

Chemistry 1B-AL
Homework #9
(#60-#63)
Required (submit via [WebAssign](#))

SAMPLE SPECTROSCOPY QUESTIONS

| <i>bond</i> | <i>approximate vibrational group frequency (cm⁻¹)</i> |
|-------------|--|
| C–C | ~ 1000–1400 |
| C=C | ~1600 |
| C–O | ~ 1100 |
| C=O | ~ 1800 |
| C–N | ~ 1000 |
| C≡N | ~ 2100–2200 |
| C–H | ~ 2800–3200 |
| N–H | ~ 3300 (weak) ~1600 (intense) |
| O–H | ~ 3600 |
| C–Cl | ~ 550-800 |

60. Indicate the correct choice for each part (students interested in getting points for this problem should answer **using the letter representing the correct molecule** and **not the phrases or formulas !!**)

_____ (i) Lowest energy photon: **a.** IR; **b.** radiowave; **c.** X-ray; **d.** UV

_____ (ii) Highest energy electronic transition (generally):
a. $\sigma \rightarrow \sigma^*$; **b.** $n \rightarrow \pi^*$; **c.** $\pi \rightarrow \pi^*$; **d.** $n \rightarrow \sigma^*$

_____ (iii) Wavelength range where absorbed photons flip nuclear (hydrogen nuclei) spins:
a. UV-VIS; **b.** far UV; **c.** IR; **d.** radiowave

_____ (iv) Molecule with an infrared absorptions near 1800 cm⁻¹ and 1600 cm⁻¹
a. CH₃CH₂OH; **b.** CH₃CH₂COCH₃; **c.** CH₂CHCOCH₃;
d. CH₃OCH₂CH₂OH

61. Provide the name which describes each of the following:

- _____ i. Wavelength region for $\sigma \rightarrow \sigma^*$ transitions
- _____ ii. Absorption of a photon and "slow" return to ground state by way of intermediate electronic state with photon emitted of longer wavelength than the photon absorbed.
- _____ iii. Spectral region where photons excite molecular vibrations
- _____ iv. Return from excited state to ground state releasing energy as heat (motion of molecules)
- _____ v. Wavelength region used in ESCA spectroscopy
- _____ vi. Absorption of a photon and "fast" return to ground state with photon emitted of equal (or slightly longer) wavelength than the photon absorbed.
- _____ vii. Wavelength region for $\pi \rightarrow \pi^*$ transitions
- _____ viii. Type of electronic excitation which could absorb light in visible spectral region
- _____ ix. Molecule responsible for absorption of light in the eye (name of protein plus chromophore).

62.

- _____ (a) Number of peaks (major) in the $^1\text{H-NMR}$ spectrum of n-butane
 $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$

63.

a. Draw the Lewis structures for:

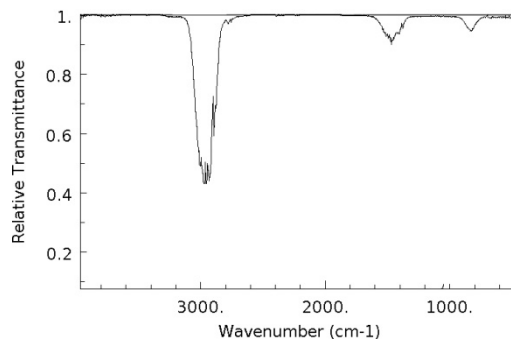
I. acetaldehyde C_2H_4O (CH_3CHO)

II. ethane C_2H_6 (CH_3CH_3)

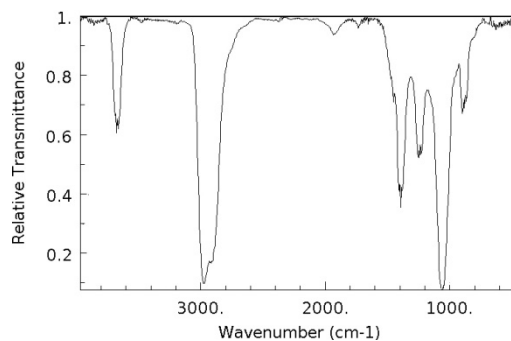
III ethyl alcohol C_2H_6O (CH_3CH_2OH)

b. The three IR spectra below correspond to the three compounds in part (a) above. Match the compounds with their respective IR spectra (the needed group frequencies are on the front page). *Your answers to i, ii, and iii the below should be selected from I, II, and III, corresponding to the three molecules in part a:*

_____ (i)



_____ (ii)



_____ (iii)

