Ordinary Thinking

Objective Questions

Alkane

1. Which represents an alkane **[CPMT 1976]**

(a) C_5H_8 (b) C_8H_6

(c) C_9H_{10} (d) C_7H_{16}

2. The decreasing order of boiling points is **[BHU 1999]**

(a) *n*-Pentane > iso-Pentane > neo-Pentane

(b) iso-Pentane > *n*-Pentane > neo-Pentane

(c) neo-Pentane > iso-Pentane > *n*-Pentane

(d) *n*-Pentane > neo-Pentane > iso-Pentane

3. To prepare a pure sample of n-hexane using sodium metal as one reactant, the other reactant will be **[BHU 1999]**

(a) *n*-propyl bromide

(b) Ethyl bromide and *n*-butyl bromide

(c) Ethyl chloride and *n*-butyl chloride

(d) Methyl bromide and *n* -pentyl chloride

4. In the preparation of Grignard reagent from haloalkane, the metal **[RPET 1999]**

(a) Mg (b) Zn

(c) Li (d) K

5. Sodium acetate can be converted to ethane by **[Pune CET 1998]**

(a) Heating with $LiAlH_4$

(b) Electrolysing its aqueous solution

(c) Heating with sodalime

(d) Heating with calcium acetate

6. Which of the following compounds is used in antiknock compositions to prevent the deposition of oxides of lead on spark plug, combustion chamber and exhaust pipe **[KCET 1998]**

(a) Glycerol (b) Glycol

(c) 1, 2-dibromoethane (d) Benzene

7. Which of petroleum corresponds to kerosene oil **[DCE 1999]**

(a) $C_{15}-C_{18}$ (b) $C_{10}-C_{12}$

(c) C_5-C_9 (d) C_1-C_9

8. In the reaction $CH_3-Br+2Na+Br-CH_3 \rightarrow$, the product called **[Pb. CET 1999; CPMT 1983. 86; KCET 1992; MP PMT 1994; BHU 1998; MP PMT 2002; MP PET 1986]**

(a) Wurtz reaction (b) Aldol condensation

(c) Perkin's reaction (d) Levit reaction

9. Iodoethane reacts with sodium in the presence of dry ether. The product is **[AFMC 1997; KCET 1998]**

(a) Pentane (b) Propane

(c) Butene (d) Butane

10. Which of the following is oxidised by $KMnO_4$

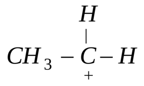
(a) Methane (b) Pentane

(c) Isobutane (d) Neopentane

11. Which of the following has maximum stability **[AIIMS 2001**

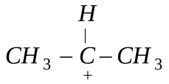
(a) $\overset{+}{C}H_3$

(b)



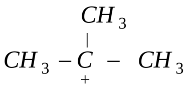
$CH_3-\underset{+}{\overset{\overset{H}{|}}{C}}-H$

(c)



$CH_3-\underset{+}{\overset{\overset{H}{|}}{C}}-CH_3$

(d)



$CH_3-\underset{+}{\overset{\overset{CH_3}{|}}{C}}-CH_3$

12. The most volatile compound is **[DPMT 2000]**

(a) 2, 2-dimethyl propane (b) 2-methyl butane

(c) Isobutane (d) *n*-pentane

13. In Wurtz reaction, the reagent used is **[EAMCET 1998]**

(a) Na (b) $Na/\text{liquid } NH_3$

(c) $Na/\text{dry ether}$ (d) $Na/\text{dry alcohol}$

14. Which of the following has highest octane number **[MP PMT 2000]**

(a) *n*-hexane (b) *n*-heptane

(c) *n*-pentane (d) 2, 2, 4-trimethyl pentane

15. What is freon-12 **[RPET 1999]**

(a) Pesticide (b) Refrigerant

(c) Solvent (d) Lubricant

16. The petrol having octane number 80 has **[MP PET 2000]**

(a) 20% normal heptane + 80% iso-octane

(b) 80% normal heptane + 20% iso-octane

(c) 20% normal heptane + 80% normal octane

(d) 80% normal heptane + 20% normal octane

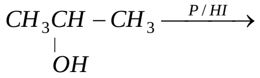
17. Which of the following reactions will not give propane **[DPMT 2005]**

(a) $CH_3CH_2CH_2Cl \xrightarrow[H_2O]{Mg/\text{ether}}$

(b) $CH_3COCl \xrightarrow[H_2O]{CH_3MgX}$

(c) $CH_3CH=CH_2 \xrightarrow[CH_3COOH]{B_2H_6}$

(d)



$CH_3\underset{\underset{OH}{|}}{CH}-CH_3 \xrightarrow{P/HI}$

18. The shape of methane molecule is **[MP PET 1997, 2001]**

(a) Linear (b) Trigonal planar

(c) Square planar (d) Tetrahedral

19. Which of the following shows only one brominated compound **[CPMT 1996]**

(a) Butene-2 (b) 2, 2-dimethylpropane

(c) Butyne-1 (d) Butanol-3

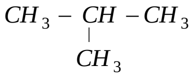
20. Kerosene is used as fuel because it is **[CPMT 1996]**

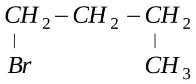
(a) Less volatile (b) More volatile

(c) Cheap (d) Abundantly available

21. $CH_3-CH_2-CH_2-CH_3 \xrightarrow[HBr]{AlCl_3} \text{Product}$. Product in above reaction is **[RPMT 2003]**

(a) 
$CH_3-\underset{\underset{Br}{|}}{CH}-CH_2-CH_3$

(b) 
$CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_3$

(c) 
$\underset{\underset{Br}{|}}{CH_2}-CH_2-\underset{\underset{CH_3}{|}}{CH_2}$

(d) All of these

22. Which of the following statements is not true for ethane **[AIIMS 1996]**

(a) It can be chlorinated with chlorine

(b) It can be catalytically hydrogenated

(c) When oxidised produces CO_2 and H_2O

(d) It is a homologue of iso-butane

23. Petroleum refining is **[AIIMS 1996; KCET 2004]**

(a) Distillation of petroleum to get different fractions

(b) Obtaining aromatic compounds from aliphatic compounds present in petroleum

(c) Cracking of petroleum to get gaseous hydrocarbons

(d) Purification of petroleum

24. The chemical added to leaded petrol to prevent the deposition of lead in the combustion chamber is **[Kerala (Med.) 2003]**

(a) Iso-octane (b) Ethylene dibromide

(c) Tetraethyl lead (d) Mercaptan

(e) *n*-Heptane

25. In the commercial gasolines, the type of hydrocarbons which are more desirable is**[CBSE PMT 1997; AFMC 1997]**

(a) Branched hydrocarbon

(b) Straight-chain hydrocarbon

(c) Linear unsaturated hydrocarbon

(d) Toluene

26. Which of the following is not formed by the reaction of Cl_2 on CH_4 in sunlight **[AIIMS 1987]**

(a) $CHCl_3$ (b) CH_3Cl

(c) CH_3CH_3 (d) $CH_3CH_2CH_3$

27. Which of the following has the highest boiling point **[DPMT 1986]**

(a) Neopentane (b) *n*-butane

(c) *n*-heptane (d) Isobutane

28. Which gives CH_4 when treated with water **[CPMT 1974, 79; NCERT 1976; IIT-JEE 1990]**

(a) Silicon carbide (b) Calcium carbide

(c) Aluminium carbide (d) Iron carbide

29. Which of the following does not react with PCl_5 **[CPMT 1973]**

(a) CH_3OH (b) CH_3COOH

(c) CH_3CHO (d) C_2H_6

30. Which of the following compounds is insoluble even in hot concentrated H_2SO_4 **[IIT-JEE 1983]**

(a) Ethylene (b) Benzene

(c) Hexane (d) Aniline

31. A reaction between methyl magnesium bromide and ethyl alcohol gives**[CPMT 1979; MNR 1986; UPSEAT 199**

(a) Methane (b) Ethane

(c) Propane (d) Butane

32. Methane and ethane both can be obtained in single step from **[CPMT 1974; MP PET 1995; AFMC 1998, 2000; BHU 2005]**

(a) CH_3I (b) C_2H_5I

(c) CH_3OH (d) C_2H_5OH

33. Paraffin wax is **[MP PMT 1986; CPMT 1993]**

(a) Ester

(b) Alcohol

(c) Unsaturated hydrocarbon

(d) Saturated hydrocarbon

34. The number of possible enantiomeric pairs that can be produced during monochlorination of 2-methylbutane is **[IIT-JEE 1997]**

(a) 2 (b) 3

(c) 4 (d) 1

35. Petroleum consists mainly of**[CPMT 1985, 94; KCET 1991]**

(a) Aliphatic hydrocarbons (b)Aromatic hydrocarbons

(c) Aliphatic alcohols (d) None of these

36. Petroleum ether can be used as

(a) Solvent for fat, oil, varnish and rubber

(b) As a fuel

(c) Both (a) and (b)

(d) None of these

37. Which of the following are produced from coaltar **[MNR 1987; UPSEAT 2002]**

(a) Synthetic dyes (b) Drugs

(c) Perfumes (d) All the three

38. In alkanes, the bond angle is**[MP PMT 1989; BHU 1996]**

(a) 109.5^o (b) 109^o

(c) 120^o (d) 180^o

39. In the preparation of alkanes; a concentrated aqueous solution of sodium or potassium salts of saturated carboxylic acid are subjected to**[CPMT 1985; MP**

(a) Hydrolysis (b) Oxidation

(c) Hydrogenation (d) Electrolysis

40. Halogenation of alkanes is an example of **[MP PET 1993; KCET 1998]**

(a) Electrophilic substitution

(b) Nucleophilic substitution

(c) Free-radical substitution

(d) Oxidation

41. Propionic acid is subjected to reduction with hydroiodic acid in the presence of a little *P*, the product formed is

[JIPMER 1997]

(a) Ethane (b) Propane

(c) Butane (d) None of these

42. When ethyl iodide and propyl iodide react with *Na* in the presence of ether, they form **[BHU 1997]**

(a) One alkane (b) Two alkanes

(c) Four alkanes (d) Three alkanes

43. The alkane that yields two isomeric monobromo derivatives is

(a) Neopentane (b) Ethane

(c) Methane (d) Propane

44. Kerosene is a mixture of **[CPMT 1979; AFMC 1992]**

(a) Alkanes (b) Aromatic compounds

(c) Alcohols (d) Aliphatic acids

45. When petroleum is heated the vapours contain mainly

[CPMT 1981]

(a) Kerosene (b) Petroleum ether

(c) Diesel (d) Machine oil

46. Iso-octane is mixed to the petrol **[NCERT 1972]**

(a) To precipitate inorganic substances

(b) To prevent freezing of petrol

(c) To increase boiling point of petrol

(d) As an antiknock

47. Tetraethyl lead is used as **[NCERT 1976, 79; DPMT 1984; CPMT 1989, 91; BHU 1995]**

(a) Fire extinguisher (b) Pain reliever

(c) Petroleum additive (d) Mosquito repellent

48. Cyclohexane, a hydrocarbon floats on water because

[NCERT 1976]

(a) It is immiscible with water

(b) Its density is low as compared to water

(c) It is non-polar substance

(d) It is immiscible and lighter than water

49. Natural gas contains mainly

[MNR 1990; UPSEAT 1999, 2000, 01, 02; BCECE 2005]

(a) Methane (b) *n*-butane

(c) *n*-octane (d) Mixture of octane

50. Which compound is not inflammable **[MP PET 2001]**

(a) CCl_4 (b) C_2H_5OH

(c) CH_4 (d) C_6H_6

51. Propane is obtained from propene, by which of the following methods **[CBSE PMT 2001; AFMC 2001]**

(a) Wurtz reaction (b) Dehydrogenation

(c) Frankland reaction (d) Catalytic hydrogenation

52. The organic compound used as antiknock agent in petroleum is **[DCE 1999; CPMT 2000; Pb. CET 2000; MP PET 2001]**

(a) $(C_2H_5)_4Pb$ (b) TNT

(c) CH_3MgBr (d) $(C_2H_5)_2Hg$

53. In catalytic reduction of hydrocarbons which catalyst is mostly used **[DCE 2001]**

(a) Pt/Ni (b) Pd

(c) SiO_2 (d) Misch Metal

54. Ethylene reacts with bromine to form **[MP PET 2001]**

(a) $Br-CH_2-CH_3$ (b) CH_3-CBr_3

(c) $Br-CH_2-CH_2Br$ (d) $CHBr_3$

[EAMCET 1997]

55. Gasoline is obtained from crude petroleum oil by its

[MP PMT 1999]

(a) Fractional distillation (b) Vacuum distillation

(c) Steam distillation (d) Pyrolysis

56. Which of the following does not give alkane

[MP PMT 1999]

(a) Reaction of CH_3I with *Na* in ether

(b) Reaction of sodium acetate with sodalime

(c) Electrolysis of concentrated sodium acetate solution

(d) Reaction of ethyl chloride with alco. *KOH*

57. *LPG* is a mixture of **[MP PMT 1999; KCET 2005]**

(a) $C_6H_{12}+C_6H_6$ (b) $C_4H_{10}+C_3H_8$

(c) $C_2H_4+C_2H_2$ (d) $C_2H_4+CH_4$

58. Carbon black, which is used in making printer's ink, is obtained by decomposition of **[MP PET 1993]**

(a) Acetylene (b) Benzene

(c) Carbon tetrachloride (d) Methane

59. The addition of tetraethyl lead to petrol **[MP PET 1993]**

(a) Lowers its octane number

(b) Raises its octane number

(c) May raise or lower the octane number

(d) Has no effect on octane number

60. Which of the following compound has maximum boiling point **[IIT-JEE 1982; MP PMT 1986; MADT Bihar 1995; Pb. PMT 1999]**

(a) *n*-hexane (b) *n*-pentane

(c) 2, 2-dimethyl propane (d) 2-methyl butane

61. Knocking sound occurs in engine when fuel **[CPMT 1981]**

(a) Ignites slowly

(b) Ignites rapidly

(c) Contains water

(d) Is mixed with machine oil

62. Petroleum is mainly a mixture of

[CPMT 1984; Pb. PMT 1999]

(a) Alkanes (b) Cyclohexane

(c) Benzenoid hydrocarbons (d) Alkenes

63. Which of the following has maximum boiling point

[IIT-JEE 1986; MP PMT 1986; CPMT 1989]

