

Final Exam: Wednesday Dec 22, 2010

Allowed: **Time – three hours**
Bernath text: *Spectra of Atoms and Molecules*
Calculator

Each question carries equal marks. Answer four from the following five questions.

1. a) Calculate the magnetic field required to produce a splitting of 1 cm^{-1} between the states of a 1P term.
b) Find in their simplest forms in terms of only L and S the Landé factor for both a term in which J has its maximum value for a given L and S , and a term in which J has its minimum value for a given L and S .
2. Bernath, Chapter 6, Qu. 6. Sketch the resulting energy levels and explain how you would verify its structure through spectroscopic means. [BF_3 molecule]
3. Bernath, Chapter 7, Qu.11. [H_2CO molecule]
4. Using a calculator, answer Bernath, Chapter 7, Qu. 20, parts (a) and (b) **only**. [HCl molecule]
5. Bernath, Chapter 10, Qu. 8, parts (a) and (b) **only**. [Note that in part (a), you are asked to find which irreducible representations are contained within the reducible representation formed from these 10 atomic orbitals.] [HOOH molecule]