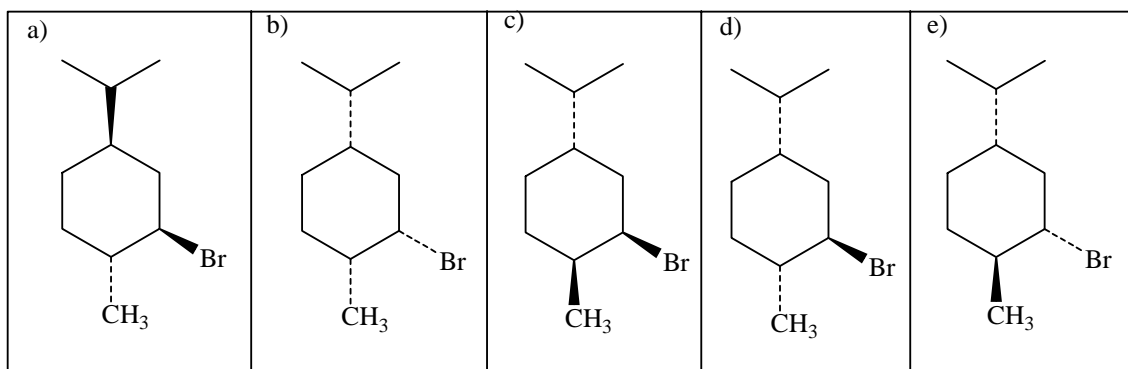
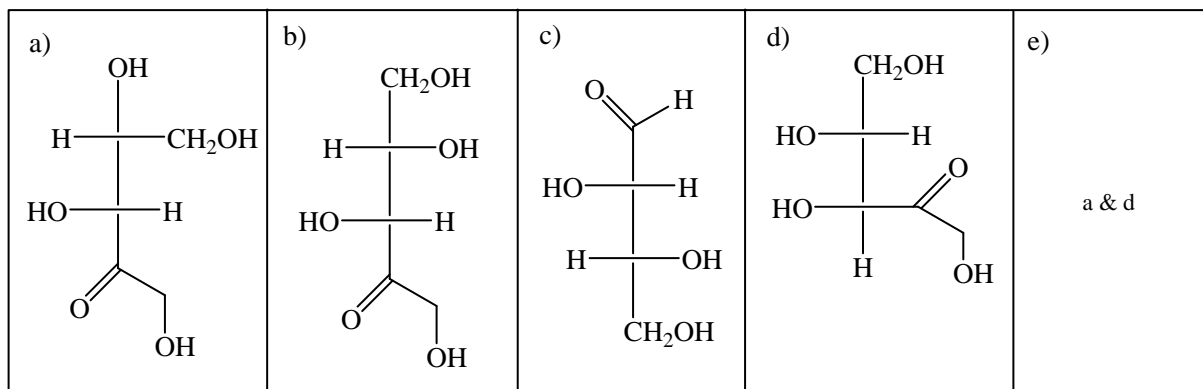


1. Which of the following structures represents 1R-bromo-5S-isopropyl-2R-methylcyclohexane? **D**

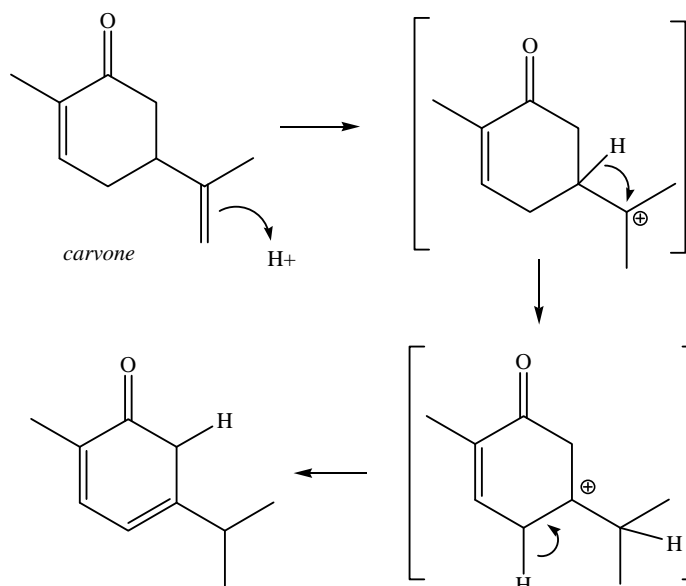


2. The ketose, D-xylulose has two chiral carbons. One of its chiral carbons has an R configuration the other chiral carbon has an S configuration. Which Fisher projection below represents D-xylulose? **D**

