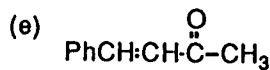
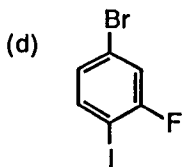
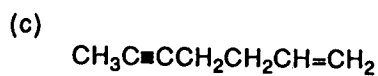
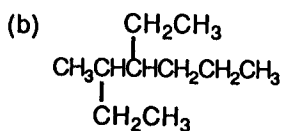
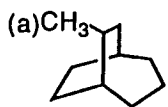
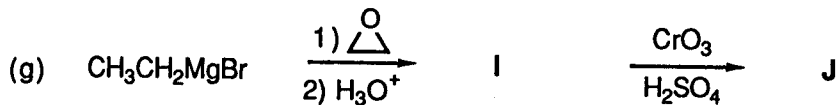
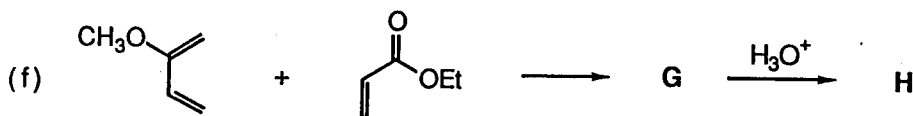
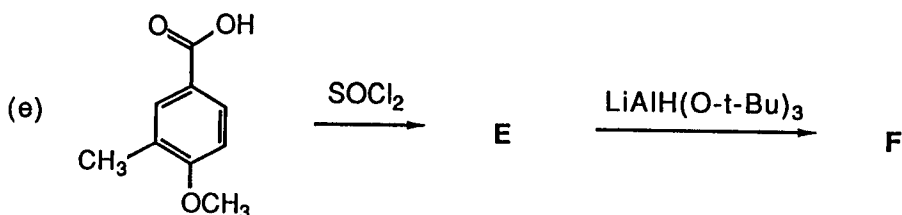
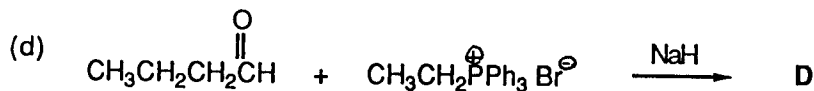
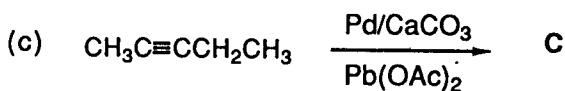
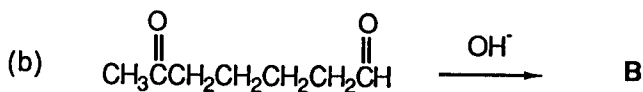
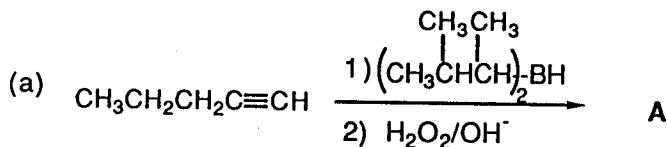


PART I

1. Name the following compounds in English. (10%)

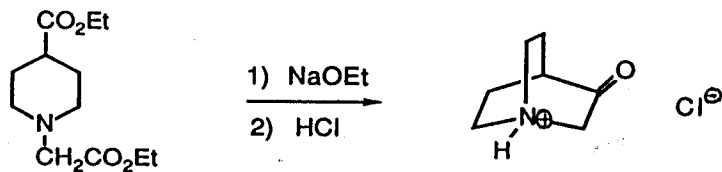



2. Write the products (A to J) of the following reactions. (20%)



PART II

3. Propose a mechanism for the following reaction: (4%)

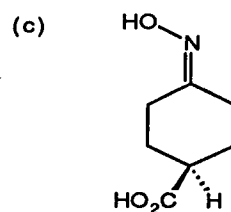
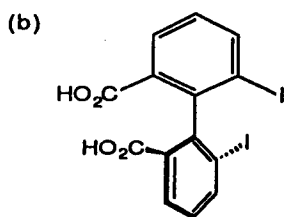
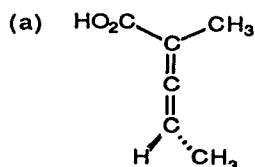