(a) *iso*-octane

(b) *n*-octane

(c) 2, 2, 3, 3-tetramethyl butane

(d) *n*-butane

64. Aqueous solution of the following compound on electrolysis gives ethane **[NCERT 1983; MP PET 1985; CPMT 1975, 79]**

(a) Acetic acid (b) Acetamide

(c) Potassium acetate (d) Ethyl acetate

65. Which of the following does not decolourise bromine solution in carbon disulphide **[MP PET 1986]**

(a) Acetylene (b) Propene

(c) Ethane (d) Propyne

66. Anhydrous sodium acetate on heating with sodalime gives **[CPMT 1972, 84; Pb. CET 2001, 2003]**

(a) Acetic acid (b) Methane

(c) Calcium acetate (d) Ethane

67. Water gas is **[CPMT 1993, 2004; Pb. PMT 2004]**

(a) $CO+CO_2$ (b) $CO+N_2$

(c) $CO+H_2$ (d) $CO+N_2+H_2$

68. A sample of gasoline contains 81% *iso*-octane and 19% *n*-heptane. Its octane number will be **[MP PMT 1995]**

(a) 19 (b) 81

(c) 100 (d) 62

69. The natural petroleum contains **[MP PMT 1995]**

(a) Saturated hydrocarbons

(b) Cyclic saturated hydrocarbons

(c) Compounds of sulphur

(d) All of these

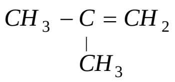
70. The preparation of ethane by electrolysis of aqueous solution of potassium acetate is called as **[MP PMT 1995]**

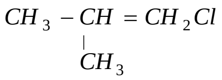
(a) Wurtz reaction

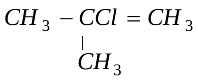
(b) Sabatier-Senderen's reaction

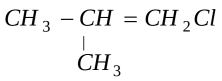
(c) Kolbe's synthesis

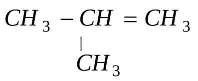
(d) Grignard reaction

71. Action of hydrogen chloride on  $CH_3-\underset{\substack{|\\CH_3}}{C}=CH_2$ and on $CH\equiv CH$ will predominantly give the compounds, respectively

(a)  $CH_3-\underset{\substack{|\\CH_3}}{CH}=CH_2Cl$ and CH_2Cl-CH_2Cl

(b)  $CH_3-\underset{\substack{|\\CH_3}}{CCl}=CH_3$ and CH_3-CHCl_2

(c)  $CH_3-\underset{\substack{|\\CH_3}}{CH}=CH_2Cl$ and CH_3-CHCl_2

(d)  $CH_3-\underset{\substack{|\\CH_3}}{CH}=CH_3$ and CH_2Cl-CH_2Cl

72. As the number of carbon atoms in a chain increases the boiling point of alkanes **[AFMC 1989]**

(a) Increases

(b) Decreases

(c) Remains same

(d) May increase or decrease

73. In the fractional distillation of crude petroleum **[Roorkee 1989]**

(a) Petrol condenses at the bottom of the column

(b) The gases condense at the top of the column

(c) High boiling constituents condense at the bottom of the column

(d) High boiling constituents condense at the top of the column

74. Which of the following is not an endothermic reaction **[J & K 2005]**

(a) Dehydrogenation

(b) Ethane to ethene

(c) Combustion of propane

(d) Change of chlorine molecule into chlorine atoms.

75. Gasoline is the name of **[Roorkee 1989]**

(a) Crude oil

(b) The gaseous constituents of petroleum

(c) The mixture of uncondensed gases produced in the distillation of crude oil

(d) The mixture of the residue and gas oil obtained in the distillation of crude oil

76. In the process of cracking **[Roorkee 1989]**

(a) Organic compounds decompose into their constituent elements

(b) Hydrocarbons decompose into carbon and hydrogen

(c) High molecular weight organic compounds decompose to give low molecular weight organic compounds

(d) Hydrocarbons yield alkyl radicals and hydrogen

77. Octane number has 0 value for **[Roorkee 1989; MP PET 1999, 2002; MP PMT 2001; KCET 2002]**

(a) iso-octane (b) *n*-hexane

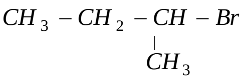
(c) *n*-heptane (d) iso-heptane

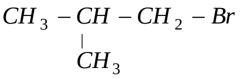
78. Dry distillation of sodium propanoate with sodalime gives **[CPMT 1996]**

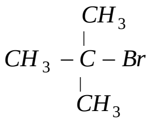
(a) Propane (b) Propene

(c) Ethane (d) Ethene

79. What is the chief product obtained when *n*-butane is treated with bromine in the presence of light at 130^oC **[IIT-JEE 1995]**

(a)  $CH_3-CH_2-\underset{\substack{|\\CH_3}}{CH}-Br$

(b)  $CH_3-\underset{\substack{|\\CH_3}}{CH}-CH_2-Br$

(c) 
$CH_3-C(CH_3)_2-Br$

(d) $CH_3-CH_2-CH_2-CH_2-Br$

80. A mixture of propene and methane is obtained by the cracking of

(a) 1-butene (b) 2-butene

(c) *n*-butane (d) Isobutane

81. Which of the following fractions of petroleum refining contains kerosene ? (Boiling ranges in ^{o}C are given below)

(a) 40 - 80 (b) 80 - 200

(c) 200 - 300 (d) Above 300

82. Which of the following statements is incorrect ? The members of the homologous series of alkanes **[NCERT 1974]**

(a) Are all straight chain compounds

(b) Have the general formula C_nH_{2n+2}

(c) Have similar chemical properties

(d) Show a regular gradation of physical properties

83. On mixing tetraethyl lead to gasoline available at petrol pumps **[CPMT 1981]**

(a) Calorific value of the fuel increases

(b) Odour diminishes

(c) Less smoke is obtained on combustion

(d) Antiknock property of fuel increases

84. A liquid hydrocarbon can be converted to gaseous hydrocarbon by **[CPMT 1980; MP PMT 2001]**

(a) Cracking

(b) Hydrolysis

(c) Oxidation

(d) Distillation under reduced pressure

85. The tetrahedral nature of carbon was first given by **[MP PMT 1994]**

(a) Kekule (b) Le Bell and Van't Hoff

(c) Pauling (d) Armstrong and Bayer

86. Formation of alkane by the action of *Zn* on alkyl halide is called **[DPMT 1984; MHCET 2004]**

(a) Frankland's reaction (b) Wurtz reaction

(c) Cannizzaro reaction (d) Kolbe's reaction

87. Which of the following compounds will form a hydrocarbon on reaction with Grignard reagent **[CPMT 1988, 93]**

(a) CH_3CH_2OH (b) CH_3CHO

(c) CH_3COCH_3 (d) $CH_3CO_2CH_2$

88. Name the hydrocarbon that is a liquid at STP

(a) Ethane (b) Propane

(c) n-butane (d) *n*-pentane

89. Which statement is not true concerning alkanes **[MP PET 2003]**

(a) Large number alkanes are soluble in water

(b) All alkanes have a lower density than water

(c) At room temperature some alkanes are liquids, some solids and some gases

(d) All alkanes burn

90. Fischer Tropsch process is used for the manufacture of **[DCE 1999; MP PET 2003]**

(a) Synthetic petrol (b) Thermosetting plastics

(c) Ethanol (d) Benzene

91. Which one of the following compounds cannot be prepared by Wurtz reaction **[Kurukshetra CEE 2002; MP PMT 2002; MP PET 2003]**

(a) CH_4 (b) C_2H_6

(c) C_3H_8 (d) C_4H_{10}

92. A fuel contains 25 % *n*-heptane and 75 % iso-octane. Its octane number is **[MP PMT 1993; MP PET 1994]**

(a) 50 (b) 75

(c) 100 (d) 25

93. Sodium ethoxide is a specific reagent for **[CPMT 1985]**

(a) Dehydration

(b) Dehydrogenation

(c) Dehydrohalogenation

(d) Dehalogenation

94. Which of the following has highest percentage of hydrogen **[CPMT 1975; 79]**

(a) CH_4 (b) C_2H_4

(c) C_6H_6 (d) C_2H_2

95. What is the molecular formula of the alkane, the 5.6 *litre* of which weight 11 *g* at STP **[MP PMT 2003]**

(a) C_6H_{14} (b) C_4H_{10}

(c) C_3H_8 (d) C_2H_6

96. The reference compound `iso-octane' which is used in determining the octane number of gasoline has the structure

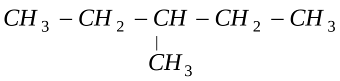
(a) $CH_3-CH(CH_3)-CH(CH_3)-CH(CH_3)-CH_3$

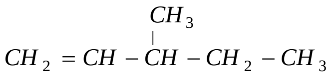
(b) $CH_3-C(CH_3)_2-CH_2-CH(CH_3)-CH_3$

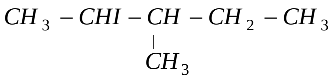
(c) $CH_3-C(CH_3)_2-CH(CH_3)-CH_2-CH_3$

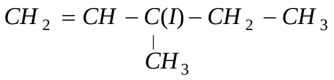
(d) $CH_3-C(CH_3)_2-C(CH_3)_2-CH_3$

97. Sample of 2, 3-dibromo-3-methylpentane is heated with zinc dust. The resulting product is isolated and heated with *HI* in the presence of phosphorus. Indicate which is the structure that represent the final organic product formed in the reaction **[CBSE PMT 1991]**

(a) 
$CH_3-CH_2-CH(CH_3)-CH_2-CH_3$

(b) 
$CH_2 = CH - \overset{\overset{CH_3}{|}}{CH} - CH_2 - CH_3$

(c) 
$CH_3 - CHI - \underset{\underset{CH_3}{|}}{CH} - CH_2 - CH_3$

(d) 
$CH_2 = CH - \underset{\underset{CH_3}{|}}{C(I)} - CH_2 - CH_3$

98. The order of appearance of the following with rising temperature during the refining of crude oil is **[MNR 1993; UPSEAT 2002]**

(a) Kerosene oil, gasoline, diesel
(b) Diesel, gasoline, kerosene oil
(c) Gasoline, diesel, kerosene oil
(d) Gasoline, kerosene oil, diesel

99. When sodium propionate is heated with soda lime, the main product is

(a) Ethane (b) Methane
(c) Propane (d) Butane

100. Gasoline is a mixture of alkanes with the number of carbon atoms **[CPMT 1983, 84; BVP 2003]**

(a) $C_3 - C_5$ (b) $C_5 - C_6$
(c) $C_6 - C_8$ (d) $C_7 - C_9$

101. The final product of complete oxidation of hydrocarbons is **[CPMT 1981]**

(a) Acid (b) Aldehyde
(c) $H_2O + CO_2$ (d) Dihydric alcohol

102. Which of the following will have least hindered rotation about carbon-carbon bond**[IIT-JEE 1987; CPMT 1989, 94]**

(a) Ethane (b) Ethylene
(c) Acetylene (d) Hexachloroethane

103. Which of the following represents the most oxidized form of hydrocarbon **[MP PMT/PET 1988]**

(a) CO_2 (b) $RCHO$
(c) $RCOOH$ (d) $RCOOOH$

104. Name the reaction

$$C_{10}H_{22} \xrightarrow{900\,K} C_4H_8 + C_6H_{14}$$

[MP PET 1995; MP PMT 1997]

(a) Alkylation (b) Cracking
(c) Pyrolysis (d) Fractionation

105. How many types of carbon atoms are present in 2, 2, 3-trimethylpentane

(a) One (b) Two
(c) Three (d) Four

106. Which one gives only one monosubstitution product on chlorination **[AIEEE 2003]**

(a) *n*-pentane (b) Neopentane
(c) Isopentane (d) *n*-butane

107. CH_4 is formed when **[AFMC 1987]**

(a) Sodium acetate is heated with sodalime
(b) Iodomethane is reduced
(c) Aluminium carbide reacts with water
(d) All of these

108. A mixture of methane, ethylene and acetylene gases is passed through a Wolf's bottle containing ammoniacal cuprous chloride. The gas coming out is **[NCERT 1976]**

(a) Methane
(b) Acetylene
(c) A mixture of methane and ethylene
(d) The original mixture

109. At room temperature solid paraffin is**[RPET/PMT 1999]**

(a) C_3H_8 (b) C_8H_{18}
(c) C_4H_{10} (d) $C_{20}H_{42}$

[AMU 2002]

110. Which one of the following compounds does not give addition reactions **[MADT Bihar 1981]**

(a) Aldehydes (b) Alkanes
(c) Alkenes (d) Alkynes
(e) Ketones (f) All of these

111. The most important method of preparation of hydrocarbons of lower carbon number is**[CBSE PMT 1989]**

(a) Pyrolysis of higher carbon number hydrocarbons
(b) Electrolysis of salts of fatty acids
(c) Sabatier and Senderen's reaction
(d) Direct synthesis

112. The inorganic origin of petroleum is indicated by the fact that

(a) Its constituents can be separated by fractional distillation
(b) Carbon and hydrocarbon can combine by absorption of solar energy to give hydrocarbons
(c) Petroleum contains traces of chlorophyll
(d) Oil fields are located with the help of seismograph

113. Which of the following is a gemdihalide**[CPMT 1976, 88]**

(a) $CH_3.CHBr.CHBr.CH_3$ (b) $CH_2Br.CH_2Br$
(c) $CHBr = CHBr$ (d) CH_3CHBr_2

114. Which one of the following contain isopropyl group **[BHU 2005]**

(a) 2,2,3,3-tetramethylpentane
(b) 2-methylpentane
(c) 2,2,3-trimethylpentane
(d) 3,3-dimethylpentane

115. Natural gas is a mixture of **[MP PMT 1986]**

(a) $CO + CO_2$ (b) $CO + N_2$

(c) $CO + H_2 + CH_4$ (d) $CH_4 + C_2H_6 + C_3H_8$

116. By Wurtz reaction, a mixture of methyliodide and ethyliodide gives **[BHU 2003]**

(a) Butane

(b) Ethane

(c) Propane

(d) A mixture of the above three

117. Product obtained by nitration of propane is **[RPMT 2003]**

(a) Nitropropane (b) Nitromethane

(c) Nitroethane (d) All of these

118. Isomerism in saturated hydrocarbons is due to

(a) Change in the valence of carbon

(b) Change in the ratio of elements in compounds

(c) Formation of branches in the chain of C atoms

(d) Formation of double bond

119. Photochemical chlorination of alkane is initiated by a process of **[DPMT 1985; NCERT 1978]**

(a) Pyrolysis (b) Substitution

(c) Homolysis (d) Peroxidation

120. Which of the following is not linked with methane

(a) Marsh gas (b) Natural gas

(c) Producer gas (d) Coal gas

121. Which of the following has highest octane number **[MP PET 1996]**

(a) *n*-hexane

(b) *n*-heptane

(c) *Iso*-octane

(d) *n*-heptane and iso-octane mixed in ratio 50 : 50

122. A mixture of ethyl iodide and *n*-propyl iodide is subjected to Wurtz reaction. The hydrocarbon that will not be formed is **[IIT-JEE (Screening) 1990]**

