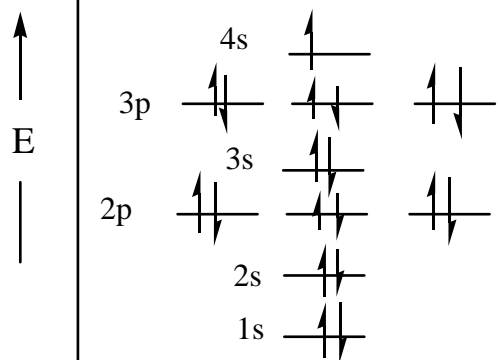


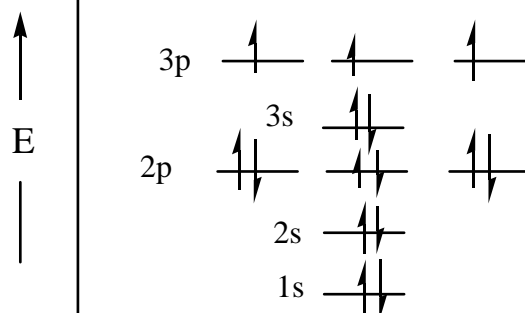
1. Which of the following represents the correct electronic configuration diagram for phosphorous?

B

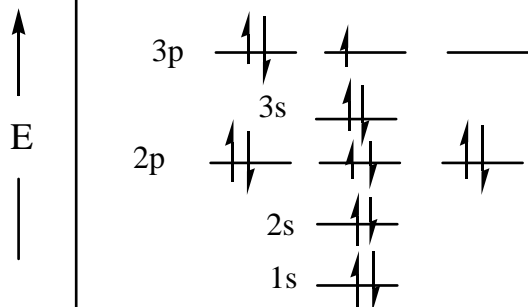
a)



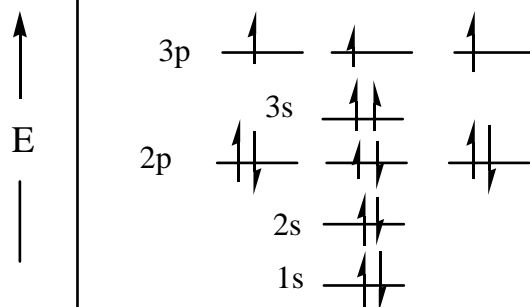
b)



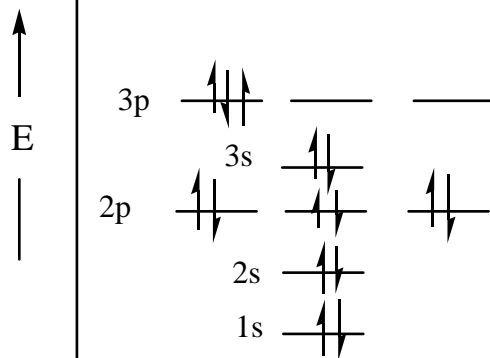
c)



d)



e)

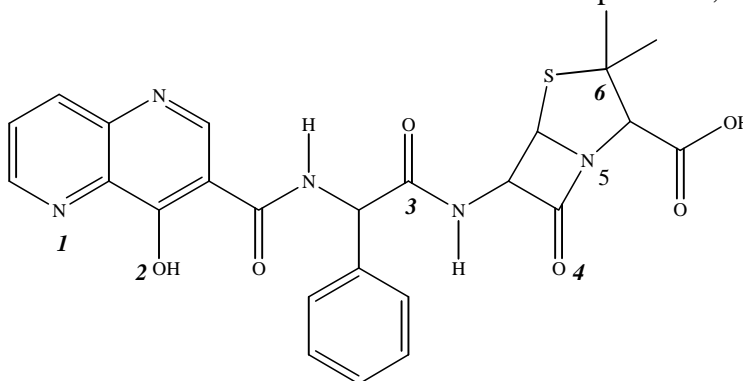


2. For which molecular formula can at least one set of positional isomers, one set of functional group isomers and one set of stereoisomers be drawn?

