2 The alcohols are an example of an homologous series.

The table shows the boiling points for the first four members of straight-chain alcohols.

alcohol	structural formula	boiling point / °C
methanol	CH_3OH	65
ethanol	CH_3CH_2OH	78
propan-1-ol	$CH_3CH_2CH_2OH$	97
butan-1-ol	$CH_3CH_2CH_2CH_2OH$	118

(a) (i) What is the general formula of a member of the alcohol homologous series?

..... **[1]**

(ii) Deduce the molecular formula of the alcohol that has 13 carbon atoms per molecule.

..... **[1]**

(b) Alcohols contain the hydroxyl functional group.

What is meant by the term *functional group*?

.....

.....

.....

..... **[2]**

(c) (i) At room temperature and pressure, the first four members of the alcohol homologous series are liquids whereas the first four members of the alkanes homologous series are gases.

Explain this difference.

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..... **[3]**

(ii) Methylpropan-1-ol and butan-1-ol are structural isomers. Methylpropan-1-ol has a lower boiling point than butan-1-ol.

Suggest why.

.....

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.....

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..... **[2]**

(d) Alcohols, such as methanol, can be used as fuels.

(i) Write equations for the complete and incomplete combustion of methanol.

complete: .....

incomplete: ..... **[2]**

(ii) Suggest what conditions might lead to incomplete combustion of methanol.

.....

..... **[1]**

(iii) In addition to its use as a fuel, methanol can be used as a solvent and as a petrol additive to improve combustion.

State **another** large-scale use of methanol.

..... **[1]**

(e) Butan-1-ol can be oxidised by heating under reflux with excess acidified potassium dichromate(VI).

Write an equation for the reaction that takes place.
Use [O] to represent the oxidising agent.

..... **[2]**

(f) Butan-1-ol is one of the structural isomers of $C_4H_{10}O$.

(i) Write the name and draw the structure of the structural isomer of $C_4H_{10}O$ that is a tertiary alcohol.

name: .....

structure:

[2]

(ii) Draw the structure of the structural isomer of $C_4H_{10}O$ that can be oxidised to form butanone.

[1]

[Total: 18]