

OCR A-Level Chemistry A

Carbonyls, carboxylic acids and esters

Questions only

The newest questions, about an hour. All 23 are in the exam generator.

Questions

9

Total marks

44

Time allowed

59 min

Name

Class or teacher

Date

Instructions

- Answer all questions in the spaces provided.
- Use black ink. Show your working for every calculation.
- You may use a scientific calculator and the OCR Data Sheet.
- Print the separate mark scheme when you are ready to mark your answers.

For marking

Q	Source	Marks	Score
1	2022 P2 Q10	1	
2	2023 P2 Q12	1	
3	2023 P2 Q14	1	
4	2023 P2 Q2	1	
5	2024 P2 Q17	8	
6	2024 P2 Q20	13	
7	2025 P2 Q13	1	
8	2025 P2 Q21	17	
9	2025 P2 Q9	1	

Total _____ / 44 Percentage _____ %

Questions from OCR past papers, 2022–2025, reproduced for revision. Practise these topics online, with instant marking:

whiteboardchemistry.com/revision/exam-questions/ocr-a-level-chemistry/?topics=carbonyls-carboxylic-acids-and-esters&len=0

Questions

Carbonyls, carboxylic acids and esters · 9 questions · 44 marks · time allowed 59 min

Q1 · June 2022 · Paper 2 (Synthesis and analytical techniques) · Q10 · [1 mark]

Butyl propanoate is hydrolysed by aqueous sodium hydroxide.

Which compound is one of the products of this hydrolysis?

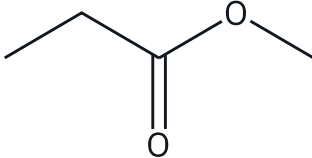
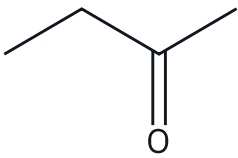
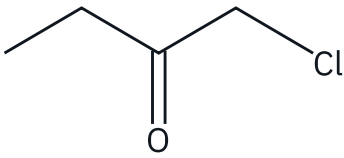
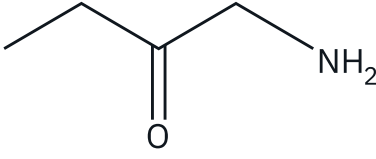
Tick (✓) one box.

- ☐ **A** $\text{C}_3\text{H}_7\text{ONa}$
- ☐ **B** $\text{C}_3\text{H}_5\text{O}_2\text{Na}$
- ☐ **C** $\text{C}_4\text{H}_9\text{ONa}$
- ☐ **D** $\text{C}_4\text{H}_7\text{O}_2\text{Na}$

Q2 · June 2023 · Paper 2 (Synthesis and analytical techniques) · Q12 · [1 mark]

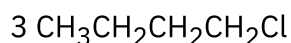
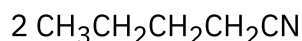
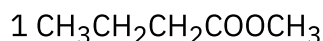
Which compound reacts with ethanoyl chloride?

Tick (✓) one box.

- ☐ **A** 
- ☐ **B** 
- ☐ **C** 
- ☐ **D** 

Q3 · June 2023 · Paper 2 (Synthesis and analytical techniques) · Q14 · [1 mark]

Which compound(s) is/are hydrolysed by HCl(aq) to produce butanoic acid?



Tick (✓) one box.

- ☐ **A** 1, 2 and 3
- ☐ **B** Only 1 and 2
- ☐ **C** Only 2 and 3
- ☐ **D** Only 1

Q4 · June 2023 · Paper 2 (Synthesis and analytical techniques) · Q2 · [1 mark]

Which compound reacts with 2,4-dinitrophenylhydrazine but does **not** react with Tollens' reagent?

Tick (✓) one box.

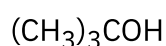
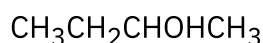
- ☐ **A** $\text{C}_6\text{H}_5\text{COCO}_2\text{H}$
- ☐ **B** $\text{C}_6\text{H}_5\text{CH}(\text{OH})\text{CHO}$
- ☐ **C** CH_3COCHO
- ☐ **D** $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$

Q5 · June 2024 · Paper 2 (Synthesis and analytical techniques) · Q17 · [8 marks]

This question also needs Alcohols and haloalkanes.

