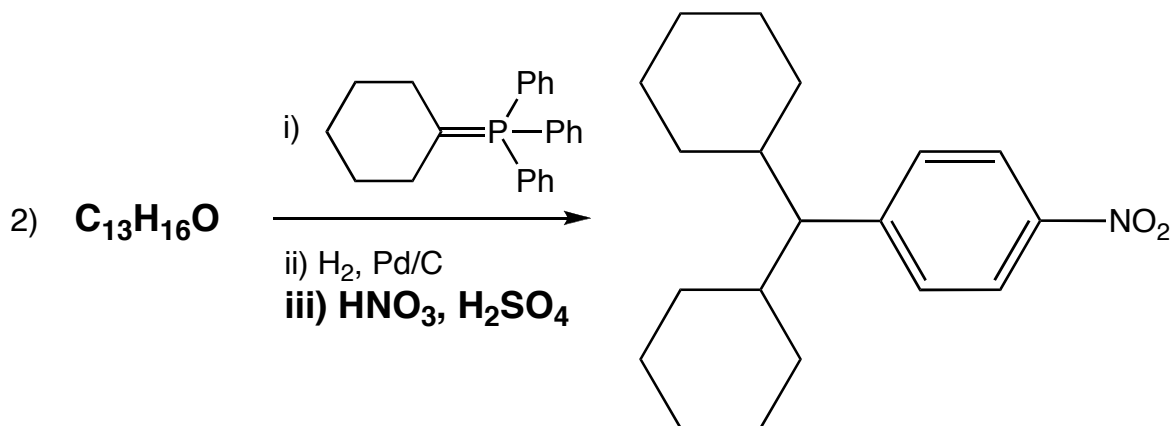
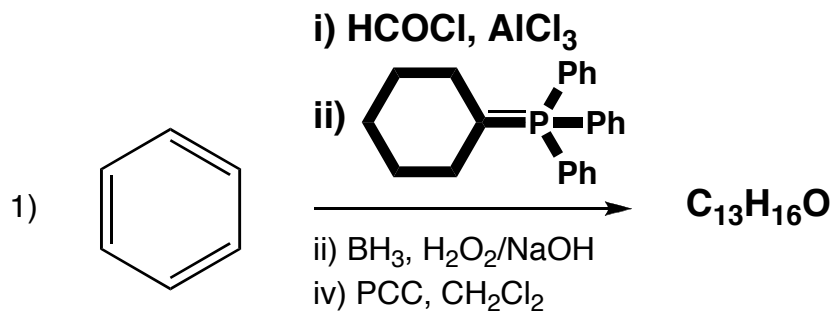


Exam II – Principles of Organic Chemistry II – CH 212  
 April 10<sup>th</sup> 2007 – 1:00 PM to 3:00 PM

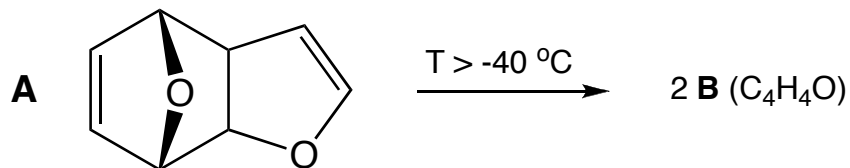
**Look over the whole exam and work on what you feel more comfortable FIRST!**  
**Show all your work if you want to receive partial credit. Use front and back of each page to write your answers. Be clear and concise, and use PENCIL to avoid making a big mess...**

1) (30 points) Consider the following reaction schemes:



