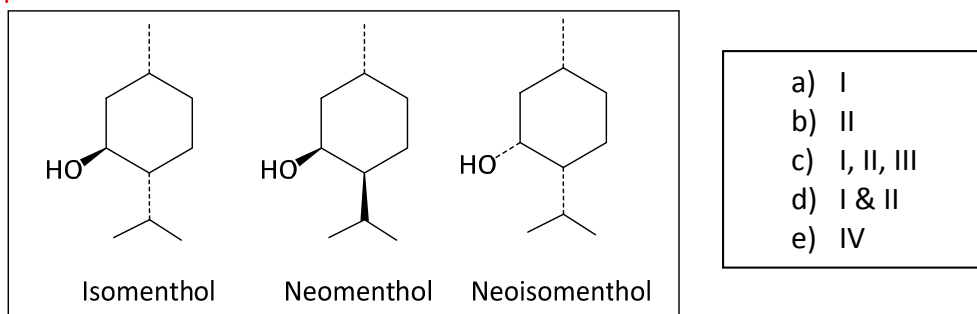
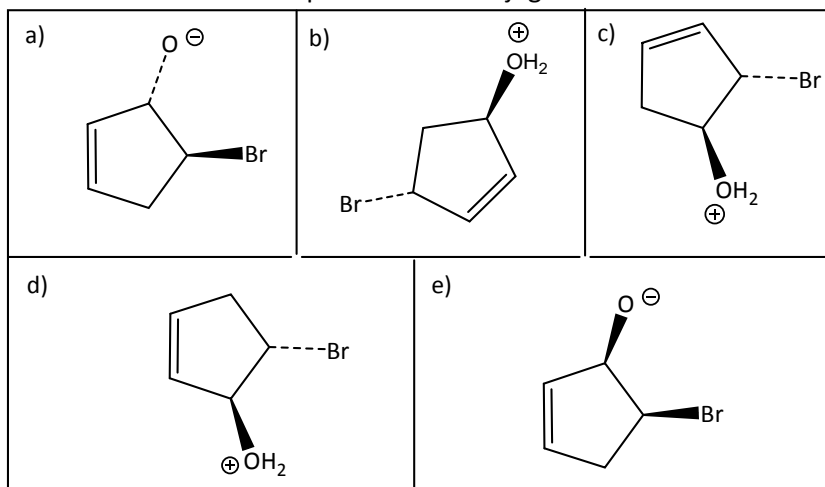


1. Which of the following statements is true as they relate to the four compounds below? **No correct answer provided. Credit for all choices.**

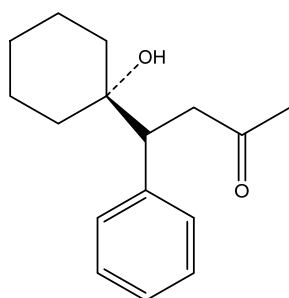


- I. Reaction of 1-isopropyl-4R-methylcyclohexene with H_3O^+ will provide a mixture of all three compounds as major kinetic products
- II. Reaction of each compound with PCC, CH_2Cl_2 will provide the same product
- III. All three compounds, when reacted with POCl_3 , pyr, will provide 1-isopropyl-4R-methylcyclopentene as a major thermodynamic product
- IV. The product of the reaction of each compound with NaH, then 2-bromopropane will contain four chiral centers.

