

Key

Chem 242 sample exam 1

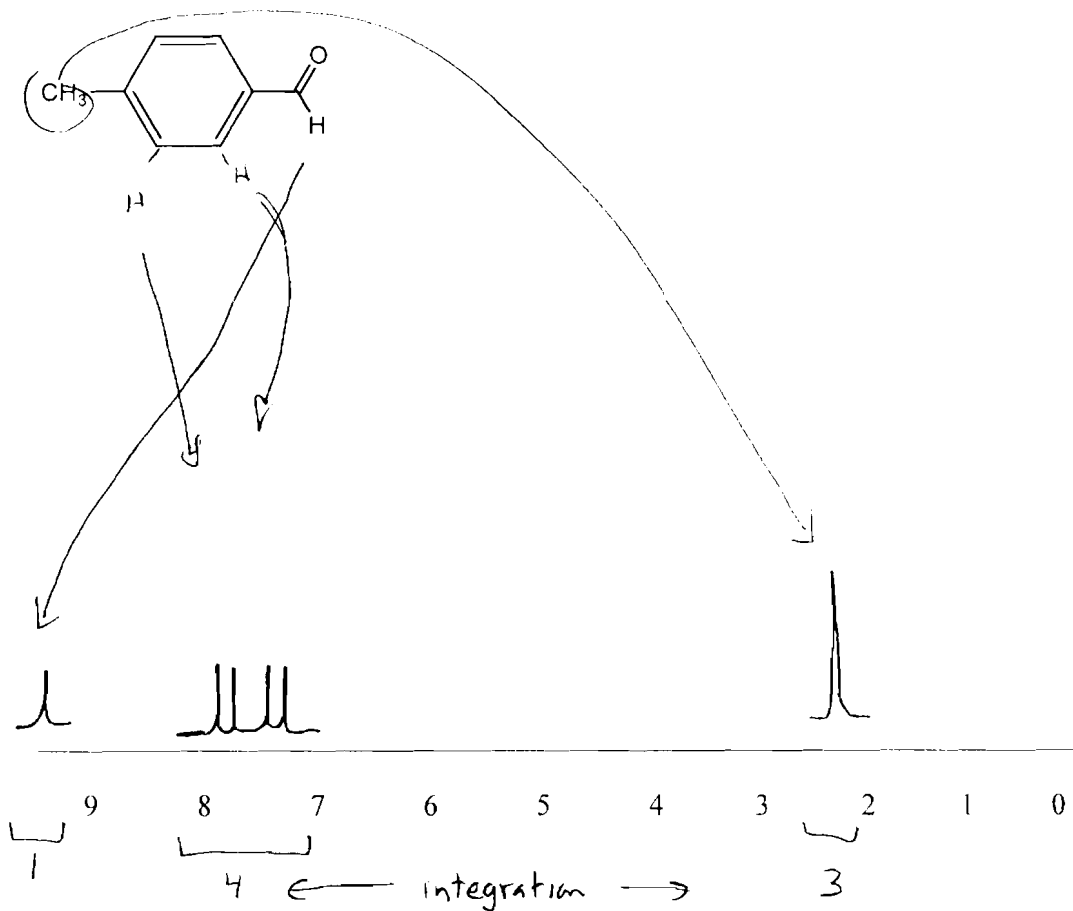
1. (8 pts) Circle what is true about NMR.

- a) NMR stands for 'No Magnetism Required'.
- b) Protons that are 'upfield' are in electron poor environments
- c) 'I had my spin flipped' is what chemists say when they fall in Love
- d) Integration measures the number of hydrogens that give rise to an NMR signal.
- e) In order to 'flip the spin of a proton', the proton must absorb radiation.
- f) NMR spectroscopy gave rise to MRI (magnetic resonance imaging) technology

