

Past-paper walk-through

Esters ■ 18.2

eXercise

Questions in this set

- 9701/11 N25 Q35 ■ 1 mark
- 9701/14 N25 Q36 ■ 1 mark
- 9701/33 N25 Q3 ■ 14 marks

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- **//** separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = “or words to that effect” – the wording need not match.

Question 35

9701/11 N25 ■ Q35 ■ 1 mark

35 Which compound is a product of the hydrolysis of $\text{CH}_3\text{CO}_2\text{CH}_2\text{C}_2\text{H}_5$ using aqueous sodium hydroxide?

- A** $\text{CH}_3\text{CO}_2^-\text{Na}^+$
- B** $\text{CH}_3\text{CO}_2\text{H}$
- C** $\text{C}_2\text{H}_5\text{CH}_2\text{O}^-\text{Na}^+$
- D** $\text{C}_2\text{H}_5\text{CH}_2\text{CO}_2^-\text{Na}^+$

Solution 35

Answer: **A**

Why

- Alkaline hydrolysis of an ester gives the sodium *salt* of the acid plus the alcohol.
- The acyl part here is $\text{CH}_3\text{CO}-$, so the salt is sodium ethanoate.
- The alcohol formed is propan-1-ol, which is neutral – not an alkoxide.

Question 36

9701/14 N25 ■ Q36 ■ 1 mark

36 The structural formula of compound P is $\text{CH}_3\text{CH}_2\text{COOCH}_2\text{CH}_3$.

P can be formed by reacting together two organic compounds in the presence of a suitable catalyst.

Which pair of compounds could react together to produce P?

- A** ethanoic acid and propanoic acid
- B** ethanoic acid and propan-1-ol
- C** ethanol and propanoic acid
- D** ethanol and propan-1-ol

Solution 36

Answer: **C**

Why

- In an ester the acyl part (before the O) comes from the acid and the part after the O comes from the alcohol.
- $\text{CH}_3\text{CH}_2\text{CO}-$ comes from propanoic acid.
- $-\text{OCH}_2\text{CH}_3$ comes from ethanol.

Question 3

9701/33 N25 ■ Q3 ■ 14 marks

- 3 Half-fill the 250cm³ beaker with water and place it on a tripod and gauze. Heat the water until boiling then switch off your Bunsen burner. This will be your hot water bath for use in (b)(i). Start (a)(i) while the water is heating.
- (a) **FA 4** is an aqueous solution containing three ions. One ion is **not** listed in the Qualitative analysis notes. **FA 5** is an aqueous solution containing two ions. The cation in **FA 5** is listed in the Qualitative analysis notes. The anions in both **FA 4** and **FA 5** contain sulfur.
- (i) Carry out the following tests using a 1 cm depth of either **FA 4** or **FA 5** in a test-tube. Record your observations in Table 3.1.

Table 3.1

<i>test</i>	<i>observations</i>	
	FA 4	FA 5
Test 1 Add aqueous		

Question 3

Add aqueous sodium hydroxide.		
Test 2 Add aqueous ammonia.		
Test 3 Add aqueous sodium carbonate.		
Test 4 Add aqueous barium chloride or aqueous barium nitrate.		

Question 3

Test 5 Add acidified aqueous potassium manganate(VII).		
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[5]

- (ii) From your observations in (a)(i), deduce the identities of the ions present in **FA 4** and **FA 5**. Give the formula of each ion in Table 3.2. If you are unable to identify an ion write 'unknown'.

Table 3.2

<i>ions present</i>	FA 4	FA 5
cations		

Question 3

anions		
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[3]

- (b) (i) Both **FA 6** and **FA 7** are one of propan-1-ol, propan-2-ol, methanoic acid or ethanoic acid. You will carry out tests to investigate the identities of **FA 6** and **FA 7**. For each test use a 1 cm depth of **FA 6** or **FA 7** in a test-tube. Record your observations in Table 3.3.

