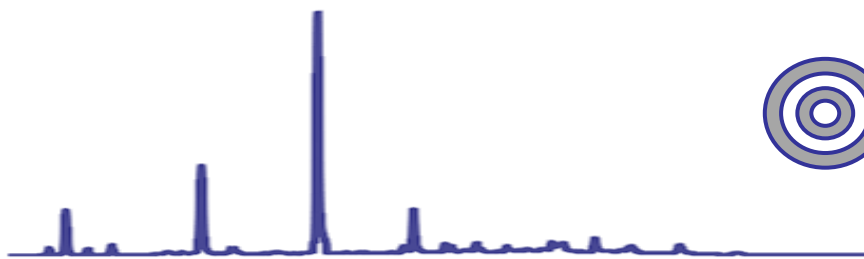
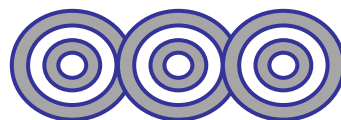


Analytical Chemistry - An Overview



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كرسي أبحاث
المواد المتقدمة
Advanced Materials
Research Chair



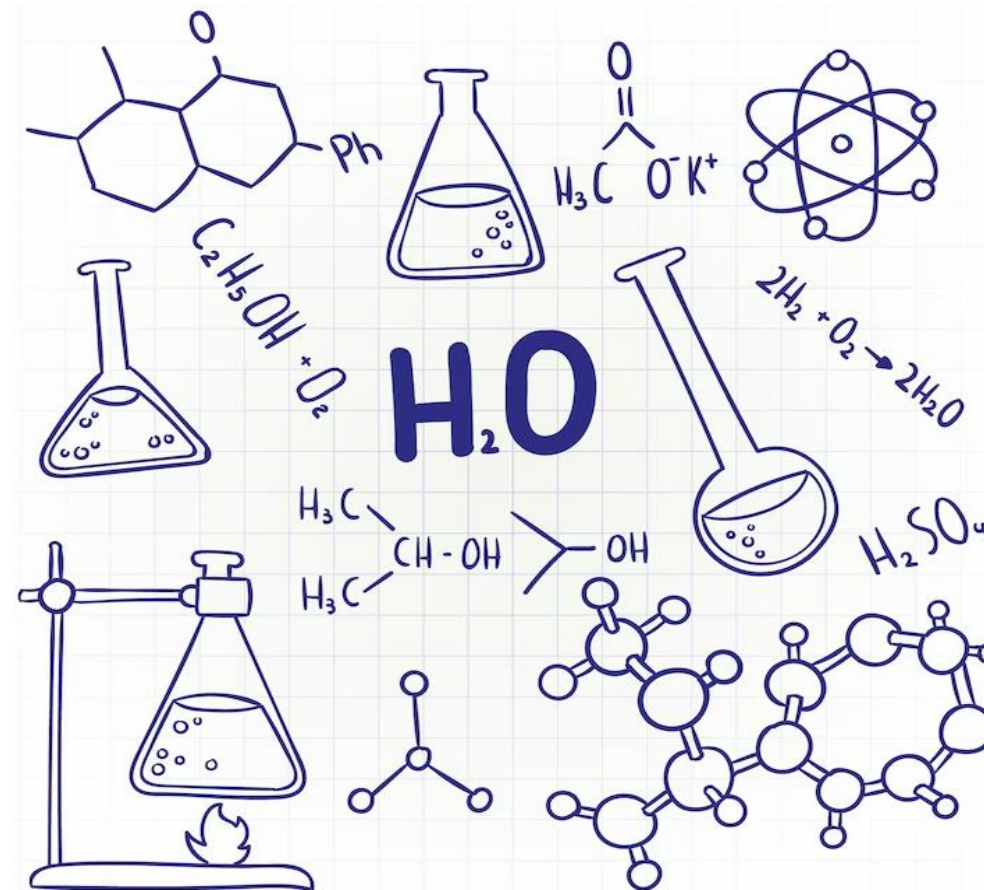
What is Chemistry ???

Chemistry is the study of the **properties** and **behavior** of **matter**.

