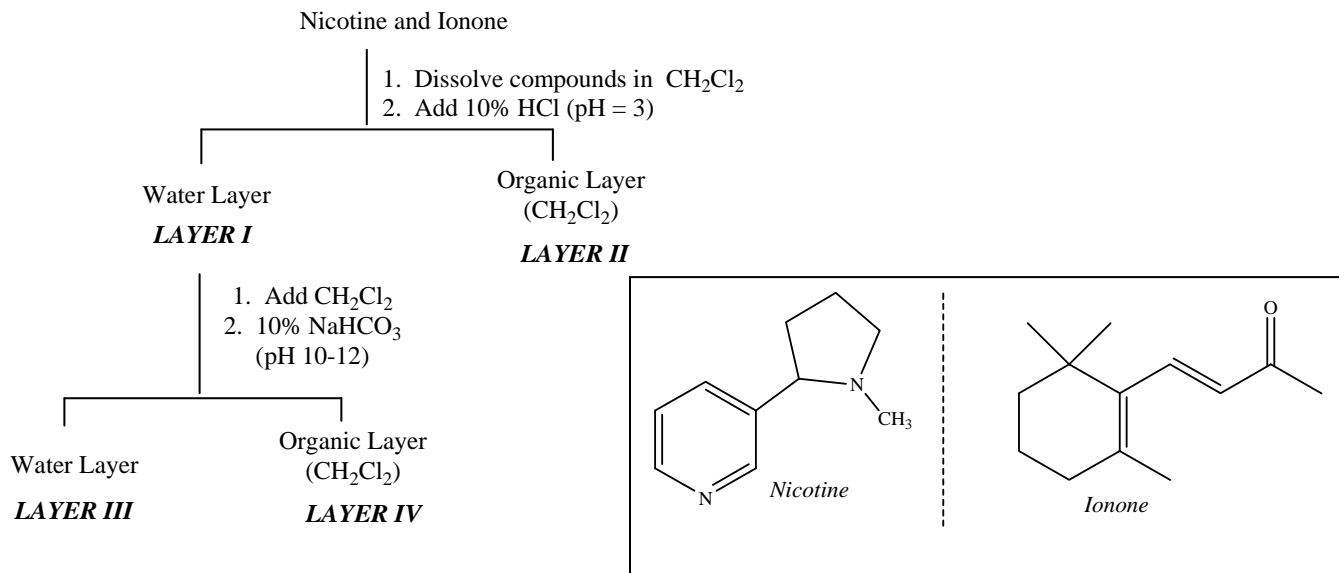
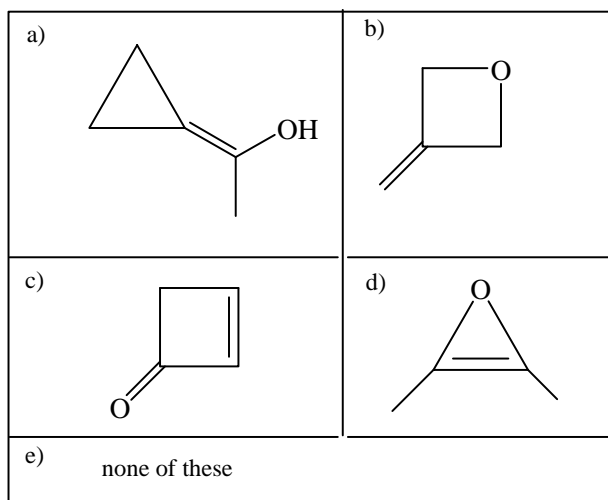


1. Nicotine and ionone are two naturally occurring constituents of tobacco leaves. These compounds can be extracted from tobacco leaves and separated using the procedure outlined in the flowchart below.