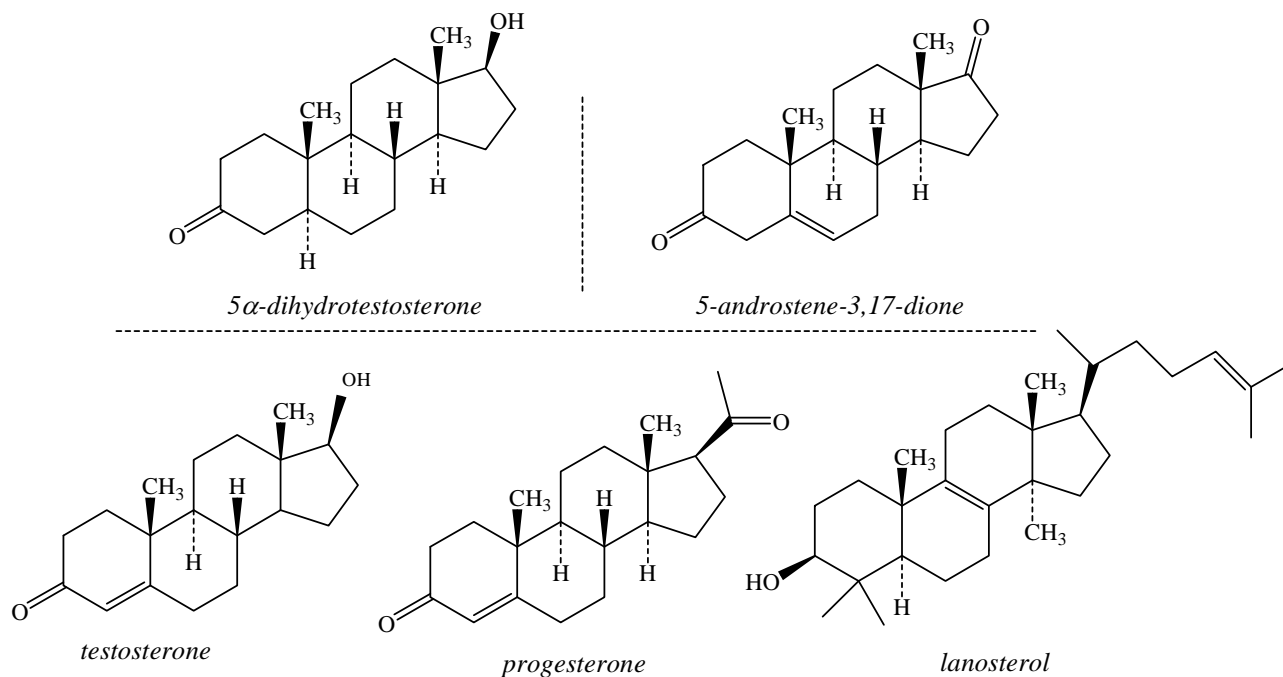


3. The reaction below is best described as: **E**

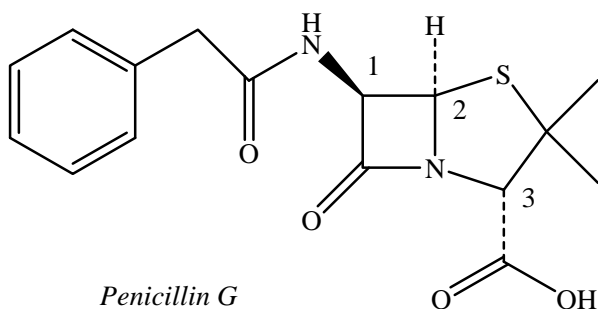
- an addition
- an elimination
- a rearrangement
- a substitution
- a combination of a, c and b



4. Which of the following statements is true related to the five steroids given below? **C**

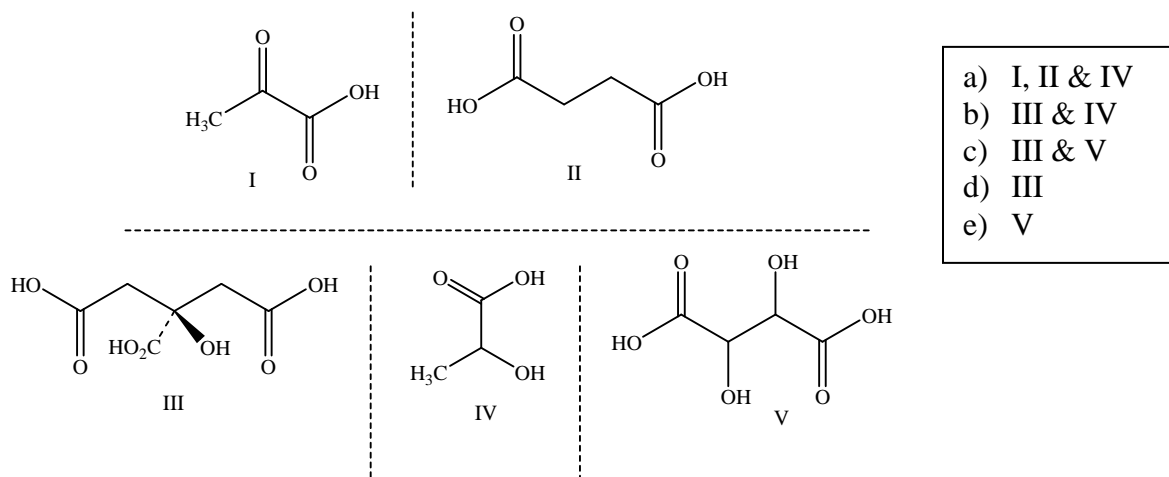


- Lanosterol and testosterone will react with both silver nitrate in ethanol and with sulfuric acid.
  - 5 $\alpha$ -Dihydrotestosterone and 5-androstene-3,17-dione will both react with sulfuric acid but neither will react with silver nitrate in ethanol.
  - Progesterone and testosterone will both react with sulfuric acid.
  - All five steroids will react with bromine.
  - a & c
5. Penicillin G has three chiral carbons, labeled as 1, 2 and 3 in the structure below. The absolute configurations of these three chiral carbons are: **C**

