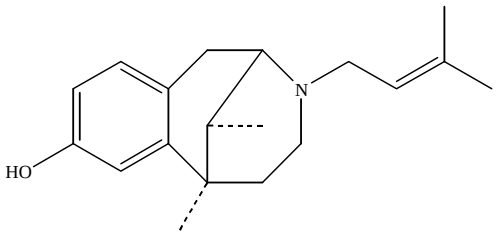
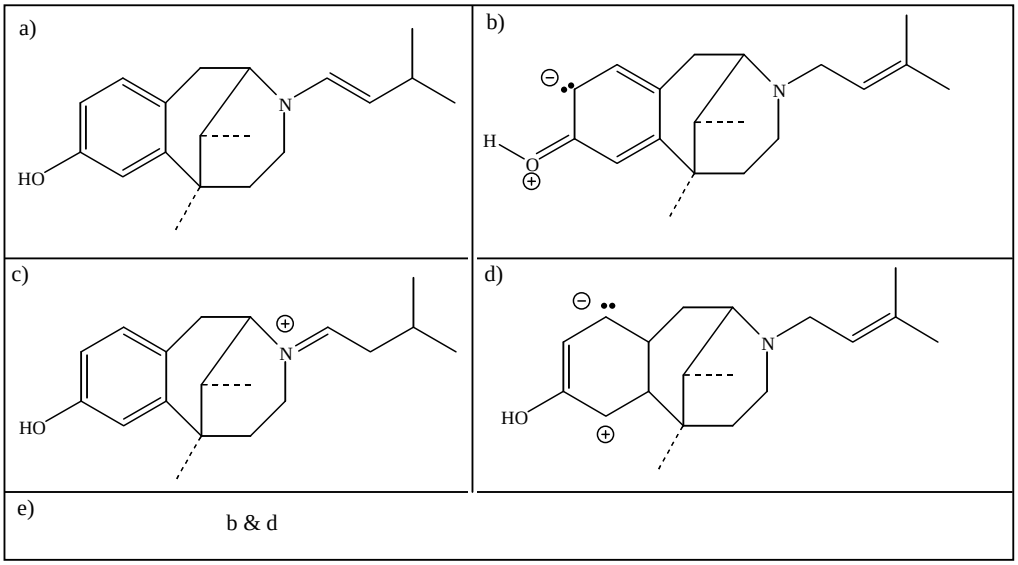
1. A resonance form of pentazocine is:

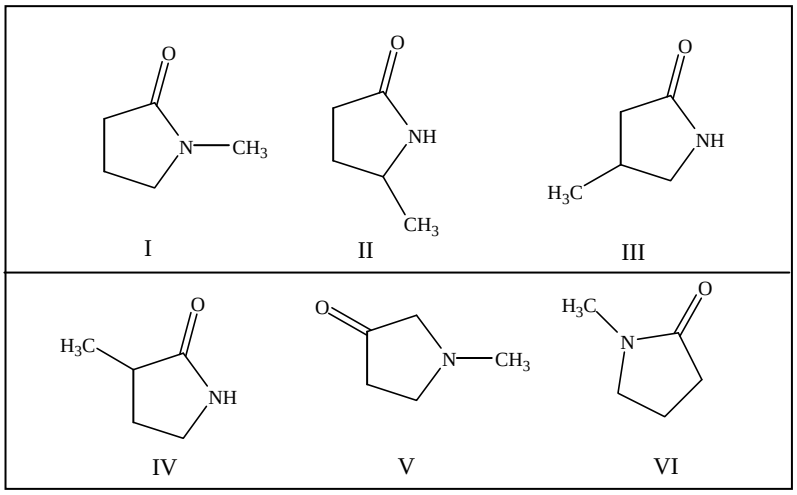


Pentazocine
(narcotic analgesic)

B




2. A pair of functional group isomers with a molecular formula of $C_5H_9NO$




E

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

3. The degree of unsaturation of anisomysin, an antimicrobial agent with a molecular formula of $C_{14}H_{19}NO_4$ is:
   a) 2
   b) 3
   c) 4
   d) 5
   e) 6