E

- a) $C_5H_6O_2$
- b) $C_5H_{12}O_2$
- c) $C_5H_{10}Br_2$
- d) $C_5H_{11}NO$
- e) a & d

3. The hybridizations of each of the atoms indicated in the structure of apalicyllin, an antibacterial agent, are:



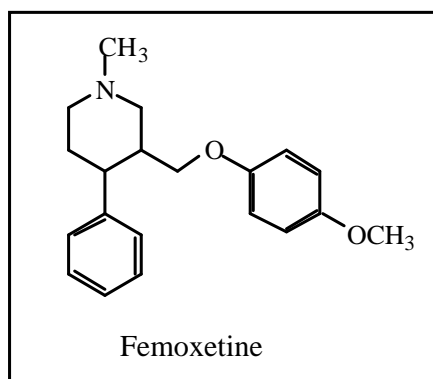
E

Apalicyllin
(antibacterial)

- a) $N_1 = sp$; $O_2 = sp^3$; $C_3 = sp^2$; $O_4 = sp^3$; $N_5 = sp^2$; $C_6 = sp^3$
- b) $N_1 = sp^2$; $O_2 = sp^2$; $C_3 = sp^2$; $O_4 = sp^2$; $N_5 = sp^3$; $C_6 = sp^3$
- c) $N_1 = sp^3$; $O_2 = sp^3$; $C_3 = sp^3$; $O_4 = sp^2$; $N_5 = sp^2$; $C_6 = sp^3$
- d) $N_1 = sp^2$; $O_2 = sp^2$; $C_3 = sp^3$; $O_4 = sp^2$; $N_5 = sp$; $C_6 = sp^3$
- e) $N_1 = sp^2$; $O_2 = sp^3$; $C_3 = sp^2$; $O_4 = sp^2$; $N_5 = sp^3$; $C_6 = sp^3$

4. How many polar covalent bonds are associated with femoxetine, an antidepressant?

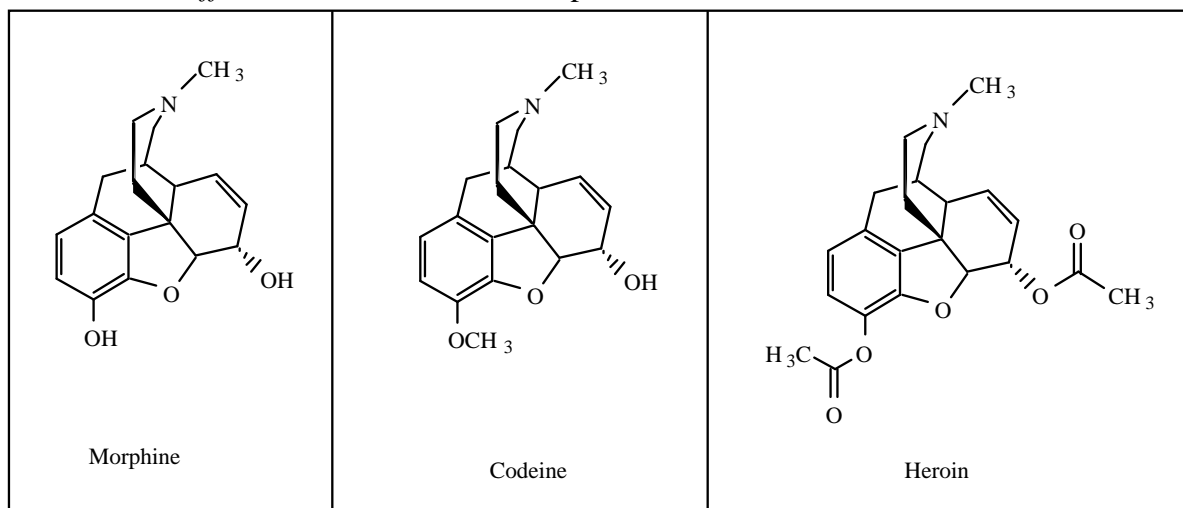
D



- a) four
- b) five
- c) six
- d) seven
- e) eight

5. Morphine, codeine and heroin are structurally similar to each other. Which of the following statements best describes the structural *differences* between these compounds?

B

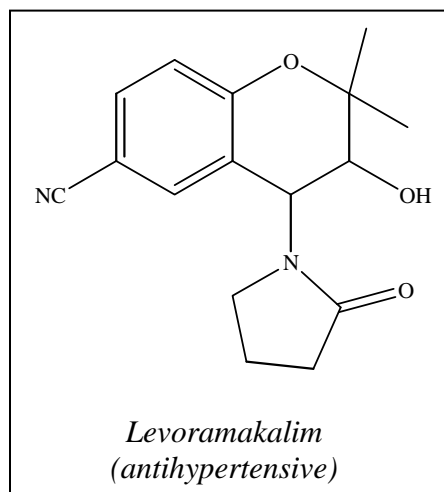


- Morphine contains a disubstituted alkene while heroin contains a trisubstituted alkene.
- Codeine contains a secondary alcohol while heroin contains two ester functional groups.
- The amine functional group of heroin is tertiary while the amine functional group of codeine is secondary.
- Codeine contains one tertiary alcohol and heroin contains two ketone functional groups.
- None of the above statements accurately describe the structural differences between these compounds.