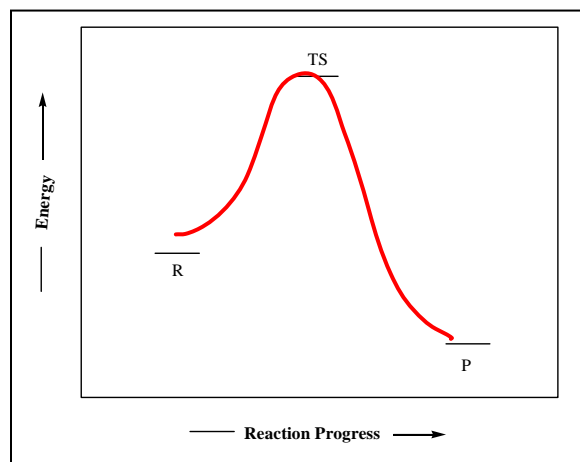
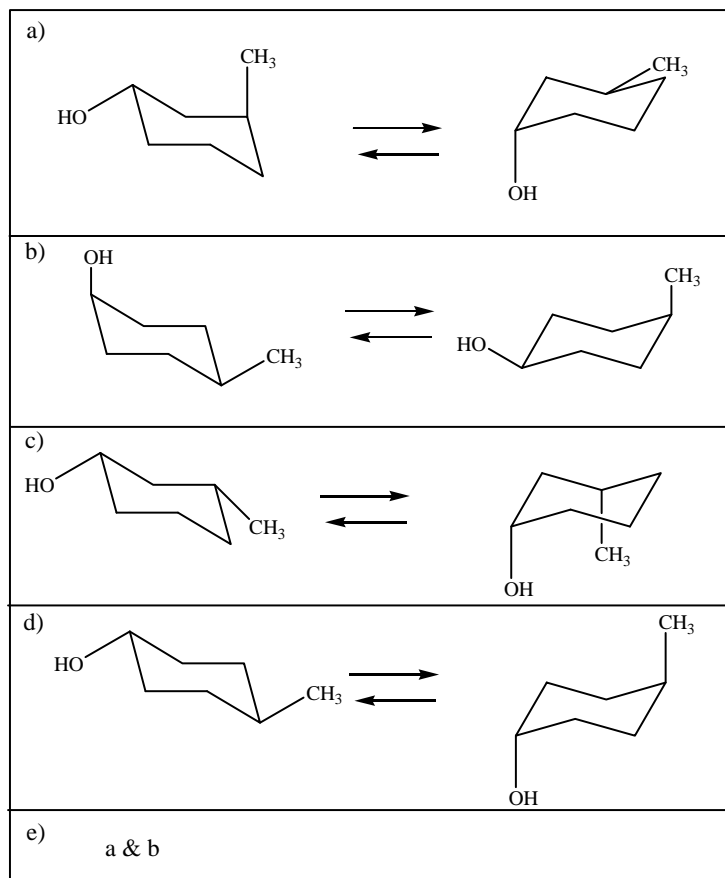


- |  |
|--|
| <ol style="list-style-type: none"> <li>1R, 2R, 3R</li> <li>1R, 2S, 3R</li> <li>1R, 2R, 3S</li> <li>1S, 2S, 3R</li> <li>1R, 2S, 3S</li> </ol> |
|--|

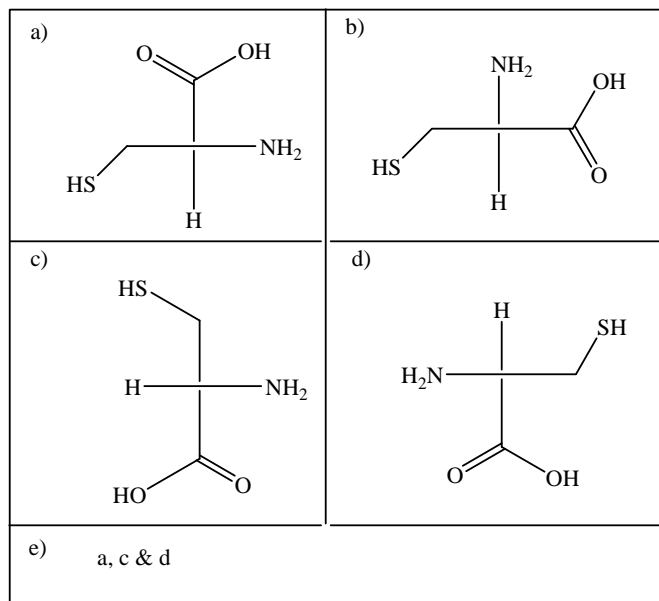
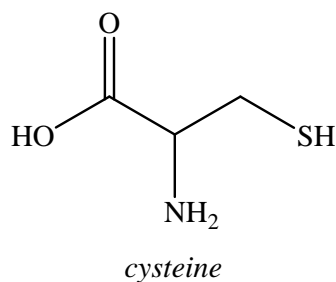
6. Which of the following compounds has a stereoisomer that is meso? **E**



