OCR A-Level Chemistry A

Chromatography and functional group tests mark scheme · goes with “Chromatography and functional group tests” · whiteboardchemistry.com/revision/exam-questions/ocr-a-level-chemistry/

Mark schemes

Chromatography and functional group tests · 7 questions

Q1 · June 2017 · Paper 3 (Unified chemistry) · Q5 · [12 marks]

OCR MARK SCHEME

5(a)(i)

For 5a(i)–(iv) IGNORE poor connectivity to SH groups

Given in question

$$K_a = \frac{[H^+]\,[C_4H_9S^-]}{[C_4H_9SH]}$$ ✓

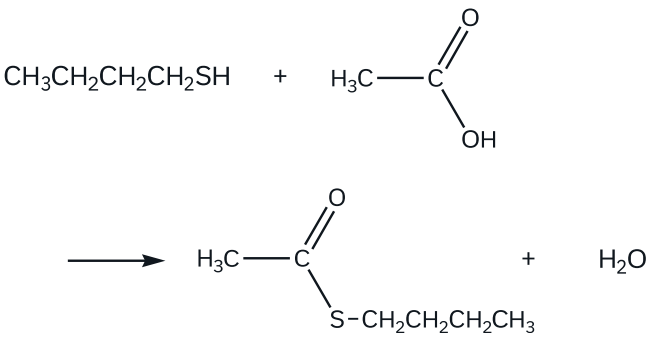
Square brackets required

[1 mark]

EXAMINER GUIDANCE

ALLOW *correct structural* ***OR*** *skeletal* ***OR*** *displayed formula* ***OR*** *mixture of the above as long as non-ambiguous*

5(a)(ii)



Structure of thioester ✓

Complete equation ✓

[2 marks]

ALLOW *correct skeletal* ***OR*** *displayed formula* ***OR*** *mixture of the above as long as non-ambiguous*

ALLOW C_4H_9SH

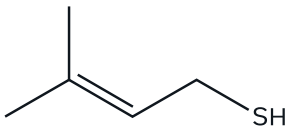
ALLOW CH_3COOH

Thioester functional group must be fully displayed,

OR as a skeletal formula

but allow SC_4H_9 in thioester

5(a)(iii)

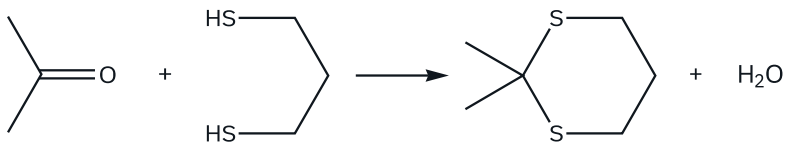


✓

[1 mark]

IF *correct skeletal formula is shown, IGNORE displayed formula in a second structure*

5(a)(iv)



Reactants ✓

ALLOW *correct structural* ***OR*** *skeletal* ***OR*** *displayed formula* ***OR*** *mixture of the above as long as non-ambiguous*

Products **AND** balanced equation ✓

[2 marks]

5(b)

Level 3 (5–6 marks)

Develops a plan that identifies all compounds by a process of elimination

AND

includes essential detail for all required tests and observations

There is a well-developed line of reasoning which is clear and logically structured

Level 2 (3–4 marks)

Develops a plan that identifies at least half of the compounds **OR** identifies the functional groups in most of the compounds

AND

includes detail of the required tests and observations

There is a line of reasoning with some structure. The information is mostly relevant and supported by some evidence.

Level 1 (1–2 marks)

Develops a plan that attempts to identify the compounds **OR** functional groups

AND

includes detail of the required tests and observations

There is a line of reasoning using information that is mostly relevant.

0 marks – No response or no response worthy of credit with no compounds identified

Appendix for Q5b Level of Response

Results of tests

	B	C	D	E	F	G
Bromine	✓	✓	✓			✓
$(H^+/)Cr_2O_7^{2-}$		✓	✓		✓	
2,4-DNP		✓		✓		✓
Tollens		✓				

Possible processes of elimination (not inclusive)

Indicative scientific points may include:

Functional groups

- B alkene and tertiary alcohol
- C alkene and aldehyde
- D alkene and primary alcohol
- E ketone
- F secondary alcohol
- G alkene and ketone

Tests

- B, C, D and G → Bromine decolourises
- C, D and F → $(H^+/)Cr_2O_7^{2-}$ green
- C, E and G → 2,4-DNP orange precipitate
- C → Tollens silver mirror

For Tollens' **ALLOW** alternative: Fehling's solution produces a 'brown/brick red/orange precipitate

For 2,4-DNP, **ALLOW** 2,4-DNPH and Brady's

	B	C	D	E	F
Bromine	✓	✓	✓		
$(H^+/)Cr_2O_7^{2-}$		✓	✓		✓
2,4-DNP		✓		✓	
Tollens'		✓			

No credit for tests on products of tests, melting points, spectra, etc.

