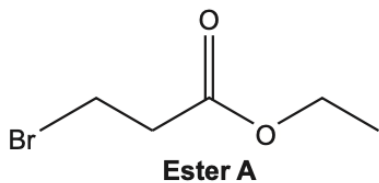


GCE A level Chemistry A (H432)
H432/02 Synthesis and analytical techniques

Question Set 23

1. This question is about esters.

(a) The structure of ester **A** is shown below.

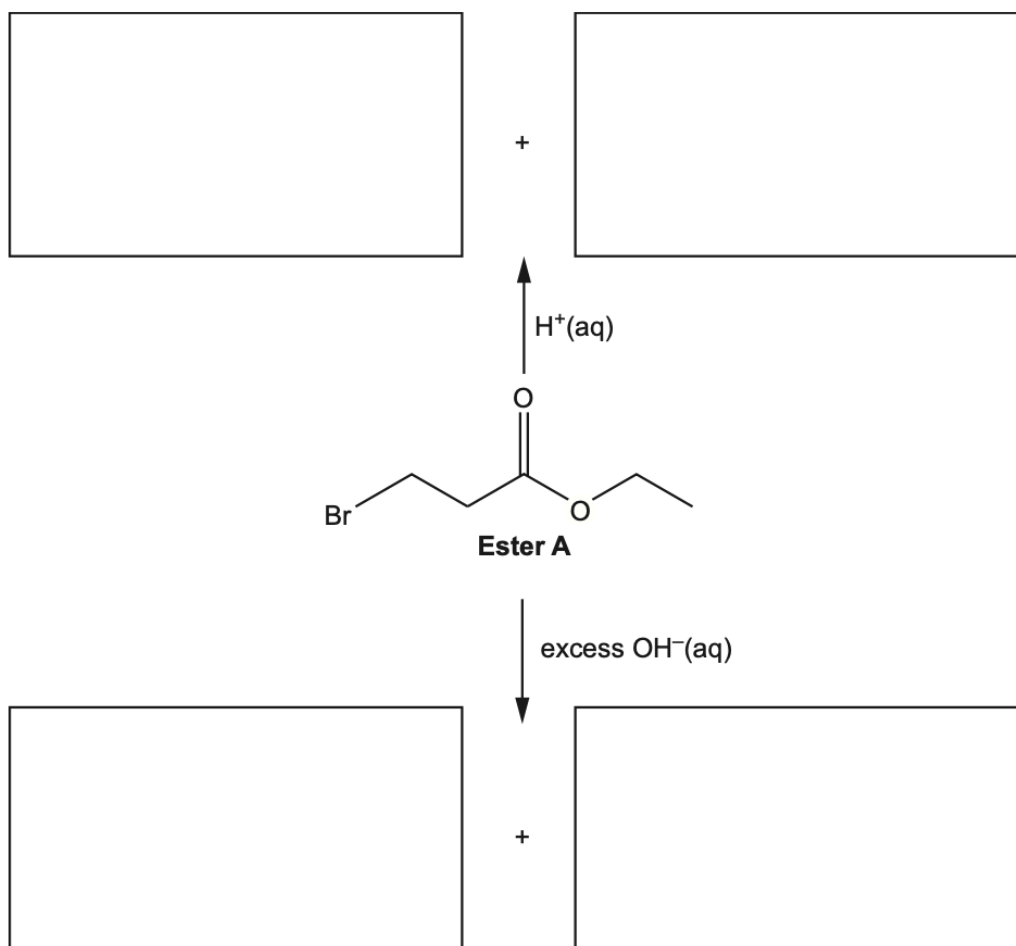


(i) What is the systematic name of ester **A**?

[1]

(ii) In the boxes, draw the organic products for the reactions of the functional groups in ester **A** shown below.

Each reaction forms two organic products.

