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CHEMISTRY

ORGANIC CHEMISTRY II

Level & Board	AQA (A-LEVEL)
TOPIC:	CHROMATOGRAPHY
PAPER TYPE:	QUESTION PAPER - 2
TOTAL QUESTIONS	10
TOTAL MARKS	33

Chromatography - 2

1. A chemist discovered unlabelled bottles of liquid, each of which contained a different pure organic compound.

The compounds were known to be propan-1-ol and propanal.

Describe different test-tube reactions, one for each compound, that could be used to identify the organic compounds.

Your answer should include the name of the organic compound, the reagent(s) used and the expected observation for each test.

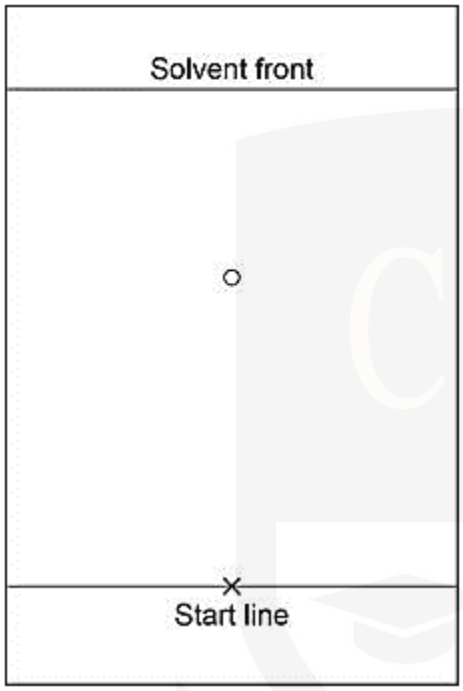
(4)

2. 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 the diagram below



(a) Use the chromatogram in the diagram above to deduce the R_f value of 1,4-dinitrobenzene in this experiment.

A. 0.41
B. 0.46
C. 0.52
D. 0.62

(1)

(b) 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)

3. Why is it important to run standard compounds alongside unknown samples in chromatography?

(3)

4. This question is about nitrobenzenes.

(a) Nitrobenzene reacts when heated with a mixture of concentrated nitric acid and concentrated sulfuric acid to form a mixture of three isomeric dinitrobenzenes.

Write an equation for the reaction of concentrated nitric acid with concentrated sulfuric acid to form the species that reacts with nitrobenzene.

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(1)

(b) Name and outline a mechanism for the reaction of this species with nitrobenzene to form 1,3-dinitrobenzene.

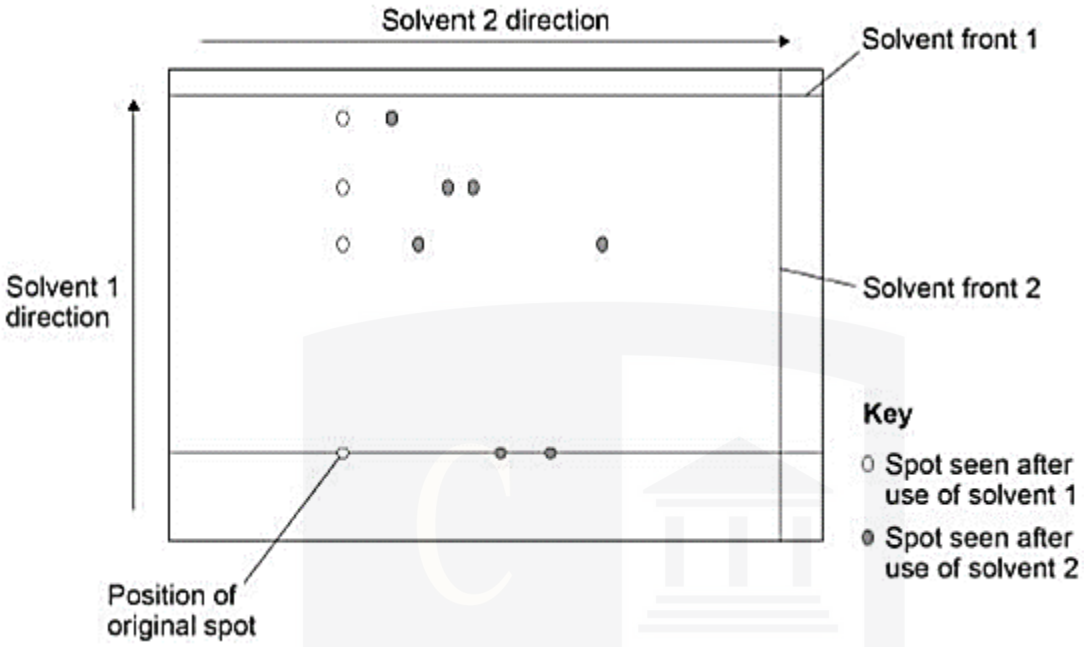
(4)

(c) State in general terms what determines the distance travelled by a spot in TLC.

(1)

5. 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.
- The diagram shows the final TLC plate.



(a) Suggest a suitable reagent for the hydrolysis of a protein.

(1)

(b) Suggest how the positions of the amino acids on the TLC plate were located.

(1)

(c) Deduce the minimum number of amino acids present in the original mixture.

(1)

(d) Suggest why it was necessary to use two different solvents.

(1)

6. What does the stationary phase mean?

(2)

7. A chemist discovered unlabelled bottles of liquid, each of which contained a different pure organic compound.

The compounds were known to be propanoic acid and 1-chloropropane.

Describe different test-tube reactions, one for each compound, that could be used to identify the organic compounds.

Your answer should include the name of the organic compound, the reagent(s) used and the expected observation for each test.

(4)

8. What precautions should be taken when applying the sample to the TLC plate to ensure accurate results?

(3)

9. Define R_f value and retention time used in chromatography.

(2)

10. Chromatography is a versatile technique that may be used to separate and identify compounds.

(a) Name a type of chromatography that is used to separate and identify dissolved substances.

(1)

(b) State what quantitative value may be determined from the chromatogram to identify the substances present in the solution.

(1)

(c) Sketch a chromatogram to show how the value is determined.

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(1)

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