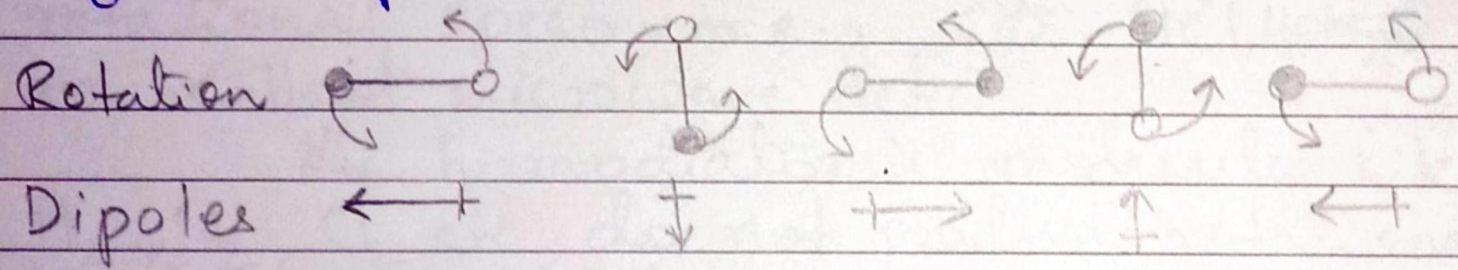
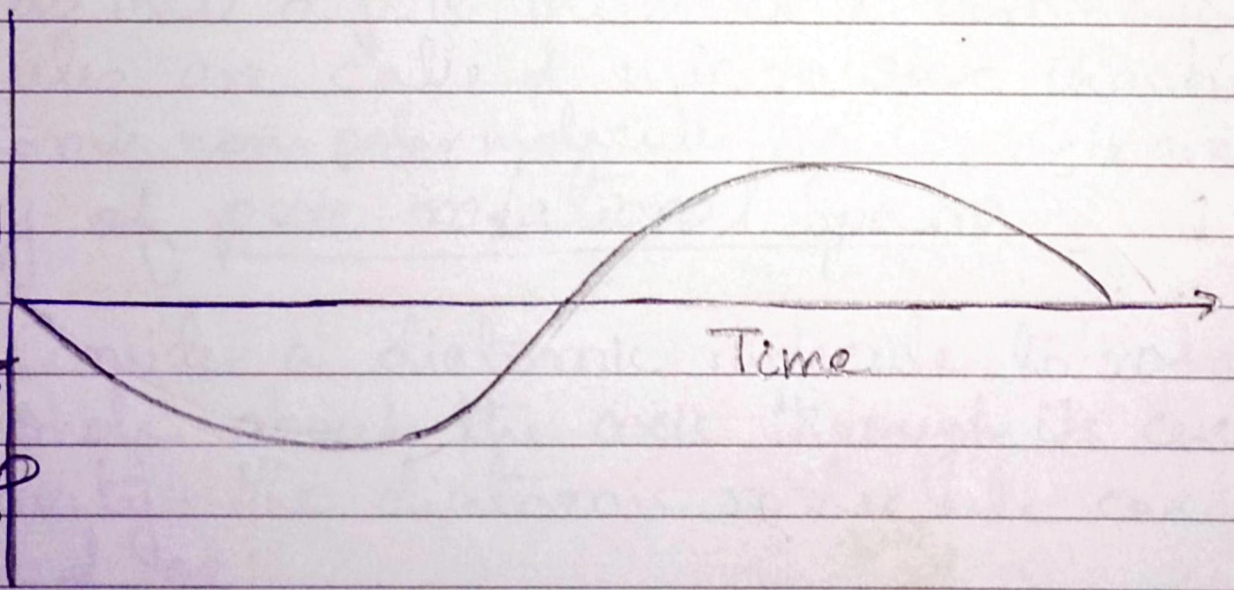
Rotational Spectrum

Rotational or Microwave or Far infrared spectrosc

Pure rotational molecular spectra are produced in far infrared (~~1-100 cm^{-1}~~) ~~region, caused by the rotations~~ and microwave regions (1-100 cm^{-1}) caused by rotations of the molecules. The molecules possessing permanent dipoles give rotational spectra. During rotational motion, the direction of dipole undergoes a periodic change, resulting in periodic fluctuations in the magnitude of a component of the dipole.





When frequency of electromagnetic radiation coincides with that of molecular rotation, the electromagneti radiation interacts with the molecular dipole and keeps pushing the molecule to a higher energy level. This absorption of radiation thus gives the pure rotational spectrum of the molecule.

The emission or absorption of electromagnetic radiation in rotational energy levels would occur only if a change in dipole moment is associated with it. That is molecule must be polar with permanent dipole produce a rotational spectrum e.g., CO, HCl, ~~H_2O~~ NO, NO_2 etc are called microwave active.

The homodiatomic molecules like H_2, N_2, Cl_2 etc. do not produce rotational band as their dipole moment is zero. Such molecules are called microwave inactive.

Polyatomic non-polar molecules like CO_2, C_6H_6 are inactive

Theory of pure rotational Spectra

Consider a diatomic molecule to rotate as a whole about the axis through its centre of gravity. The diatomic molecule can be pictured as:

1) Rigid rotator model
2) Non rigid rotator model.