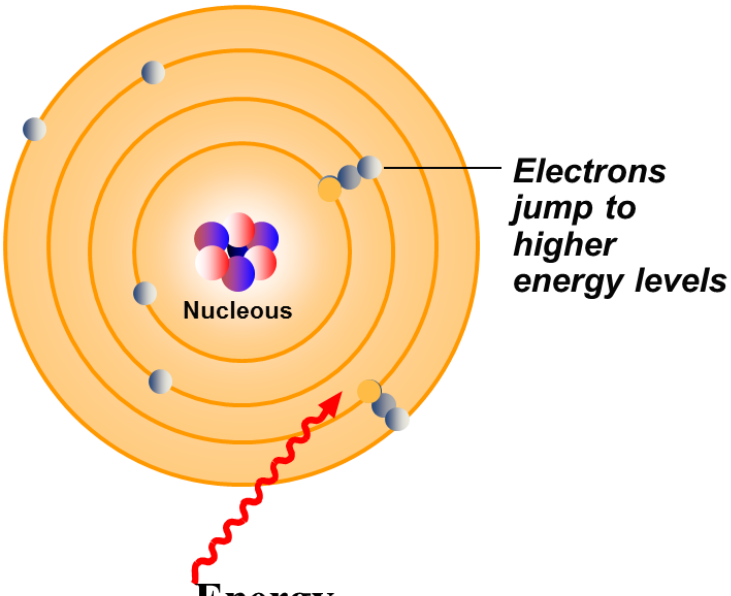
Spectrographic Analysis

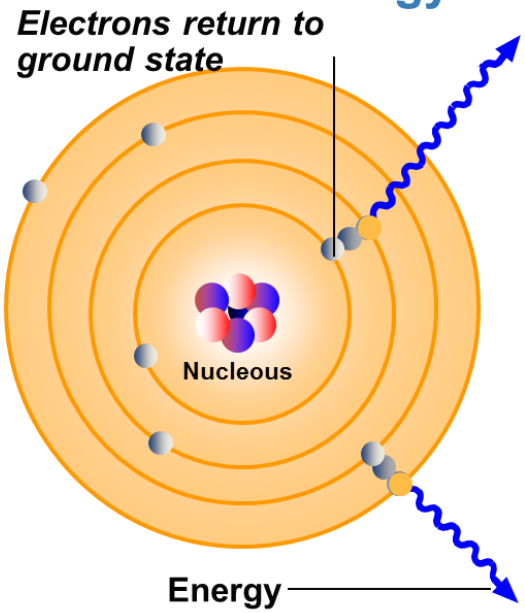
- Electrons revolve around nucleus of an atom in fixed orbitals (or quanta).
- Several fixed orbitals are around the nucleus in which the electrons may be found.
- Atoms appear in nature as stable particles and are said to be in their "ground state".
- If an atom absorbs certain energy it can become "excited".
- In this excited state, an electron jumps to a higher orbital.
- Because this state is unstable, the atom tends to return to its ground state.
- To do this, it has to emit the energy equivalent to that which it has absorbed.
- It emits the energy in the form of photons or light.