7. Which of the following transformations is represented by the reaction energy diagram at the right? **B**

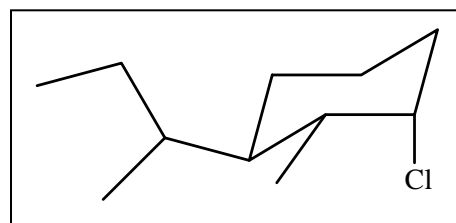


8. Which of the following Fisher projections represents the *S*-stereoisomer of the amino acid cysteine, given below? **B**

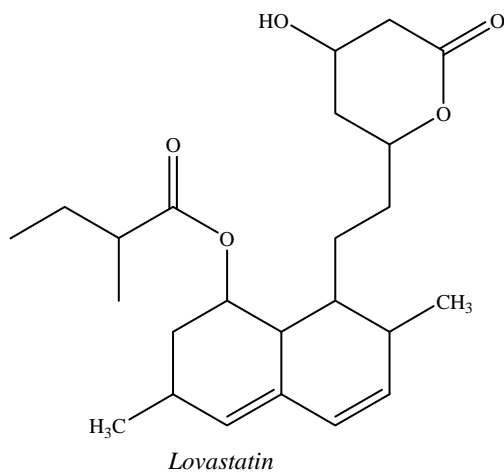


9. The correct name of the molecule represented in the chair conformation below is: **B**

- 1*R*-sec-butyl-3*R*-chloro-2*R*-methylcyclohexane
- 3*R*-sec-butyl-1*S*-chloro-2*R*-methylcyclohexane
- 3*S*-sec-butyl-1*R*-chloro-2*R*-methylcyclohexane
- 3*R*-sec-butyl-1*S*-chloro-2*S*-methylcyclohexane
- 2*S*-methyl-3*S*-chloro-6*S*-sec-butylcyclohexane

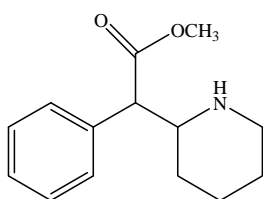


10. How many chiral carbons are in the structure of lovastatin, a cholesterol lowering drug? **D**



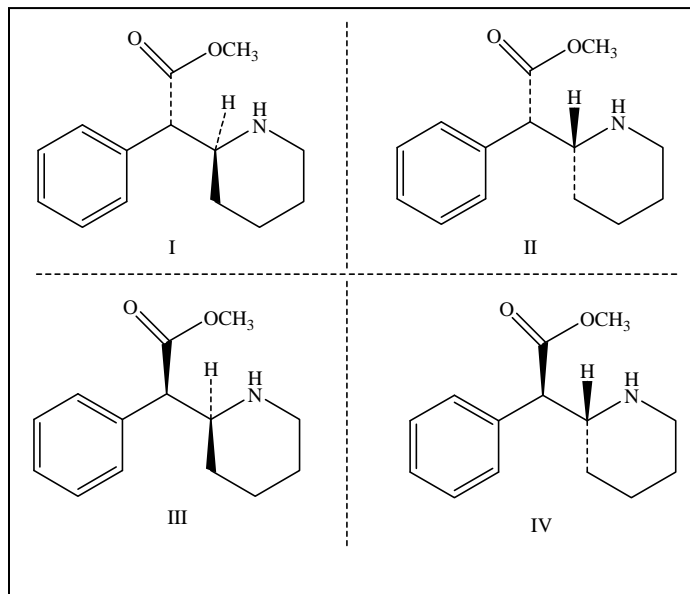
- |         |
|---------|
| a) 5    |
| b) 6    |
| c) 7    |
| d) 8    |
| e) none |

11. Methylphenidate (RITALIN) is a chiral drug sold as a racemic mixture to treat ADHD (attention deficit and hyperactivity disorder). Recently, Focalin, the *d*-isomer (R,R) of methylphenidate was approved by the FDA for treating ADHD. It has a longer duration of action and is more effective in reducing the symptoms of ADHD. Which of the following represents the racemic mixture marketed as RITALIN? **D**