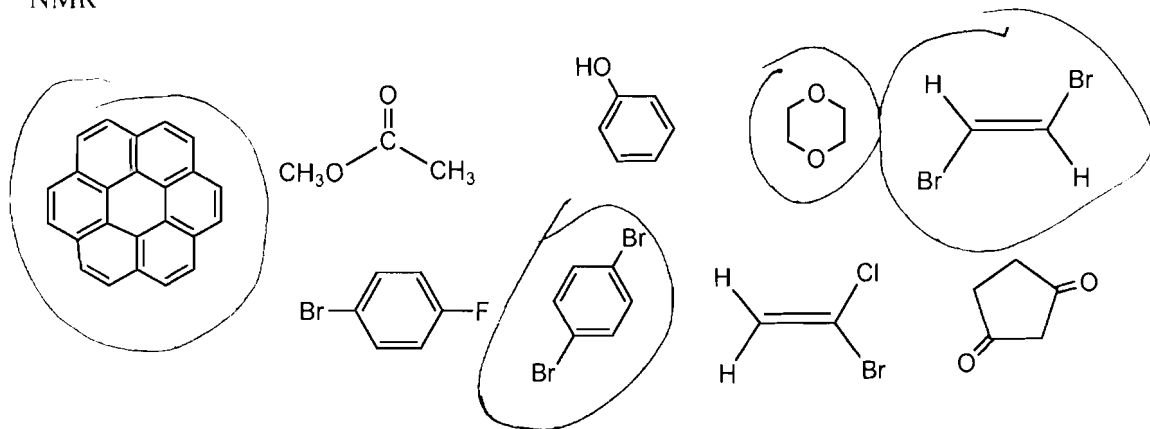
2. (8 pts) Circle what is true about IR

- a) IR stands for "Infrared" spectroscopy
- b) The intensity of an IR absorption band depends on the polarity of the bond.
- c) In IR, 'upfield' is term used to describe absorptions above 2000 cm^{-1} .
- d) IR spectroscopy can measure the molecular mass of a molecule.
- e) A triple bond will absorb IR radiation at a higher frequency than a double bond.

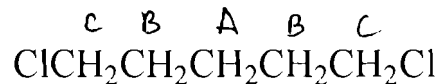
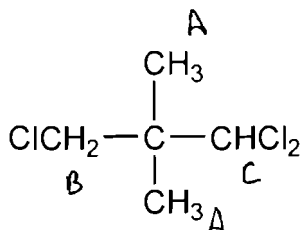
3. (8 pts) Draw the NMR spectrum for the compounds below. Be sure to include splitting and integration values.



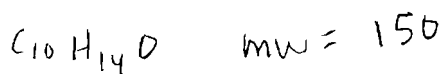
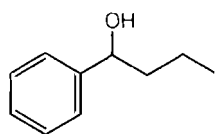
4. (8 pts) Circle the molecules below that would only give one signal (one peak) on the NMR



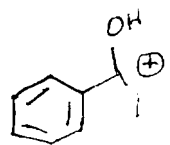
5. (6 pts) For each molecule shown below, label each set of equivalent protons using an 'a' for the set that is the furthest upfield in the NMR spectra and 'b', for the next furthest and so on.



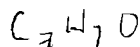
6. A Mass Spec is taken of the compound shown below.



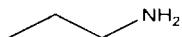
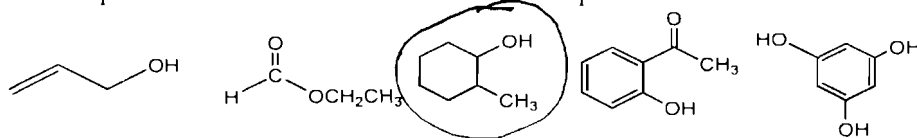
- (2 pts) What would be the m/z ratio of the molecular ion peak (parent ion)? 150
- (2 pts) What would be the mass of the **base peak** of the molecule above? 107
- (4 pts) What fragment is responsible for the base peak (draw the structure)?