Realms

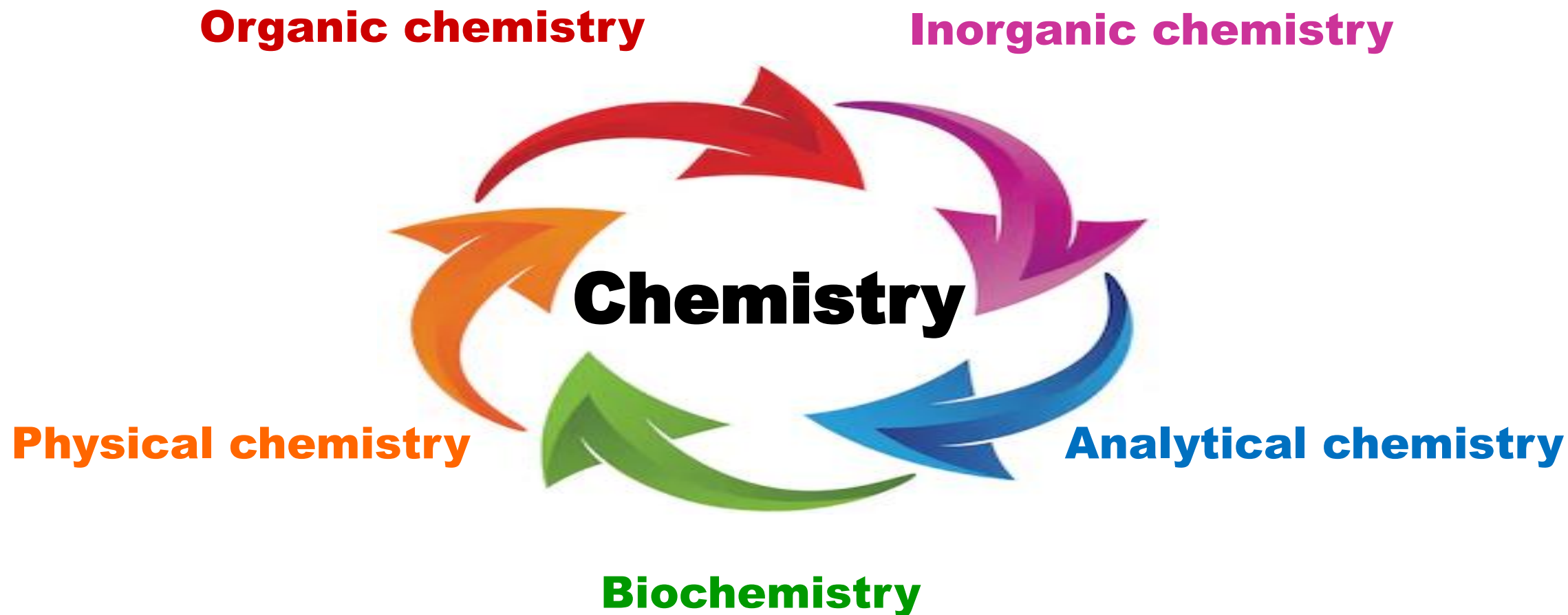
Macroscopic
Ordinary sized objects

Sub-microscopic
Atoms and molecules



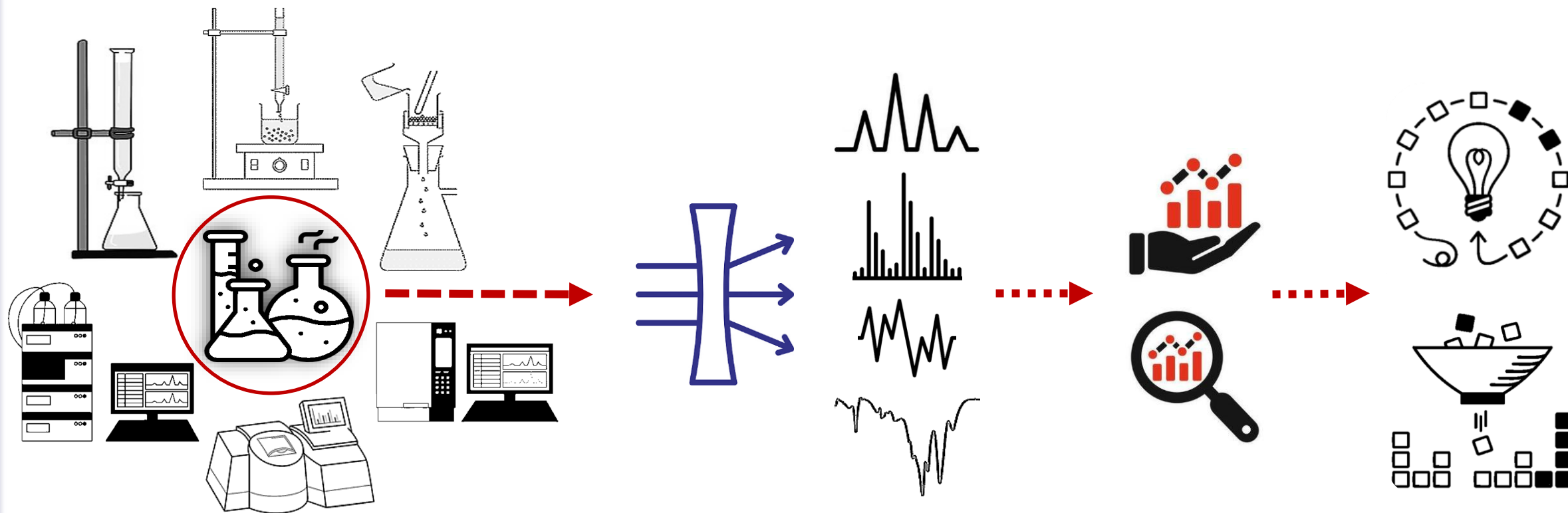
Chemistry is the science that seeks to understand the properties and behavior of matter by studying the properties of atoms and molecules. Chemistry provides important understanding of our world and how it works.

Main Branches of Chemistry



Definition of Analytical Chemistry

