

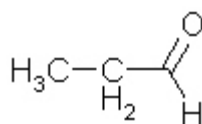
Chemical Instrumentation

Final Exam with emphasis on chapters 19, 20, 27, and 28

1. In NMR the position and shape of a peak is affected by two major interactions, chemical shift and chemical coupling.

A. Explain the chemical shift. Why is the position of a CH_3 proton different than a CH_2 and a CH Proton. Also how are chemical shifts affected by bonding, I.E. Why is a $\text{CH}_3\text{-CH}_3$ proton different than a $\text{CH}_2=\text{CH}_2$ proton or a $\text{HC}\equiv\text{CH}$ proton or a benzene (C_6H_6) proton.

B. Explain coupling. How are nuclei coupled, predict and explain the coupling pattern observed for



Also you have seen coupling in proton spectra, but not in C spectra. Does coupling only occur in protons, or does it occur in other nuclei, is it only seen between identical nuclei, or can it be observed between different types of nuclei?

2. Diagram a CI quadrupolar mass spec and explain how it works. What would you change to make it into an EI Mass Spec, and how would this change the mass spectra you get out of this machine.

3. Do problem 27-21 from your text with the following change. Do it for your A, B, and C peaks from your Guinness beer sample. Use the parameters of the column, etc from the actual column on the GC/MS. If you have any questions I'll help you find the numbers you need. Also be sure to include all these parameters in your write up so I don't have to dig them out myself a second time.

4. Describe the three general methods for improving resolution in partition chromatography.

5. You've seen the hood in the chem lab filled with various waste materials waiting for disposal. It is much cheaper to dispose of a known chemical compound than an unknown. Suppose I gave you one of the unknown chemicals in the hood and asked you to identify it. Propose a series of test you could perform using the instruments available in chemistry. For each instrument say why you chose that instrument, what you hope to learn from the instrument, and any particular strengths or weaknesses of the instrument.

6. Betty (my wife) has been acting strangely lately. For no apparent reason she has taken out a 1 million dollar life insurance policy on me. She also keep complaining about a rat in the house, and how she will has to get some poison to kill the rat. I have never seen this rat. Today she brought me some coffee for breakfast, but I don't drink

coffee. On the following pages are the results of various tests I have done a compound that I isolated from my 'coffee' Can you comment on what the compound is?