↔ many resonance structures



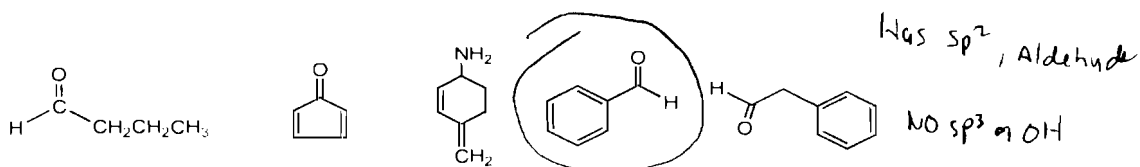
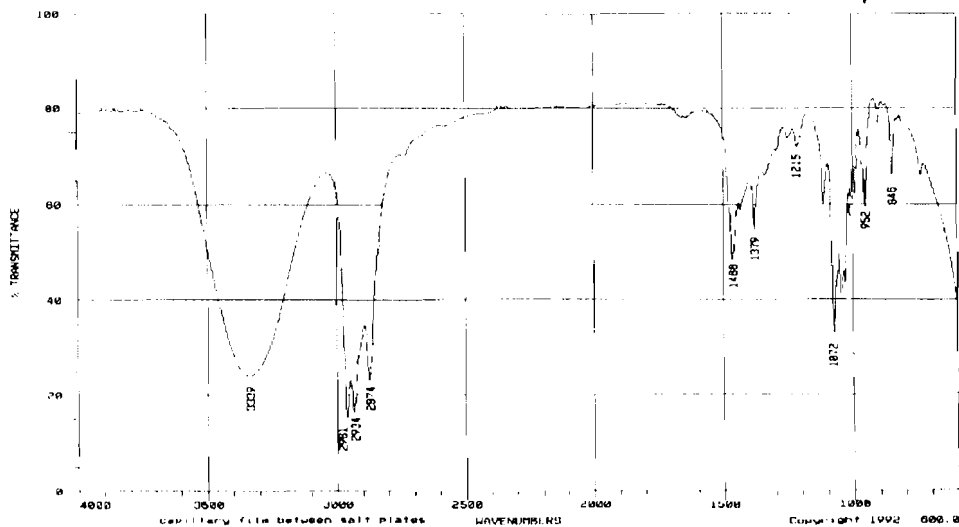
7. (10 pts-5 pts ea) Above each of the 2 IR spectra there are compounds that it could be. Circle the compound which would best match the IR spectra.