This question is about reactions of alcohols.

There are 4 structural isomers of $\text{C}_4\text{H}_{10}\text{O}$ that are alcohols:



Alcohols take part in many different types of reaction, including

- elimination
- oxidation
- substitution
- esterification.

For each type of reaction, choose appropriate reagent(s) and/or catalyst, and show the organic product formed.

17(a) Elimination reaction of $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$

[2 marks]

Reagent(s) and/or catalyst

organic product

17(b) Oxidation reaction of $\text{CH}_3\text{CH}_2\text{CHOHCH}_3$

[2 marks]

Reagent(s) and/or catalyst

organic product

17(c) Substitution reaction of $(\text{CH}_3)_2\text{CHCH}_2\text{OH}$

[2 marks]

Reagent(s) and/or catalyst

organic product

17(d) Esterification reaction of $(\text{CH}_3)_3\text{COH}$

[2 marks]

Reagent(s) and/or catalyst

organic product

Q6 · June 2024 · Paper 2 (Synthesis and analytical techniques) · Q20 · [13 marks]

This question also needs Amines, amino acids and polymers.

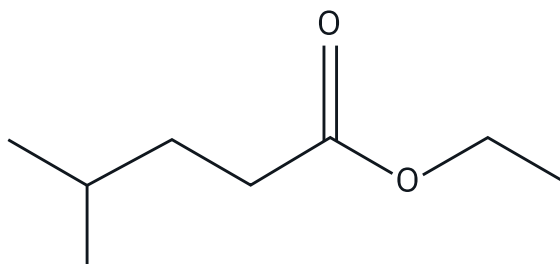
This question is about carboxylic acids and esters.

20(a) Short-chain carboxylic acids, such as methanoic acid, HCOOH , are soluble in water.

Explain, with a labelled diagram, how HCOOH interacts with water when it dissolves.

[2 marks]

Ester F has the structure shown below.



Ester F

20(b)(i) What is the systematic name for this ester?

[1 mark]

20(b)(ii) Ester F can be prepared from a carboxylic acid in two steps.

Step 1 The carboxylic acid is converted into an acyl chloride.

Step 2 The acyl chloride is converted into ester F.

Write equations for Step 1 and Step 2.

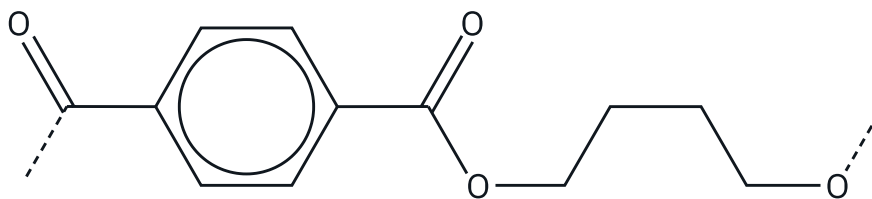
Show organic compounds as structures.

[4 marks]

Step 1

Step 2

20(c) The repeat unit of a polyester is shown below.

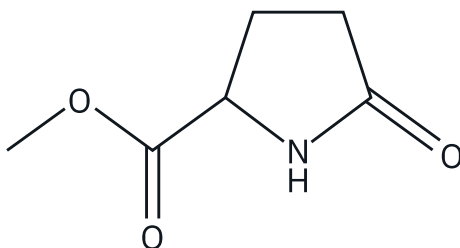


Draw the structures of monomers required to form this polyester.

