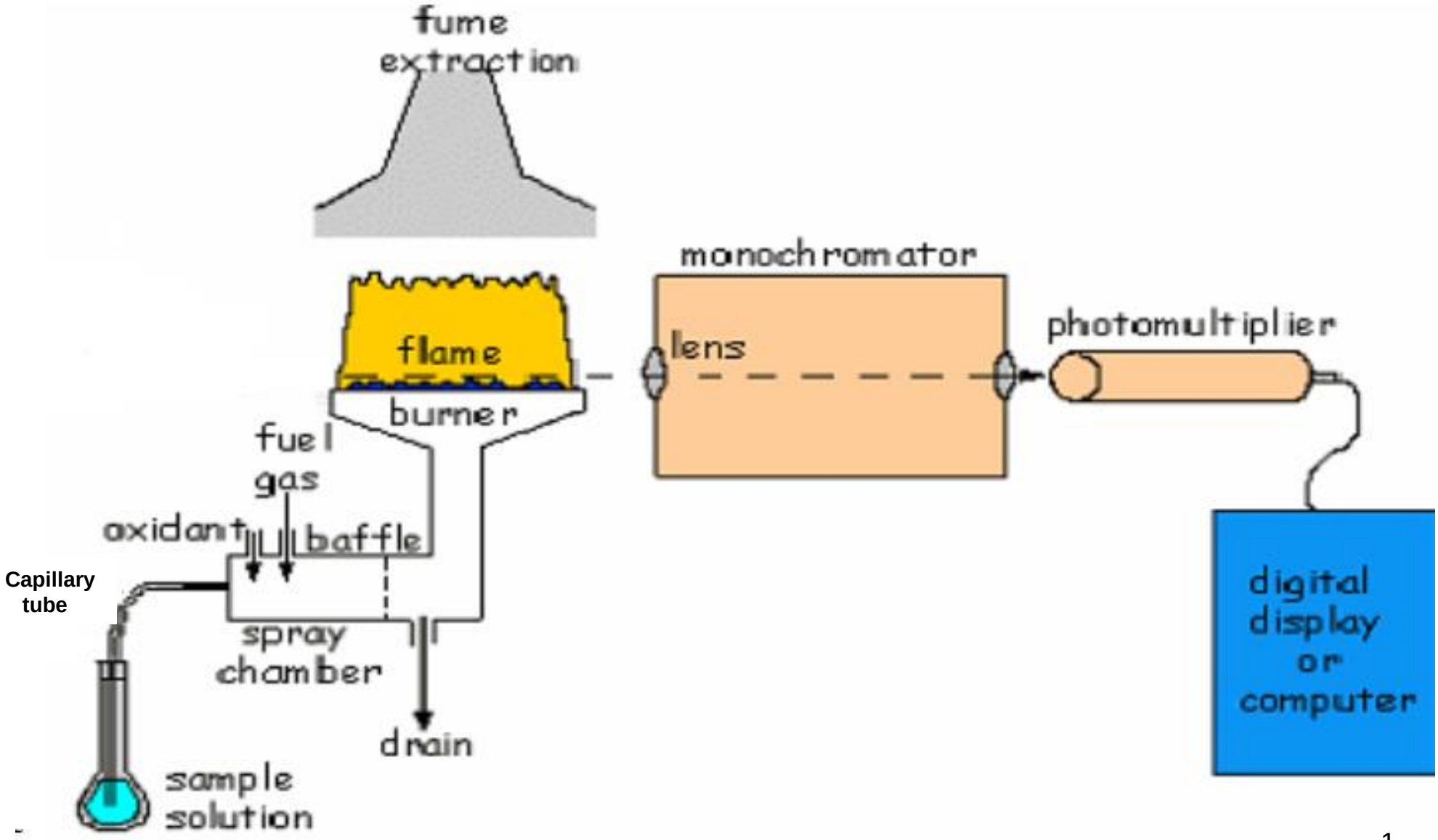
Flame Atomic Emission Spectrometer

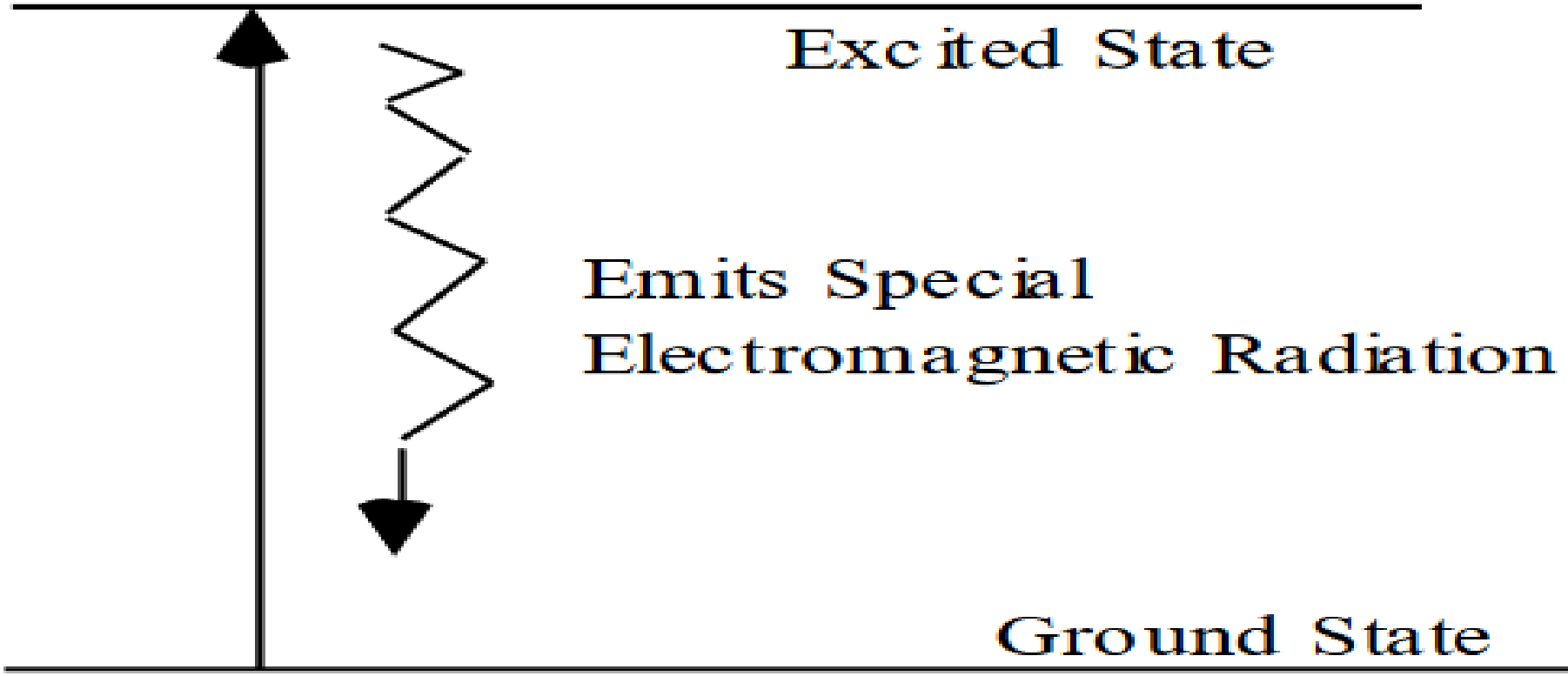


Emission Techniques

Type	Method of Atomization
Arc	sample heated in an electric arc (4000-5000°C)
Spark	sample excited in a high voltage spark
Flame	sample solution aspirated into a flame (1700 – 3200 oC)
Argon plasma	sample heated in an argon plasma (4000-6000°C)

