5.80 Small-Molecule Spectroscopy and Dynamics

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Chemistry 5.76
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Problem Set #4

Some problems [indicated] were taken from various chapters of Molecules and Radiation by J. I. Steinfeld, Harper & Row, 1974

1. [Steinfeld, Ch. 7, #1]

2. [Steinfeld, Ch. 8, # 2]

3. [Steinfeld, Ch. 8, # 4]

4. [Steinfeld, Ch. 8, # 6]

5. [Steinfeld, Ch. 8, # 8]

6. $^{16}O^{12}C^{32}S$ is a linear molecule. The bond lengths are

   r_{CO} = 1.16Å

   r_{CS} = 1.56Å

   and the observed fundamental vibrational frequencies are

   ν_1 = 858.9 cm^{-1} stretch

   ν_2 = 520.4 cm^{-1} bend

   ν_3 = 2062.2 cm^{-1} stretch.

   (a) Obtain k_{CS}, k_{CO}, and $k_\theta[r_{CO}r_{CS}]^{-1}$ in dynes/cm.

   (b) What are the amplitudes for C-O and C-S stretch in the ν_1 fundamental level?

   (c) What are the vibrational frequencies for $^{18}O^{12}C^{32}S$?

7. [Steinfeld, Ch. 9, #1]