(a) *n*-butane (b) *n*-propane

(c) *n*-pentane (d) *n*-hexane

123. Most of the hydrocarbons from petroleum are obtained by **[CPMT 1974, 80]**

(a) Fractional distillation (b)Fractional crystallization

(c) Vaporization (d) Polymerization

124. Which is the best antiknock compound or Which one of the following substances is used as an antiknock compound **[CPMT 1974, 81, 99, 2000;RPMT 2002; CBSE PMT 1996; KCET (Med.) 2000 MP PET 1985, 87, 97, 2001; MP PMT 1994, 96; AIIMS 2000]**

(a) Lead tetrachloride (b) Lead acetate

(c) Zinc ethyl (d) Tetraethyl lead (TEL)

125. In the dichlorination reaction of propane, mixture of products are obtained. How many isomers, the mixture contains **[Orissa JEE 2003]**

(a) 2 (b) 3

(c) 4 (d) 5

126. Which of the following cycloalkane gives open chain compound, when reacts with bromine **[Orissa JEE 20**

(a) Cyclopropane (b) Cyclopentane

(c) Cyclohexane (d) Cyclo-octane

127. Grignard reagent is not prepared in aqueous medium but prepared; in ether medium because the reagent **[KCET 2002]**

(a) Reacts with water

(b) Is insoluble in water

(c) Is highly reactive in ether

(d) Becomes inactive in water

128. A sample of petrol is a mixture of 30% *n*-heptane and 70% *iso*-octane. The sample has octane number **[MP PET 1985]**

(a) 30 (b) 70

(c) 15 (d) 35

129. For the reduction of ketones to hydrocarbon, the appropriate agent is **[DPMT 2002]**

(a) HI (b) $Zn - Hg / HCl$

(c) Red phosphorous (d) H_2SO_4

130. Heating of alkanes with fuming sulphuric acid or oleum at high temperature, which forms sulphonic acid, is called **[MH CET 1999]**

(a) Nitration (b) Halogenation

(c) Sulphonation (d) Oxidation

131. Propane is obtained from propene by which method ? **[CPMT 1997; CBSE PMT 2001; AFMC 2001; MH CET 2001]**

(a) Catalyst hydrogenation (b) Wurtz reaction

(c) Dehydrogenation (d) Frankland reaction

132. B.P. of branched chain alkanes as compared to straight chain alkanes are **[MP PMT 1987; AIIMS 1999]**

(a) Lower

(b) Equal

(c) Higher

(d) Independent of the chain

133. Daily use candles (paraffin wax) contain **[CPMT 1996]**

(a) Higher saturated hydrocarbon

(b) Lower saturated hydrocarbon

(c) Higher unsaturated hydrocarbon

(d) Lower unsaturated hydrocarbon

134. The reaction $CH_4 + Cl_2 \xrightarrow{\text{uv light}} CH_3Cl + HCl$ is an example of **[CBSE PMT 1999, 2002]**

(a) Addition reactions (b) Substitution reaction

(c) Elimination reaction (d) Rearrangement reaction

135. Normal butane convert into isobutane by **[RPMT 2002]**

(a) $LiAlH_4$ (b) $AlCl_3$

(c) $NaBH_4$ (d) Zn/HCl

136. Alcoholic solution of KOH is used for **[CPMT 1982, 86; IIT-JEE 1990]**

(a) Dehydration (b) Dehydrogenation

(c) Dehydrohalogenation (d) Dehalogenation

137. Aluminium carbide on reacting with water gives **[NCERT 1981; MP PET 1985]**

(a) Methane (b) Ethane

(c) Ethene (d) Ethyne

138. Maximum carbon-carbon bond distance is found in **[MP PMT 1987; IIT-JEE 1981; Bihar MEE 1995]**

(a) Ethyne (b) Ethene

(c) Ethane (d) Benzene

139. Which of the following reaction is expected to readily give a hydrocarbon product in good yields **[CBSE PMT 1997]**

(a) $RCOOK \xrightarrow{\text{Oxidation Electrolysis}}$

(b) $RCOOAg \xrightarrow{I_2}$

(c) $CH_3-CH_3 \xrightarrow[hv]{Cl_2}$

(d) $(CH_3)_2CCl \xrightarrow{C_2H_5OH}$

140. Out of the following fractions of petroleum, the one having the lowest boiling point is or Which of the following is obtained at lowest temperature by fractional distillation of petroleum **[MP PMT 1993; MP PET 1996]**

(a) Kerosene (b) Diesel oil

(c) Gasoline (d) Heavy oil

141. The marsh gas detector used by miners works on the principle of **[AMU 1984]**

(a) Difference in the rates of diffusion of gases

(b) Avogadro's hypothesis

(c) Gay-Lussac's law of gaseous volumes

(d) Berzelius hypothesis

142. Methane can be prepared by **[DCE 2001]**

(a) Wurtz's reaction (b) Decarboxylation

(c) Hydrogenation reaction (d) All of these

143. The most strained cycloalkane is **[IIT-JEE 1981]**

(a) Cyclopropane (b) Cyclobutane

(c) Cyclopentane (d) Cyclohexane

144. Which does not react with chlorine in dark **[Pb. PMT 2000]**

(a) C_2H_4 (b) C_2H_2

(c) CH_4 (d) CH_3CHO

145. Main constituent of *marsh gas* is **[IIT-JEE 1980; MP PMT 1994; AFMC 1997]**

(a) C_2H_2 (b) CH_4

(c) H_2S (d) CO

146. Which of the following method can be used for the preparation of methane

(a) Wurtz reaction (b) Kolbe's reaction

(c) Reduction of alkyl halide (d) Hydrogenation of alkene

147. Which hydrocarbon will be most stable **[MP PET 2000, 03]**

(a) Methane (b) Ethane

(c) Propane (d) Butane

148. C-H bond length is greatest in **[IIT-JEE 1989; MNR 1990; AMU 2002]**

(a) C_2H_2 (b) C_2H_4

(c) C_2H_6 (d) $C_2H_2Br_2$

149. Which one of the following compounds does not form an ozonide **[EAMCET 1997]**

(a) Ethene (b) Propyne

(c) Propene (d) Propane

150. Which type of hybridisation occurs in ethylene **[CBSE PMT 1991; Bihar MEE 1996; JIPMER 1997]**

(a) sp (b) sp^2

(c) sp^3 (d) sp^3d

151. Silver acetylide when heated with HCl gives

(a) C_2H_2 (b) H_2

(c) C_2H_4 (d) None of these

152. When sodium reacts with ethyl iodide, which of the following hydrocarbons is produced **[NCERT 1984; BHU 1982]**

(a) Methane (b) Ethane

(c) Butane (d) Ethene

153. Solid methane is **[DPMT 1983; CBSE PMT 1989]**

(a) Molecular solid (b) Ionic solid

(c) Covalent solid (d) Not possible

154. The shape of ethane is **[Bihar CEE 1995]**

(a) Triangular (b) Tetrahedral

(c) Linear (d) None of these

155. CH_3MgI will give methane with **[Roorkee 1995]**

(a) C_2H_5OH (b) $CH_3-CH_2-NH_2$

(c) $CH_3-CO-CH_3$ (d) All of these

156. Propane-1-ol can be prepared from propene by its reaction with **[MP PMT 2003]**

(a) CH_3COOH (b) H_3BO_3

(c) $B_2H_6/NaOH, H_2O_2$ (d) H_2SO_4/H_2O

157. The process in which higher hydrocarbons are broken down into lower hydrocarbons by controlled pyrolysis, is called **[MP PMT 2002]**

(a) Hydrolysis (b) Cracking

(c) Oxidation (d) Reduction

158. Successive alkanes differ by **[MP PMT 2002]**

(a) $>CH_2$ (b) $>CH$

(c) $-CH_3$ (d) C_2H_4

159. General formula of alkane is **[EAMCET 1979; Manipal MEE 1995]**

(a) C_nH_{2n+2} (b) C_nH_{2n-1}

(c) C_nH_{2n} (d) C_nH_{2n+1}

160. Methane and ethane both can be prepared in one step by which of the following compound **[BHU 2004]**

(a) C_2H_4 (b) CH_3O

(c) CH_3Br (d) CH_3CH_2OH

161. Photochemical chlorination of alkane is initiated by a process of **[Kerala PMT 2004]**

(a) Pyrolysis (b) Substitution

(c) Cracking (d) Peroxidation

(e) Homolysis

162. A petroleum fraction having boiling range 70-200°C and containing 6-10 carbon atoms per molecule is called

[UPSEAT 2004]

(a) Natural gas (b) Gas oil

(c) Gasoline (d) Kerosene

163. Producer gas is a mixture of

[Pb. CET 2002; UPSEAT 2004]

(a) CO and N_2 (b) CO_2 and H_2

(c) N_2 and O_2 (d) CH_4 and N_2

164. The highest boiling point is expected for**[DEC. 2003]**

(a) $n-$butane

(b) iso-octane

(c) $n-$octane

(d) 2,2,3,3-tetramethyl butane

165. Which of the following is a good conductor of heat of electricity **[Pb. CET 2003]**

(a) Diamond (b) Graphite

(c) Anthracite (d) Charcoal

166. Which one of the following has the minimum boiling point

[AIEEE 2004]

(a) 1-Butene (b) 1-Butyne

(c) n-Butane (d) Isobutane

167. Octane number can be changed by **[AFMC 2004]**

(a) Isomerisation (b) Alkylation

(c) Cyclisation (d) All of these

168. Gasoline has composition **[AFMC 2004]**

(a) C_8-C_{12} (b) C_2-C_5

(c) C_6-C_{11} (d) None of these

169. The complete combustion of CH_4 gives **[BHU 2004]**

(a) $CO+H_2$ (b) $CO+N_2$

(c) CO_2+H_2O (d) $CO+N_2O$

170. Which of the following has highest knocking

[UPSEAT 2004]

(a) Olefins

(b) Branched chain olefins

(c) Straight chain olefins

(d) Aromatic hydrocarbons

171. Which one of the following compounds gives methane on treatment with water**[Kerala PMT 2004; MH CET 2004]**

(a) Al_4C_3 (b) CaC_2

(c) VC (d) SiC

(e) B_4C

172. Pick out the alkane which differs from the other members of the group. **[KCET 2004]**

(a) 2,2-dimethyl propane

(b) Pentane

(c) 2-methyl butane

(d) 2,2-dimethyl butane

173. 2-Methylbutane on reacting with bromine in the presence of sunlight gives mainly **[AIEEE 2005]**

(a) 1-bromo-2-methylbutane

(b) 2-bromo-2-methylbutane

(c) 2-bromo-3-methylbutane

(d) 1-bromo-3-methylbutane

174. Of the five isomeric hexanes, the isomer which can give two monochlorinated compounds is**[AIEEE 2005]**

(a) *n*-hexane

(b) 2, 3-dimethylbutane

(c) 2, 2-dimethylbutane

(d) 2-methylpentane

175. The product obtained on reaction of C_2H_5Cl with hydrogen over palladium carbon is **[AFMC 2005]**

(a) C_3H_8 (b) C_4H_{10}

(c) C_2H_6 (d) C_2H_4

Alkene

1. Addition of bromine to 1, 3-butadiene gives

[CPMT 1987, 93]

(a) 1, 2 addition product only

(b) 1, 4 addition product only

(c) Both 1, 2 and 1, 4 addition products

(d) No reaction

2. When ethylene bromide is treated with Zn, we get

[RPMT 1997]

(a) Alkane (b) Alkene

(c) Alkyne (d) All

3. Ethene when treated with Br_2 in the presence of CCl_4 which compound is formed

[RPMT 1997; DCE 2001; KCET (Med.) 1999]

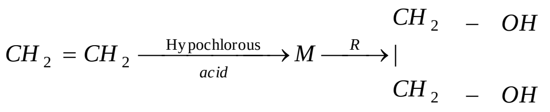
(a) 1, 2-dibromoethane

(b) 1-bromo-2-chloroethane

(c) Both (a) and (b)

(d) 1, 1, 1-tribromoethane

4. In a reaction



$$CH_2=CH_2 \xrightarrow[\text{acid}]{\text{Hypochlorous}} M \xrightarrow{R} \begin{array}{l} CH_2-OH \\ | \\ CH_2-OH \end{array}$$

Where M = molecule; R = reagent M and R are

[CBSE PMT 1997; CPMT 2001]

(a) CH_3CH_2Cl and $NaOH$

(b) CH_2Cl-CH_2OH and aq. $NaHCO_3$

(c) CH_3CH_2OH and HCl

(d) $CH_2=CH_2$ and heat

5. Alkenes usually show which type of reaction

[AIIMS 1999; MADT Bihar 1980]

(a) Addition (b) Substitution

(c) Elimination (d) Superposition

6. The propene reacts with HBr to form

[AIIMS 1999; RPET 1999]

(a) Ethane (b) Hexane

(c) 1-bromo-propane (d) 2-bromo propane

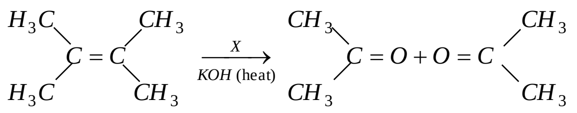
7. Ethylene may be obtained by dehydration of which of the following with concentrated H_2SO_4 at $160-170^oC$

[RPET 1999]

(a) C_2H_5OH (b) CH_3OH

(c) $CH_3CH_2CH_2OH$ (d) $(CH_3)_2CHCH_2OH$

8.