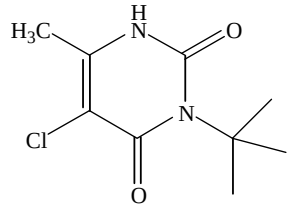
E

4. Which of the following structures is consistent with *all* of the information given below.

*Molecular formula: $C_{16}H_{13}ClN_2O_2$*
*Degree of Unsaturation: 11*
*One $sp^2$ hybridized N atom and one $sp^3$ hybridized N atom*
*Contains one amide functional group*

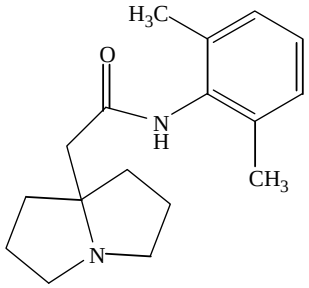
C

a)



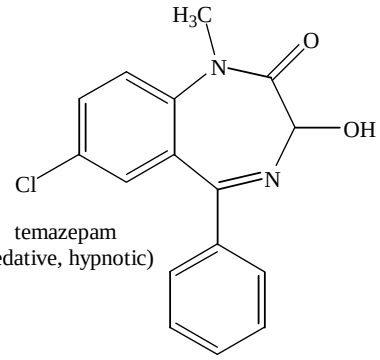
terbacil
(herbicide)

b)



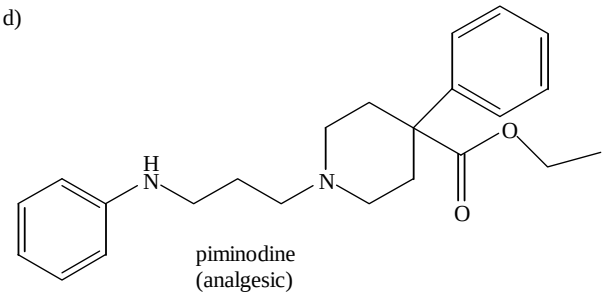
pilsicainide
(antiarrythmic)

c)



temazepam
(sedative, hypnotic)

d)

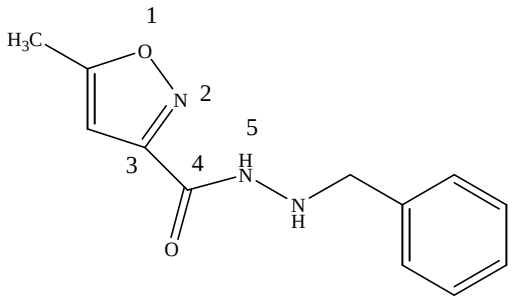


piminodine
(analgesic)

e) none of these

5. The hybridization of each of the indicated atoms in isocarboxazid, an antidepressant, is:

a) $O_1 = sp^3$ ; $N_2 = sp^2$; $C_3 = sp^2$ ; $C_4 = sp^2$ ; $N_5 = sp^3$
b) $O_1 = sp^2$ ; $N_2 = sp^3$; $C_3 = sp$ ; $C_4 = sp^2$ ; $N_5 = sp^2$
c) $O_1 = sp^3$ ; $N_2 = sp^3$; $C_3 = sp^3$ ; $C_4 = sp^2$ ; $N_5 = sp^2$
d) $O_1 = sp^3$ ; $N_2 = sp^2$; $C_3 = sp^3$ ; $C_4 = sp^2$ ; $N_5 = sp^3$
e) $O_1 = sp^3$ ; $N_2 = sp^2$; $C_3 = sp^2$ ; $C_4 = sp$ ; $N_5 = sp^2$

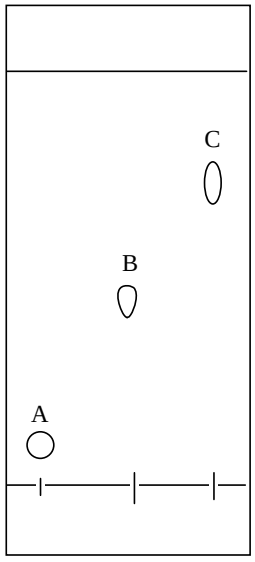


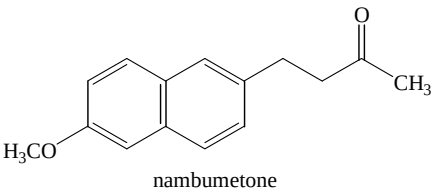
isocarboxazid
(anti-depressant)

A

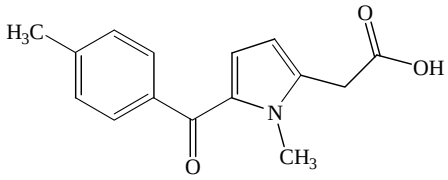
6. A silica gel TLC plate, developed with 5% acetic acid in ethyl acetate is depicted below. Each spot on the plate corresponds to one of the compounds given on the right. Match each spot with a compound.

