1. Molecules of 1-propanol and 2-propanol have different (1) percentage compositions; (2) molecular masses; (3) molecular formulas; (4) structural formulas.

2. Which compound is an organic acid? (1) CH₃CH₂OH; (2) CH₃OCH₃; (3) CH₃COOH; (4) CH₃COOCH₃.

3. Each member of the alkane series differs from the preceding member by one additional carbon atom and (1) 1 hydrogen atom; (2) 2 hydrogen atoms; (3) 3 hydrogen atoms; (4) 4 hydrogen atoms.

4. Which formula represents a saturated hydrocarbon? (1) C₂H₂; (2) C₂H₄; (3) C₃H₆; (4) C₃H₈.

5. The members of the alkane series of hydrocarbons are similar in that each member has the same (1) empirical formula; (2) general formula; (3) structural formula; (4) molecular formula.

6. What could be the name of a compound that has the general formula R-OH? (1) methanol; (2) methane; (3) methyl methanoate; (4) methanoic acid.

7. A compound with the formula C₆H₆ is (1) toluene; (2) benzene; (3) butene; (4) pentene.

8. C₂H₄ + H₂ ⇌ C₂H₆ The above reaction is an example of (1) addition; (2) substitution; (3) saponification; (4) esterification.

9. The compound C₄H₉OH is an isomer of (1) C₃H₇COCH₃; (2) C₂H₅OC₂H₅; (3) CH₃COOC₂H₅; (4) CH₃COOH.

10. What is the total number of carbon atoms contained in an ethyl group? (1) 1; (2) 2; (3) 3; (4) 4.

11. Which compound is a member of the alkane series? (1) C₂H₆; (2) C₃H₈; (3) C₄H₁₀; (4) C₆H₁₄.

12. A reaction between an acid and alcohol produces an ester and (1) carbon dioxide; (2) water; (3) glycerol; (4) ethanol.

13. The general formula for the alkyne series is (1) CₙHₙ; (2) CₙH₂ₙ; (3) CₙH₂ₙ₊₂; (4) CₙH₂ₙ₋₂.

14. Which compound represents a member of the benzene series? (1) acetylene; (2) ethylene; (3) toluene; (4) propene.

15. Which compound is an isomer of CH₃COOH? (1) HCOOCH₃; (2) CH₃CH₂OH; (3) CH₃CH₂COOH; (4) CH₃COOCH₃.

16. Which compound is a member of the alkene series? (1) benzene; (2) acetylene; (3) toluene; (4) ethene.

17. All carbon-carbon bonds in a saturated hydrocarbon molecule are (1) single
covalent; (2) double covalent; (3) triple covalent; (4) coordinate covalent.

18. Which normal alkene has the highest boiling point at 1 atmosphere? (1) \( \text{C}_2\text{H}_4 \); (2) \( \text{C}_3\text{H}_6 \); (3) \( \text{C}_4\text{H}_8 \); (4) \( \text{C}_5\text{H}_{10} \).

19. Which reaction produces ethyl alcohol as one of the principal products? (1) an esterification reaction; (2) a neutralization reaction; (3) a saponification reaction; (4) a fermentation reaction.

20. Given the following reaction: \( \text{C}_4\text{H}_{10} + \text{Br}_2 \xrightleftharpoons{} \text{C}_4\text{H}_9\text{Br} + \text{HBr} \). The above reaction is an example of (1) substitution; (2) addition; (3) polymerization; (4) fermentation.

21. In a molecule of \( \text{C}_3\text{H}_8 \) the total number of covalent bonds is (1) 11; (2) 10; (3) 3; (4) 8.

22. Which compound is an ester? (1) \( \text{CH}_3\text{COOH} \); (2) \( \text{CH}_3\text{CHO} \); (3) \( \text{CH}_3\text{COOCH}_3 \); (4) \( \text{CH}_3\text{COCH}_3 \).

23. The fermentation of \( \text{C}_6\text{H}_{12}\text{O}_6 \) will produce carbon dioxide and (1) a polymer; (2) a soap; (3) an ester; (4) an alcohol.

24. Compounds which have the same molecular formula but different molecular structures are called (1) isomers; (2) isotopes; (3) allotropes; (4) homologs.

