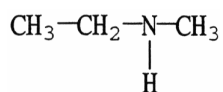


MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) What is the IUPAC name of the compound shown?

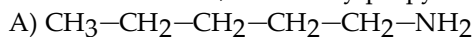
1) _____



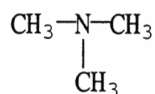
- A) N-methylethylamine
- B) 2-propylamine
- C) 1-methylethylamine
- D) propylamine
- E) isopropylamine

2) Which molecule is N,N-dimethylpropylamine?

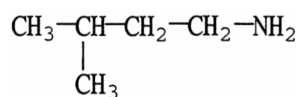
2) _____



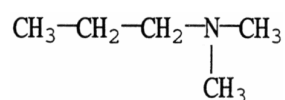
B)



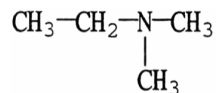
C)



D)

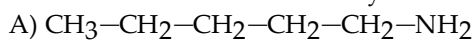


E)

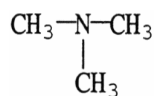


3) Which molecule shown is trimethylamine?

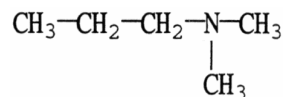
3) _____



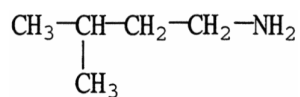
B)



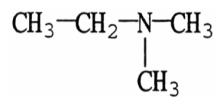
C)



D)



E)

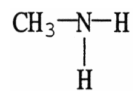


- 4) Which molecule shown is N,N-dimethylethylamine? 4) _____
- A) $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-NH}_2$
- B)
- $$\begin{array}{c} \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-N-CH}_3 \\ | \\ \text{CH}_3 \end{array}$$
- C)
- $$\begin{array}{c} \text{CH}_3\text{-CH}_2\text{-N-CH}_3 \\ | \\ \text{CH}_3 \end{array}$$
- D)
- $$\begin{array}{c} \text{CH}_3\text{-CH-CH}_2\text{-CH}_2\text{-NH}_2 \\ | \\ \text{CH}_3 \end{array}$$
- E)
- $$\begin{array}{c} \text{CH}_3\text{-N-CH}_3 \\ | \\ \text{CH}_3 \end{array}$$
- 5) When the nitrogen atom in an organic compound has four covalent bonds, it is called a 5) _____
- A) quaternary ammonium ion.
- B) tertiary amine.
- C) secondary amine.
- D) tetraamine.
- E) primary amine.
- 6) All of the following compounds are amines **except** 6) _____
- A) histamine.
- B) amphetamine.
- C) aniline.
- D) aspirin.
- E) caffeine.
- 7) Which compound is a secondary amine? 7) _____
- A) diethylamine
- B) trimethylamine
- C) N-ethyl-N-methylpropylamine
- D) N,N-dimethylethylamine
- E) isopropylamine
- 8) Which compound is a primary amine? 8) _____
- A) trimethylamine
- B) isopropylamine
- C) diethylamine
- D) N-ethyl-N-methylpropylamine
- E) N,N-dimethylethylamine

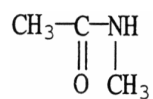
9) Which of the following molecules is an example of a primary amine?

9) _____

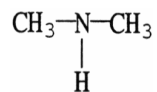
A)



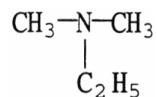
B)



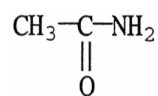
C)



D)



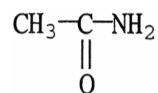
E)



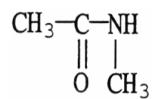
10) Which of the following molecules is an example of a secondary amine?

10) _____

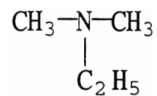
A)



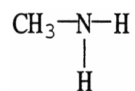
B)



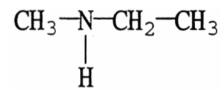
C)



D)



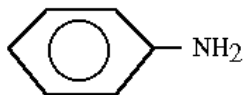
E)



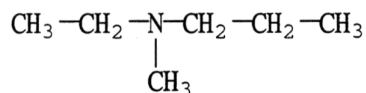
11) Which molecule is a tertiary amine?

