



CHEMISTRY ONLINE
— **TUITION** —

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CHEMISTRY

ORGANIC CHEMISTRY II

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

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Chromatography - 2

1.

Propan-1-ol:

Reagent:

Acidified Potassium Dichromate

Observation:

Orange dichromate (VI) ions turn green.

Reagent:

Concentrated sulfuric acid

Observation:

Effervescence (bubbling) occurs.

Propanal:

Reagent:

Tollens' reagent (or Fehling's/Benedict's solution)

Observation:

A silver mirror forms.

Reagent: Brady's reagent or 2,4-dinitrophenylhydrazine (2,4-DNPH)

Observation: Formation of an orange or yellow precipitate.

(4)

2.

(a) D

(1)

(b)

The solvent depth must be below the start line (baseline) where the samples are spotted on the TLC plate.

This ensures that the solvent moves up the plate by capillary action, carrying the samples with it and allowing for proper separation of the

components based on their affinities to the stationary phase (the TLC plate) and the mobile phase (the solvent).

(1)

3.

Running standard compounds alongside unknown samples allows for accurate identification of the unknowns by comparing their R_f values or retention times to those of the known standards.

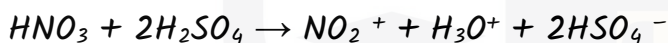
It also helps to ensure consistency and reliability in the chromatographic conditions.

(3)

4.

(a)

Equation:



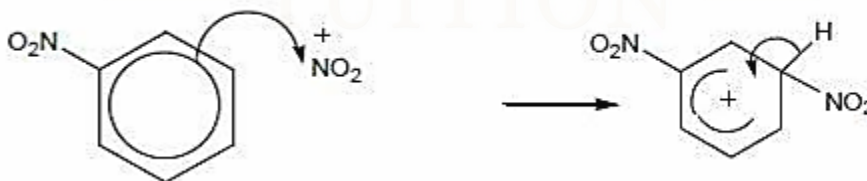
(1)

(b)

Name of the mechanism:

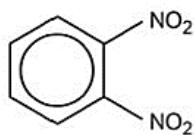
Electrophilic substitution (nitration)

Mechanism:



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Product:



(4)

(c)

The distance travelled by a spot in TLC is determined by the balance between its solubility in the mobile phase (solvent) and its retention by the stationary phase (solid).

(1)

5.

(a)

A suitable reagent for the hydrolysis of a protein is concentrated hydrochloric acid (HCl).

This strong acid is commonly used to break down proteins into their constituent amino acids during hydrolysis reactions.

(1)

(b)

The positions of the amino acids on the TLC plate were likely located using either ninhydrin or ultraviolet (UV) light visualization techniques.

(1)

(c)

There are seven minimum amino acids present in the original mixture.

(1)

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(d)

Two different solvents are necessary because some amino acids may not separate or dissolve with the first solvent, or they had the same R_f value or affinity with it.

(1)

6.

The stationary phase in chromatography is the fixed material that the mobile phase moves over or through, allowing separation of the mixture's components based on their interactions with this phase.

In TLC, it's typically a thin layer of silica gel or alumina on a plate.

(2)

7.

Propanoic Acid:

Reagent:

Sodium Bicarbonate (Sodium Hydrogen Carbonate)

Observation:

Effervescence (bubbling) occurs as propanoic acid reacts with sodium bicarbonate to release carbon dioxide gas.

1-Chloropropane:

Reagent:

NaOH, then acidified AgNO_3

Observation:

White precipitate forms.

(4)

8.

Following precautions should be taken when applying the sample to the TLC plate to ensure accurate results:

- Apply small, concentrated spots.
- Use a clean and dry plate.
- Ensure consistent spot size.

- Apply spots evenly and well-separated.
- Avoid overloading spots.
- Allow spots to dry completely.
- Mark a proper baseline above the solvent level.

(3)

9.

R_f value (Retention factor):

In chromatography, the R_f value is the ratio of the distance travelled by a compound to the distance travelled by the solvent front.

It is calculated as:

$$R_f = \frac{\text{Distance travelled by the compound}}{\text{Distance travelled by the solvent front}}$$

Retention time:

In chromatography, the retention time is the time taken for a compound to travel from the injection point to the detector within the chromatographic system.

It is used to help identify and quantify compounds in a mixture.

(2)

10.

(a)

Paper or thin-layer chromatography is used to separate and identify dissolved substances.

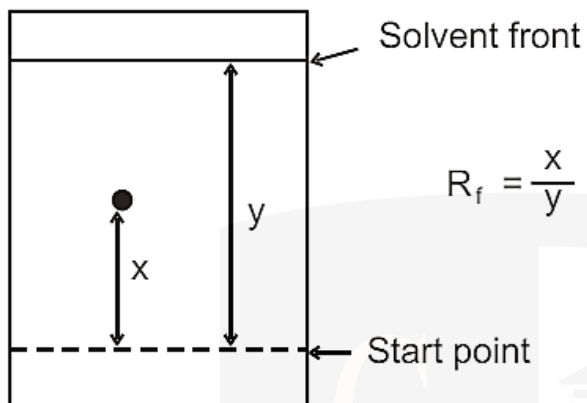
(1)

(b)

*The quantitative value that may be determined from the chromatogram to identify the substances present in the solution is the **R_f value** in Thin Layer Chromatography (TLC) or paper Chromatography.*

(1)

(c)



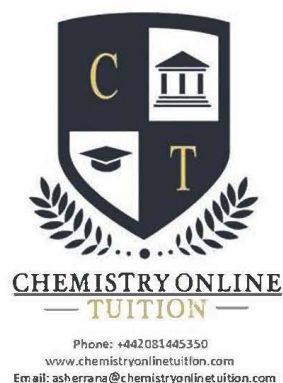
(1)

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