

Q. Discuss about the hyperfine structure of the ESR spectrum of H atom and D-atom? 4 marks

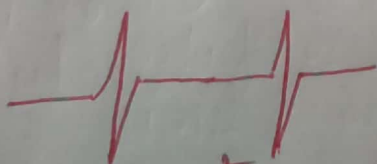
⇒ Hyperfine splitting The hyperfine splitting (hfs) is a special feature of ESR caused by the interaction of electron spins with the magnetic nuclei in the sample. A magnetic nucleus with quantum number I will split a single ESR line (peak) into $2I+1$ lines (peaks). When a number of magnetic nuclei coexist in a radical and interact with the unpaired electrons, the ESR spectra will contain many lines. The magnetic field separation between two neighboring peaks in the splitting due to the same nucleus is called the hfs-constant of that magnetic nucleus. The values of hfs constant depends on the nature of nucleus and the density of electron spin distributed in on the nucleus.

For H atom

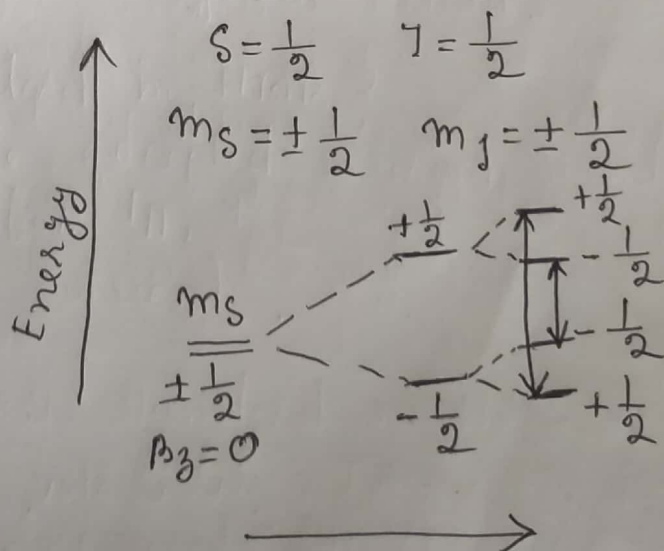
$$n=1, I = \frac{1}{2}$$

$$2nI + 1 = 2 \times 1 \times \frac{1}{2} + 1 = 2 \text{ lines}$$

H₁ H₂



(ESR spectrum of H atom)
doublet lines with equal intensity)

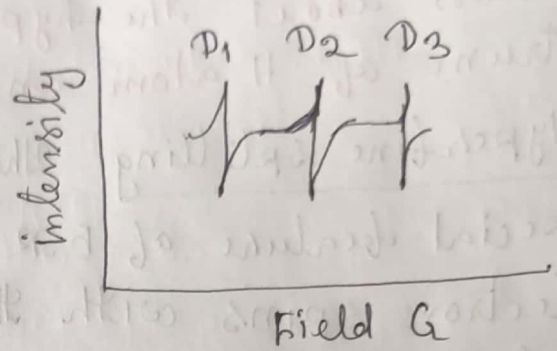


For Deuterium

$$I = 1, n = 1$$

$$2nI + 1 = 2 \times 1 \times 1 + 1$$

= 3 lines



Thus, hyper fine ESR lines for (peaks) Deuterium is 3 having equal intensity.