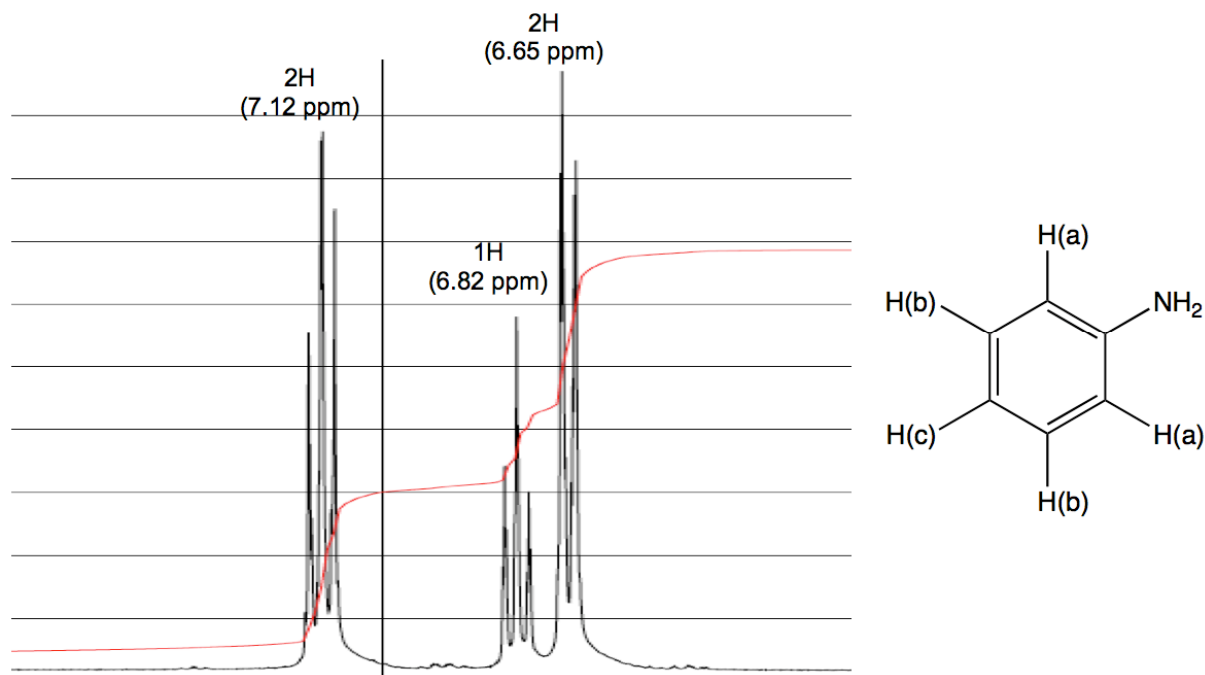
- Provide the structures of all the intermediates and products.
- Write detailed reaction mechanisms for the steps highlighted with bold/oversized letters.

- 2) (20 points) After several months of arduous work, you finished with one of the target compounds for your thesis (**A**). Unfortunately, as soon as you rise the temperature of the reaction mixture above  $-40\text{ }^{\circ}\text{C}$ , it decomposes to give you two moles of a liquid with molecular formula  $\text{C}_4\text{H}_4\text{O}$  (compound **B**):



- a) Propose a detailed mechanism for the transformation of **A** into **B**. Yep, Otto and Kurt came up with it while they were still *uber alles*...
- b) Why is this decomposition reaction spontaneous? There are two reasons, one of which is a lot more important than the other...

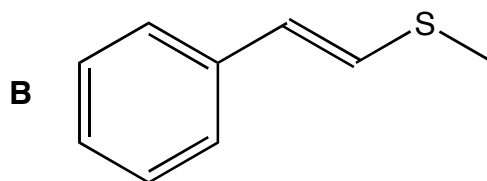
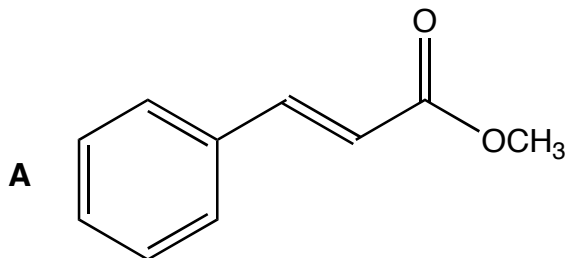
3) (20 points) The  $^1\text{H}$  spectrum of aniline (aminobenzene) is shown below. Notice that all the  $^1\text{H}$  resonances are upfield with respect to those of plain benzene (7.28 ppm):



- Assign all the  $^1\text{H}$  resonances of aniline (i.e., to what signals in the spectrum do protons **H(a)**, **H(b)**, and **H(c)** belong to...).
- Why are all the  $^1\text{H}$  signals of aniline upfield with respect to those of plain benzene? In particular, how can you explain the large shielding of the protons corresponding to the signal at 6.65 ppm in aniline?

