

OCR A-Level Chemistry A

Chromatography and functional group tests

Questions only

All 7 chromatography and functional group tests questions

Questions

7

Total marks

35

Time allowed

47 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	2017 P3 Q5	12	
2	2024 P2 Q13	1	
3	2024 P3 Q5	13	
4	2025 P2 Q14	1	
5	2025 P2 Q22	6	
6	2020 P2 Q13	1	
7	2021 P2 Q10	1	

Total _____ / 35 Percentage _____ %

Questions from OCR past papers, 2017–2025, reproduced for revision. Practise these topics online, with instant marking:

whiteboardchemistry.com/revision/exam-questions/ocr-a-level-chemistry/?topics=chromatography-and-functional-group-tests&len=0

Questions

Chromatography and functional group tests · 7 questions · 35 marks · time allowed 47 min

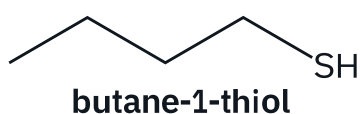
Q1 · June 2017 · Paper 3 (Unified chemistry) · Q5 · [12 marks]

This question also needs Acids, bases and buffers, Basic concepts of organic chemistry and Carbonyls, carboxylic acids and esters.

This question is about organic molecules that have a strong smell.

Thiols are foul-smelling, organic sulfur compounds with the functional group -SH .

Butane-1-thiol, shown below, contributes to the strong smell of skunks.



5(a)(i) Thiols are weak acids.

Write the expression for the acid dissociation constant, K_a , for butane-1-thiol.

[1 mark]

5(a)(ii) Thiols react with carboxylic acids to form thioesters.

Write an equation for the reaction of butane-1-thiol with ethanoic acid.

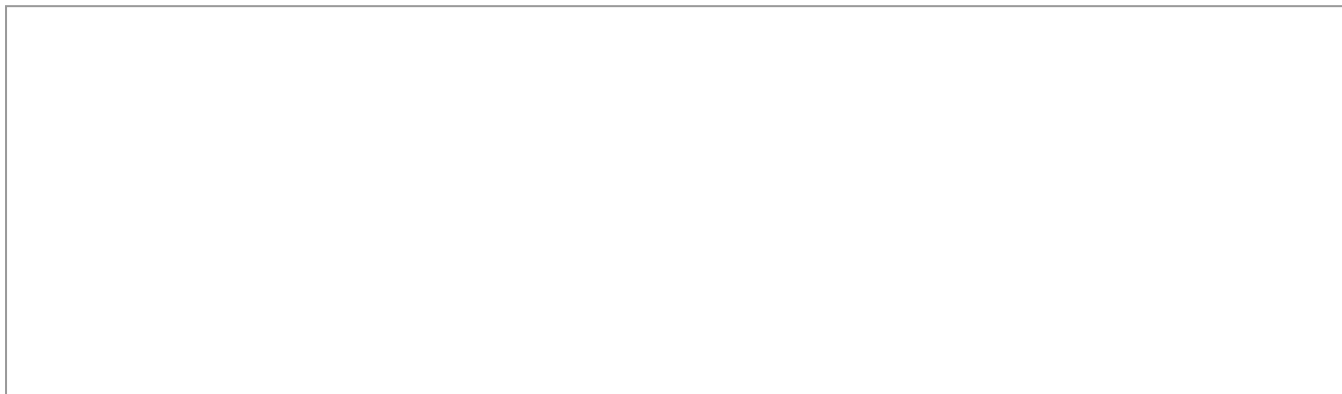
Use structures for all organic compounds with the functional groups clearly displayed.

[2 marks]

5(a)(iii) When beer is exposed to light, 3-methylbut-2-ene-1-thiol is formed, which gives an unpleasant smell and flavour to the beer.

Draw the skeletal formula for 3-methylbut-2-ene-1-thiol.

[1 mark]



5(a)(iv) Propane-1,3-dithiol reacts with carbonyl compounds in a condensation reaction to form a cyclic organic sulfur product.

