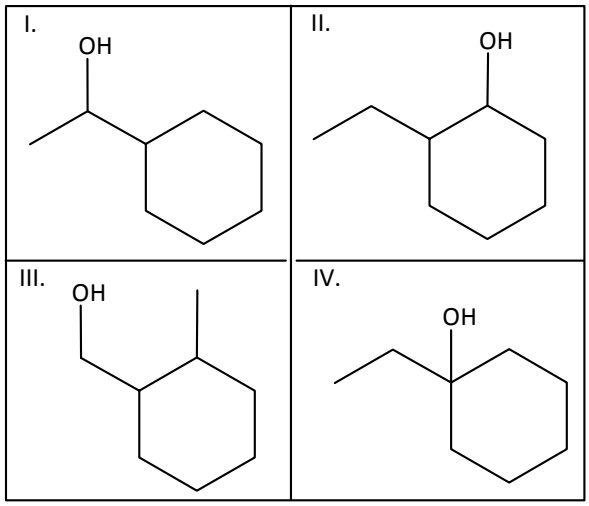
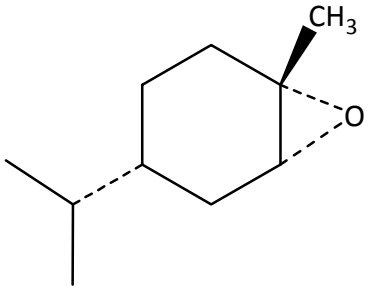
1. Which of the following alcohols will react the *fastest* with H_3PO_4? (Assume no rearrangements) **E**



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

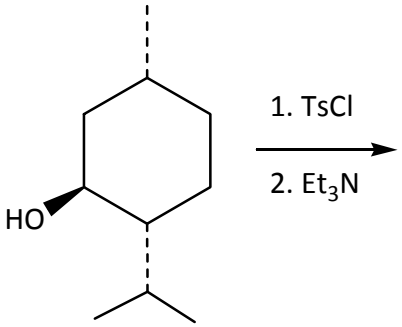
2. The *major* product(s) of the reaction below is (are): **C**



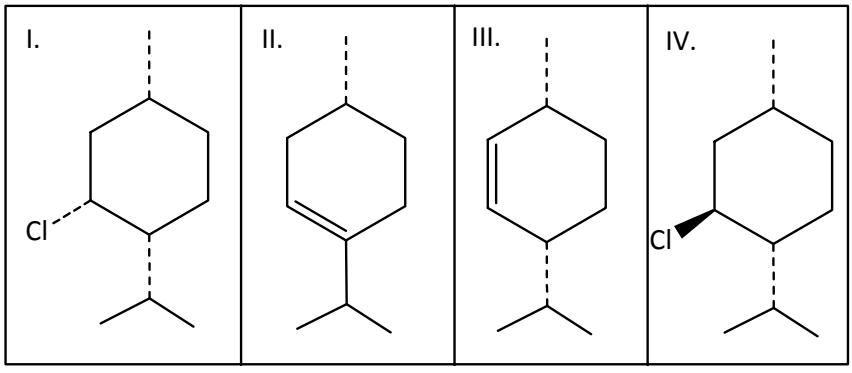
H_3O^+

a) A racemic mixture
b) A single stereoisomer
c) A mixture of diastereomers
d) A mixture of positional isomers
e) c & d

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



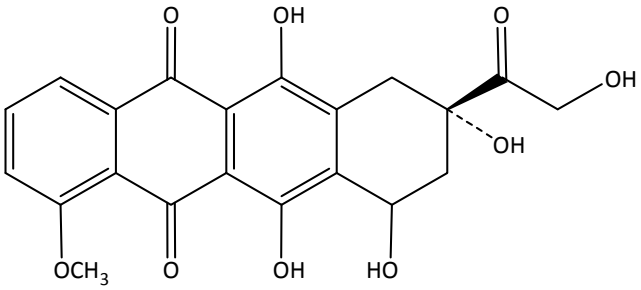
1. TsCl
2. Et_3N



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

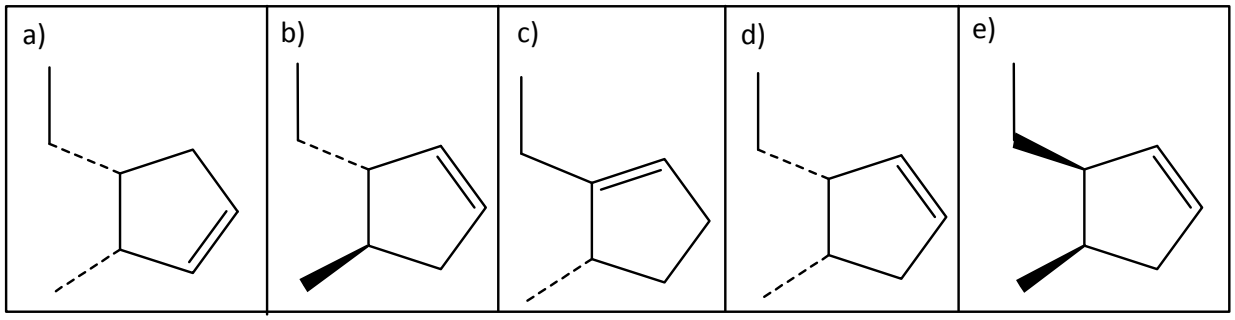
4. Which of the following functional groups are present in the compound below? **B**