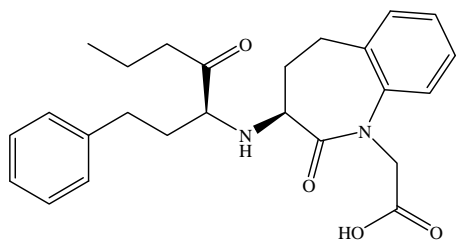
Which of the following statements related to the separation of these compounds is true? **B**



- a) Ionone is in *both* layer II and layer IV
 b) Nicotine is in layer IV and the conjugate acid of nicotine is in layer I
 c) The conjugate acid of nicotine is in *both* layer I and layer III
 d) Nicotine is in layer II
 e) b & c
2. Compound A has a molecular formula of C₄H₆O. It has significant angle strain but no torsional strain energy. Compound A contains a tetra-substituted double bond, but has no stereochemistry associated with it. Which of the following structures represents compound A? **D**

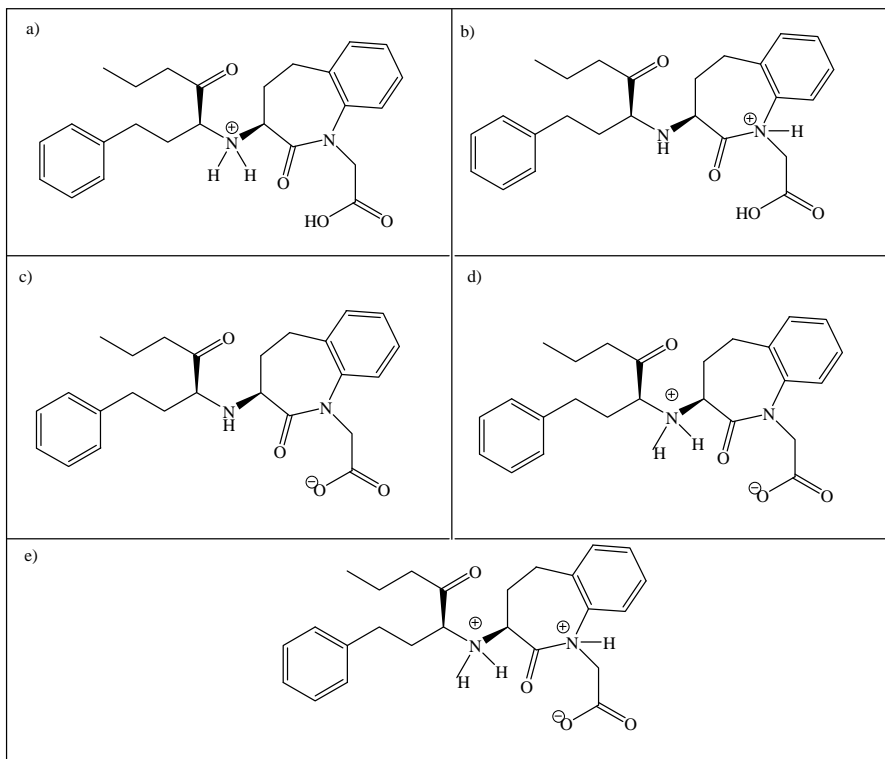


3. Which of the following structures most accurately reflects how the structure of benzazepril will look at pH = 8.1? **C**

