A' Level Chemistry

Year 2

Unit 20: Chromatography

Summer Examination Revision Pack

The questions in this pack should be attempted **AFTER** completing all other revision.

Grade Accelerator

Recall Definitions
Drawing Diagrams
Using Equations
Drawing Graphs

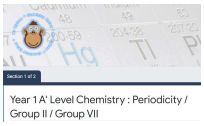
Quizlet

Quizlet Classes

Flashcard Based
Games
Tests & Quizzes
Keyword Spell Checker

Condensed Notes

Keywords & Definitions
Key Concepts
Application
Key Skills



Online Forms

Take Time to Answer
Use Paper & Calculator
Work It Out
Review Missed Marks

Use the 3 Wave Process when completing these revision packs.

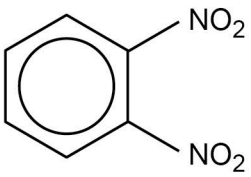
1. Complete the questions without assistance
(Can't answer a question? Leave it and move on)
2. Use your notes to fill any gaps after step 1
3. Use the mark scheme to fill in any remaining gaps.

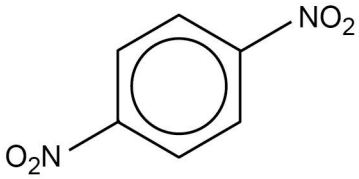
1. Having gaps after step 1 is normal, that's why we are doing revision!
2. If your notes don't help during step 2, they are not good enough!
(Change your note taking method and try to understand the problem)
3. If you don't understand why the mark scheme answer is correct, **see Andy.**

If you struggle with the questions in the pack, **STOP!** and complete some more revision.

If you come to a complete dead-end, **STOP!** and speak to **Andy** asap.

0 8 . 3 The dinitrobenzenes shown were investigated by thin layer chromatography (TLC).

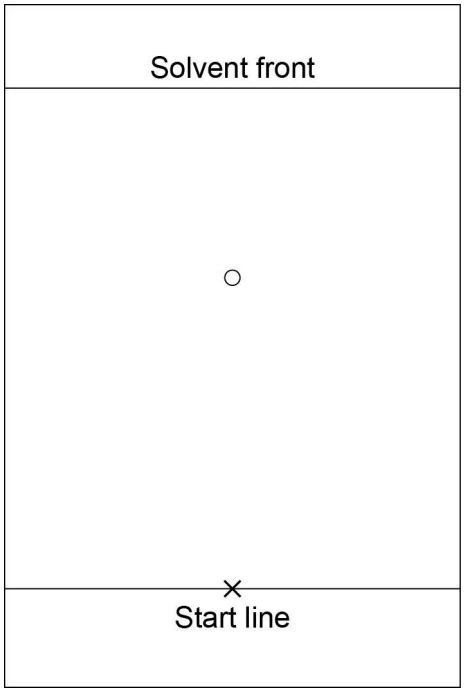




In an experiment, carried out in a fume cupboard, a concentrated solution of pure 1,4-dinitrobenzene was spotted on a TLC plate coated with a solid that contains polar bonds. Hexane was used as the solvent in a beaker with a lid.

The start line, drawn in pencil, the final position of the spot and the final solvent front are shown on the chromatogram in **Figure 3**

Figure 3



Use the chromatogram in **Figure 3** to deduce the R_f value of 1,4-dinitrobenzene in this experiment.

Tick (✓) **one** box.

[1 mark]

A 0.41 ☐

B 0.46 ☐

C 0.52 ☐

D 0.62 ☐

0 8 . 4 State in general terms what determines the distance travelled by a spot in TLC.

[1 mark]

0 8 . 5 To obtain the chromatogram, the TLC plate was held by the edges and placed in the solvent in the beaker in the fume cupboard. The lid was then replaced on the beaker.

Give one other practical requirement when placing the plate in the beaker.

[1 mark]

0 8 . 6 A second TLC experiment was carried out using 1,2-dinitrobenzene and 1,4-dinitrobenzene. An identical plate to that in Question **8.3** was used under the same conditions with the same solvent. In this experiment, the R_f value of 1,4-dinitrobenzene was found to be greater than that of 1,2-dinitrobenzene.

