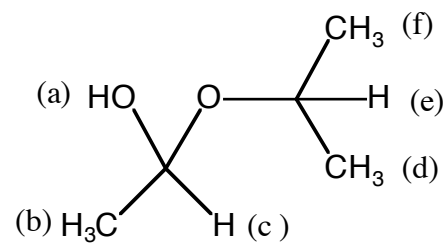


Chemistry 125 Seventh Examination
April 16, 2004

Name _____

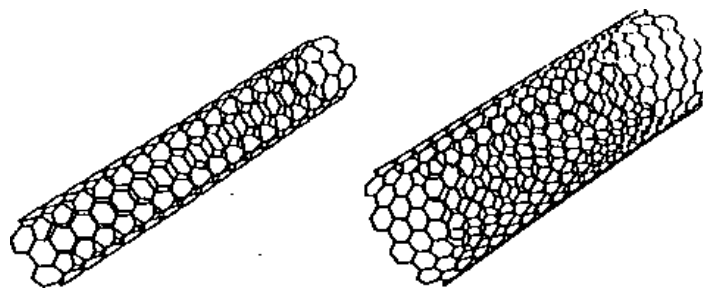
1. (3 min) Name the functional group in the molecule on the right and suggest reagents and conditions for its preparation (no mechanism necessary).



2. (9 min) Sketch the proton nmr spectrum you would expect for the compound in Question 1. Say a few words about your selection of **chemical shift** and **splitting pattern** for each of the 6 labelled (sets of) protons.

3. (9 min) Answer **ONE (1 only)** of the following TWO questions about NMR:

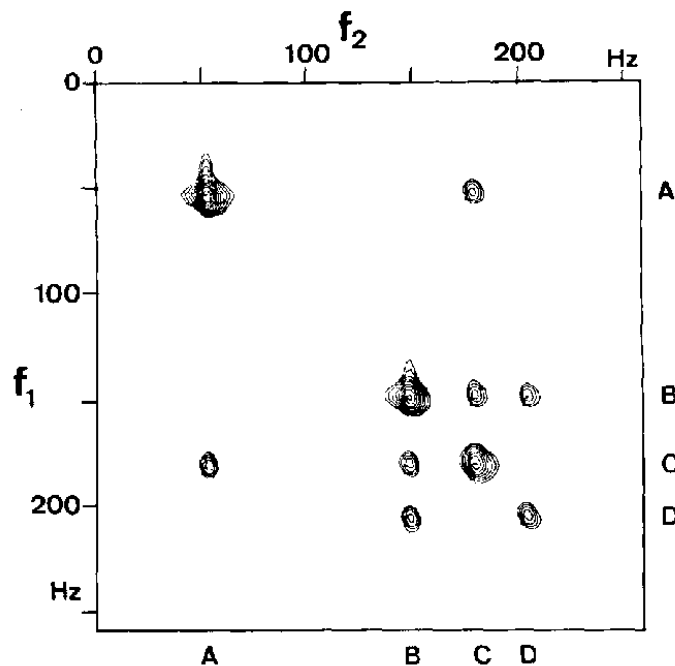
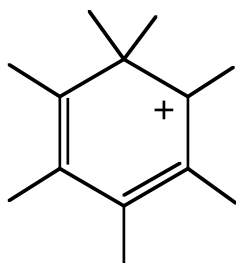
- A) Carbon “nanotubes”, are isomers of diamond or graphite, whose cylindrical walls are hexagons of carbon as shown on the right. A recent issue of the journal “Nature” reports that a magnetic field along the axis of such tubes causes electron circulation about the axis of the tube. These hollow cylinders can contain other molecules, such as methane.



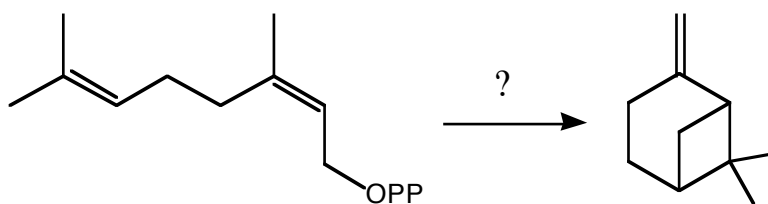
Explain how in a solution containing freely tumbling nanotubes and methane you might **distinguish methane molecules inside and outside the nanotubes by their NMR spectra**.

