



## **Topic 4.1 Analytical methods in modern research.Chromatography.**

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# Outline

- ◆ **Introduction**
- ◆ **Main part**
  - ◆ **1. Qualitative analysis**
  - ◆ **2. Quantitative analysis**
    - ◆ physical methods of analysis;
    - ◆ classical methods of analysis;
    - ◆ physicochemical methods of analysis;
  - ◆ **3. Chromatography.**
- ◆ **Conclusion**
- ◆ **Literature**

# Introduction



The methods of analysis are divided into two group:

## **1. Qualitative analysis**

A qualitative analysis determines the presence or absence of a particular compound, but not the mass or concentration. By definition, qualitative analyses do not measure quantity.

## **2. Quantitative analysis**

Quantitative analysis is the measurement of the quantities of particular chemical constituents present in a substance.



# Physical methods of analysis

Physical methods of analysis involves the analysis, which is based on the measurement of the physical parameters of substances or solutions that are subjected to a specific study. This method has three directions.



# Physical methods of analysis

**Refractometry.** Its essence lies in measuring the values of the refractive index.

**Polarimetry.** In this case, the measurement of optical rotation indicators is performed.

**Fluorimetry.** This method helps to establish the intensity of emission of radiation.

This category is notable for its rapidity, low detection limit, objectivity of the data obtained and the possibility of process automation. The use of such methods is not always possible, since this requires the operation of complex equipment.





# Classical methods of analysis

This group also has its own classification. So, it is necessary to highlight the following methods:

**1.Gravimetric method.**

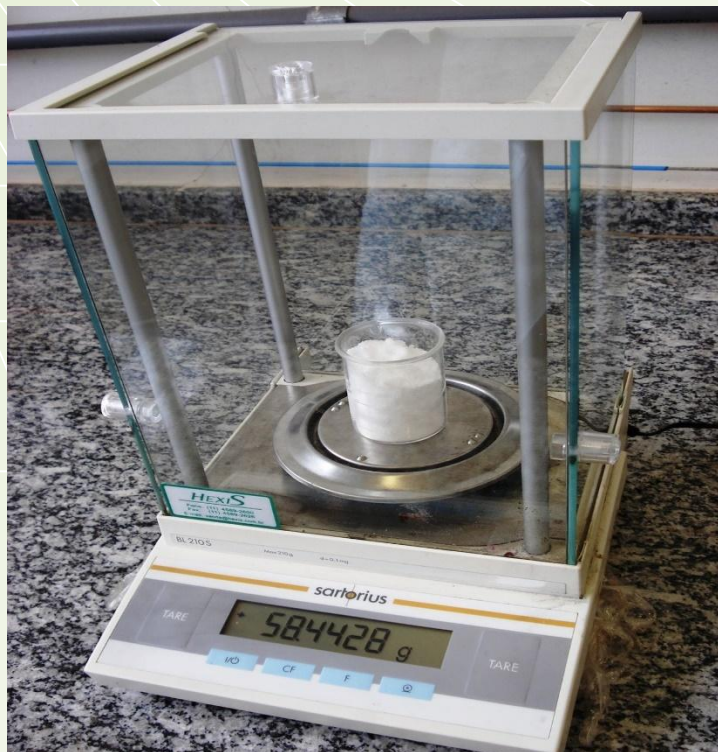
**2.Titrimetric or volumetric method.**

**3.Gas method.**



# Classical methods of analysis

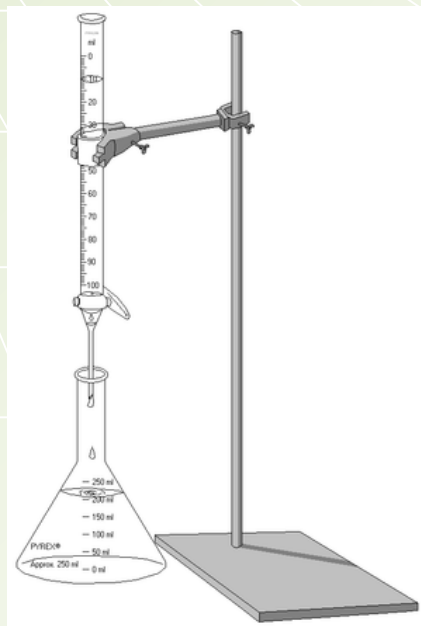
**Gravimetric analysis (gravimetry, weight analysis) is a method of quantitative chemical analysis based on the accurate measurement of the mass of a substance.**