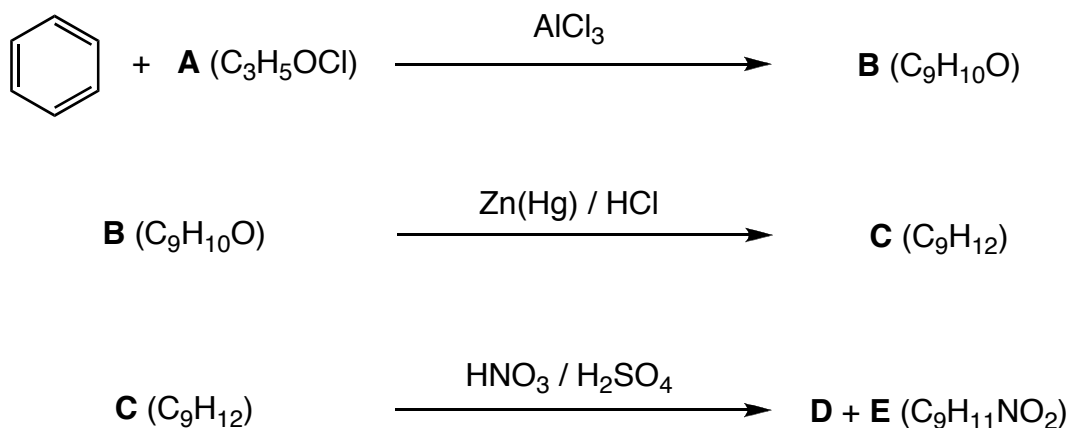
*Hint:* Think of the electron withdrawing/donating character of the amino group, which resonant in the ring forms will be stabilized by the presence of this group, and what will happen to the electron density of the protons in the ring...

4) (20 points) Consider the following aromatic compounds:



Based on your knowledge of aromatic electrophilic substitution reactions, predict the major products that will be obtained from the mono-bromination of each compound. Make sure to explain the results based on the mechanism of the reaction and the directing properties of each substituent.

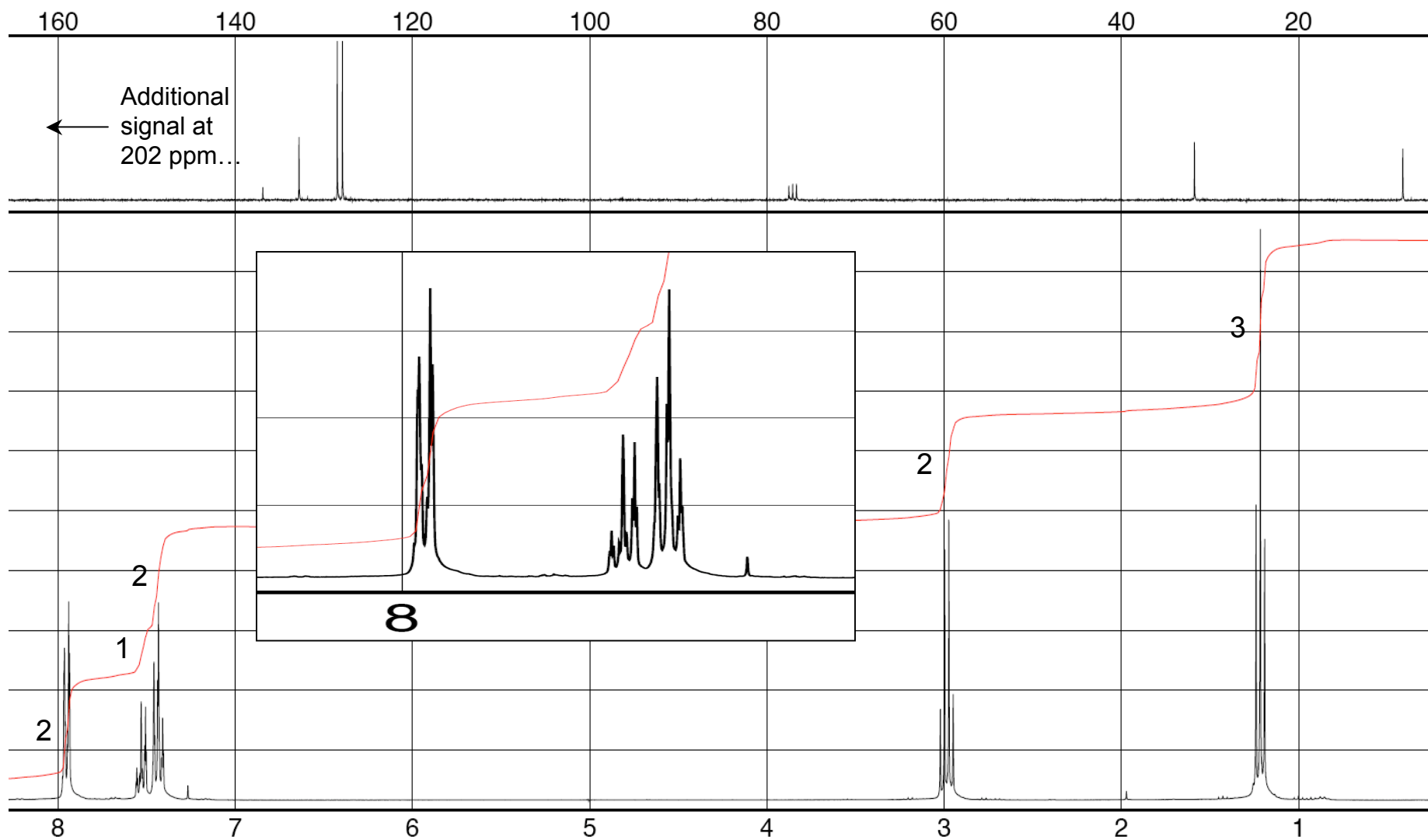
- 5) (30 points) You treat benzene with an acyl chloride of formula  $C_3H_5OCl$  (compound **A**) in the presence of  $AlCl_3$  to obtain compound **B**. After that, you decided to carry out some additional reactions:



