Chemistry 217
Problem Set 3

Recommended Problems from the Book: 13.6-13.14, 14.28-14.33, 2.1-2.12, 2.30-2.37
(1st ed.:14.7-14.15, 14.28-14.34, 2.1-2.11, 2.27-2.36)

Klein: Ch. 3

1. Circle and identify the functional groups in the following molecules.

(a)

(b)

zaragozic acid: isolated from fungi, significantly reduces cholesterol, but is too toxic to be pharmaceutically viable.

penicillin

2. The following are compounds isolated from plants. Assign the important peaks in the IR spectrum of each compound.

menthol

IR spectrum
perillic acid

carvone
2. The IR spectra for four constitutional isomers are shown below. Match each spectrum to the correct compound. Assign the important peaks of each spectrum.

A

B

C

D
3. A portion of the IR spectrum for three different amines is shown below. Explain the differences in these spectra.
4. The IR spectrum of the molecule shown below has a peak that is slightly above 3000 cm\(^{-1}\). Why? (hint: think about the geometry of the carbons in the ring)

\[ \text{OH} \]

5. IR spectroscopy is commonly used by crime labs to determine the type of fiber found at a crime scene. Explain how you could use IR to distinguish between the following synthetic fibers. Note that these fibers are all polymers made up of repeating units between the brackets.

- **Nylon**
- **Polypropylene**
- **Polyester**

4. Give the products of the following acid/base reactions. The most acidic proton is shown in a box in each case. Using the pKa table on pages A1-A2 of your textbook, predict to which side of the reaction the equilibrium will lie.

   (a) \[ \equiv \text{H} + \text{NaNH}_2 \]

   (b) \[ \text{CH}_3\text{OH} + \text{H} \overset{\equiv}{\text{N}}\text{H} \]

   (c) \[ \text{CH}_3\text{C} \overset{\text{O}}{\text{O}} \text{H} + \text{PhSO}_2\overset{\text{H}}{\text{H}} \]

   (d) \[ \text{CH}_2\text{CH}_2\overset{\text{O}}{\text{O}} \text{H} + \text{CH}_3\text{CH}_2\overset{\text{H}}{\text{H}} \]

   (e) \[ \text{CH}_3\overset{\text{H}}{\text{O}} + \text{F}_3\text{C} \overset{\text{O}}{\text{O}} \]
5. The most acidic proton on each of the compounds below is marked with a star. Draw the conjugate base. Draw as many resonance forms of the conjugate base as you can.

(a) CH$_3$OH$^-$
(b) HO$_2$COOH$^-$
(c) H$_2$CO$_2$O$^-$

(d) 

(e) 

(f) 

6. The following are commonly used bases among organic chemists. Draw the conjugate acid for each one. For each one, the pKa of the conjugate acid is given in parentheses. Rank all of the bases from weakest to strongest base.

(a) 
(b) H$_3$C$^-$O$^-$ Na$^+$

(c) 
(d) NaH (36)

(e) 
(f) NaNH$_2$ (38)

(g) 
(h) Li$^+$ 

Rank: (a) 10.6, (b) 15.54, (c) 5.21, (d) 36, (e) 17, (f) 38, (g) 36, (h) 50