6. The molecular formula of levoramakalim, an antihypertensive agent is:

D

- $C_{14}H_{18}N_2O_3$
- $C_{15}H_{20}N_2O_3$
- $C_{16}H_{20}N_2O_3$
- $C_{16}H_{18}N_2O_3$
- none of these

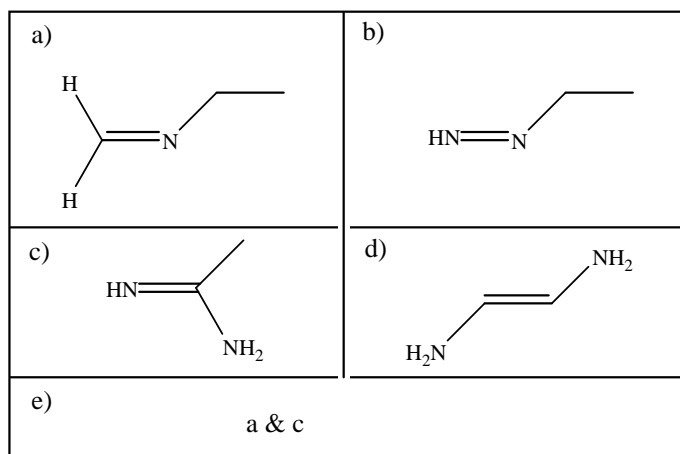


7. Which of the following structures represents acetamidine?

C

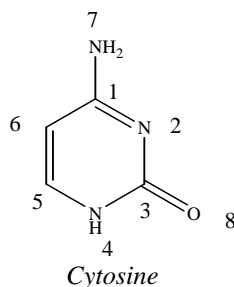
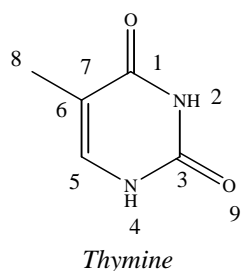
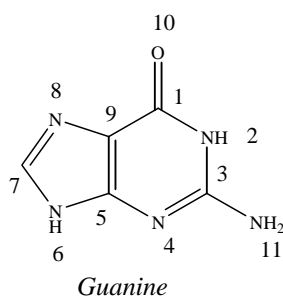
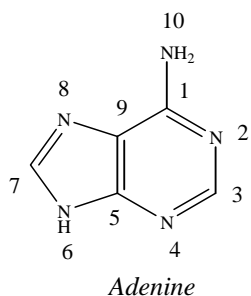
A proper Lewis structure for acetamidine, $C_2H_6N_2$ contains the following:

only one sp^3 carbon,
only one sp^2 carbon,
only one sp^3 nitrogen
only one sp^2 nitrogen
only one primary carbon
in the molecule



8. DNA is a long chain biological molecule made up of repeating units containing four distinct bases, guanine, adenine, cytosine and thymine (shown below). The long chain molecules of DNA coil around each other to form a double helical structure that is held together through non-covalent interactions between the base unit in one molecule and a base unit in another molecule. In DNA molecules, adenine forms interacts only with thymine (and thymine only with adenine) and guanine interacts only with cytosine (and cytosine only with guanine). This is referred to as base pairing. Which of the following statements is true?

C



- | |
|---|
| a) The bonds connecting the two strands of DNA in a double helix are polar covalent bonds |
| b) Adenine interacts in a DNA double helix with thymine through an intramolecular ion-dipole interaction |
| c) Thymine interacts in a DNA double helix with adenine through an intermolecular dipole-dipole interaction |
| d) Guanine interacts in a DNA double helix with thymine through an intermolecular H-bond. |
| e) c & d |

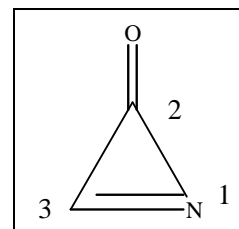
9. Which one of the following compounds is NOT a skeletal isomer of heptane?