[2 marks]

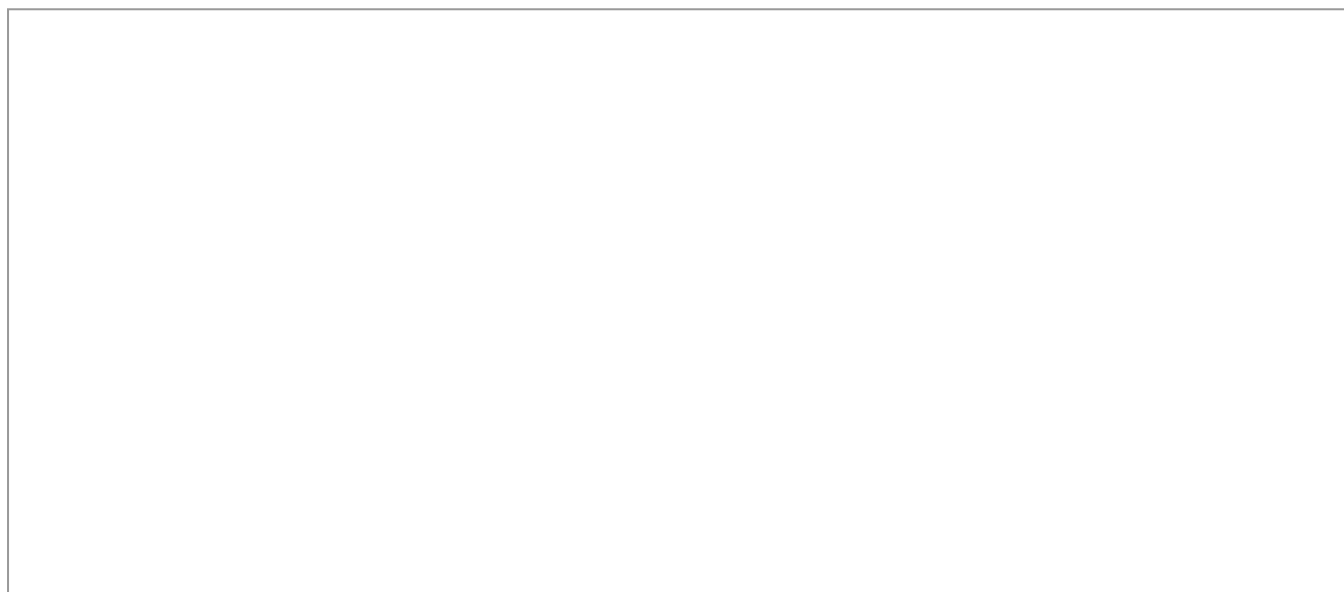
Blank area for drawing the structures of monomers required to form this polyester.

20(d) The compound below contains an ester and an amide group.



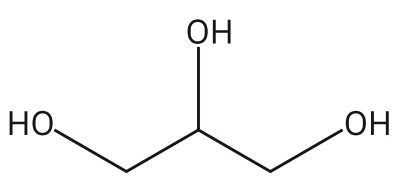
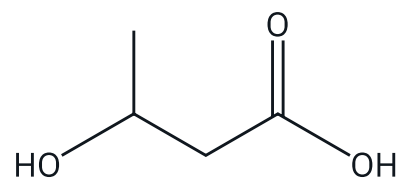
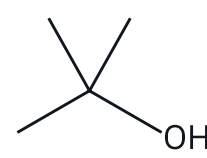
Draw the structures of the organic products formed by the complete **alkaline** hydrolysis of this compound using NaOH(aq).

[4 marks]



Q7 · June 2025 · Paper 2 (Synthesis and analytical techniques) · Q13 · [1 mark]

Which molecule(s) would form a ketone group when oxidised?

1	
2	
3	

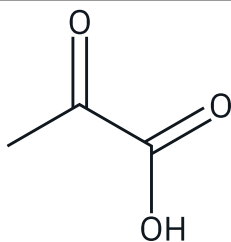
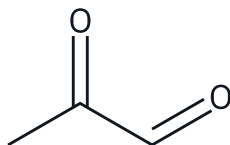
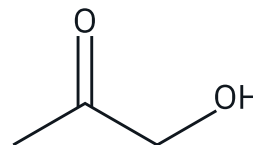
Tick (✓) one box.

- ☐ **A** 1, 2 and 3
- ☐ **B** Only 1 and 2
- ☐ **C** Only 2 and 3
- ☐ **D** Only 1

Q8 · June 2025 · Paper 2 (Synthesis and analytical techniques) · Q21 · [17 marks]

This question is about carbonyl compounds.

