

- Explain the following terms: (20%)
 - Markovnikov's orientation;
 - Saytzeff orientation;
 - Stereoselective reaction and Stereospecific reaction;
 - Tautomerism (give example);
 - Friedel-Crafts alkylation and acylation
- Addition of HCl to 3-methyl-1-butene yields a mixture of two alkyl chlorides. What are they likely to be, and how is each formed? Give detailed equations. (10%)
- Predict the products of addition of bromine to *trans*-2-pentene and *cis*-2-pentene. Write the complete equations. (10%)
- When allowed to react with aqueous HBr, 3-buten-2-ol ($\text{CH}_3\text{CHOHCH}=\text{CH}_2$) yields not only 3-bromo-1-butene but also 1-bromo-2-butene. How do you account for these results? (10%)
- Most methods of making alkenes yield predominantly the more stable isomer, usually the *trans*. Outline all steps in the conversion of a mixture of 75% *trans*-2-pentene and 25% *cis*-2-pentene into essentially pure *cis*-2-pentene? (10%)
- Outline all steps in the laboratory synthesis of the following compounds from cyclohexanol. a) cyclohexene; b) *trans*-1,2-cyclohexanediol; c) 1,3-cyclohexadiene. (10%)
- Using only individual step with which you are already familiar, outline a likely mechanism for the following reaction. (10%)

$$\text{C}_6\text{H}_5\text{C}(\text{CH}_3)_3 + \text{Br}_2(\text{AlBr}_3) \rightarrow \text{C}_6\text{H}_5\text{Br} + \text{HBr} + (\text{CH}_3)_2\text{C}=\text{CH}_2$$
- Explain the reason why a) the acidity of phenol is higher than alcohol and b) the basicity of aniline is much lower than ammonia. (10%)
- Describe exactly how you would go about separating a mixture of the three water-insoluble liquids, aniline (b.p. 184°C), *n*-butylbenzene (b.p. 183°C), and *n*-valeric acid (b.p. 187°C), recovering each compound pure and in essentially quantitative yield. (10%)