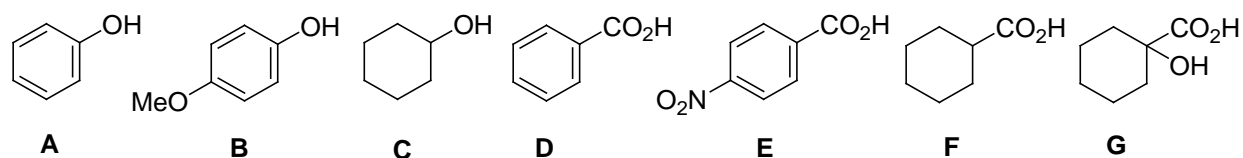
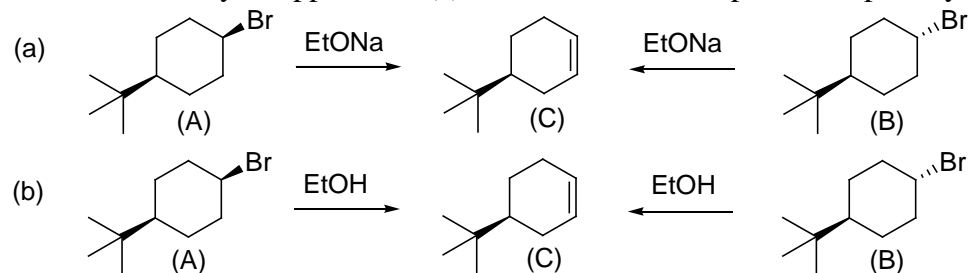


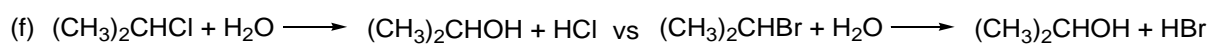
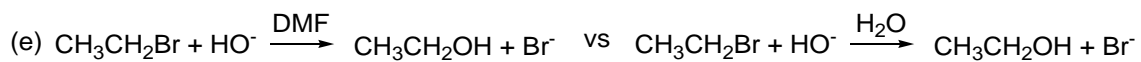
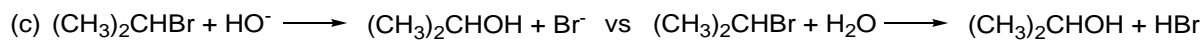
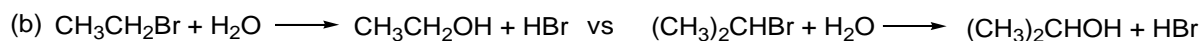
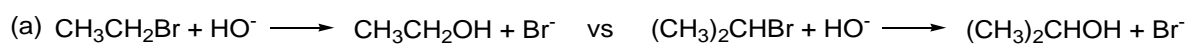
1. (15 points) Arrange the following compounds in the increasing order of acidity. Explain your answer by comparing each acidity one by one.



2. (20 points) (a) Compare the relative reactivity in each set of the elimination reactions and explain your answer based on the reaction mechanism. (b) Name the three compounds, (A), (B), and (C), with absolute stereochemistry, if applicable. (c) Indicate if each compound is optically active or not, and explain.

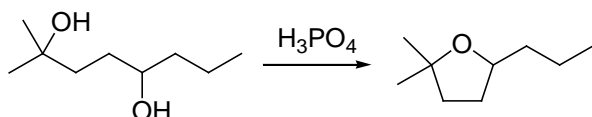


3. (30 points) Compare the relative reactivity in each of the following substitution reaction sets and explain your answer based on the reaction mechanism.



4. (10 points) How can the deuterium kinetic isotope effect be used to determine whether an elimination reaction is an E1 or E2 mechanism? Explain and you can use any substrates and reaction conditions to support your answer.

5. (10 points) Explain the following reaction result with a stepwise mechanism.



6. (10 points) Explain the role of a phase-transfer catalyst in organic reactions with a detailed reaction example. You can use any example. Suggest also at least two different types of phase-transfer catalysts.

7. (15 points x 3) Propose one effective synthetic pathway to produce each target compound starting with the compound(s) given. It may involve more than one step of the reaction and you can use any reagents and reaction conditions for the desired reaction in each step.

