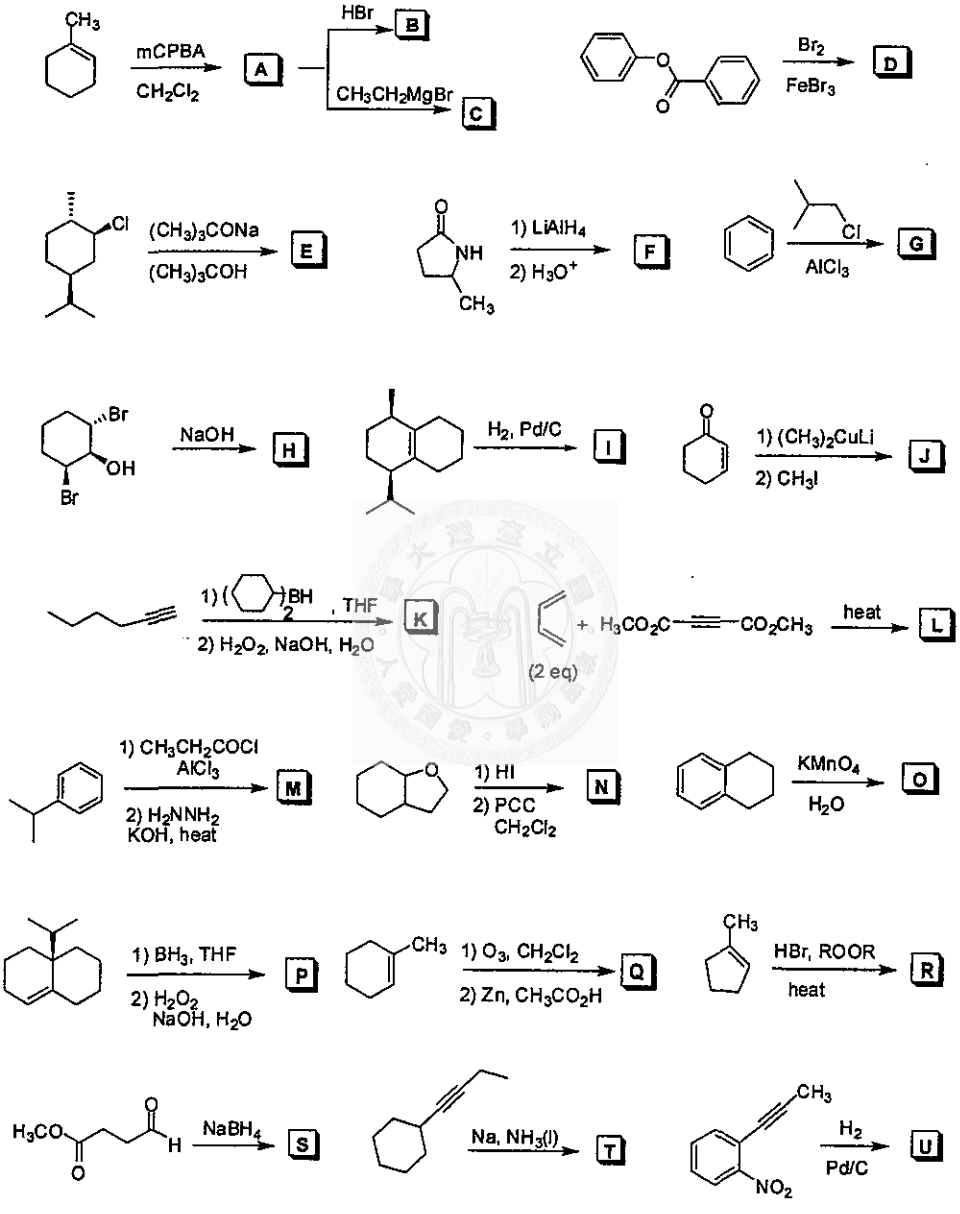
1. Give chemical structure of the major product for the following reactions. Provide the stereochemistry if it is necessary. (75%)



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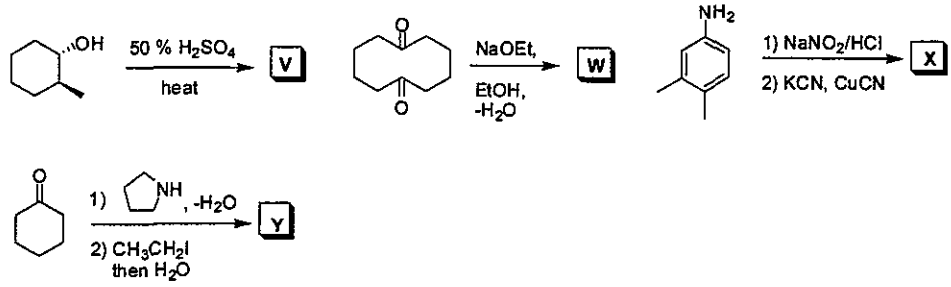
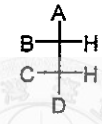


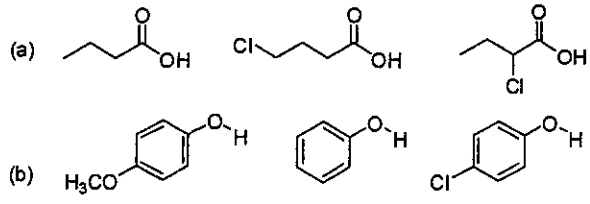
2. If the Fischer projection shown below is to represent (2R,3R)-2,3-dibromopentane, give the identities of A-D. (4%)



3. The NMR spectrum of compound $C_{10}H_{12}O_2$ consists of a pair of doublets at 7.0 and 8.0 ppm (total of 4 H), a singlet at 3.9 ppm (3 H), a quartet at 2.9 ppm (2 H), and a triplet at 1.2 ppm (3 H). Give the structure of compound $C_{10}H_{12}O_2$. (6%)

4. Compare the relative stability of the carbocations shown below and give your reasons. (6%)

5. Compare the relative acidity of the following acids and give your reasons. (9%)



(c) Explain why cyclopentadiene exhibits a similar pKa compared to that of H_2O?

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