A branch of chemistry focused on the **qualitative** and **quantitative** determination of chemical components in materials, as well as the development of tools and methods used to analyze **chemical composition**.



Chemicals,
apparatus,
equipment, &
instruments

Numbers,
units, &
concentration
expressions

Chemical
calculations,
stoichiometry,
& equilibrium

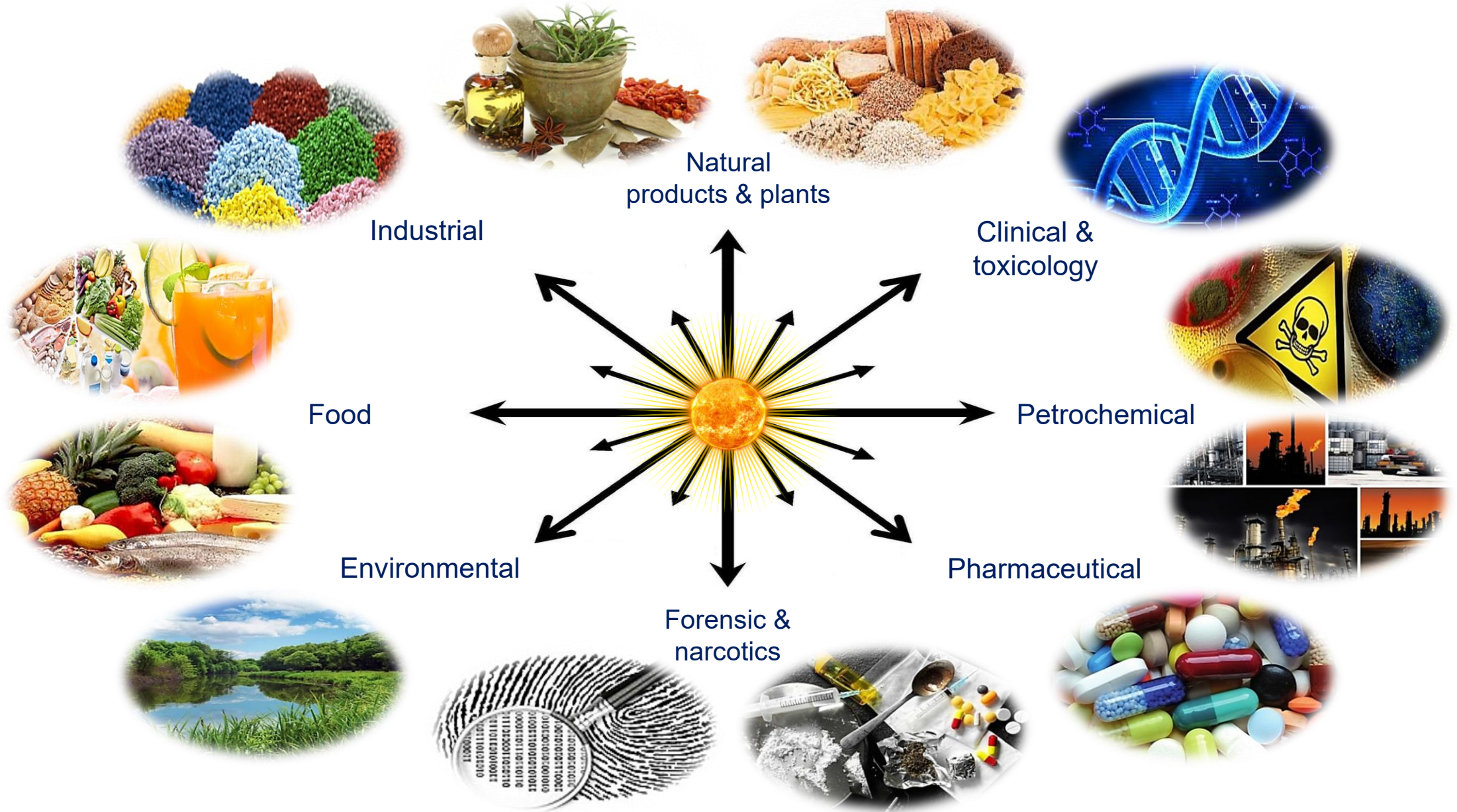
Errors in
chemical
analyses &
measurements