2. Which structure below represents the conjugate acid of trans-5-bromocyclopent-2-en-1-ol? **D**



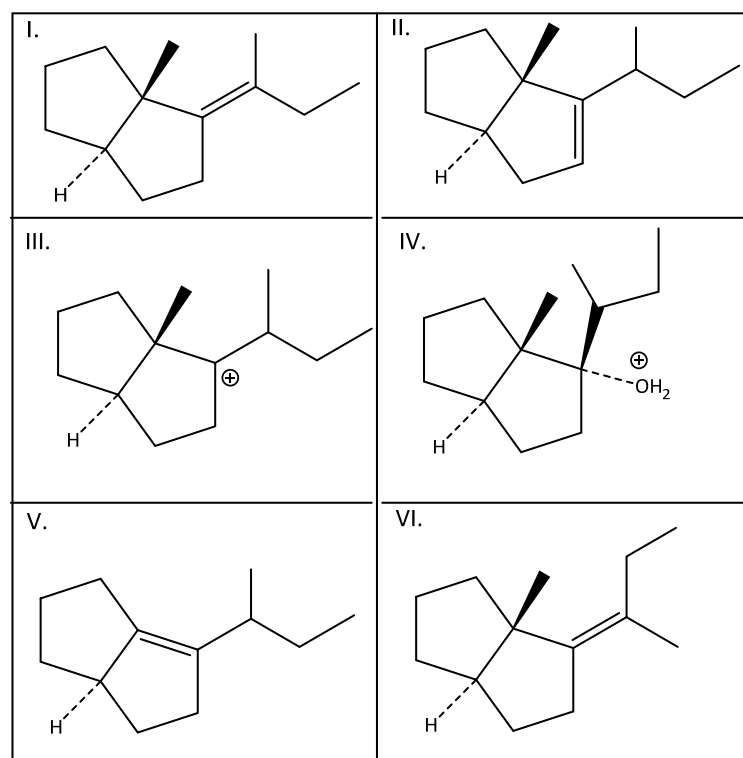
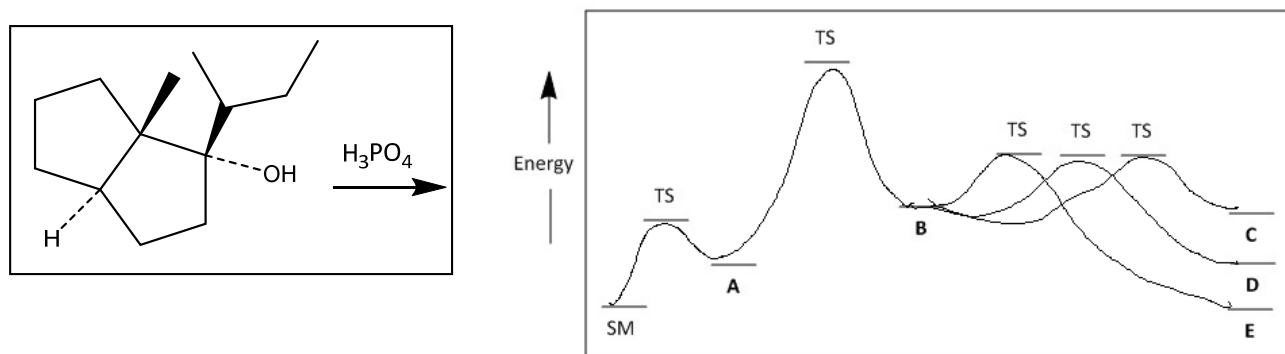
3. Which of the following tests will provide a positive result for the compound below? **C**



- a) I, III & IV
b) I, II & III
c) II & III
d) II, III, & V
e) III, IV & V

- | |
|---|
| I. Jones Test |
| II. Iodoform Test |
| III. Lucas Test |
| IV. $\text{Br}_2/\text{H}_2\text{O}$ Test |
| V. KMnO_4 Test |

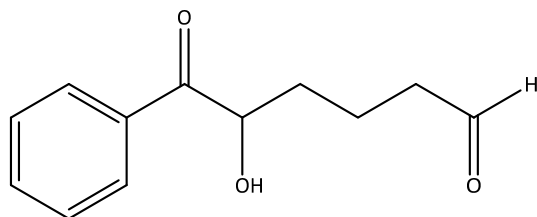
4. The reaction energy diagram below corresponds to the reaction shown. Match the reaction species in the reaction energy diagram (labeled as A, B, C etc) with the structures II, II, II, etc). **A**



Reaction Progress →

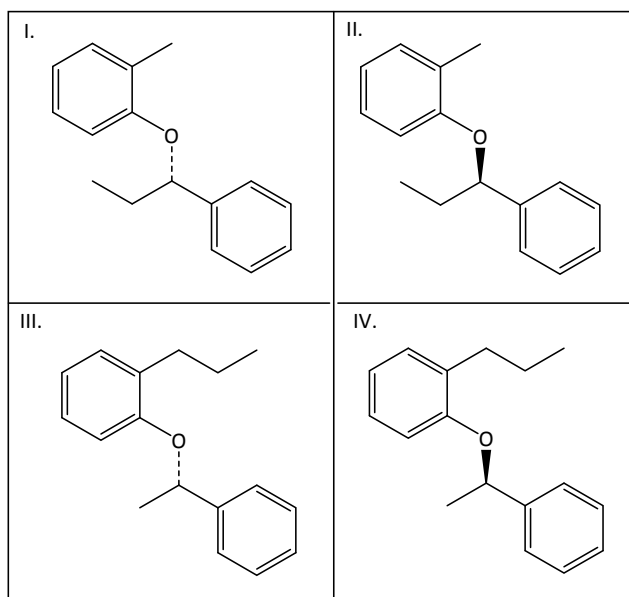
- | | | | | | |
|----|---------|---------|--------|--------|--------|
| a) | A = IV | B = III | C = II | D = VI | E = I |
| b) | A = IV | B = III | C = II | D = I | E = VI |
| c) | A = IV | B = III | C = VI | D = I | E = V |
| d) | A = III | B = IV | C = II | D = I | E = V |
| e) | A = IV | B = III | C = I | D = VI | E = II |

5. Which of the following reagents could be used to prepare the product shown from 2-phenylcyclohex-2-en-1-ol as starting material? **No correct answer provided. Credit given for all choices.**



- | | |
|---|-------------|
| I. HIO ₄ | a) I & II |
| II. 1. O ₃ 2. Zn, HCl | b) II & III |
| III. CrO ₃ , H ₂ SO ₄ , H ₂ O | c) I & V |
| IV. PCC, CH ₂ Cl ₂ | d) I |
| V. KMnO ₄ , Δ, H ⁺ | e) I & IV |