11) _____

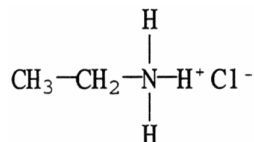
A)



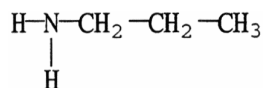
B)



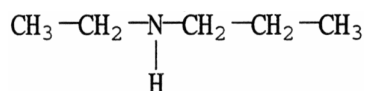
C)



D)



E)



12) Amines are classified by _____

12) _____

- A) the number of hydrogens attached to the nitrogen.
- B) the number of alkyl groups attached to the nitrogen.
- C) the number of carbons attached to the carbon bonded to the nitrogen.
- D) the number of carbons present in the molecule.
- E) none of the above

13) Amines are most similar in chemical structure and behavior to

13) _____

- A) a primary alcohol.
- B) the hydronium ion.
- C) water.
- D) ammonia.
- E) sodium hydroxide.

14) Amines can be considered organic derivatives of the inorganic compound

14) _____

- A) water.
- B) carbon dioxide.
- C) ammonia.
- D) sodium hydroxide.
- E) none of these

15) Which organic functional group is important for its basic properties?

15) _____

- A) amine
- B) aromatic
- C) carbonyl
- D) phenol
- E) hydroxyl

16) All of the following are properties of amines **except** 16) _____

A) They react with acids to form amides.

B) They frequently have offensive odors.

C) Those that can form hydrogen bonds have higher boiling points than expected for their molecular weight.

D) Those with low molecular weights are soluble in water.

E) They act as bases in many reactions.

17) Which amine has the **lowest** boiling point? 17) _____

- A)
- $$\begin{array}{c} \text{CH}_3-\text{N}-\text{CH}_2-\text{CH}_3 \\ | \\ \text{H} \end{array}$$
- B)
- $$\begin{array}{c} \text{CH}_3-\text{CH}_2-\text{N}-\text{CH}_2-\text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$$
- C)
- $$\begin{array}{c} \text{CH}_3-\text{CH}_2-\text{N}-\text{CH}_2-\text{CH}_3 \\ | \\ \text{H} \end{array}$$
- D)
- $$\begin{array}{c} \text{CH}_3-\text{N}-\text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$$
- E)
- $$\begin{array}{c} \text{H}-\text{N}-\text{CH}_2-\text{CH}_2-\text{CH}_3 \\ | \\ \text{H} \end{array}$$

18) Which amine has the **highest** boiling point? 18) _____

- A)
- $$\begin{array}{c} \text{H}-\text{N}-\text{CH}_2-\text{CH}_2-\text{CH}_3 \\ | \\ \text{H} \end{array}$$
- B)
- $$\begin{array}{c} \text{CH}_3-\text{CH}_2-\text{N}-\text{CH}_2-\text{CH}_2-\text{CH}_3 \\ | \\ \text{H} \end{array}$$
- C)
- $$\begin{array}{c} \text{CH}_3-\text{N}-\text{CH}_2-\text{CH}_3 \\ | \\ \text{H} \end{array}$$
- D)
- $$\begin{array}{c} \text{CH}_3-\text{CH}_2-\text{N}-\text{CH}_2-\text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$$
- E)
- $$\begin{array}{c} \text{CH}_3-\text{N}-\text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$$

19) Which class of amines can form intermolecular hydrogen bonds?

19) _____

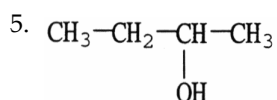
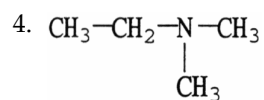
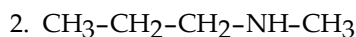
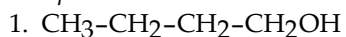
- A) 1°
- B) 3°
- C) 2°
- D) A and B
- E) all of the above

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

20) Arrange the following compounds in order of increasing boiling point. List and describe the criteria that must be considered in answering this question.