Sampling,
standardization,
& calibration

Methods
development
& validation

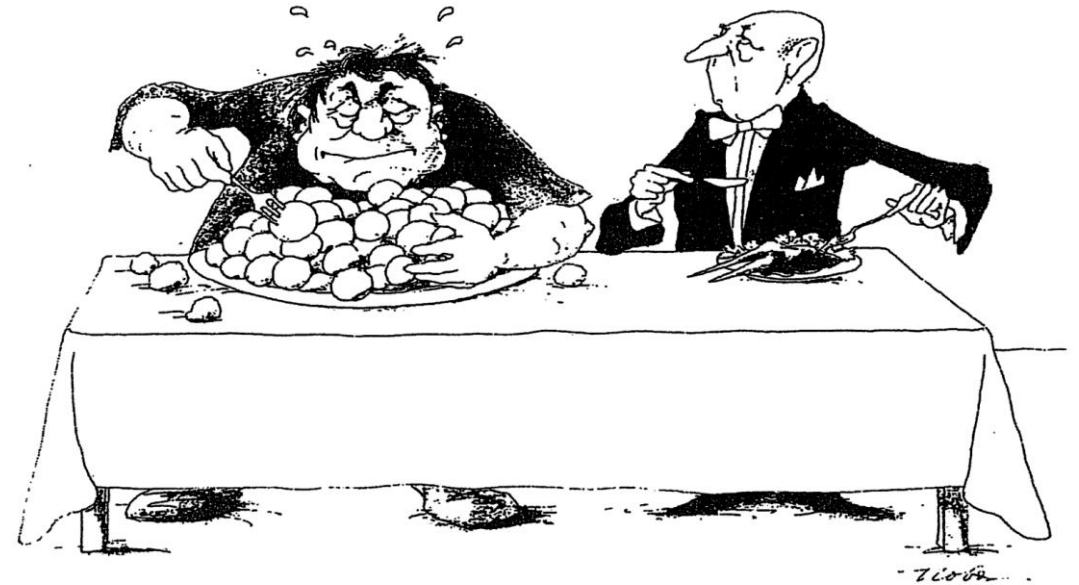
Statistical
data
treatment &
evaluation

Interactions with all other fields and application areas



Qualitative vs. Quantitative Chemical Analysis

Analytical chemistry study the identification and quantification of the chemical components of natural and artificial materials.



