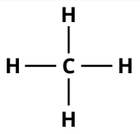
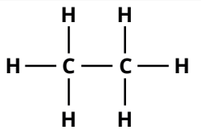
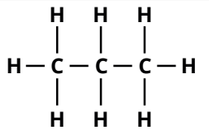
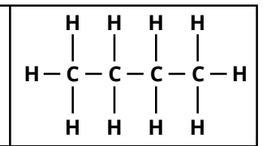
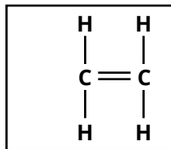
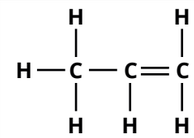
2.5 Alkanes, alkenes, alcohols and plastics

Alkanes and alkenes:

Alkanes contain single bonds between the carbon atoms only and are said to be saturated. The general formula for alkanes is C_nH_{2n+2}. The names of alkanes end with '-ane'.

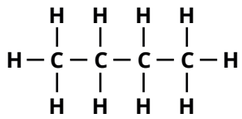
			
methane	ethane	propane	butane
CH_4	C_2H_6	C_3H_8	C_4H_{10}

The alkenes contain a double covalent bond between two carbon atoms and are said to be unsaturated. The general formula for alkenes is C_nH_{2n}. The names of alkenes end with '-ene'.

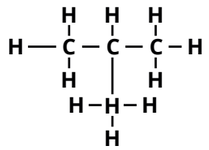
	
ethene	propene
C_2H_4	C_3H_6

Isomerism:

Isomers are molecules which have the same molecular formula but different structures, e.g. C_4H_{10}



butane



methylpropane

Addition reactions:

Two atoms can be added across the C=C bond in an unsaturated compound thus forming a saturated compound. One atom is added to each of the carbon atoms involved.

When hydrogen is added to an alkene (hydrogenation), the corresponding alkane is formed.

$$C_2H_4 + H_2 \rightarrow C_2H_6$$

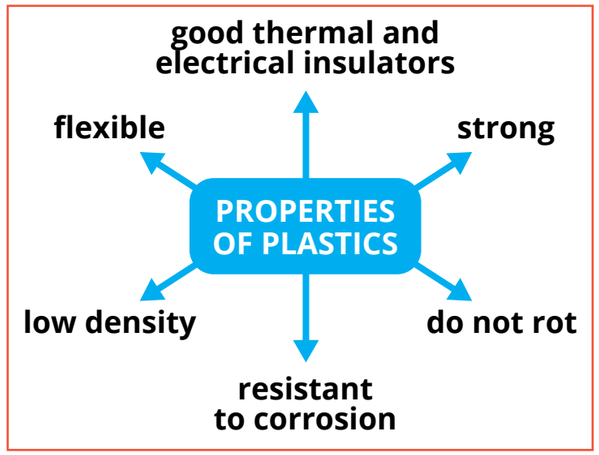
Bromine water is used in the test for alkenes as it is safer and easier to handle than bromine. It turns from orange/brown to colourless when added to an alkene.

$$C_2H_4 + Br_2 \rightarrow C_2H_4Br_2$$

Cracking hydrocarbons:

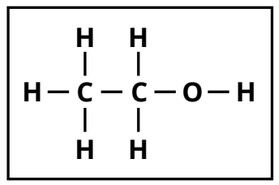
Cracking hydrocarbons involves breaking large hydrocarbons into smaller ones by heating heavier fractions to a high temperature in the presence of a catalyst. An alkene is also formed. There is greater demand for the smaller hydrocarbons and alkenes, such as ethene, are the starting material for the production of many plastics.

e.g. $C_{12}H_{26} \rightarrow C_{10}H_{22} + C_2H_4$



Alcohols (SS only):

Alcohols contain the functional group —OH, and this is responsible for their properties. The general formula for alcohols is $C_nH_{2n+1}OH$. The names of alcohols end with '-ol'.



Ethanol can be made in a process called fermentation. Yeast contains an enzyme which breaks down sugar, making ethanol and carbon dioxide. It needs to happen in anaerobic conditions (when deprived of oxygen) and at about 35°C.

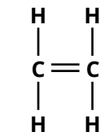
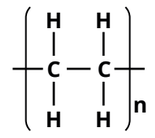
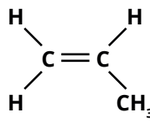
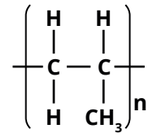
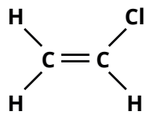
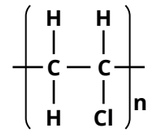
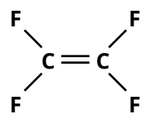
$$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$$

There are social and health problems associated with 'binge drinking' and misuse of alcohol over a long period. Tax raised from the sale of alcoholic drinks generates significant revenue for the government.

On the other hand, a significant amount of public money is spent each year in treating alcohol-related illnesses and in dealing with various other issues resulting from alcohol abuse.

Polymerisation:

Monomers are small, reactive molecules that can be joined together to make a polymer. The reactivity of a monomer arises from the presence of its double bond. As polymerisation happens, one of the bonds breaks to allow the molecule to join to another.

Name of monomer	Structural fomula of monomer	Name of polymer	Repeating unit
ethene		polyethene	
propene		polypropene	
vinylchloride		PVC	
tetrafluo-ethene		PTFE