



Al-Mustaqbal University

College of Science

Forensic Evidence Department



جامعة المستقبل  
AL MUSTAQBAL UNIVERSITY

## كلية العلوم قسم الادلة الجنائية

المحاضرة الاولى

**Analytical Chemistry**

المادة : كيمياء تحليلية

المرحلة : الثانية

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## Overview of analytical methods

Analytical chemistry is the branch of chemistry which deals with the analysis of substances.

It is mainly divided into two categories:

- (1) Qualitative Analysis
- (2) Quantitative Analysis

**Qualitative analysis** is primarily concerned with the identification of the constituents present in a chemical substance or a mixture of substances.

**Quantitative analysis** is also primarily concerned with the exact determination of the amount of the number of constituents present in a chemical substance or a mixture of substances

Category	Method	Type/Example
Classical Methods	Volumetric Analysis	Acid–Base Titration Redox Titration Complexometric Titration Precipitometry
Classical Methods	Gravimetric Analysis	Precipitation & Weighing
Instrumental Methods	Spectroscopic Methods	UV–Vis Spectroscopy IR Spectroscopy Atomic Absorption NMR, etc.
Instrumental Methods	Electrochemical Methods	Potentiometry Conductometry Voltammetry Coulometry
Instrumental Methods	Chromatographic Methods	Gas Chromatography (GC) High Performance Liquid Chromatography (HPLC) Thin Layer Chromatography (TLC)

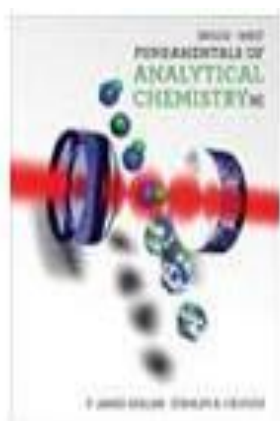


## Methods of Analysis

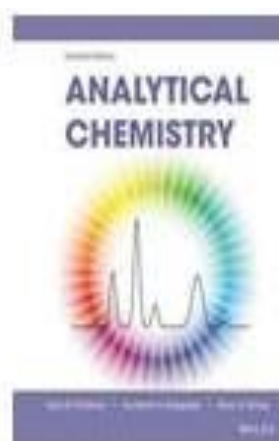
Quantitative analysis is also primarily concerned with the exact determination of the amount of the number of constituents present in a chemical substance or a mixture of substances.

Various methods like volumetric analysis, gravimetric analysis, polarimetry, refractometry, photometry, fluorimetry, electrochemical methods, chromatographic methods and biological methods comes under the category of quantitative analysis. • Quantitative analysis is carried out mainly for determining the purity of chemical substances. • The method used for the determination of purity is called the assay method.

# References



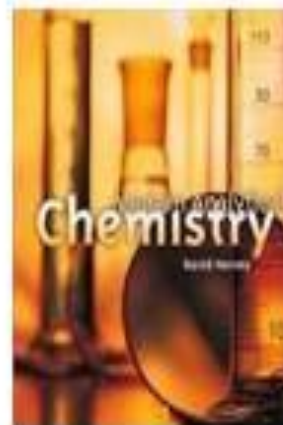
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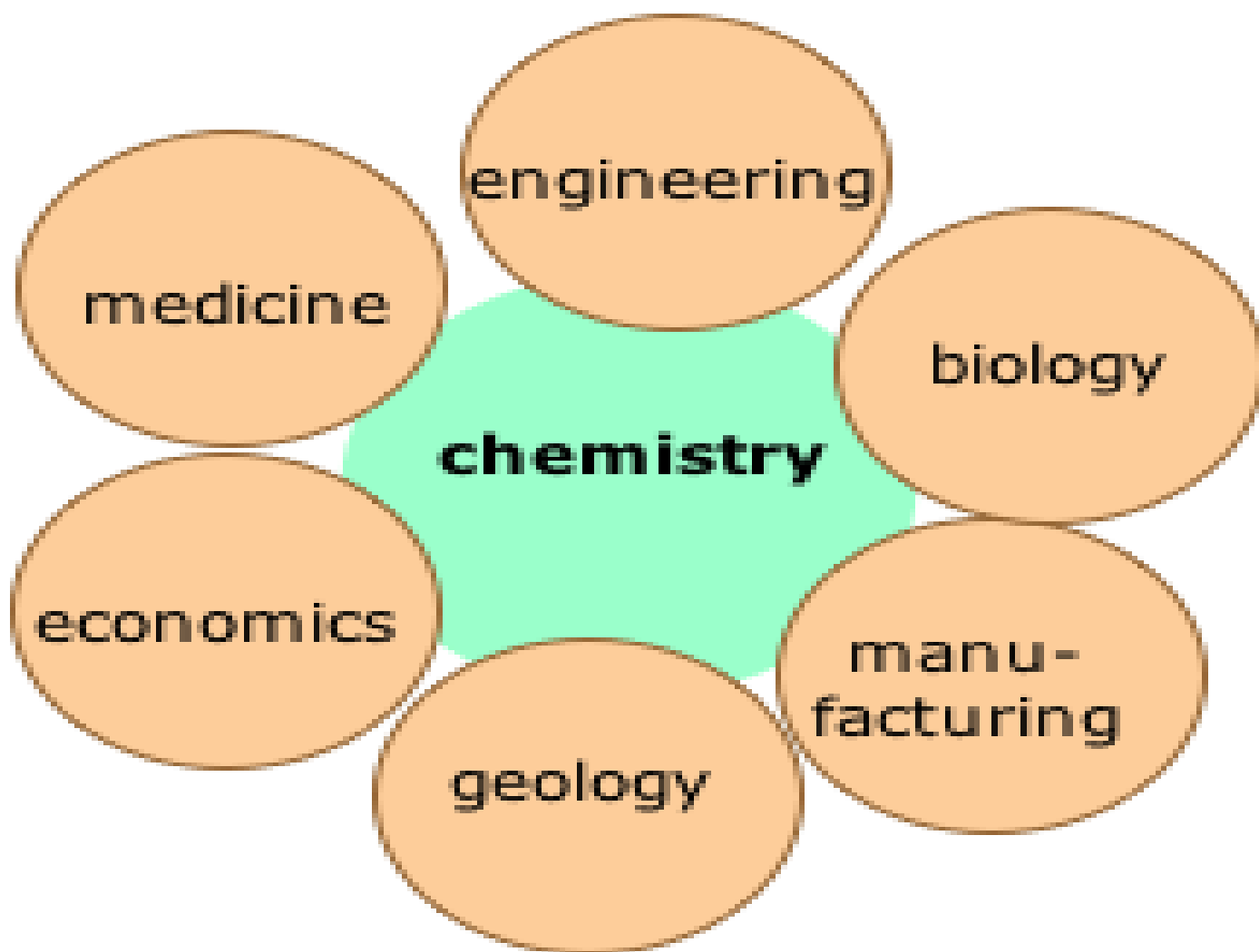
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Modern Analytical Chemistry,  
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Chemistry play a very important role in all areas of science and technology :