No sp^2

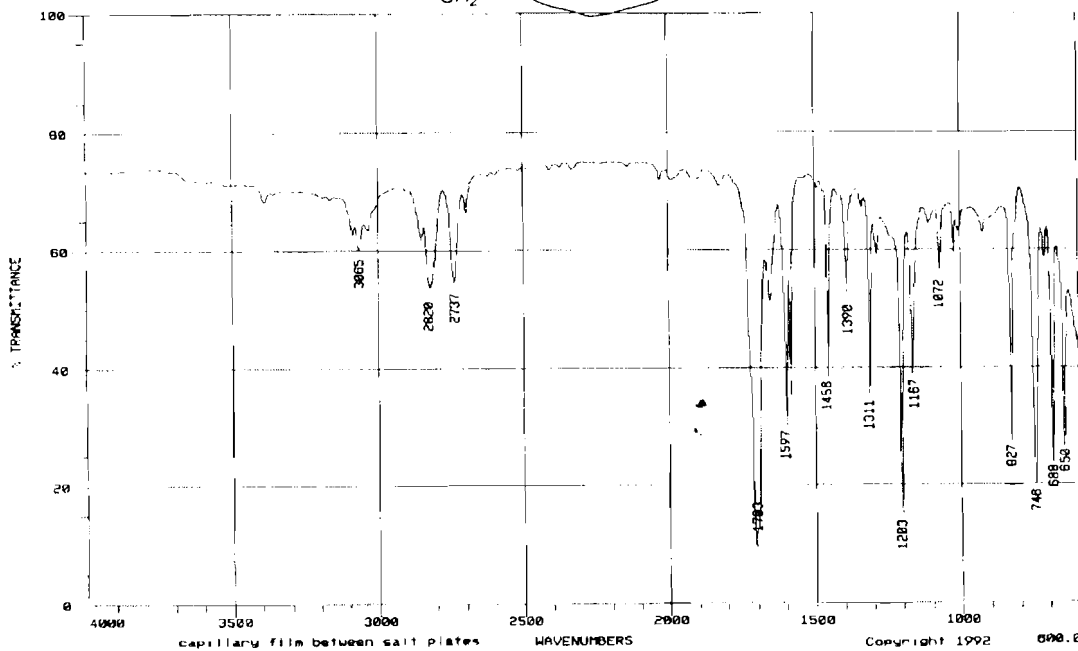
No $C=O$

Has OH
 sp^3

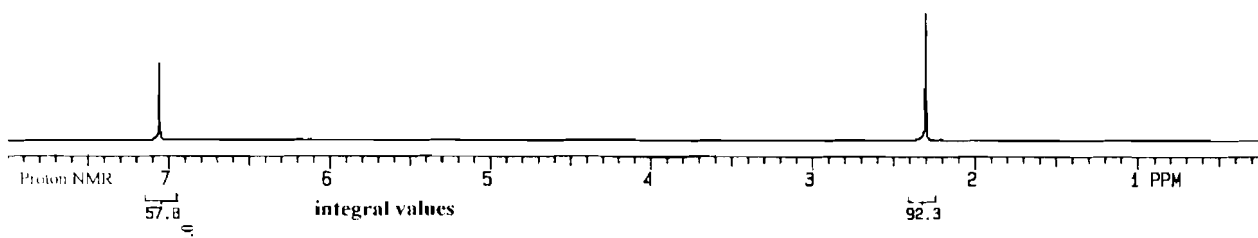
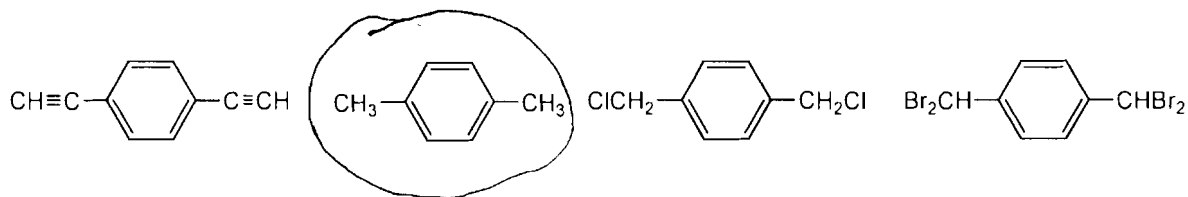


Has sp^2 , Aldehyde

No sp^3 or OH

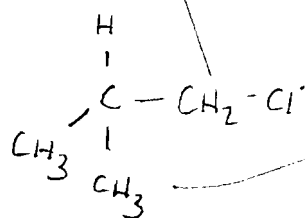
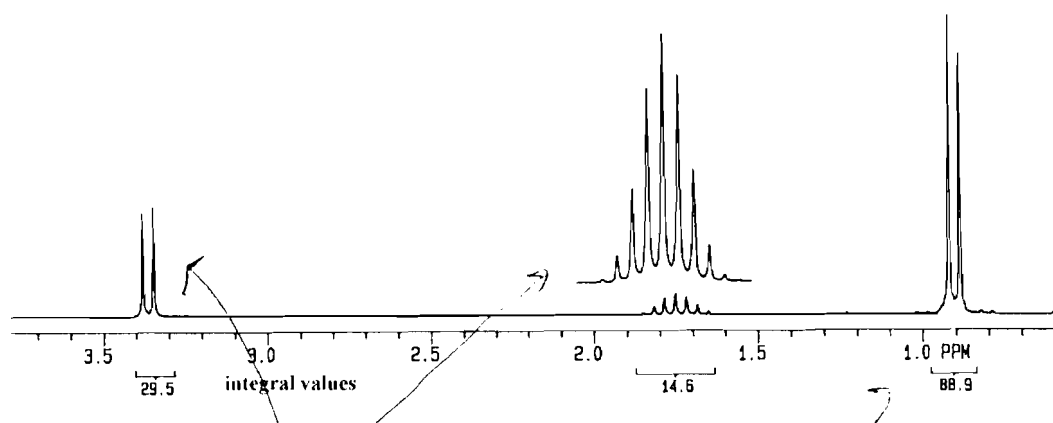


8. (6 pt) Above the NMR spectrum there are compounds that it could be. Circle the compound which would best match the NMR spectra. (Integration values are listed below each peak).