6. The conjugate base of 2-methylphenol reacts with 1R-chloro-1-phenylpropane to provide an ether product. Which of the following compounds is the ether product of this reaction? **A**



- | |
|--|
| <p>a) I
b) II
c) I & II
d) III
e) III & IV</p> |
|--|

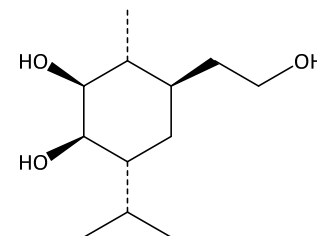
7. Rank the phenols below from most acidic to least acidic (most>least) **C**

- I. Phenol
II. 4-Ethylphenol
III. 4-Methoxyphenol
IV. 4-Nitrophenol

- | |
|---|
| <p>a) III > II > I > IV
b) I > IV > III > II
c) IV > I > II > III
d) II > I > IV > III
e) III > I = IV > II</p> |
|---|

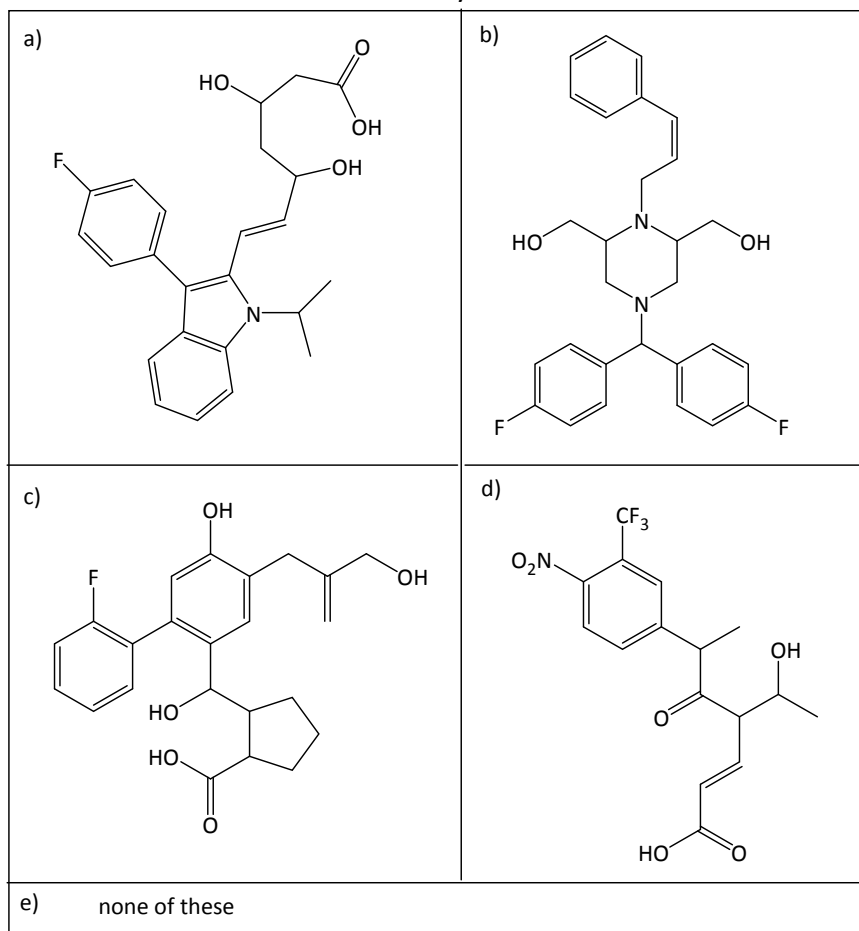
8. Which of the following statements is true as it relates to the structure below? **E**

- I. Treatment with HIO_4 will provide a product that is a single molecule containing two aldehydes and a primary alcohol.
II. Reaction with Jones reagent will provide a mixture of diastereomers.
III. The starting material contains three secondary alcohols
IV. The product that forms after reaction with PDC, CH_2Cl_2 cannot undergo intramolecular hydrogen bonding.

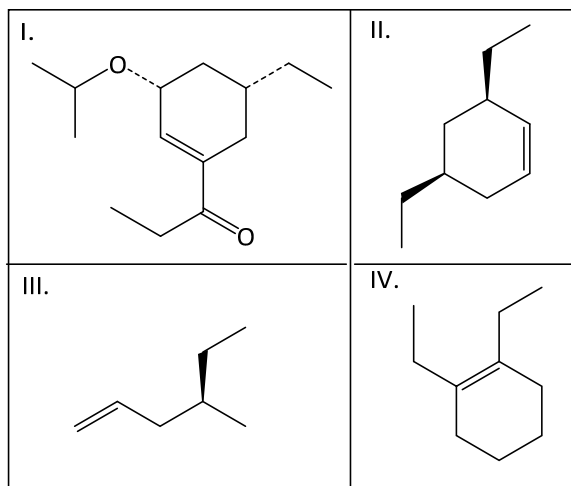


- a) I, II, III & IV
b) I, II & III
c) I, III & IV
d) III & IV
e) I & IV

9. At pH =2 and pH = 7, fluvastatin can form inter- and intramolecular ion-dipole interactions. Fluvastatin contains a disubstituted, E-alkene. Reaction of fluvastatin with PCC, CH₂Cl₂ provides a product that contains two ketones and a carboxylic acid. Which of the following structures is fluvastatin? **A or D**

