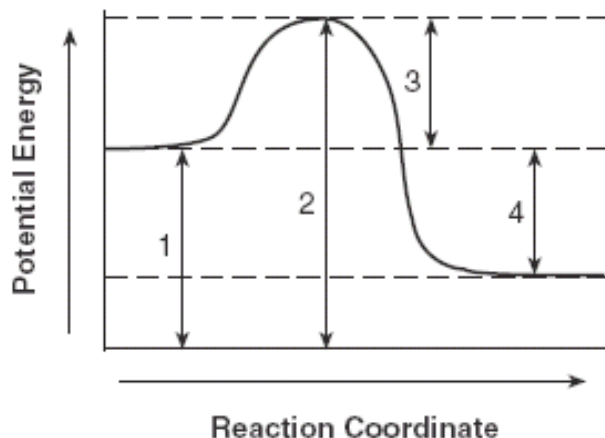


1. In the energy diagram shown below, which interval corresponds to the activation energy (E_a , 2 pts)?

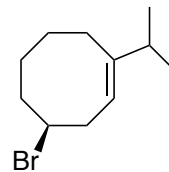


- (a) 1
(b) 2
(c) 3
(d) 4
(e) E_a is not labeled on this diagram

2. Which of the anions shown below would be the STRONGEST nucleophile in ethanol ($\text{CH}_3\text{CH}_2\text{OH}$, 3 pts)?

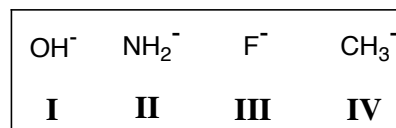
- (a) F^-
(b) Cl^-
(c) Br^-
(d) I^-

3. What is the classification of the organic halide shown below? (circle all that apply, 2 pts)



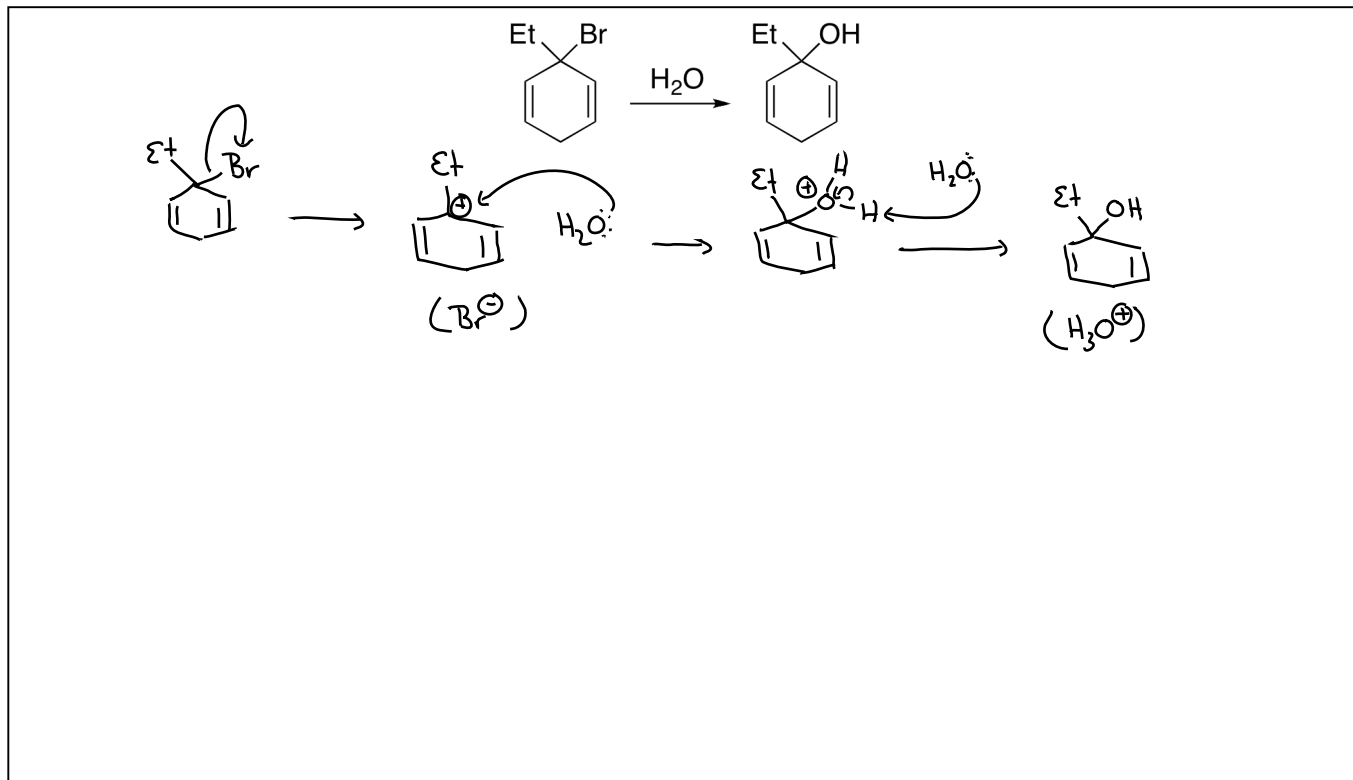
- (a) 1° (primary)
(b) 2° (secondary)
(c) 3° (tertiary)
(d) aryl