20) _____

Compounds



MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

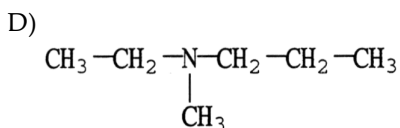
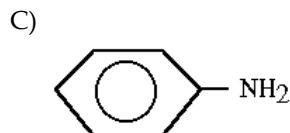
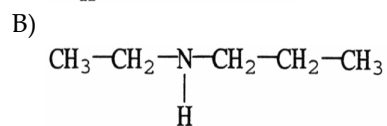
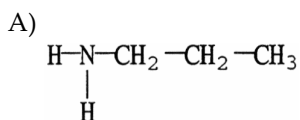
21) Which molecule listed is heterocyclic?

21) _____

- A) benzoic acid
- B) pyridine
- C) aniline
- D) naphthalene
- E) phenol

22) Which molecule is a heterocyclic compound?

22) _____



E) none of these

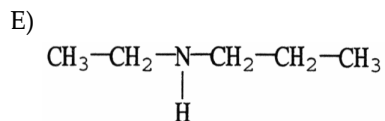
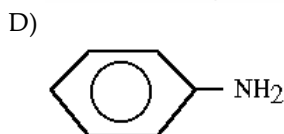
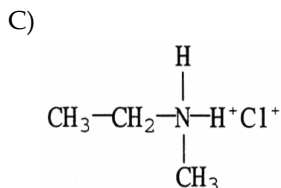
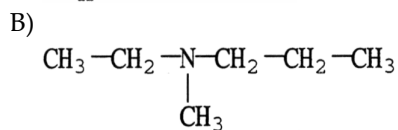
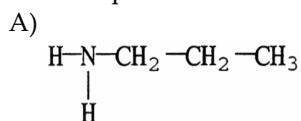
- 23) The reaction that occurs between an amine and an acid is best illustrated by 23) _____
- A) $(\text{CH}_3)_2\text{NH} + \text{HCl} \rightarrow (\text{CH}_3)_2\text{NH}_2^+ + \text{OH}^-$.
 B) $(\text{CH}_3)_2\text{NH} + \text{HCl} \rightarrow (\text{CH}_3)_2\text{N}^+\text{Cl}^-$.
 C) $(\text{CH}_3)_2\text{NH} + \text{HCl} \rightarrow (\text{CH}_3)_2\text{NH Cl}^- + \text{H}_3\text{O}^+$.
 D) $(\text{CH}_3)_2\text{NH} + \text{HCl} \rightarrow (\text{CH}_3)_2\text{NH}_2^+\text{Cl}^-$.
 E) $(\text{CH}_3)_2\text{NH} + \text{H}_2\text{O} \rightarrow (\text{CH}_3)_2\text{N} + \text{H}_3\text{O}^+$.
- 24) Which formula best represents the form an amine takes in acidic solution? 24) _____
- A) RNH_3^+ B) RNH^- C) RNH_2 D) RNH_2^+ E) RNH_2^-
- 25) Which formula best represents the form an amine takes in basic solution? 25) _____
- A) RNH^- B) RNH_3^+ C) RNH_2^- D) RNH_2^+ E) RNH_2
- 26) When an amine behaves as a base it _____ a hydrogen ion to form a(an) _____ ion. 26) _____
- A) loses; hydronium
 B) loses; ammonium
 C) gains; hydronium
 D) loses; hydroxide
 E) gains; ammonium
- 27) The reaction of an amine with water is best represented by 27) _____
- A) $\text{R-NH}_2 + \text{H}_2\text{O} \rightleftharpoons \text{R-NH}_3^+ + \text{OH}^-$.
 B) $\text{R-NH}_2 + 2 \text{H}_2\text{O} \rightleftharpoons \text{R-N}^{2-} + 2 \text{H}_3\text{O}^+$.
 C) $\text{R-NH}_2 + \text{H}_2\text{O} \rightleftharpoons \text{R-N}^{2-} + \text{M}^+ + \text{H}_3\text{O}^+$.
 D) $\text{R-NH}_2 + 2 \text{H}_2\text{O} \rightleftharpoons \text{R-N}_4^{2+} + 2 \text{OH}^-$.
 E) $\text{R-NH}_2 + \text{H}_2\text{O} \rightleftharpoons \text{R-NH}^- + \text{H}_3\text{O}^+$.
- 28) What is the most important physical property of amines? 28) _____
- A) they are weak bases
 B) they are oxidizing acids
 C) they are weak acids
 D) they are strong acids
 E) they are strong bases
- 29) Which type of amine will react with mineral acids to form soluble ammonium salts? 29) _____
- A) 3°
 B) 2°
 C) 1°
 D) A and B
 E) A, B and C