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

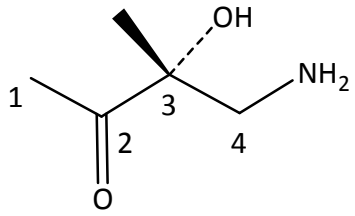


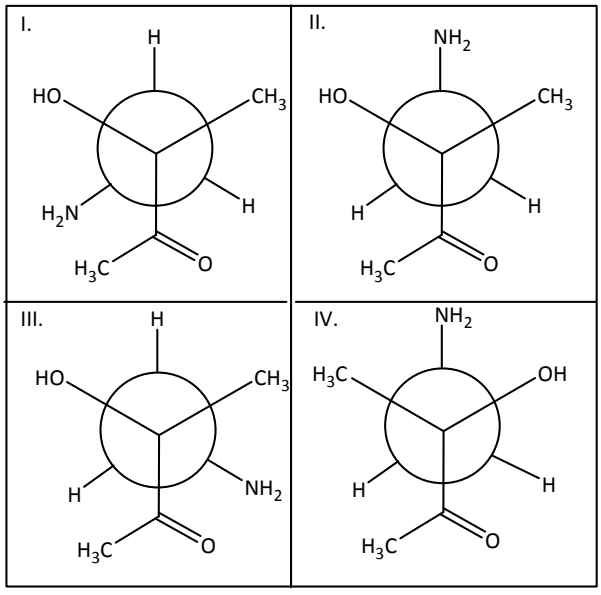
a) IV, VII, VI, VIII, II
b) I, II, VIII, V, VI, VII
c) I, II, IV, VIII, VI, VII
d) V, II, VII, III, I, IV
e) I, II, III, IV, V, VI, VII, VIII

5. Which of the following *starting materials* will provide 1S, 2R, 3S, 4S-3-ethyl-4-methyl-1,2-cyclopentanediol and 1R, 2S, 3S, 4S-3-ethyl-4-methyl-1,2-cyclopentanediol upon treatment with cold, dilute $KMnO_4$? **D**



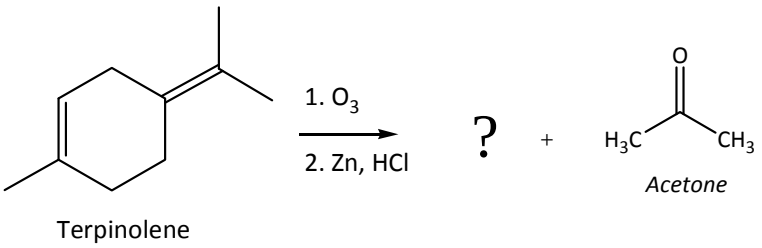
6. Which of the following Newman projections represents the *most favorable conformation*, across the C_3-C_4 bond, of the molecule given below? **A**



