Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.

1. What is the IUPAC name of
   - CH₃CHCH₃
     \[ \text{CH₃CHCH₂CHCH₂OH} \]
     \[ \text{CH₃CH₂} \]
   a. 5-ethyl-2,3-dimethyl-6-hexanol
   b. 2-ethyl-4-isopropyl-1-pentanol
   c. 2-ethyl-4,5-dimethyl-1-hexanol
   d. none of these

2. In diols and triols the hydroxyl groups are never attached to the same carbon atom. Given this condition how many isomers of butanetriol exist?
   a. 1
   b. 2
   c. 3
   d. 4

3. Which of the following compounds will have the highest boiling point?
   a. 1-butanol
   b. ethanol
   c. 1-pentanol
   d. 1-propanol

4. Which of the following compounds is most soluble in water?
   a. 1-butanol
   b. 1-hexanol
   c. 1-pentanol
   d. 1-propanol

5. The hydration of alkenes and the dehydration of alcohols are a pair of competing reactions which establish an equilibrium. Which of the following statements properly describes the relationship between the hydration of alkenes and the dehydration of alcohols?
   a. the amount of water present does not affect the relative amounts of the alkene and the alcohol
   b. in the reaction mixture there will always be equal amount of the alkene and the alcohol
   c. the presence of large amounts of water favors the formation of alcohols
   d. the presence of large amounts of water favors the formation of alkenes
6. Which of the following compounds are obtainable by the oxidation of primary alcohols?
   a. carboxylic acids
   b. ketones
   c. both (a) and (b)
   d. neither (a) nor (b)

7. Which of the following is a synonym for thiol?
   a. mercaptan
   b. sulfate
   c. sulfide
   d. sulfoxide

8. Which of the following types of isomers must possess a stereocenter?
   a. cis-trans isomers
   b. constitutional isomers
   c. both (a) and (b)
   d. neither (a) nor (b)

9. Which of the following molecules is(are) chiral?
   a. 1-pentanol
   b. 2-pentanol
   c. 3-pentanol
   d. all of them

10. Which of the following molecules is(are) achiral?
    a. 2-methylhexane
    b. 3,3-dimethylhexane
    c. 3-ethyl-3-methylhexane
    d. all of them

11. Which of the following molecules is achiral?
    a. 2,3,4-trimethylheptane
    b. 3,4,5-trimethylheptane
    c. 2,4,6-trimethylheptane
    d. none of them

12. Which of the following molecules has an R configuration?
    a. [Diagram of molecule]
    b. [Diagram of molecule]
    c. both (a) and (b)
    d. neither (a) nor (b)
13. Some molecules with multiple stereocenters are achiral. Which of the following molecules is(are) achiral?

a.  
\[
\begin{align*}
\text{CH}_3 & \\
\text{HO} & \\
\text{H} & \\
\text{C} & \\
\text{H} & \\
\text{OH} & \\
\end{align*}
\]

b.  
\[
\begin{align*}
\text{CH}_3 & \\
\text{H} & \\
\text{C} & \\
\text{OH} & \\
\text{H} & \\
\text{C} & \\
\text{OH} & \\
\text{CH}_3 & \\
\end{align*}
\]

c. both (a) and (b)

d. neither (a) nor (b)

14. Which of the following bonds is found in all amines?

a. C–N
b. H–N
c. C=N
d. both (a) and (b)

15. How many hydrogen atoms are attached to a nitrogen atom in a tertiary amine?

a. 0
b. 1
c. 2
d. 3

16. What is the IUPAC name of

\[
\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2
\]

a. butylamine
b. 1-butanamine
c. 4-butanamine
d. none of these
17. What is the IUPAC name of
   
   ![Chemical Structure](image)

   a. N-methylaniline
   b. N-methylcyclohexanamine
   c. cyclohexylmethylamine
   d. none of these

18. Which of the following gives the correct order of solubility in water?
   
   a. aniline > methylamine > trimethylamine
   b. aniline > trimethylamine > methylamine
   c. methylamine > trimethylamine > aniline
   d. methylamine > aniline > trimethylamine

