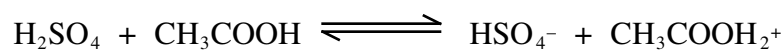


1. Which of the following compounds is the most soluble in water?

A. $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
B. $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$
C. $(\text{CH}_3)_2\text{CHCH}_2\text{OH}$
D. $(\text{CH}_3)_2\text{CHCH}_2\text{Br}$

2. What species act as bases in the reaction shown?



I

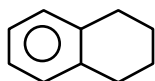
II

III

IV

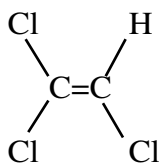
A. I and III B. I and IV C. II and III D. II and IV

3. How many hydrogen atoms are present in a molecule of tetralin? The structure of tetralin is given below.



A. 10 B. 12 C. 14 D. 16

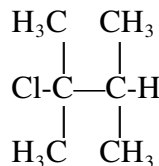
4. What is the direction of the dipole moment in the molecule shown?



A.  B.  C.  D. 

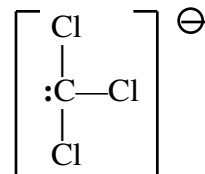
5. What is the IUPAC name of the molecule shown?

A. 1-chloro-1,1,2,2-tetramethylethane
B. 2-chloro-2-isopropylpropane
C. 2-chloro-2,3-dimethylbutane
D. 2-chlorohexane

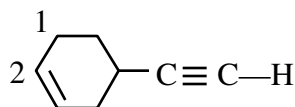


6. Which of the following gives a peak at 1710 cm^{-1} in its IR spectrum?
- A. $\text{CH}_3\text{CH}_2\text{C}(=\text{O})\text{CH}_3$ B. $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_3$ C. $\text{CH}_3\text{CH}_2\text{CHOHCH}_3$ D. $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{NH}_2$

7. What is the predicted shape and bond angle for the species shown?



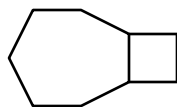
- A. Trigonal planar, 120°
 B. Trigonal planar, 109.5°
 C. Trigonal pyramid, 120°
 D. Trigonal pyramid, 109.5°
8. What are the respective hybridizations of the carbon atoms numbered 1 and 2 in the structure shown?



- A. sp^3 , sp^2 B. sp^2 , sp C. sp , sp^3 D. sp , sp
9. Which of the following is a pair of resonance structures?
- A. $\begin{array}{c} :\text{O}: \\ || \\ \text{H}-\text{C}-\text{O}^- \\ \text{O}^- \end{array} \longleftrightarrow \begin{array}{c} :\text{O}: \\ \text{O}^- \\ | \\ \text{O}^- - \text{C}-\text{H} \end{array}$ B. $\begin{array}{c} \text{H}-\text{C}=\text{C}-\text{C}^+-\text{H} \\ | \quad | \quad | \\ \text{H} \quad \text{H} \quad \text{H} \end{array} \longleftrightarrow \begin{array}{c} \text{H}-\text{C}^+-\text{C}=\text{C}-\text{H} \\ | \quad | \quad | \\ \text{H} \quad \text{H} \quad \text{H} \end{array}$
- C. $\begin{array}{c} \text{H}-\text{C}^+-\text{C}=\text{C}-\text{H} \\ | \quad | \quad | \\ \text{H} \quad \text{H} \quad \text{H} \end{array} \longleftrightarrow \begin{array}{c} \text{H}-\text{C}=\text{C}-\text{C}^+-\text{H} \\ | \quad | \quad | \\ \text{H} \quad \text{H} \quad \text{H} \end{array}$ D. $\begin{array}{c} \text{H} \quad :\text{O}: \quad \text{H} \\ | \quad || \quad / \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ | \quad | \\ \text{H} \quad \text{H} \end{array} \longleftrightarrow \begin{array}{c} \text{H} \quad :\text{O}^+-\text{H} \\ | \quad | \\ \text{H}-\text{C}-\text{C}=\text{C}-\text{H} \\ | \quad | \\ \text{H} \quad \text{H} \end{array}$

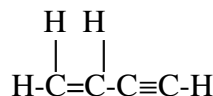
10. What is the structure of neopentyl alcohol?
- A. $(\text{CH}_3)_3\text{CCH}_2\text{CH}_2\text{OH}$ B. $(\text{CH}_3)_3\text{CCH}_2\text{OH}$
 C. $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{CH}_2\text{OH}$ D. $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{OH}$

11. What is the name of the compound shown?



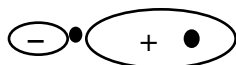
- A. bicyclo[3.2.2]nonane
B. bicyclo[4.2.1]nonane
C. bicyclo[4.3.0]nonane
D. bicyclo[5.2.0]nonane
12. Which of these statements is true of the molecule shown?