D

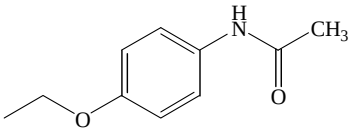



nambumetone



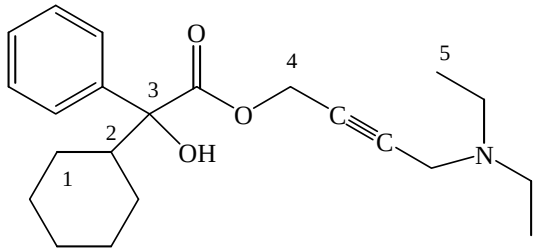

tolmetin




phenacetin

a) A = nambutone
   B = tolmetin
   C = phenacetin
b) A = nambutone
   B = phenacetin
   C = tolmetin
c) A = phenacetin
   B = tolmetin
   C = nambutone
d) A = tolmetin
   B = phenacetin
   C = nambutone
e) A = phenacetin
   B = nambutone
   C = tolmetin

7. What are the correct degrees of alkyl substitution of the indicated C atoms in oxybutynin?




Oxybutynin
(anticholinergic)

E

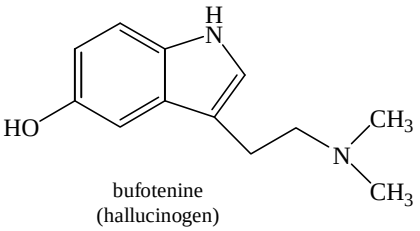
a) $C_1 = 2°$; $C_2 = 4°$; $C_3 = 2°$; $C_4 = 2°$; $C_5 = 2°$
b) $C_1 = 2°$; $C_2 = 3°$; $C_3 = 3°$; $C_4 = 2°$; $C_5 = 1°$
c) $C_1 = 3°$; $C_2 = 2°$; $C_3 = 3°$; $C_4 = 1°$; $C_5 = 1°$
d) $C_1 = 1°$; $C_2 = 3°$; $C_3 = 3°$; $C_4 = 1°$; $C_5 = 1°$
e) $C_1 = 2°$; $C_2 = 3°$; $C_3 = 3°$; $C_4 = 1°$; $C_5 = 1°$

8. Which of the following pairs of compounds are skeletal isomers?
   a) 2,3-dimethylhexane and 3,3-dimethylhexane
   b) 3,3-diethylpentane and 3-ethylheptane
   c) 2,3-dimethylpentane and 2,2,3-trimethylbutane
   d) 3,4-dimethylheptane and 3-ethyl-4-methylhexane
   e) All of these pairs of compounds are skeletal isomers.

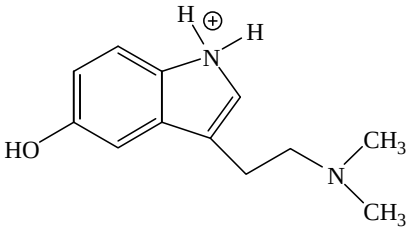
E

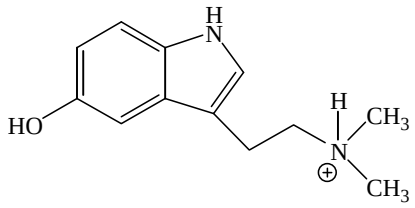
9. Which of the following structures represents the conjugate base of bufotenine, a hallucinogen?