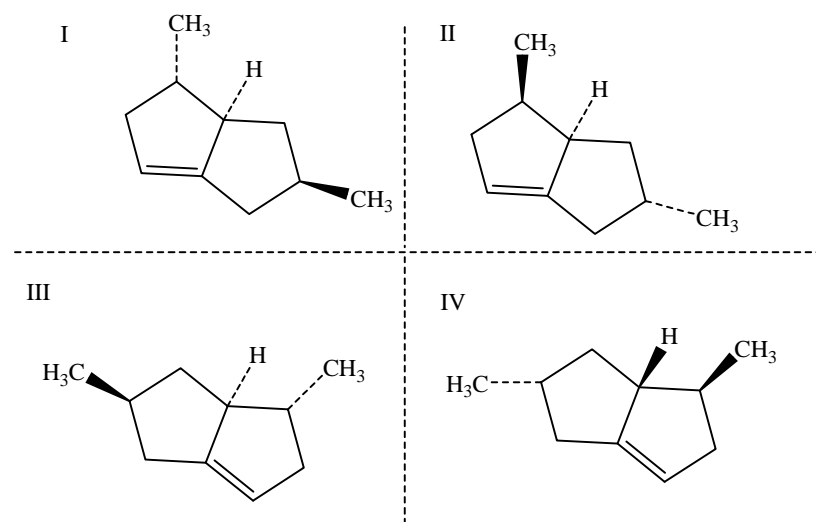


Methylphenidate  
(Ritalin)

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



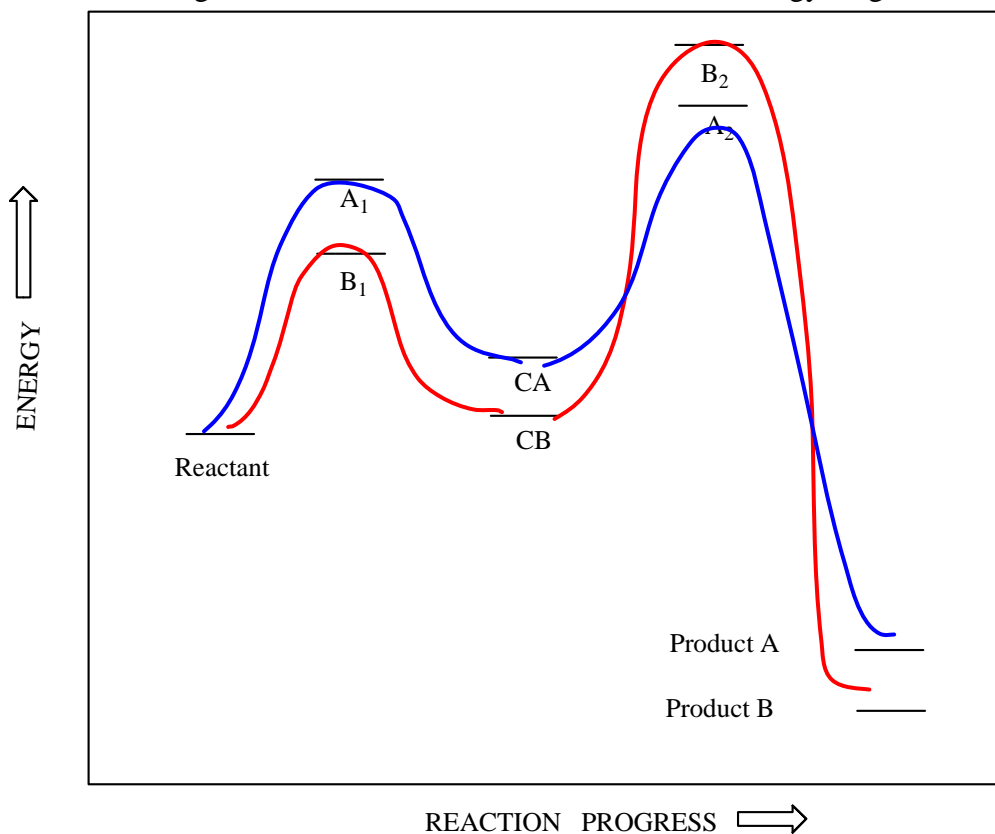
12. Which best describes the stereochemical relationships among/between the compounds below? **D**



- a) I & IV are identical  
b) I & IV are enantiomers  
c) II & IV are diastereomers  
d) a & c  
e) b & c

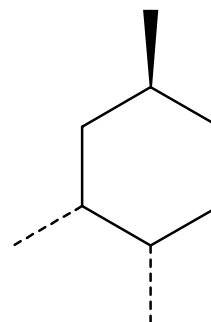
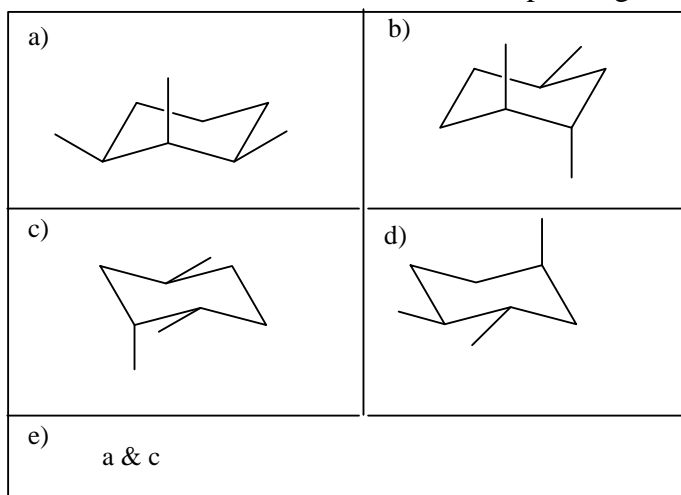
13. The product that forms the *fastest* in the reaction of 1-pentene with HCl is: **B**
- a) 1-chloropentane  
b) 2-chloropentane  
c) 3-chloropentane  
d) 1,2-dichloropentane  
e) all of these products form at the same rate

