

File-8: Problems in ESR

1. In a 9.25GHz ESR spectrometer two lines appear at 357.3 T and 306.6 MT .Calculate the hyperfine constant.

$$E_1 = h\nu = g\beta B + haM_I$$

$$E_2 = h\nu = g\beta B + haM_I$$

For , $M_I = +\frac{1}{2}$ or $-\frac{1}{2}$

$g = 2.002$; $\beta = 9.273 \times 10^{-24} \text{JT}^{-1}$ are constants.

Calculate E_2 & E_1 and hence “a”

$$E_2 - E_1 = ah[(+\frac{1}{2}) - (-\frac{1}{2})] = ah$$

$$\mathbf{Ans} = 1.6 \times 10^9 \text{ Hz}$$

2. Calculate the frequency required at a magnetic field strength of 0.3 T.

$$h\nu = g\beta B$$

$$g = 2.002; \beta = 9.273 \times 10^{-24} \text{JT}^{-1}; B = 0.3 \text{ T}; h = 6.625 \times 10^{-34} \text{ Js}$$

$$\text{Hence, } \nu = 8.4 \times 10^9 \text{ Hz} = 8.4 \text{ GHz}$$

3. ESR frequency = 9000 MHz. Calculate the field (**Ans:** 0.3215 T)
4. What will be the frequency for resonance for a free electron in a magnetic field of 0.3T
5. Calculate the frequency for an unpaired electron in a magnetic field of 0.35T
6. The ESR frequency for a free electron is 9000 MHz . Calculate the corresponding magnetic field .
7. The ESR spectrum of methyl radical occurs at 330 mT in a spectrometer operating at 9250 MHz. Calculate the g value of the radical,
8. An irradiated sample of MgO has a strong ESR line at 0.163 T, when the spectrometer is operating at 9.4 GHz. What is the g-value of the line?
9. The g value of an electron in atomic hydrogen is 2.0032. In a spectrometer at 9,250 GHz two lines from appeared at 357.3 and 306.6 mT. Calculate the hyper fine coupling constant.
10. The ESR spectrum of a radical with a single magnetic nucleus is split into four lines of equal intensity. What is the nuclear spin of the magnetic nucleus

11. Compare the number of lines in the ESR spectra of the radicals XH_2 and X_2H_2 if the nuclear spin of X is $5/2$
12. Some commercial ESR spectrometer use 8 mm microwave radiation, what magnetic field is needed to bring an electron spin resonance.
13. The centre of the ESR spectrum of atomic H lies at 329.12 mT in a spectrometer operating at 9.233 GHz . What is the g value of the electron in H atom
14. The g value of the unpaired electron in benzene radical anion C_6H_6^- is 2.0025. At what field it will resonate in a spectrometer operating at (a) 9.302GHz (b) 33.67 GHz?
15. The electron in ^{23}Na ($I=3/2$) has $g=2.0022$. In a spectrometer operating at 9.250 GHz four lines appear at 284.4, 316.0, 347.6 and 379.2mT were obtained for it . Calculate the hyperfine coupling constant for ^{23}Na .