



**SNS COLLEGE OF TECHNOLOGY**  
**(An Autonomous Institution)**  
Coimbatore - 641035.  
**Department of CHEMISTRY**



**UNIT II**

**ANALYTICAL TECHNIQUES**

**Introduction to Spectroscopy**

Spectroscopy is an important analytic technique which deals with the study of interaction of electromagnetic radiation with matter. During the interaction, the energy is absorbed or emitted in definite quanta by the matter. The measurement of absorbed or emitted radiation is done by using spectroscopy which gives an idea about the atomic and molecular structure of the given substance

**TYPES OF SPECTROSCOPY**

There are two types of spectroscopy:

**(1) Atomic spectroscopy (2) Molecular spectroscopy**

**1. Atomic spectroscopy**

Atomic spectroscopy deals with the interaction of electromagnetic radiation with atom. During the interaction, the atom absorbs radiation and gets excited from ground state electronic energy level to higher electronic energy level. Here, electronic transition occurs which produces a single line spectrum.

**2. Molecular Spectroscopy**

It deals with the interaction of electromagnetic radiation with molecules. During the interaction, the molecules undergo rotational, vibrational transition in addition to electronic transition. Here, three transitions are occurred simultaneously which produce a band spectrum not a single line spectrum. So, molecular spectroscopy is more complicated than the atomic spectroscopy..



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### Differences between Molecular Spectra and Atomic Spectra

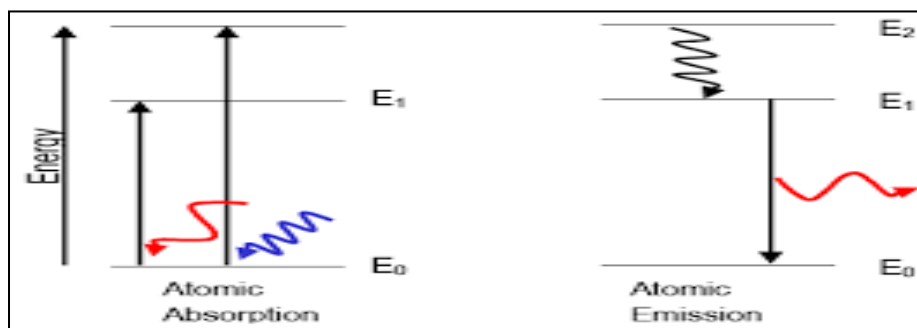
Atomic Spectra	Molecular Spectra
Atomic spectra are obtained by the interaction of electro magnetic radiation with atoms.	Atomic Spectra Molecular Spectra Molecular spectra are obtained by the interaction of electromagnetic radiation with molecules.
It is line spectrum.	It is a band spectrum.
It is a simple spectrum.	It is a complicated spectrum.
It is due to electronic transition of atoms.	It is due to the electronic transition in associated with rotational and vibrational transition.

**Types of Spectrum** There are two types of Spectrum:

**(1) Absorption Spectrum. (2) Emission Spectrum.**

#### 1. Absorption Spectrum

Consider a molecule having only two energy levels  $E_1$  (G.S.) and  $E_2$  (E.S.) as shown in Fig. When a beam of electromagnetic radiation is allowed to pass through the molecule, it absorbs energy and undergoes transition from lower energy level to higher energy level. The measurement of decrease in intensity of the incident radiation is the basis for absorption spectroscopy. The spectrum obtained is called absorption spectrum (Fig).





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### **Emission Spectrum**

When a beam of electromagnetic radiation is allowed to pass through a molecule in the ground state, the molecule absorbs energy and undergoes transition from ground state to excited state. In the excited state, molecules are highly unstable and it returns back to ground state with emission of energy “  $h\nu$  ”. The measurement of intensity of emitted radiation by the molecule is the basis for emission spectroscopy. The spectrum obtained is called emission spectrum (Fig).