National 5 Unit 2 Nature's Chemistry – *KU statements*

Homologous series

A homologous series is a set of compounds that share the same general formula and have similar chemical and physical properties

Alkanes, alkenes and cycloalkanes are all homologous series

The general formula of the alkanes is C_nH_{2n+2}

The general formula of the alkenes is C_nH_{2n}

Cycloalkanes are a homologous series of hydrocarbons that contain only carbon to carbon single bonds with the carbon atoms in a ring

Cycloalkane	Number of carbon atoms	Molecular formula
cyclopropane	3	C_3H_8
cyclobutane	4	C_4H_{10}
cyclopentane	5	C_5H_{12}
cyclohexane	6	C_6H_{14}
cycloheptane	7	C_7H_{16}
cyclooctane	8	C_8H_{18}

The general formula of the cycloalkanes is C_nH_{2n}

Alkanes and alkenes can have branches off of the main chain. These branches must be named and their position numbered.

Branch	Number of carbon atoms	Molecular formula
methyl	1	CH_3
ethyl	2	C_2H_5
propyl	3	C_3H_7

Isomers are molecules with the same molecular formula but different structural formulae. The alkenes and cycloalkanes are isomeric

Alkenes are unsaturated hydrocarbons because they contain a double C=C bond

Alkanes and cycloalkanes are saturated because they contain only single C-C bonds

During an addition reaction, the double bond breaks and another molecule joins on

The reaction of bromine water with alkenes is an example of an addition reaction

The larger the molecule the higher the melting point, the higher the viscosity and the lower the flammability

Hydrocarbon molecules can be used for a variety of purposes depending on their size:

- The gas, petrol, kerosene, diesel and fuel oil fractions can be used as fuels
- The naphtha fraction can be used as a feedstock for making other chemicals
- The residue can be used for bitumen for roads

Everyday consumer products

Molecules that contain a hydroxyl (–OH) functional group are alcohols

Alcohol	Number of carbon atoms
methanol	1
ethanol	2
propanol	3
butanol	4
pentanol	5

Alcohols are very flammable and are soluble in water

Alcohols are used for solvents, fuels and producing esters

Molecules that contain the carboxyl (–COOH) functional group are carboxylic acids

Carboxylic acid	Number of carbon atoms
methanoic acid	1
ethanoic acid	2
propanoic acid	3
butanoic acid	4

Alcohols react with carboxylic acids to form esters and water

Esters can be identified due to their pungent, often fruity smell

Ester names end in –oate. The first part of the name comes from the alcohol, the second from the acid

Esters can be used for perfumes and flavourings

Energy from fuels

A fuel is a substance that burns, giving out energy

A combustion reaction is exothermic