4. A mixture of unknown organic materials was found in an unlabeled bottle in the refrigerator of an organic research lab. Chromatographic analysis showed the mixture to be primarily two compounds: **A**, an acidic material and **B**, a relatively neutral compound. The molecular weights of **A** and **B** are 178 and 162, respectively. Compound **B** on standing in air is slowly converted into compound **A**. Compound **B** gives a positive Tollens' test and readily forms a DNP derivative, whereas **A** does not. Treatment of compound **A** with thionyl chloride yields compound **C**, $C_{11}H_{13}OCl$, which when refluxed under Friedel-Crafts conditions (treatment with aluminum chloride in benzene) yields two α -tetralone, one with a methyl group adjacent to the ring fusion and peri to the carbonyl group, and the other with the methyl group para to the carbonyl carbon atom. What are compounds **A**, **B** and **C** and what is the sequence of reactions occurring? (Hint: α -tetralone ) (6%)

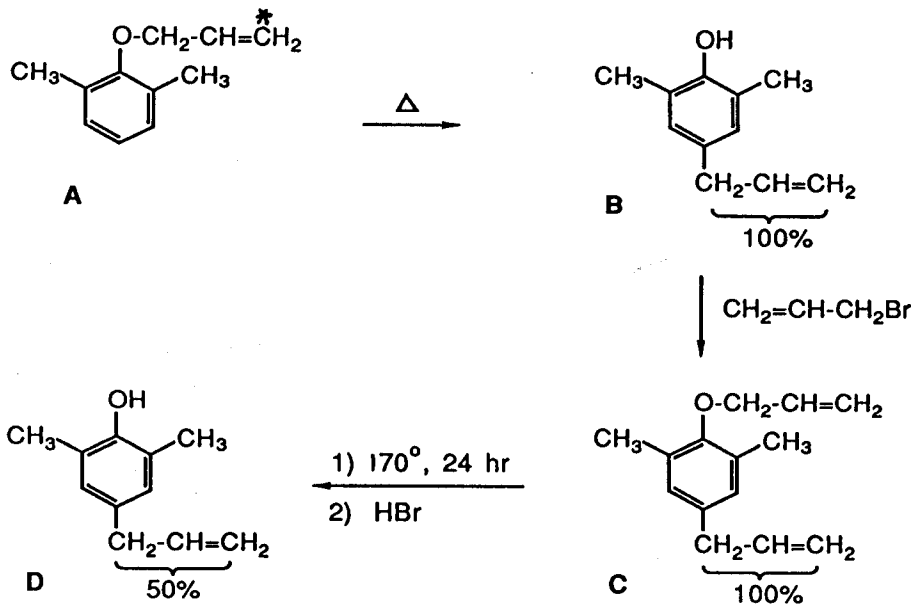
5. By using the solubility solvents in multiple steps, show how the following mixtures might be effectively separated: benzoic acid, phenol, and toluene. (4%)

6. Explain the fact that the pK_a of acetic acid is 4.8 in water but is 9.7 in methanol. (2%)

7. Determine the R, S configuration of the following compounds: (6%)

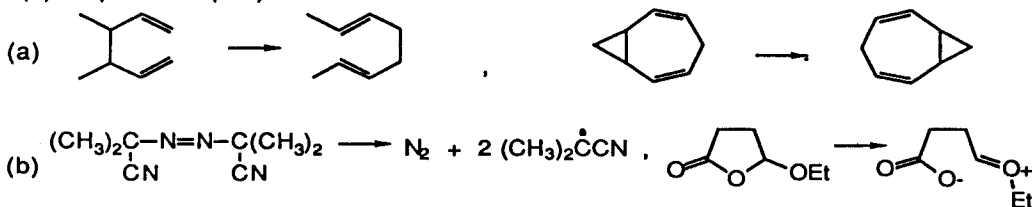


8. ^{14}C -Labeled 2,6-dimethylphenyl allyl ether rearranges on heating as shown below. (4%)

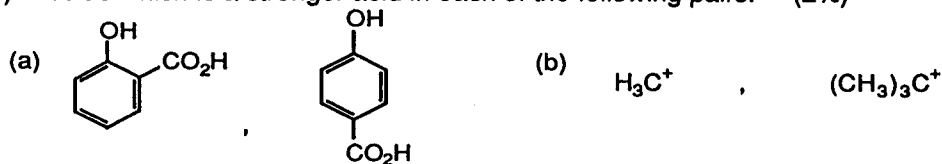


- (a) On what carbon atoms would the radioactivity be located in compound B, C, and D, and how may this be demonstrated experimentally for D?
 (b) How does this rearrangement occur?