- a) 2-ethylbutane
- b) 2,4-dimethylpentane
- c) 3,3-dimethylpentane
- d) 2,2,3-trimethylbutane
- e) 3-methylhexane

A

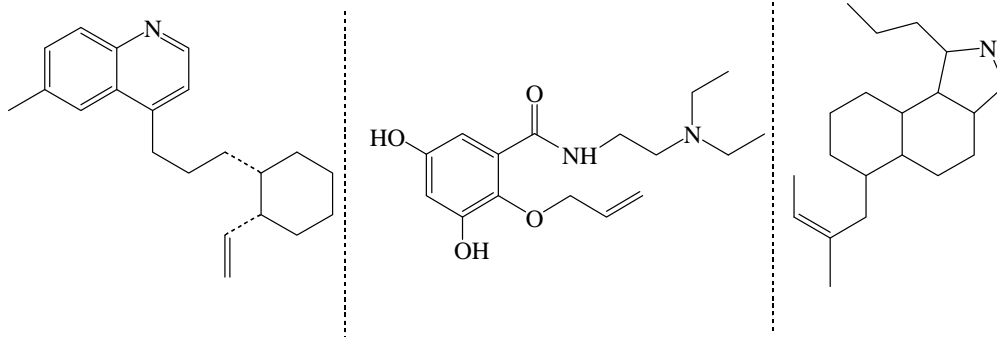
10. The bond between N₁ and C₂ in the molecule below:

- a) is formed by overlap between the 2p orbital of N₁ and the 2p orbital of C₂
- b) is formed by overlap between 2sp² orbital of N₁ and 2sp² orbital of C₂
- c) is formed by overlap between 2sp³ orbital of N₁ and 2sp² orbital of C₂
- d) is formed by overlap between 2sp² orbital of N₁ and 2sp³ orbital of C₂
- e) is formed by overlap between 2sp² orbital of N₁ and 2p orbital of C₂



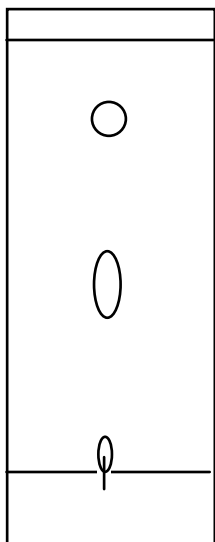
B

11. TLC analysis (silica gel plate, developing solvent: 5% acetic acid in ethyl acetate) was performed on a mixture of the three compounds below? Which of the following TLC plates would be generated in this analysis?

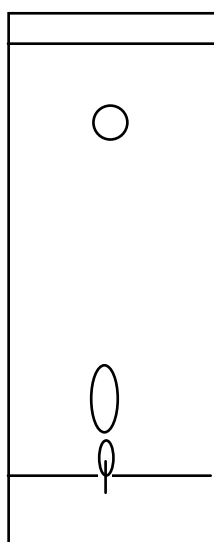


C

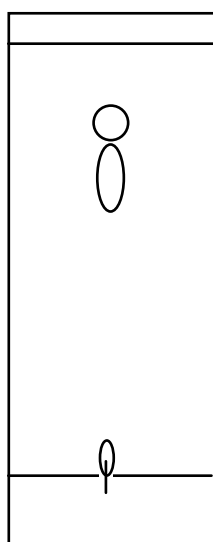
a)



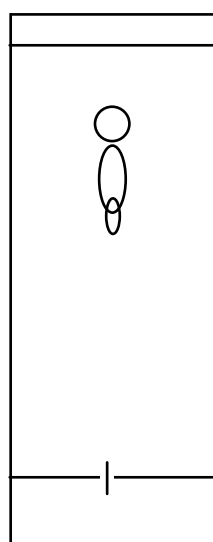
b)



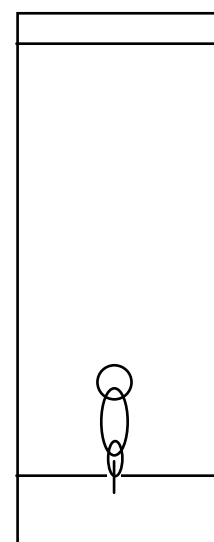
c)



d)