Emission Spectroscopy

Measure the intensity of emitted radiation



Atomic Emission Spectroscopy

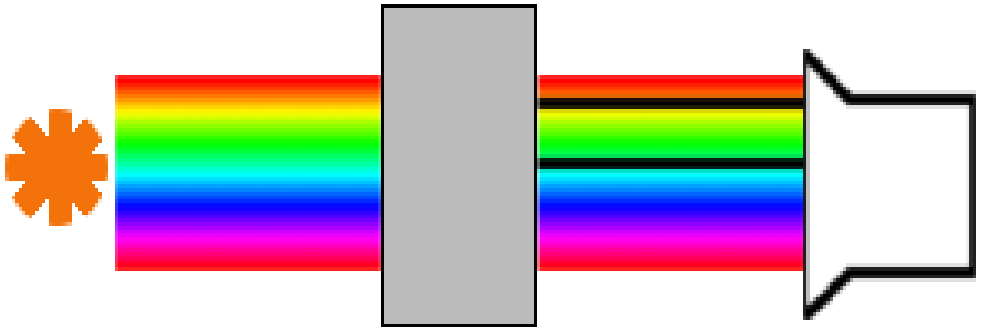
Qualitative analysis

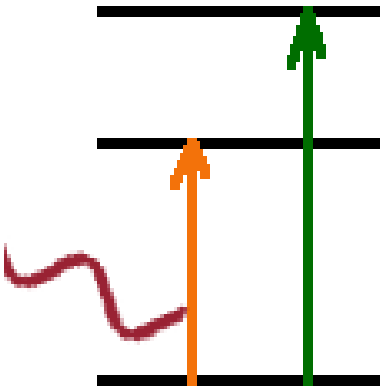
Methods rely on the presence of specific emission lines.

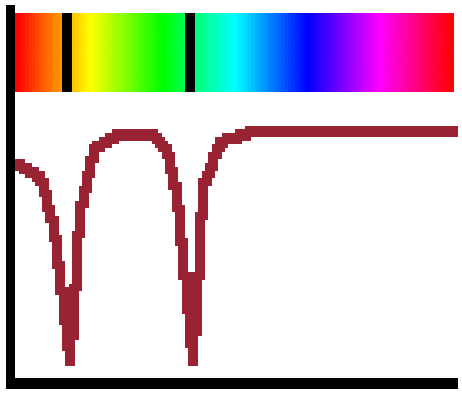
Element	Major emission line, Å
Ag	3281
Cu	3248
Hg	2537
K	3447
Zn	3345