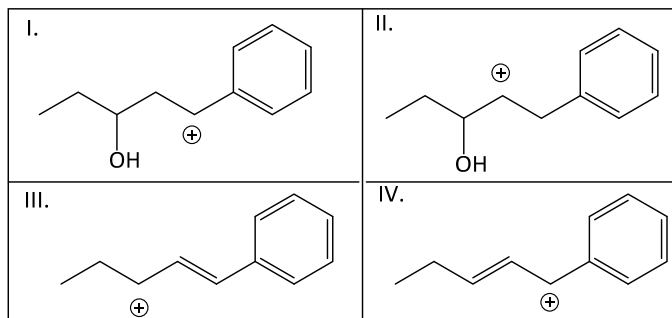
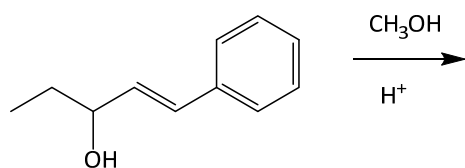


10. Which of the following starting materials will provide a mixture of diastereomers upon reaction with cold, basic KMnO₄? **C**



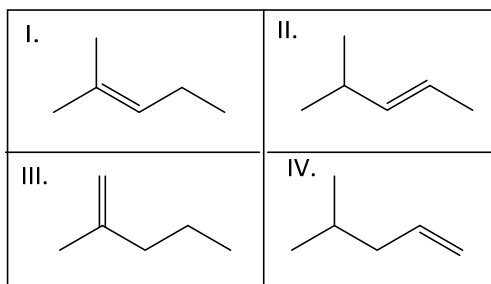
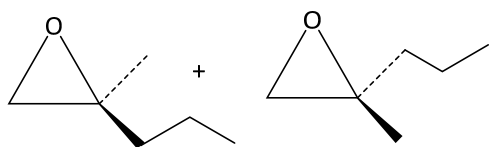
- | |
|--------------------|
| a) I & II |
| b) II & III |
| c) I, II & III |
| d) IV |
| e) I, II, III & IV |

11. Which of the following reaction intermediates, generated in the reaction below, gives rise to the major **thermodynamic** product(s)? **D**



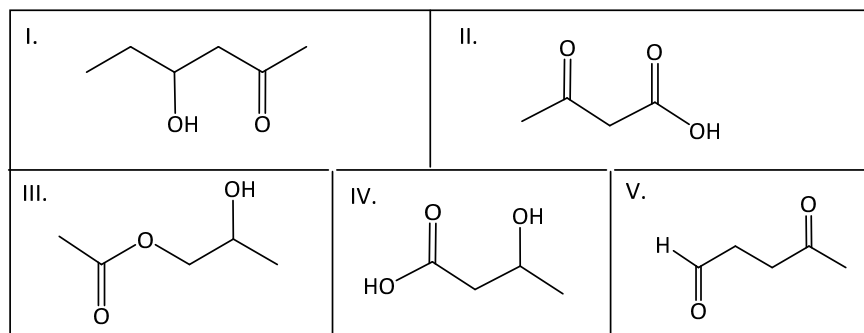
- a) I
b) II
c) I & II
d) III
e) IV

12. Which of the following starting materials could be used to prepare the epoxides below using m-chloroperbenzoic acid? **D**