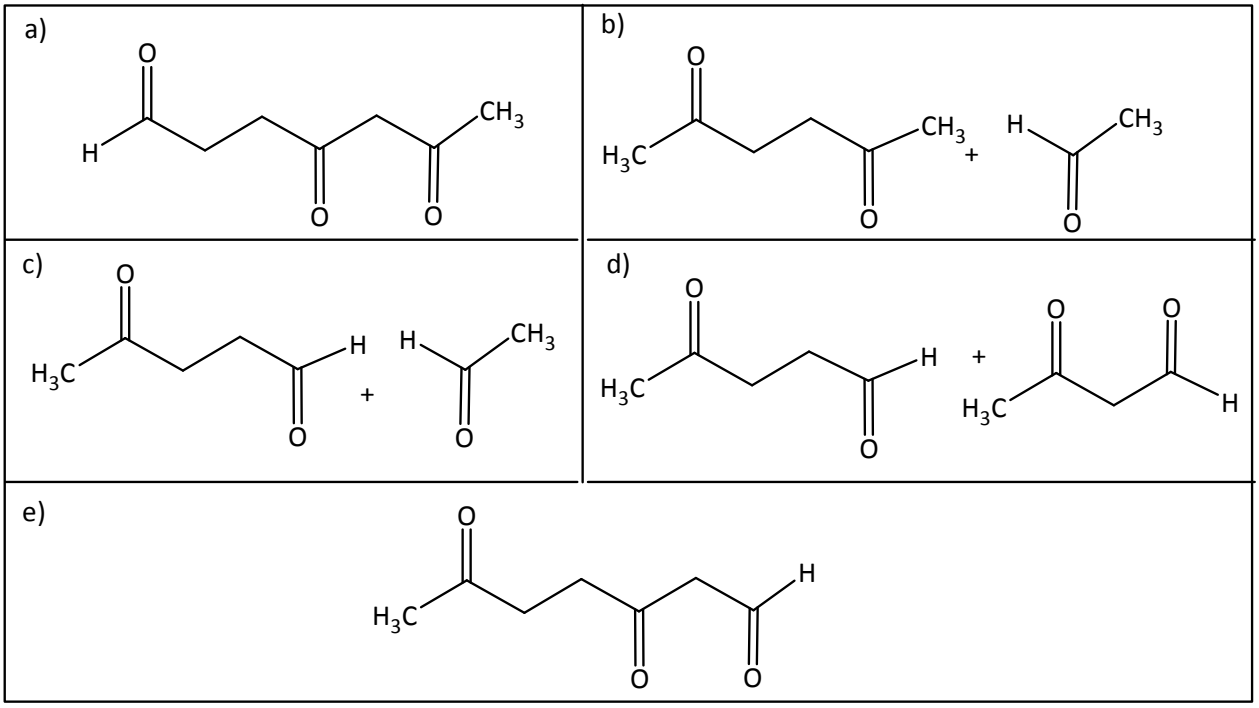


a) I
b) II
c) III
d) II & III
e) II, III, & IV

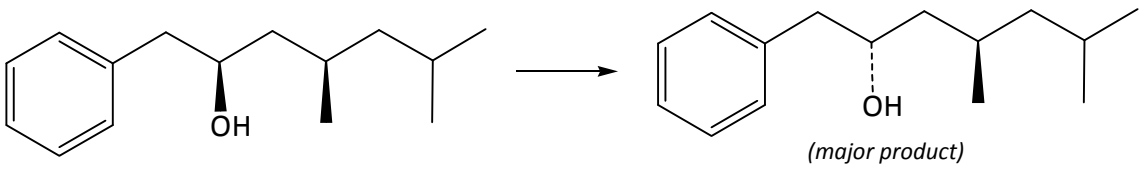
7. Ozonolysis of terpinolene (assume excess reagent) will provide acetone and: **E**



Terpinolene

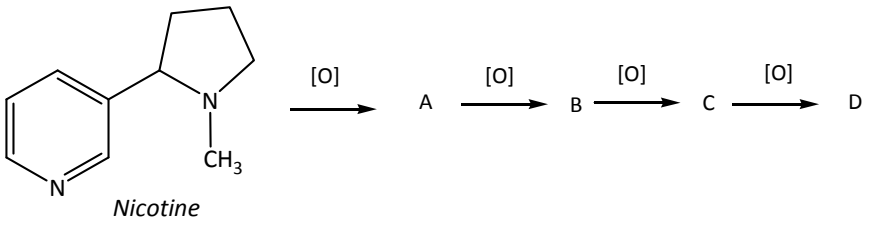


8. Which sequence of reagents could be used to accomplish the transformation outlined below? **B**



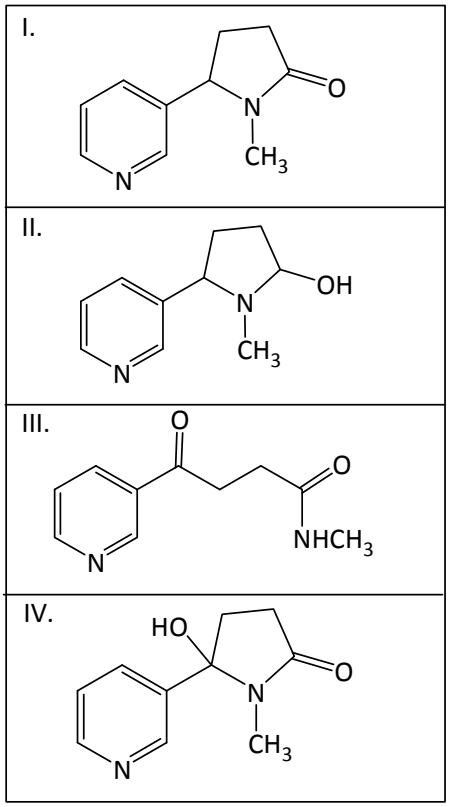
a) 1. H_3PO_4 (thermodynamic) 2. m-ClPBA 3. H_3O^+
b) 1. TsCl 2. NaOH
c) 1. $SOCl_2$ 2. NaOH
d) 1. $POCl_3$, Et_3N 2. cold, dilute $KMnO_4$
e) b & c

9. Nicotine undergoes a series of oxidations when it is metabolized *in vivo*, referred to as oxidative metabolism. Each step of the oxidative metabolism of nicotine results in a metabolite (A, B, C and D) of higher oxidation state. Match each metabolite (A, B, C and D) to the structures provided (I, II, III, and IV). **C**

