

Definitions

Spectroscopy	Interaction of radiation, traditionally electromagnetic radiation, with matter
Spectrometry	Measurement of the intensity of radiation
Spectrophotometry	Quantitative measurement of light absorption and transmission as function of the wavelength
Absorbance	Log measure of the amt of light that is absorbed when passing through a substance
Beer's Law: $A = \log I_0/I_t$	

Components of spectroscopic instruments

Instrument	Energy Source (stimulus)	Information Source	Input Transducer	Data Domain of Transduced Information	Signal Processor/Readout	Analytical Information
Photometer	Tungsten lamp	Filter	Photodiode	Electrical current	Amplifier, digitizer, LED display	
Atomic emission spectrometer	Inductively coupled plasma	Monochromator	Photomultiplier tube	Electrical current	Amplifier, digitizer, digital display	
Coulometer	Direct current source	Cell potential	Electrodes	Time	Amplifier, digital timer	
pH meter	Sample/glass electrode		Glass-calomel electrodes		Amplifier, digitizer, digital display	Hydrogen ion activity
Mass spectrometer	Ion source	Mass analyzer	Electron multiplier	Electrical current	Amplifier, digitizer, computer system	Mass-to-charge ratio
Gas chromatograph with flame ionization	Flame	Chromatographic column	Flame ionization electrodes	Electrical current	Electrometer, digitizer, computer system	

Instrument	Energy Source (stimulus)	Information Source	Input Transducer	Data Domain of Transduced Information	Signal Processor/Readout	Analytical Information
Atomic emission spectrometer	Inductively coupled plasma	Monochromator	Photomultiplier tube	Electrical current	Amplifier, digitizer, digital display	UV or visible radiation

Figures of Merit

Sensitivity	High, steep curve so that for every small change in conc, there is a large change in signal
Signal to noise ratio (S/N)	Compares level of desired signal to level of background noise. Mean of signal/standard deviation of noise. Large S/N > 3 times that SD of noise
Specificity	High responsiveness to target analyte

Figures of Merit (cont)

Detection limit	Lowest analyte conc. that can be measured at a certain confidence level. 1) Run solvent/blank multiple times 2) Signal for LOD = mean of blank + 3SD of blank. In conc. below detection limit, cannot measure sample because don't know if signal is from analyte or solvent
Dynamic range	Wide, linear concentration range that can be determined using the calibration curve ie. calibration curve to be proportional
Accuracy	Closeness of a measured value to a standard value (reference sample)

Precision	Closeness of 2 or > measurements to each other ..
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Speed

Ease and convenience

Skill required of operator	As conc. decrease, we are limited by prep error and instrumental error (signal fluctuates) ie. % error will increase
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Cost and availability of equipment

Per-sample cost

Relative standard deviation (RSD) ... % = standard deviation/mean-	We are reaching LOD of instrument thus decrease in concentration, RSD increases
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