14. Which of the following statements is true related to the reaction energy diagram below? **A**



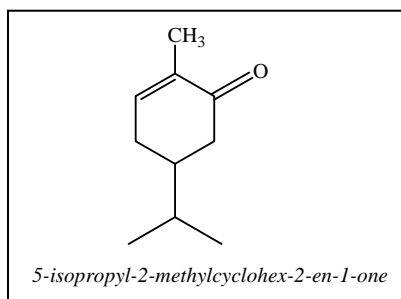
- a) Step 2 is the rate-determining step of the reaction.
- b) The reaction has a positive  $\Delta G^\circ$
- c) The equilibrium constant is less than 1.
- d) Products A and B will form equally.
- e) a & d

15. The most stable conformation of the compound given below is : **C**

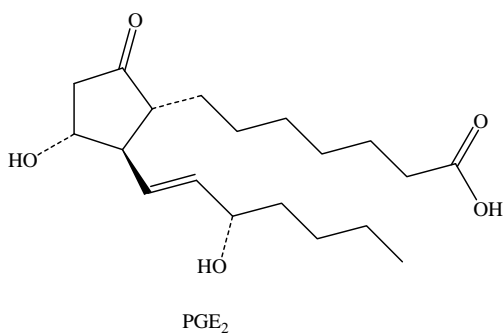


16. Reaction of the *R*-isomer of the 5-isopropyl-2-methylcyclohex-2-en-1-one (below) with Br<sub>2</sub> will provide: **C**

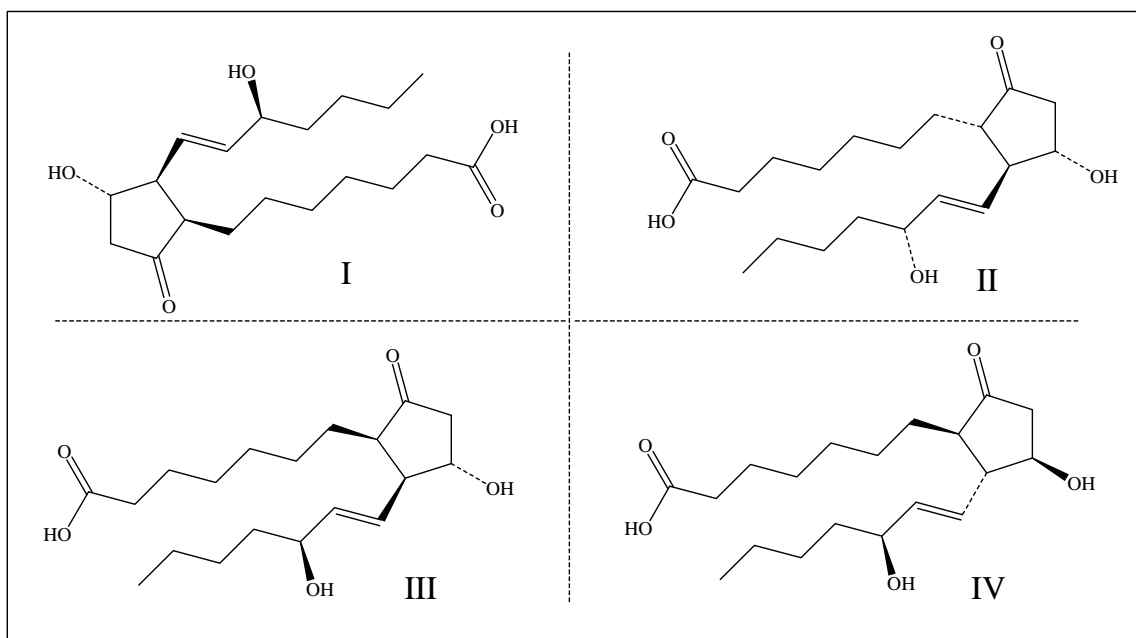
- a) a meso compound
- b) a racemic mixture
- c) a mixture of diastereomers
- d) a single stereoisomer
- e) a molecule with no chiral centers



17. A diastereomer of PGE<sub>2</sub>, a naturally occurring prostaglandin is: **A**



- a) I & III
- b) IV & II
- c) II & III
- d) I, II, & III
- e) none of these are diastereomers