The three compounds below each contain a ketone and one other functional group.

**Pyruvic acid****Methylglyoxal****Acetol**

21(a) What is a **functional group**?

[1 mark]

21(b) A chemical test is carried out which gives a positive result for **all three** compounds.

Suggest the reagent and observation of this chemical test.

[2 marks]

Reagent

Observation

21(c) A student is provided with three unlabelled sample tubes, containing either pyruvic acid, methylglyoxal or acetol.

The student carries out three chemical tests on each sample.

Complete the table with the expected observations, including 'no change' where appropriate.

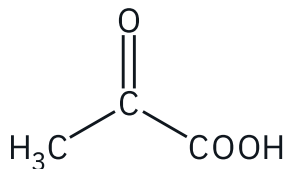
Expected observations			
Chemical test	Pyruvic acid	Methylglyoxal	Acetol
Tollens' reagent			
$\text{Na}_2\text{CO}_3(\text{aq})$			
$\text{Cr}_2\text{O}_7^{2-}(\text{aq})/\text{H}^+(\text{aq})$			

[3 marks]

21(d) Pyruvic acid reacts with NaBH_4 .

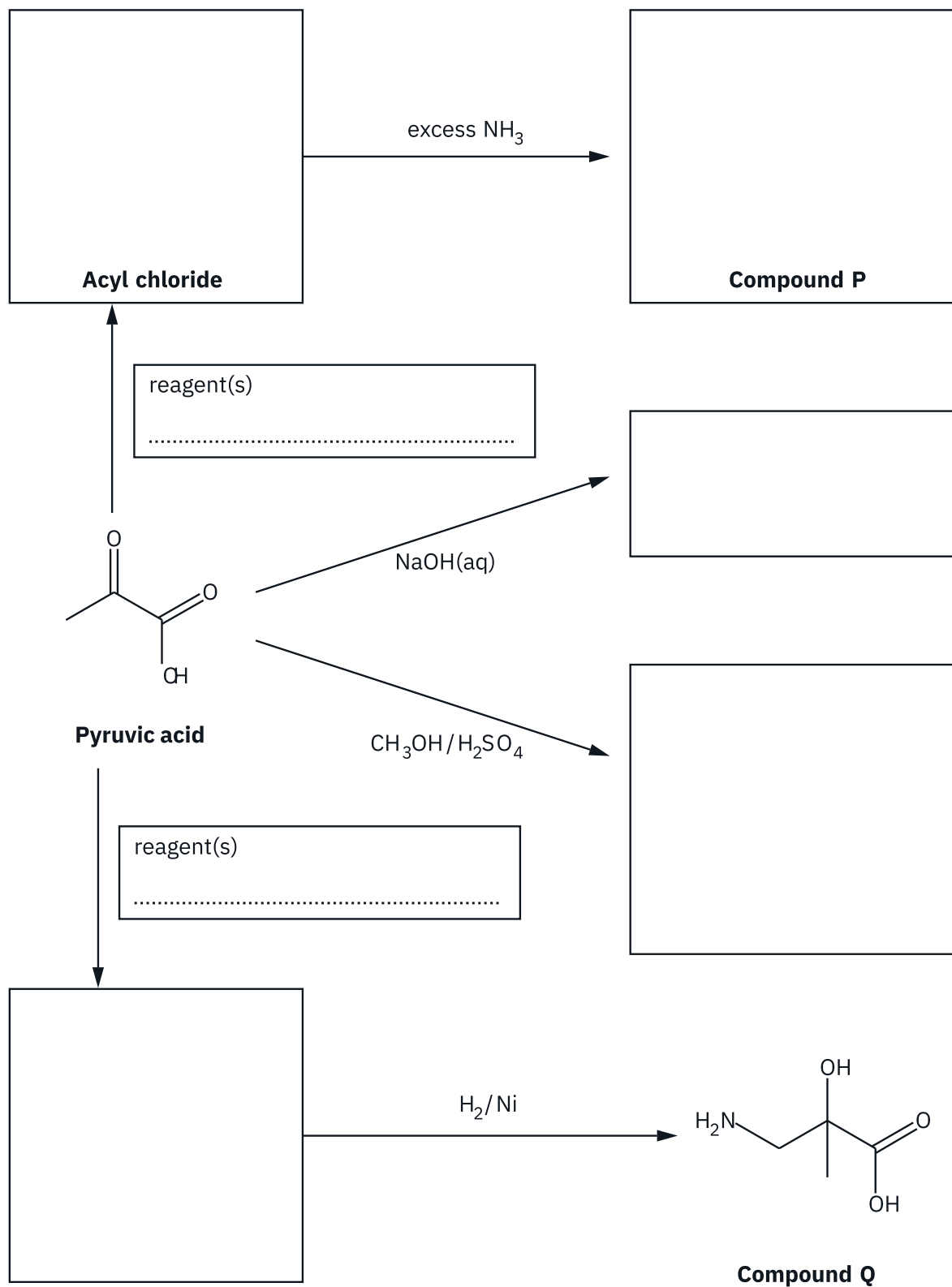
Outline the mechanism for the reaction of pyruvic acid with NaBH_4 .