- A. It contains five pi bonds.
B. It contains seven sigma bonds.
C. The H-C-H bond angle is 109.5° .
D. The hydrogen atoms are sp^3 hybridized.



13. What words complete the following sentence? $(CH_3)_2COHCH_3$ is a _____ alcohol, and $(CH_3)_2CNH_2CH_3$ is a _____ amine.

- A. primary . . . tertiary
B. tertiary . . . primary
C. primary . . . secondary
D. secondary . . . tertiary
14. What class does the orbital shown belong to? Each dot represents a nucleus, and the signs of the wave function are shown.

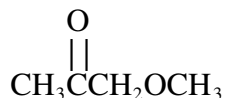


- A. σ B. π C. p D. sp^3
15. Which of the following compounds is NOT an isomer of the others?

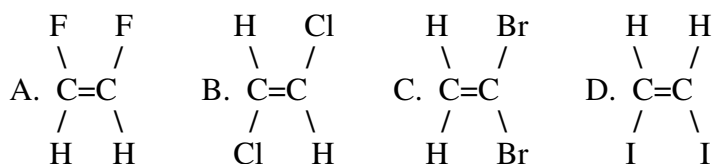


16. What functional groups is/are present in the molecule shown?

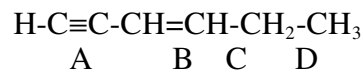
- A. Ester only
B. Carboxylic acid and ether
C. Ketone and ether
D. Aldehyde only



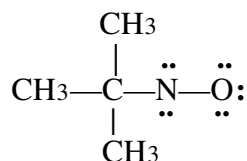
17. Which of the following is NEITHER a *cis* isomer NOR a *trans* isomer?



18. What is the SHORTEST carbon-carbon bond in the molecule shown?

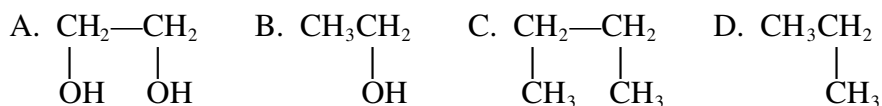


19. What is the formal charge on the oxygen atom in the structure shown?

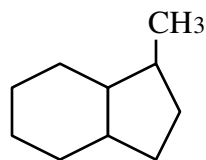


- A. +2 B. +1 C. 0 D. -1
20. What is the definition of a Lewis base?
- A. Proton acceptor
 B. Proton donor
 C. Electron pair acceptor
 D. Electron pair donor

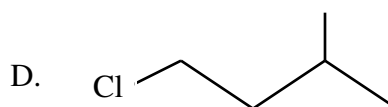
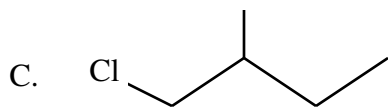
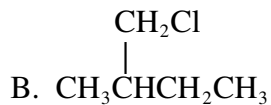
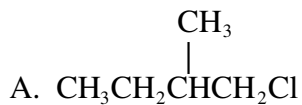
21. Which of the compounds shown has the LOWEST boiling point?



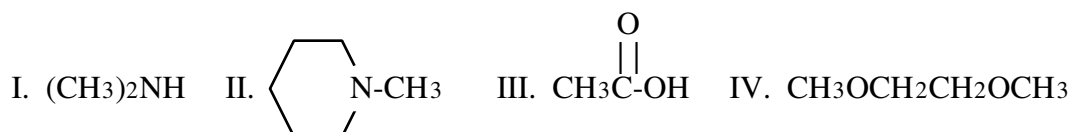
22. What is the IUPAC name of the compound shown?



- A. 9-methylbicyclo[4.3.0]nonane
 B. 7-methylbicyclo[4.3.0]nonane
 C. 2-methylbicyclo[4.3.0]nonane
 D. 1-methylbicyclo[4.3.0]nonane
23. How many secondary amines are there with the formula $C_4H_{11}N$?
- A. 2 B. 3 C. 4 D. 5
24. Which of the formulas shown represents a compound that is different from all the others?



25. Which of the compounds shown can form hydrogen bonds with other molecules of the same kind?



- A. II and III only B. I and III only C. I and IV only D. I, II, and III