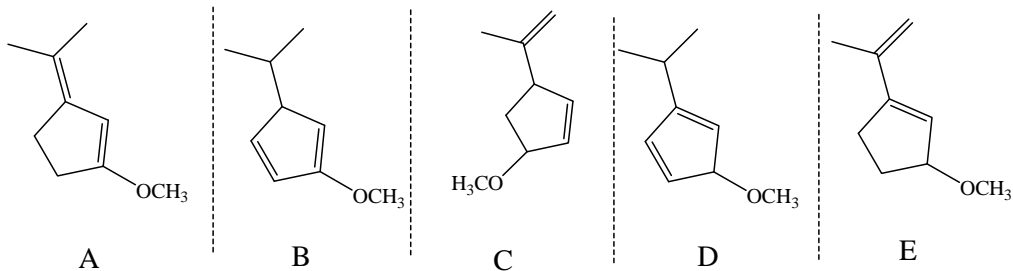


Benzazepril

Functional Group	pKa
Amine	7.8
Carboxylic acid	3.8



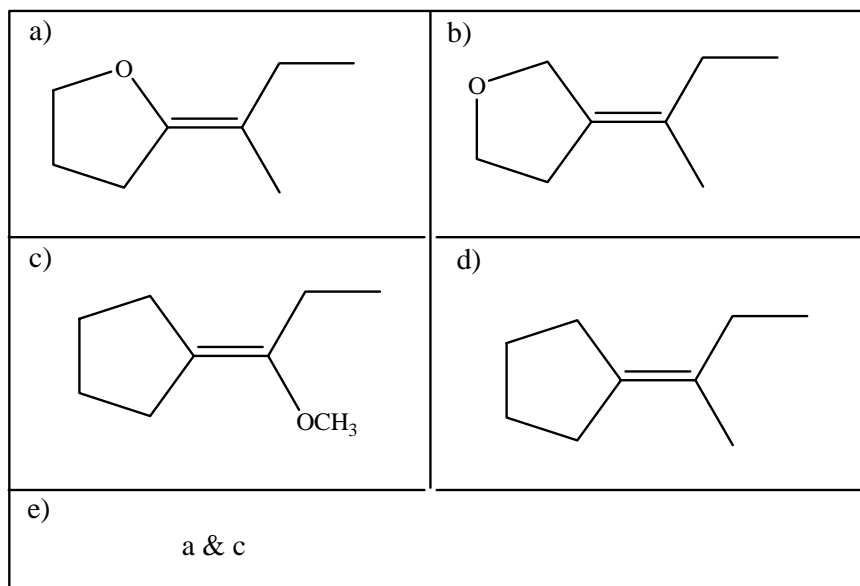
4. The stability order, going from most stable to least stable (MOST >> LEAST), of the compounds given below is: **E**



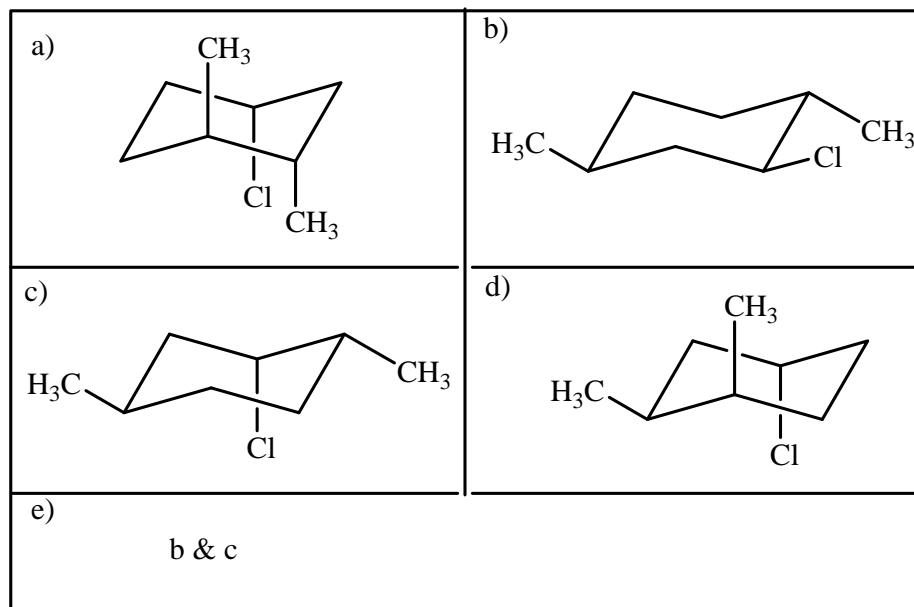
- | |
|----------------------|
| a) A > B > C = D > E |
| b) D > E > B > A > C |
| c) A > B = E = D = C |
| d) A > B = D = E > C |
| e) A > B > D = E > C |

5. Conversion of Z alkenes to E alkenes typically requires that the pi bond is broken in a chemical reaction, then re-generated in a second chemical step. However, in some alkenes, conversion of a Z alkene to an E alkene occurs readily without the need of a chemical reaction to break the pi bond. In which of the following alkenes would conversion of a Z alkene to an E alkene occur without a chemical reaction?

