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5.80 Small-Molecule Spectroscopy and Dynamics
Fall 2008

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MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Chemistry 5.76
Spring 1978

Take Home Examination
due May 19, 1978
(Late papers will not be accepted)

This is an open book, open note, unlimited time examination. I expect that you will discuss the listed articles with each other and with me.

Select one of the following research articles:

1. M. Bixon and J. Jortner, "Intramolecular Radiationless Transitions", *J. Chem. Phys.* **48**, 715 (1968).
2. D. L. Rousseau and P. F. Williams, "Resonance Raman Scattering of Light from a Diatomic Molecule", *J. Chem. Phys.* **64**, 3519 (1976).
3. J. N. Murrell and J. M. Taylor, "Predissociation in Diatomic Spectra with Special Reference to the Schumann-Runge Bands of O₂", *Mol. Phys.* **16**, 609 (1969).
4. R. N. Zare, "Molecular Level Crossing Spectroscopy", *J. Chem. Phys.* **45**, 4510 (1966) and *Accts. Chem. Res.* **4**, 361 (1976).
5. W. M. Gelbart and K. F. Freed, "Intramolecular Perturbations and the Quenching of Luminescence in Small Molecules," *Chem. Phys. Lett.* **18**, 470 (1973).
6. R. W. Field, "Assignment of the Lowest ³Π and ¹Π States of CaO, SrO, and BaO", *J. Chem. Phys.* **60**, 2400 (1974).
7. H. E. Radford and H. P. Broida, "Rotational Perturbations in CN. Zero Field Theory, Optical Zeeman Effect, and Microwave Transition Probabilities", *Phys. Rev.* **128**, 231 (1962) and "Chemical and Magnetic Enhancement of Perturbed Lines in the Violet Spectrum of CN", *J. Chem. Phys.* **38**, 644 (1963).
8. R. E. Drullinger and R. N. Zare, "Optical Pumping of Molecules", *J. Chem. Phys.* **51**, 5532 (1969).
9. S. R. Hartmann and E. L. Hahn, "Nuclear Double Resonance in the Rotating Frame", *Phys. Rev.* **128**, 2042 (1962).
10. A. M. Portis, "Electronic Structure of F Centers: Saturation of the Electron Spin Resonance", *Phys. Rev.* **91**, 1071 (1953).

Your discussion of one of these papers should consist of two parts:

- I. A brief (500–1000 words) summary. DO NOT simply rephrase the abstract. Focus on the aspect that seems to you to be most unexpected, elegant, or interesting.

- II. A brief description (500–1000 words) of an original experiment which you have designed to test or utilize some aspect of the selected paper. You should not worry about whether your experiment has already been attempted, nor should you search for and summarize another paper which reports “your” experiment.

Assume that you have access to light sources with unlimited power, frequency tuning range, spectral bandwidth, and time resolution. Be specific about the required operating characteristics of the components of your experiment.