A – health and medicine

B – energy and environment's

C – materials and technology

D – food and agriculture



## **Instrumental Methods of Analysis**

The instrumental methods of analysis have a fundamental importance in pharmacy. By using a proper instrument and technique, the analyst can determine the nature and the amount of the substance in a drug, in dosage form, or in biological fluids.

### **Advantages of Instrumental Methods**

1. Very minute quantities can be determined qualitatively and quantitatively, even in microgram or nanogram amounts.
2. The analyzed substance can be recovered and used again.
3. Spectroscopic methods allow routine analysis in a short time.
4. Mixtures of substances can be analyzed without separation.

### **Disadvantages of Instrumental Methods of Analysis**

1. The instruments are mostly expensive.
2. Special knowledge must be present about the apparatus. In general, it is always followed by the principle of “black box”; i.e., it is not necessary to know every function of the instrument. It is only necessary to know the principal functions of the instrument and then to evaluate the spectra obtained through good interpretations.

### **Process:**

substance → instrument → spectrum → interpretation

### **Spectroscopic methods in pharmacy**

- ✓ The spectroscopy methods of analysis are the most frequently used techniques in pharmaceutical analysis.
- ✓ Many drugs interact with electromagnetic radiation (light).
- ✓ Most spectroscopic methods are based on the ability of molecules to absorb radiant energy.



- ✓ Spectroscopic analysis involves measuring the amount of light absorbed by a substance in solution.

## **Applications of Spectrophotometry:**

### **1. Quantitative chemical analysis**

- Determination of concentration of substances using Beer–Lambert law
- Analysis of metal ions, dyes, and inorganic compounds

### **2. Pharmaceutical analysis**

- Assay of drugs in bulk and dosage forms
- Quality control and purity testing
- Stability studies of pharmaceuticals

### **3. Biochemical and clinical analysis**

- Estimation of proteins, DNA, RNA, and enzymes
- Measurement of blood components (glucose, hemoglobin, cholesterol)
- Enzyme kinetics studies

### **4. Environmental analysis**

- Detection of pollutants in water and air
- Determination of nitrate, phosphate, and heavy metals
- Monitoring water quality

### **5. Food and beverage analysis**

- Determination of color, additives, and preservatives
- Analysis of vitamins, sugars, and antioxidants
- Quality control in food processing



## **6. Industrial applications**

- Monitoring chemical reactions and process control
- Analysis of raw materials and finished products
- Dye and pigment analysis

## **7. Medical and diagnostic applications**

- Clinical diagnostics and laboratory tests
- Drug monitoring in biological fluids

## **8. Research and academic laboratories**

- Study of reaction kinetics and mechanisms
- Identification of compounds
- Characterization of new materials

## **9. Agricultural analysis**

- Soil and fertilizer analysis
- Determination of nutrients and pesticides