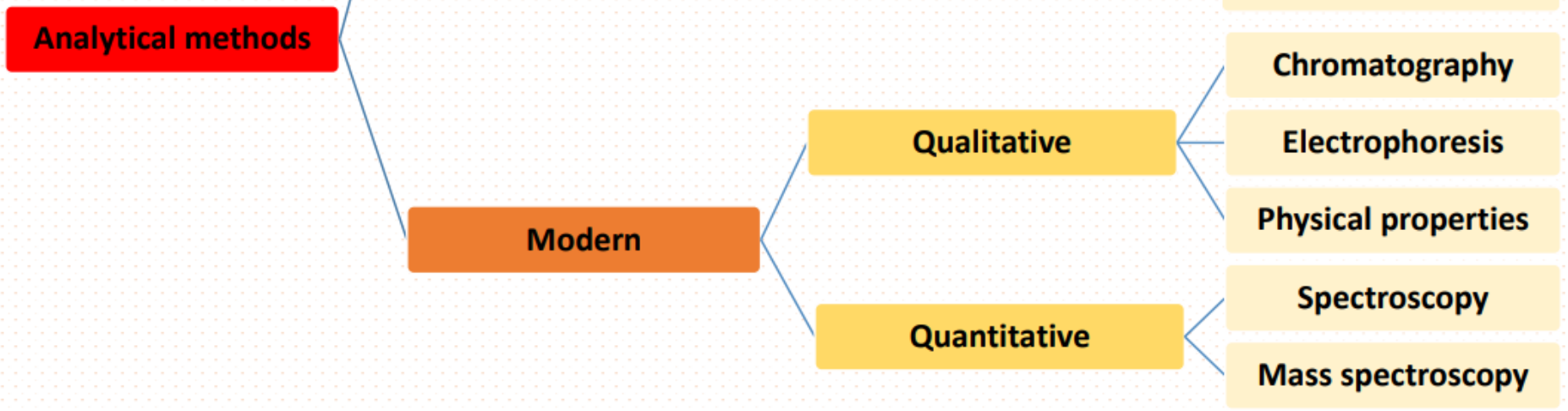
Lab ANALYTICAL CHEMISTRY

Areas of Chemical Analysis and Questions They Answer

1. Detection: Does the sample contain substance X?
2. Identification: What is the identity of the substance in the sample?
3. Separation : How can the species of interest be separated from the sample matrix for better quantitation and identification?
4. Quantitation: How much of substance X is in the sample?


Analytical methods
Classical
Qualitative
Melting point
Colour
Odor
Solubility
Quantitative
Gravimetric
Volumetric
Modern
Qualitative
Chromatography
Electrophoresis
Physical properties
Quantitative
Spectroscopy
Mass spectroscopy

Separation and Detection for Cations

- Separation of cations involve removal of one or more cations from mixture by formation of insoluble precipitates.

The groups of reagents used for most common cations are :

- 1- dil. HCl
- 2- H_2S in acidic medium
- 3- $(NH_4)_2S$ in neutral medium
- 4- $(NH_4)_2CO_3$ in neutral medium
- The classification is based on whether a cation reacts with these reagents to form a precipitate or not .
- The cations are distributed into five groups

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Draw | Read aloud | Ask Copilot | 2 of 14

Groups	Precipitant factor	Cations
Group I	dil. HCl	Pb^{+2} , Hg^{+} , Ag^{+}
Group II	H_2S in acidic medium	Hg^{+2} , Cu^{+2} , Bi^{+3} , Cd^{+2} , Sn^{+2} , Sn^{+4} As^{+3} , As^{+5}
Group III	$(NH_4)_2S$ in neutral medium	Co^{+5} , Fe^{+2} , Cr^{+3} , Al^{+3} , Zn^{+2} , Mn^{+2} , Ni^{+2}
Group IV	$(NH_4)_2CO_3$ in neutral medium	Ca^{+2} , Sr^{+2} , Ba^{+2} , Mg^{+2}
Group V	No precipitant factor	Na^{+} , K^{+} , NH_4^{+} , Li^{+} , H^{+}

- The caions of group I are provided as nitrate :
- $AgNO_3$, $Hg_2(NO_3)_2$, $pb(NO_3)_2$
- and precipitated as chlorides AgCl , Hg_2Cl_2 , $PbCl_2$

according to the following equations

$$Ag\,NO_3 + HCl \text{ ----------} AgCl + H\,NO_3$$

$$Hg2\,(NO_3)_2 + 2HCl \text{ ----------} Hg_2Cl_2 + 2H\,NO_3$$

$$Pb(NO_3)_2 + 2HCl \text{ ----------} PbCl2 + 2H\,NO_3$$

- Types of Questions Asked in Analytical Chemistry
- a.) What is in the sample? (qualitative analysis)
- b.) How much is in the sample? (quantitative analysis

- Choosing a method can be influenced by two factors:
- 1. Complexity of the sample
- 2. Number of components in the sample

- Typical quantitative analysis

1. Select your method
2. Acquire sample
3. Sample processing
4. Eliminate interferences
5. Calibration and conc.
6. Measurements.
7. Calculations and results reporting

- 1. Preparing a laboratory sample

A:Solids:

- a. Grounding
- b. Mixing
- c. Drying
- d. Storing

B:Liquids:

a. Covering

b. Keeping inside evacuated container

- 2. Sample replications

It improves the quality of the results and provides a measure of their reliability

- 3. Preparing liquid samples
- It requires choosing a suitable solvent

  Materials like silicates, high molecular mass polymers, samples of

  animal tissues require extraordinary conditions to prepare a suitable form for
- measurement (time-consuming and expensive)

- impurities It is advisable to remove the impurities before starting measurements
- Interferences: It is advisable to remove all Other compounds in the sample matrix that interfere with the measurement of the analyte.
- Calibration: The process of determining the proportionality between analyte conc. And a measured quantity
- Calculations: The final event in the analytical process is to perform the calculations and present the results in an acceptable manner.