Include curly arrows and relevant dipoles.



[4 marks]

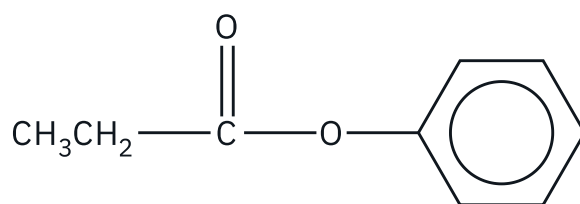
21(e) Complete the flowchart for the reactions of pyruvic acid.



[7 marks]

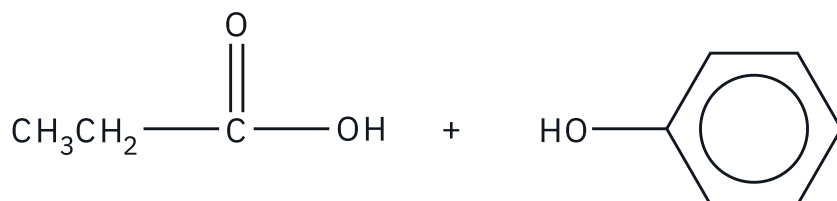
Q9 • June 2025 • Paper 2 (Synthesis and analytical techniques) • Q9 • [1 mark]

Which reagents could a student use to prepare the ester shown?



Tick (✓) one box.

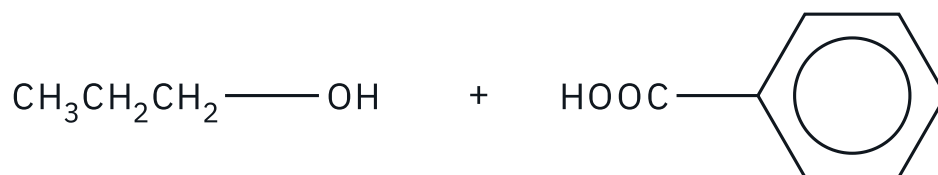
☐ **A**



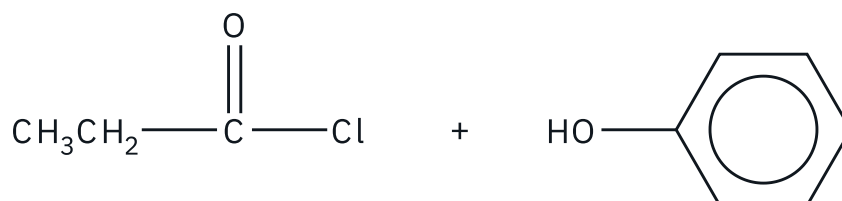
☐ **B**



☐ **C**



☐ **D**



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Mark scheme:

[whiteboardchemistry.com/revision/exam-questions/ocr-a-level-chemistry/pdf/
carbonyls-carboxylic-acids-and-esters-mark-scheme.pdf](http://whiteboardchemistry.com/revision/exam-questions/ocr-a-level-chemistry/pdf/carbonyls-carboxylic-acids-and-esters-mark-scheme.pdf)