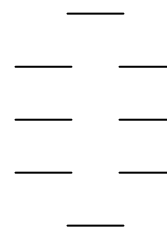


# CHEM 260

## Assignment 6

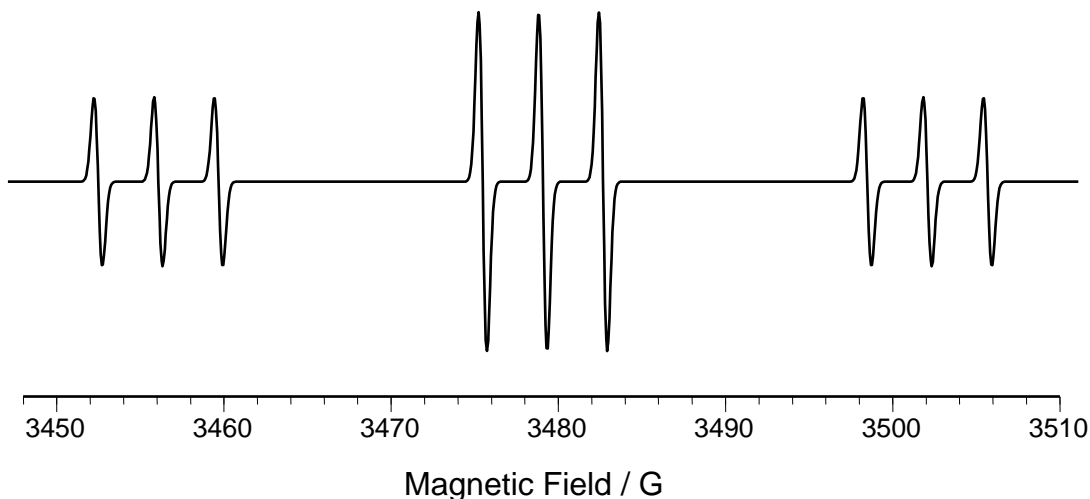
Due Monday 17th February 2003

22. (a) The energy level diagram for the  $\pi$  molecular orbitals of cyclooctatetraene is sketched on the right. Explain why some energy levels occur in pairs and some not.
- (b) Why might biochemists prefer to use a 800 MHz NMR spectrometer to one that operates at 100 MHz?
- (c) Describe the different types of angular momentum that can exist in a molecule. What quantum numbers are commonly used to specify them.



(Question from 2002-1 mid-term exam)

23. Suppose a mixture of deuteromethanes ( $\text{CH}_3\text{D}$ ,  $\text{CH}_2\text{D}_2$  and  $\text{CHD}_3$ ) is irradiated with a high energy electron beam and the following spectrum is detected by X-band ESR.
- a) Explain the intensity pattern.
- b) What radical gives this spectrum?
- c) Estimate the proton and deuteron hyperfine coupling constants.



24. You are given a sample with the molecular formula  $\text{C}_5\text{H}_{10}\text{O}$ . From chemical tests you know it is a ketone. What are the possible molecular structures? How could you distinguish between them by proton NMR?