X in the above reaction is

(a) HNO_3 (b) O_2

(c) O_3 (d) $KMnO_4$

9. The disappearance of the characteristic purple colour of $KMnO_4$ in its reaction with an alkene is the test for unsaturation. It is known as

[CPMT 1989, 94; CBSE PMT 1990]

(a) Markownikoff's test (b) Baeyer's test

(c) Wurtz's test (d) Grignard test

10. A gas formed by the action of alcoholic KOH on ethyl iodide, decolourises alkaline $KMnO_4$. The gas is

[KCET 2003]

(a) C_2H_6 (b) CH_4

(c) C_2H_2 (d) C_2H_4

11. $CH_3-CH_2-Cl\xrightarrow{alc.KOH}A$, the product is

[CPMT 2003]

(a) CH_3CH_2OK (b) CH_3CHO

(c) $CH_3CH_2OCH_2CH_3$ (d) $CH_2=CH_2$

12. The final product formed when ethyl bromide is treated with excess of alcoholic KOH is**[MP PET 1999]**

(a) Ethylene (b) Ethane

(c) Ethyne (d) Vinyl bromide

13. Which of the following hydrocarbons cannot be obtained by Sabatier and Senderen's reaction

(a) CH_4 (b) C_2H_6

(c) C_3H_8 (d) All

14. When 3, 3-dimethyl-2-butanol is heated with H_2SO_4 the major product obtained is**[CBSE PMT 1995]**

(a) *cis* and *trans* isomers of 2, 3-dimethyl-2-butene

(b) 3, 3-dimethyl-1-butene

(c) 2, 3-dimethyl-2-butene

(d) 2, 3-dimethyl-1-butene

15. The intermediate during the addition of HCl to propene in the presence of peroxide is**[IIT-JEE 1997]**

(a) $CH_3\overset{\bullet}{C}HCH_2Cl$ (b) $CH_3\overset{+}{C}HCH_3$

(c) $CH_3CH_2\overset{\bullet}{C}H_2$ (d) $CH_3CH_2\overset{+}{C}H_2$

16. $CH_2=CH_2\xrightarrow[KOH/H_2O]{KMnO_4}X$. Product '$X$' in above reaction is

[RPMT 2003]

(a) Ethylene glycol (b) Glucose

(c) Ethanol (d) All of these

17. Which of the following compounds represents acrylonitrile

[JIPMER 1997]

(a) Vinyl cyanide (b) Cyanoethene

[CPMT 1985, 93]

(c) Prop-2-ene nitrile (d) All of them

18. When acetylene reacts with arsenic trichloride in the presence of anhydrous aluminium chloride, it produces

[AFMC 1999]

(a) Lewisite

(b) β-chlorovinyl dichloroarisine

(c) Nitrobenzene

(d) Both (a) and (b)

19. Ozonolysis of which one of the following will give two molecules of acetaldehyde

[Bihar MEE 1997; MP PET 2000]

(a) 1-butene (b) 2-butene

(c) 1-pentene (d) 2-pentene

(e) None of these

20. In which of the following, addition of HBr does not take place against Markownikoff's rule **or** Anti-Markownikoff addition of HBr is not observed for

[IIT-JEE 1985; CBSE PMT 1994; MADT Bihar 1995; MP PMT 1999; AMU 2002]

(a) Propene (b) But-1-ene

(c) But-2-ene (d) Pent-2-ene

21. Which one of the following characteristics apply to both ethene and ethyne

(a) Explode when mixed with chlorine

(b) Decolourise Baeyer's reagent giving brown precipitate

(c) Rapidly absorbed by cold conc. H_2SO_4

(d) Form white precipitate with silver nitrate solution

22. Which of the following has highest knocking property

(a) Aromatic hydrocarbons

(b) Olefins

(c) Branched chain paraffins
(d) Straight chain paraffins

23. Dilute aqueous $KMnO_4$, at room temperature reacts with $R-CH=CH-R$ to give **[Roorkee 1992]**
(a) $R-CHO$ (b) $R-COOH$
(c) $RCHOH-CHOHR$ (d) CO_2+H_2O

24. Aqueous sulphuric acid reacts with 2-methyl-1-butene to give predominantly
(a) Isobutyl hydrogen sulphate
(b) 2-methyl-2-butanol
(c) 2-methyl-1-butanol
(d) Secondary butyl hydrogen sulphate

25. How can ethene be produced from ethanol **[BHU 1996]**
(a) By dehydrohalogenation
(b) By dehydrogenation
(c) By dehydration with conc. H_2SO_4 at 170^oC
(d) By reduction with hydrogen iodide

26. Baeyer's reagent is used in the laboratory for **[CBSE PMT 1991, 92; AIIMS 1998; AFMC 1999]**
(a) Detection of double bonds
(b) Detection of glucose
(c) Reduction
(d) Oxidation

27. Isopropyl alcohol is obtained by reacting which of the following alkenes with conc. H_2SO_4 and H_2O **[MP PMT 1999]**
(a) Ethylene (b) Propylene
(c) 2-methyl propene (d) Isoprene

28. Which of the following compound is produced when $CH_2=CH-(CH_2)_2COOH$ reacts with HBr in presence of peroxides **[AIIMS 2000]**
(a) $CH_3CH(CH_2)_5COOH$
(b) $BrCH_2CH_2(CH_2)_5COOH$
(c) $CH_3CH_2CH_2(CH_2)_5COOH$
(d) $CH_3CH_2BrCH_2CH_2COOH$

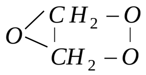
29. One mole of each of the following alkenes is catalytically hydrogenated. The quantity of heat evolved will be the lowest in the case of
(a) 1-butene (b) Trans-2-butene
(c) Cis-2-butene (d) 1, 3-butadiene

30. Which of the following is not used to distinguish ethene from ethane **[KCET (Med.) 2001; UPSEAT 2002; CBSE PMT 2002]**
(a) Iodine in CCl_4 (b) Bromine in CCl_4
(c) Alkaline $KMnO_4$ (d) Ammonical Cu_2Cl_2

31. A hydrocarbon X adds on one mole of hydrogen to give another hydrocarbon and decolourised bromine water. X reacts with $KMnO_4$ in presence of acid to give two moles of the same carboxylic acid. The structure of X is **[JIPMER 2001]**
(a) $CH_2=CH-CH_2CH_2CH_3$
(b) $CH_3CH_2CH_2-CH=CHCH_3$
(c) $CH_3CH_2CH=CHCH_2CH_3$
(d) $CH_3CH=CHCH_2CH_2CH_3$

32. When 2-bromobutane reacts with alcoholic KOH, the reaction is called **[KCET (Med.) 2001]**
(a) Halogenation (b) Hydrogenation
(c) Chlorination (d) Dehydro-halogenation
[Roorkee 1992]

33. 1, 3-butadiene reacts with ethylene to form **[BHU 2001]**
(a) Benzene (b) Cyclohexane
(c) Cyclohexene (d) 2, 3 dimethyl butane

34. Ethylene reacts with ozone gas to form the compound **[UPSEAT 2001]**
(a) $HCHO$ (b) C_2H_5OH
(c)  (d) CH_3CHO

35. Oils are converted into fats by **[Kerala (Med.) 2002]**
(a) Hydration (b) Decarboxylation
(c) Hydrogentation (d) Dehydrogenation
(e) Hydrogenolysis

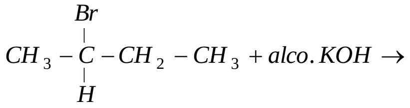
36. Which process converts olefins into parafins **[MP PET 2002]**
(a) Halogenation (b) Dehydration
(c) Hydrogenation (d) Hydrolysis

37. Of the following the formula which represents a saturated cyclic compound is
(a) C_3H_6 (b) C_3H_8
(c) C_8H_{10} (d) C_8H_{12}

38. In a reaction, if half of the double bond is broken and two new bonds are formed, this is a case of **[AMU 1983; NCERT 1978; CPMT 1983]**
(a) Elimination (b) Addition
(c) Displacement (d) Rearrangement

39. Which of the following are formed on addition reaction of DCl with 3-methyl-1-butene **[Roorkee 2000]**
(a) $CH_2DCHClCH(CH_3)_2$ (b) $CH_2DCH_2CCl(CH_3)_2$
[Roorkee 2000]
(c) $CH_3CDClCH(CH_3)_2$ (d) $ClCH_2CHDCH(CH_3)_2$

40. Major product of the following reaction is



$$CH_3-\underset{H}{\overset{Br}{C}}-CH_2-CH_3+alco.KOH\rightarrow$$ **[MP PMT 1986]**

(a) Butene-1 (b) Butene-2
(c) Butane (d) Butyne-1

41. Cyclopentene on treatment with alkaline $KMnO_4$ gives **[CPMT 1987]**
(a) Cyclopentanol
(b) *trans* 1, 2-cyclopentanediol
(c) *cis* 1, 2-cyclopentanediol
(d) 1 : 1 mixture of *cis* and *trans* 1, 2-cyclopentanediol

42. Which of the following is the most stable alkene

[AIIMS 1998; KCET (Med.) 2000; CPMT 2003]

(a) $R_2C = CR_2$ (b) $RCH = CHR$

(c) $RCH_2 = CH_2R$ (d) $CH_2 = CH_2$

43. Ethene gives with acidic $KMnO_4$ solution **[MP PMT 1997]**

(a) Ethylene glycol (b) Ethylene oxide

(c) Formaldehyde (d) Acetaldehyde

44. In paraffins, with the increasing molecular weight, it is found that

(a) Freezing point decreases

(b) Boiling point decreases

(c) Boiling point increases

(d) Vapour pressure decreases

45. When alcoholic solution of ethylene dibromide is heated with granulated zinc, the compound formed is **[CPMT 1990]**

(a) Ethylene (b) Ethyne

(c) Cyclobutane (d) Butane

46. A gas formed by the action of alcoholic KOH on ethyl iodide, decolorises alkaline $KMnO_4$ solution. The gas is

[CPMT 1974, 91; MP PET 1985; IIT-JEE 1982]

(a) CH_4 (b) C_2H_6

(c) C_2H_4 (d) C_2H_2

47. Markownikoff's rule provides guidance of addition of HBr on

[MNR 1994]

(a) $CH_2 = CH_2$ (b) $CH_3 - CH_2 - CH_3$

(c) $CH_3CH = CHCH_3$ (d) $CH_2 = CHBr$

48. Ethyl bromide gives ethylene when reacted with

[CPMT 1982, 93; RPET 2000; Pb. PMT 2001]

(a) Ethyl alcohol (b) Dilute H_2SO_4

(c) Aqueous KOH (d) Alcoholic KOH

49. Ethylene is prepared by the dehydration of

[CPMT 1974, 79; DPMT 1985; BHU 1989]

(a) Ethyl alcohol (b) Methyl alcohol

(c) Acetic acid (d) Oxalic acid

50. Which reactions are most common in alkenes

[Pb. CET 1989]

(a) Electrophilic substitution reactions

(b) Nucleophilic substitution reactions

(c) Electrophilic addition reactions

(d) Nucleophilic addition reactions

51. A mixture of 1-chloropropane and 2-chloropropane when treated with alcoholic KOH gives **[NCERT 1990]**

(a) 1-propene (b) 2-propene

(c) Isopropylene (d) All the three

52. The compound formed by passing ethylene gas into cold alkaline solution of $KMnO_4$ is

[NCERT 1974, 81; CPMT 1979, 86, 88;
MP PET 1985, 95; AFMC 1998]

(a) Ethyl alcohol (b) Acetaldehyde

(c) Acetic acid (d) Ethylene glycol

53. A gas decolourised $KMnO_4$ solution but gives no precipitate with ammoniacal cuprous chloride is **or** Which of the following gases does not give a precipitate with ammoniacal solution of silver nitrate but decolourizes $KMnO_4$ (neutral or slightly alkaline)

[CPMT 1974]

[NCERT 1974, 77; CPMT 1974, 77, 78;
MP PMT 1996; MP PET 1996, 99]

(a) Ethane (b) Methane

(c) Ethene (d) Acetylene

54. A hydrocarbon reacts with hypochlorous acid to give 1-chloro-2-hydroxyethane. The hydrocarbon is

[CBSE PMT 1989]

(a) Ethylene (b) Methane

(c) Ethane (d) Acetylene

55. When ethene is heated at 400^oC under high pressure, the product is/are

(a) Carbon and H_2 (b) Polyethylene

(c) Acetylene and H_2 (d) None of these

56. Which decolorize aqueous bromine and gives white fumes of HCl on reaction with PCl_5 **[Pb. PMT 1999]**

(a) $CH_3COCH_2CH = CH_2$

(b) $CH_3CH_2CH_2CH_2CH_3$

(c) $CH_3CH = CHCH_2CH_2OH$

(d) $CH_3OCH_2CH_2CH_2CH_2OH$

57. During debromination of meso-dibromobutane, the major compound formed is **[IIT-JEE 1997]**

(a) *n*-butane (b) 1-butane

(c) *cis*-2-butene (d) *trans*-2-butene

58. What product is formed when 1-chlorobutane react with alcoholic KOH **[RPMT 2002]**

(a) 1-butene (b) 2-butene

(c) 1-butanol (d) 2-butanol

59. The olefin which on ozonolysis gives CH_3CH_2CHO and CH_3CHO is **[Roorkee 1992]**

(a) 1-butene (b) 2-butene

(c) 1-pentene (d) 2-pentene

60. Bond length between carbon-carbon in ethylene molecule is

[MP PET 1997]

(a) 1.54 Å (b) 1.35 Å

(c) 1.19 Å (d) 2.4 Å

61. The compound having both *sp* and sp^2 hybridised carbon atom is **[IIT-JEE 1981]**

(a) Propene (b) Propyne

(c) Propadiene (d) None of these

62. The halogen which is most reactive in the halogenation of alkenes under sunlight is **[IIT-JEE 1981]**

(a) Chlorine (b) Bromine

(c) Iodine (d) All equal

63. When ethene reacts with bromine, it forms **[AFMC 2000; KCET 2001]**

(a) Chloroethane (b) Ethylene dibromide

(c) 1 bromopropane (d) 1,2-dichloroethene

64. Paraffins are soluble in **[NCERT 1978]**

(a) Distilled water (b) Benzene

(c) Methanol (d) Sea water

65. Addition of HCl to propene in presence of peroxides gives **[BHU 1981, 98]**

(a) 1-Chloropropane (b) 2-Chloropropane

(c) 3-Chloropropane (d) Propene dichloride

66. The name of the product obtained by the addition of HI to propene in presence of peroxide catalyst is **[KCET 2000]**

(a) Isopropyl iodide (b) 2-Iodopropene

(c) 2-Iodopropane (d) 1-Iodopropane

67. In the reaction $C_2H_5CH=CH_2+H-X \rightarrow$ Product. What is the product **[BHU 2002]**

(a) $C_2H_5-CH_3$

(b) $C_2H_5CH_2-CH_2X$

(c) $C_2H_5-CHX-CH_3$

(d) $CH_3-CH_2X-CH=CH_2$

68. Alkene can be prepared from alkyl halide by the following reagent $R-X+Nu^- \rightarrow \text{Alkene}+NuH$ **[RPET 2000]**

