

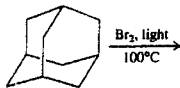
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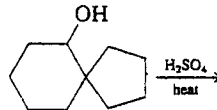
請將答案寫在答案紙上並清楚地註明題號

1. Show the principal product for the following reactions. (2% each)

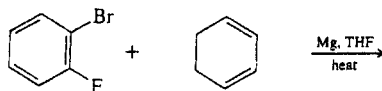
a).



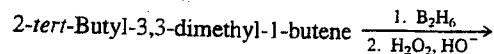
b).



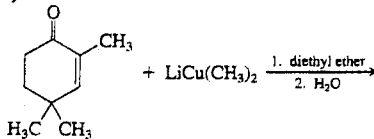
c).



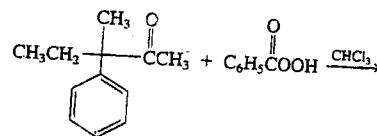
d).



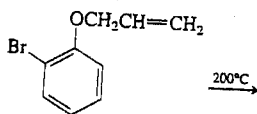
e).



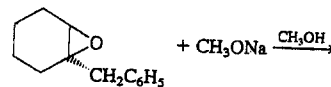
f).



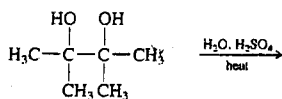
g).



h).



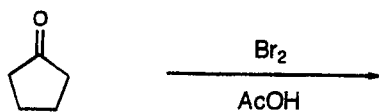
i).



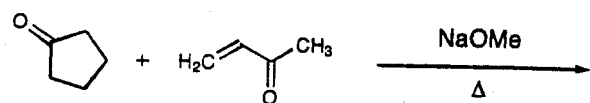
j).



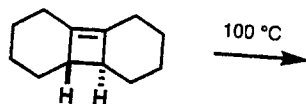
k).



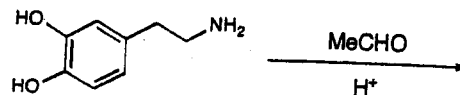
l).



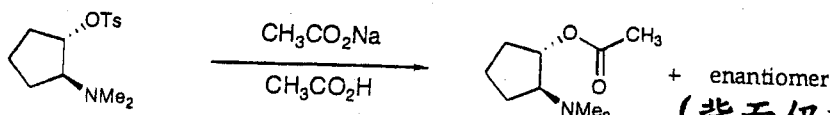
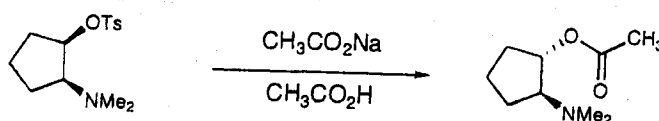
m).



n).



2. Provide a mechanism for each of the following reactions. Your mechanisms must account for the observed selectivity. (8%)

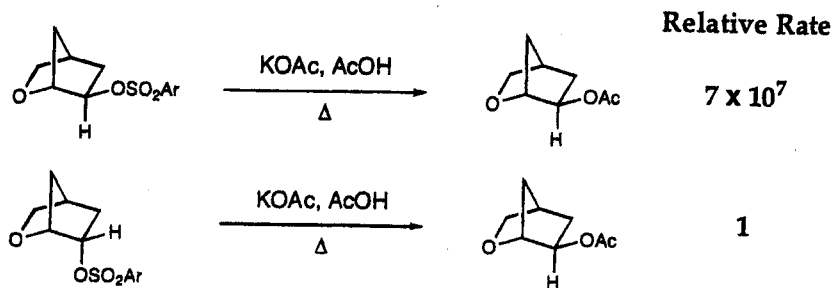


(背面仍有題目,請繼續作答)

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3. Please provide a rationale for the following observations. (8%)



4. a). Propose two possible structures for compound A using the information provided below (6%)

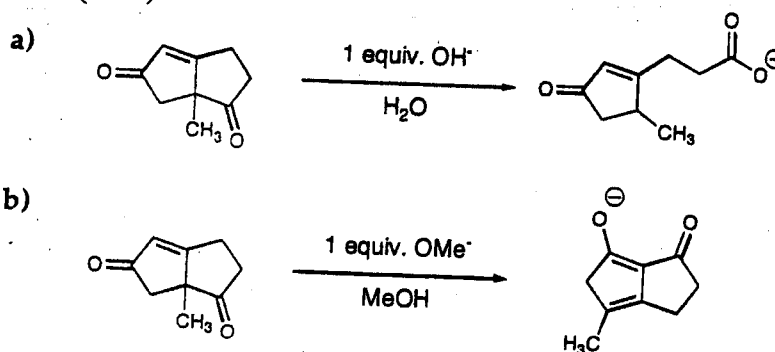
EA (found): C: 75.01%; H: 6.59%

MS: 176 (M^{+}), 161

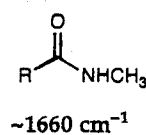
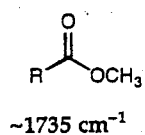
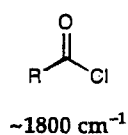
$^{13}\text{C-NMR}$: 166.9, 144.5, 134.4, 130.1, 128.8, 128.0, 118.2, 60.4 and 14.3 ppm

b). The coupling constant between the signals at 6.4 ppm and 7.8 ppm in $^1\text{H-NMR}$ is 15 Hz. Based on this information, which of the two structures that you proposed in part a) is more likely to be the structure A? Explain. (4%)

5. For the following reactions, please provide a detailed mechanism and briefly explain why different products are observed under the different reaction conditions. (10%)



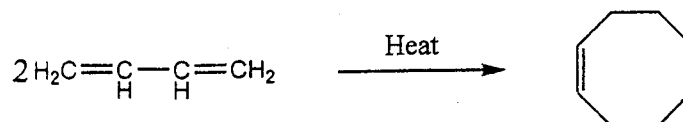
6. Explain the following observations in IR stretching frequencies. (8%)



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7. Using frontier orbital analysis to decide whether the dimerization of 1,3-butadiene shown below is thermally allowed or forbidden. (8%)



8. a). An aqueous solution containing 10 g of optically pure fructose was diluted to 500 mL with water and placed in a 20 cm polarimeter tube. The measured rotation was -5.20° . Calculate the specific rotation of fructose. (3%)
 b). If this solution was mixed with 500 mL of a solution containing 5 g of racemic fructose, what would be the specific rotation of the resulting fructose mixture? (3%) What would be its optical purity? (4%)
9. Compound A was synthesized in a racemic form, (\pm A), in a total synthesis of natural product. In order to resolve the mixture, it was treated with compound B to form two diastereomers. After separation of the two products, they were treated respectively with 5% $\text{H}_2\text{SO}_4/\text{H}_2\text{O}$ to regenerate (+)- and (-)-A. It turned out not a successful way to resolve them.
- a). Why would this method be unsuccessful? (5%)
 b). Suggest a method which might be working? (5%)