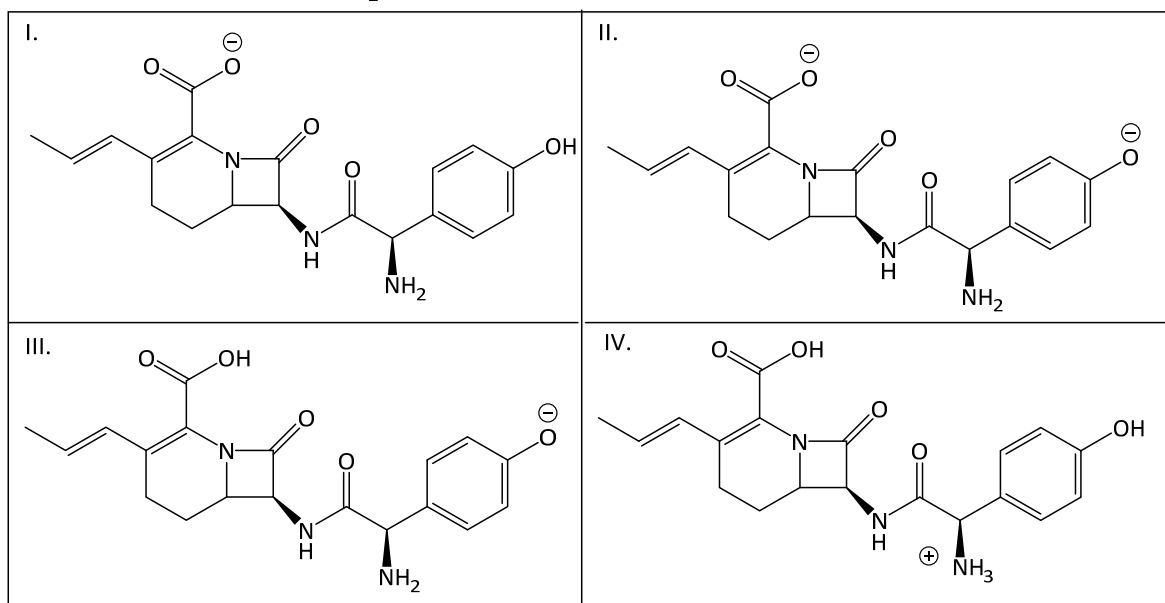
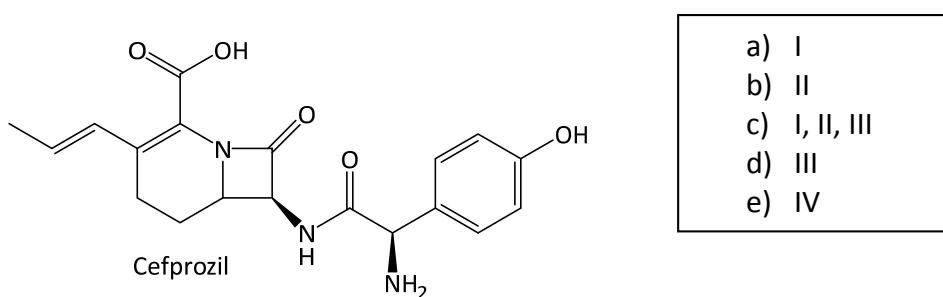
- a) I
b) II
c) III & IV
d) III
e) I & III

13. Rank the following compounds from highest oxidation state to lowest oxidation state. (Highest>Lowest) **A**

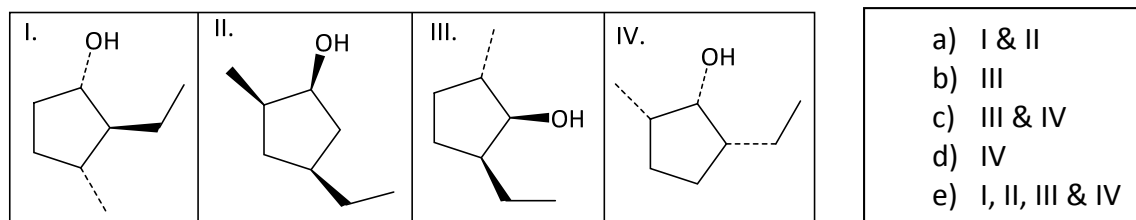


- a) II > V = III = IV > I
b) II > IV = III > I > V
c) II > IV = III > V > I
d) II > IV > I > III = V
e) V = II = III = IV > I

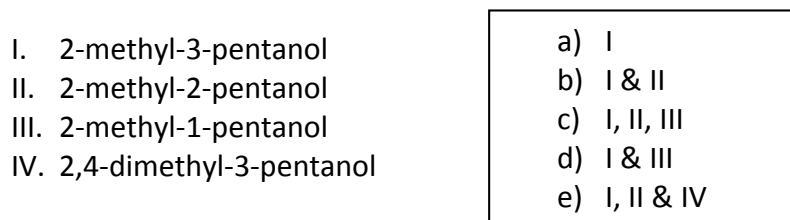
14. Which of the following represents the structure of cefprozil, an antibiotic used to treat bacterial infections at pH = 12? **B**



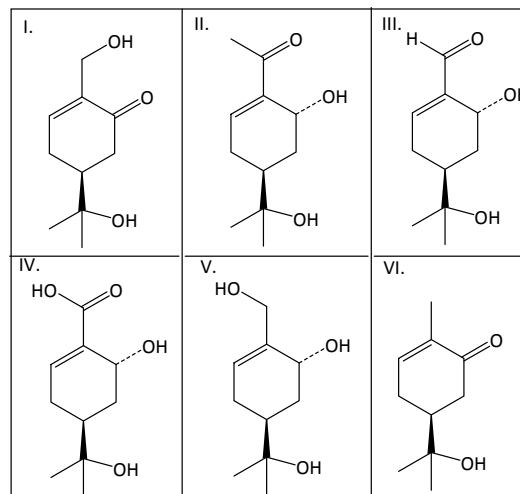
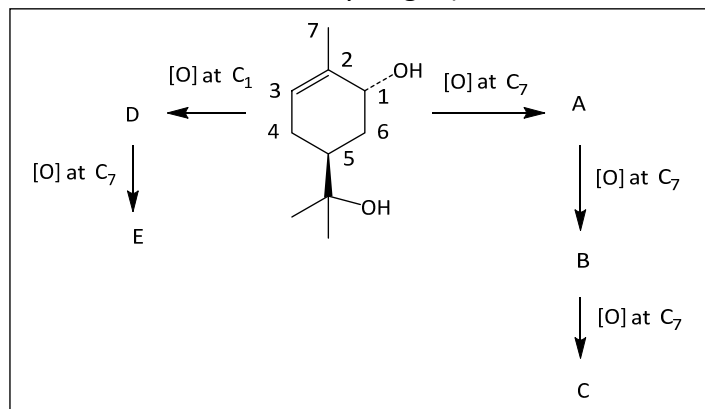
15. Which of the following starting materials will provide **two, major thermodynamic** products upon reaction with POCl_3 , Et_3N ? **D**