(a) Alc. KOH + heat (b) $Aq.\ KOH$ + cold water

(c) $NaOH$ (d) $LiOH$

69. 2-chlorobutane is heated with alcoholic $NaOH$, the product formed in larger amount is**[RPET 1999; AMU 2000]**

(a) 1-Butene (b) 1-Butyne

(c) 2-Butene (d) All of these

70. Ethylene has high b.p. and high vapour pressure at $100\,^oC$ and does not dissolve in water. Hence ethylene is separated by this method

(a) Simple distillation (b) Vacuum distillation

(c) Vapour distillation (d) Alkali treatment

71. Addition of bromine to 1, 3-butadiene gives**[AMU 1999]**

(a) 1, 4-addition product only

(b) 1, 2-addition product only

(c) Both 1, 2-and 1, 4 addition product

(d) None of these

72. In the presence of peroxide, hydrogen chloride and hydrogen iodide do not give anti-Markovnikoff's addition to alkenes because**[IIT-JEE Screening 2001]**

(a) Both are highly ionic

(b) One is oxidising and the other is reducing

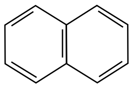
(c) One of the steps is endothermic in both the cases

(d) All the steps are exothermic in both the cases

73. The compound most likely to decolourize a solution of potassium permanganate is**[NCERT 1978]**

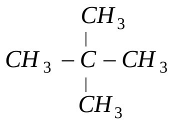
(a) CH_3CH_3

(b)



(c) $CH_3CH=CHCH_2CH_3$

(d)



$CH_3-C(CH_3)_2-CH_3$

74. Ethylene is converted to X on passing through a mixture of an acidified aqueous solution of palladium chloride and cupric chloride. Which of the following reagents readily take part in addition reaction with X **[UPSEAT 2003]**

(a) Br_2 (b) HBr

(c) HCl (d) HCN

75. Addition of HCl does not obey antimarkownikoff's rule because **[UPSEAT 2003]**

(a) It is a strong acid (b) It is a gas

(c) Its bond energy is high (d)Its bond energy is less

76. Correct statement about1, 3-dibutene**[UPSEAT 2003]**

(a) Conjugated double bonds are present

(b) Reacts with HBr

(c) Forms polymer

(d) All of these

77. At low temperatures, the slow addition of molecular bromine to $CH_2=CH-CH_2-C\equiv CH$ gives **[Roorkee Qualifying 1998]**

(a) $CH_2=CH-CH_2-CBr=CHBr$

(b) $BrCH_2-CHBr-CH_2-C\equiv CH$

(c) $CH_2=CH-CH_2-CH_2-CBr_3$

(d) $CH_3-CBr_2-CH_2-C\equiv CH$

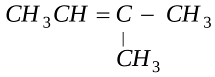
78. PCl_5 reacts with propanone, to give **[Pb. PMT 2001]** **[UPSEAT 1999]**

(a) *vic*-dichloride (b) Propanal

(c) propane-chloride (d) gem-dichloride

79. The compounds that will give an isomer of 2; 2-dimethyl propane on catalytic hydrogenation are **[AMU 19**

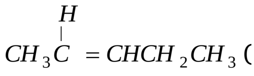
(1)



$CH_3CH=C(CH_3)-CH_3$

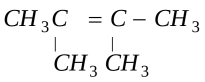
(2) $CH_3CH=CHCH_3$

(3)



$CH_3C(H)=CHCH_2CH_3$

(4)



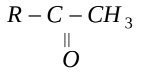
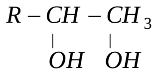
$CH_3C(CH_3)=C(CH_3)-CH_3$

(a) 1 and 4 (b) 2 and 4

(c) 1 and 3 (d) 1 and 2

80. Alkene $R-C-H=CH_2$ reacts readily with B_2H_6 and the product on oxidation with alkaline hydrogen peroxides produces

(a) $R-CH_2-CHO$ (b) $R-CH_2-CH_2-OH$

(c)  $R-\underset{\underset{O}{\|}}{C}-CH_3$ (d)  $R-\underset{OH}{\underset{|}{CH}}-\underset{OH}{\underset{|}{CH_3}}$

81. Bayer's reagent is used for detection of **[RPMT 2002]**

(a) Amines (b) Glucose

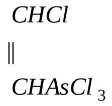
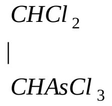
(c) Unsaturated bond (d) Alcohol

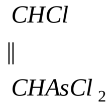
82. Which of the following is(are) example(s) of nucleophilic addition reaction in case of acetylene

(a) Addition of water (b) Addition of HCN

(c) Addition of $AsCl_3$ (d) All

83. Structural formula for lewisite is

(a)  $\begin{array}{c}CHCl\\ \|\\ CHAsCl_3\end{array}$ (b)  $\begin{array}{c}CHCl_2\\ |\\ CHAsCl_3\end{array}$

(c)  $\begin{array}{c}CHCl\\ \|\\ CHAsCl_2\end{array}$ (d) None of these

84. Propene when heated with chlorine at about $500\,^oC$ forms **[MP PET 1997]**

(a) $CH_2Cl.CH=CH_2$ (b) $CH_3.CHCl.CH_2Cl$

(c) $CH_2Cl.CHCl.CH_2Cl$ (d) All the three

85. PVC is obtained from vinyl chloride by a reaction called

(a) Addition (b) Isomerization

(c) Polymerization (d) Substitution

86. Reaction of Br_2 on ethylene in presence of $NaCl$ gives

(a) $BrCH_2-CH_2Br$ (b) $ClCH_2-CH_2Br$

(c) Both (a) and (b) (d) None of these

87. $CH_3-CH=CH_2+HBr \longrightarrow$.........., the product formed is **[AIIMS 1983; CPMT 1997; RPMT 1999, 2003]**

(a) $CH_3-CH_2-CH_2-Br$ (b) $CH_3-CHBr-CH_3$

(c) $BrCH_2-CH=CH_2$ (d) $CH_2=C=CH_2$

88. The product of reaction between propene and HBr in the presence of a peroxide is

(a) $CH_3-CH_2-CH_2Br$ (b) $CH_3-CHBr-CH_3$

(c) CH_3-CH_2Br (d) $CH_3-CH=CHBr$

89. Ozonolysis of 2-methyl butene-2 yields

(a) Only aldehyde

(b) Only ketone

(c) Both aldehyde and ketone

(d) None of these

90. The final product formed by the ozonolysis of compound $RCH=CR_2$ is **[NCERT 1978]**

(a) $RCHO$ (b) R_2CO

(c) Both (a) and (b) (d) None of these

91. Which one is an unsaturated compound **[BIT 1990]**

(a) C_6H_{14} (b) C_4H_8

(c) C_3H_7OH (d) CH_3OH

92. Ethyl alcohol on heating with conc. H_2SO_4 gives **[EAMCET 1979; MP PMT 1996]**

(a) $CH_3COOC_2H_5$ (b) C_2H_6

(c) C_2H_4 (d) C_2H_2

93. Monohalides on reacting with alcoholic KOH give **[MP PET 1982, 86; DPMT 1981; CPMT 1979, 83]**

(a) Alkanes (b) Alkenes

(c) Alkynes (d) Aromatic hydrocarbons

94. Ethylene is a member of..... series **[BHU 1979]**

(a) Alkyne (b) Olefin

(c) Paraffin (d) Amine

95. In a double bond between two carbon atoms of ethene, there are **[NCERT 1981]**

(a) Two sigma bonds perpendicular to each other

(b) One sigma and one pi bond

(c) Two pi bonds perpendicular to each other

(d) Two pi bonds at an angle of 60^o

96. The formation of alkene from alkyl halide is an example of **[CPMT 1983; AMU 1982; Pb. CET 1986]**

(a) Addition (b) Elimination

(c) Substitution (d) (a) and (c)

97. In the following reaction

$CH_3-CH_2-CH_2-CH_3 \xrightarrow[475\,K]{H_2SO_4}$ **[AIIMS 1983]**

(a) $CH_3CH=CHCH_3$ predominates

(b) $CH_2=CHCH_2CH_3$ predominates

(c) Both are formed in equal amounts

(d) The amount of production depends on the nature of catalyst

98. The compound B formed in the following sequences of reactions is

$CH_3CH_2CH_2OH \xrightarrow{PCl_5} A \xrightarrow{Alco.\,KOH} B$

[NCERT 1981]

(a) Propyne (b) Propene

(c) Propanol (d) Propane

99. n-propyl bromide on treatment with ethanolic potassium hydroxide produces **[IIT-JEE 1987; MP PMT 1997]**

(a) Propane (b) Propene

(c) Propyne (d) Propanol

100. The dehydrohalogenation of neopentyl bromide with alcoholic KOH mainly gives **[IIT-JEE (Screening) 1990; MP PET 1993]**

(a) 2-methyl-1-butene (b) 2-methyl-2-butene

(c) 2, 2-dimethyl-1-butene (d) 2-butene

101. Which is the most reactive hydrocarbon in the following

[JIPMER 2002]

(a) Ethane (b) Ethyne

(c) Ethene (d) Methane

102. Shape of ethylene molecule is **[MP PET 1993]**

(a) Tetrahedral (b) Pyramidal

(c) Planar (d) Linear

103. Electrophilic addition on a carbon-carbon double bond involves the intermediate formation of a more stable carbocation. This statement is called

(a) Saytzeff's rule (b) Baeyer's effect

(c) Markownikoff's rule (d) None of these

104. $CH_2=CHCl$ reacts with HCl to form **[CPMT 1985, 93]**

(a) CH_2Cl-CH_2Cl (b) CH_3-CHCl_2

(c) $CH_2=CHCl.HCl$ (d) None of these

105. Deviation from Markownikoff's rule occurs in presence of

(a) Zinc (b) Peroxides

(c) $Hg-Zn/HCl$ (d) All of these

106. Presence of peroxides affects the addition of **[BHU 1987]**

(a) HBr (b) HCl

(c) HI (d) All of these

107. Catalyst used in dimerisation of acetylene to prepare chloroprene is **[BHU 1984]**

(a) $HgSO_4+H_2SO_4$ (b) Cu_2Cl_2

(c) $Cu_2Cl_2+NH_4Cl$ (d) $Cu_2Cl_2+NH_4OH$

108. Chloroprene is

(a) 2-chloro-1, 3-butadiene

(b) 3-chloro-2, 3-butadiene

(c) 2, 3-dichlorobutadiene

(d) None of these

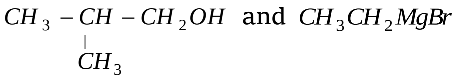
109. Chloroprene is used in making **[MP PET 1985]**

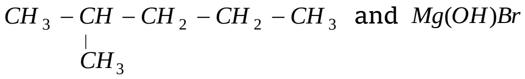
(a) Synthetic rubber (b) Plastic

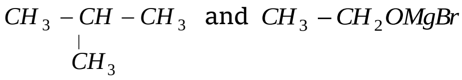
(c) Petrol (d) All of these

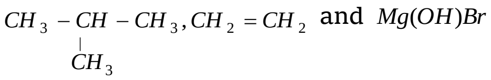
110. When isobutyl magnesium bromide in dry ether is treated with absolute ethyl alcohol, the products formed are

[IIT-JEE 1995]

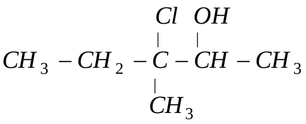
(a)

$CH_3-\underset{CH_3}{\underset{|}{CH}}-CH_2OH$ and CH_3CH_2MgBr

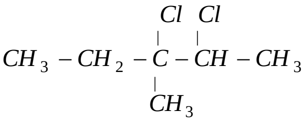
(b)

$CH_3-\underset{CH_3}{\underset{|}{CH}}-CH_2-CH_2-CH_3$ and $Mg(OH)Br$

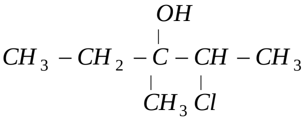
(c)

$CH_3-\underset{CH_3}{\underset{|}{CH}}-CH_3$ and CH_3-CH_2OMgBr

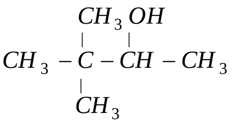
(d)

$CH_3-\underset{CH_3}{\underset{|}{CH}}-CH_3, CH_2=CH_2$ and $Mg(OH)Br$

111. The predominant product formed, when 3-methyl-2-pentene reacts with $HOCl$, is **[IIT-JEE 1995]**

(a)

$CH_3-CH_2-\underset{CH_3}{\overset{Cl}{C}}-\overset{OH}{CH}-CH_3$

(b)

$CH_3-CH_2-\underset{CH_3}{\overset{Cl}{C}}-\overset{Cl}{CH}-CH_3$

(c)

$CH_3-CH_2-\underset{CH_3}{\overset{OH}{C}}-\underset{Cl}{CH}-CH_3$

(d)

$CH_3-\underset{CH_3}{\overset{CH_3}{C}}-\overset{OH}{CH}-CH_3$

112. Which of the following occurs easily in ethylene

[MNR 1987; NCERT 1979]

(a) Addition (b) Substitution

(c) Elimination (d) Rearrangement

113. How many *gm* of bromine will react with 21 *gm* C_3H_6

[MP PET 1985]

(a) 80 (b) 160

(c) 240 (d) 320

114. Conjugate double bond is present in **[MP PMT 1987]**

(a) Propylene (b) Butadiene

(c) Isobutylene (d) Butylene

115. On passing vapours of an organic liquid over finely divided Cu at $573\,K$ the product was an alkene. This reaction is

(a) Catalytic oxidation of primary alcohol

(b) Catalytic dehydrogenation of secondary alcohol

(c) Catalytic dehydrogenation of tertiary alcohol

(d) Catalytic dehydration of tertiary alcohol

116. The total number of sigma σ and pi (π) bonds in an ethylene molecule are

(a) $4\sigma, 2\pi$ (b) $4\sigma, 1\pi$

(c) $5\sigma, 2\pi$ (d) $5\sigma, 1\pi$

117. Cyclic hydrocarbon molecule A has all the carbon and hydrogens in a single plane. All the carbon-carbon bonds are of same length and less that 1.54 $\mathring{A}$ but more than 1.34 $\mathring{A}$. $C-C-C$ bond angle will be **[CBSE PMT 1989]**

