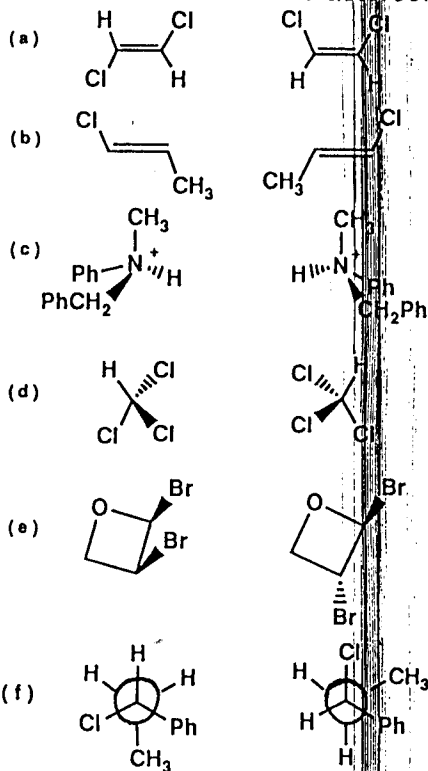
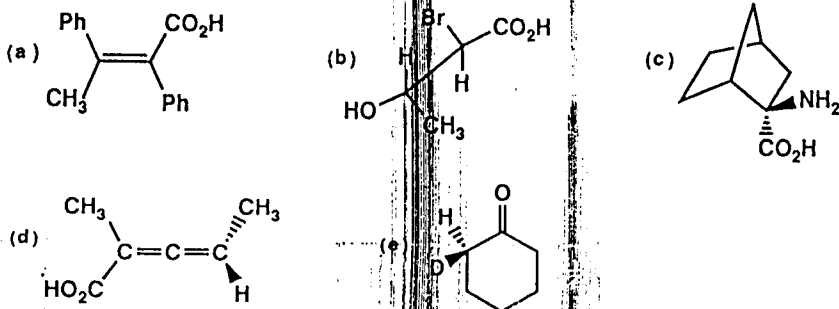


PART I

(1) Label the following pairs of compounds as homomers, enantiomers, constitutional isomers or diastereomers. (6%)



(2) Give a correct name in English for each of the following compounds. (Note the stereochemistry of the chiral center(s) in each compound.) (10%)



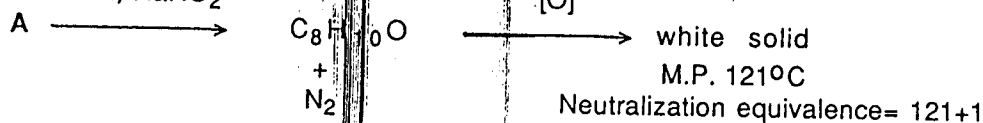
(3) By using the solubility solvents in multiple steps, outline a scheme for effectively separating a mixture consisting of the following substances. (6%)
Toluene, *p*-Toluic Acid (4-Methylbenzoic Acid), Phenol

(4) Outline a practical procedure by which one would determine the purity of a liquid organic compound. (3%)

(5) Identify compound A, $C_8H_{11}N$, consistent with the following facts: (3%)

(a) soluble in aqueous HCl; (b) optically active;

(c) $\xrightarrow{HCl, NaNO_2}$



(6) An unknown compound is soluble in cold concentrated sulfuric acid, but insoluble in sodium hydroxide. It does not decolorize bromine and does not react with metallic sodium. The class of compounds to which the unknown belongs is: (2%)

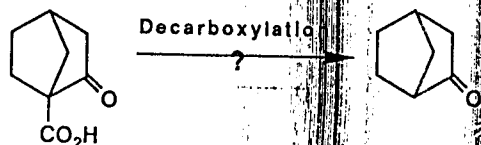
(a) alkanes (b) alkenes (c) alcohols (d) phenols (e) ethers

(7) An unknown compound gave a positive Tollen's test. Treatment of the unknown with iodine and sodium hydroxide gave a solid which was identified as iodoform. The unknown was which of the following compounds? (2%)

(a) CH_3CH_2OH (b) $Ph-\overset{O}{\parallel}C-CH_3$ (c) $CH_3-\overset{O}{\parallel}C-H$

(d) $CH_3CH_2-\overset{O}{\parallel}C-H$ (e) $CH_3-\overset{O}{\parallel}C-CH_3$

(8) Can the following reaction proceed as indicated? Explain clearly but concisely. (3%)