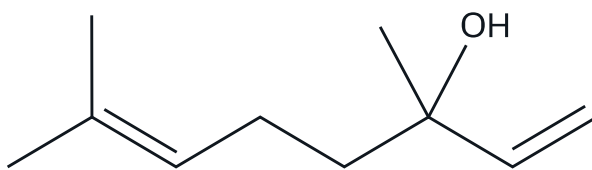
Write an equation for the reaction of propane-1,3-dithiol with propanone.

Use structures for organic compounds.

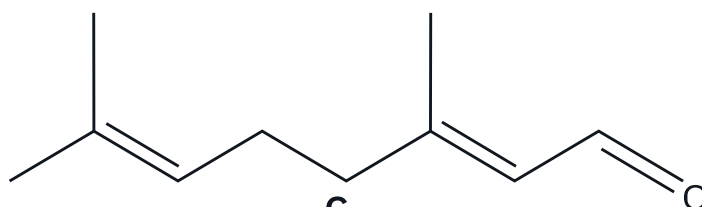
[2 marks]



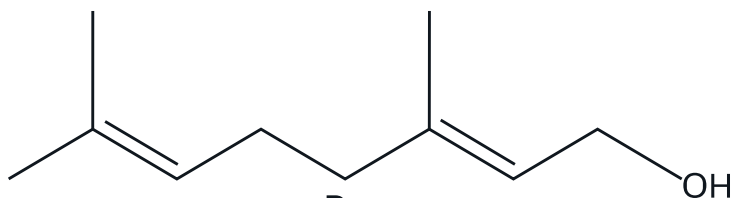
5(b) The structures for six naturally occurring organic compounds with pleasant smells, B–G, are shown below. The common names in brackets relate to their source and smell.



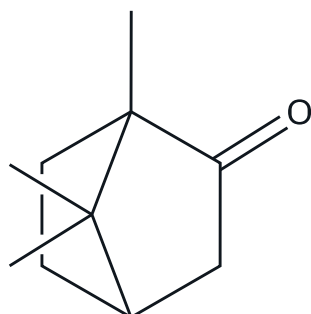
B
(linalool)



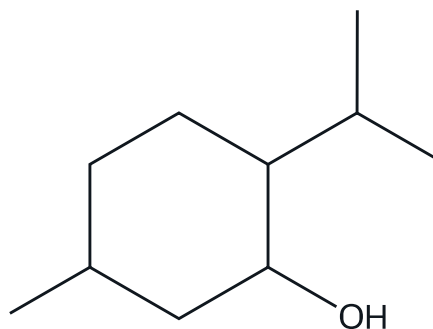
C
(citral)



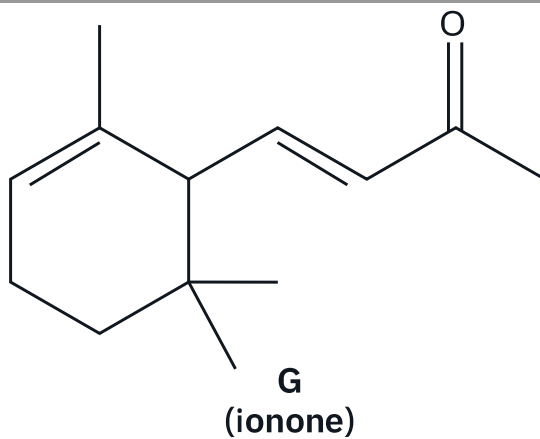
D
(geraniol)



E
(camphor)



F
(menthol)



Explain how chemical tests would allow each compound to be distinguished from the other compounds.

In your answer, include essential details for all test procedures and observations.

Details of apparatus and quantities are not required.