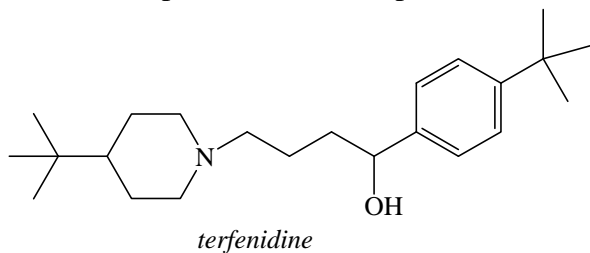
A



6. Which of the chair conformations of substituted cyclohexanes contains two equatorial and one axial substituent (substituent \neq hydrogen)? **C**

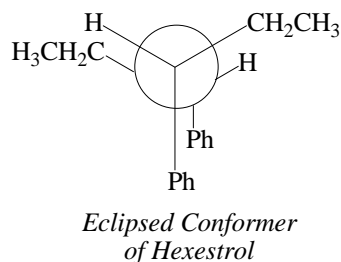


7. At what pH is terfenidine ($pK_a = 8.6$) 85% ionized? **B**

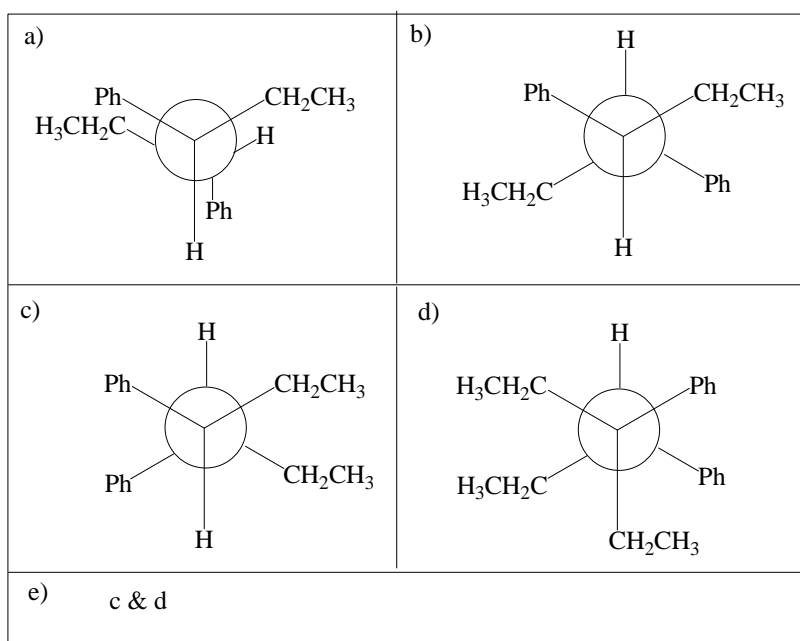


- | |
|---------|
| a) 3 |
| b) 7.8 |
| c) 8.4 |
| d) 9.35 |
| e) 10.1 |

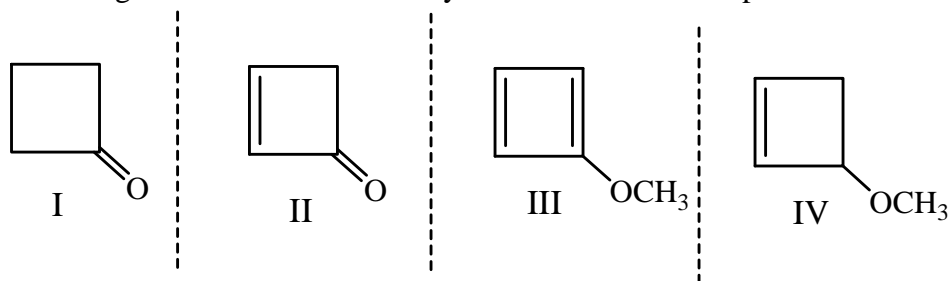
8. An eclipsed conformer of hexestrol, an estrogen agonist is given below. The gauche conformer is inactive and the anti conformer is the active form of the drug. Which of the following represent the active form of hexestrol? **B**