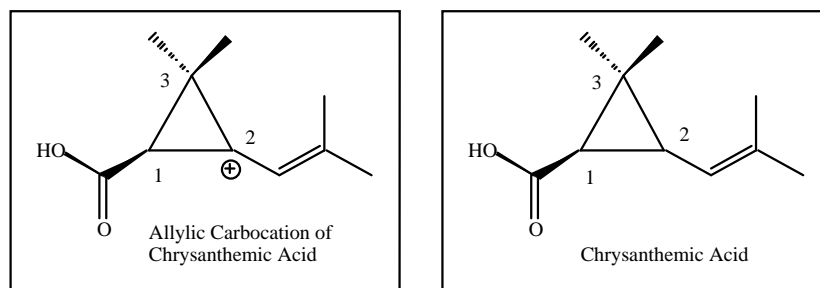


e)



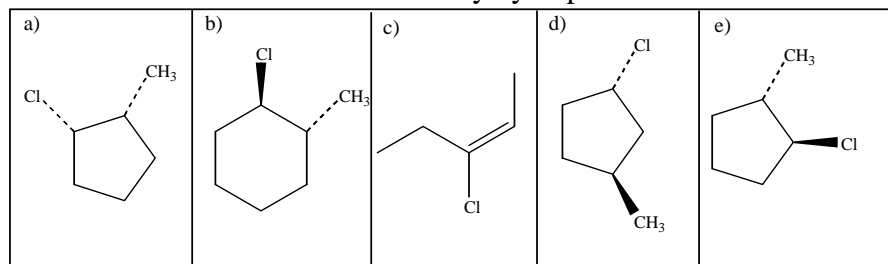
12. An allylic carbocation intermediate generated from chrysanthemic acid and chrysanthemic acid itself are shown below. Which of the following statement(s) is (are) true about these compounds?

D



- The molecular formula of both compounds is $C_{10}H_{16}O_2$.
- Both compounds contain a cis, disubstituted alkene
- The stereochemistry of the cyclopropane ring of chrysanthemic acid is trans.
- The C_2 carbon of the allylic carbocation is tertiary.
- b & d