AAS

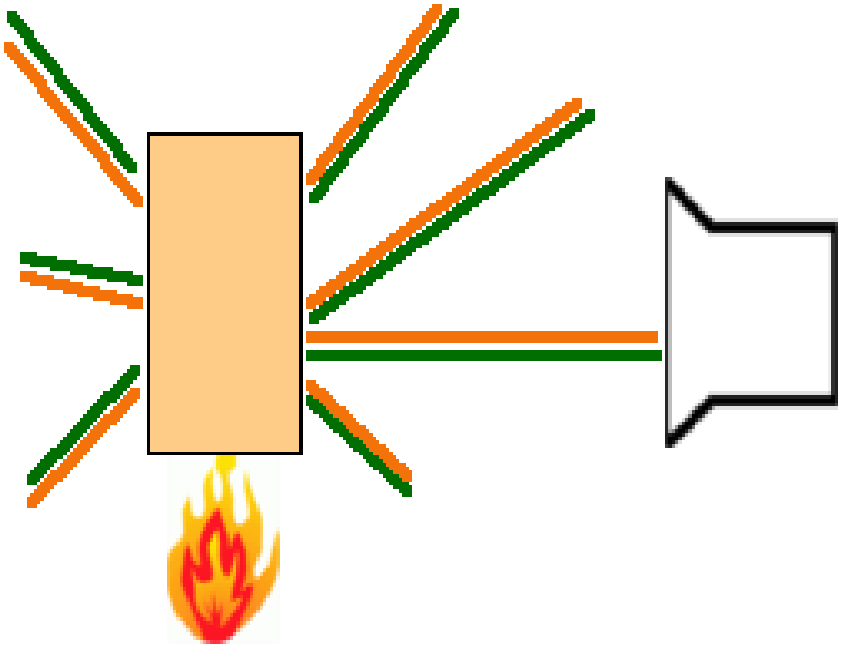
source sample detector

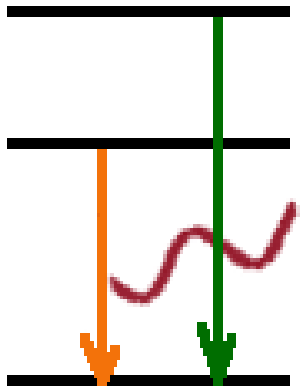


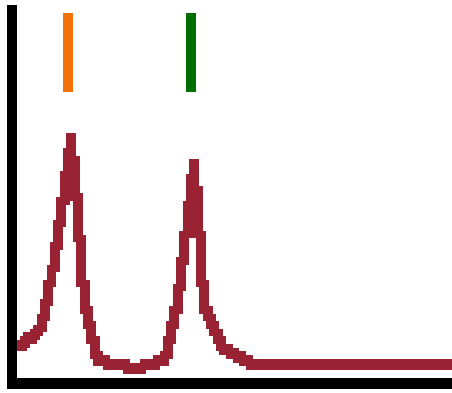




AES







https://www.youtube.com/watch?v=mFVEibKeZtA

https://www.youtube.com/watch?v=0NNcrB7aUK4

Inductively coupled plasma-Atomic Emission Spectrometry, ICP-AES

An ICP-AES system can be divided up into two basic parts:

- The inductively coupled plasma source
- The atomic emission spectrometry detector.

Steps of atomization and excitation of sample:

- The sample is introduced to the nebulizer chamber via a peristaltic pump and tygon tubing attached to an automatic sampler.
- Flow of sample and Ar gas through the small aperture of the nebulizer creates very small droplets that form a mist of µm-sized particles in the nebulizer chamber.

Inductively coupled plasma-Atomic Emission Spectrometry, ICP-AES

Steps of atomization and excitation of sample:

- Larger sample droplets collect on the chamber walls and are removed through a drain.
- Smaller particles travel with the Ar flow and enter the torch.
- Evaporation, atomization, and excitations/ionizations occur in the plasma at T reaching 10 000 K.
- Ar not related to the sample is also excited and ionized because this gas both carries the sample aerosol and confines the location of the plasma to prevent damage to the rest of the instrument.

Inductively coupled plasma-Atomic Emission Spectrometry, ICP-AES

Steps of atomization and excitation of sample:

- As the excited/ionized atoms leave the hot portion of the plasma, excited valence electrons relax and emit a photon characteristic of the electron transition.
- This photon is specific to the element but does not yield any information about the isotopic state of the element.
- Visible and UV radiation emitted from the sample constituents enters the monochromator through a small slit where the wavelengths are separated by grating(s) and/or prism(s) before being captured and measured by a wide variety of detectors.

Inductively coupled plasma-Atomic Emission Spectrometry, ICP-AES

The Inductively Coupled Plasma Torch:

- The torch unit of an ICP is used to create and sustain a plasma.
- A plasma is an electrically conducting gaseous mixture containing enough cations and electrons to maintain the conductance.
- The purpose of the torch is to (1) evaporate the solvent from the analyte salts, (2) atomize the atoms in the salt and (3) excite or ionize the atoms, then exit the high temperature region and electronically relax.
- This results in the emission of at least one element-specific photon available for detection.

Inductively coupled plasma-Atomic Emission Spectrometry, ICP-AES