25. Which is the formula of a saturated hydrocarbon? (1) \( \text{C}_2\text{H}_4 \); (2) \( \text{C}_2\text{H}_6 \); (3) \( \text{C}_5\text{H}_8 \); (4) \( \text{C}_5\text{H}_{12} \).

26. \( \text{C}_n\text{H}_{2n+2} \) is the general formula of a homologous series. Which is a member with this characteristic? (1) acetylene; (2) benzene; (3) propane; (4) toluene.

27. A molecule of ethene is similar to a molecule of methane in that they both have the same (1) structural formula; (2) molecular formula; (3) number of carbon atoms; (4) number of hydrogen atoms.

28. Which is the formula for ethanoic acid? (1) \( \text{CH}_3\text{COOH} \); (2) \( \text{CH}_3\text{CH}_2\text{OH} \); (3) \( \text{CH}_3\text{CH}_2\text{COOH} \); (4) \( \text{CH}_3\text{CH}_2\text{CH}_2\text{OH} \).

29. The compound \( \text{CH}_3\text{COOCH}_3 \) is classified as (1) an acid; (2) an alcohol; (3) an ester; (4) a hydrocarbon.

30. Each member in the alkane series of hydrocarbons, when considered in successive order, has 1 more carbon atom and how many more hydrogen atoms? (1) 1; (2) 2; (3) 3; (4) 4.

31. Which molecular formula represents pentene? (1) \( \text{C}_4\text{H}_8 \); (2) \( \text{C}_4\text{H}_{10} \); (3) \( \text{C}_5\text{H}_{10} \); (4) \( \text{C}_5\text{H}_{12} \).

32. A molecule of which alcohol contains more than one hydroxyl group? (1) propanol; (2) butanol; (3) pentanol; (4) glycerol.

33. Hydrogen bonding is most noticeable in (1) organic acids; (2) esters; (3) alkynes; (4) alkanes.
34. Which molecule contains a triple covalent bond?  (1) C₂H₆; (2) C₂H₄; (3) C₃H₆; (4) C₃H₈.

35. Which formula represents an acid?  (1) CH₃COOCH₃; (2) CH₂OH; (3) CH₃COOH; (4) CH₃CH₂CH₃.

36. Ethyl formate can be produced by heating concentrated sulfuric acid, ethyl alcohol and formic acid. This type of reaction is called (1) fermentation; (2) esterification; (3) saponification; (4) polymerization.

37. Which formula represents a member of the alkene series?  (1) C₂H₆; (2) C₂H₄; (3) C₃H₆; (4) C₆H₆.

38. Ethyne (acetylene) has which one of the following shapes?  (1) tetrahedral; (2) planar triangular; (3) linear; (4) bent.

39. Compared with organic compounds in general, organic compounds usually have (1) greater solubility in water; (2) a tendency to form ions more readily; (3) more rapid reaction rates; (4) lower melting points.

40. Which represents the functional group of an organic acid?  (1) -COOH; (2) -OR; (3) -CHO; (4) -NH₂.

41. C₃H₆ + H₂ = C₃H₈ The above reaction is an example of (1) substitution; (2) addition; (3) polymerization; (4) esterification.

42. The isomers of propanol differ in (1) the number of carbon atoms; (2) molecular mass; (3) the arrangement of the carbon atoms; (4) the type of functional group.

43. Which is the formula of an alcohol?  (1) Ba(OH)₂; (2) HCHO; (3) CH₃COOH; (4) C₅H₁₁OH.

44. C₅H₅(OH)₃ The above organic compound is classified as (1) a carbohydrate; (2) an ester; (3) an organic acid; (4) an alcohol.

45. Which compound can have isomers?  (1) C₂H₄; (2) C₂H₂; (3) C₂H₆; (4) C₄H₈.

46. C₃H₄ + Br₂ = ? What reaction occurs when the above chemicals react? (1) polymerization; (2) substitution; (3) addition; (4) esterification.

47. Which organic compound is a product of a fermentation reaction?  (1) CCl₂F₂; (2) C₂H₂; (3) C₂H₅OH; (4) C₂H₅OC₂H₅.

48. Which organic compound is a product of an esterification reaction?  (1) C₃H₆; (2) C₃H₅OH; (3) CH₃COOH; (4) CH₃COOCH₃.