# Classical methods of analysis

**Titrimetric analysis (titration)** is a method of quantitative / mass analysis, which is often used in analytical chemistry, based on measuring the volume of a reagent solution of a precisely known concentration, consumed for the reaction with an analyte.







# Physicochemical methods of analysis

In this case, the values of the physical parameters of the studied systems are measured, which appear or change in the course of chemical reactions. They have a low detection limit, but their execution speed is very high.

Almost all quantitative methods of analysis in chemistry require the use of certain instruments.

### 3. Chromatography.

## Chromatography

- **Chromatography** (from Greek *chroma* "color" and *graphein* "to write") is the collective term for a set of laboratory techniques for the separation of mixtures. The mixture is dissolved in a fluid called the *mobile phase*, which carries it through a structure holding another material called the *stationary phase*. The various constituents of the mixture travel at different speeds, causing them to separate. The separation is based on differential partitioning between the mobile and stationary phases.

# 3. Chromatography.



## PRINCIPLES

- Chromatography usually consists of mobile phase and stationary phase. The mobile phase refers to the mixture of substances to be separated dissolved in a liquid or a gas. The stationary phase is a porous solid matrix through which the sample contained in the mobile phase percolates. The interaction between the mobile phase and the stationary phase results in the separation of the compound from the mixture.



# 3. Chromatography.

## APPLICATIONS OF CHROMATOGRAPHY

- The chromatographic technique is used for the separation of amino acids, proteins & carbohydrates.
- It is also used for the analysis of drugs, hormones, vitamins
- Helpful for the qualitative & quantitative analysis of complex mixtures.
- The technique is also useful for the determination of molecular weight of proteins.

# 3. Chromatography.



## Types of Chromatography

- There are following types of Chromatography
  - Paper Chromatography
  - Thin Layer Chromatography(TLC)
  - Gel Chromatography
  - Column Chromatography
  - Ion Exchange Chromatography
  - Gel Filtration Chromatography
  - Gas Liquid Chromatography
  - Affinity Chromatography