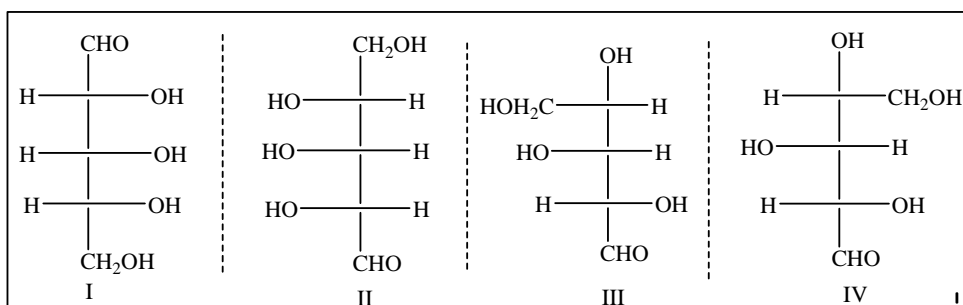


18. The percent ratio of the two conformers of *cis*-1-isopropyl-4-methylcyclohexane at 30°C is:

- a) 6.36% : 93.64%
- b) 23.8% : 76.2%
- c) 87.1% : 12.9%
- d) 11.8% : 88.2%
- e) 96.8% : 3.21%

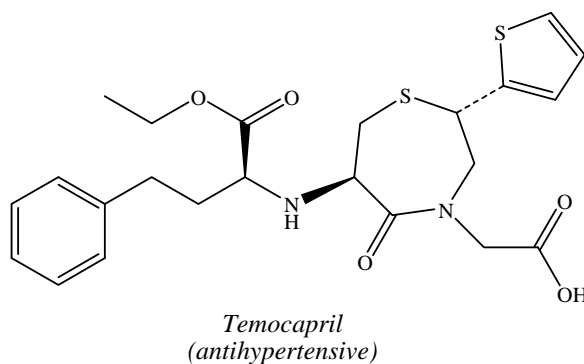
*Credit given for all*

19. Which sugar(s) given below has (have) an L-configuration? **D**



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

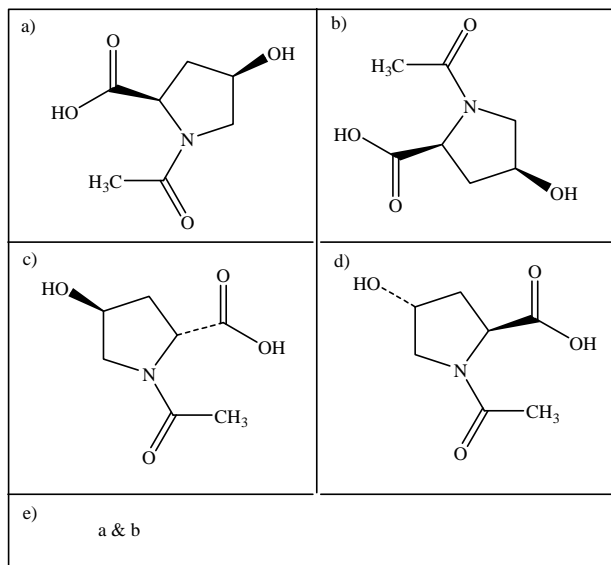
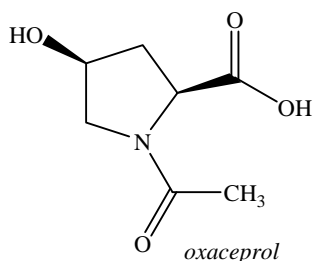
20. Which compound(s) will have a boiling point identical to temocapril? **D**



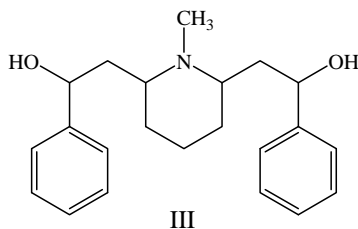
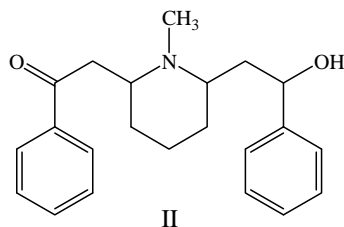
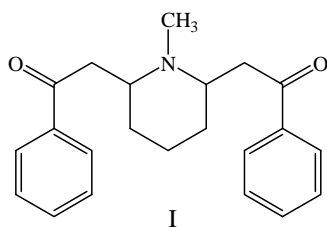
a)	b)
c)	d)
e) All of these will have the same boiling point as temocapril	



21. Oxaceprol, an anti-inflammatory agent (given below) has an optical rotation of  $-116.5^\circ$ . Which of the following compounds will have an optical rotation of  $+116.5^\circ$ ? **A**



22. Lobelanine, lobelanidine and lobeline are three compounds that are used as respiratory stimulants. All of these molecules have chiral carbons. Lobelanine has three stereoisomers (one meso compound), lobelanidine has 14 stereoisomers (2 meso compounds), and lobeline has 8 stereoisomers (no meso compounds). Which of the structures below correspond to lobelanine, lobelanidine and lobeline? **E**