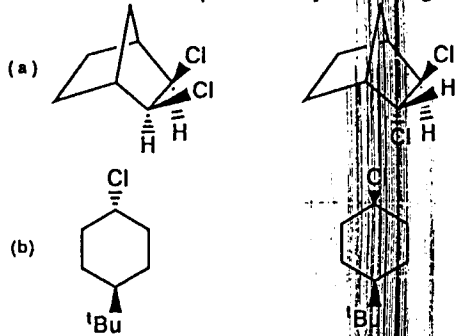
Part II

Give the structural formulas for the following reaction products (A to M) (25%)

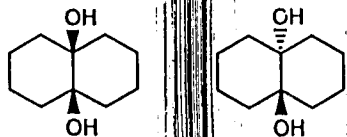
- (1) CC1=CC=C(S(=O)(=O)O)C=C1 $\xrightarrow[2) H_2O]{1) NaOH, \text{fusion}}$ A
- (2) C1=CN=CN=C1 $\xrightarrow[2) H_2O]{1) BuLi/\text{pentane}}$ B
- (3) CC(O)C(N)C(=O)O + C1=CC=CC=C1COC(=O)Cl $\xrightarrow[2) HCl]{1) Na_2CO_3}$ C
- (4) CC(Br)C(Br)C $\xrightarrow[CH_3COOH]{Zn}$ D $\xrightarrow[\text{Peroxide}]{C_2H_5SH}$ E
- (5) O=[N+]([O-])c1ccc(Cl)cc1 $\xrightarrow[2) OH^-]{1) Fe/HCl}$ F $\xrightarrow[HCl, 5^\circ]{NaNO_2}$ G $\xrightarrow[OH^-]{Cl-C_6H_4-OH}$ H
- (6) CC(C)C=O + O=C $\xrightarrow[H_2O]{K_2CO_3}$ I $\xrightarrow[2) KCN]{1) NaHSO_3}$ J
- (7) ClC#C + CC(=O)C=C $\xrightarrow{NH_4Cl}$ K (C₆H₈O) $\xrightarrow{H_3O^+}$ L (C₆H₈O)
- (8) O=C(O)c1ccccc1 $\xrightarrow[2) \text{benzene, } AlCl_3]{1) SOCl_2}$ M

Part III

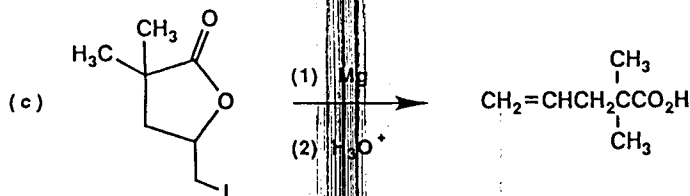
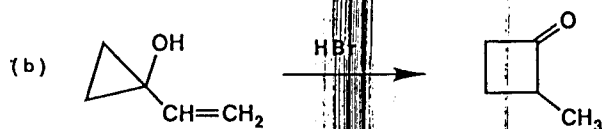
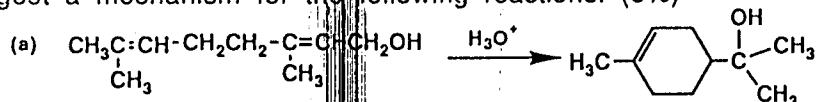
- (1) On the E2 elimination with ^tBuOK/^tBuOH, which one of the following pairs reacts faster? explain why? and give the structure for the product. (6%)



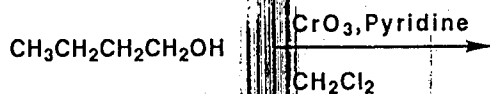
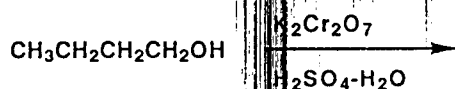
(2) On the periodate oxidation (H_5IO_6), which one of the following pair reacts faster? explain why? and give the structure for the product. (4%)



(3) Suggest a mechanism for the following reactions. (6%)



(4) Predict the products for the following reactions. Explain why different products were obtained? (4%)



Part IV

- Explain why the chemical shift of aromatic proton is much greater (downfield) than that of aliphatic proton. (2%)
- The mass spectrum of 3-butyn-2-ol shows the base peak at $m/z=55$. Explain why this fragment giving rise to this peak would be very stable. (3%)

- (3) Draw the broadband decoupled ^{13}C NMR spectrum for the compound acetophenone, PhCOCH_3 . Show peaks in proper proportions. (5%)
- (4) A compound contains C, H, O, N. The UV spectrum shows no maximum above 205 nm. other spectra are as follows. (10%)
- (a) what is the molecular formula of this compound?
- (b) What is the structural formula of this compound?

