

# CHEM 6472: Quantum Mechanics

## IR Spectroscopy Sample Questions

(Not to turn in)

1. For a nonlinear molecule with  $N$  atoms, how many vibrational modes does it have?
2. Explain why a molecule with low symmetry is likely to have all its IR modes active.
3. For the  $\text{H}_2\text{O}$  molecule, the combination band (111) is not electric-dipole allowed, but it might still be visible as a weak band. Is it allowed or disallowed by symmetry?
4. The point-group of the formaldehyde molecule,  $\text{H}_2\text{CO}$ , is  $\text{C}_{2v}$ . Using the character table for  $\text{C}_{2v}$ , work out how many vibrational modes of each irrep there are. Which ones are IR active by symmetry?