4. Rank the following groups in order of DECREASING leaving group ability (best \rightarrow worst, 3 pts)

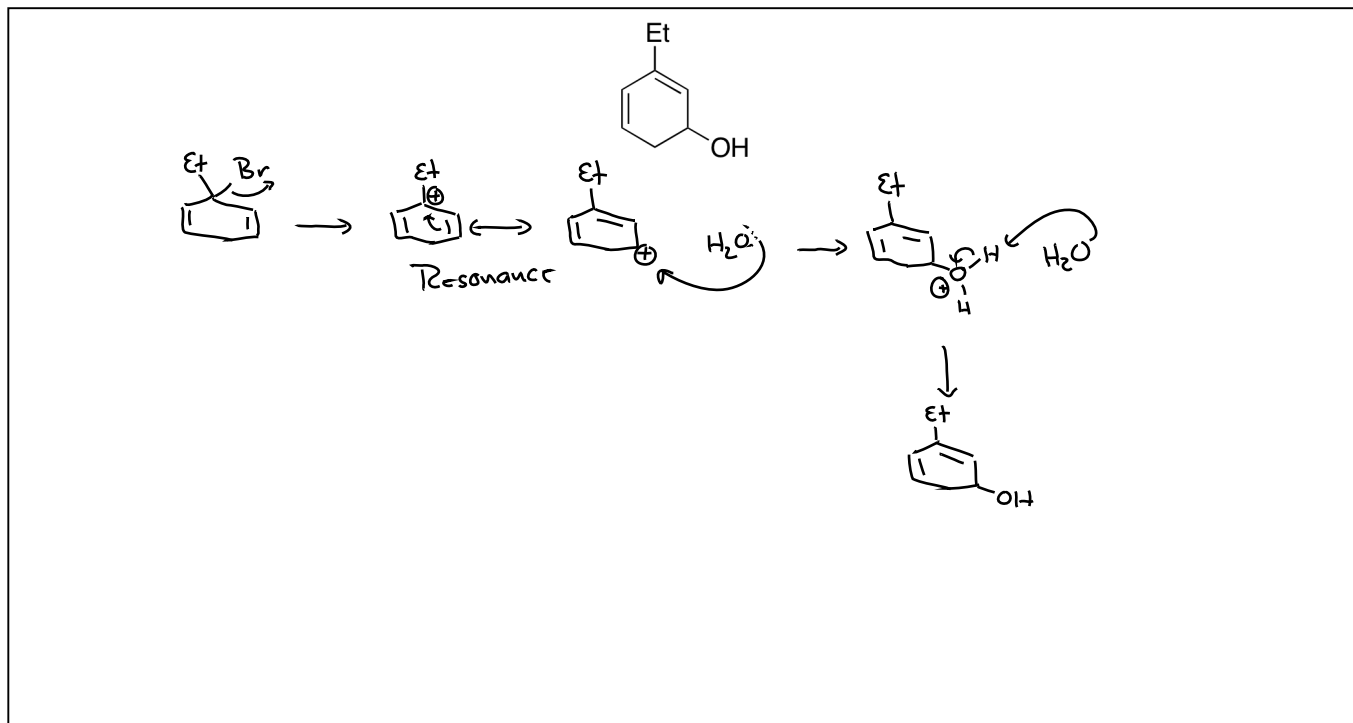


- (a) **IV > I > II > III**
(b) **III > II > I > IV**
(c) **II > I > III > IV**
(d) **IV > II > I > III**
(e) **III > I > II > IV**

Part A: Exposure of the alkyl bromide shown below to water gives the resulting alcohol as a product. Please draw a mechanism to account for its formation. Be sure to use electron flow arrows and account for ALL byproducts produced in this reaction.

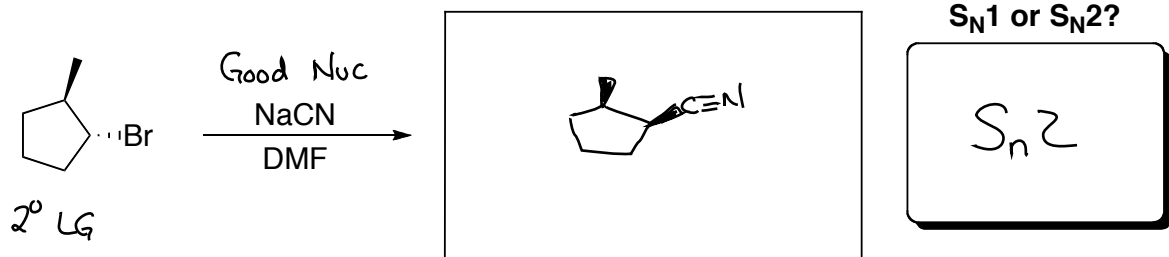


Part B: Interestingly, the constitutional isomer shown below was isolated as a minor product of the reaction in Part A. Please propose a mechanism to account for its formation.



Each of the following reactions gives a substitution product. Identify the major product in each case and indicate whether the reaction is likely to proceed via a bimolecular (S_N2) or a unimolecular (S_N1) mechanism.

(a)



(b)