# 3. Chromatography.

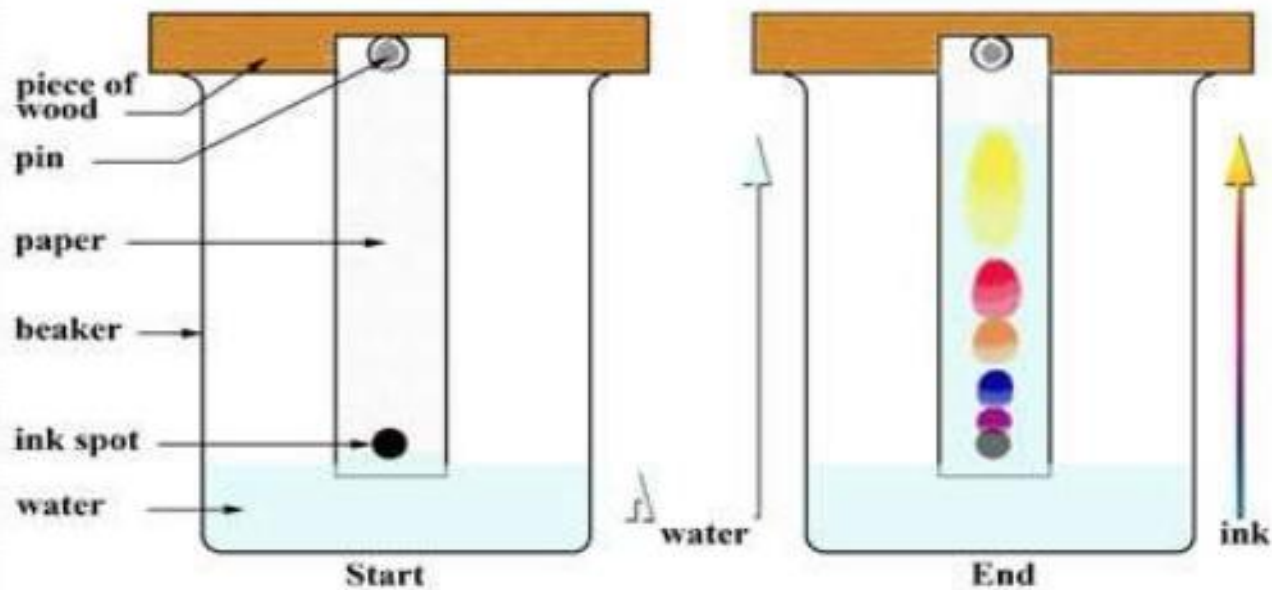


## Paper chromatography

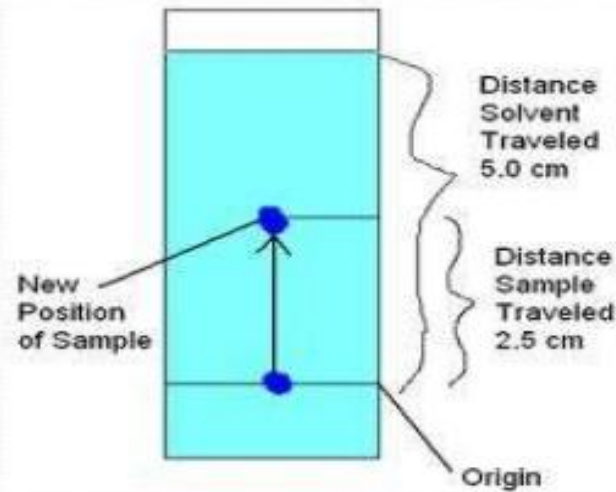
- Paper chromatography is a technique that involves placing a small dot or line of sample solution onto a strip of chromatography paper. The paper is placed in a jar containing a shallow layer of solvent and sealed. As the solvent rises through the paper, it meets the sample mixture, which starts to travel up the paper with the solvent.
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# 3. Chromatography.

## Simple chromatography



# 3. Chromatography.



# 3. Chromatography.

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

The  $R_f$  value helps for the identification of unknown.



# Questions for self control

**1. The analysis which determines the presence or absence of a particular compound, but not the mass or concentration.**

