

Homework no. 3

Modern Techniques in Biophysics

Topic: Electron paramagnetic resonance

Due date: February 13, 2015

Problem 1: EPR vs NMR

- (a) What are some of the similarities and differences between EPR and NMR.
- (b) Name the 5 main parameters that contribute to EPR properties (from the EPR Hamiltonian) and briefly explain each one of them.

Problem 2: Hyperfine coupling ($S=1/2$ unpaired electron and 8 equivalent $I=1/2$ nuclei)

- (c) Calculate explicitly the relative intensities of EPR signals emanating from the interaction of an unpaired electron ($S=1/2$) and 8 equivalent $I=1/2$ nuclei.
- (d) Draw the predicted EPR spectrum.

Problem 3: Hyperfine coupling ($S=1/2$ unpaired electron and 5 equivalent $I=1$ nuclei)

- (a) Predict the relative intensities of EPR signals emanating from the interaction of an unpaired electron ($S=1/2$) and 5 equivalent $I=1$ nuclei.
- (b) Draw the predicted EPR spectrum.

Problem 4: g-anisotropy

Assuming the other parameters are negligible or isotropic, predict and draw the EPR spectra (absorption) of powder samples with the following g-tensor values:

- (a) Isotropic g-tensor: $g_x=g_y=g_z$
- (b) Axial g-tensor: $g_x=g_y>g_z$.
- (c) Rhombic g-tensor: $g_x\neq g_y\neq g_z$.