BCDEFG with 2,4 DNP	**CEG** orange ppt		
	CEG with Tollens	**C** silver mirror	
	EG with bromine	**G** decolourises	**E** no change
BDF with **$(H^+)/Cr_2O_7^{2-}$**	**DF** green	**B** no colour change	
	DF with bromine	**D** decolourises	**F** no change

BCDEFG with **$(H^+)/Cr_2O_7^{2-}$**	**CDF** green		
	CDF with Tollens/2,4DNP	**C** silver mirror/orange ppt	
	DF with bromine	**D** decolourises	**F** no change
BEG with 2,4 DNP	**EG** orange ppt	**B** no change	
	EG with bromine	**G** decolourises	**E** no change

BCDEFG with **bromine**	**BCDG** decolourise	**EF** no change	
	EF with 2,4-DNP/**$(H^+/)Cr_2O_7^{2-}$**	**E** orange ppt/**F** green	
	BCDG with Tollens'	**C** silver mirror	**BDG** no change
	BDG with **$H^+/Cr_2O_7^{2-}$**	**D** green	**BG** no change
	BG with 2,4-DNP	**G** orange ppt	**B** no change

[6 marks]

Q2 · June 2024 · Paper 2 (Synthesis and analytical techniques) · Q13 · [1 mark]

Answer: **C**

Only 2 and 3

Q3 · June 2024 · Paper 3 (Unified chemistry) · Q5 · [13 marks]

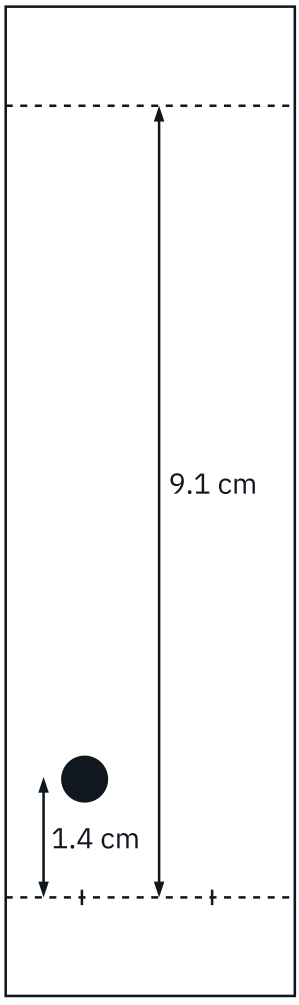
OCR MARK SCHEME

5(a)(i)

$R_f \sim \frac{1.4}{9.1}$ in cm OR $\frac{14}{91}$ in mm = 0.15 ✓

Working required

Check for ~ 9.1 as denominator



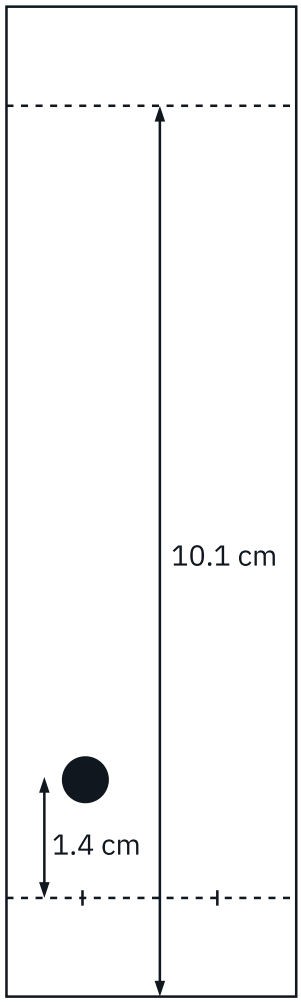
[1 mark]

EXAMINER GUIDANCE

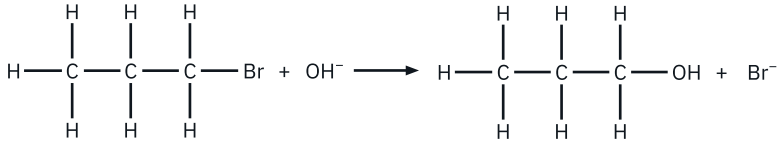
ALLOW *0.12 – 0.18 (i.e. ±0.03)*

DO NOT ALLOW $\frac{1.4}{10.1}$ *= 0.14*

10.1 measured from bottom of plate to solvent front



5(a)(ii)



