Paper 3

Questions are applicable for both core and extended candidates

1 **(d)** Ethene can be converted to ethane.

(i) Ethane is an alkane.

Name the type of bonding in alkanes.

..... [1]

(ii) Draw the displayed formula of a molecule of ethane.

[1]

(iii) Complete this sentence.

Alkanes are unreactive except in terms of combustion and substitution by

..... . [1]

(iv) Complete the symbol equation for the complete combustion of methane.

$$CH_4 + ...O_2 \rightarrow ..... + 2H_2O$$ [2]

2 A list of substances is shown.

ammonium nitrate
carbon monoxide
copper(II) chloride
ethane
ethene
litmus
methane
methyl orange
sodium chloride
sodium sulfate
sulfur dioxide
thymolphthalein

Answer the following questions using only the substances from the list.
Each substance may be used once, more than once or not at all.

Give the name of the substance that:

(e) is a hydrocarbon with a total of five atoms in a molecule

..... [1]

3 Hydrogen is a fuel which can be obtained from water by electrolysis.

Refinery gas and petrol are fuels obtained by the fractional distillation of petroleum.

(d) Petrol is a mixture of alkanes.

One of the alkanes in petrol is octane, C_8H_{18}.

Name the **two** products formed when octane is burnt in excess air.

..... and ..... [2]

4 This question is about fuels and energy production.

(d) Name the **two** products formed when a hydrocarbon fuel undergoes complete combustion.

..... and ..... [2]

Paper 4

Questions are applicable for both core and extended candidates unless indicated in the question

5 Butane and but-1-ene are colourless gases at room temperature and pressure.

(b) Identify the products formed when butane undergoes complete combustion.

..... [1]

(c) One molecule of butane reacts with one molecule of chlorine in the presence of ultraviolet light. During the reaction, one hydrogen atom in butane is replaced by one chlorine atom.

(i) Name the type of reaction which needs ultraviolet light. **(extended only)**

..... [1]

(ii) State the purpose of ultraviolet light during this reaction. **(extended only)**

..... [1]

(iii) Name the type of reaction which takes place when one atom of chlorine replaces one atom of hydrogen. **(extended only)**

..... [1]

(iv) Determine how many different structural isomers can form during this reaction.

(extended only)

..... [1]

6 Propane, propene, propan-1-ol and propanoic acid are members of different homologous series.

Molecules of these substances contain three carbon atoms.

(e) Propane and propene can be manufactured by heating decane, $C_{10}H_{22}$, in the presence of a catalyst. One other product is formed.

(i) Complete the equation for this reaction.

$C_{10}H_{22} \rightarrow$ ..... + ... + ... [2]

(ii) Name this manufacturing process.

..... [1]

7 This question is about organic compounds.

(a) Butane reacts with chlorine in a photochemical reaction.

$$C_4H_{10} + Cl_2 \rightarrow C_4H_9Cl + HCl$$

(i) State the meaning of the term photochemical. **(extended only)**

..... [1]

(ii) An organic compound with the formula C_4H_9Cl is formed when one molecule of butane reacts with one molecule of chlorine.

Draw the displayed formulae of **two** possible structural isomers with the formula C_4H_9Cl formed in this reaction. **(extended only)**

[2]