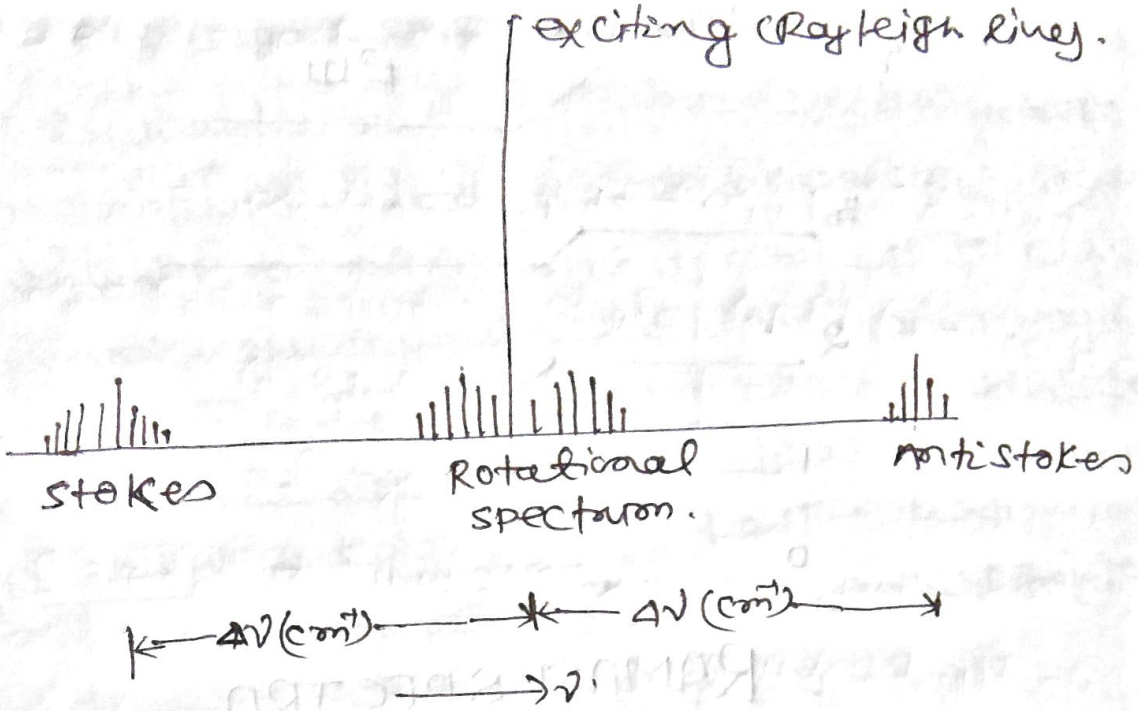
B.Sc-III, Paper-VII, Group-B

RAMAN SPECTRA

When a strong beam of visible or ultra-violet line-spectral light illuminates a gas, a liquid, or a transparent solid, a small fraction of light is scattered in all directions. The spectrum of the scattered light is found to consist of lines of the same frequencies as the incident beam (Rayleigh lines) and also certain weak lines of changed frequencies. These additional lines are called Raman lines. The Raman lines corresponding to each exciting (Rayleigh) line occur symmetrically on both sides of the exciting line, are called Stokes lines while those on the higher frequency side are called anti-Stokes lines, while those on the right. The lines on the low frequency side of the exciting lines are called stokes lines.

The displacements [in (cm^{-1})] of the Raman lines from the corresponding exciting lines are independent of the frequencies of the latter. If another light source with a different line-spectrum is used, other Raman lines are obtained for the same scattering substance. However the displacements from the same scattering substance, however, the displacements from the exciting lines are the same. For different scattering substances, the displacements have different magnitudes. Thus the Raman displacements are characteristic of the scattering substance.



Under low resolution, there is one stokes Raman line and one anti-stokes Raman line each having the same wave number displacement Δν agree exactly with the wave-no of the main vibrational-rotational absorption band to the case for all those diatomic molecules for which both the Raman spectra and the infra-red spectra are observed.

Under high resolution the exciting line is found to have on both sides close, approximately equidistant lines. This is pure rotational Raman spectrum. The separation b/n successive rotational lines is very nearly twice the separation b/n successive lines in the far infra-red spectrum of the molecule. The stokes and anti stokes line referred above are also found to be bands composed of rotational fine structure. They constitute the vibrational (strictly vibrational-rotational) Raman spectrum of the molecule.