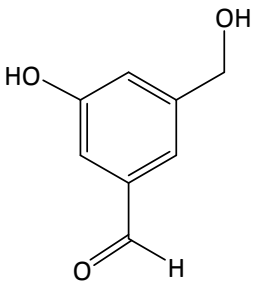


Nicotine

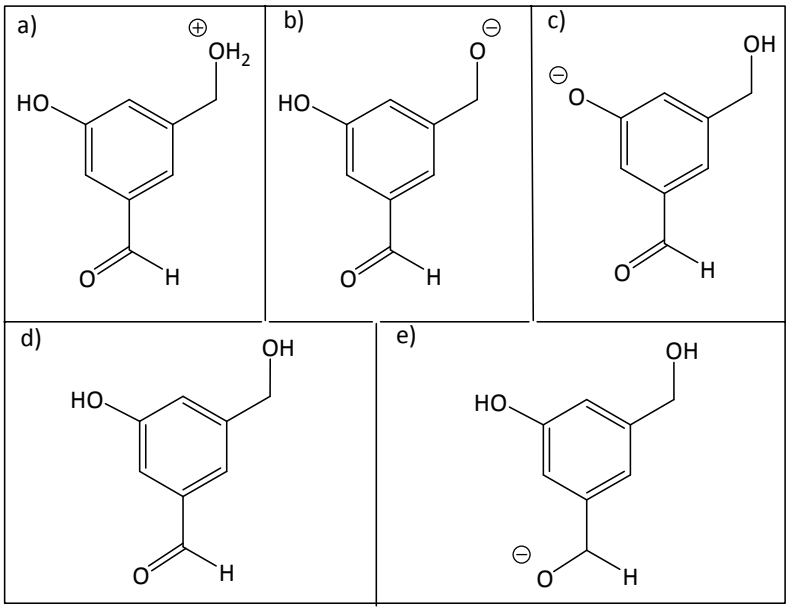
a) A = I; B= II; C = III; D = IV
b) A = II; B =III; C = IV; D = IV
c) A = II; B = I; C = IV; D = III
d) A = II; B = IV; C = II; D = III
e) A = III; B = IV; C = I; D = II



10. Which of the following structures best represents 5-(hydroxymethyl)-3-hydroxybenzaldehyde at pH = 10? **C**



5-(Hydroxymethyl)-3-hydroxybenzaldehyde

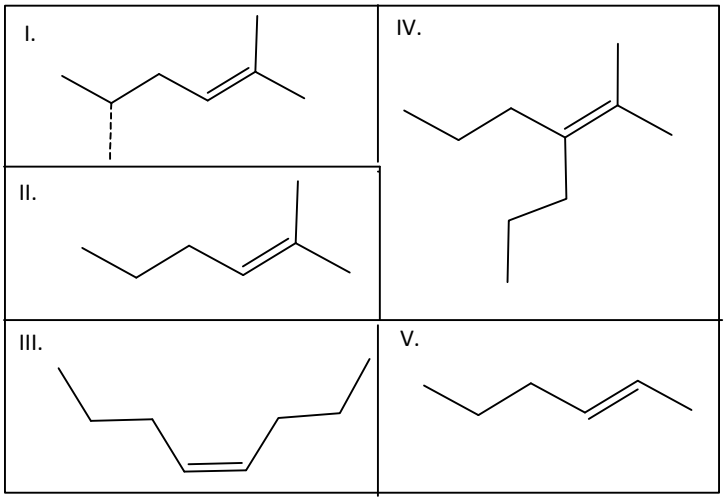


11. The major kinetic product(s) of the reaction of 1R,2S-2,4-dimethylcyclopent-3-en-1-ol with H_2SO_4 is (are): (Assume no rearrangements). **D**

I. 5R-2,5-dimethyl-1,3-cyclopentadiene
II. 5S-2,5-dimethyl-1,3-cyclopentadiene
III. 1R,2S-2,4-dimethylcyclopent-3-en-1-ol
IV. 1,3-dimethyl-1,3-cyclopentadiene

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

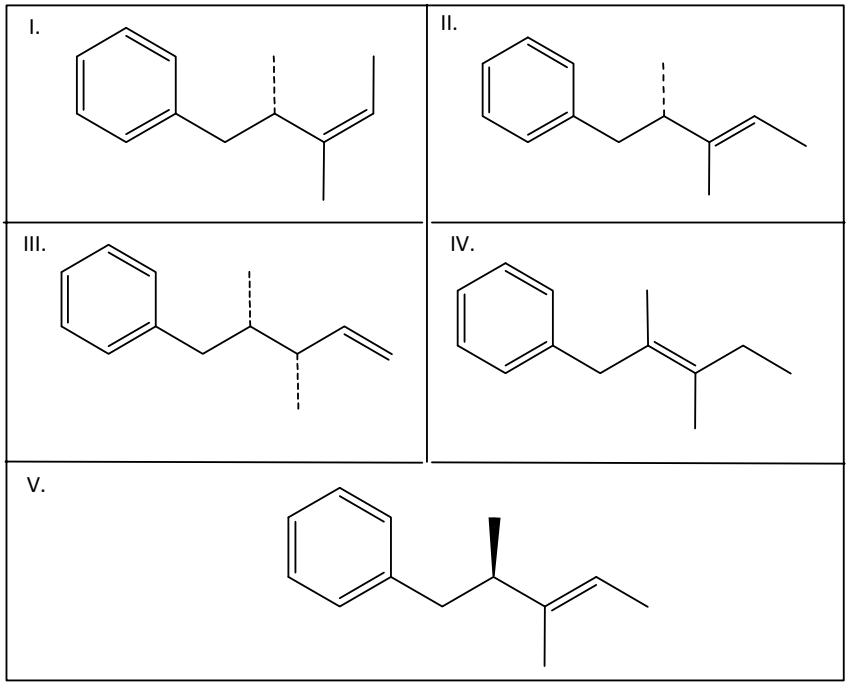
12. Which of the following alkenes will give a *racemic mixture* upon reaction with m-chloroperbenzoic acid? **A or E**