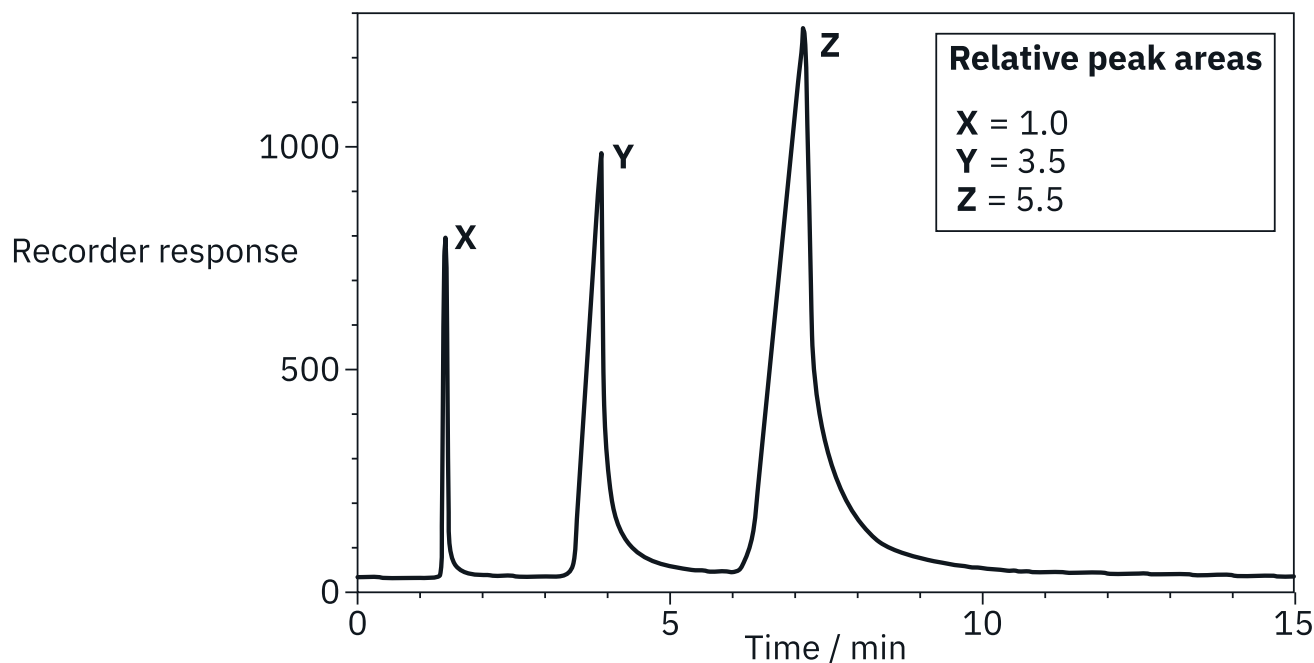
[6 marks]

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

A sample containing a mixture of 3 components, X, Y and Z, is analysed using gas chromatography.

The gas chromatogram below is obtained.

The relative peak areas of X, Y and Z are included.



Which statement(s) is/are true?

- 1 The peak for component X shows the mass of one mole.
- 2 Component Y stays in the column for longer than component X.
- 3 Component Z consists of more than half of the sample.

Tick (✓) one box.

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

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

This question also needs Alcohols and haloalkanes.

This question is about the analysis of organic compounds.

A student investigates the alkaline hydrolysis of 1-bromopropane as outlined below.