1. Ground state



2. Absorption of energy

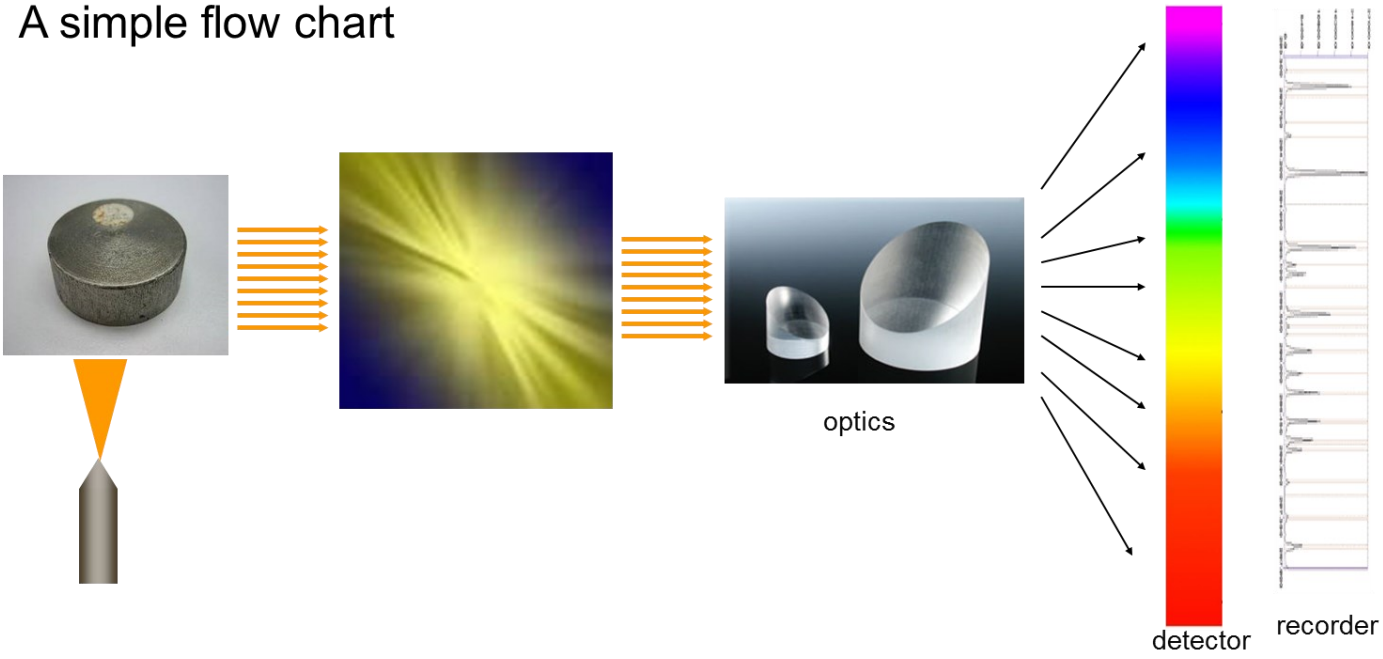
3. Emission of energy



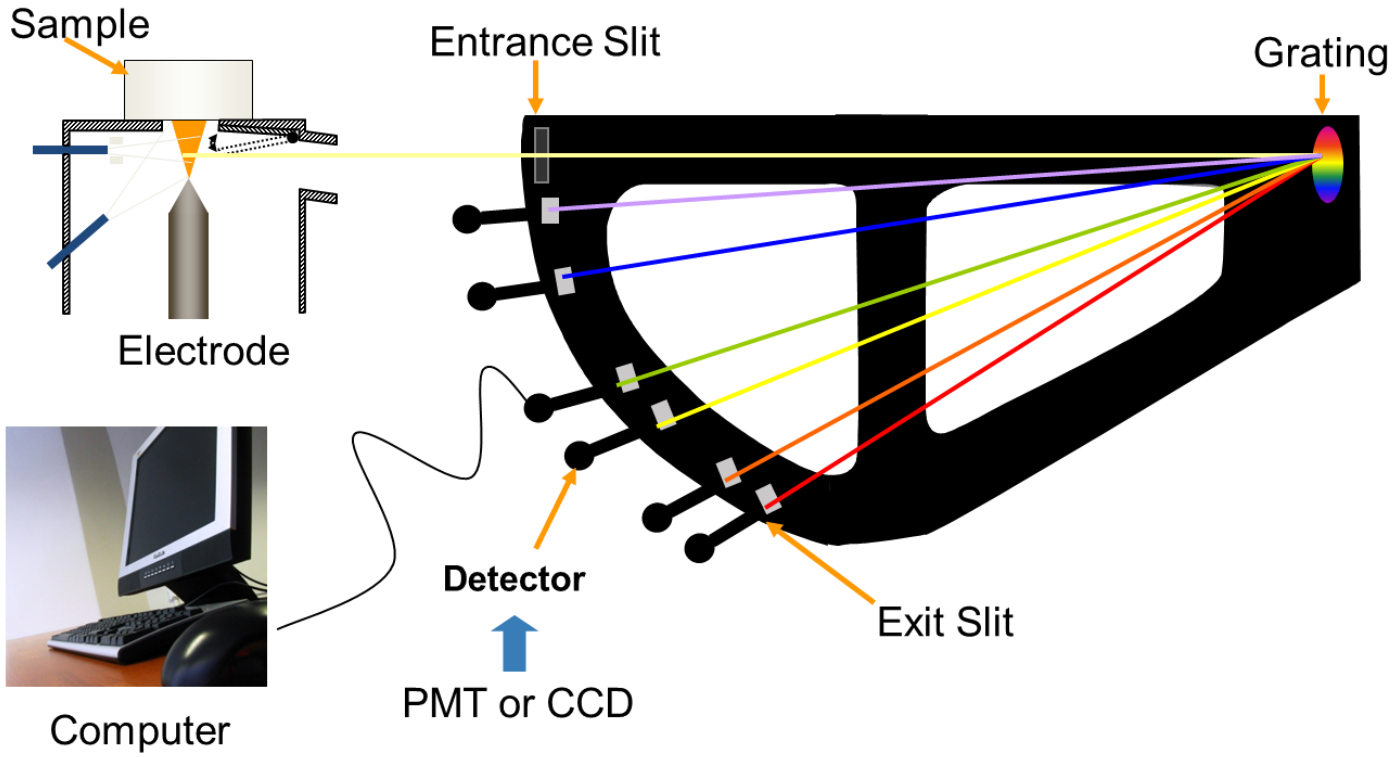
4. Ground state

Fundamentals

A simple flow chart



From the time that the electrode "sparks" the sample light is emitted. This light movees through the optics of the spectrographic machine which splits the light into different colours. Each of these colours represent different wave lengths. As each element of the periodic table burns at a specific colour it is possible for the for the spectrometer to measure these colours (wavelengths) as a percentage of the total light emitted form the spark. The below illustration gives further insight into this process.



As per the above, the sample is placed on a specific place. After this the sample is sparked by the electrode. This light moved through the entrance slit and through the grating system (optics) which then splits the colours (wavelengths) up. The intensity or amount of colour is them measured by the detectors after exiting the Exit Slit. The resulting information is then tabulated by a computer in order to present a meaningful result in the form of percentages. It is important to note that this entire process takes place in the presence of an inert gas (Argon 6 or Argon 5) which allows for the light to move more freely (be influenced less by contaminants).

