Chemistry Study Materials for Class 11 (NCERT Based Notes of Chapter- 02)

Ganesh Kumar Date:- 07/09/2020

Structure of Atom

Dual Behaviour of Electromagnetic Radiation

Electromagnetic radiations possess both particle and wave nature. This is known as dual nature of Electromagnetic Radiation.

Atomic spectrum

When a ray of white light is passed through a prism, we get a series of coloured bands called spectrum. This spectrum is called continuous spectrum, because here violet merges into blue, blue into green and so on.

Similarly, when electromagnetic radiation interacts with matter, atoms and molecules may absorb energy and reach to a higher energy unstable state. To attain stability, they emit radiations in the form of spectrum.

Such a spectrum is called ***atomic spectrum***.

Emission and Absorption Spectra

The spectrum of radiation emitted by a substance that has absorbed energy is called an ***emission spectrum***. Atoms, molecules or ions that have absorbed radiation are said to be “excited”. To produce an emission spectrum, energy is supplied to a sample by heating it or irradiating it and the wavelength (or frequency) of the radiation emitted is recorded.

An ***absorption spectrum*** is like the photographic negative of an emission spectrum. Here a continuum of radiation (like white light) is passed through a sample which absorbs radiation of certain wavelengths. The missing wavelengths leave dark spaces in the bright continuous spectrum.

The study of emission or absorption spectra is referred to as ***spectroscopy***.

The emission spectra of atoms in the gas phase do not form a continuous spectrum. The excited atoms emit light only at specific wavelengths with dark spaces between them. Such spectra are called **line spectra or atomic spectra.**

Line emission spectra are very useful in the study of electronic structure of atoms. Each element has a unique line emission spectrum. The characteristic lines in atomic spectra can be used in chemical analysis to identify unknown atoms in the same way as finger prints are used to identify people. So line emission spectra are also called ***finger print of atoms***.

Line Spectrum of Hydrogen

When an electric discharge is passed through gaseous hydrogen, the H_2 molecules dissociate and the energetically excited hydrogen atoms produced emit electromagnetic radiation of discrete frequencies. The hydrogen spectrum consists of several series of lines named after their discoverers. The first five series of lines are **Lyman, Balmer, Paschen, Brackett and Pfund series**. Among these lines, the Balmer series is the only series that we can be visible (since it lies in the visible region of emr).
Hydrogen spectrum : When e^- in hydrogen atom is provided energy it gets excited to higher shell from ground state, it comes back to ground state by emitting energy in definite values.

"Quanta" : The emission of light energy is known as emission spectra. It corresponds to each atom depending upon which energy shell e^- is excited. It is **discontinuous** spectra as of light radiations do not merge with each other like is VIBGYOR (Continuous Spectra).

Johannes Rydberg proposed an equation for finding the wave number of the different lines in Hydrogen spectrum.

When e^- falls from any excited state to

$$\bar{\upsilon} = 1/\lambda = 109677\,(1/n_1^2 - 1/n_2^2)\ cm^{-1}$$

Where $n_1 = 1, 2, 3, \ldots\ldots$ and $n_2 = n_1 + 1, n_1 + 2, \ldots\ldots$

(a) Ist energy level $\mathbf{n_1}$ = 1, n_2 = 2, 3, 4,[Lyman series] (UV)

(b) When e^- to final state $\mathbf{n_1}$ = 2, n_2 = 3, 4, 5, [Balmer series] (Visible)

(c) When e^- to falls to final state $\mathbf{n_1}$ = 3 n_2 = 4, 5, 6 [Paschen series] IR.

(d) When e^- to falls to final state $\mathbf{n_1}$ = 4 n_2= 5, 6, 7 [Bracket series] IR.

(e) When e^- to falls to final state $\mathbf{n_1}$ = 5 n_2 = 6, 7, 8 [Pfund series] IR.

The expression is:

The different spectral lines, their n_1 and n_2 values and their spectral region are:

Series	Spectral region	n_1	n_2
Lyman	**Ultra violet**	1	2,3,4….
Balmer	**Visible**	2	3,4,5….
Paschen	**Infra red**	3	4,5,6…..
Brackett	**Infra red**	4	5,6,7….
Pfund	**Infra red**	5	6,7,8…..

****