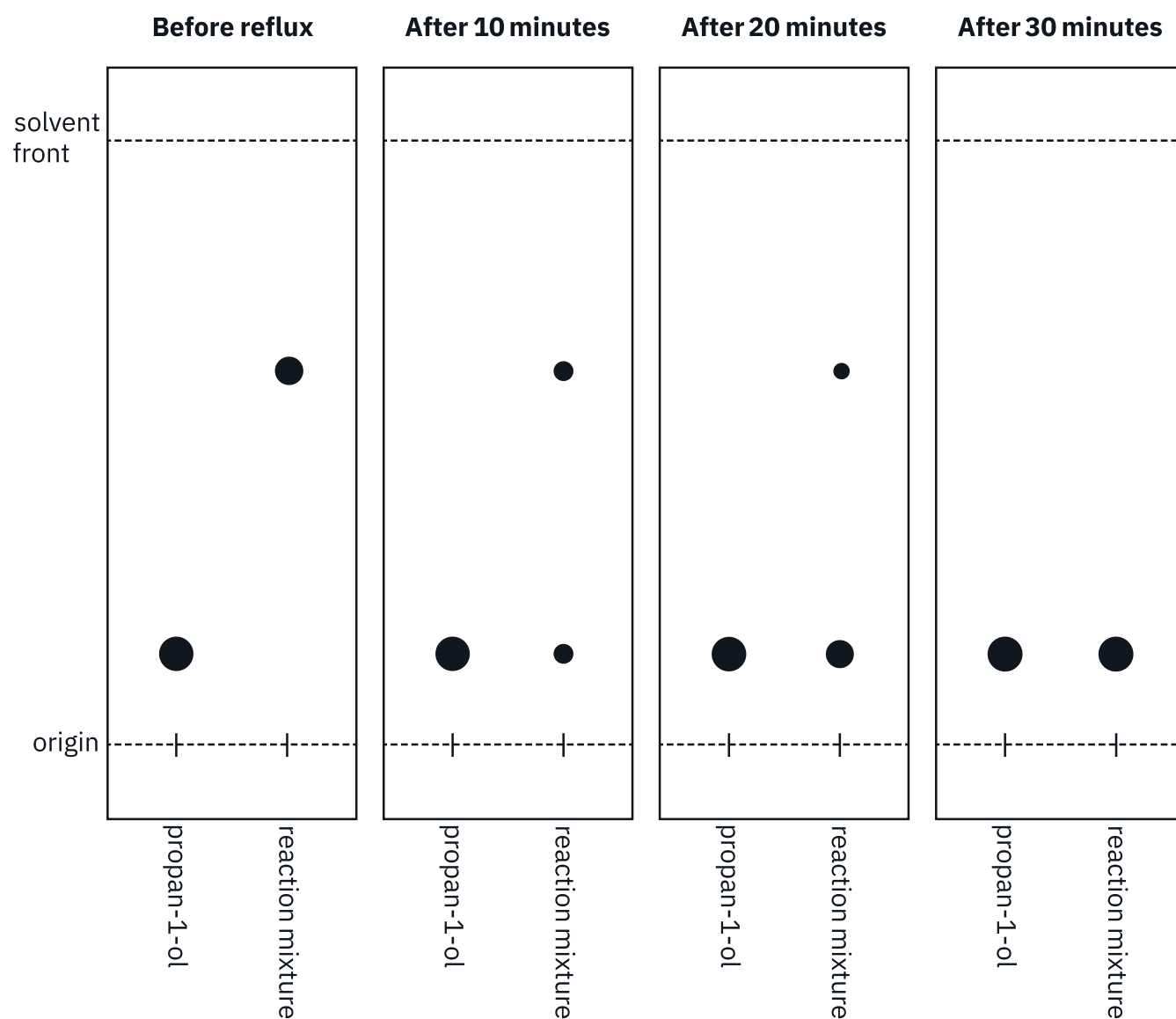
Step 1 The student adds 1-bromopropane to an excess of aqueous potassium hydroxide, KOH(aq), in a pear-shaped flask.

Step 2 A TLC chromatogram is run using propan-1-ol and the reaction mixture.

Step 3 The reaction mixture is refluxed.

A TLC chromatogram of the reaction mixture is run every 10 minutes.

The TLC chromatograms are shown below.



5(a)(i) Determine the R_f value of propan-1-ol.

Show your working.

$R_f =$

[1 mark]

5(a)(ii) Write an equation for the alkaline hydrolysis of 1-bromopropane.

Show structures of organic compounds.

[1 mark]

5(a)(iii) A student investigates the alkaline hydrolysis of 1-chloropropane using the same method as for 1-bromopropane.

Predict, with reasons, how the appearance of the reaction mixture in the chromatogram produced after 20 minutes would be different when 1-chloropropane is used instead of 1-bromopropane.

Suggest why propan-1-ol is run alongside the reaction mixture.

[3 marks]

Compounds F, G, H and I are structural isomers.

A student carries out test-tube tests on the compounds.

The student records the observations after carrying out each test.

These are shown in Table 5.1.

In Table 5.1, 2,4-dinitrophenylhydrazine has been abbreviated to 2,4-DNP.

Table 5.1

Test				
Compound	2,4-DNP	Acidified dichromate(VI) reflux	Bromine water	Tollens' reagent
F	Orange solution	Green solution	Colourless solution	Colourless solution
G	Orange solution	Green solution	Orange solution	Colourless solution
H	Orange precipitate	Orange solution	Orange solution	Colourless solution
I	Orange precipitate	Green solution	Orange solution	Silver mirror

5(b)(i) Write the formula of the species causing the colours after refluxing with acidified dichromate(VI).