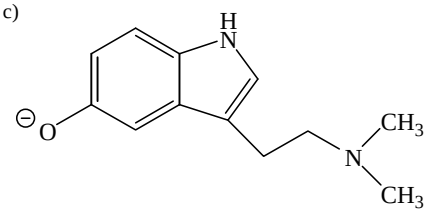
C

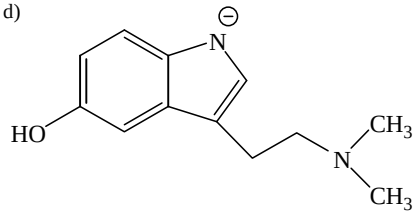


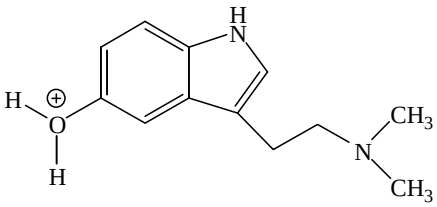

bufotenine
(hallucinogen)

a)



b)


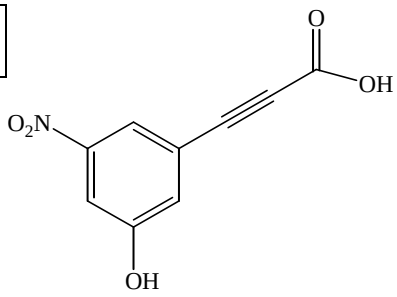

c)



d)



e)



10. Which of the following non-covalent interactions can occur for 3-hydroxy-5-nitrophenylpropiolic acid?

A



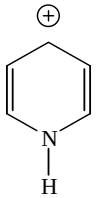

3-hydroxy-5-nitrophenylpropiolic acid

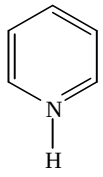
| | |
|---|---|
| **1** | Intermolecular H-bonds |
| **2** | Intramolecular H-bonds |
| **3** | Intermolecular Dipole-Dipole |
| **4** | Intramolecular Dipole-Dipole |
| **5** | Intermolecular Ion-Dipole |
| **6** | Intramolecular Ion-Dipole |
| **7** | Intermolecular Hydrophobic |
| **8** | Intramolecular Hydrophobic |

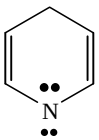
a) 1, 2, 3, 5
b) 1, 3, 5, 7
c) 1, 2, 3, 5, 7
d) 1, 2, 3, 5, 6, 7
e) 1, 2, 3, 4, 5, 7, 8

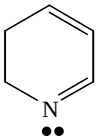
11. The structure given below is a resonance form of the *conjugate acid* of pyridine. Pyridine is a stable, aromatic compound with no formal charges on any of its atoms. Which of the following structures represents pyridine?

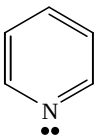
D




a)



b)


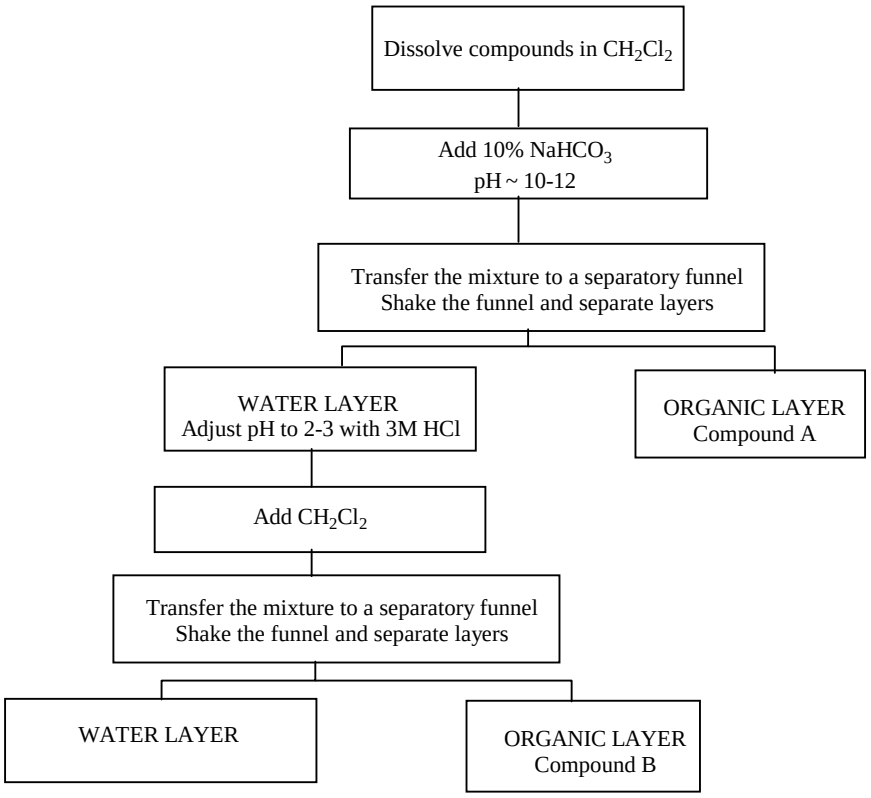

c)



d)


