

AS level Chemistry A

H032/02 Depth in chemistry

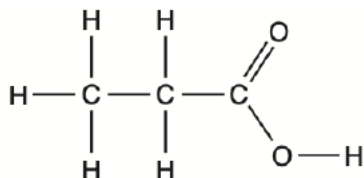
Question Set 5

5. Propanoic acid, $\text{CH}_3\text{CH}_2\text{COOH}$, 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 $\text{C}-\text{O}-\text{H}$ bond angle in propanoic acid.

[1]

(c) Compound **D** is a neutral compound which is a structural isomer of propanoic acid, $\text{CH}_3\text{CH}_2\text{COOH}$.

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

www.sdb.sdb.aist.go.jp, Spectral Database for Organic Compounds
SDBS. Item removed due to third party copyright restrictions.

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

[4]

(d) 2-Chloropropanoic acid, $\text{CH}_3\text{CHClCOOH}$, 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

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