Unit 4 Introduction to Organic Chemistry (Paper 2 & 3)

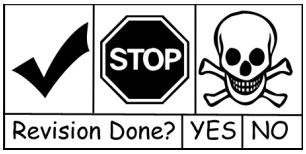
4.1 Introduction to Organic Chemistry

Nomenclature

Organic compounds can be represented by:
- empirical formula
- molecular formula
- general formula
- structural formula
- displayed formula
- skeletal formula.

The characteristics of a homologous series, a series of compounds containing the same functional group.
IUPAC rules for nomenclature.

You should be able to:
- draw structural, displayed and skeletal formulas for given organic compounds
- apply IUPAC rules for nomenclature to name organic compounds limited to chains and rings with up to six carbon atoms each
- apply IUPAC rules for nomenclature to draw the structure of an organic compound from the IUPAC name limited to chains and rings with up to six carbon atoms each.

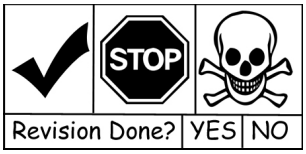


4.2 Reaction Mechanisms

Reactions of organic compounds can be explained using mechanisms.
Free-radical mechanisms:
- the unpaired electron in a radical is represented by a dot
- the use of curly arrows is **not** required for radical mechanisms.

You should be able to write balanced equations for the steps in a free-radical mechanism.
Other mechanisms:
- the formation of a covalent bond is shown by a curly arrow that starts from a lone electron pair or from another covalent bond
- the breaking of a covalent bond is shown by a curly arrow starting from the bond.

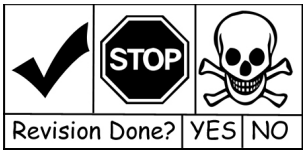
You should be able to outline mechanisms by drawing the structures of the species involved and curly arrows to represent the movement of electron pairs.



4.3 Isomerism

Structural isomerism.
Stereoisomerism.
E–Z isomerism is a form of stereoisomerism and occurs as a result of restricted rotation about the planar carbon–carbon double bond.
Cahn–Ingold–Prelog (CIP) priority rules.

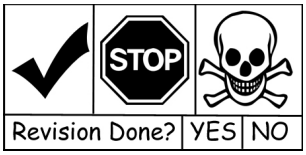
You should be able to:
- define the term structural isomer
- draw the structures of chain, position and functional group isomers
- define the term stereoisomer
- draw the structural formulas of E and Z isomers
- apply the CIP priority rules to E and Z isomers.



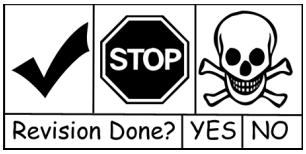
4.3 Alkanes

Fractional Distillation of Crude Oil
Alkanes are saturated hydrocarbons.
Petroleum is a mixture consisting mainly of alkane hydrocarbons that can be separated by fractional distillation.

Modification of alkanes by cracking
Cracking involves breaking C–C bonds in alkanes.
Thermal cracking takes place at high pressure and high temperature and produces a high percentage of alkenes **(mechanism not required).**
Catalytic cracking takes place at a slight pressure, high temperature and in the presence of a zeolite catalyst and is used mainly to produce motor fuels and aromatic hydrocarbons **(mechanism not required)**.
You should be able to explain the economic reasons for cracking alkanes.



Combustion of Alkanes
Alkanes are used as fuels.
Combustion of alkanes and other organic compounds can be complete or incomplete.
The internal combustion engine produces a number of pollutants including NOx , CO, carbon and unburned hydrocarbons.
These gaseous pollutants from internal combustion engines can be removed using catalytic converters.
Combustion of hydrocarbons containing sulfur leads to sulfur dioxide that causes air
You should be able to explain why sulfur dioxide can be removed from flue gases using calcium oxide or calcium carbonate.



Chlorination of alkanes
The reaction of methane with chlorine.

You should be able to explain this reaction as a free-radical substitution mechanism involving initiation, propagation and termination steps.