

# Chemistry Analytical Equipment

## ACADs (08-006) Covered

4.6.5.2

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## Keywords

analytical balance, conductivity bridge with flow cell, inductively coupled plasma analyzer, in-line sodium monitor, ion selective electrode, microwave digestion

## Description

Describe the operation and purpose of chemistry analytical equipment

## Supporting Material



# analytical balance

**Balance**



Purpose:

Measure weights

# analytical balance

## Operation:

- Require a draft-free location on a solid bench that is free of vibrations.
- Do not bump or place objects on the bench after zeroing the balance.
- Weigh powders on weighing paper or in weighing dishes.
- Handle objects with tongs, gloves, or weighing paper to prevent fingerprints.
- Let hot objects cool before weighing.
- Weigh hygroscopic materials rapidly since they will absorb water during weighing.

# conductivity bridge with flow cell



Purpose:

Measurement of both electrical resistance and conductance of solutions.

If a measurement is to be performed in pure water, it is necessary to use a flow cell.



# conductivity bridge with flow cell

## Operation:

- Rinse the apparatus with sample by filling the receptacle and putting it in place on the apparatus.
- Discard this rinse and then fill the receptacle with sample and place it on the apparatus so no air bubbles are inside the conductivity cell.
- Adjust the temperature to 25.0EC, and record the reading from the conductivity meter.

# inductively coupled plasma analyzer



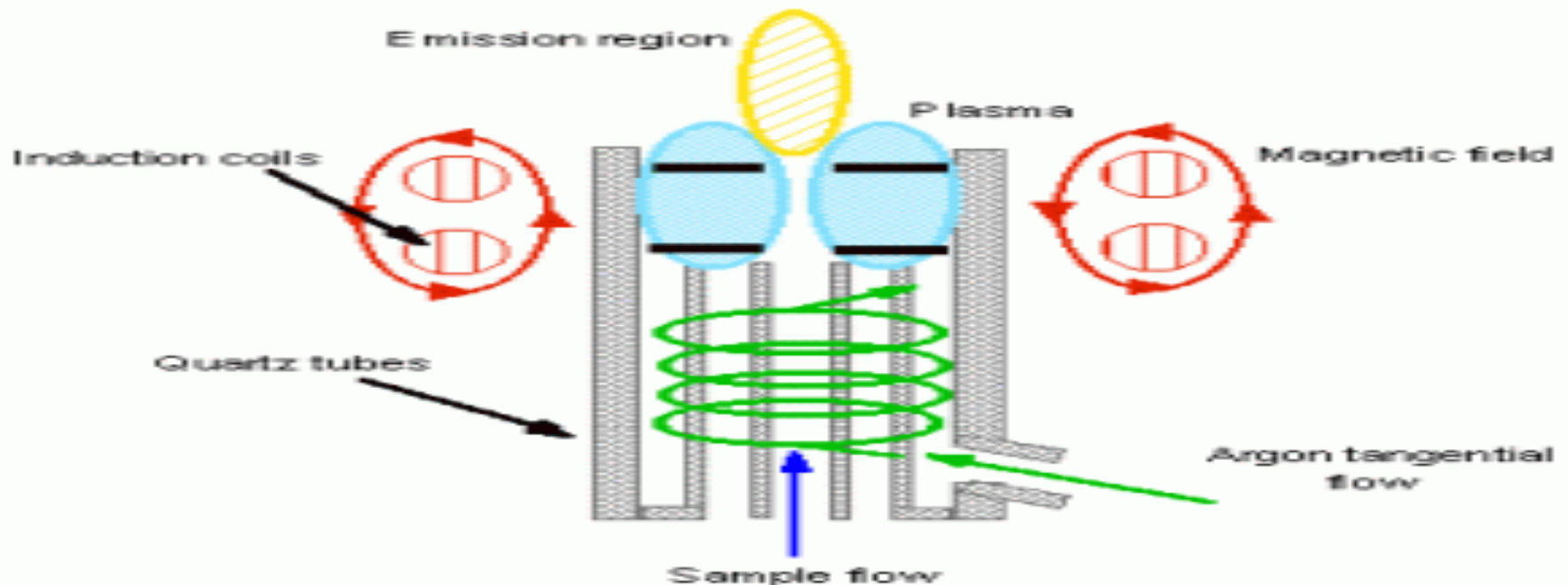
Purpose:

Measure the isotopic ratios of elements used in geochronologic/thermochronologic, radiogenic isotopic, and stable isotopic studies

# inductively coupled plasma analyzer

Operation:

- ICP-AES, a type of atomic emission spectroscopy
- ICP-MS, a type of mass spectrometry
- ICP-RIE, a type of reactive-ion etching





# in-line sodium monitor

Purpose:

Continuous monitoring of sodium in the process water

- To detect sodium breakthrough and to ensure the process water is pure.



# in-line sodium monitor

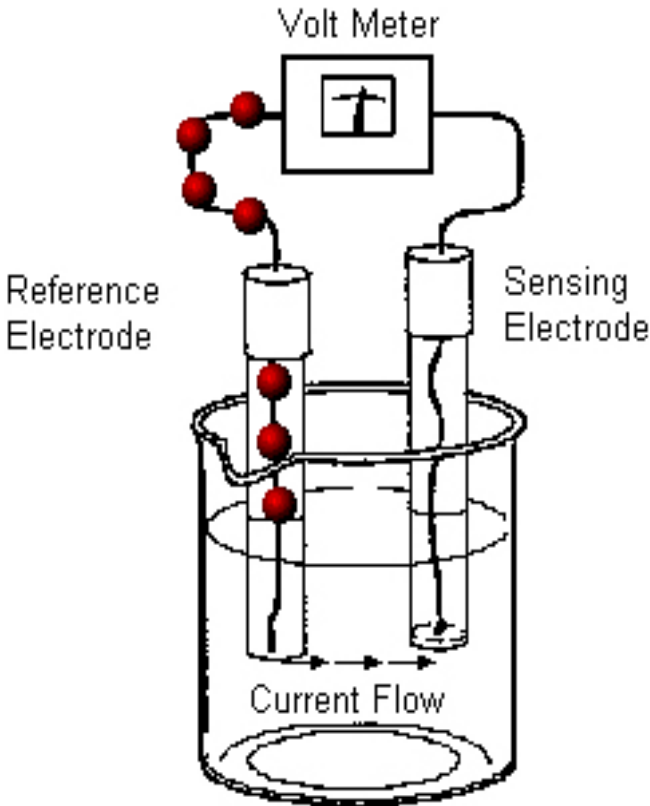
## Operation:

- The hydrogen ion interference is controlled by raising the pH of the sample (reducing the hydrogen ion concentration).
  - This is achieved by adding an alkali – usually ammonia gas or a volatile amine.
- Temperature effects are reduced by monitoring temperature and carrying out automatic temperature compensation.
- The monitor is calibrated by use of solutions of known sodium ion concentration, with the electrode pair producing a millivolt output proportional to the sodium ion concentration.

# ion selective electrode

Purpose:

Converts the activity of a specific ion dissolved in a solution into an electrical potential, which can be measured by a voltmeter or pH meter.



# ion selective electrode

## Operation:

- ISE measures the potential of a specific ion in solution.
- This potential is measured against a stable reference electrode of constant potential.
- The potential difference between the two electrodes will depend upon the activity of the specific ion in solution.
- This activity is related to the concentration of that specific ion, therefore allowing the end-user to make an analytical measurement of that specific ion.

# microwave digestion

Purpose: Sample decomposition

- Dissolve heavy metals in the presence of organic molecules prior to analysis by inductively coupled plasma, atomic absorption, or atomic emission measurement



# microwave digestion

3 main approaches to microwave dissolution:

- focused open-vessel
- low-pressure closed-vessel
- high-pressure closed-vessel.



# microwave digestion

## Operation:

- Expose a sample to a strong acid
- Raise the pressure and temperature through microwave irradiation.
  - This increase in temperature and pressure of the low pH sample medium thereby increases both the speed of thermal decomposition of the sample, and the solubility of heavy metals in solution.
- Once these heavy metals are in solution, it is possible to quantitate or quantify the sample through elemental techniques.