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 same molecular configuration and hence the vibrational kinetic energy in the exited state remains the same as it had in the ground state at the moment of absorption.
b. ***Electronic transitions between vibrational states:*** Frequently, transitions occur from the ground vibrational level of the ground electronic state to many different vibrational levels of particular excited electronic states. Such transitions may give rise to vibrational fine structure in the main peak of the electronic transition. Since all the molecules are present in the ground vibrational level, nearly all transitions that give rise to a peak in the absorption spectrum will arise from the ground electronic state. If the different excited vibrational levels are represented as υ1, υ2, etc., and the ground state as υ0, the fine structure in the main peak of the spectrum is assigned to $\upsilon 0 \rightarrow \upsilon 0$, Σ(longest wave length) transition.
c. ***Symmetry requirement:*** Electronic transitions occur between split'd' levels of the central atom giving rise to so called d-d or ligand field spectra. The spectral region

where these occur spans the near infrared, visible and U.V. region.

Ultraviolet (UV)	Visible (Vis)	Near infrared (NIR)	
50,000 - 26300	26300 - 12800	12800 -5000	cm^{-1}
200 - 380	380 - 780	780 - 2000	nm