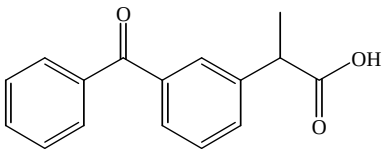

e) none of these

12. Which pairs of compounds could be separated using the procedure described in the flowchart given below?

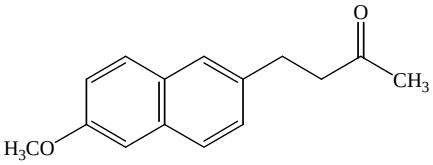
E



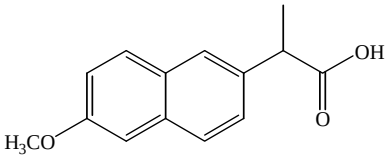

| | |
|---|---|
| a) | adenine & nambumetone |
| b) | adenine & ketoprofen |
| c) | naproxen & ketoprofen |
| d) | nambumetone & naproxen |
| e) | b & d |



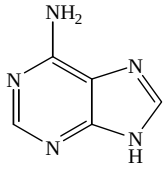
ketoprofen



nambumetone



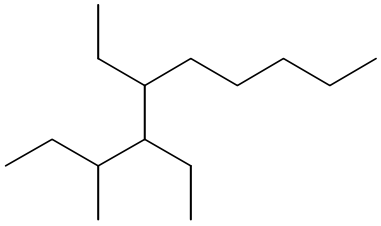
naproxen



adenine

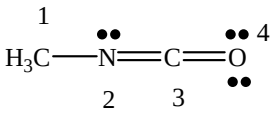
13. The proper IUPAC name of the structure given below is:

B



a) 2,3,4-triethylnonane
b) 4,5-diethyl-3-methyldecane
c) 4-ethyl-3-butylnonane
d) 3-heptyloctane
e) all of these

14. The formal charges on the indicated atoms of methylisocyanate are:

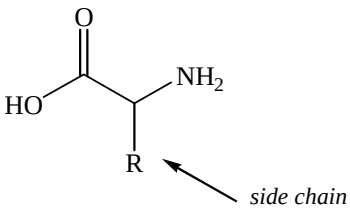



D

a) $C_1 = 0$; $N_2 = -1$; $C_3 = +1$; $O_4 = 0$
b) $C_1 = +1$; $N_2 = -1$; $C_3 = 0$; $O_4 = 0$
c) $C_1 = 0$; $N_2 = +1$; $C_3 = 0$; $O_4 = -1$
d) $C_1 = 0$; $N_2 = 0$; $C_3 = 0$; $O_4 = 0$
e) $C_1 = -1$; $N_2 = +1$; $C_3 = 0$; $O_4 = 0$

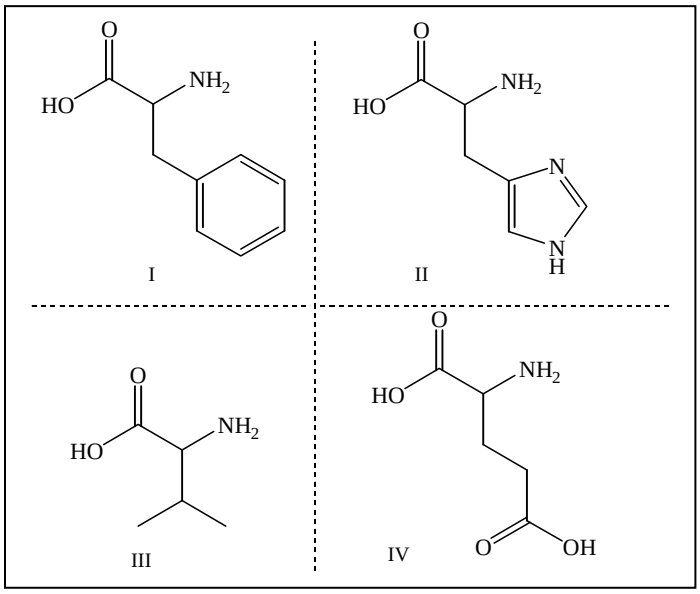
15. α-Amino acids are important biological molecules that are the building blocks of proteins and peptides. α-Amino acids have the generic structure given below. Specific α-amino acids differ from each other based on the R group, sometimes referred to as "a side chain". α-Amino acids are often categorized as "acidic (A)", "basic (B)" or "hydrophobic (H)" based *exclusively on the functional groups and structure of the side chain*. Which of the following α-amino acids (I-IV) are acidic, which are basic and which are hydrophobic?

