Applications of Atomic Absorption Spectroscopy

Atomic absorption spectrometry (AAS) is an analytical technique that measures the concentrations of elements. Atomic absorption is so sensitive that it can measure down to parts per billion of a gram (μg dm–3) in a sample. The technique makes use of the wavelengths of light specifically absorbed by an element. They correspond to the energies needed to promote electrons from one energy level to another, higher, energy level.

Atomic absorption spectrometry has many uses in different areas of chemistry.

Clinical analysis.

Analysing metals in biological fluids such as blood and urine.

Environmental analysis.

Monitoring our environment – *eg* finding out the levels of various elements in rivers, seawater, drinking water, air, petrol and drinks such as wine, beer and fruit drinks.

Pharmaceuticals.

In some pharmaceutical manufacturing processes, minute quantities of a catalyst used in the process (usually a metal) are sometimes present in the final product. By using AAS the amount of catalyst present can be determined.

Industry.

Many raw materials are examined and AAS is widely used to check that the major elements are present and that toxic impurities are lower than specified – *eg* in concrete, where calcium is a major constituent, the lead level should be low because it is toxic.

Mining.

By using AAS the amount of metals such as gold in rocks can be determined to see whether it is worth mining

Qualitative and Quantitative Analysis.

Applications of atomic absorption spectroscopy:-

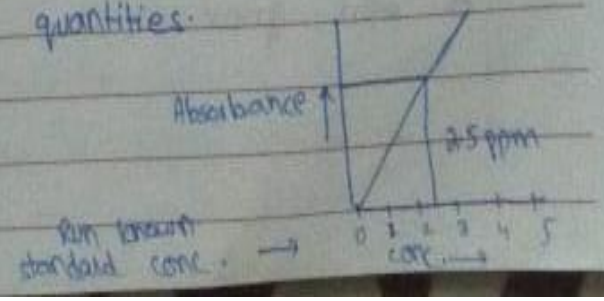
1) Qualitative analysis:-

In atomic absorption spectroscopy, different hollow cathode lamp (H.C.L) to be used for each element to be tested. So, only the element is detected which is used in the construction of Hollow cathode lamp. It involves the checking of one element at a time.

2) Quantitative analysis:-

It is based on the determination of the amount of radiations absorbed by the sample.

Quantitative analysis based on calibration curve. Calibration curve: It is also known as "standard curve." It is a general method for determining the conc. of a substance in an unknown sample by comparing the unknown to a set of standard sample of known quantities.



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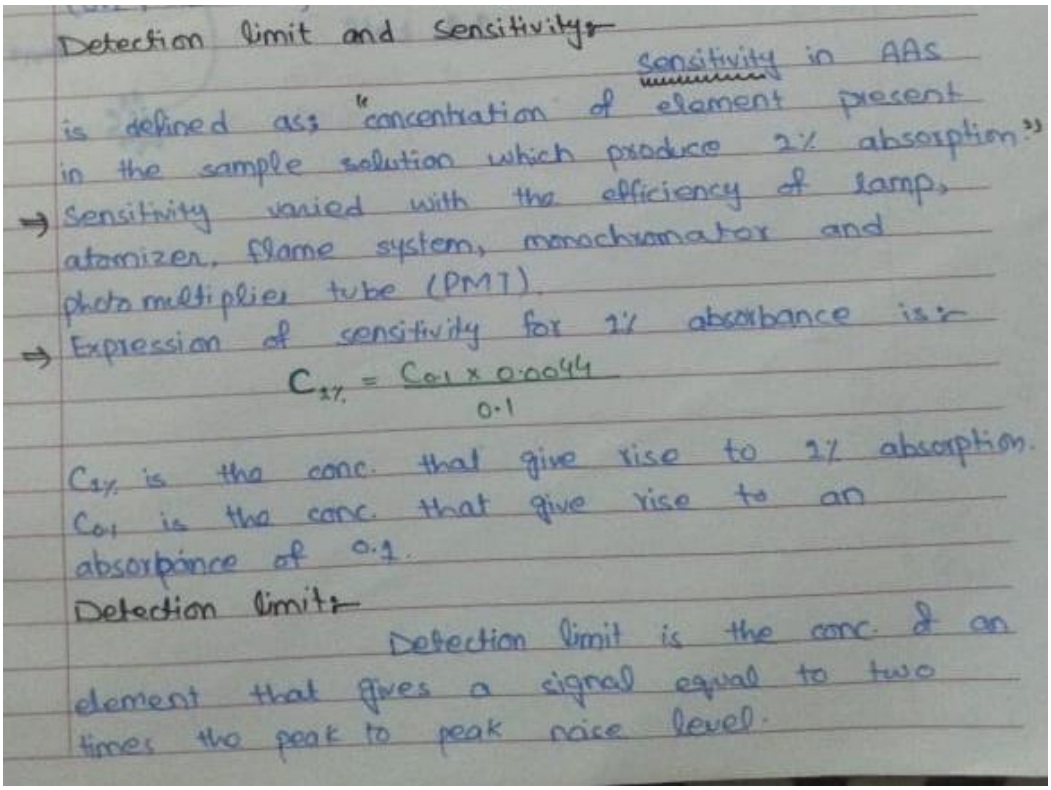
Detection limit and sensitivity in AAS and FE