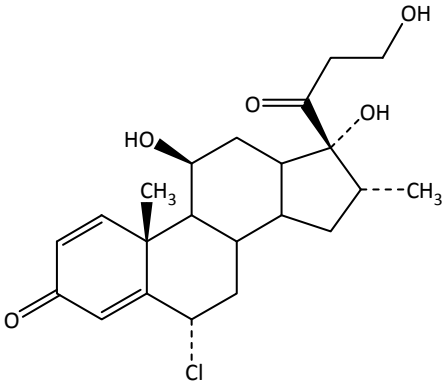
a) I
b) II
c) II, IV & V
d) III & IV
e) II & V

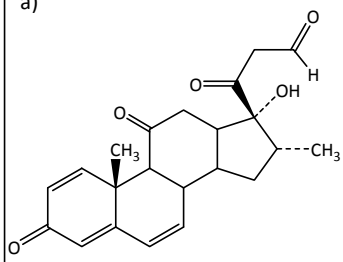
13. The *major thermodynamic* product(s) of the reaction of 2S,3R, 4S-3,4-dimethyl-5-phenyl-2-pentanol with $POCl_3$, Et_3N is (are): **A**

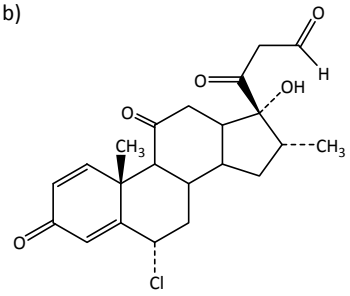
a) I
b) I & II
c) IV
d) III
e) V

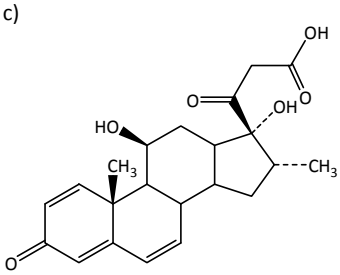


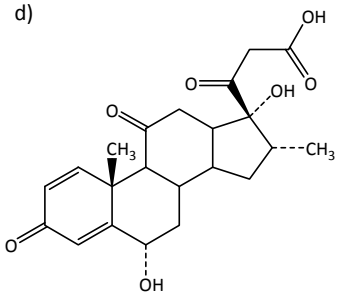
14. Treatment of the compound below with PCC, CH_2Cl_2 will provide: **B**

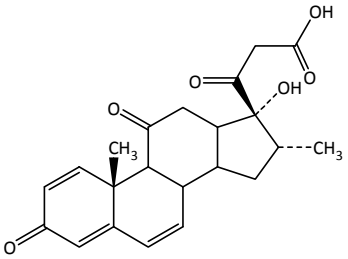


a)


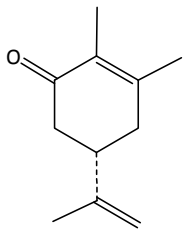
b)


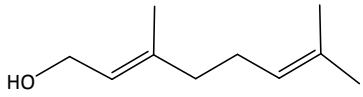
c)


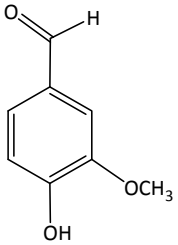
d)


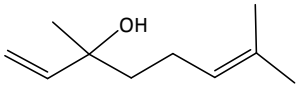
e)


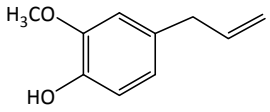
15. Eugenol belongs to a class or organic compounds called terpenes. It has the aroma of cloves. Eugenol does not react with Jones reagent or $POCl_3$, Et_3N, but it does react with ozone. One of the products of ozonolysis reacts with Jones reagent to form a product that contains a carboxylic acid. Treatment with cold, dilute $KMnO_4$ gives only two products that are enantiomers. Which of the following compounds is eugenol? **E**

a)


b)


c)


d)


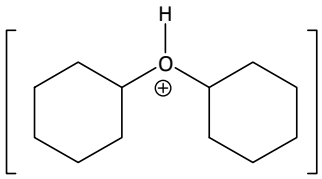
e)


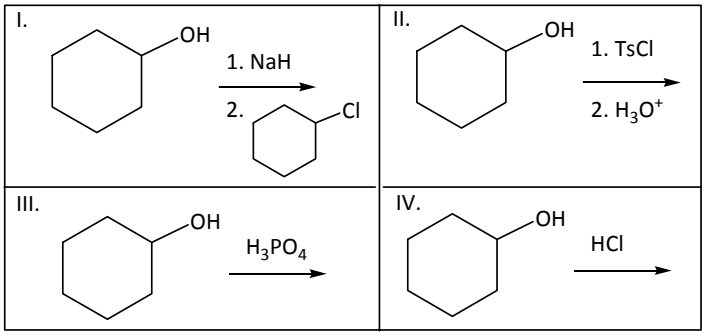
16. Which of the following alcohols would be converted to a secondary alkyl bromide upon reaction with PBr_3? **C**