D



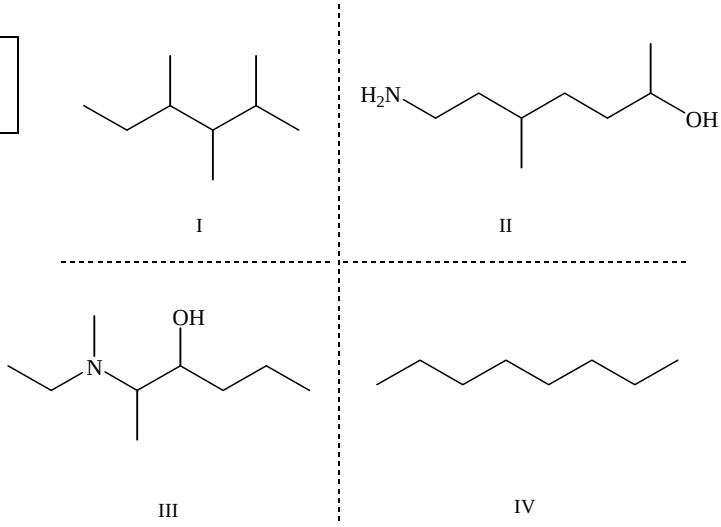

Generic structure of α-amino acid

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




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

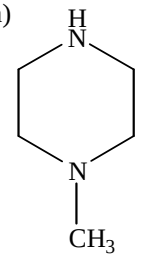
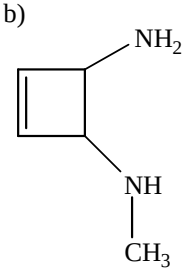
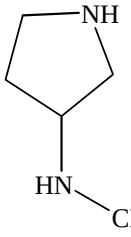
C




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

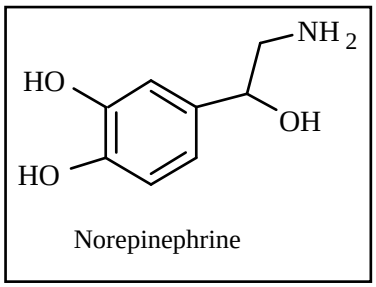
17. Which of the following is (are) a correct Lewis structure for the molecular formula $C_5H_{12}N_2$?

D

| a) | b) | c) | d) | e) |
|---|---|---|---|---|
|  |  |  | a & c | a, b & c |

18. Norepinephrine contains which of the following functional groups?

B

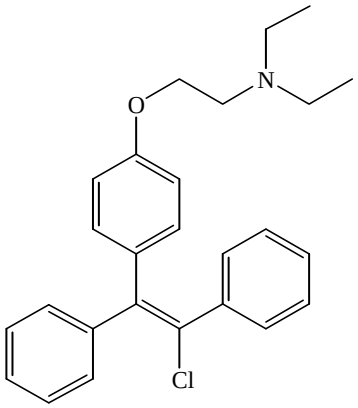


Norepinephrine

a) phenol, alkene, 2° alkyl halide, 1° alcohol
b) phenol, 2° alcohol, 1° amine
c) 2° amine, alkene, 1° alcohol, ether
d) amide, phenol, 1° alcohol, 1° amine
e) phenol, 2° amine, 2° alcohol