Detection limit and Sensitivity:-

Sensitivity in AAS is defined as; "concentration of element present in the sample solution which produce 1% absorption."

⇒ Sensitivity varied with the efficiency of lamp, atomizer, flame system, monochromator and photo multiplier tube (PMT).

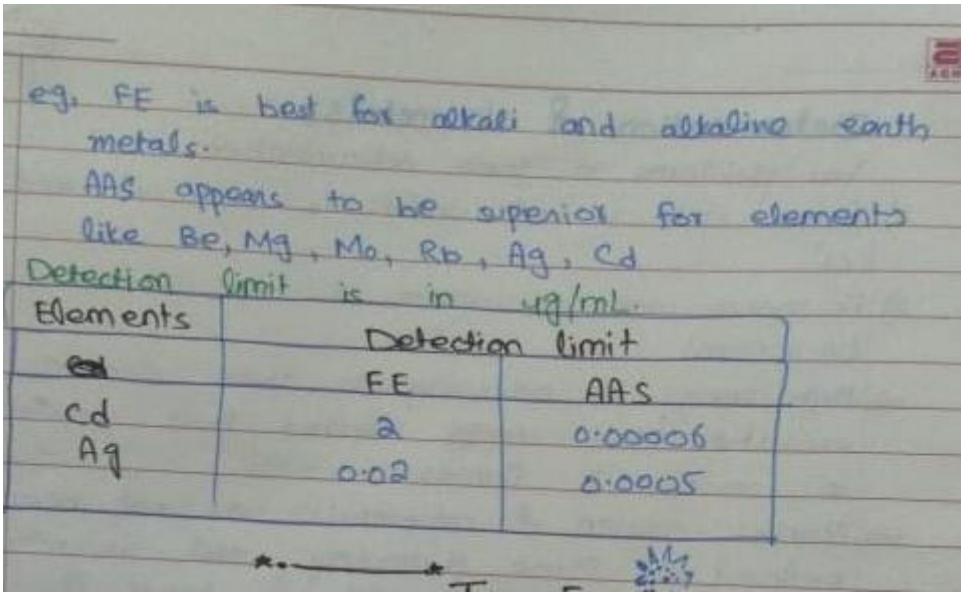
⇒ Expression of sensitivity for 1% absorbance is:-

$$C_{1\%} = \frac{C_{0.1} \times 0.0044}{0.1}$$

$C_{1\%}$ is the conc. that give rise to 1% absorption.
$C_{0.1}$ is the conc. that give rise to an absorbance of 0.1.

Detection limit:-

Detection limit is the conc. of an element that gives a signal equal to two times the peak to peak noise level.



eg. FE is best for alkali and alkaline earth metals.

AAS appears to be superior for elements like Be, Mg, Mo, Rb, Ag, Cd

Detection limit is in µg/mL.

Elements	Detection limit	
	FE	AAS
Cd	2	0.00006
Ag	0.02	0.0005