Quantitative analysis

Qualitative analysis

Qualitative analysis	Quantitative analysis
Identify what is present in the sample	Determination of the amount of analyte in the sample
Examples	Examples
Identifying the products of chemical reaction.	Measuring the concentration of glucose in blood.
Screening an athlete's urine for stimulants, steroids, and other banned substances.	Determining the concentration of metals and ions in water (drinking water standard).

Methods and Equipment

Analytical methods can be separated into **classical** and **instrumental** methods of analysis

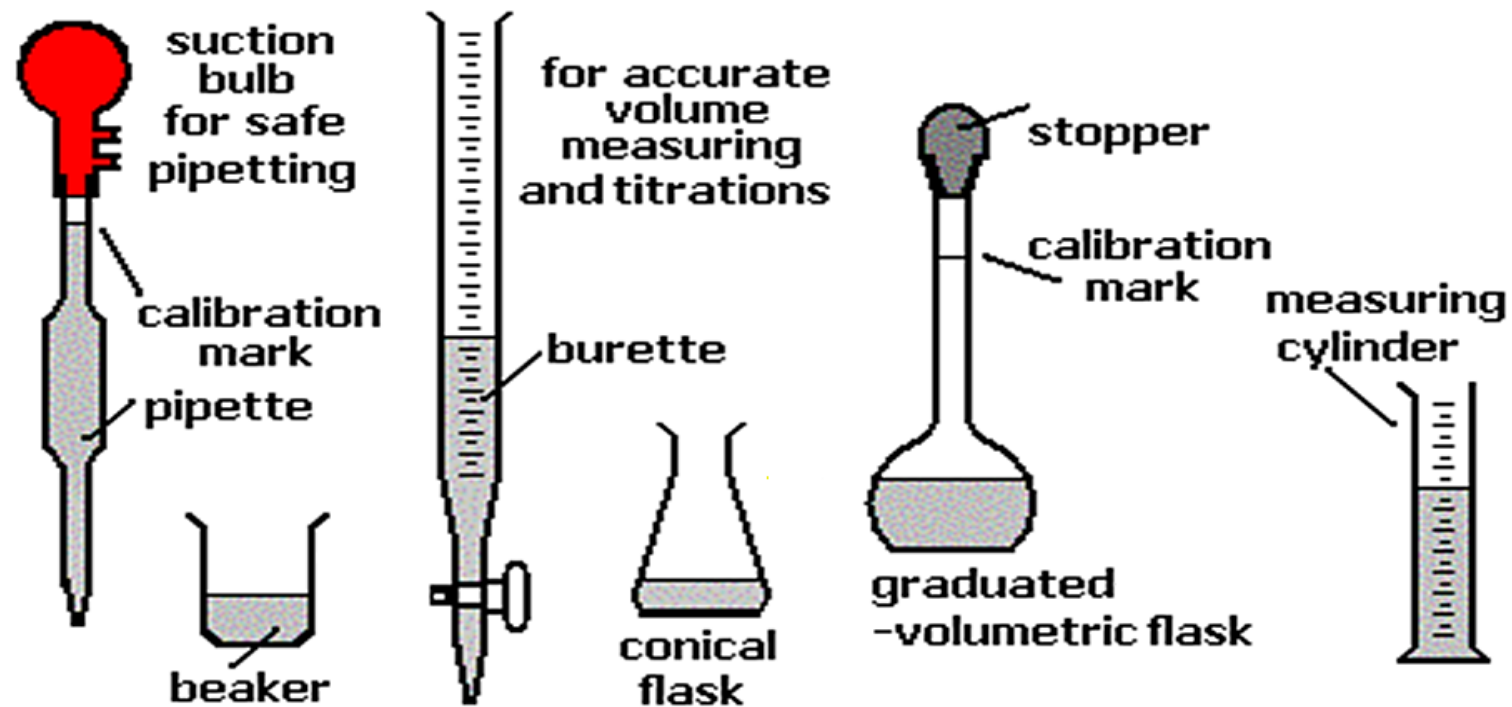


Classical Methods of Analysis

Classical methods (also known as wet chemistry or bench chemistry)

Classical methods involve the use of laboratory glass and plastic wares, such as beakers and flasks, and excludes chemical analysis using instrumentation.