I. 3-methylhexanol
II. 3-methylcyclohexanol
III. 3-methylphenol
IV. 2-methylcyclohexanol

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

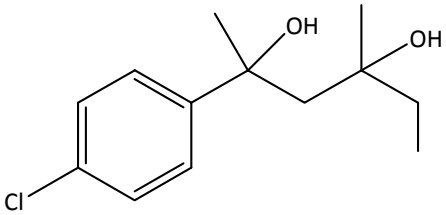
17. The reaction intermediate below could form in which of the following reactions? **C**



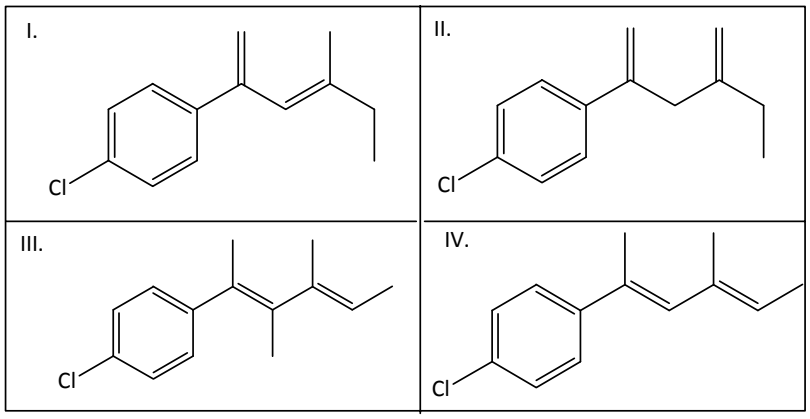


a) I
b) I & II
c) III
d) II & III
e) II, III & IV

18. The major thermodynamic product(s) of the reaction of fenpentadiol with H_3PO_4 is (are): (Assume no rearrangements) **A**

