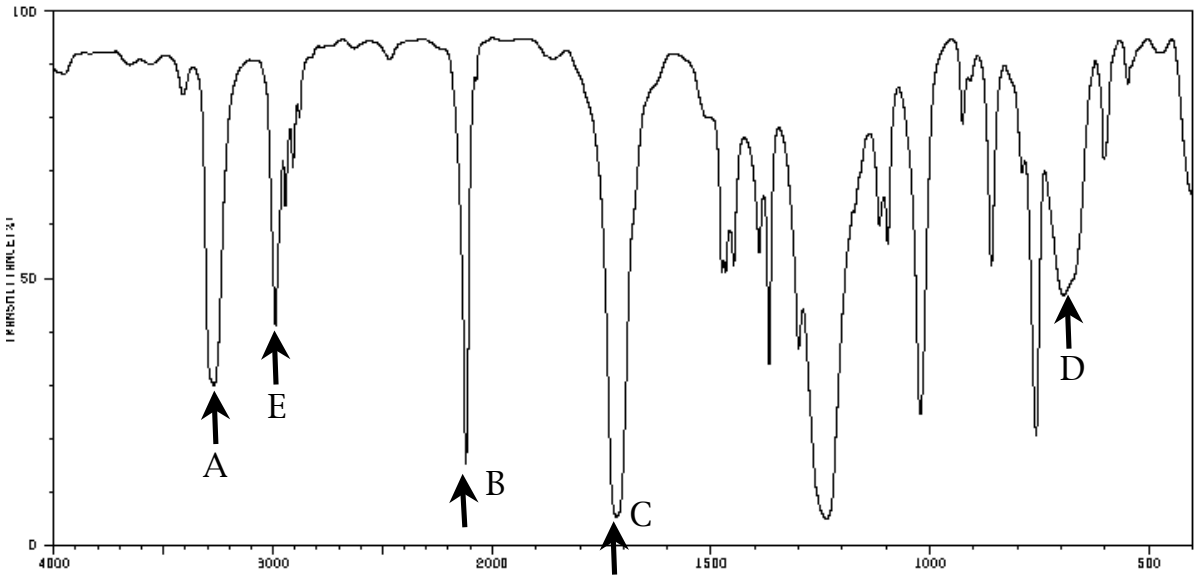
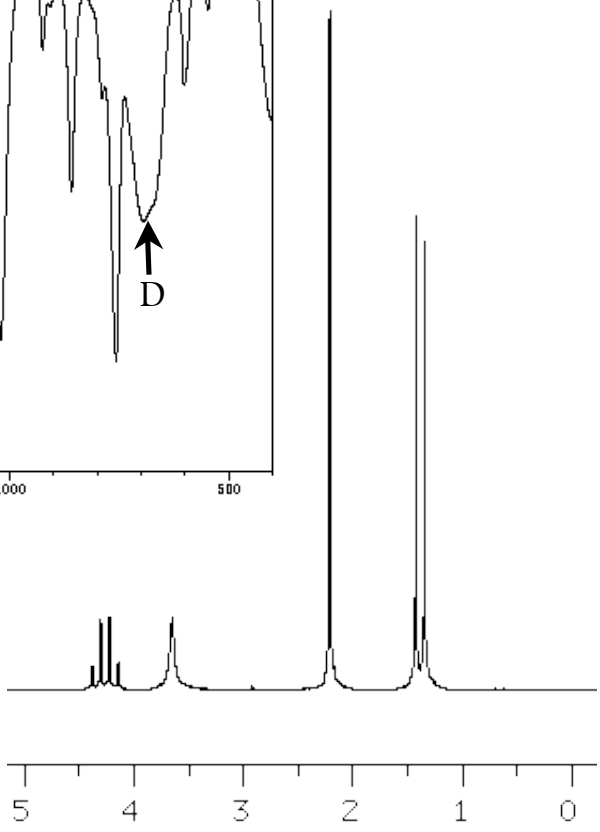
Chemistry 125 Seventh Examination Name _____

April 13, 2007

1. (12 min) One of spectra below is for ethyl propiolate, H-C≡C-C(=O)-O-CH_2-CH_3, the other for acetoin, CH_3-C(=O)-CH(OH)-CH_3. ***Label*** each spectrum with the compound name ***and explain*** with just a few words ***every*** significant PMR peak and the four IR peaks labeled **A-D**. (**E**) is given as an example.



(E) alkane C-H stretch, high frequency because H is so light



2. (3 min) Explain what a "normal mode" means in the context of the "fingerprint region" of IR spectra.

3. (9 min) Suggest reagent(s) to achieve each of the following purposes: [Just list reagent(s) - NO mechanism required]

a) converting an internal alkyne into a *cis* double bond

b) converting an internal alkyne to a terminal alkyne

c) converting a terminal alkyne into a ketone

d) converting a terminal alkyne into an aldehyde

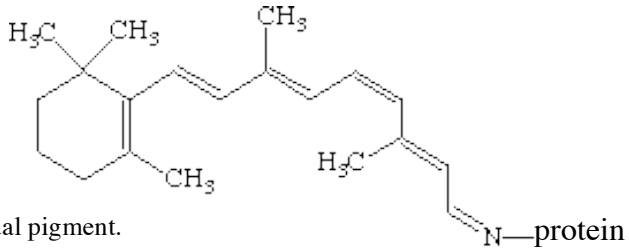
e) converting a C=C double bond into a C=O double bond

f) converting a C=O double bond into a C=C double bond

4. (4 min) Explain ***why*** different kinds of magnetic fields are appropriate for chemical NMR and medical MRI.

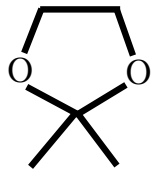
5. (5 min) Answer A **OR** B, ***NOT BOTH***

(A) In studying the mechanism of lanosterol biosynthesis using NMR and ^{13}C double-labeled isopentenyl pyrophosphate, why is it crucial that most of the isopentenyl pyrophosphate not be labeled at all? That is, ***why*** was ***dilute*** double labeling used?



(B) Explain why this molecule on the right is well suited to be the visual pigment.

6. (7 min) Show the mechanism for acid-catalyzed hydrolysis of the following molecule to 1,2-ethanediol and acetone. **Use curved arrows**. Several steps are required



7. (10 min) Historically organic chemists speak of "electrophilic" addition of CCl_2 to the C=C group of an alkene and "nucleophilic" addition of CH_3Li to the C=O group of a ketone. Draw pictures to explain in terms of the ***shapes*** of ***reagent*** HOMOs and LUMOs, and ***transition state structures***, how these processes are fundamentally similar.