16. Under kinetic conditions, which of the following alcohols will provide two **major kinetic** products upon reaction with acetic acid? (Assume no rearrangements.) **B**

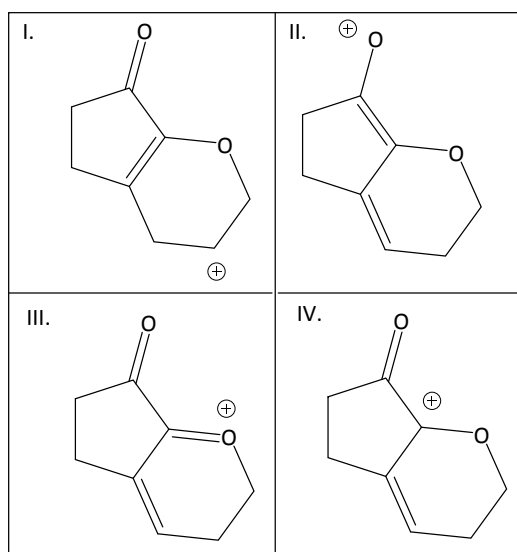
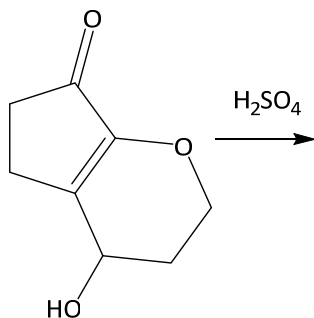


17. trans-Sobroleol is a mucolytic agent that undergoes oxidation in humans through two pathways. Match the oxidation products (A, B, C, D and E) in the scheme below with its structure (I, II, III, etc.). Each oxidation step ([O]) represents an increase of +1 in oxidation state (i.e., increase in one bond to oxygen and/or decrease in one bond to hydrogen). **C**



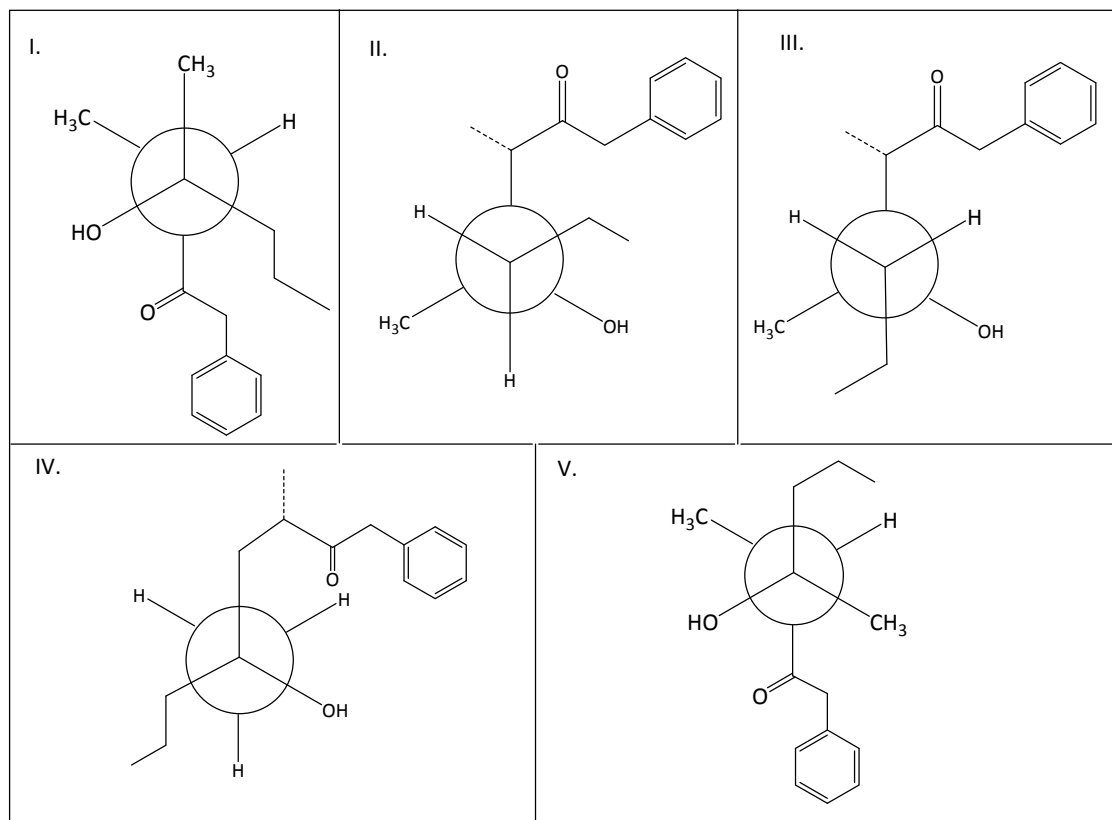
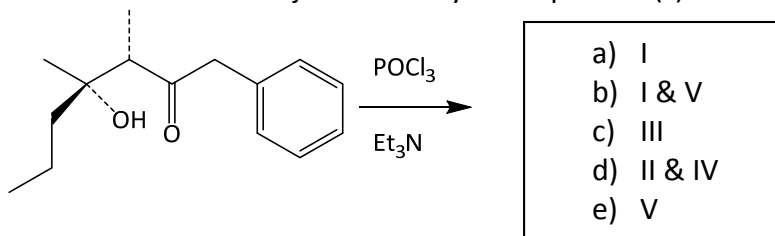
- a) A = I B = II C = IV D = VI E = IV
 b) A = V B = II C = IV D = VI E = I
 c) A = V B = III C = IV D = VI E = I
 d) A = V B = III C = I D = VI E = IV
 e) A = V B = IV C = III D = VI E = II