✓

ALLOW *any combination of skeletal OR structural OR displayed formula as long as unambiguous*

DO NOT ALLOW *Missing H atoms*

DO NOT ALLOW *H_2O and HBr*

Question asks for alkaline hydrolysis

Correct balanced equation

ALLOW *OH^- above the arrow*

DO NOT ALLOW *if a CON reagent is present,*

e.g. an acid

For OH^- and Br^-

ALLOW *KOH and KBr OR NaOH and NaBr*

BUT **DO NOT ALLOW** K–OH

implies covalent bond

[1 mark]

DO NOT ALLOW *C_3H_7, i.e. C_3H_7Br OR C_3H_7OH*

Structure asked for in Question

IGNORE *connectivity, e.g.*

ALLOW



BUT **DO NOT ALLOW** —HO

5(a)(iii)

Difference

propan-1-ol/product/bottom spot is smaller

OR 1-chloropropane/reactant/top spot bigger ✓

Reasons

C–Cl bond is stronger than C–Br

AND

1-chloropropane reacts slower/is less reactive ✓

Use of propan-1-ol

shows formation of propan-1-ol

OR shows when reaction has finished

OR monitors course/progress of reaction ✓

[3 marks]

ALLOW ECF *and* ***ORA*** *throughout*

IGNORE *references to halogens as elements:*

i.e. chlorine is less reactive than bromine etc.

DO NOT ALLOW *chloride, bromide*

DO NOT ALLOW *1-chloropropane has larger bond enthalpy*

C–Cl bond required

IGNORE *1-chloroproane has different R_f value*

IGNORE *'as a control' OR 'as a comparison'*

..... with no further explanation

5(b)(i)

Green solution Cr^{3+} OR $[Cr(H_2O)_6]^{3+}$ ✓

Orange solution $Cr_2O_7^{2-}$ ✓

Formulae **AND** charges must be correct

[2 marks]

Green solution

IGNORE *H^+*

ALLOW *$Cr_2(SO_4)_3$ OR $CrCl_3$ OR Cr^{+3}*

Orange solution

IGNORE *H^+*

ALLOW *$K_2Cr_2O_7$ OR $Na_2Cr_2O_7$*

DO NOT ALLOW *Cr^{6+}*

ALLOW *1 mark for correct formulae but wrong way round*

5(b)(ii)

Level 3 (5–6 marks)

Reaches a comprehensive conclusion to determine possible correct structures for ALL of F, G, H and I

AND ALL functional groups of F, G, H and I

There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.

Indicative scientific points may include:

Identity of F, G, H and I showing CORRECT structures

Level 2 (3–4 marks)

Reaches a conclusion to determine possible correct structures for two of F, G, H and I

AND most functional groups of F, G, H and I

There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.

Level 1 (1–2 marks)

Reaches a simple conclusion to determine a possible correct structure for one of F, G, H and I

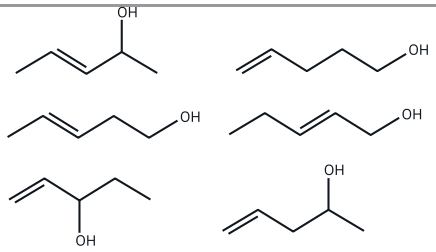
OR some functional groups of F, G, H and I

There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.

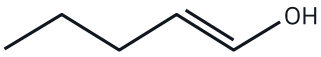
0 marks No response or no response worthy of credit.

[6 marks]

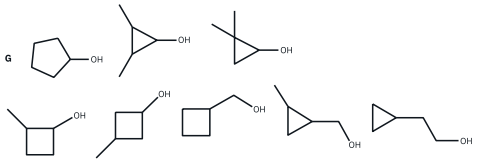
F



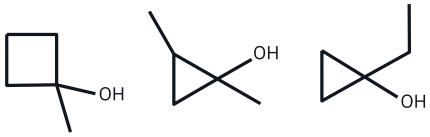
ALLOW *enols for F, e.g.*



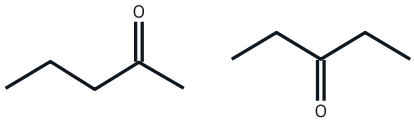
G



For G, **DO NOT ALLOW** tertiary –OH. e.g.



H



I



IGNORE *names, even if incorrect*

For communication, a typical 'logical structure' would link functional groups to SOME of the test results,

e.g.