Deduce the relative polarities of the 1,2-dinitrobenzene and 1,4-dinitrobenzene and explain why 1,4-dinitrobenzene has the greater R_f value.

[2 marks]

Relative polarities

Explanation

0 8 . 7 A third TLC experiment was carried out using 1,2-dinitrobenzene. An identical plate to that in Question **8.3** was used under the same conditions, but the solvent used contained a mixture of hexane and ethyl ethanoate.

A student stated that the R_f value of 1,2-dinitrobenzene in this third experiment would be greater than that of 1,2-dinitrobenzene in the experiment in Question **8.6**

Is the student correct? Justify your answer.

[2 marks]

12

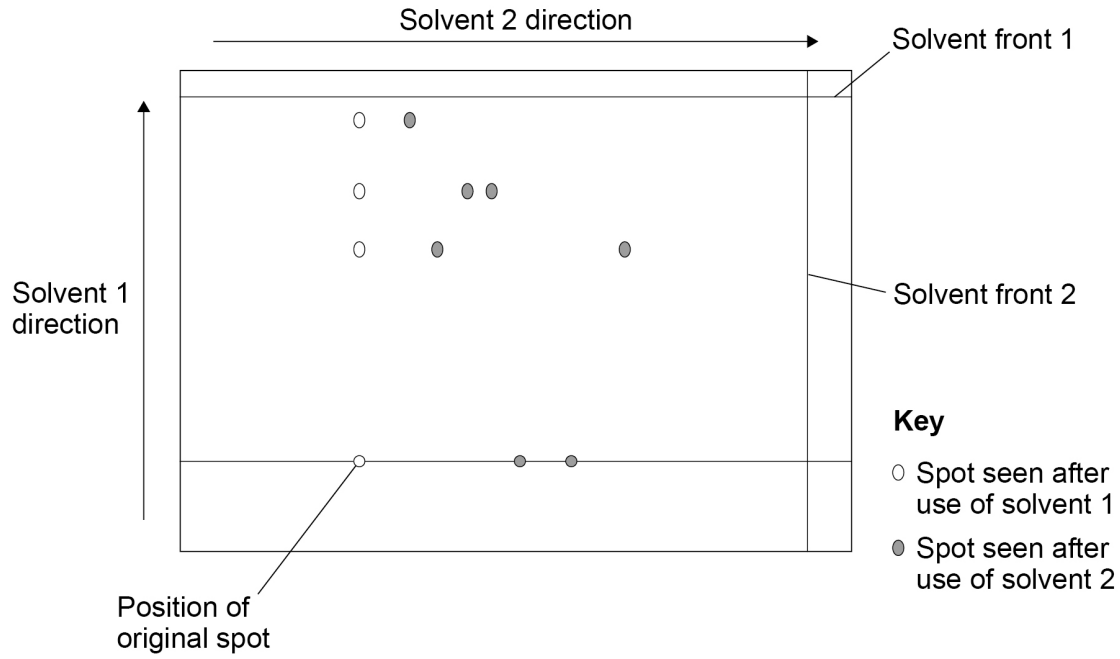
08.3	D	1	
08.4	(Balance between) solubility in moving phase and retention by stationary phase	1	OR (relative) affinity for stationary/solid and mobile/liquid/solvent (phase)
08.5	Solvent depth must be below start line	1	Ignore safety
08.6	1,2- is more polar **OR** 1,4- is less polar **OR** 1,2 is polar, 1,4- is non-polar 1,4- (or Less/non polar is) less attracted to (polar) plate / stationary phase / solid **OR** (Less/non polar is) more attracted to / more soluble in (non-polar) solvent / mobile phase / hexane	1 1	M2 dependent on correct M1 If M1 is blank then read explanation for possible M1 and M2 Allow converse argument for 1,2
08.7	No CE = 0 Yes - mark on but there is **NO MARK FOR YES** Solvent (more) polar or ethyl ethanoate is polar Polar isomer more attracted to / more soluble in / stronger affinity to the solvent (than before)	 1 1	Mark independently following yes Penalise bonded to mobile phase in M2
Total		**12**	

Do not write outside the box

0 9 This question is about thin-layer chromatography (TLC).