19. How many polar covalent bonds are present in clomiphene?

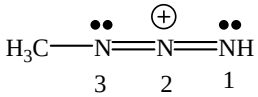
B



clomiphene

a) 7
b) 6
c) 5
d) 4
e) 3

20. Which of the following statements are true as they relate to methyl azide, given below?



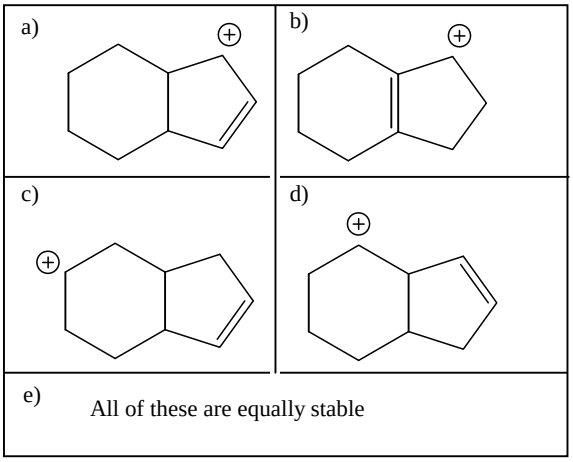
methyl azide

a) The $N_3$-$N_2$ sigma bond is formed by overlap of an $sp^2$ orbital of $N_2$ and an $sp^3$ orbital of $N_3$
b) There is one polar covalent bond in methyl azide.
c) The carbon atom of methyl azide is primary.
d) The degree of unsaturation of methylazide is 2
e) b & d

D

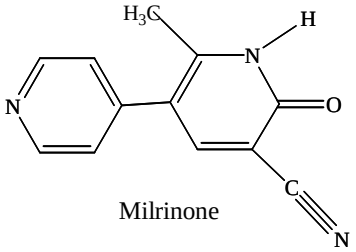
21. Which of the following compounds is the most stable?

B




22. How many pi bonds are in the structure of milrinone, a drug used in the treatment of congestive heart failure?

A



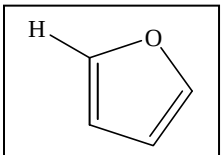
Milrinone

a) 8
b) 7
c) 10
d) 14
e) 16

23. The H-C-O bond angle of furan is (approximately):

B

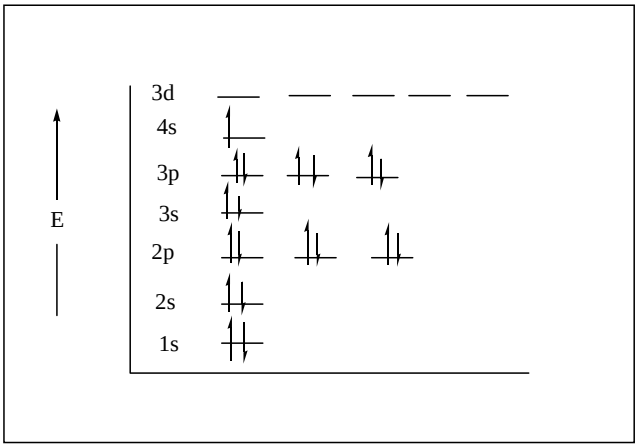
a) 109°
b) 120°
c) 180°
d) 90°
e) 45°



Furan

24. The number of valance electrons associated with an atom with the following electronic configuration is:

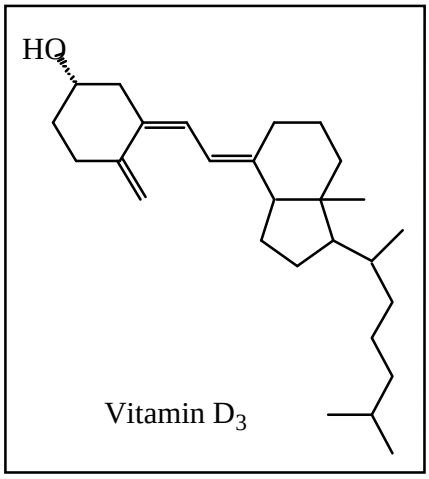
A




a) 1
b) 2
c) 8
d) 11
e) 18

25. How many allylic carbon atoms are present in the structure of vitamin $D_3$?

D




Vitamin $D_3$

a) 7
b) 6
c) 5
d) 4
e) 3