Unit – 5 : Electronic spectra of complexes

Structure of Unit:

18.0 Objectives

18.1 Introduction

18.2 Electronic spectra of complexes

18.0 Objectives

At the end of the unit learner will be able to

Familiar with Ion complexes.

Learn the spectro chemical & nephleauxetic series.

- Understand about Charge transfer & absorption spectra.
- Increase knowledge about Jablonski diagram & Molecular emission spectra.

Familiar with Electronic spectra of Transition Metal Ions complexes.

18.1 Introduction

This Chapter deals with increasing the knowledge of electronic spectra of complexes and its compound, and their knowledge about Electronic spectra of transition metal ions complexes and as well as Charge transfer & Molecular emission spectra. Chapter also explain brief about spectro chemical series, nephlauxetic series and calculations of Dq, B, β parameters.

18.2 Electronic spectra of complexes

Spectra are broadly classified into two groups (i) emission spectra and (ii) absorption spectra **i. Emission spectra:** Emission spectra are of three kinds (a) continuous spectra,(b) band spectra and (c) line spectra.

(A) Continuous spectra: Solids like iron or carbon emit continuous spectra when they are heated until they glow. Continuous spectrum is due to the thermal excitation of the molecules of the substance.

(B) Band spectra: The band spectrum consists of a number of bands of different colours separated by dark regions. The bands are sharply defined at one edge called the head of the band and shade off gradually at the other edge. Band spectrum is emitted by substances in the molecular state when the thermal excitement of the substance is not quite sufficient to break the molecules into continuous atoms.

(C) Line spectra: A line spectrum consists of bright lines in different regions of the visible spectrum against a dark background. All the lines do not have the same intensity. The number of lines, their nature and arrangement depends on the nature of the substance excited. Line spectra are emitted by vapours of elements. No two elements do ever produce similar line spectra.

ii. Absorption spectra: When a substance is placed between a light source and a spectrometer, the substance absorbs certain part of the spectrum. This spectrum is called the absorption spectrum of the substance. Electronic absorption spectrum is of two types. d-d spectrum and charge transfer spectrum. d-d spectrum deals with the electronic transitions within the d-orbitals. In the charge – transfer spectrum, electronic transitions occur from metal to ligand or vice-versa. three types of transitions spectra are important to consider are Metal to Ligand Charge Transfer (MLCT), Ligand to Metal Charge Transfer (LMCT), and d-d transitions. Studying spectra provides information about bonding and structure in these species. Transition metal spectroscopic transitions are employed in industrial pigments, display devices, lasers etc

18.3 Electronic absorption spectroscopy principles:

Electronic absorption spectroscopy requires consideration of the following principles:

a. ***Franck-Condon Principle:*** Electronic transitions occur in a very short time (about 10-15 sec.) and hence the atoms in a molecule do not have time to change position appreciably during electronic transition .So the molecule will find itself with the