Ph = Benzene ring

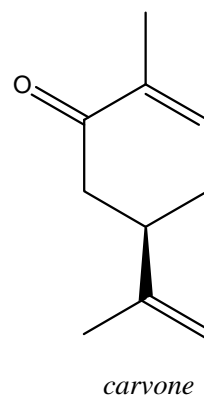
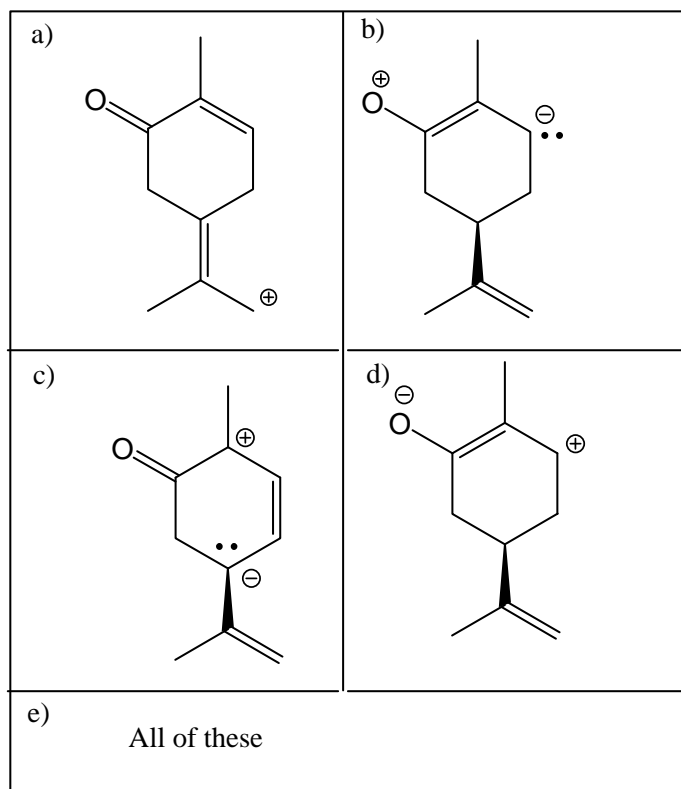


9. Which of the following statements is true as they relate to the four compounds below? **E**

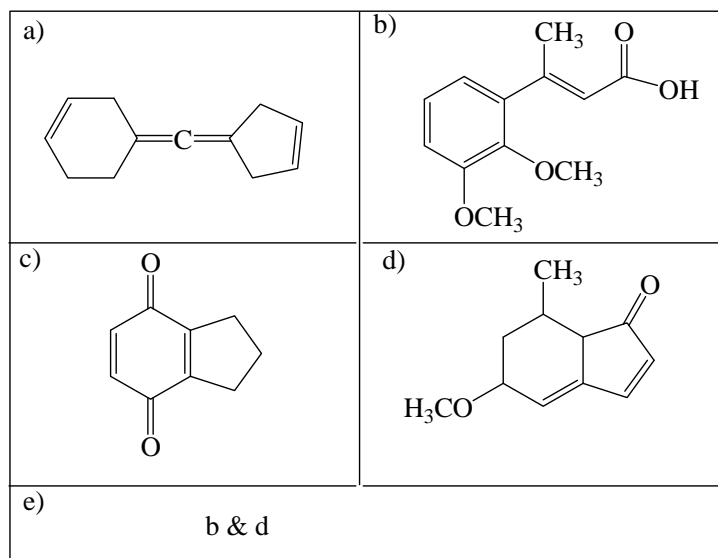


- II has more angle strain than III but less angle strain than I
- I has the least angle strain and the most torsional strain energy.
- III has no torsional strain energy
- IV has less torsional strain energy than II
- b & c

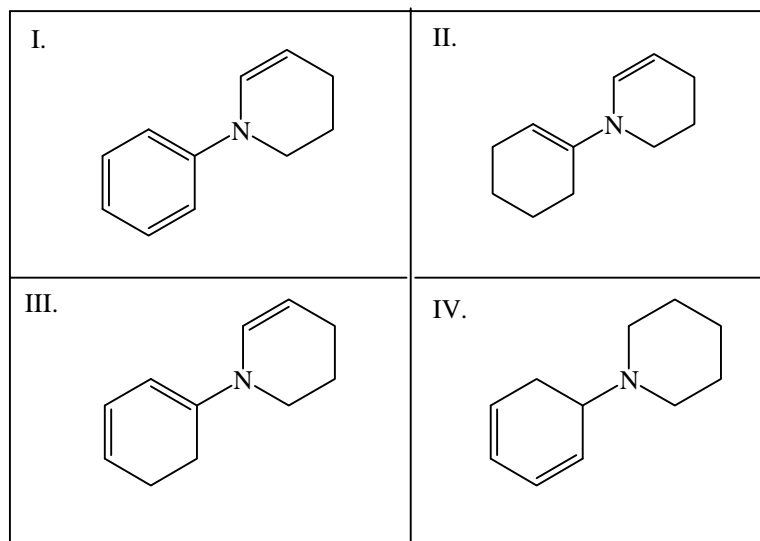
10. A resonance form of carvone is: **D**



