Answer **all** the questions.

1. Alcohols are used in organic synthesis.

Pentan-2-ol can be prepared by the alkaline hydrolysis of 2-iodopentane.

$$CH_3CH(I)CH_2CH_2CH_3 + NaOH \rightarrow CH_3CH(OH)CH_2CH_2CH_3 + NaI$$

The reaction mixture is boiled for 20 minutes.

i. State the most appropriate technique that could be used to boil the reaction mixture for 20 minutes.

[1]

---

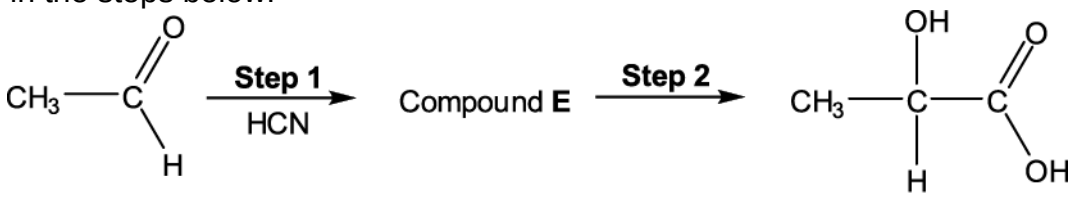
ii. Describe the mechanism for the alkaline hydrolysis of 2-iodopentane.

In your answer, include the name of the mechanism, curly arrows and relevant dipoles.

name of mechanism: .....

[4]

2(a). Lactic acid is a naturally occurring chemical, which can be synthesised from ethanal, CH_3CHO, as shown in the steps below.



lactic acid

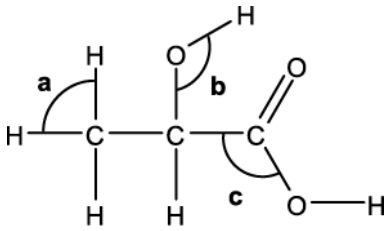
i. Draw the structure for compound **E**.

[1]

ii. Suggest a reagent that could be used for **Step 2**.

[1]

iii. The displayed formula of lactic acid is shown below.



lactic acid

Suggest a value for each bond angle **a**–**c**.

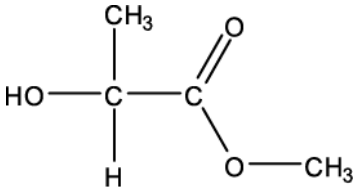
Bond angle **a**: .....

Bond angle **b**: .....

Bond angle **c**: .....

[2]

(b). Methyl lactate is an ester of lactic acid which is used as a solvent.



methyl lactate

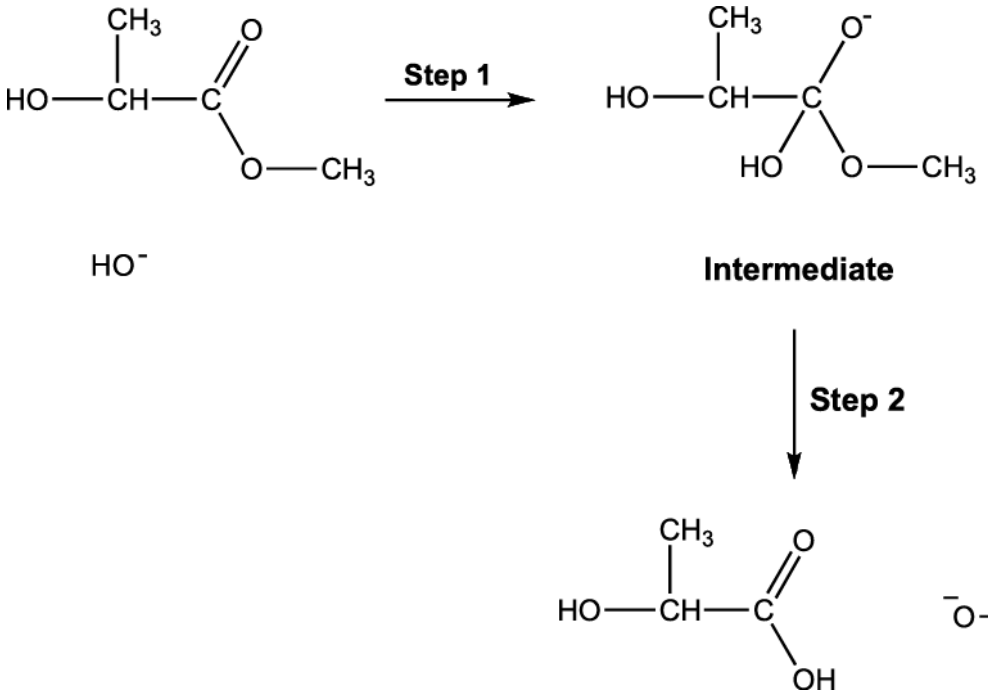
Methyl lactate can be hydrolysed by refluxing with sodium hydroxide solution.

In this reaction the hydroxide ion acts as a nucleophile.

i. Suggest how the hydroxide ion can act as a nucleophile.

[1]

ii. Part of the mechanism for the hydrolysis is shown below.