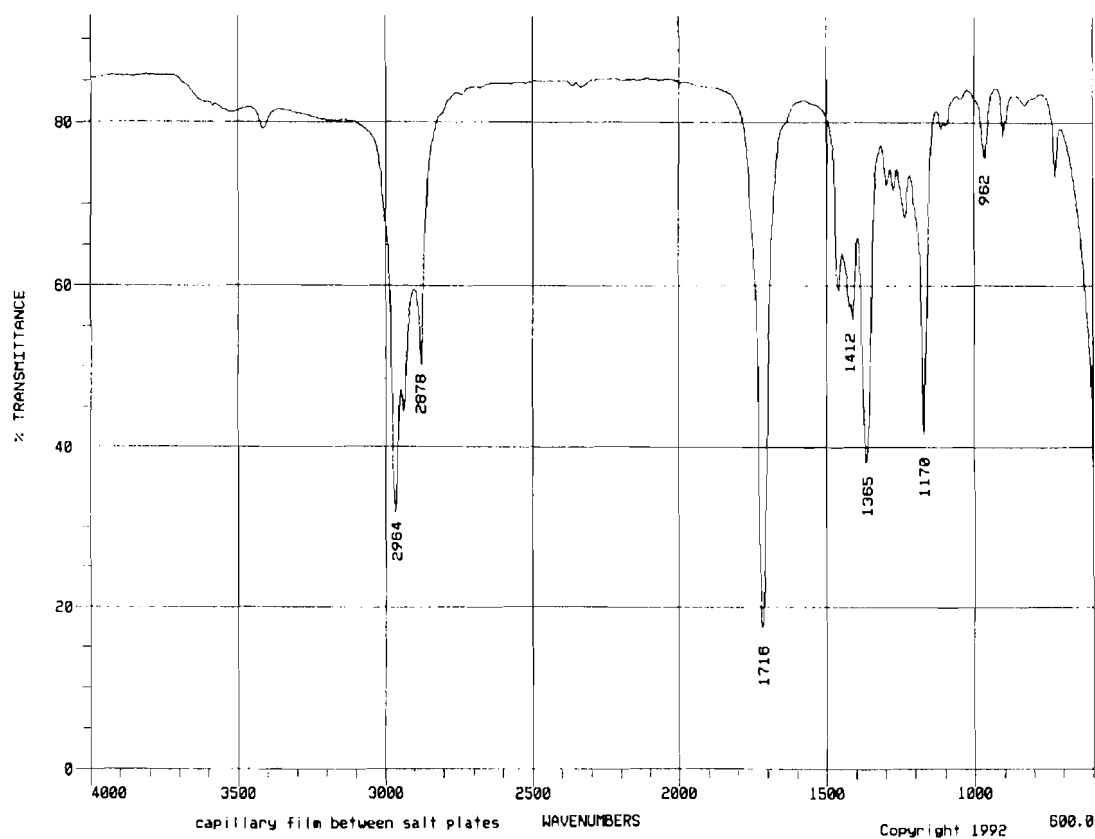
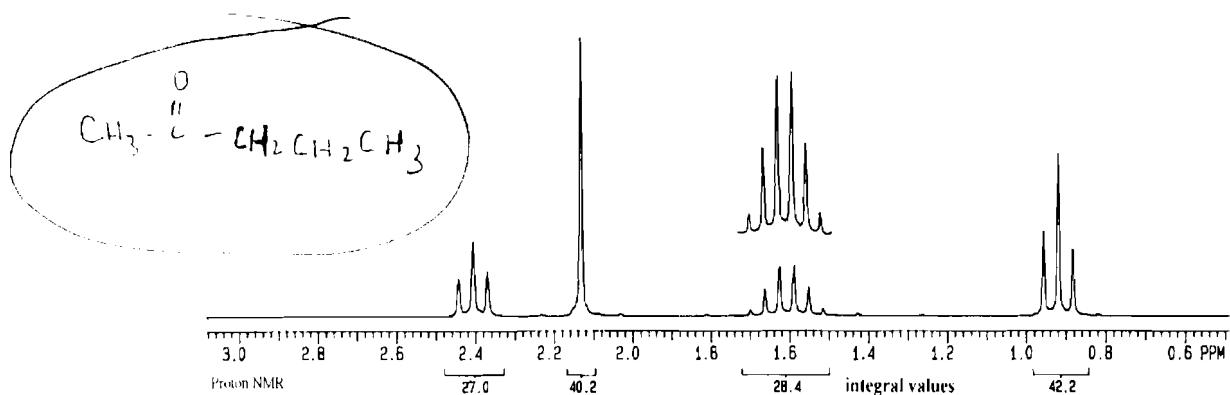


9. (8 pts) Give the structure for the following unknown using the NMR and molecular formula data provided.

Molecular formula: $\text{C}_4\text{H}_9\text{Cl}$



10. (10 pts) Give the structure for the following unknown using the NMR, IR and Mass Spec data provided.



Mass Spectroscopy data: Parent ion $m/z = 86$, Base peak $m/z = 71$

Extra credit (2 pts) Draw a compound that would have an NMR that would consist of just two triplets (and no other signals). You can use any combination of atoms that you wish.