11. Which of the following compounds contains a conjugated diene? **D**

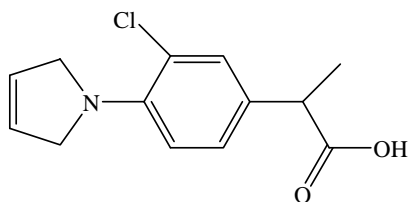


12. Rank the following compounds from highest pKa to lowest pKa (highest >> lowest). **E**



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

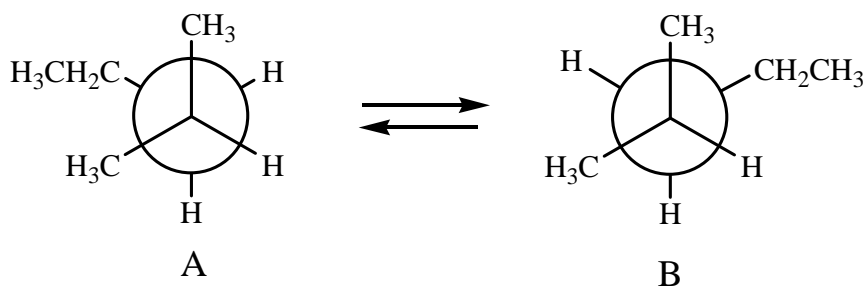
13. The percent ionization of the basic functional group (pKa = 8.1) of piroprofen, an anti-inflammatory agent, at pH 7.8 is: **A**



Piroprofen

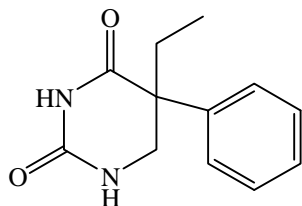
- | |
|---|
| <p>a) 66%
 b) 33%
 c) 43%
 d) 57%
 e) 75%</p> |
|---|

14. At what temperature (in °C) would the ratio of the two conformers below be 8% A and 92% B? **C**



- | |
|---|
| <p>a) 375
 b) 477
 c) 102
 d) 66
 e) 25</p> |
|---|

15. The ionized form of phenobarbital is: **B**



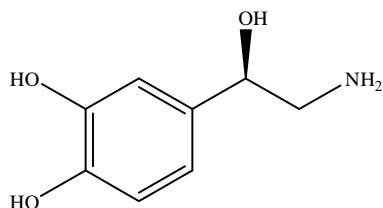
Phenobarbital

a)		b)	
c)		d)	
e) Phenobarbital contains no ionizable functional groups			

16. The gauche conformation of 2-methylpentane (along C3-C4 bond) has: **C**

- higher energy than both eclipsed conformations.
- lower energy than the anti conformation.
- one methyl-isopropyl gauche interaction
- one methyl-ethyl gauche interaction
- b & c

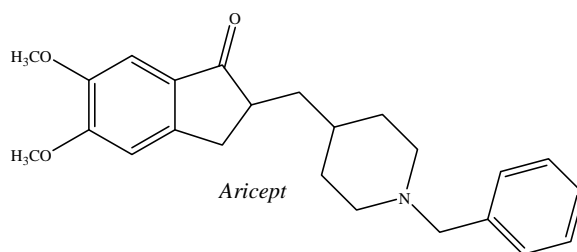
17. Norepinephrine has a specific rotation of -37.3° . Which of the following structures has a specific rotation of $+37.3^\circ$? **D**