18. Which of the following structures represents **a resonance form** of the reaction intermediate that is generated in the rate determining step of the reaction below? **D**

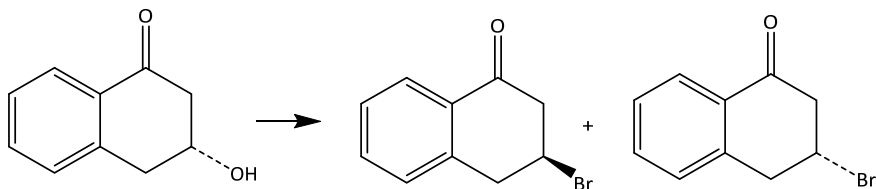


- a) I
 b) II & III
 c) III
 d) III & IV
 e) IV

19. Which of the following Newman projections represent the conformation(s) of the starting material that will lead to the major thermodynamic product(s) of the reaction below? **A**



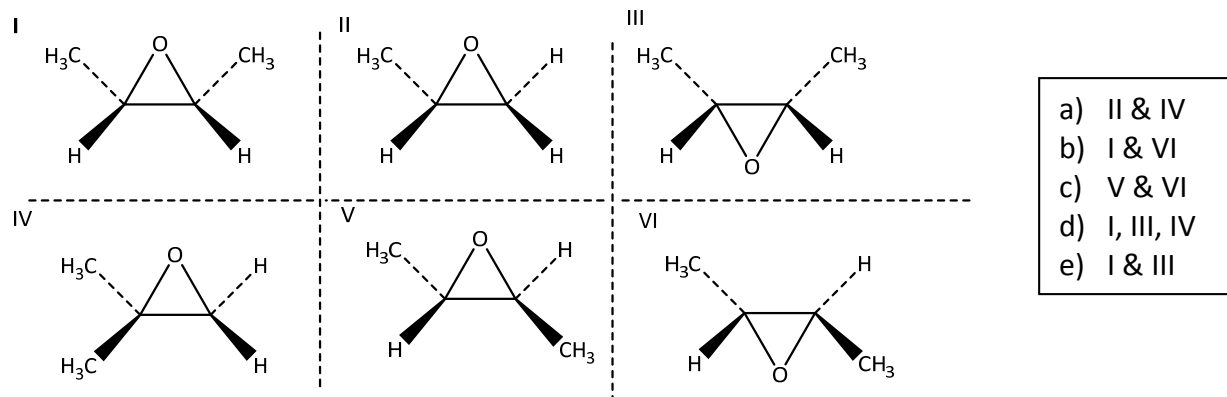
20. The reaction outlined below occurs through which of the following mechanisms? **A**



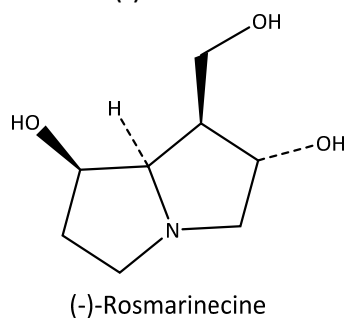
- I. S_N1
II. S_N2
III. E_1
IV. E_2
V. Electrophilic Addition