[2 marks]

Green solution

Orange solution

5(b)(ii) The student is provided with further information about compounds F–I.

- They all have the molecular formula $C_5H_{10}O$.
- One of the compounds is alicyclic.
- The other compounds are unbranched.

Use this further information and the student's observations in Table 5.1 to answer the following.

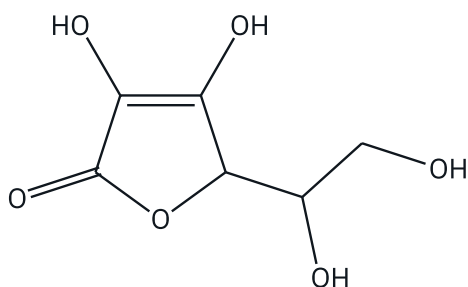
- How do the observations provide evidence for the possible functional groups in compounds F–I?
- Suggest a possible structure for each of the compounds F–I.

Show your reasoning.

[6 marks]

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

The structure of vitamin C is shown.



Which reagent(s) will react with vitamin C?

- 1 Aqueous bromine water
- 2 Acidified potassium dichromate(VI)
- 3 Aqueous silver nitrate in ethanol

Tick (✓) one box.

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

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

This question also needs Amines, amino acids and polymers.

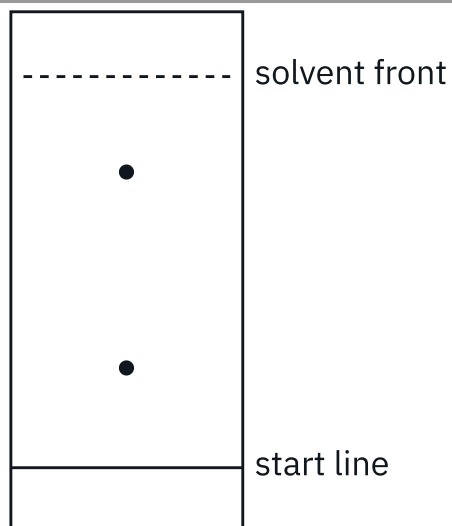
This question is about organic acids.

α -Amino acids have the general formula $\text{RCH}(\text{NH}_2)\text{COOH}$.

Compound S is made of two α -amino acids bonded together.

Compound S is hydrolysed into its component α -amino acids.

The resulting mixture is analysed using TLC to produce a chromatogram:



The R group and the R_f value is shown for some α -amino acids.

R group	R_f value
-H	0.18
-CH ₃	0.25
-CH ₂ CH(CH ₃) ₂	0.64
-CH(CH ₃) ₂	0.77

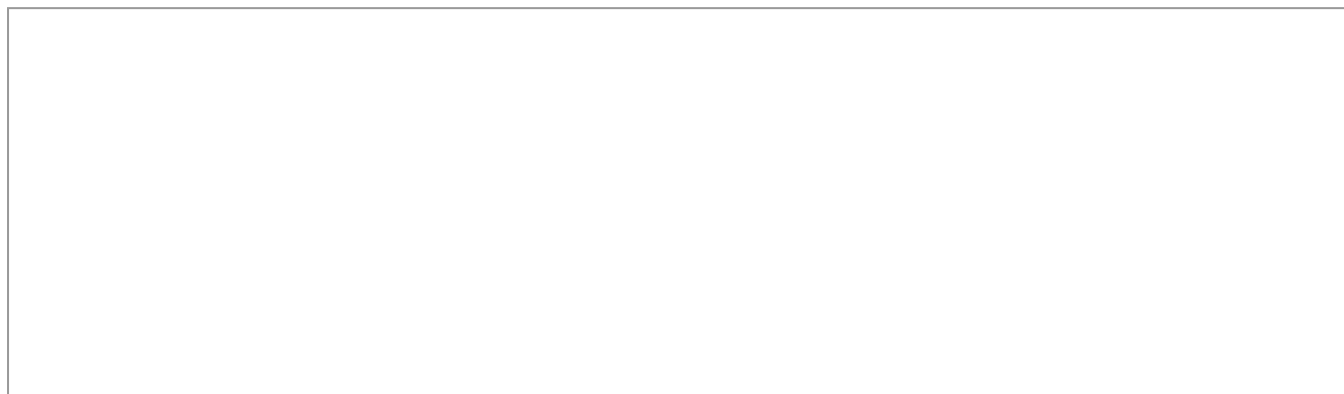
22(a)(i) Determine the R_f values of the **two** α -amino acids in the chromatogram.