2,4-DNP

H and I have carbonyl group/aldehyde or ketone

$H^+/Cr_2O_7^{2-}$

F, G and I are primary or secondary alcohols or aldehydes

Bromine

F is unsaturated/has C=C

Tollens

I is aldehyde

Correct functional groups may be shown in correct structures

Q4 · June 2025 · Paper 2 (Synthesis and analytical techniques) · Q14 · [1 mark]

Answer: **B**

Only 1 and 2

Q5 · June 2025 · Paper 2 (Synthesis and analytical techniques) · Q22 · [6 marks]

OCR MARK SCHEME

22(a)(i)

Calculation of R_f values

$R_f = \frac{34.5}{46} = 0.75$

AND

$R_f = \frac{11.5}{46} = 0.25$ ✓

[1 mark]

EXAMINER GUIDANCE

ALLOW *±1 mm on each measurement, i.e.*

$R_f = 0.71 – 0.79$

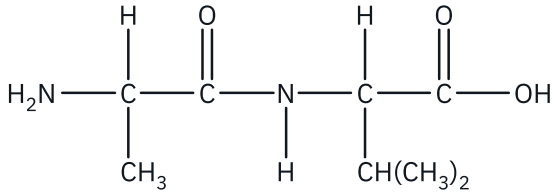
$R_f = 0.22 – 0.28$

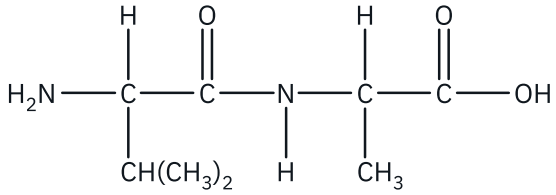
ALLOW *values that round to 2dp to give a value in the acceptable range*

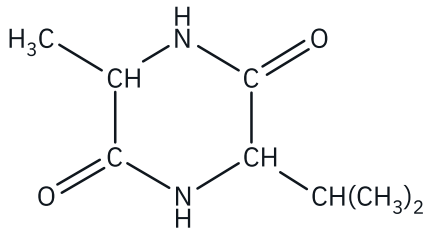
Working is not required

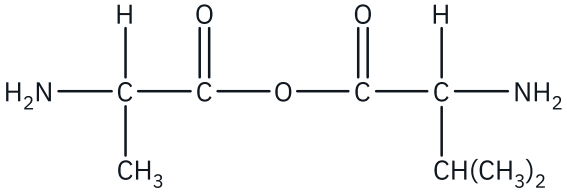
22(a)(ii)

Any 2 from the following: ✓✓









[2 marks]

ALLOW *any combination of skeletal* ***OR*** *structural* ***OR*** *displayed formula as long as unambiguous*

IGNORE *connectivity*

Check structures carefully to ensure they are different from each other

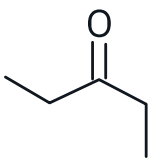
ALLOW ECF *from wrong R_f values in 22a(i)*

R group should be consistent with R_f values however **ALLOW ECF** if incorrect R group is repeated in second structure

ALLOW ECF *for one small slip e.g. missing H on NH group*

22(b)(i)

Pentan-3-one



✓

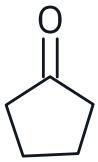
Cyclopentanone

ALLOW *any combination of skeletal* ***OR*** *structural* ***OR*** *displayed formula as long as unambiguous*

IGNORE *non-organic products e.g. CO_2,*

O=C=O

, H_2O etc



✓

[2 marks]

22(b)(ii)

Mark is for a clear description of the relative positions of the C=O/ketone and carboxylic acid/COOH in alpha and beta keto acids

Alpha-keto acids:

ketone/C=O is adjacent/next/bonded to carboxylic acid/COOH

AND

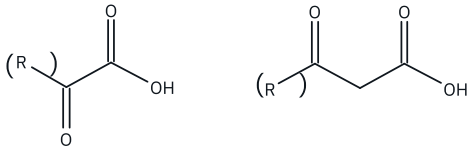
Beta-keto acids:

ketone/C=O two carbons away from carboxylic acid/COOH ✓

OWTTE

[1 mark]

ALLOW *labelled structures e.g.*



Alpha-keto acids:

ALLOW *ketone/C=O is on the adjacent C to the carboxylic acid//COOH (matches alpha amino acid description)*

ALLOW *Bonded to the same C*

Beta-keto acids:

ALLOW *ketone/C=O on 3rd carbon (from COOH)*

ALLOW *has carbon in-between functional groups*

IGNORE *bonded to different C (must be specific)*

Alternative approach – comparison of decomposition

ALLOW *alpha keto acids decompose to form an aldehyde and beta keto acids form a ketone OWTTE*

Q6 · November 2020 · Paper 2 (Synthesis and analytical techniques) · Q13 · [1 mark]

Answer: **A**

1, 2 and 3

Q7 · November 2021 · Paper 2 (Synthesis and analytical techniques) · Q10 · [1 mark]

Answer: **A**

0.25

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