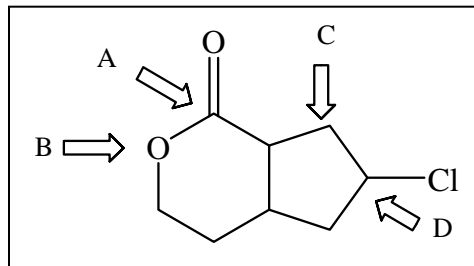


- |   |
|---|
| <p>a) I = lobelanine<br/>II = lobelanidine<br/>III = lobeline</p> |
| <p>b) I = lobelanidine<br/>II = lobelanine<br/>III = lobeline</p> |
| <p>c) I = lobeline<br/>II = lobelanidine<br/>III = lobelanine</p> |
| <p>d) I = lobelanine<br/>II = lobelanidine<br/>III = lobeline</p> |
| <p>e) I = lobelanine<br/>II = lobeline<br/>III = lobelanidine</p> |

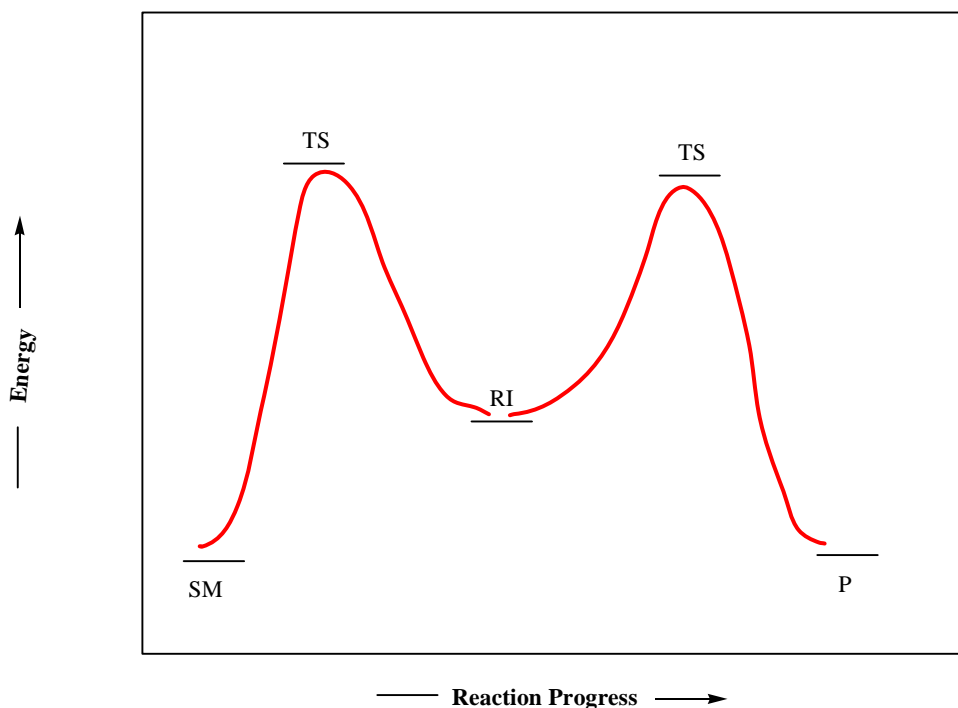
23. Assume that in a two step reaction, the rate determining step is step 2 and the reaction has a positive  $\Delta G^\circ$ . Which of the following statements is true? **E**
- Step 2 occurs faster than step 1
  - The product is more stable than the reactant
  - There are *at least* three reaction intermediates
  - The reaction favors formation of the product.
  - The activation energy of step one is smaller than the activation energy of step 2

24. Four atoms are labeled A, B, C and D in the structure below. Which of these atoms would be the *most reactive with a nucleophile*? **D**

- A
- B
- C
- D
- All of these atoms will react equally with a nucleophile.



25. Which reaction below corresponds to the reaction energy diagram given? **A**



- 2-butene + HCl  $\rightarrow$
- 1-butene + HCl  $\rightarrow$
- 2-methylpropene + HCl  $\rightarrow$
- b & c
- none of these

USEFUL INFORMATION

Periodic Table of the Elements

Representative (main group) elements

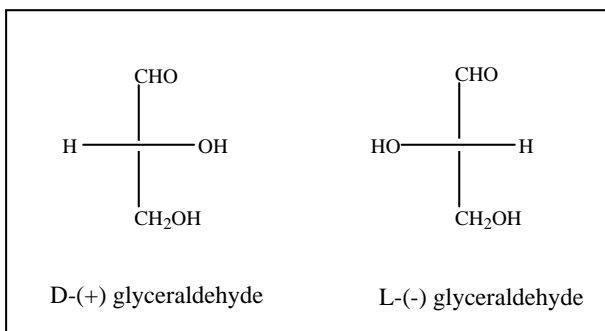
Transition metals

Rare earth elements

Lanthanides

Actinides

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1,3-Diaxial Interactions	
H-Methyl	0.9 kcal
H-Ethyl	1.2 kcal
H-isopropyl	1.6 kcal
H-sec-butyl	1.8 kcal
H-OH	1.1 kcal
H-Cl	1.0 kcal
Methyl-Methyl	2.8 kcal
Methyl-Ethyl	3.1 kcal
Methyl-isopropyl	3.5 kcal
Methyl-sec-butyl	3.7 kcal
Me-OH	3.0 kcal

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

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

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

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