Examples: Precipitation, extraction, recrystallization, distillation, and qualitative analysis by color, odor or melting point.

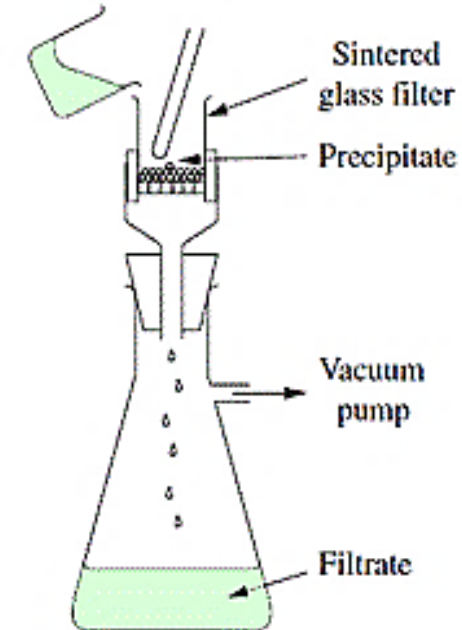
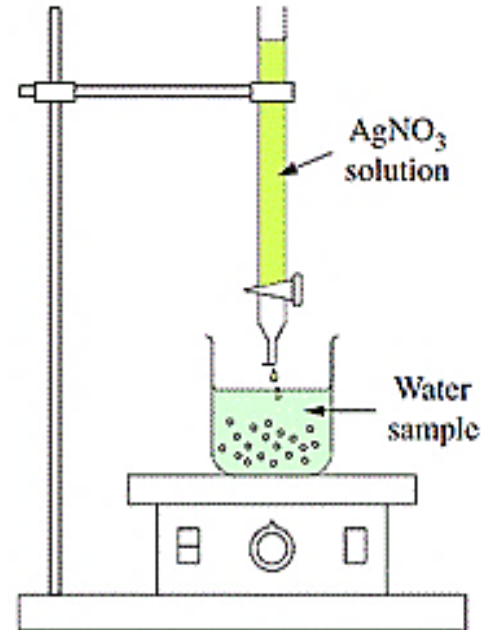
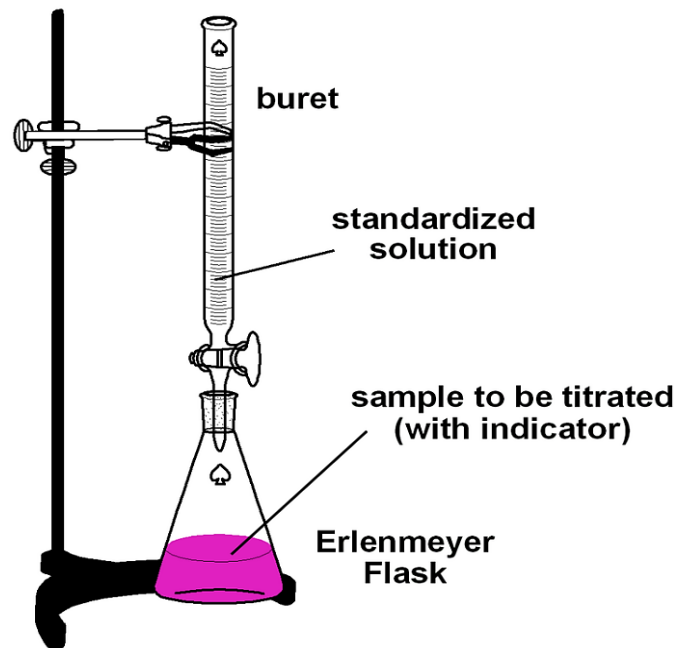


Volumetric and Gravimetric Analysis Methods

Classical quantitative analysis is achieved by measurement of **weight** or **volume**.