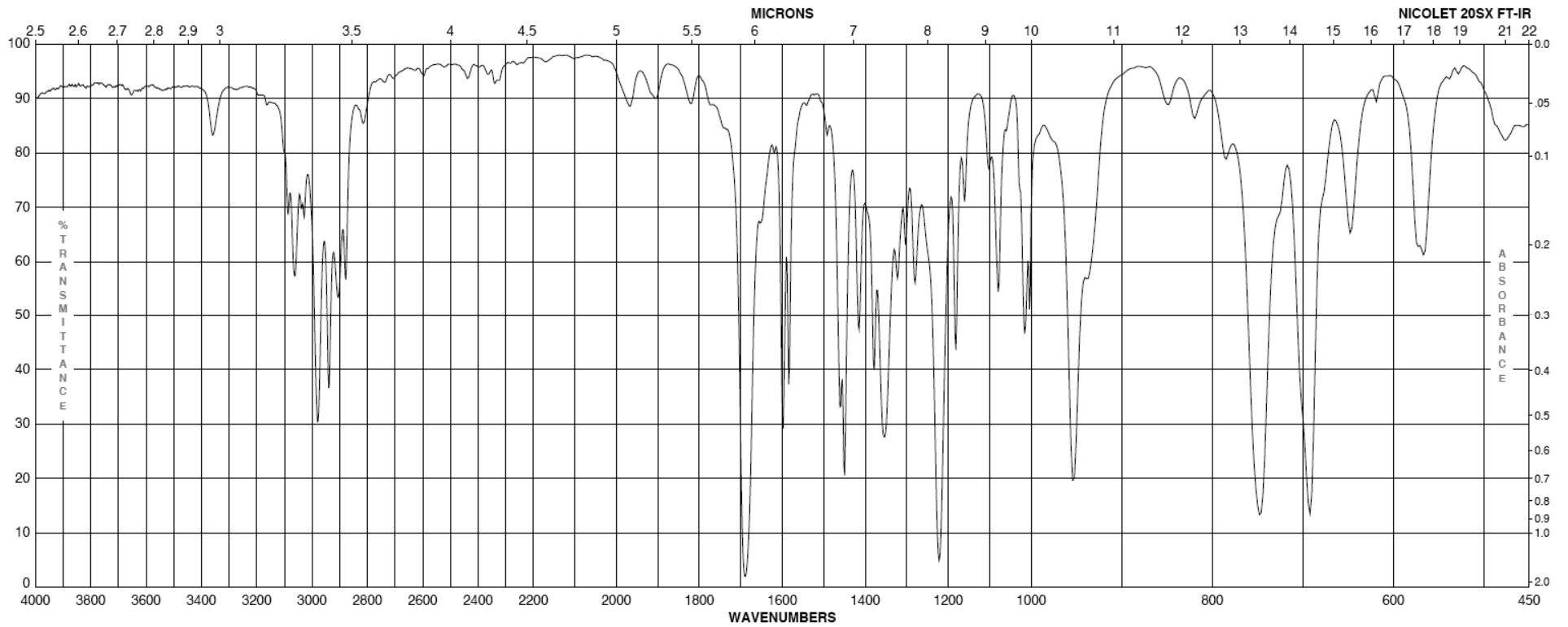
In addition to the information provided above, you recorded NMR spectra for compounds **B**, **C**, and **D**, and IR spectra for compounds **B** and **C**, which are provided in the following pages.

