Questions: Text book assignment #9

17-2 The spectrum in FIgure 17-15 (shown below) was obtained for a liquid with an empirical formula of C_3H_6O. Identify the compound.

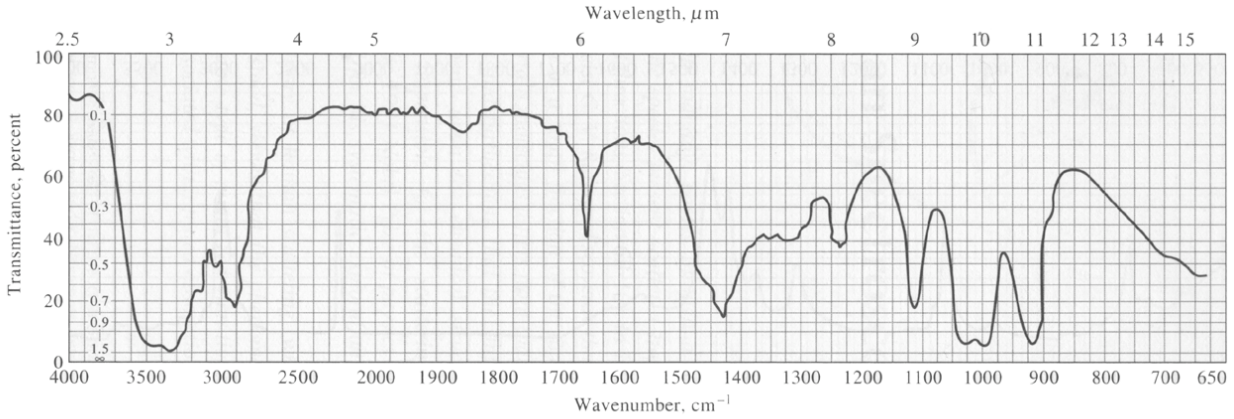

Figure 17-15 See Problem 17-2. *(Spectrum courtesy of Thermodynamics Research Center Data Project, Texas A & M University, College Station, Texas.)*

17-3 THe spectrum in FIgure 17-16 is that of a high-boiling liquid having an empirical formula $C_9H_{10}O$. Identify the compound as closely as possible.

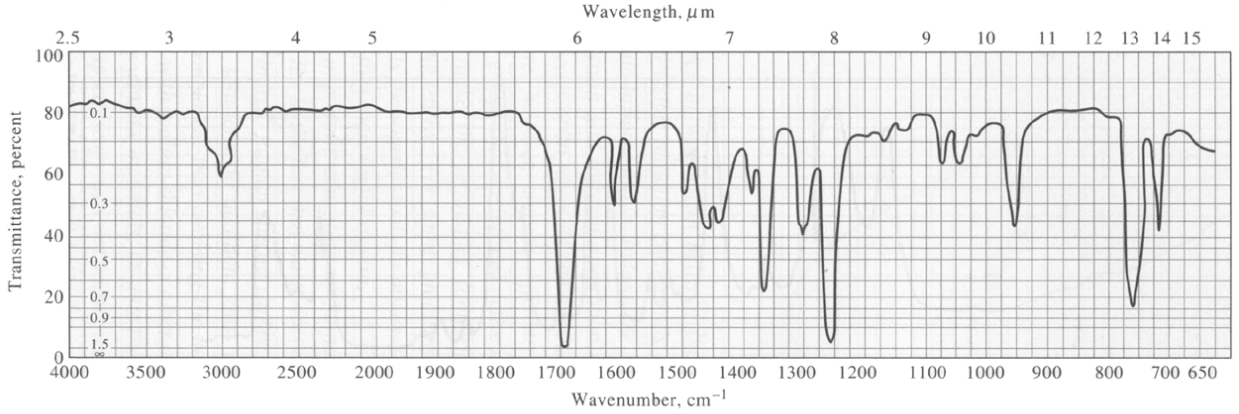

Figure 17-16 See Problem 17-3. *(Spectrum courtesy of Thermodynamics Research Center Data Project, Texas A & M University, College Station, Texas.)*

17-6 Why are quantitative analytical methods based upon near-infrared radiation likely to be more precise and accurate than methods based upon mid-infrared radiation?

17-9 An empty cell showed 12 interference peaks in the wavelength range of 6.0 to 12.2 μm. Calculate the path length of the cell.

18-3 At what wavelengths in nanometers would the Stokes and anti-Stokes Raman lines for carbon tetrachloride ($\overline{\upsilon}$ = 218, 314, 459, 762, 790 cm^{-1}) appear if the source was (a) a helium-neon laser at 632.8 nm? or (b) an argon-ion laser at 488.0 nm?

18-4 Assume the excitation sources in Problem 18-3 (above) have the same power. (a) Compare the relative intensities of the CCl_4 Raman lines when each of the two excitation sources is used. (b) If the intensities were recorded with a typical monochromator/photomultiplier system, why would the measured intensity ratios differ from the ratio calculated in part (a)?

18-5 Under what circumstances would a helium-neon laser be preferable to an argon-ion laser as a Raman source?

18-6 For vibrational states, the Boltzmann equation can be written as

$$\frac{N_1}{N_0} = e^{-\Delta E/kT}$$

where N_0 and N_1 are the populations in the lower and higher energy states, respectively. ΔE is the energy difference between the states, k is the Boltzmann constant, and T is the temperature in kelvin. For temperatures of 20 ˚C and 40 ˚C, calculate the ratios of the intensities of the anti-Stokes and Stokes lines for CCl_4 at (a) 218 cm^{-1}; (b) 459 cm^{-1}; and (c) 790 cm^{-1}.