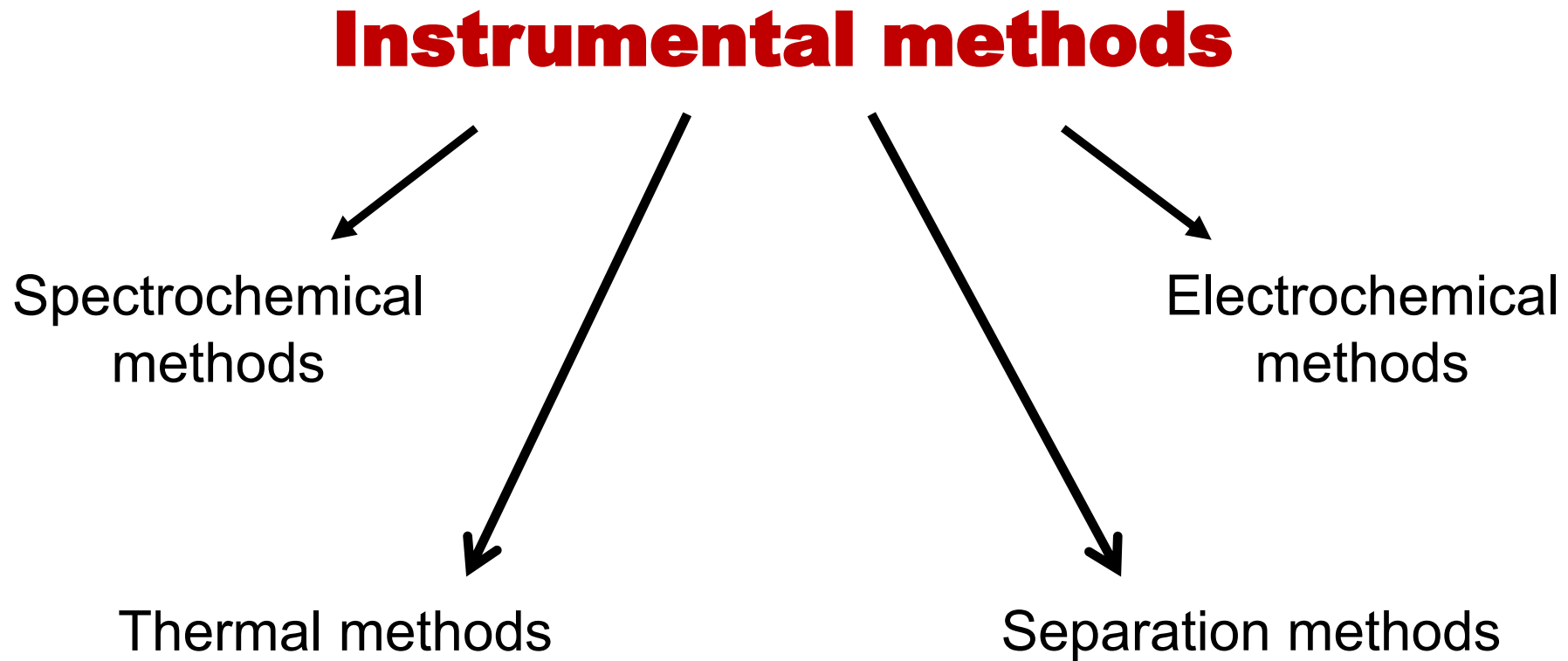
Gravimetric analysis: determining the amount of material present by weighing the sample before and/or after some transformation.

Volumetric analysis: titration involves the addition of a reactant to a solution being analyzed until some equivalence point is reached.