[1 mark]

22(a)(ii) Compound S has **two** possible structures.

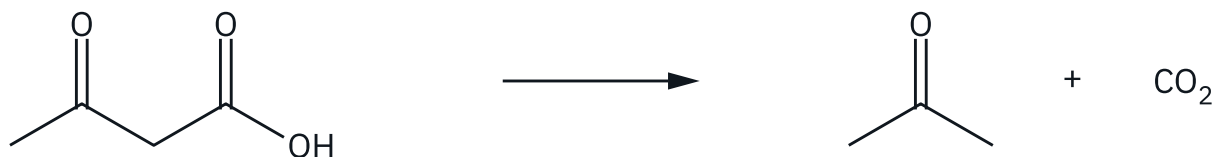
Draw both of these structures.

[2 marks]

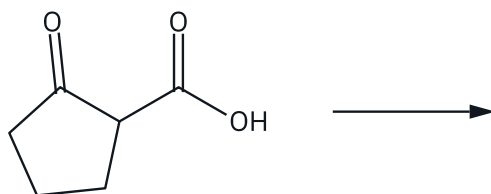
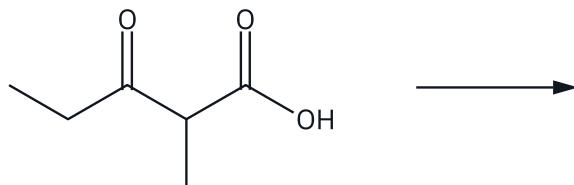


This part is about compounds called β -keto acids.

The equation shows the decomposition of a β -keto acid.



22(b)(i) Draw the structures of the organic products you would expect from the decomposition of the **two** other β -keto acids below.



[2 marks]

22(b)(ii) α -Amino acids have the NH_2 group bonded to the carbon atom adjacent to the carboxylic acid group.

Suggest the difference between an α -keto acid and a β -keto acid.

[1 mark]

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

Which statement(s) is/are correct for gas chromatography?

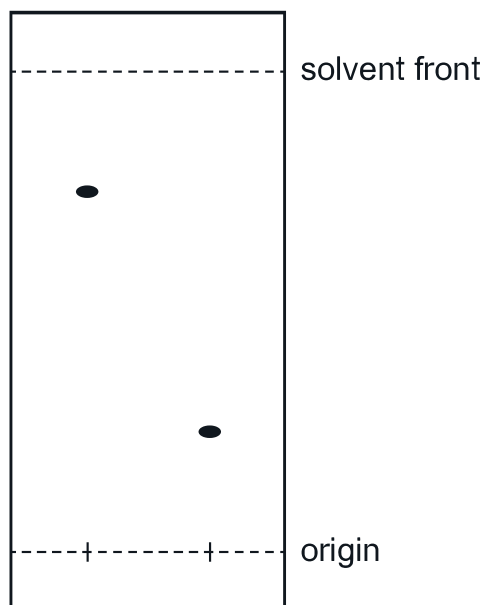
- 1 The components in a mixture can be identified from their retention time.
- 2 The relative peak areas give the proportions of components in a mixture.
- 3 Calibration curves are used to confirm the concentrations of components in a mixture.

Tick (✓) one box.

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

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

A TLC chromatogram for two compounds is shown below.



What is the R_f value for the compound that is most strongly adsorbed onto the stationary phase?

Tick (✓) one box.

- ☐ **A** 0.25
- ☐ **B** 0.33
- ☐ **C** 0.69
- ☐ **D** 0.78

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Mark scheme:

whiteboardchemistry.com/revision/exam-questions/ocr-a-level-chemistry/pdf/chromatography-and-functional-group-tests-mark-scheme.pdf