With all these data, elucidate the structures of compounds **A** through **E**. You do not need to write detailed mechanisms for the reactions or present extensive spectral assignments. However, it would help if you draw the molecules in the spectra and draw arrows from the different protons to their corresponding signals...

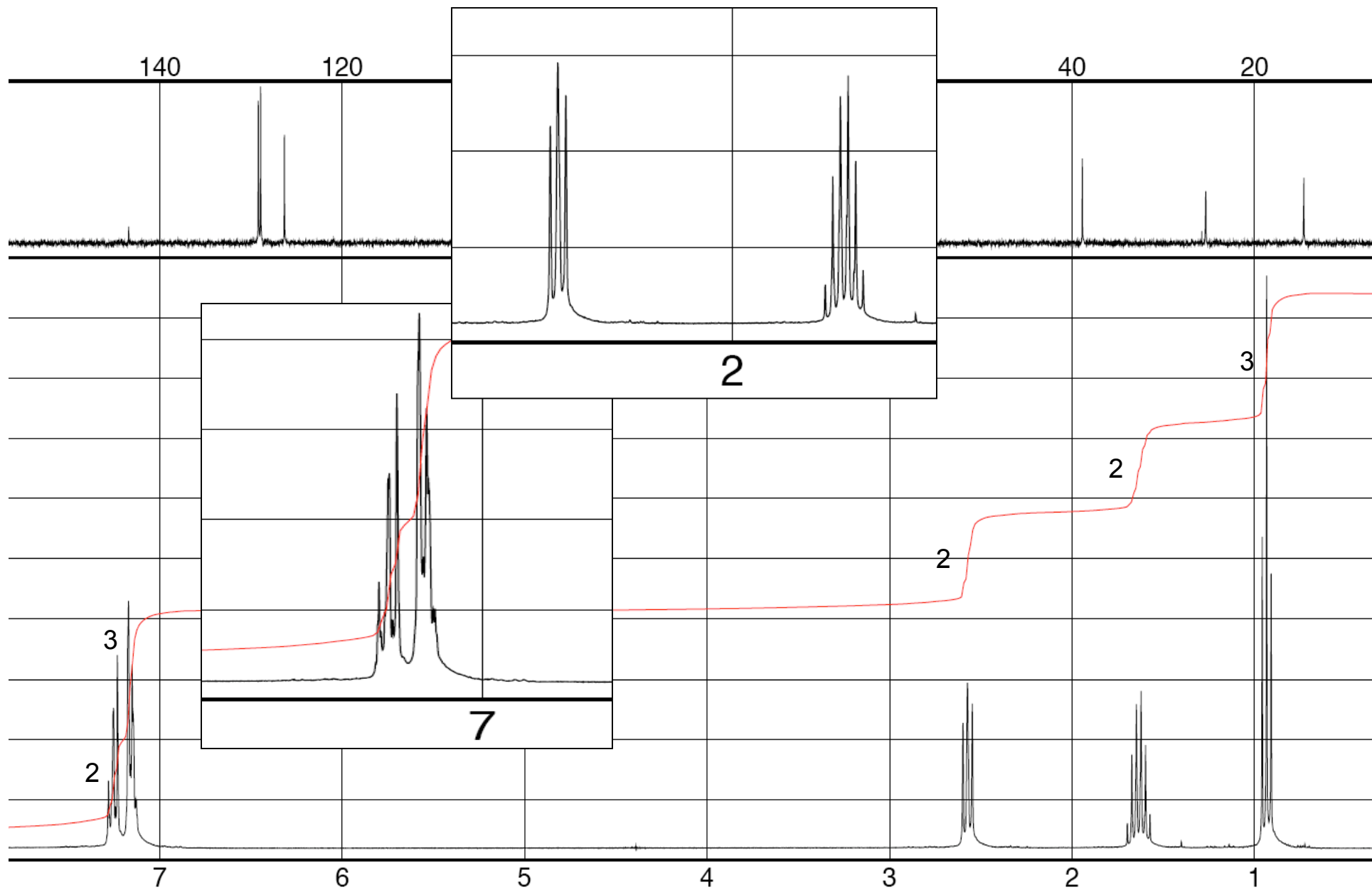
# Problem 5 - Compound B



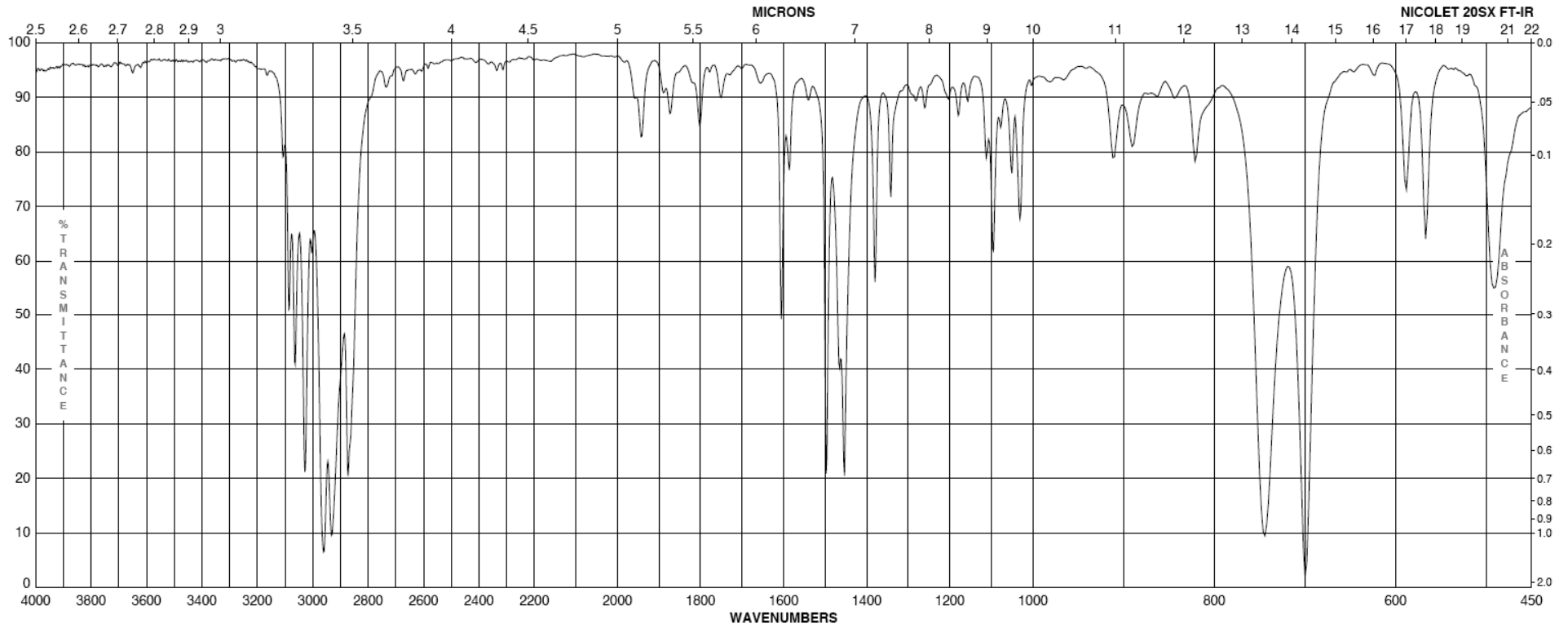
# Problem 5 - Compound B - IR



# Problem 5 - Compound C



# Problem 5 - Compound C - IR



# Problem 5 - Compound D