Table 3.3

<i>test</i>	<i>observations</i>	
	FA 6	FA 7
Test 1 Add a few drops of acidified aqueous potassium manganate(VII), then		

Question 3

| place the test-tube in the hot |

| |

Question 3

place the test-tube in the hot water bath.		
Test 2 Add a 2 cm depth of aqueous iodine followed by drops of aqueous sodium hydroxide until the colour just disappears.		
If no reaction is visible, place the test-tube in the hot water bath.		
Test 3 Add aqueous sodium carbonate.		

[3]

- (ii) From your observations in (b)(i) deduce the identities of **FA 6** and **FA 7**. Give reasons for

Question 3

YOUR ANSWERS

Question 3

your answers.

Question 3

Question 3

Question 3

Question 3

Question 3

Question 3

[2]

- (c) A student carrying out a similar set of tests identifies two unknown compounds to be ethanol and propanoic acid.

Write an equation for the reaction between these two compounds.

Question 3

[Total: 14]

Qualitative analysis notes

1 Reactions of cations

cation	reaction with	
	NaOH(aq)	NH ₃ (aq)
aluminium, Al ³⁺ (aq)	white ppt. soluble in excess	white ppt. insoluble in excess
ammonium, NH ₄ ⁺ (aq)	no ppt. ammonia produced on warming	–
barium, Ba ²⁺ (aq)	faint white ppt. is observed unless [Ba ²⁺ (aq)] is very low	no ppt.
calcium, Ca ²⁺ (aq)	white ppt. unless [Ca ²⁺ (aq)] is very low	no ppt.

Question 3



Question 3

chromium(III), $\text{Cr}^{3+}(\text{aq})$	grey-green ppt. soluble in excess giving dark green solution	grey-green ppt. insoluble in excess
copper(II), $\text{Cu}^{2+}(\text{aq})$	pale blue ppt. insoluble in excess	pale blue ppt. soluble in excess giving dark blue solution
iron(II), $\text{Fe}^{2+}(\text{aq})$	green ppt. turning brown on contact with air insoluble in excess	green ppt. turning brown on contact with air insoluble in excess
iron(III), $\text{Fe}^{3+}(\text{aq})$	red-brown ppt. insoluble in excess	red-brown ppt. insoluble in excess
magnesium, $\text{Mg}^{2+}(\text{aq})$	white ppt. insoluble in excess	white ppt. insoluble in excess
manganese(II), $\text{Mn}^{2+}(\text{aq})$	off-white ppt. rapidly turning brown on contact with air insoluble in excess	off-white ppt. rapidly turning brown on contact with air insoluble in excess
zinc, $\text{Zn}^{2+}(\text{aq})$	white ppt. soluble in excess	white ppt. soluble in excess

Question 3

Question 3

2 Reactions of anions

anion	reaction
carbonate, CO_3^{2-}	CO_2 liberated by dilute acids
chloride, $\text{Cl}^-(\text{aq})$	gives white ppt. with $\text{Ag}^+(\text{aq})$ (soluble in $\text{NH}_3(\text{aq})$)
bromide, $\text{Br}^-(\text{aq})$	gives cream/off-white ppt. with $\text{Ag}^+(\text{aq})$ (partially soluble in $\text{NH}_3(\text{aq})$)
iodide, $\text{I}^-(\text{aq})$	gives pale yellow ppt. with $\text{Ag}^+(\text{aq})$ (insoluble in $\text{NH}_3(\text{aq})$)
nitrate, $\text{NO}_3^-(\text{aq})$	NH_3 liberated on heating with $\text{OH}^-(\text{aq})$ and Al foil
nitrite, $\text{NO}_2^-(\text{aq})$	NH_3 liberated on heating with $\text{OH}^-(\text{aq})$ and Al foil; decolourises acidified aqueous KMnO_4
sulfate, $\text{SO}_4^{2-}(\text{aq})$	gives white ppt. with $\text{Ba}^{2+}(\text{aq})$ (insoluble in excess dilute strong acids); gives white ppt. with high $[\text{Ca}^{2+}(\text{aq})]$
sulfite, $\text{SO}_3^{2-}(\text{aq})$	gives white ppt. with $\text{Ba}^{2+}(\text{aq})$ (soluble in excess dilute strong acids); decolourises acidified aqueous KMnO_4