Instrumental Methods of Analysis

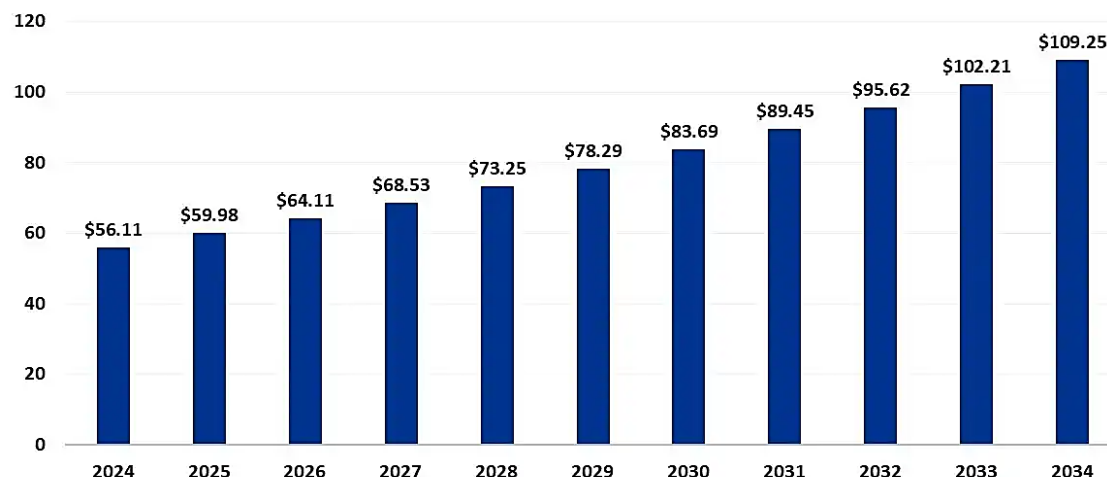
Instrumental methods use an apparatus for chemical analysis of the analyte.



Market size



Analytical Chemistry Market Size 2024 to 2034 (USD Billion)



Source: www.towardschemandmaterials.com

By product

The instruments segment dominated the market; approximately 50% share in the market in 2024

By region

North America dominated the market; approximately 30% share in the market in 2024

By application

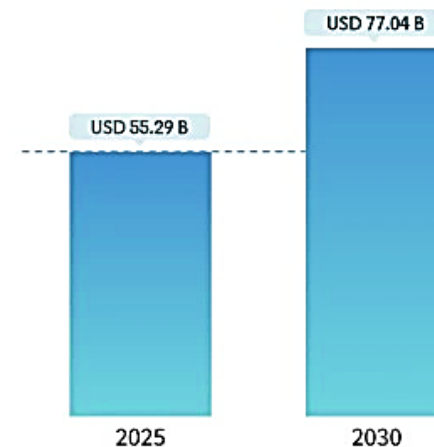
The pharmaceutical & biotechnology segment dominated the market; approximately 40% share in the market in 2024

By technique

The chromatography segment dominated the market; approximately 35% share in the market in 2024

Analytical Instrumentation Market

Market Size in USD Billion
CAGR 6.86%



Source: Mordor Intelligence



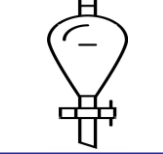
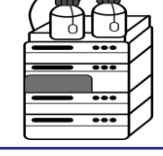
Study Period	2020 - 2030
Market Size (2025)	USD 55.29 Billion
Market Size (2030)	USD 77.04 Billion
CAGR (2025 - 2030)	6.86 %
Fastest Growing Market	Asia Pacific
Largest Market	North America
Market Concentration	Medium

Major Players



*Disclaimer: Major Players sorted in no particular order

The Main Steps in Chemical Analysis

Target	Define the problem, what is the problem, what we need to found, qualitative and/or quantitative, objectives, what will the information be used for and who will use it, when will it be needed, how accurate and precise does it have to be, what is the budget,etc.	
Method	Select a method, sample type, size, sample preparation needed, concentration, range, sensitivity needed, selectivity, interferences, accuracy, precision, tools, instruments, expertise, experience, cost, speed, manual or automated, literature, standard, regulations that need to be followed,etc.	
Sampling	Sample collection, obtain a representative sample, sample type, homogeneity, size, statistics and errors, physical state, solid, liquid, gas, dissolve, ash or digest,etc.	
Preparation	Sample preparation and extraction, separation and avoiding matrix effect needed, need to concentrate the analyte, preconcentration, need to change and derivatize the analyte, need to adjust solution conditions, pH, add reagents,etc.	
Separation	Perform any necessary separations, distillation, precipitation, extraction, solid phase extraction, chromatography, electrophoresis,etc.	
Instrument	Perform the measurement (instrument). Calibration, validation, controls, blanks, replicates, ... etc.	
Data	Analyzing data and interpreting results, statistical analysis, reliability, critically evaluate results, validation, report results with limitations/accuracy information, interpret carefully for intended audience,etc.	

Thank You!