49. Which organic compound is a product of a saponification reaction?  (1) CCl₄; (2) C₃H₅(OH)₂; (3) C₆H₆; (4) C₆H₁₂O₆.

50. The structure of an alkene contains (1) only single bonds; (2) a double bond; (3) two double bonds; (4) a triple bond.

51. As the members of the alkane series increase in molecular mass the magnitude of the van der Waals forces between the molecules (1) decreases; (2) increases;
52. Which hydrocarbon has more than one possible structural formula? (1) CH₄; (2) C₂H₆; (3) C₃H₈; (4) C₄H₁₀r

53. What is the number of hydrogen atoms in a molecule of ethyne? (1) 6; (2) 2; (3) 8; (4) 4.

54. In an aqueous solution, which compound will be acidic? (1) CH₃COOH; (2) C₃H₅(OH); (3) CH₃CH₂OH; (4) CH₃OH.

55. A process in which large molecules are broken down into smaller molecules is used commercially to increase the yield of gasoline from petroleum. This process is called (1) polymerization; (2) hydrogenation; (3) esterification; (4) cracking.

56. Organic compounds must contain (1) oxygen; (2) nitrogen; (3) hydrogen; (4) carbon.

57. The angle formed between any two carbon-hydrogen bonds in a molecule of an organic compound is a(an) (1) dihedral angle; (2) right angle; (3) tetrahedral angle; (4) acute angle.

58. A specific arrangement of several atoms which gives characteristic properties to an organic molecule is known as a(an) (1) carboxyl group; (2) functional group; (3) group; (4) alkyl group.

59. The ability of the carbon atom to form covalent bonds result in the formation of compounds that are (1) molecular; (2) ionic; (3) polar; (4) atomic.

60. How many carbon atoms are in one molecule of 2,3,3-trimethyl-pentane? (1) 5; (2) 8; (3) 6; (4) 13.

61. The series of unsaturated hydrocarbons containing a triple bond shared between two adjacent carbon atoms is known as the (1) alkanes; (2) alkenes; (3) alkynes; (4) benzenes.

62. Addition reactions occur in unsaturated hydrocarbons rather than in saturated hydrocarbons because unsaturated hydrocarbons (1) contain multiple bonds; (2) have a greater molecular mass; (3) have tetrahedral bonds; (4) contain more atoms.

63. A dihydroxy alcohol that is made from ethane is (1) ethanol; (2) glycerol; (3) ethylene glycol; (4) ethane.

64. A long chain protein is an example of a(an) (1) fat; (2) polymer; (3) isomer; (4) monomer.

65. Which represents an unsaturated hydrocarbon? (1) C₄H₄; (2) C₅H₁₀; (3) C₃H₆; (4) C₄H₁₀r.

66. How many double bonds are in one molecule of 1,3-butadiene? (1) 1; (2) 2; (3) 3; (4) 4.

67. Which is an isomer of 2-chloropropane? (1) butane; (2) propane; (3) 1-chlorobutane; (4) 1-chloropropane.
68. A fermentation reaction and a saponification reaction are similar in that they both can produce (1) an ester; (2) an alcohol; (3) an acid; (4) a soap.

69. Which is a saturated hydrocarbon? (1) \( \text{C}_3\text{H}_8 \); (2) \( \text{C}_6\text{H}_{16} \); (3) \( \text{C}_2\text{H}_5\text{OH} \); (4) \( \text{C}_2\text{H}_4\text{O}_2 \).

70. Which molecule will have a single pi bond? (1) benzene; (2) propene; (3) propane; (4) propyne.

71. \( \text{CH}_3\text{CH}_2\text{OH} \) The above organic compound is classified as (1) a carbohydrate; (2) an ester; (3) an alcohol; (4) an organic acid.

72. Which organic molecule undergoes resonance? (1) benzene; (2) propyne; (3) methane; (4) ethanol.

73. As the molecular mass of the compounds of the alkane series increases their boiling points (1) decreases; (2) increases; (3) remains the same.

74. As the number of carbon atoms in the members of the alkene series increases, the ratio of carbon atoms to hydrogen atoms (1) decreases; (2) increases; (3) remains the same.