19. What is the minimum number of carbon atoms present in a ketone?
   
   a. 1
   b. 2
   c. 3
   d. 4

20. What is the IUPAC name of
   
   ![Chemical Structure](image)

   a. o-methylbenzaldehyde
   b. o-methylcyclohexanal
   c. 2-methylcyclohexanal
   d. none of these

21. What is the name of
   
   ![Chemical Structure](image)

   a. cyclohexene-2-one
   b. cyclohexene-3-one
   c. 2-cyclohexenone
   d. 3-cyclohexenone
22. For compounds of comparable molecular mass which of the following gives the correct order of boiling points?
   a. alcohols < aldehydes < alkanes
   b. aldehydes < alcohols < alkanes
   c. aldehydes < alkanes < alcohols
   d. alkanes < aldehydes < alcohols

23. What reagent is most commonly used in the laboratory reduction of aldehydes?
   a. hydrogen atoms
   b. hydrogen molecules
   c. aqueous acidic sodium borohydride
   d. a transition metal hydride

24. Which of the following is obtained by the reduction of 3-pentanone?
   a. pentanal
   b. 3-pentanol
   c. pentanoic acid
   d. none of these

25. Which of the following compounds is most likely to form a stable hemiacetal?
   a. 
   b. 
   c. 
   d. 

26. Which of the following molecules can show keto-enol tautomerism?
   a. 
   b. 
   c. both (a) and (b)
   d. neither (a) nor (b)
27. Which of the following is butanoic acid?
   a. CH₃CH₂COOH  
   b. CH₃(CH₂)₂COOH  
   c. CH₃(CH₂)₃COOH  
   d. CH₃(CH₂)₄COOH

28. What is the name of
   ![Chemical Structure](image)
   a. 5-amino-2-ethylhexanoic acid  
   b. 2-amino-5-ethylhexanoic acid  
   c. 2-amino-5-methylheptanoic acid  
   d. none of these

29. Which of the following is the strongest carboxylic acid?
   a. ClCH₂COOH  
   b. Cl₂CHCOOH  
   c. Cl₃CCOOH  
   d. they are all equally strong

30. What is the common name of
   ![Chemical Structure](image)
   a. methyl acetate  
   b. methyl ethanoate  
   c. ethyl methanoate  
   d. ethyl acetate

31. What reagents can be used to prepare
   ![Chemical Structure](image)
   a. acetic acid and methanol  
   b. formic acid and methanol  
   c. acetic anhydride and water  
   d. none of these

32. What is the formula of triphosphoric acid?
   a. H₄P₅O₆  
   b. H₄P₅O₁₀  
   c. H₃P₃O₈  
   d. H₃P₃O₁₀
33. What type(s) of esters can be formed by phosphoric acid?
   a. monoesters
   b. diesters
   c. triesters
   d. all of these

34. Lactomer, the polymer in absorbable stitches, is an example of what type of polymer?
   a. a polyamide
   b. a polycarbonate
   c. a polyester
   d. none of these

35. Which of the following reagents can be used to prepare a polyamide?
   a. a difunctional acid and an difunctional alcohol
   b. a difunctional alcohol and a difunctional ester
   c. both (a) and (b)
   d. neither (a) nor (b)

36. Label the chiral carbons in the molecules below with an asterisk (*). If a molecule has no chiral carbons, write “None” below it. Caution: Incorrect labels cancel correct ones if both are present! However, if a negative score results, it will not be recorded. (5 points total)

   a. 
   b. 
   c. 

37. For each of the reactions below, write the structure of the major organic product. Note: These reaction are not balanced. Assume all reagents to be present sufficient for the reaction. (2 points each)

   a. 
   b. 
37. (cont.)

c.  \[
\begin{align*}
\text{CH}_3\text{CH}_2\text{OH} & \quad \text{H}_2\text{SO}_4 \text{ (cat.)} \\
\text{CH}_2=\text{O} & \quad + \\
\end{align*}
\]

d.  \[
\begin{align*}
\text{N} & \quad + \\
\text{HCl} & \quad \rightarrow \\
\text{H} & \quad \text{N} \\
\text{O} & \quad + \\
\end{align*}
\]

e.  \[
\begin{align*}
\text{CH}_3\text{C}_2\text{O}_2\text{H} & \quad + \\
\text{NH}_2 & \quad \rightarrow \\
\end{align*}
\]