13. The trans isomer of 1-chloro-2-methylcyclopentane is:



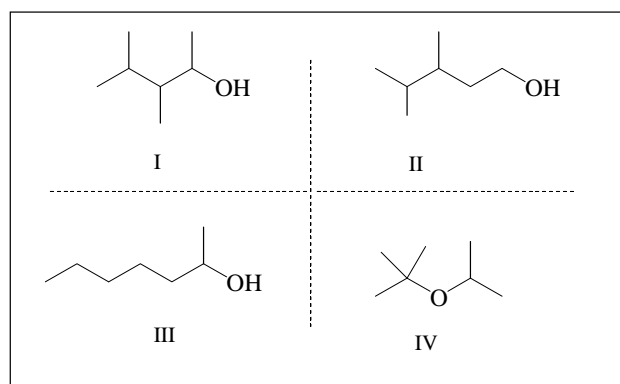
E

14. Which of the following molecules has a degree of unsaturation of 2?

- $C_{16}H_{10}$
- $C_{10}H_{22}N_4$
- $C_4H_4O_4$
- C_7H_6BrCl
- none of these

B

15. Rank the following compounds from highest boiling point to lowest boiling point.

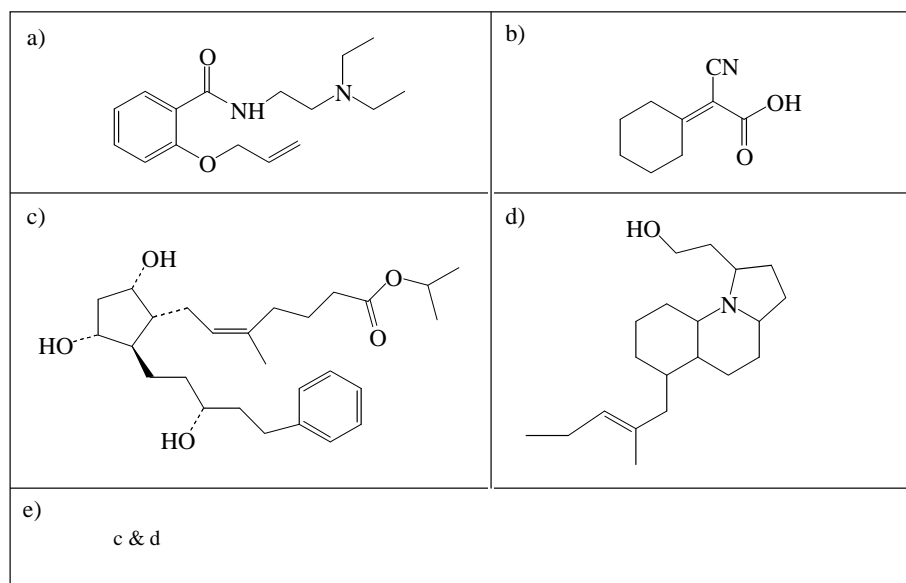


- I > II > III > IV
- II > I > IV > III
- III > II > I > IV
- III > I > II > IV
- IV > II > I > III

C

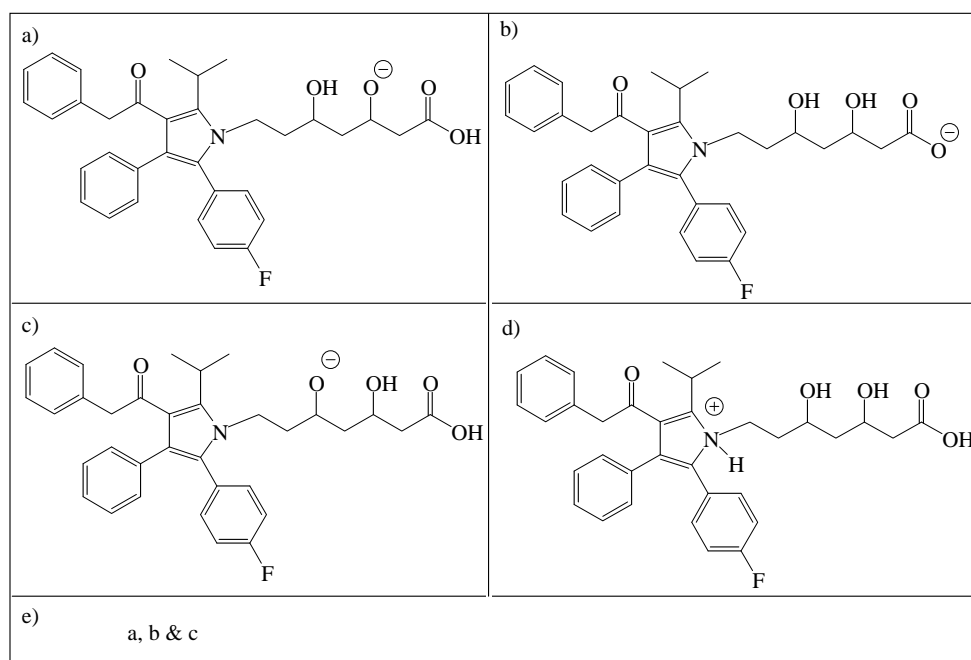
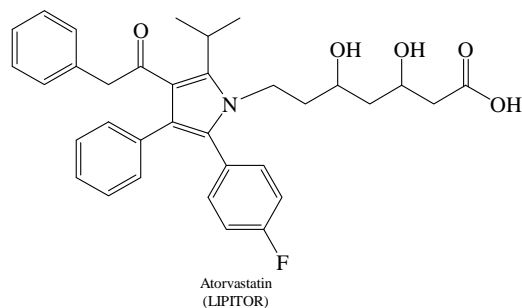
16. Which of the following compounds contains a trisubstituted, Z-alkene?

C

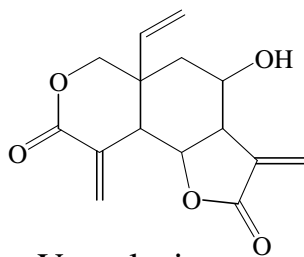


17. Which of the following structures represents the conjugate base of atorvastatin, a cholesterol lowering drug?

B



18. Vernolepin has:

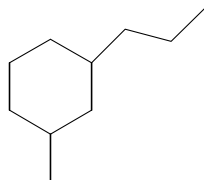


Vernolepin

- a) 3 vinylic and 3 allylic carbons
- b) 6 vinylic and 5 allylic carbons
- c) 8 vinylic and 3 allylic carbons
- d) 6 vinylic and 3 allylic carbons
- e) 4 vinylic and 4 allylic carbons

D

19. The proper IUPAC name of the compound below is:



- a) 1-methyl-5-propylcyclohexane
- b) 1-methyl-3-propylcyclohexane
- c) 1-ethyl-3-methylcyclohexane
- d) 1,3-ethylpropylcyclohexane
- e) 1,3-methylpropylcyclohexane

B

20. What is the degree of alkyl substitution of the number 4 carbon of 1-chloro-3,3-dimethylcyclopentane?

- a) primary
- b) secondary
- c) tertiary
- d) quarternary

B