75. Which compound is most likely to react by addition? (1) \( \text{CH}_4 \); (2) \( \text{C}_3\text{H}_6 \); (3) \( \text{C}_4\text{H}_{10} \); (4) \( \text{C}_5\text{H}_{12} \).

76. Which alcohol contains three hydroxyl groups per molecule? (1) propanol; (2) glycerol; (3) butanol; (4) pentanol.

77. Toluene belongs to the same series of hydrocarbons as (1) benzene; (2) propene; (3) pentene; (4) butene.

78. A hydrocarbon molecule containing one triple covalent bond is classified as an (1) alkene; (2) alkane; (3) alkyne; (4) alkadiene.

79. Both cellulose and proteins are classified as (1) aldehydes; (2) esters; (3) polymers; (4) ketones.

80. The compound 2-propanol is classified as a (1) primary alcohol; (2) secondary alcohol; (3) tertiary alcohol; (4) dihydroxy alcohol.

81. What is the total number of hydrogen atoms in a molecule of butene? (1) 10; (2) 8; (3) 6; (4) 4.

82. Which of the following compounds has the greatest possible number of isomers? (1) butane; (2) ethane; (3) pentane; (4) propane.

83. Which is the correct molecular formula of pentene? (1) \( \text{C}_5\text{H}_6 \); (2) \( \text{C}_5\text{H}_{10} \); (3) \( \text{C}_5\text{H}_{12} \); (4) \( \text{C}_5\text{H}_{14} \).

84. The bonds between the atoms in an organic molecule are generally (1) ionic; (2) coordinate covalent; (3) covalent; (4) hydrogen.

85. As the length of the chain of carbon atoms in molecules of the alkene series increases, the number of double bonds per molecule (1) decreases; (2) increases;
86. In a condensation polymerization, the two products formed are a polymer and (1) water; (2) carbon dioxide; (3) an acid; (4) a base.

87. Which is the correct molecular formula of 1,2-ethanediol? (1) C₂H₅OH; (2) C₂H₄(OH)₂; (3) C₃H₉(OH)₃; (4) C₄H₆(OH)₂.

88. In the reaction C₂H₅OH + CH₃OH → C₂H₅OCH₃ + H₂O, the organic compound formed is (1) an ester; (2) a ketone; (3) an acid; (4) an ether.

89. Which compound is a saturated hydrocarbon? (1) ethene; (2) ethane; (3) ethylene; (4) ethyne.

90. The compound C₄H₂ belongs to the series of hydrocarbons with the general formula (1) CₙHₙ; (2) CₙH₂ₙ; (3) CₙH₂ₙ₋₂; (4) CₙH₂ₙ₊₂.

91. Which compound is a dihydroxy alcohol? (1) Al(OH)₃; (2) C₃H₅(OH)₂; (3) Ca(OH)₂; (4) C₂H₄(OH)₂.

92. The name of the compound having the formula C₃H₅(OH)₃ is (1) glycerol; (2) ethylene glycol; (3) propene; (4) propanoic acid.

93. Which organic compound is a ketone? (1) CH₃OH; (2) CH₃COCH₃; (3) CH₃COOH; (4) CH₃COOCH₃.

94. Which of the following compounds has the lowest normal boiling point? (1) butane; (2) ethane; (3) methane; (4) propane.

95. Which process increases the yield of gasoline and kerosene from crude oil? (1) oxidation; (2) cracking; (3) Haber; (4) contact.

96. Organic compounds that are essentially nonpolar and exhibit weak intermolecular forces have (1) low melting points; (2) low vapor pressure; (3) high conductivity in solution; (4) high boiling points.

97. What is the formula for pentanol? (1) C₅H₁₂; (2) C₅H₁₁OH; (3) C₅H₁₀; (4) C₄H₉OH.

98. Which compound is a member of the alkene series of hydrocarbons? (1) benzene; (2) propene; (3) toluene; (4) butadiene.

99. Which compound contains a triple bond? (1) CH₄; (2) C₂H₂; (3) C₃H₆; (4) C₄H₁₀.

100. Which organic reaction involves the bonding of monomers by a dehydration process? (1) substitution; (2) oxidation; (3) addition polymerization; (4) condensation polymerization.

101. In crude petroleum, fractions can be separated according to their differing boiling points by (1) the contact process; (2) the Haber process; (3) fractional distillation; (4) cracking.