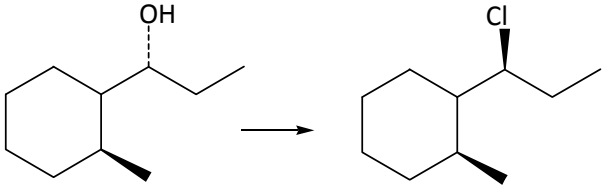


Fenpentadiol



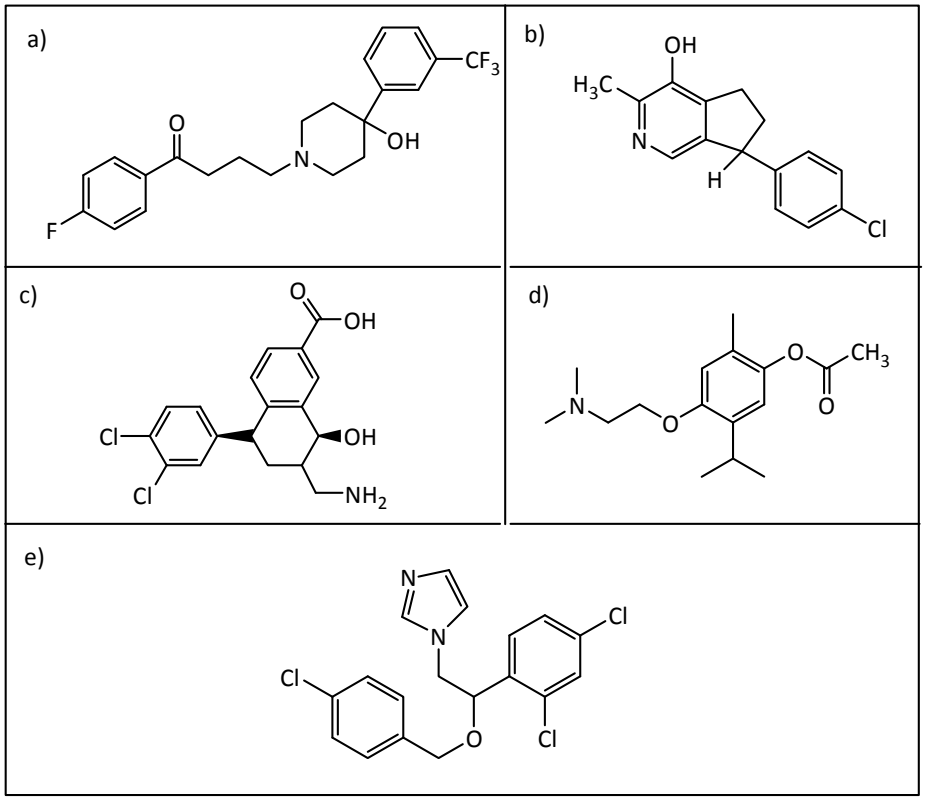
a) IV
b) I & II
c) III
d) III & IV
e) I

19. The mechanism of the reaction below is: **D**



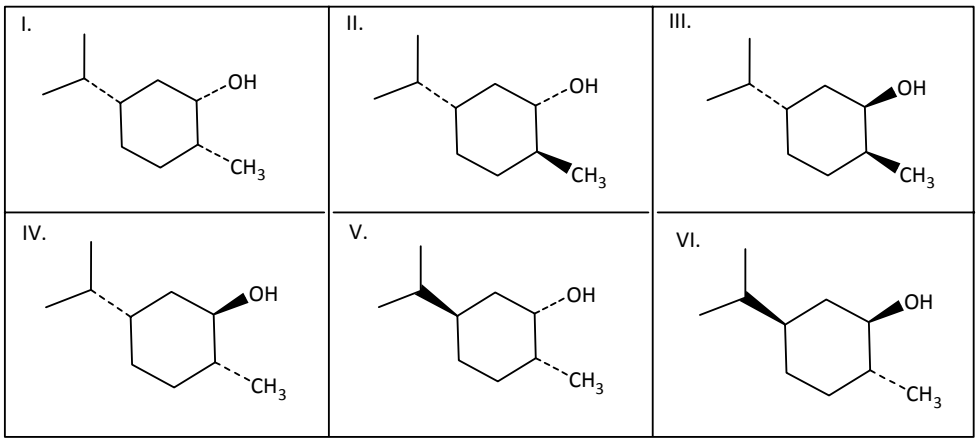
a) E_1
b) E_2
c) SN_1
d) SN_2
e) Cannot determine from the information provided.

20. At pH = 3, cicletanine, an antihypertensive agent, participates in ion-dipole, dipole-dipole and hydrogen bonding non-covalent interactions. At pH = 7, cicletanine participates *only* in dipole-dipole interactions and hydrogen bonding but *not* ion-dipole interactions. At pH =12, cicletanine participates *only* in ion-dipole and dipole-dipole interactions, but *not* hydrogen bonding. Which of the following compounds represents cicletanine? **B**



pKa ranges
amines: 7-10
carboxylic acids: 4-6
phenols: 8-10
alcohols: 15-20

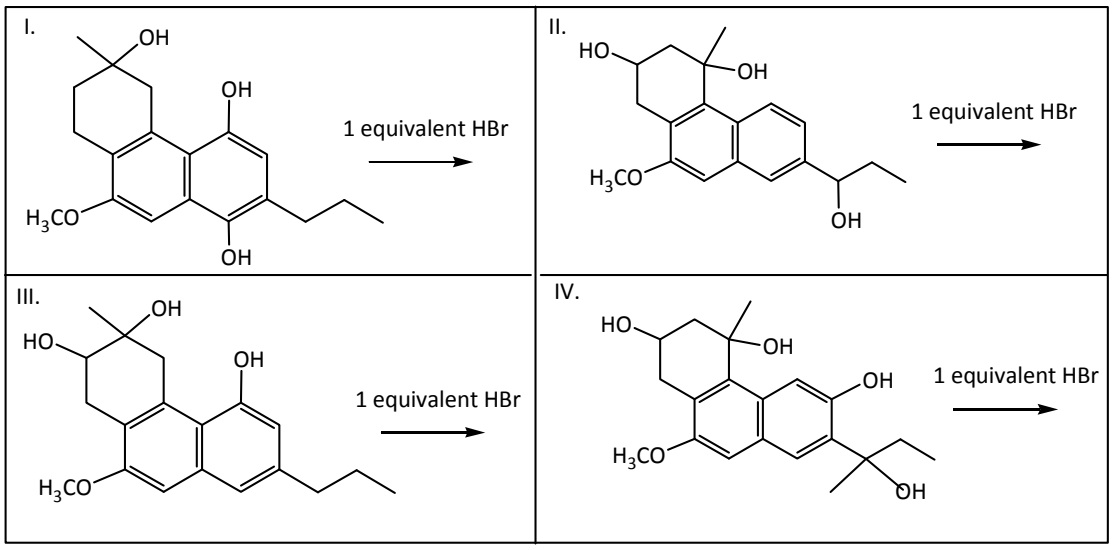
21. Reaction of 1R-bromo-5S-isopropyl-2R-methylcyclohexane with NaOH will provide: **A**