- A) Quantitative analysis
- B) Qualitative analysis

**2. The physical method of analysis which is based on intensity of emission of radiation.**

- A) Refractometry
- B) Polarimetry
- C) Fluorimetry

**3. The classical methods of analysis**

- A) Refractometry
- B) Polarimetry
- C) Fluorimetry
- D) Gravimetric method





# Questions for self control



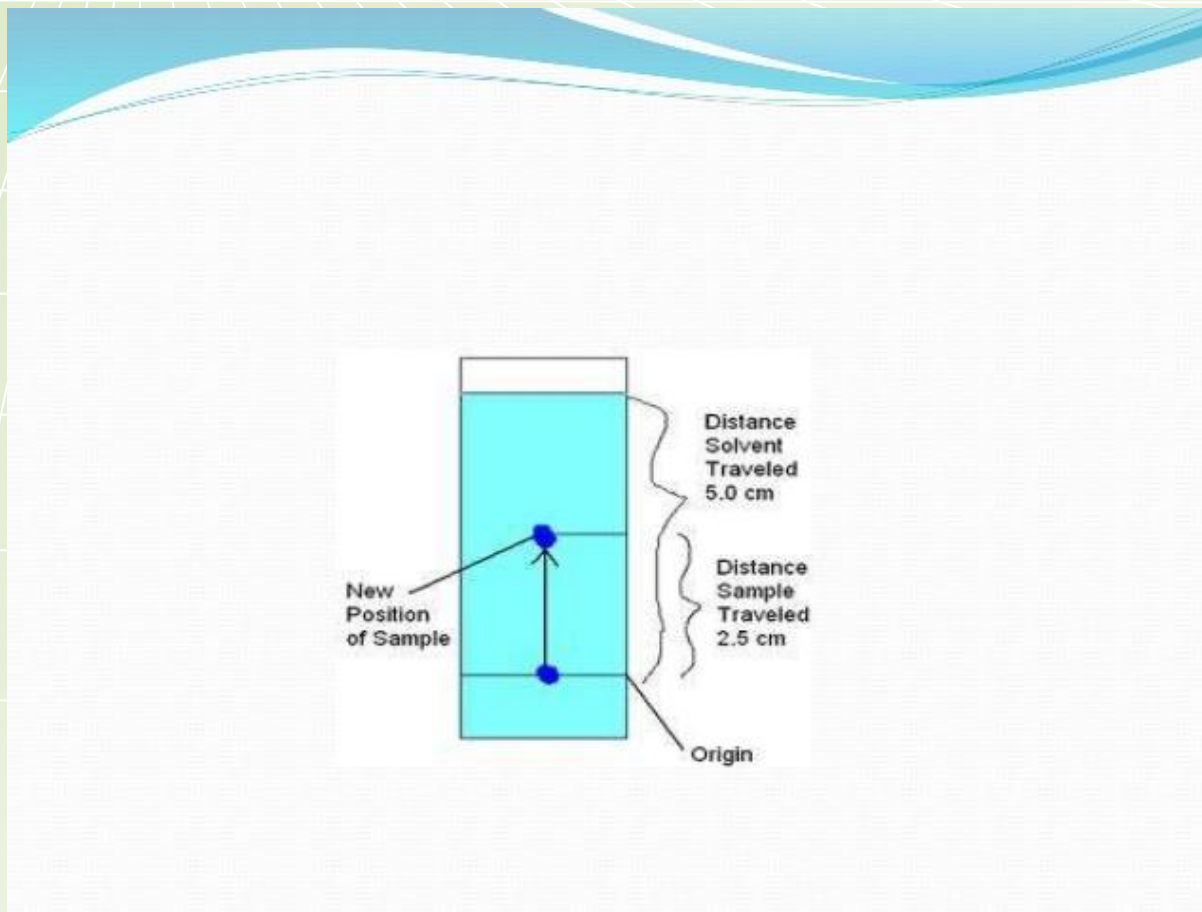
**4. In chromatography the mixture dissolved in a fluid is:**

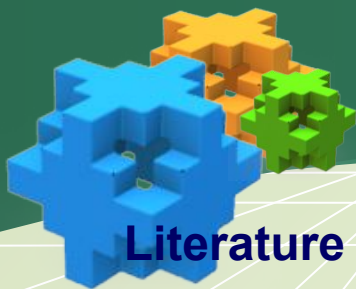
- A) stationary phase
- B) mobile phase



# Questions for self control

5. What is the  $R_f$  value of the chromatography shown in the picture?





## Literature

### 1. Basic literature :

1. Jenkins, Chemistry, ISBN 978-0-17-628930-0
2. Alberta Learning, Chemistry data booklet 2010, product №755115, ISBN 10645246
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## 2. Additional literature :

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4. Г.Джексембина «Методическое руководство» Алматы: Мектеп, 2015г
5. А.Темирболатова., А.Казымова., Ж.Сагымбекова «Книга для чтения» Мектеп 2015г.
6. Торгаева Э., Шуленбаева Ж. и др Химия.Электронный учебник.10-класс.2016 Национальный центр информатизации
7. Жакирова Н., Жандосова И. и др Химия.Электронный учебник.11-класс.2016 Национальный центр информатизации
8. Электронные ресурсы с [www.bilimland.kz](http://www.bilimland.kz)





**Do you have any questions?**