A Spectrometer is a very advanced piece of machinery that requires upkeep and maintenance. A skilled operator/technician is required in order to ensure that an accurate representation of the material is achieved during the spectrographic process,

CHEMICAL PROPERTIES

Element	C	Mn	Si	P	S	Cr	Mo	Ni	Al	Cu	Nb	Ti
Sample Tested	0.15	0.23	0.51	0.010	0.007	0.40	0.30	0.04	0.01	0.30	0.002	0.001
Sample Tested	0.15	0.22	0.53	0.009	0.005	0.42	0.28	0.03	0.010	0.03	0.001	0.001
Sample Tested	0.16	0.25	0.55	0.011	0.003	0.51	0.22	0.04	0.013	0.03	0.002	0.001
Sample Tested	0.15	0.23	0.51	0.010	0.008	0.38	0.29	0.04	0.010	0.04	0.002	0.001

Element	V	Sn	Sb	B
Sample Tested	0.01	0.0002	0.0002	0.0002
Sample Tested	0.009	0.0002	0.0002	0.0002
Sample Tested	0.011	0.0002	0.0002	0.0002
Sample Tested	0.010	0.0002	0.0002	0.0002
Sample Tested	0.011	0.0002	0.0002	0.0002

Results expressed in % Note: All values maximum unless otherwise specified.

Not all spectrometers are created equal. With the passing of time, technology moves forward in leaps and bounds. Spectrometers of today are more compact and significantly more accurate that those of years gone by. When carrying out a spectrographic analysis it is key to initially determine if your spectrometer is capable of the accuracy required with respect to the reporting of results as well as that it has the ability of analysing for the trace elements you require (i.e. not all machines are able to analyse for Nitrogen, ferrous as well as non-ferrous materials).