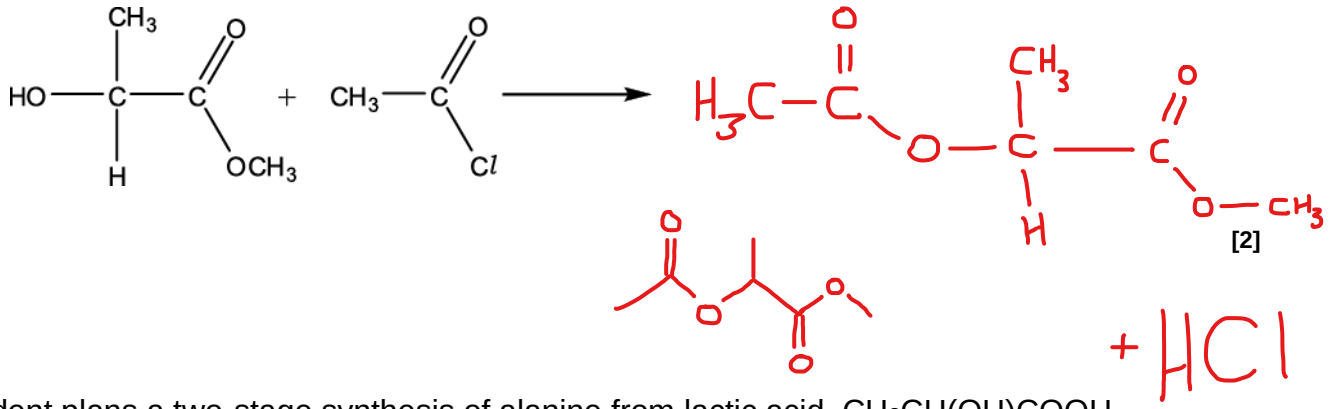


- Add relevant dipoles and curly arrows to show how the intermediate is formed in **Step 1** of the mechanism.
- Add curly arrows to show how the carboxylic acid and $^{-}OCH_3$ ion are formed from the intermediate in **Step 2** of the mechanism.

[4]

iii. Methyl lactate can also react with ethanoyl chloride (**This is A2 but you can look it up**).

Complete the equation for this reaction.

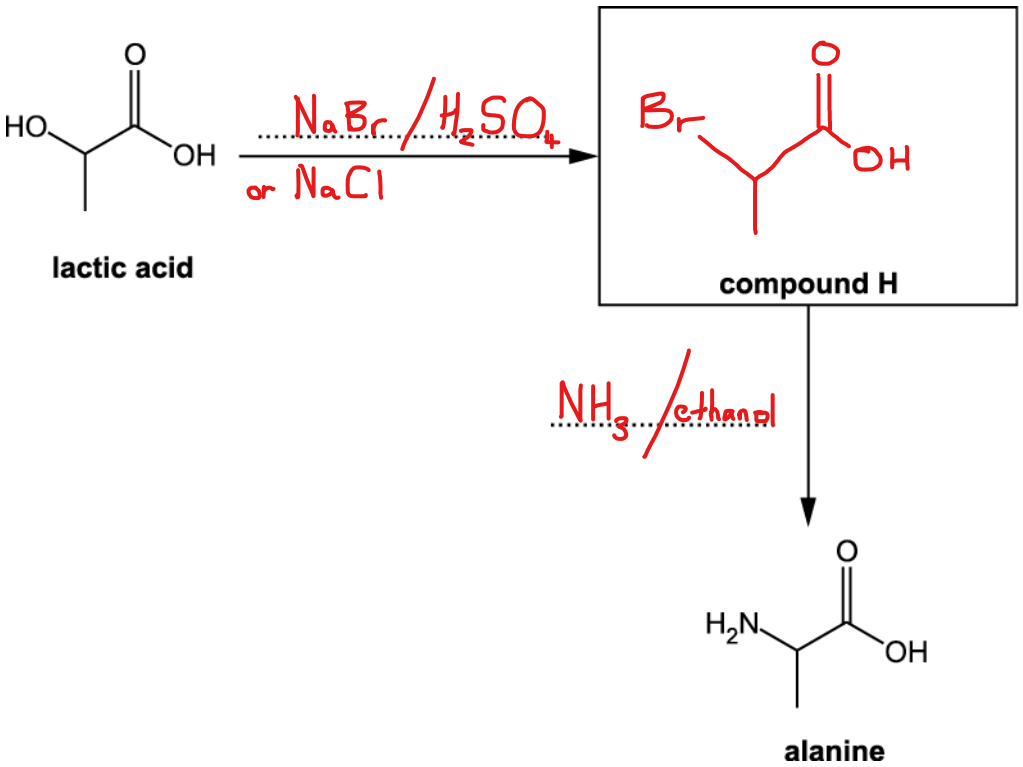


[2]

3. A student plans a two-stage synthesis of alanine from lactic acid, $CH_3CH(OH)COOH$.

The synthesis first prepared compound **H**, as shown in the flowchart.

Draw the structure of compound **H** in the box and add the formulae of the reagents for each stage on the dotted lines.



[3]

END OF QUESTION paper