

Things You Should Know

Chapter 2: Overview of Molecular Spectroscopy

Be able to define the following terms (using words, equation, or figures):

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|--------------------------------|--------------------------|
| Born-Oppenheimer Approximation | Potential Energy Surface |
| Spherical Harmonics | Absorption |
| Stimulated Emission | Spontaneous Emission |
| Einstein A and B coefficients | Homogeneous Broadening |
| Natural Line Broadening | Pressure Broadening |
| Inhomogeneous Broadening | Doppler Effect |

Concepts and Exercises:

1. Know the basic principle of the Born-Oppenheimer approximation.
2. Be able to interpret simple figures in which we draw an electronic potential curve for a diatomic molecule with the vibrational and rotational levels superimposed on it. Understand how this picture results from the approximate separation of the electronic, vibrational and rotational motion in the Hamiltonian.
3. Know the general approach used to go beyond the Harmonic oscillator and Rigid Rotor approximations for diatomic molecules.
4. Be able to describe the physical significance of each term in the expression for the energy levels of a diatomic molecule.
5. Know in which wavelength regions different types of spectra occur.
6. Be able to discuss all the factors that determine the intensity of a spectroscopic transition.
7. Know where the various types of selection rules come from.
8. Know the various sources of spectral broadening and be able to calculate the contributions of each type under a particular set of conditions.
9. Be able to do all the assigned exercises.