(a) 120^o (b) 180^o

(c) 100^o (d) $109^o28'$

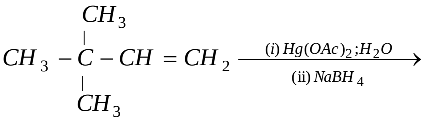
118. General formula of alkenes is

[CPMT 1975, MNR 1987; NCERT 1987; MP PMT 1994]

(a) C_nH_{2n} (b) C_nH_{2n-2}

(c) C_nH_{2n+2} (d) C_nH_{2n-1}

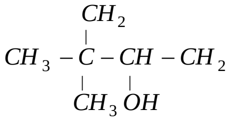
119. The product of following reaction is



$$CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH=CH_2 \xrightarrow[\text{(ii) } NaBH_4]{\text{(i) } Hg(OAc)_2;H_2O}$$

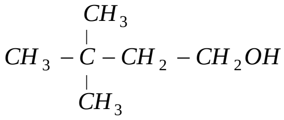
[MP PMT 1986; MP PET 1997]

(a)



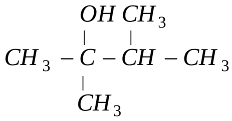
$CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_2}{|}}{C}}-\underset{\underset{OH}{|}}{CH}-CH_2$

(b)



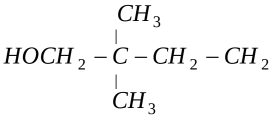
$CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_2-CH_2OH$

(c)



$CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{OH}{|}}{C}}-\overset{\overset{CH_3}{|}}{CH}-CH_3$

(d)



$HOCH_2-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_2-CH_2$

120. Which one of the following organic compounds decolourizes an alkaline $KMnO_4$ solution**[CPMT 1987, 93]**

(a) CS_2 (b) C_3H_6

(c) C_3H_8 (d) CH_3OH

121. Decolourization of alkaline $KMnO_4$ is used as a test for

[AMU 1983]

(a) Aromatic hydrocarbons
(b) Olefinic hydrocarbons
(c) Acetylenic hydrocarbons
(d) Cycloalkanes

122. The reaction

$CH_2=CH_2+H_2 \xrightarrow[250-300^oC]{Ni} CH_3-CH_3$ is called

[MP PMT 1996; CBSE PMT 2001; MH CET 2001; BHU 2002]

(a) Wurtz's reaction
(b) Kolbe's reaction
(c) Sabatier and Senderen's reaction
(d) Carbylamine reaction

123. The alkene which on ozonolysis yields acetone is

[MP PMT 1986, 2000]

(a) $CH_2=CH_2$

(b) $CH_3-CH=CH_2$

(c) $(CH_3)_2C=C(CH_3)_2$

(d) $CH_3-CH=CH-CH_3$

124. $CH_3CH=CHCHO$ is oxidized to $CH_3CH=CHCOOH$ using

(a) Alkaline potassium permanganate
(b) Acidified potassium permanganate
(c) Selenium dioxide
(d) Osmium tetroxide

125. The order of increasing reactivity towards HCl of the following compounds will be

(1) $CH_2=CH_2$

(2) $(CH_3)_2C=CH_2$

(3) $CH_3CH=CHCH_3$ **[MP PET 1994]**

(a) $1<2<3$ (b) $1<3<2$

(c) $3<2<1$ (d) $2<1<3$

126. The reagent which is used to distinguish between propene and propyne is **[MP PET 1994; IIT-JEE (Screening)**
AIIMS 2000; Pb. PMT 2002; BHU 2003]

(a) Bromine (b) Alkaline $KMnO_4$

(c) Ammoniacal $AgNO_3$ (d) Ozone

127. Which one of the following reactions would be the best for the formation of 2-bromobutane**[MP PET 1994]**

(1) $CH_3CH=CHCH_2CH_3 \xrightarrow{HBr}$

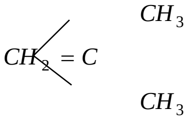
(2) $CH_3CH_2CH=CH_2 \xrightarrow{HBr}$

(3) $CH_3CH=CHCH_3 \xrightarrow{Br_2}$

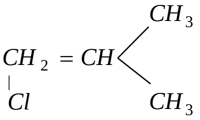
(4) $CH_3CH_2CH=CH_2 \xrightarrow[\text{Peroxide}]{HBr}$

(a) 1 (b) 2

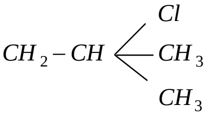
(c) 3 (d) 4

128. If HCl is added over  then what is formed **[CPMT 1996]**

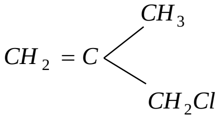
(a)



(b)



(c)



(d) None of these

129. Position of double bond in an organic compound is determined by **[DCE 2001; RPMT 2002]**

(a) Ozonolysis (b) Oxidation

(c) Reduction (d) Hydrogenation

130. A gas decolourises Bayer's reagent but does not react with Tollen's reagent, this gas is**[MP PMT 2001]**

(a) Ethene (b) Ethyne

(c) Ethane (d) Methane

131. Formation of 2-butene from 2-bromobutane is according to **[NCERT 1978]**

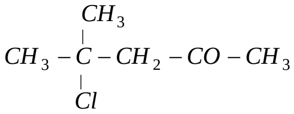
(a) Markowikoff's (b) Bayer

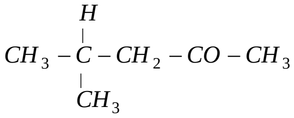
(c) Saytzeff (d) Wurtz

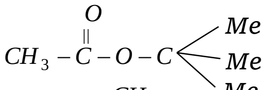
132. An alkene on ozonolysis gave acetaldehyde the alkene is

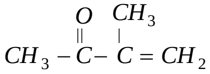
(a) Ethylene (b) Propene
(c) 1-butene (d) 2-butene

133. Indicate the organic structure for the product expected when 2-methyl propene is heated with acetyl chloride in presence of anhydrous zinc chloride **[CBSE PMT 1989]**

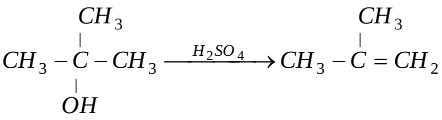
(a) 
$CH_3-\underset{Cl}{\overset{CH_3}{C}}-CH_2-CO-CH_3$

(b) 
$CH_3-\underset{CH_3}{\overset{H}{C}}-CH_2-CO-CH_3$

(c) 
$CH_3-\overset{O}{\overset{\|}{C}}-O-C\begin{smallmatrix}Me\\Me\\Me\end{smallmatrix}$

(d) 
$CH_3-\overset{O}{\overset{\|}{C}}-\overset{CH_3}{C}=CH_2$

134. The reaction


$CH_3-\underset{OH}{\overset{CH_3}{C}}-CH_3\xrightarrow{H_2SO_4}CH_3-\overset{CH_3}{C}=CH_2$

is the example of **[AMU 1983]**

(a) Sulphonation (b) Dehydration
(c) Alkylation (d) Decomposition

135. Olefins can be hydrogenated by **[AIIMS 1991]**

(a) Zinc and HCl (b) Nascent hydrogen
(c) Raney Ni and H_2 (d) Lithium hydride in ether

136. Electrolysis of cold concentrated aqueous solution of potassium succinate yields

(a) Ethane (b) Ethyne
(c) Ethene (d) Ethane-1, 2-diol

137. A hydrocarbon containing 2 carbon atoms gives Sabatier and Senderen's reaction but does not give precipitate with ammoniacal silver nitrate solution. The hydrocarbon in the question is**[MADT Bihar 1983]**

(a) Ethane (b) Acetylene
(c) Ethylene (d) None of these

138. The reaction

$CH_2=CH-CH_3+HBr\rightarrow CH_3CHBr-CH_3$ is

[CBSE PMT 1996]

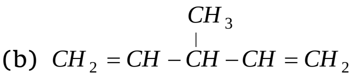
(a) Nucleophilic addition (b)Electrophilic addition
(c) Electrophilic substitution (d) Free radical addition

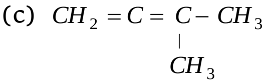
139. What is the product of the reaction of 1, 3-butadiene with Br_2

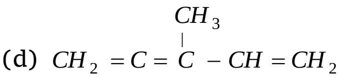
(a) 1,4 –dibromobutene (b) 1,2 -dibromobutene
(c) 3,4-dibromobutene (d) 2,3-dibromo-2-butene

140. An alkene given two moles of $HCHO$, one mole of CO_2 and one mole of CH_3COCHO on ozonolysis. What is its structure **[Orissa JEE 2003]**

(a) $CH_2=C=CH-CH_2-CH_3$

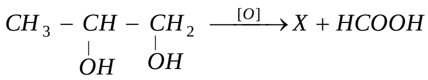
(b) 
$CH_2=CH-\overset{CH_3}{CH}-CH=CH_2$

(c) 
$CH_2=C=\underset{CH_3}{C}-CH_3$

(d) 
$CH_2=C=\overset{CH_3}{C}-CH=CH_2$

141. In the reaction

$CH_3CH=CH_2+H_2O+[O]\xrightarrow[Acid]{KMnO_4}$


$CH_3-\underset{OH}{CH}-\underset{OH}{CH_2}\xrightarrow{[O]}X+HCOOH$

X is

(a) CH_3CH_2COOH (b) CH_3COOH
(c) CH_3CH_2CHO (d) CH_3CH_2OH

142. Which of the following alkenes gives only acetic acid and on oxidation with potassium permanganate solution

[MP PET 2003]

(a) Ethylene (b) 1-Butene
(c) Propene (d) 2-Butene

143. Butene-1 may be converted to butane by reaction with

[AIEEE 2003]

(a) Zn-HCl (b) Sn-HCl
(c) Zn-Hg (d) Pd/H_2

144. The major product formed when propene reacts with HBr in presence of peroxides is**[NCERT 1980; CBSE PM**
[CPMT 1983; MP PMT 1986]

(a) n-propyl bromide (b) Isopropyl bromide
(c) n-propyl alcohol (d) 1, 3-dibromopropane

145. Ethyl hydrogen sulphate is obtained by the reaction of H_2SO_4 on **[CPMT 1985]**

(a) Ethylene (b) Ethane
(c) Ethyl chloride (d) Ethanol

146. Ethylene reacts with ozone to give **[DPMT 1981]**

(a) Formaldehyde (b) Ethyl alcohol
(c) Ozonide (d) Acetaldehyde

147. Which of the following aliphatic compounds will discharge red colour of bromine

(a) C_2H_4 (b) C_3H_6
(c) C_4H_8 (d) All of these

148. Chlorination can be done on **[Orissa JEE 2003]**

(a) $CH_3-CH=CH_2$ (b) $CH_2=CH_2$
(c) $CH\equiv CH$ (d) None of these

149. Addition of HI on the double bond of propene yields isopropyl iodide and not n-propyl iodide as the major product. This is because the addition proceeds through

[CPMT 1988]

(a) A more stable carbonium ion

(b) A more stable carbanion

(c) A more stable free radical

(d) None of the above being a concerted reaction

150. When butene-1 is mixed with excess of bromine, the expected reaction product is **[CPMT 1974; BHU 1980]**

(a) 1, 2-dibromobutane (b) 1, 1-dibromobutane

(c) 2, 2-dibromobutane (d) Perbromobutane

151. A compound '*X*' on ozonolysis forms two molecules of *HCHO*. Compound '*X*' is **[AIIMS 1987; CPMT 1993]**

(a) C_2H_4 (b) C_2H_2

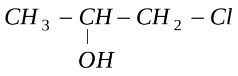
(c) C_2H_6 (d) C_6H_6

152. For the reaction

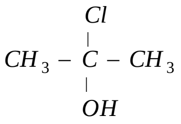
$CH_3-CH=CH_2+HOCl\rightarrow A$ the product *A* is

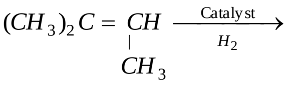
[Orissa JEE 2002]

(a) $CH_3-CHCl-CH_2OH$

(b) 
$CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_2-Cl$

(c) $CH_3-CH_2-CH_2-COCl$

(d) 
$CH_3-\overset{\displaystyle Cl}{\overset{|}{\underset{\displaystyle OH}{\underset{|}{C}}}}-CH_3$

153. 
$(CH_3)_2C=\underset{\displaystyle CH_3}{\underset{|}{CH}}\xrightarrow[H_2]{\text{Catalyst}}$ Optical isomers **[BHU 2003]**

(a) 2 (b) 4

(c) Zero (d) 3

154. Isobutene $+HBr\xrightarrow[\text{Peroxide}]{}$ product is **[BHU 2003]**

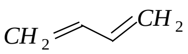
(a) Tertiary butyl bromide (b) Isobutyl bromide

(c) Tertiary butyl alcohol (d) Isobutyl alcohol

155. Which of the following represents the given mode of hybridisation $sp^2-sp^2-sp-sp$ from left to right

[IIT-JEE (Screening) 2003]

(a) $H_2C=CH-C\equiv CH$ (b) $HC\equiv C-C\equiv CH$

(c) $H_2C=C=C=CH_2$ (d) 

156. "The negative part of addenda adds on to the carbon atom linked with least number of hydrogen atoms". This statement is called **[DPMT 1982; AIIMS 1988; AFMC 1994]**

(a) Thiele's principle (b) Bayer's strain theory

(c) Markownikoff's rule (d) Peroxide effect

157. The product obtained, heating ethanol with conc. H_2SO_4 at 165^o-170^o, is **[MP PMT 2003]**

(a) $(C_2H_5)_2SO_4$ (b) $CH_2=CH_2$

(c) CH_3COOH (d) $C_2H_5HSO_4$

158. Which of the following is the most stable

(a) 1-butene (b) 2-butene

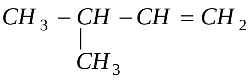
(c) 1-pentene (d) 2-pentene

159. Which doesn't follow Markownikoff's rule

[JEE Orissa 2004; MP PMT 2004; BCECE 2005]

(a) $CH_3-CH=CH_2$

(b) $CH_3CH=CHCH_3$

(c) 
$CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH=CH_2$

(d) $CH_3-CH_2-CH=CH_2$

160. The product of acid catalyzed hydration of 2-phenyl propene is **[IIT JEE (Screening) 2004]**

(a) 3-phenyl-2-propanol (b) 1-phenyl-2-propanol

(c) 2-phenyl-2-propanol (d) 2-phenyl-1-propanol

161. A reagent used to test for unsaturation of allkene is

[BHU 2004]