Norepinephrine

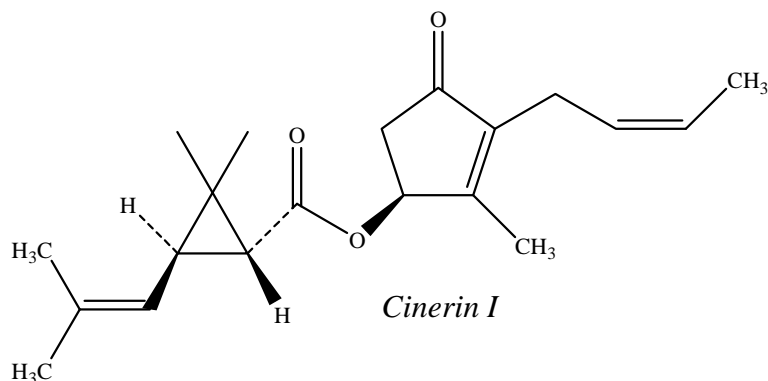
a)		b)	
c)		d)	
e) None of these			

18. The *blood-brain barrier* (BBB) is a specialized membrane that surrounds the capillaries of the circulatory system in the brain. The BBB protects the brain from dangerous substances and only allows very lipophilic compounds to pass through. Aricept is a drug that is used to treat Alzheimer's disease. In order to be effective, this drug must cross the BBB and enter the brain and central nervous system. At physiologic pH, Aricept does not cross the BBB effectively. Pharmaceutical companies are working on modifying the structure to improve the ability of the drug to cross the BBB. Which of the following compounds would be more effective than Aricept in crossing the BBB? **C**



a)	
b)	
c)	
d)	
e)	b & c

19. The structure of cinerin I, an insecticide, is given below. Which of the following statements is true about cinerin I? **D**



- | |
|---|
| a) Cinerin I contains an E alkene and a Z alkene |
| b) The cyclopropane of cinerin I has trans stereochemistry |
| c) Cinerin I contains a disubstituted, a trisubstituted and tetrasubstituted alkene |
| d) b & c |
| e) a, b & c |

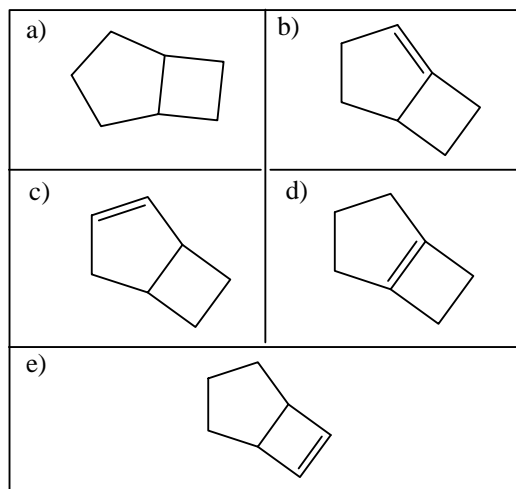
20. Which of the following changes in experimental procedure would result in an observed change in the optical rotation of an optically active compound? **D**

- Dilution of the sample
- Changing the volume of sample in the sample tube from 20ml to 15 ml
- Warming the sample solution
- a, b & c
- none of these

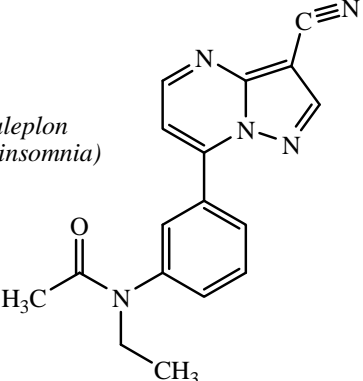
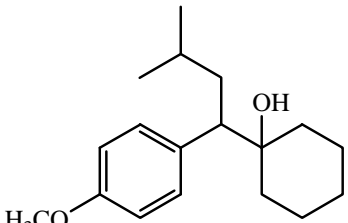
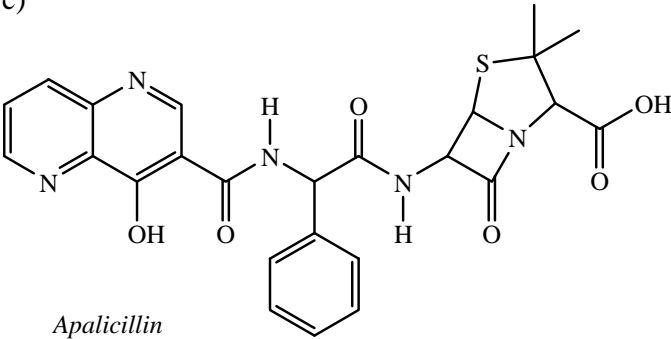
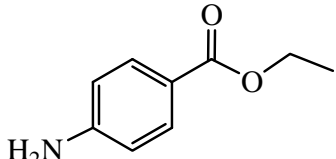
21. Which of the following compounds has resonance associated with it? **E**

