# AS level Chemistry A

**H032/02** Depth in chemistry

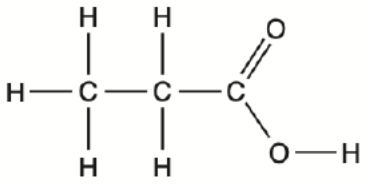
# Question Set 5

**5.** Propanoic acid, $CH_3CH_2COOH$, is a member of the homologous series of carboxylic acids.

**(a)** Suggest the general formula for a carboxylic acid.

**[1]**

**(b)** The displayed formula for propanoic acid is shown below.



**(i)** State the shape and bond angle around a carbon atom in the alkyl group of propanoic acid. Explain the shape.

**[2]**

**(ii)** Suggest a value for the C–O–H bond angle in propanoic acid.

**[1]**

**(c)** Compound **D** is a neutral compound which is a structural isomer of propanoic acid, $CH_3CH_2COOH$.

The infrared spectrum of compound **D** is shown below.



Suggest **two** possible structures of compound **D**.Explain **all** your reasoning.

**[4]**

**(d)** 2-Chloropropanoic acid, $CH_3CHClCOOH$, can be made by reacting propanoic acid with chlorine in a radical substitution reaction.

**(i)** State the conditions for the reaction.

**[1]**

**(ii)** Write the overall equation for the reaction.

**[1]**

**(iii)** The first step in the reaction mechanism involves homolytic fission of a chlorine molecule to form two chlorine radicals.

Why is this step an example of *homolytic fission*?

**[2]**

**(iv)** Write **two** equations to show the propagation steps in the mechanism for this reaction.

Use dots,•, to show the unpaired electrons on radicals.

**[1]**

**(v)** Draw the displayed formula of the radical formed in the first propagation step.

Use a dot,•, to show the position of the unpaired electron.

**[1]**

**(vi)** Further substitution forms a mixture of organic products.

Draw the structure of an organic product formed from 2-chloropropanoic acid by further substitution.

**[1]**

## Total Marks for Question Set 5: 15