(a) conc. H_2SO_4 (b) Ammonical Cu_2Cl_2

(c) Ammonical $AgNO_3$ (d) Solution of Br_2 in CCl_4

162. Propylene on hydrolysis with sulphuric acid forms

[MH CET-2003]

(a) *n*-propyl alcohol (b) Isopropyl alcohol

(c) Ethyl alcohol (d) Butyl alcohol

163. An alkene, on ozonolysis gives formaldehyde and acetaldehyde. The alkene is :

(a) Ethene (b) Propene

(c) Butene-1 (d) Butene-2

164. In the reaction, $H_2C=CH_2\xrightarrow[\text{KMnO}_4]{\text{cold alkaline}}(A)$:

Product *A* is : **[Pb. CET 2000]**

(a) Ethylene glycol (b) Acetic acid

(c) Ethane (d) Butyric acid

165. Using anhydrous $AlCl_3$ as catalyst, which one of the following reaction produces ethylbenzene $(PhEt)$

[CBSE PMT 2004]

(a) $H_2C=CH_2+C_6H_6$

(b) $H_3C-CH_3+C_6H_6$

(c) $H_3C-CH_2OH+C_6H_6$

(d) $CH_3-CH=CH_2+C_6H_6$

166. Which of these does not follow Anti-Markownikoff's rule

[Orissa JEE 2005]

(a) 2-butene (b) 1-butene

(c) 2-pentene (d) 2-hexene

167. Reaction of *HBr* with propene in the presence of peroxide gives **[CBSE PMT 2004]**

(a) Allyl bromide (b) *n*-propyl bromide

(c) Isopropyl bromide (d) 3-bromo propane

168. Which of the following react with $KMnO_4$ but does not react with $AgNO_3$? **[BCECE 2005]**

(a) C_2H_6 (b) CH_4

(c) C_2H_4 (d) C_2H_2

169. 3-Phenylpropene on reaction with HBr gives (as a major product) **[AIIMS 2005]**

(a) $C_6H_5CH_2CH(Br)CH_3$

(b) $C_6H_5CH(Br)CH_2CH_3$

(c) $C_6H_5CH_2CH_2CH_2Br$

(d) $C_6H_5CH(Br)CH=CH_2$

170. Reaction of one molecule of HBr with one molecule of 1,3-butadiene at 40^oC gives predominantly **[AIEEE 2005]**

(a) 3-bromobutene under kinetically controlled conditions

(b) 1-bromo-2-butene under thermodyanamically controlled conditions

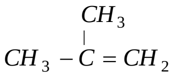
(c) 3-bromobutene under thermodynamically controlled conditions

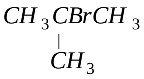
(d) 1-bromo-2-butene under kinetically controlled conditions

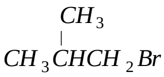
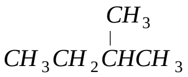
171. The only alcohol that can be prepared by the indirect hydration of alkene is **[AFMC 2005]**

(a) Ethyl alcohol (b) Propyl alcohol

(c) Isobutyl alcohol (d) Methyl alcohol

172. The reaction of HBr with  $CH_3-\overset{\overset{CH_3}{|}}{C}=CH_2$ in the presence of peroxide will give **[BHU 2005]**

(a)  $CH_3\underset{\underset{CH_3}{|}}{C}BrCH_3$ (b) $CH_3CH_2CH_2CH_2Br$

(c)  $CH_3\overset{\overset{CH_3}{|}}{C}HCH_2Br$ (d)  $CH_3CH_2\overset{\overset{CH_3}{|}}{C}HCH_3$

173. A gas decolourised by $KMnO_4$ solution but gives no precipitate with ammoniacal cuprous chloride is **[KCET 2005]**

(a) Ethane (b) Methane

(c) Ethene (d) Acetylene

174. Cyclohexene on reaction with OsO_4 followed by reaction with $NaHSO_3$ gives **[Orissa JEE 2005]**

(a) cis-diol (b) trans-diol

(c) epoxy (d) alcohol

Alkyne

1. Which of the following gases is used for welding **[CPMT 1996]**

(a) Methane (b) Ethane

(c) Acetylene (d) Ethene

2. A metallic carbide on treatment with water gives a colourless gas which burns readily in air and which gives a precipitate with ammoniacal silver nitrate solution. Gas evolved is **[NCERT 1975; CPMT 1977; MP PET 2002]**

(a) Methane (b) Ethane

(c) Acetylene (d) Ethylene

3. 1-butyne reacts with cold alkaline $KMnO_4$ to produce **[AIIMS 1997]**

(a) CH_3CH_2COOH

(b) $CH_3CH_2CH_2COOH$

(c) $CH_3CH_2COOH+CO_2$

(d) $CH_3CH_2COOH+HCOOH$

4. Identify the product D in the following series of reaction

$$CH_3COOH\xrightarrow{LiAlH_4}A\xrightarrow[443\,K]{H^+}B\xrightarrow{Br_2}C\xrightarrow[KOH]{alc.}D$$

[CBSE PMT 1998]

(a) Methane (b) Alcohol

(c) Acetylene (d) Benzaldehyde

5. The correct order towards bond length is **[RPMT 1997]**

(a) $C-C<C=C<C\equiv C$ (b) $C\equiv C<C=C<C-C$

(c) $C=C<C\equiv C<C-C$ (d) $C=C<C-C<C\equiv C$

6. In the molecule $CH\equiv C-CH=CH_2$, the hybridisation of $C-C$ bond is

(a) sp^2-sp (b) sp^3-sp^3

(c) sp^2-sp^2 (d) sp^3-sp

7. The product formed when acetylene is passed through red hot tube is **[BHU 1989; RPMT 2003]**

(a) Benzene (b) Cyclohexane

(c) Neoprene (d) Ethane

8. Acetylenic hydrogens are acidic because **[CBSE PMT 1989; Pb. PMT 1999]**

(a) Sigma electron density of $C-H$ bond in acetylene is nearer to carbon, which has 50% s-character

(b) Acetylene has only one hydrogen on each carbon

(c) Acetylene contains least number of hydrogens among the possible hydrocarbons having two carbons

(d) Acetylene belongs to the class of alkynes with molecular formula C_nH_{2n-2}

9. Which is the most suitable reagent among the following to distinguish compound (iii) from rest of the compounds

(i) $CH_3-C\equiv C-CH_3$

(ii) $CH_3-CH_2-CH_2-CH_3$

(iii) $CH_3-CH_2-C\equiv CH$

(iv) $CH_3-CH=CH_2$ **[CBSE PMT 1989]**

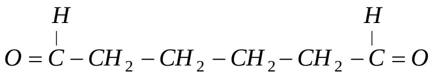
(a) Bromine in carbon tetrachloride

(b) Bromine in acetic acid

(c) Alkaline $KMnO_4$

(d) Ammoniacal silver nitrate reagent

10. A hydrocarbon of formula C_6H_{10} absorbs only one molecule of H_2 upon catalytic hydrogenation. Upon ozonolysis, the hydrocarbon yields



$O=\overset{\overset{H}{|}}{C}-CH_2-CH_2-CH_2-CH_2-\overset{\overset{H}{|}}{C}=O$

The hydrocarbon is **[MP PMT 1986]**

(a) Cyclohexane (b) Benzene

(c) Cyclohexene (d) Cyclobutane

11. Poisonous gas 'Lewissite' is obtained by the reaction of **[MP PMT 2003]**

(a) $CH\equiv CH$ and $AsCl_3$

(b) $CH_2=CH_2$ and $AsCl_3$

(c) $CH\equiv CH$ and S_2Cl_2

(d) $CH_2=CH_2$ and $NOCl$

12. Products of the following reaction $CH_3C\equiv CCH_2CH_3 \xrightarrow[(2)\ Hydrolysis]{(1)\ O_3}$ .... are **[CBSE PMT 2005]**

(a) $CH_3CHO+CH_3CH_2CHO$

(b) $CH_3COOH+CH_3CH_2CHO$

(c) $CH_3COOH+HOOCCH_2CH_3$

(d) $CH_3COOH+CO_2$

13. By coaltar distillation, which is not obtained **[SCRA 1990; MP PMT 1986]**

(a) Light oil (b) Middle oil

(c) Heavy oil (d) Mobil oil

14. Hydrocarbon containing following bond is most reactive **[AIIMS 1987]**

(a) $C\equiv C$ (b) $C=C$

(c) $C-C$ (d) All of these

15. The shapes of methane, ethene and ethyne molecules are, respectively

(a) Tetrahedral, planar and linear

(b) Tetrahedral, linear and planar

(c) Pyramidal, planar and linear

(d) Tetrahedral, pyramidal and planar

16. To synthesize the unsymmetrical alkyne $CH_3-C\equiv C-CH_2-CH_3$ the reagents needed would be

(a) Ethene, iodoethane, iodomethane and potassium hydroxide

(b) Acetaldehyde, 1-bromopropane and conc. H_2SO_4

(c) 1, 2-dichloroethane, 1-propanol and alcoholic potassium hydroxide

(d) Ethyne, iodomethane, iodoethane and sodamide

17. When propyne is treated with dilute H_2SO_4 and $HgSO_4$, the major product is**[Kurukshetra CEE 2002]**

(a) Propanal

(b) Propanol

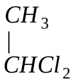
(c) Propyl hydrogen sulphate

(d) Propanone

18. Which of the following will be the final product when C_2H_2 reacts with HCl **[DPMT 1984; AFMC 1982; Bihar MEE 1982]**

(a) 

$\begin{matrix}CH\\ \|\\ CHCl\end{matrix}$

(b) 

$\begin{matrix}CH_3\\ |\\ CHCl_2\end{matrix}$

(c) 

$\begin{matrix}CHCl\\ \|\\ CHCl\end{matrix}$

(d) None of these

19. What is the end product of the following sequences of operations $CaC_2 \xrightarrow{H_2O} A \xrightarrow[Hg^{++}]{\text{dil. } H_2SO_4} B \xrightarrow[H_2]{Ni} C$ **[CPMT 1978; MP PMT 1996]**

(a) Methyl alcohol (b) Acetaldehyde

(c) C_2H_5OH (d) C_2H_4

20. $R-CH_2-CCl_2-R \xrightarrow{\text{Reagent}} R-C\equiv C-R$

The reagent is **[CBSE PMT 1989; MP PET 1995]**

(a) Na (b) HCl and H_2O

(c) KOH in C_2H_5OH (d) Zn

21. Acetylene can be prepared from **[CPMT 1988]**

(a) Potassium fumarate (b) Calcium carbide

(c) Ethylene bromide (d) All of these

22. Acetylene is obtained by the electrolysis of **[BHU 1986]**

(a) Sodium succinate (b) Potassium fumarate

(c) Both (a) and (b) (d) None of these

23. The compound C_3H_4 has a triple bond, which is indicated by its reaction with

(a) Bromine water (b) Bayer's reagent

(c) Fehling solution (d) Ammonical silver nitrate

24. $CH\equiv CH \xrightarrow[H_2SO_4]{H_2O/Hg^{2+}} X \xrightarrow{LiAlH_4} Y \xrightarrow{P_4/Br_2} Z$ Here Z is **[JIPMER 2002]**

(a) Ethylene bromide (b) Ethanol

(c) Ethyl bromide (d) Ethylidene bromide

25. $CH\equiv CH \xrightarrow[\text{Pressure}]{Ni(CN)_2} X$. Here X in the reaction

[JIPMER 2002]

(a) Benzene (b) Ethane
(c) Cyclooctatetraene (d) Cyclohexane

26. A salt producing hydrocarbon among these compounds is **[KCET (Engg.) 2002]**

(a) Ethane (b) Methane
(c) Ethene (d) Ethyne

27. An unknown compound *A* has a molecular formula C_4H_6. When *A* is treated with an excess of Br_2 a new substance *B* with formula $C_4H_6Br_4$ is formed. *A* forms a white precipitate with ammoniacal silver nitrate solution. A may be **[MP PET/PMT 1998]**

(a) Butyne-1 (b) Butyne-2
(c) Butene-1 (d) Butene-2

28. Which of the following reacts with sodium with the elimination of hydrogen

(a) CH_4 (b) C_2H_6
(c) C_2H_4 (d) C_2H_2

29. Acetylene gives **[CPMT 1985]**

(a) White precipitate with $AgNO_3$ and red precipitate with Cu_2Cl_2
(b) White precipitate with Cu_2Cl_2 and red precipitate with $AgNO_3$
(c) White precipitate with both the reagents
(d) Red precipitate with both the reagents

30. The bond length between sp^3 hybridised carbon atom and other carbon atom is minimum in **[CBSE PMT 1996; Pb. PMT 1999]**

(a) Propane (b) Butane
(c) Propene (d) Propyne

31. The *C* - *H* bond length is minimum in the bond formed by

(a) *sp* - *s* overlapping (as in alkynes)
(b) $sp^2 - s$ overlapping (as in alkenes)
(c) $sp^3 - s$ overlapping (as in alkanes)
(d) None of these

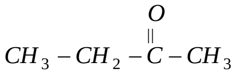
32. Which of the *C* - *C* bond is strongest

(a) Formed by $sp^3 - sp^3$ hybridised carbon atoms (as in alkanes)
(b) Formed by $sp^2 - sp^2$ hybridised carbon atoms (as in alkenes)
(c) Formed by $sp - sp$ hybridised carbon atoms (as in alkynes)
(d) All are equal

33. Which of the following pairs has the same bond angle

(a) Ethane and ethylene (b) Ethylene and acetylene
(c) Ethylene and benzene (d)Acetylene and benzene

34. The product(s) obtained via oxymercuration $(HgSO_4 + H_2SO_4)$ of 1-butyne would be**[IIT-JEE 1999]**

(a) 
$CH_3 - CH_2 - \overset{O}{\overset{\|}{C}} - CH_3$
(b) $CH_3 - CH_2 - CH_2 - CHO$
(c) $CH_3 - CH_2 - CHO + HCHO$
(d) $CH_3CH_2COOH + HCOOH$

35. A compound is treated with $NaNH_2$ to give sodium salt. Identify the compound **[AFMC 1998]**

(a) C_2H_2 (b) C_6H_6
(c) C_2H_6 (d) C_2H_4

36. A gas decolourises bromine in CCl_4 and forms a precipitate with ammoniacal silver nitrate. The gas is **[EAMCET 1998]**