- 3-amino-4-methoxycyclohexene
- 2-amino-3-methoxycyclohexene
- 3-amino-1-methoxycyclohexene
- 5-amino-4-methoxycyclohexene
- b & c

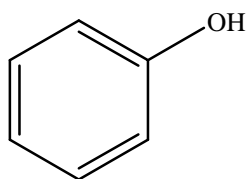
22. Which of the following compounds has the most angle strain? **D**



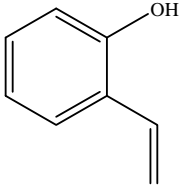
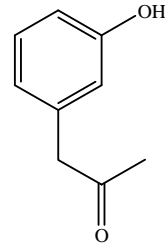
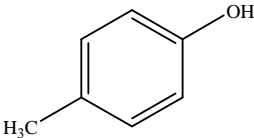
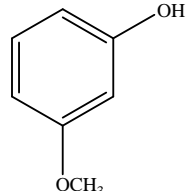
23. Which of the following compounds contains NO ionizable functional groups? **B**

<p>a)</p> <p><i>Zaleplon</i> (anti insomnia)</p> 	<p>b)</p>  <p><i>Venlafaxine</i></p>
<p>c)</p>  <p><i>Apalacillin</i> (antibacterial)</p>	<p>d)</p>  <p><i>Benzocaine</i> (local anesthetic)</p>
<p>e) All of these have at least one ionizable functional group</p>	

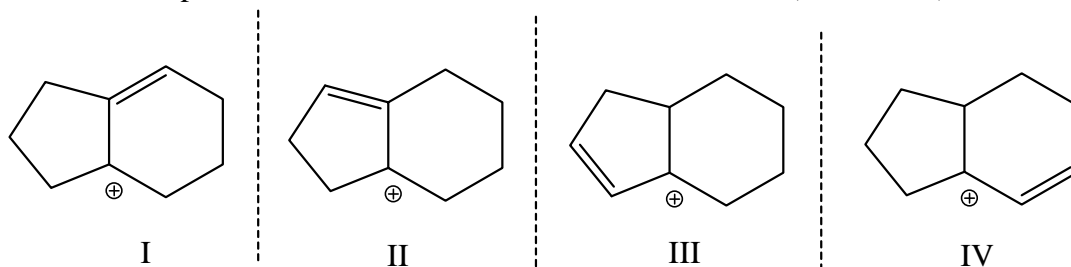
24. Phenol has a $pK_a = 9.2$. Which of the following substituted phenols would be predicted to have a pK_a lower than phenol itself? **A**



Phenol

<p>a)</p> 	<p>b)</p> 
<p>c)</p> 	<p>d)</p> 
<p>e) None of these</p>	

25. Rank the compounds below from most stable to least stable. (most>least) **A**



- a) I = II > III = IV
- b) I > II = III > IV
- c) IV > I > II > III
- d) III > I > II > IV
- e) All are equally stable

USEFUL INFORMATION

Steric Strain Energies		Torsional Strain Energies	
Me-Me	0.9kcal	H-H	1.0kcal
Me-OH	0.5kcal	H-Me	1.4kcal
Me-CH ₂ OH	1.2kcal	H-Ethyl	1.6kcal
HO-OH	0.4kcal	Me-Me	2.6kcal
HO-CH ₂ OH	1.1kcal	Me-Ethyl	2.8kcal
HOCH ₂ -CH ₂ OH	1.5kcal	Me-OH	2.2kcal
Me-Ethyl	1.8kcal	Ethyl-Ethyl	3.0kcal
		<i>H-OMe</i>	<i>1.5kcal</i>

$$[\alpha]_{\lambda}^t = \frac{\alpha}{c l}$$

$$\Delta G^{\circ} = E_p - E_r$$

$$\Delta G^{\circ} = -RT \ln K_{eq}$$

$$R = 0.00198 \text{ kcal/Kmol}$$

$$^{\circ}\text{K} = ^{\circ}\text{C} + 273$$