- a) I
b) II & IV
c) I & II
d) I & III
e) V

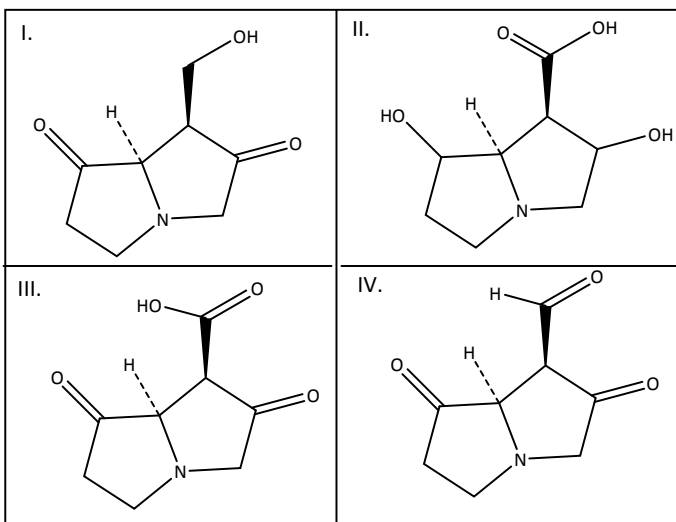
21. Cis-2-butene provides which compound(s) when treated with m-CPBA? **E**



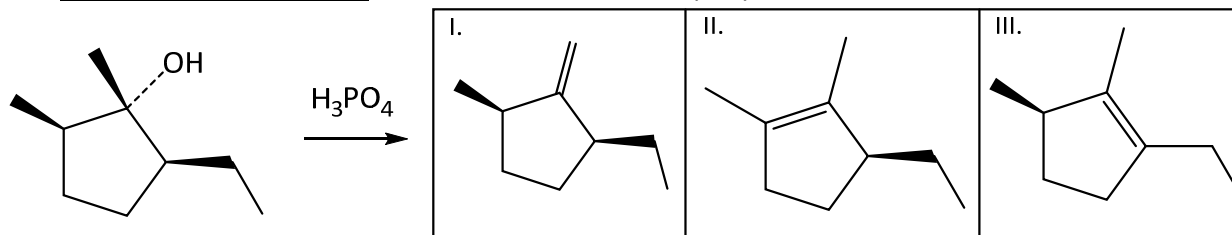
22. Reaction of (-)-rosmarinecine with excess Jones reagent will provide: **D**



- a) I
b) II
c) III & IV
d) III
e) IV

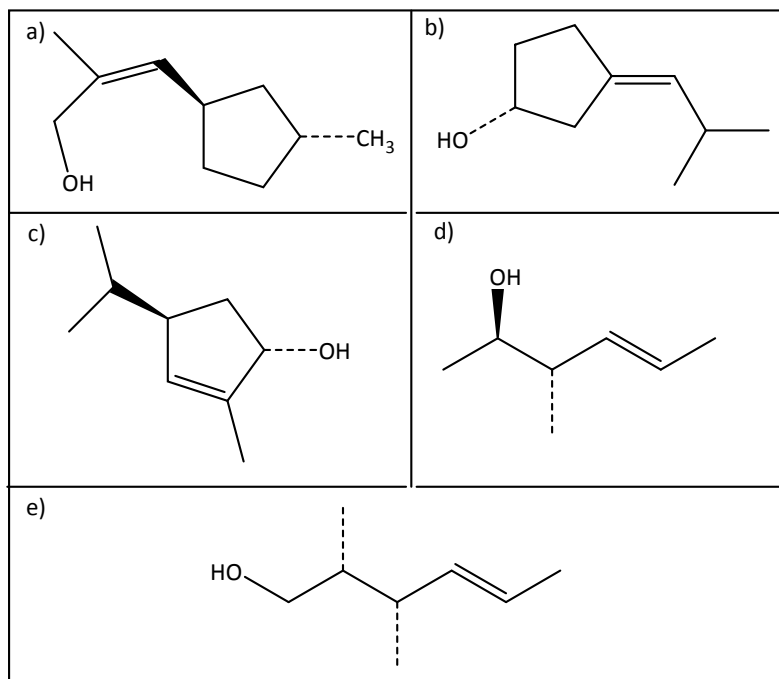


23. The major kinetic product(s) of the reaction below is (are): **C**



- a) I & III
b) II & III
c) I, II & III
d) I & II
e) I

24. Treatment of compound A with 1. cold, basic KMnO_4 and 2. HIO_4 provides two products, one containing a ketone and the other containing an aldehyde. Compound A contains two chiral centers and when reacted with PCC, CH_2Cl_2 , the product of this reaction also contains two chiral centers. However, reaction of compound A with H_3O^+ gives a major kinetic product that contains three chiral centers. Which of the following structures represents compound A? **A**



25. Which of the following functional groups are present in the compound below? **E**

I. Ether	V. Primary Alcohol
II. Ketone	VI. Secondary Alcohol
III. Aldehyde	VII. Tertiary Alcohol
IV. Carboxylic Acid	VIII. Phenol

- a) II, III, V, VI, VII
 b) I, II, III, V, VII, VIII
 c) I, III, IV, V, VII
 d) I, II, III, V, VI, VII, VIII
 e) I, II, III, V, VII