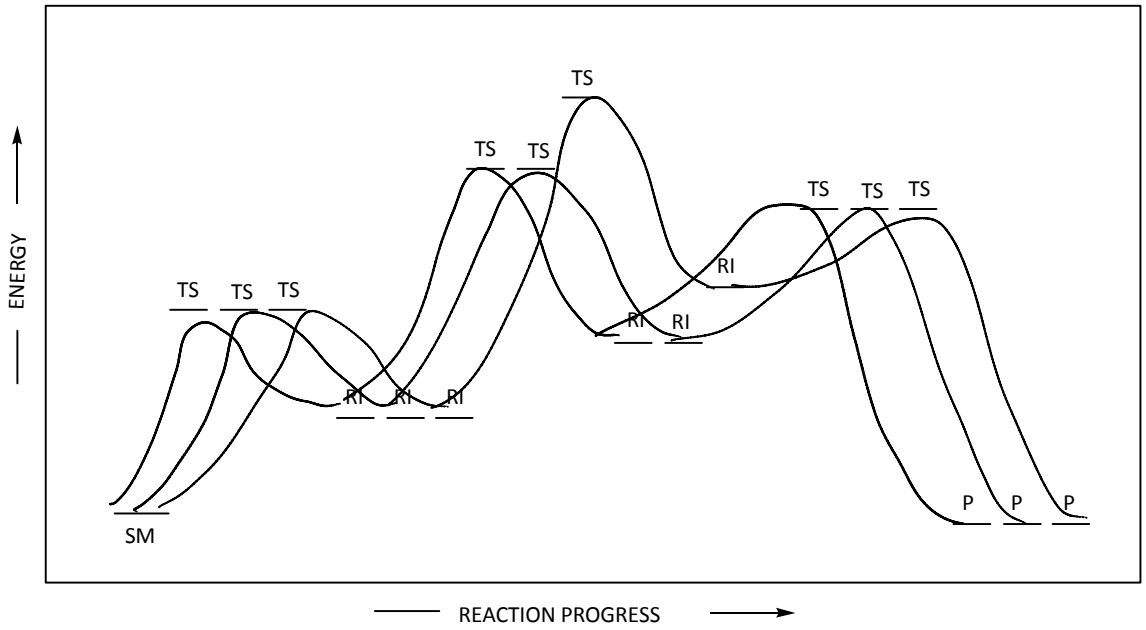
a) I
b) I & IV
c) II
d) III
e) V & VI

22. Reaction of 1-propyl-3R-methylcyclopentene with cold, dilute $KMnO_4$, followed by treatment with HIO_4 will provide: **B**
    a) A mixture of enantiomers with each stereoisomer containing one ketone and one aldehyde
    b) A single product that contains both an aldehyde and ketone
    c) A mixture of diastereomers with each stereoisomer containing one ketone and one aldehyde
    d) A single product that contains two ketones
    e) A mixture of enantiomers with each stereoisomer containing two ketones

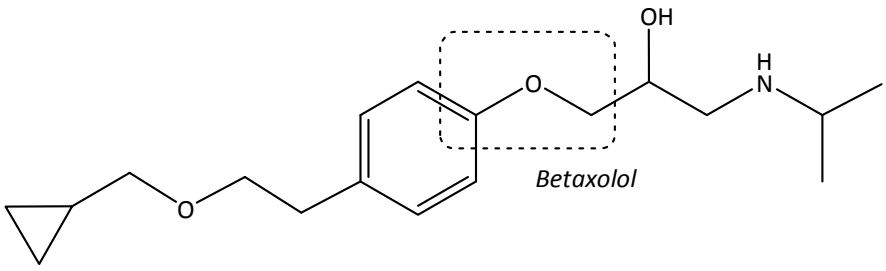
23. Which of the following reactions corresponds to the energy diagram below? (Assume no rearrangements)
    E



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

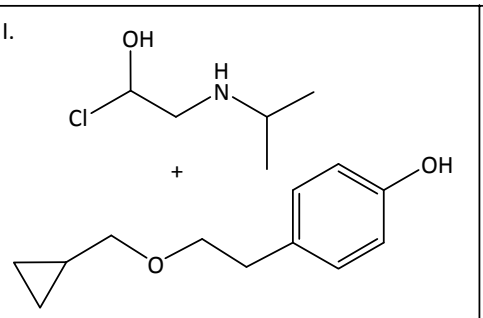


24. Betaxolol is a pharmaceutical agent used in the treatment of hypertension and glaucoma. Its structure is shown below. Which of the following starting materials (in the presence of NaH) could be used to synthesize the highlighted ether functional group of betaxolol in a Williamson ether synthesis? **C**

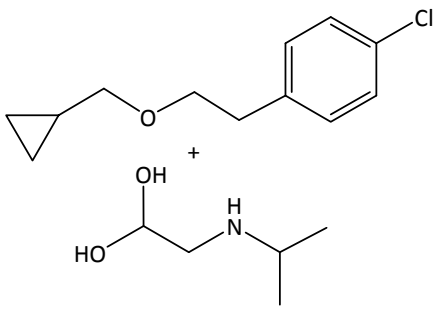


Betaxolol

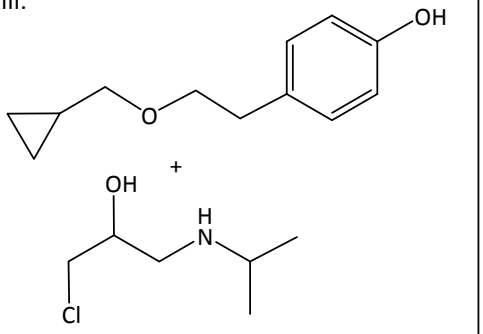
I.



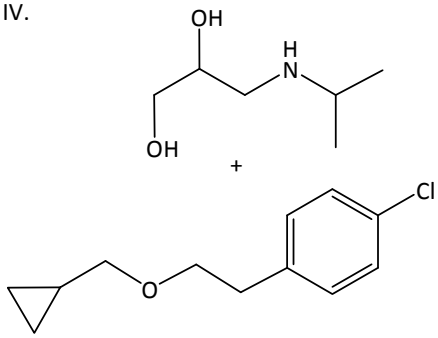
II.



III.



IV.



a) I
b) I & II
c) III
d) III & IV
e) All of these

25. Which of the following test results would be predicted for the compound below? **B**

Test	Result				
	a)	b)	c)	d)	e)
Jones Test	+	-	+	+	+
Iodoform Test	-	+	+	-	-
Bromine/Water	-	+	+	+	-
Lucas Test	-	-	+	+	+
$KMnO_4$	+	-	+	-	-