solutions of ethanol are produced when sugar solutions are fermented using yeast.			
f	I can describe the conditions used for fermentation of sugar using yeast.			

4.7.2.4. Carboxylic Acids (Chemistry Only)

a	I know that carboxylic acids have the functional group –COOH.			
b	I know that the first four members of a homologous series of carboxylic acids are methanoic acid, ethanoic acid, propanoic acid and butanoic acid.			
c	I know that the structures of carboxylic acids can be represented in the following forms: CH_3COOH or  and I can recognise carboxylic acids from their names or from given formulae.			
d	I can describe what happens when any of the first four carboxylic acids react with carbonates, dissolve in water, or react with alcohols.			
e	I can explain why carboxylic acids are weak acids in terms of ionisation and pH (see Strong and weak acids (HT only).			

4.7.3. Synthetic and Naturally Occurring Polymers (Chemistry Only)

4.7.3.1. Addition Polymerisation (Chemistry Only)

a	I know that alkenes can be used to make polymers such as poly(ethene) and poly(propene) by addition polymerisation.			
b	I know that, in addition polymerisation reactions, many small molecules (monomers) join together to form very large molecules (polymers). For example:  ethene poly(ethene)			
c	I know that in addition polymers the repeating unit has the same atoms as the monomer because no other molecule is formed in the reaction.			
d	I can relate the repeating unit in a polymer to the monomer.			
e	I can recognise addition polymers and monomers from diagrams in the forms shown above and from the presence of the functional group C=C in the monomers.			
f	I can draw diagrams to represent the formation of a polymer from a given alkene monomer.			

4.7.3.2. Condensation Polymerisation (Chemistry Only) (HT Only)

a	I know that condensation polymerisation involves monomers with two functional groups.			
b	I know that when these types of monomers react they join together, usually losing small molecules such as water, and so the reactions are called condensation reactions.			
c	I know that the simplest polymers are produced from two different monomers with two of the same functional groups on each monomer. For example: ethane diol and hexanedioic acid polymerise to produce a polyester:			
d	I can explain the basic principles of condensation polymerisation by reference to the functional groups in the monomers and the repeating units in the polymers.			

4.7.3.3. Amino Acids (Chemistry Only) (HT Only)

a	I know that amino acids have two different functional groups in a molecule. Different amino acids can be combined in the same chain to produce proteins.			
b	I know that amino acids react by condensation polymerisation to produce a polypeptide e.g. glycine is H_2NCH_2COOH and polymerises to produce the polypeptide $(-HNCH_2COO-)n$ and n H_2O			

4.7.3.4. DNA (deoxyribonucleic acid) and Other Naturally Occurring Polymers (Chemistry Only)

a	I know that DNA (deoxyribonucleic acid) is a large molecule essential for life.			
b	I know that DNA encodes genetic instructions for the development and functioning of living organisms and viruses.			
c	I know that most DNA molecules are two polymer chains, made from four different monomers called nucleotides, in the form of a double helix.			
d	I know that other naturally occurring polymers important for life include proteins, starch and cellulose.			
e	I can name the types of monomers from which these naturally occurring polymers are made.			