Question 3

thiosulfate, $\text{S}_2\text{O}_3^{2-}(\text{aq})$ | gives off-white/pale yellow ppt. slowly with H^+

3 Tests for gases

gas	test and test result
ammonia, NH_3	turns damp red litmus paper blue
carbon dioxide, CO_2	gives a white ppt. with limewater
hydrogen, H_2	'pops' with a lighted splint
oxygen, O_2	relights a glowing splint

Solution 3

(a)(i) Mark scheme

- $2 * = 1$ mark (round down). Max 5 marks.
- test
- observations
- FA 4
- FA 5/1 + NaOH(aq)
- red-brown / brown ppt
- AND
- insoluble in excess *

Solution 3

- white ppt *
- soluble in excess *
- 2
- + $\text{NH}_3(\text{aq})$
- red-brown / brown ppt
- AND
- insoluble in excess *
- white ppt
- AND
- insoluble in excess *

Solution 3

- 3
- + $\text{Na}_2\text{CO}_3(\text{aq})$
- fizzing *
- gas gives white ppt with
- limewater *
- red-brown ppt *
- white ppt *
- fizzing *
- gas gives white ppt with
- limewater (award if not awarded)

Solution 3

- for FA 4)
- 4
- + $\text{BaCl}_2(\text{aq})$ /
- $\text{Ba}(\text{NO}_3)_2(\text{aq})$
- white ppt
- AND
- white ppt *
- 5
- + H^+ / $\text{KMnO}_4(\text{aq})$
- stays purple / no change AND stays purple / no change *

Solution 3

- 5
- 9701/33
- October/November 2025

Solution 3

(a)(ii) Mark scheme

- ions
- FA 4
- FA 5
- cations
- Fe^{3+} ; H^{+}
- Al^{3+}
- anions
- SO_4^{2-}

Solution 3

- SO_4^{2-}
- 5 ions correct = 3 marks
- 3 or 4 ions correct = 2 marks
- 2 ions correct = 1 mark
- 3

Solution 3

(b)(i) Mark scheme

- $2 * = 1$ mark (round down)
- test
- observations
- FA 6
- $\text{FA 7/1} + \text{H}^+ / \text{KMnO}_4(\text{aq})$
- (turns paler pink)
- (purple fades slightly)
- and warm

Solution 3

- decolourises / turns colourless /
- turns (pale) yellow *
- decolourises / turns colourless /
- turns (pale) yellow *
- 2
- $+ \text{I}_2(\text{aq}) + \text{NaOH}$
- (and warm)
- no change *
- ppt * that is (pale) yellow *
- 3

Solution 3

- + $\text{Na}_2\text{CO}_3(\text{aq})$
- fizzing *
- no change *
- 3
- 9701/33
- October/November 2025

Solution 3

(b)(ii)

Mark scheme

- M1 (FA 6 is) methanoic acid because it produces CO_2 / reacts with sodium carbonate
- AND it can be oxidised / it reacts with KMnO_4 (M2)
- (FA 7 is) propan-2-ol as it gives a ppt in test 2
- OR gives a positive tri-iodomethane/iodoform test
- OR has the $-\text{CH}(\text{OH})\text{CH}_3$ group
- 2

Solution 3

(c)

Mark scheme

- Correct equation
- $\text{CH}_3\text{CH}_2\text{COOH} + \text{CH}_3\text{CH}_2\text{OH} \rightarrow \text{CH}_3\text{CH}_2\text{COOCH}_2\text{CH}_3 + \text{H}_2\text{O}$
- OR
- $\text{C}_2\text{H}_5\text{COOH} + \text{C}_2\text{H}_5\text{OH} \rightarrow \text{C}_2\text{H}_5\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$
- 1