30) Which compound is an example of an amine salt? 30) _____
A) sulfanilamide
B) methylammonium chloride
C) histamine
D) pyridoxine
E) thioacetamide

31) If methylamine reacts with hydrochloric acid, the major product will be 31) _____
A) dimethylammonium chloride.
B) trimethylammonium chloride.
C) methylammonium chloride.
D) ammonium chloride.
E) methylammonium hydroxide.

32) Lemon juice can be used to remove the odor of fish on a person's hands after cleaning fish. The chemical explanation for this is that the 32) _____
A) acid in the lemon juice increases the volatility of the odor-causing amines.
B) lemon juice dilutes the odor-causing amines.
C) acid in the lemon juice reacts with the odor-causing amines to form an odorless salt.
D) lemon juice removes the bitter flavor often associated with nitrogen compounds.
E) pleasant odor of the lemon juice covers the fishy odor.

33) Which compound is an example of an amine salt? 33) _____



- 34) The reaction of the pyridinium ion with water is best represented as 34) _____
- A) $C_5H_5N + H_2O \rightleftharpoons C_5H_6N^+ + OH^-$
 - B) $C_5H_5N + H_2O \rightleftharpoons C_5H_4N + H_3O^+$
 - C) $C_5H_5NH^+ + H_2O \rightleftharpoons C_5H_5NH_2^{2+} + OH^-$
 - D) $C_5H_5NH^+ + H_2O \rightleftharpoons C_5H_5N + H_3O^+$
 - E) None of these
- 35) All of the following are characteristics of alkaloids except 35) _____
- A) physiologically active
 - B) toxic to humans in high doses
 - C) basic
 - D) bitter tasting
 - E) pleasant smelling
- 36) All of the following are nitrogen-containing compounds found in living organisms **except** 36) _____
- A) proteins.
 - B) alkaloids.
 - C) carbohydrates.
 - D) nucleotides.
 - E) neurotransmitters.

Answer Key

Testname: UNTITLED1

- 1) A
- 2) D
- 3) B
- 4) C
- 5) A
- 6) D
- 7) A
- 8) B
- 9) A
- 10) E
- 11) B
- 12) B
- 13) D
- 14) C
- 15) A
- 16) A
- 17) D
- 18) B
- 19) D

20) $3 < 4 < 2 < 5 < 1$;

Criteria considered include:

1. molar mass, but in this case all were similar
2. polarity and possibility for hydrogen bonding: #3 is nonpolar; #4 is polar but cannot form hydrogen bonds; #2 is polar, but its hydrogen bonds will be weaker than those in an alcohol; #5 is a secondary alcohol, so will form fewer hydrogen bonds than its primary isomer

- 21) B
- 22) E
- 23) D
- 24) A
- 25) E
- 26) E
- 27) A
- 28) A
- 29) E
- 30) B
- 31) C
- 32) C
- 33) C
- 34) D
- 35) E
- 36) C