Point out an analogy with the curious chemical shift of the protons in acetylene.

- B) Explain what this 2D NMR spectrum shows about “heptamethylbenzenonium” ion (Note that higher frequency denotes shift downfield from TMS)

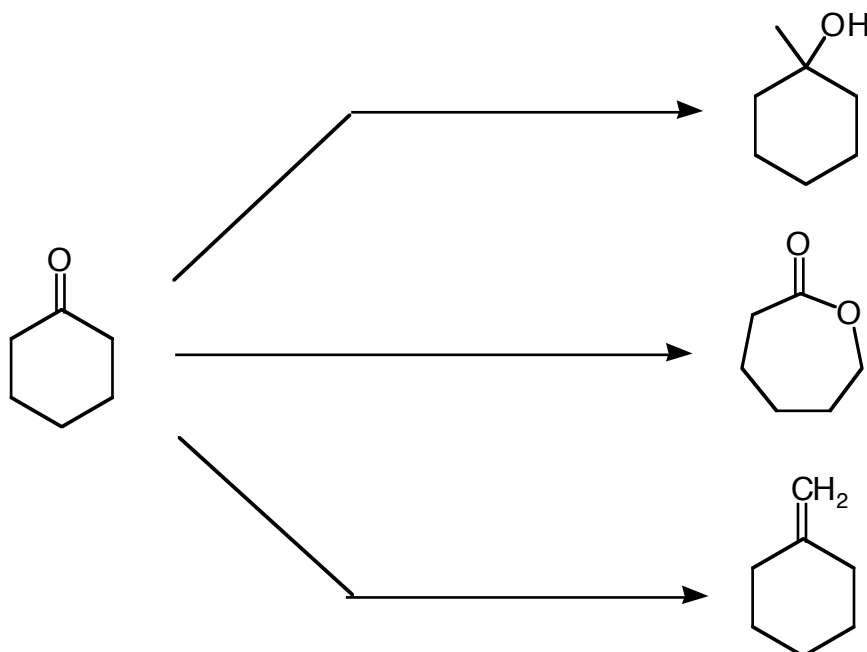


4. (9 min) Draw a detailed mechanism of **several steps** with carefully drawn **curved arrows** to show a plausible mechanism for converting neryl pyrophosphate to β -pinene.

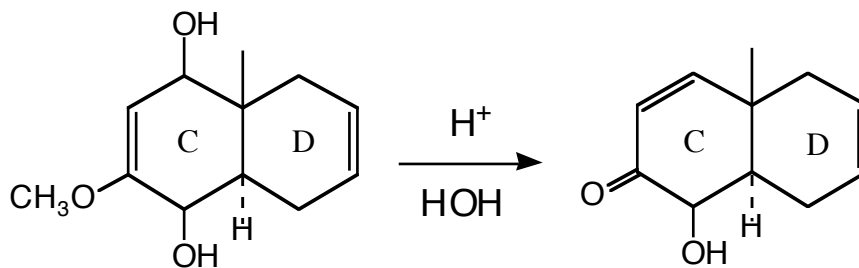


5. (6 min) Suggest **reagents** for each of these three transformations.

(No mechanisms necessary, just reagents)



6. (8 min). One step in Woodward's synthesis of cortisone involved the following transformation. Draw a mechanism with **curved arrows** to show a plausible **set of intermediates** in this transformation.



7. (6 minutes) Had protection not been necessary, Woodward might have been able to shrink the size of ring D by two reactions. Complete the scheme below by drawing the **intermediate compound** for this transformation and the **reagents** involved in the two steps. (No curved arrows necessary, just one intermediate compound and the reagents. The squiggly line means we are ignoring the rest of the molecule.)

