Modern Techniques in Biophysics

Topic: Raman Spectroscopy

Due date: *April 20, 2015*

Problem 1: Raman and Rayleigh scattering

Draw a simplified schematic diagram showing the difference between Rayleigh and Raman scattering. Explain how Raman spectroscopy can probe the vibrational states of a molecule.

Problem 2: Stokes and anti-Stokes Raman scattering

Draw and explain a simplified schematic diagram showing the difference between Stokes and anti-Stokes Raman scattering. In addition, derive the formula describing the induced dipole moment with Stokes and anti-Stokes frequency shift components.

Problem 3: Raman spectrum

Note: This is problem 8.2 in the reference material (Biomedical Applications in Biophysics). Assuming that the Raman peak for the CH stretching vibration appears at approximately 2900 cm–1, estimate the new location of the peak if the hydrogen (H) is replaced with deuterium (D). Use the fact that deuterium has approximately twice the mass of hydrogen.

Problem 4: Biomedical Applications of Raman spectroscopy

Provide two (2) examples of biomedical applications of Raman spectroscopy and explain how these Raman measurements can give medical diagnostic information.