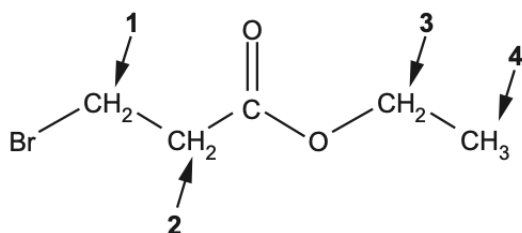


(iii) Name the type of reactions of ester **A** shown in (ii).

[5]

[1]

- (b) The protons in ester **A** are in four different environments, labelled 1–4 on the structure below.



Complete the table to predict the **proton** NMR spectrum of ester **A**.

| Proton environment | Chemical shift | Splitting pattern |
|--------------------|----------------|-------------------|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |

[4]

- (c) Compound **B** is a structural isomer of ester **A**.

- Compound **B** reacts with aqueous sodium carbonate.
- The ^{13}C NMR spectrum of **B** has 4 peaks.

Draw a possible structure for compound **B**.

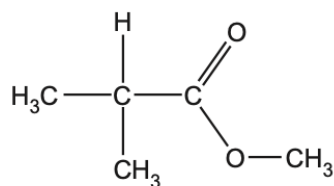
[1]

- (d) A polyester is formed from 200 molecules of 4-hydroxybenzoic acid.

What is the relative molecular mass, M_r , of the polyester?

[2]

- (e) A student intends to synthesise ester **C**.



Ester C

- (i)* Plan a two-stage synthesis to prepare 12.75 g of ester **C** starting from 2-methylpropanal, $(\text{CH}_3)_2\text{CHCHO}$.

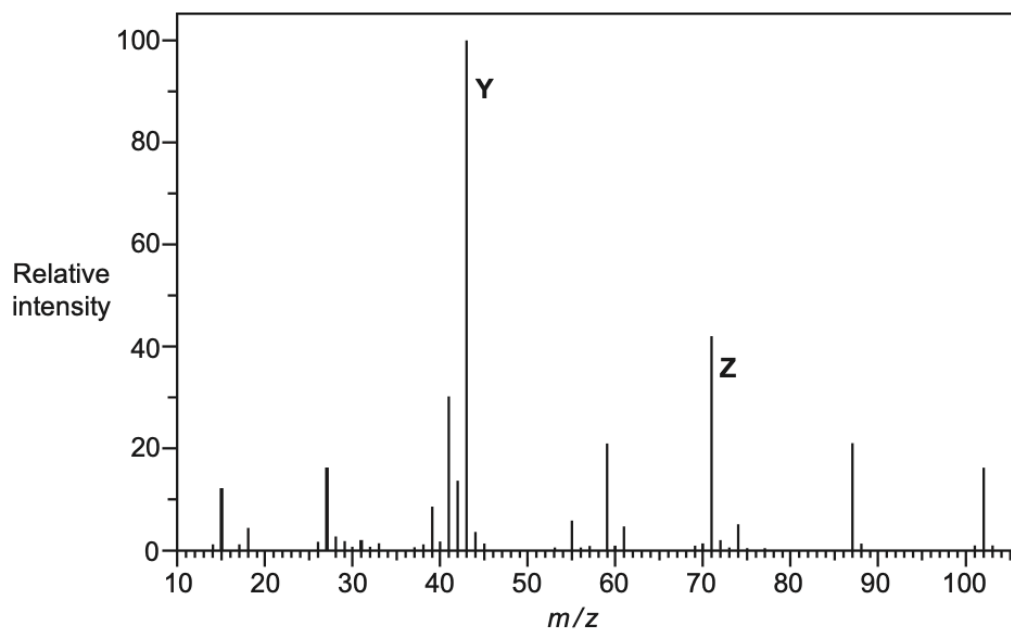
Assume the overall percentage yield of ester **C** from 2-methylpropanal is 40%.

In your answer include the mass of 2-methylpropanal required, reagents, conditions and equations where appropriate.

Purification details are **not** required.

[6]

(ii) The mass spectrum of ester **C** is shown below.



Suggest possible structures for the species responsible for peaks **Y** and **Z** in the mass spectrum.

[2]

Total Marks for Question Set 23: 22

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