

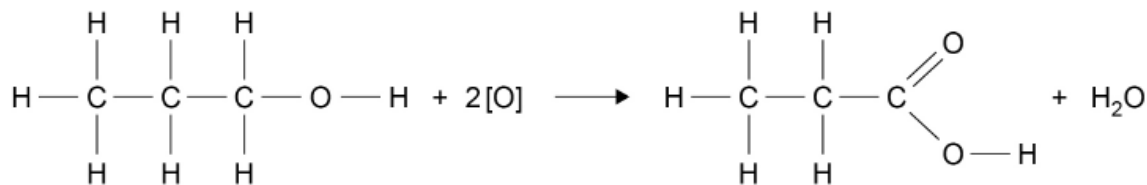
AQA – Chemical equilibria, Le Chatelier's principle and Kc – AS Chemistry P2

1. No.7

0 7

This question is about propanoic acid ($\text{CH}_3\text{CH}_2\text{COOH}$).

The equation for the oxidation of propan-1-ol under reflux to form propanoic acid is shown.



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. 1

Acidified potassium dichromate(VI) is used as the oxidising agent.

State the colour change in this reaction.

[1 mark]

0 7

. 2

A second organic product, **X**, is formed in small quantities.
The boiling point of **X** is 49°C

Identify **X**.

[1 mark]

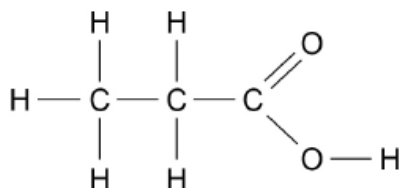
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. 3

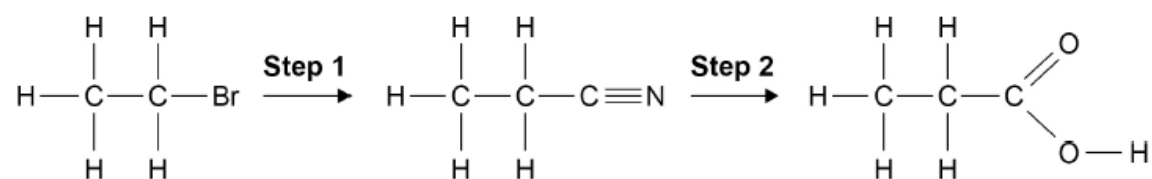
Propanoic acid molecules cannot be separated from the reaction mixture by simple distillation because propanoic acid forms hydrogen bonds with water molecules.

Complete the diagram to show how the propanoic acid molecule interacts with **one** water molecule through hydrogen bonding.
Include in the diagram all the partial charges and lone pairs of electrons involved in this hydrogen bond.

[3 marks]



An alternative method of preparing propanoic acid is shown.



Step 1 involves the reaction of bromoethane with sodium cyanide under reflux in a suitable solvent.

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Name and outline the mechanism for **Step 1**.

[3 marks]

Name of mechanism _____

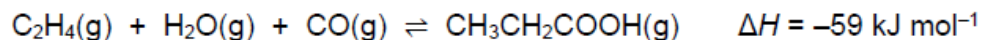
Outline of mechanism _____

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Suggest one reason why water is **not** a suitable solvent for **Step 1**.

[1 mark]

A third way of making propanoic acid uses the reaction between ethene, steam and carbon monoxide in the presence of a catalyst.



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Give an expression for the equilibrium constant (K_c) for this reaction.

[1 mark]

$K_c =$

0 7 . 7

Table 3 shows the amount of each substance in an equilibrium mixture in a container of volume 1.20 dm^3 at a constant temperature.

Table 3

Substance	$\text{C}_2\text{H}_4(\text{g})$	$\text{H}_2\text{O}(\text{g})$	$\text{CO}(\text{g})$	$\text{CH}_3\text{CH}_2\text{COOH}(\text{g})$
Amount of substance / mol	0.062	0.078	0.062	0.420

Calculate K_c

State the units.

[4 marks]

K_c _____

Units _____

07.8

Predict the effect of increasing the temperature on the yield of propanoic acid.

Explain your answer.

[3 marks]

Effect on yield _____

Explanation _____