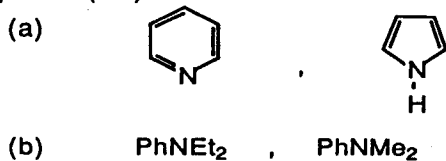
9. (1) Which reaction in each pair has the larger negative entropy of activation?
 (2) Explain. (6%)



10. (1) Decide which is a stronger acid in each of the following pairs. (2%)

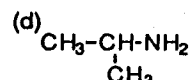
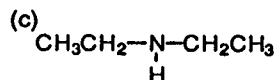
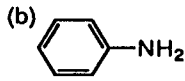
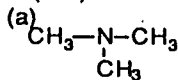


- (2) Decide which is a stronger base (reference acid: H^+) in each of following pairs. (2%)



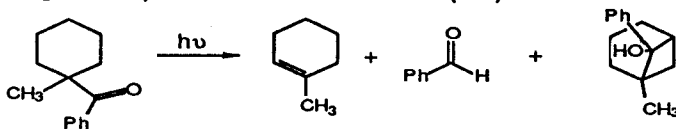
11. Which compound reacts most rapidly with sodium metal? (2%)
 (a) Cyclohexanol (b) Ethanol (c) $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$ (d) t-Butanol

12. Which amine forms a sulfonamide that is insoluble in an alkaline solution?
 (2%)



PART III

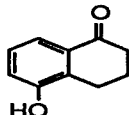
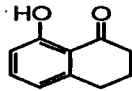
13. The cyclohexane derivative shown gives the following photoproducts. It is suggested that the latter product results from one chair form; the former one from the other. Design an experiment to check this. (3%)



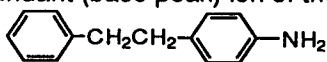
14. Give one IR band which could be used to tell apart each of the following pairs. (4%)

(a) Butanamide; 3-Pentanone

(b)



15. In mass spectra, (4%)
 (a) predict the most abundant (base peak) ion of the following compound.



(b) assign the structure of the fragment ion at m/z 59 for the compound $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CONH}_2$.

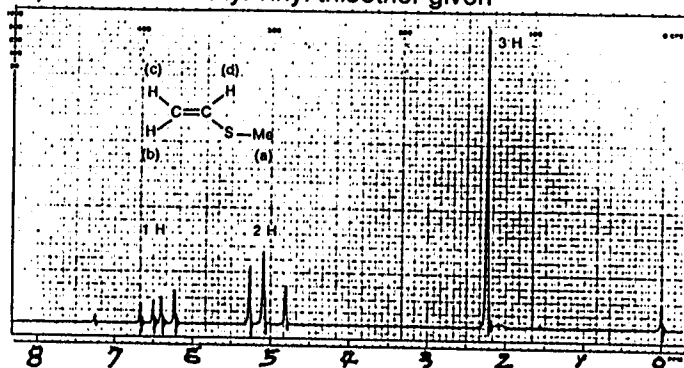
16. Using a 60 MHz spectrometer, the following absorption is observed:

δ 4.00 ppm, quartet, $J=7$ Hz

Where would this peak be located in Hz and what would J be in 100 MHz? (2%)

17. A compound with the molecular formula C_6H_8 which decolorized bromine in CCl_4 and reacted with 2 moles of H_2 in the presence of platinum to yield cyclohexane. The UV spectrum shows an absorption maximum at 256 nm. What is the structure of this compound? (2%)

18. Give a full explanation of the spectrum of methyl vinyl thioether given below (60 MHz). Assign the peaks and determine the splitting patterns. (5%)



19. Propose a structure consistent with the following data and spectra given below. Please give the detail procedures. (10%)

Elemental analysis (only containing C, H, and O):
C, 70.60%; H, 5.90%