- A protein was hydrolysed to form a mixture of amino acids.
- A spot of this mixture was added to a TLC plate and the plate placed vertically in a small volume of solvent 1.
- When the solvent front reached nearly to the top of the plate, the plate was removed and allowed to dry.
- The plate was turned anticlockwise through 90° and placed vertically in a small volume of solvent 2.
- When the solvent front reached nearly to the top of the plate, the plate was again removed and allowed to dry.
- **Figure 2** shows the final TLC plate.

Figure 2



0 9 . 1 Suggest a suitable reagent for the hydrolysis of a protein.

[1 mark]

Do not write outside the box

0 9 . 2 Suggest how the positions of the amino acids on the TLC plate were located.

[1 mark]

0 9 . 3 Deduce the minimum number of amino acids present in the original mixture.

[1 mark]

0 9 . 4 Suggest why it was necessary to use two different solvents.

[1 mark]

4

Turn over for the next question

Question	Answers	Additional Comments/Guidelines	Mark
09.1	Conc HCl	Allow concentrations of 5M or higher Allow conc sulfuric or conc strong alkalis	1
09.2	Using ninhydrin or ultraviolet light	Allow I_2 (vapour)	1
G 09.3	7 or seven		1
09.4	Some of the amino acids did not separate/dissolve with the first/either solvent **OR** Some amino acids have the same Rf value or have the same affinity with the first/either solvent	Not amino acids have different Rf values in different solvents	1

Do not write outside the box

0 2 The protein fibroin can be broken down into amino acids using an enzyme.

0 2 . 1 A student uses thin-layer chromatography (TLC) to identify these amino acids.

The student identifies two of the amino acids as alanine and serine.

Use **Figure 3** to calculate the R_f value of the unknown amino acid**.**
Show your working.

Use your R_f value and **Table 1** to identify the unknown amino acid.

[2 marks]

Figure 3

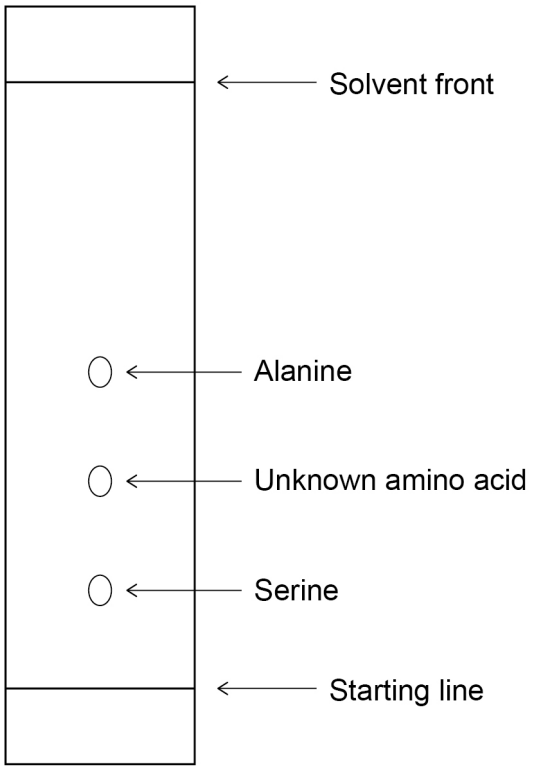


Table 1

Amino acid	**R_f value**
tyrosine	0.25
glycine	0.34
valine	0.64
leucine	0.73

R_f value _____

Identity _____

Do not write outside the box

0 2 . 2 The amino acids cannot be seen as they move during the experiment.

State how the amino acids can be made visible at the end of the experiment.

[1 mark]

0 2 . 3 State why each amino acid has a different R_f value.

[1 mark]

4

Turn over for the next question

Question	Answers	Additional comments/Guidelines	Mark
2.1	**M1** $\frac{27}{80} = 0.34$ **M2** glycine	**M1** some relevant working is needed to arrive at 0.325 - 0.35 no ECF based on **M1**	1 1

Question	Answers	Additional comments/Guidelines	Mark
2.2	use uv lamp or ninhydrin	**allow** developing / locating agent / iodine	1

Question	Answers	Additional comments/Guidelines	Mark
2.3	each amino acid has different (relative) affinity/attraction to/solubility in stationary and mobile phases	**allow** reference to different solubility in solvent OR different affinity for stationary phase	1