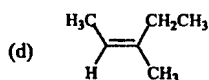
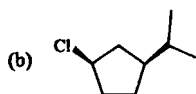
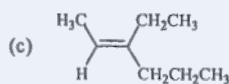
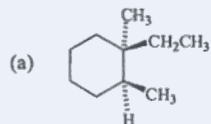


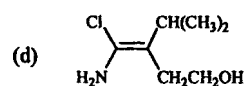
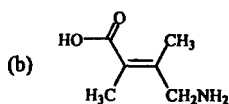
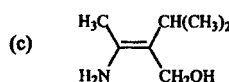
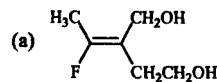
1. Write Lewis (electron-dot) structures for the following molecules: (10%)

- (a)  $\text{CH}_2=\text{CHCH}_2\text{Cl}$   
 (b)  $\text{AlCl}_3$   
 (c)  $\text{CH}_3\text{CN}$   
 (d)  $\text{CH}_3\text{OCH}_3$   
 (e)  $\text{CH}_3\text{NH}_2$

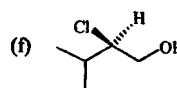
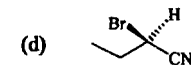
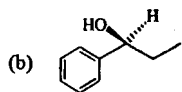
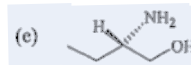
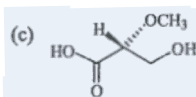
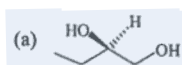
2. Give IUPAC names for the following compounds: (12%)



3. Assign E or Z configuration to the following alkenes: (8%)

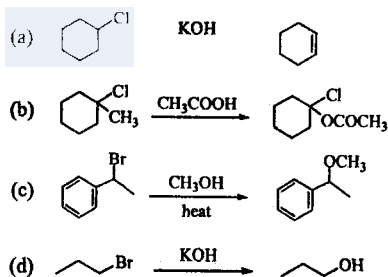


4. Assign R or S configuration to the stereocenters in the following molecules: (12%)



5. Show the steps involved in the Friedel-Crafts reaction of benzene with  $\text{CH}_3\text{Cl}$ . (8%)

6. Identify the following reactions are either  $S_N1$ ,  $S_N2$ , E1, or E2: (16%)

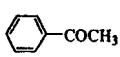


7. Predict the products of the following reactions. Indicate regioselectivity where relevant. (The aromatic ring is inert to all the indicated reagents.) (20%)



- (a) Styrene +  $H_2SO_4 + H_2O \longrightarrow$
- (b) Styrene + HBr  $\longrightarrow$
- (c) Styrene +  $KMnO_4 + H_3O^+ \longrightarrow$
- (d) Cyclohexene +  $KMnO_4 + H_3O^+ \longrightarrow$
- (e) Cyclohexene +  $Br_2 \longrightarrow$
- (f) Cyclohexene +  $KMnO_4 + NaOH, H_2O$
- (g) 1-Methylcyclohexene +  $KMnO_4 + H_3O^+$
- (h) 1-Methylcyclohexene +  $H_2SO_4 + H_2O \longrightarrow$
- (i) 1-Methylcyclohexene +  $Br_2 \longrightarrow$
- (j) 1-Methylcyclohexene + HCl  $\longrightarrow$

8. Suggest structures that give the following reaction products. (14%)

- (a) ? +  $KMnO_4 + H_3O^+ \longrightarrow CH_3COCH_3$
- (b) ? +  $KMnO_4 + H_3O^+ \longrightarrow CO_2 + CH_3CH_2COOH$
- (c) ? + HBr  $\longrightarrow$  2-Bromo-2-methylbutane
- (d) ? + KOH in  $CH_3CH_2OH \longrightarrow$  2-methyl-2-pentene
- (e) ? +  $H_2SO_4 \longrightarrow$  2,3-dimethyl-2-pentene
- (f) ? +  $H_2O + H_2SO_4 + HgSO_4 \longrightarrow$  
- (g) ? +  $KMnO_4 + H_3O^+ \longrightarrow CH_3COCH_2CH_2CH_2CH_2COCH_3$