Electromagnetic Spectrum

The collection of electromagnetic radiations covering the entire range of wavelengths/frequencies arranged in the increasing order of their wavelengths or decreasing order of their frequencies is called electromagnetic spectrum.

Different region of spectrum are identified by different names.

γ-Rays	X-rays	Ultraviolet rays (UV-rays)	Visible rays	Infrared rays (IR-rays)	Micro-waves	Radio-waves.
		less than 4000 A°	4000A° 7800A°	more than 4000 A°		

λ (wavelength)

→ Increasing wave length →
→ Decreasing frequency →
→ Decreasing energy →

Visible spectrum - VIBGYOR

Blue	Green-Yellow	Orang-Red
4000A° 400 nm	5000A° 500 nm	6000A° 600 nm	7800 A° 780 nm.

λ =

In vacuum all types of electromagnetic radiations travel at the same speed i.e., $3 \times 10^8 \, m s^{-1}$

$c = 2.997925 \times 10^8 \, m s^{-1}$.

$c = \nu \cdot \lambda$

* UV-rays have chemical effect. IR-rays have heating effect.

Spectrum → Sigular Spectra → Pluralassmate

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Study of spectra (Spectroscopy)

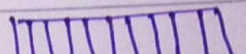
Spectroscopy deals with the study of electromagnetic radiations emitted or absorbed by a substance. The pattern of emitted or absorbed radiations recorded by spectrophotometer as a curve oragraph is called spectrum

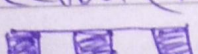
Classification of spectra -

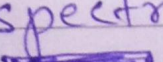
(1) Emission spectra - A spectrum which is obtained by recording radiations emitted by a substance

(2) Absorption spectra - A spectrum which is obtained by recording radiations absorbed by a substance

Emission and absorption spectra are classified as:

a) Line spectra - It consists of lines  ~~It is~~ (Atomic spectra). It is characteristic of atoms. e.g Na^+, ~~Mg~~ K^+, Ca^{2+}, Ba^{2+} etc.
(Flame test)

b) Band spectra (Molecular spectra) - It consists of bands.  . It is characteristics of molecules e.g, H_2, CH_4, CO etc.

c) Continous spectra - It consists of bands overlaping each other  . Produced by incandiescent solid (glowing with heat)

Spectrometer

Absorption spectrum of a given sample is obtained experimentally with the help of an apparatus known as spectrophotometer or spectrometer.

Light of a suitable range of wavelengths from the source is passed through the sample. The wavelength corresponds to allowed molecular transitions are absorbed. The transmitted light passes through prism which resolves it into various wave lengths. It is reflected from a mirror into a detector. The pen recorder records the intensity of radiation as a function of frequency and gives the absorption spectrum of the sample.

Teacher's Signature

The signals produced in the analysis of a sample consists of two types.

1) signals produced due to sample
2) Signals produced due to solvents and instrument used. These signals are known as 'noise'.

These 'noise' signals are unwanted and some times hinder the interpretation.

The ability of an instrument to distinguish between noise and the signal of sample is expressed as signal to noise ratio.

$$\frac{S}{N} = \frac{\text{Average signal amplitude}}{\text{Average noise amplitude}}$$

Higher value of S/N indicates greater noise reduction i.e. more precision in measurement.

Resolving power - The resolving power of a spectrometer is its ability to distinguish between adjacent absorption band or two very close spectral lines as separate entities.

Remarks

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