(a) C_2H_2 (b) C_2H_4
[BHU 1983]
(c) C_2H_6 (d) CH_4

37. Among the following compounds which have more than one type of hybridisation for carbon atom

(i) $CH_3CH_2CH_2CH_3$
(ii) $CH_3 - CH = CH - CH_3$
(iii) $CH_2 = CH - C \equiv CH$
(iv) $H - C \equiv C - H$ **[EAMCET 1998]**

(a) (ii) and (iii) (b) (ii)
(c) (iii) and (iv) (d) (iv)

38. The homologue of ethyne is **[EAMCET 1998]**

(a) C_2H_4 (b) C_2H_6
(c) C_3H_8 (d) C_3H_4

39. When acetylene reacts with *HCl* in the presence of $HgCl_2$, the product is**[MNR 1985; MP PET 1996; UPSEAT 200**

(a) Methyl chloride (b) Dichloroethane
(c) Vinyl chloride (d) Ethylidine chloride

40. When propyne reacts with aqueous H_2SO_4 in the presence of $HgSO_4$, the major product is **[IIT-JEE 1983; AFMC 1991; KCET 1993]**

(a) Propanal (b) Propyl hydrogen sulphate
(c) Acetone (d) Propanol

41. Propyne on polymerisation gives **[CPMT 1999, 2002]**

(a) Mesitylene (b) Benzene
(c) Ethyl benzene (d) Propyl benzene

42. When treated with ammoniacal cuprous chloride, which one among the following forms copper derivative **[CBSE PMT 1989; MP PMT 1993]**

(a) C_2H_6 (b) C_2H_4
(c) C_2H_2 (d) C_6H_6

43. Which of the following catalyst is used in the polymerisation of $CH \equiv CH$ to C_6H_6 **[CPMT 1999]**

(a) $AlCl_3$ (b) $HgSO_4$

(c) $NbCl_3$ (d) HCl

44. $KMnO_4$ will oxidise acetylene to **[CPMT 1999]**

(a) Ethylene glycol (b) Ethyl alcohol

(c) Oxalic acid (d) Acetic acid

45. Ethyne on reaction with dil. H_2SO_4 and $Hg(\text{II})$ gives

(a) Ethanol

(b) Ethanal

(c) Methoxymethane

(d) Ethyl hydrogen sulphate

46. Which of the following is used to distinguish ethylene and acetylene **[MP PET 2000; KCET 2000; JIPMER 2000; CPMT 1977; NCERT 1973]**

(a) Alkaline $KMnO_4$

(b) Bromine water

(c) Ammoniacal cuprous chloride

(d) Conc. H_2SO_4

47. The distinguishing test for triple bond containing acidic hydrogen is **[JIPMER 2000]**

(a) $Ag(NH_3)_2^+$ (b) Br_2 in CCl_4

(c) Alkaline $KMnO_4$ (d) $AlCl_3$

48. If acetylene is passed through an electric arc in the atmosphere of nitrogen, the compound formed is

[RPMT 1999]

(a) HCN (b) Pyrrole

(c) Pyrazole (d) Pyridine

49. Ozonolysis of acetylene gives **[RPMT 1999]**

(a) Glycol (b) Glyoxal,formic acid

(c) Formaldehyde (d) None

50. The bond length between the hybridised carbon atom and other carbon atom is minimum in **[Pb. PMT 2000]**

(a) Butane (b) Propyne

(c) Propene (d) Propane

51. The reaction of propene with $HOCl$ proceeds via the addition of **[IIT-JEE (Screening) 2001]**

(a) H^+ in the first step

(b) Cl^+ in the first step

(c) OH^- in the first step

(d) Cl^+ and OH^- in a single step

52. Acetylene reacts with ammonical $AgNO_3$ forming

[MH CET 1999; CPMT 1984, 86; MP PMT 1997]

(a) Silver acetylene (b) Silver acetate

(c) Metal silver (d) Silver mirror

53. Ethylidine dichloride can be prepared by the reaction of HCl and

(a) C_2H_4 (b) C_2H_2

(c) C_2H_5 (d) All of these

54. Which of the following order of reagent is chosen to prepare 1, 3-butadiene from C_2H_2 **[RPET 2000]**

(a) $CuCl / NH_4Cl$ and $H_2 / Pd(BaSO_4)$

(b) $NH_4Cl / CuCl$ and $H_2 / Pd(BaSO_4)$

(c) $H_2 / Pd(BaSO_4)$ and $CuCl / NH_4Cl$

(d) $H_2 / Pd(BaSO_4)$ and $NH_4Cl / CuCl$

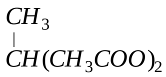
55. Benzene is the polymer of **[RPET 1999; Bihar MEE 1999]**

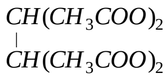
(a) Methane (b) Ethane

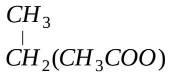
(c) Ethylene (d) Ethyne

56. $\begin{array}{c}CH\\|||\\CH\end{array}$ reacts with acetic acid in presence of Hg^{2+} to give

[BHU 2005]

(a) 
$\begin{array}{l}CH_3\\|\\CH(CH_3COO)_2\end{array}$

(b) 
$\begin{array}{l}CH(CH_3COO)_2\\|\\CH(CH_3COO)_2\end{array}$

(c) 
$\begin{array}{l}CH_3\\|\\CH_2(CH_3COO)\end{array}$

(d) None of these

57. Acetylene is prepared industrially by passing electric discharge through graphite electrodes in the atmosphere of

[CPMT 1985]

(a) Air (b) N_2

(c) H_2 (d) CO_2

58. When acetylene is passed into dilute sulphuric acid containing Hg^{2+} ions, the product formed is

[DPMT 1996; Roorkee 1995; BHU 1998; KCET 1999; MP PET 1985, 86; DCE 1999; DPMT 1999, 2002; CPMT 1975, 82, 83, 90; MP PMT 1994, 97; CBSE PMT 1999; AIIMS 2002; CBSE PMT 1999; KCET (Med.) 1999, JIPMER 1999]

(a) Acetone (b) Acetic acid

(c) Acetaldehyde (d) Formaldehyde

59. Which of the following has acidic hydrogen

[IIT-JEE 1985, 89; CPMT 1986; Bihar MEE 1997; RPET 1999; AFMC 1999]

(a) Ethyne (b) Ethene

(c) Ethane (d) Benzene

60. Xylenes on oxidation with acidic $KMnO_4$ gives

[JIPMER 2000]

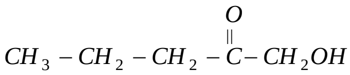
(a) Terphthalic acid (b) Phthalic acid

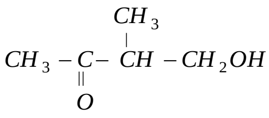
(c) Isophthalic acid (d) All of these

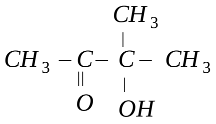
61. The structure of the product(Z) in the reactions given below

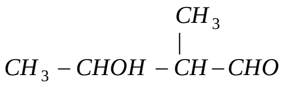
$HC\equiv CH \xrightarrow[H^+]{NaNH_2, CH_3COCH_3} X \xrightarrow[H_2O]{Hg^{2+}, H_3O^+} Z$ is

[Roorkee 2000]

(a) 
$CH_3-CH_2-CH_2-\overset{\overset{O}{||}}{C}-CH_2OH$

(b) 
$CH_3-\underset{\underset{O}{||}}{C}-\overset{\overset{CH_3}{|}}{CH}-CH_2OH$

(c) 
$CH_3-\underset{\underset{O}{||}}{C}-\underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_3$

(d) 
$CH_3-CHOH-\overset{\overset{CH_3}{|}}{CH}-CHO$

62. Carbon-carbon bond length is minimum in

[CBSE PMT 1988, 91; MNR 1984; CPMT 1989; RPMT 1997; Pb. PMT 2001]

(a) Ethane
(b) Ethene
(c) Ethyne
(d) Benzene
(e) Ethanol

63. Triple bond of ethyne is made of **or** Cylindrical shape of an alkyne is due to

[EAMCET 1978; NCERT 1979; CBSE PMT 1997; Manipal MEE 1995; Bihar MEE 1996]

(a) Three $\sigma-$bonds
(b) Three $\pi-$bonds
(c) Two σ and one $\pi-$bond
(d) Two π and one $\sigma-$bond

64. An organic compound has a triple bond and not double bond. It can be tested by **[MP PMT 2000, 03]**

(a) Bromine water
(b) Bayer's reagent
(c) Fehling solution
(d) Ammonical silver nitrate

65. Which of these will not react with acetylene

[AIEEE 2002; DCE 2002]

(a) $NaOH$
(b) Ammonical $AgNO_3$
(c) Na
(d) HCl

66. What is the product when acetylene reacts with hypochlorous acid **[RPMT 2002; AIEEE 2002]**

(a) CH_3COCl
(b) $ClCH_2CHO$
(c) Cl_2CHCHO
(d) $ClCHCOOH$

67. The alkene C_6H_{10} producing $OHC-(CH_2)_4-CHO$ on ozonolysis is **[Roorkee 1999]**

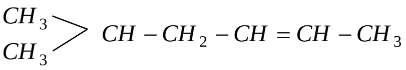
(a) Hexene-1
(b) Hexene-3
(c) Cyclohexene
(d) 1-methylcyclohexene-1

68. The number of moles of proton which can be easily given by butyne-1(1 mole) is **[MP PMT 2000]**

(a) 1
(b) 2
(c) 3
(d) 6

69. Which will undergo reaction with ammoniacal $AgNO_3$

[DPMT 1996]

(a) 
$\begin{matrix}CH_3\\CH_3\end{matrix}\!>CH-CH_2-CH=CH-CH_3$

(b) $CH_3-CH=CH-C\equiv CH$
(c) $CH_3-CH_2-CH=CH-CH_2-CH_3$
(d) $CH_2=CH-CH_2-CH_3$
(e) None

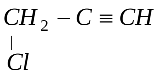
70. Acetylene gas when passed through the 20% H_2SO_4 at 80^oC gives acetaldehyde. The catalyst required for this conversion is

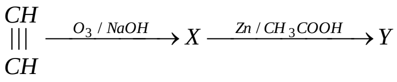
(a) Anhydrous $AlCl_3$
(b) $HgSO_4$
(c) Pd
(d) Pt

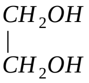
71. Which of the following reactions will yield 2, 2-dibromopropane **[MNR 1993; UPSEAT 2001]**

(a) $HC\equiv CH+2HBr\rightarrow$
(b) $CH_3C\equiv CH+2HBr\rightarrow$
(c) $CH_3CH=CH_2+HBr\rightarrow$
(d) $CH_3CH=CHBr+HBr\rightarrow$

72. Which of the following does not give white precipitate with ammoniacal $AgNO_3$

(a) $CH\equiv CH$
(b) $CH_3-C\equiv CH$
(c) $CH_3-C\equiv C-CH_3$
(d) 
$\underset{\underset{Cl}{|}}{CH_2}-C\equiv CH$

73. 
$\begin{matrix}CH\\|||\\CH\end{matrix} \xrightarrow{O_3/NaOH} X \xrightarrow{Zn/CH_3COOH} Y$ 'Y' is **[AIIMS 1988]**

(a) 
$\begin{matrix}CH_2OH\\|\\CH_2OH\end{matrix}$

(b) CH_3CH_2OH
(c) CH_3COOH
(d) CH_3OH

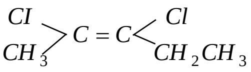
74. Which is represented by the formula C_nH_{2n-2}

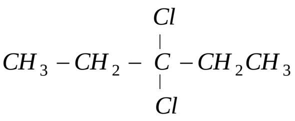
[CPMT 1975, 76; EAMCET 1979; MP PET 2003

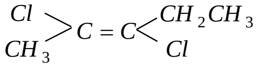
(a) Alkane
(b) Alkyne
(c) Alkene
(d) None of these

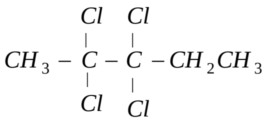
75. What is the major product of the following reaction $CH_3C\equiv C-CH_2-CH_3 \xrightarrow{\text{1 mole of } Cl_2}$

[Kerala (Med.) 2003]

(a) 
$\begin{matrix}Cl\\CH_3\end{matrix}\!>C=C<\!\begin{matrix}Cl\\CH_2CH_3\end{matrix}$

(b) 
$CH_3-CH_2-\underset{\underset{Cl}{|}}{\overset{\overset{Cl}{|}}{C}}-CH_2CH_3$

(c) 
$\begin{matrix} Cl \\ CH_3 \end{matrix} > C = C < \begin{matrix} CH_2CH_3 \\ Cl \end{matrix}$

(d) 
$CH_3 - \overset{Cl}{\underset{Cl}{C}} - \overset{Cl}{\underset{Cl}{C}} - CH_2CH_3$

76. A compound C_5H_8 which give white ppt. with ammonical $AgNO_3$. A give $(CH_3)_2CHCOOH$ with hot alcoholic KOH then compound is **[RPMT 2002]**

(a) $CH_3CH_2 - CH_2 - CH = CH_2$

(b) $CH_3 - CH_2 - C \equiv CH$

(c) $(CH_3)_2CH - C \equiv CH$

(d) $CH_2 = CH - CH_2 - CH = CH_2$

77. 1, 2-dibromoethane when heated with alcoholic potash gives **[Kerala PMT 2004]**

(a) Ethane (b) Acetylene

(c) Ethylene (d) Methane

(e) None of these

78. Which of the following is not a member of homologous series **[RPMT 2002]**

(a) Ethene (b) 1-butene

(c) 2-butene (d) 2-butyne

79. The compound formed as a result of potassium permanganate oxidation of ethylbenzene is **[MP PET/PMT 1998]**

(a) Benzoic acid (b) Benzyl alcohol

(c) Benzophenone (d) Acetophenone

80. What is the product when 2-butyne is treated with liquid NH_3 in presence of lithium **[Orissa JEE 2003]**

(a) *n*-butane (b) *cis*-2-butene

(c) *trans*-2-butene (d) 1-butene

81. Distinction in pentene-1 and pentyne-1 is done by **[CPMT 1996]**

(a) $[Ag(NH_3)_2]^+$ (b) Conc. H_2SO_4

(c) HCl (d) Br_2

82. A mixture of ethane, ethene and ethyne is passed through ammoniacal $AgNO_3$ solution. The gases which remain unreacted are

(a) Ethane and ethene (b) Ethane and ethyne

(c) Ethene and ethyne (d) Ethane only

83. In its reaction with silver nitrate acetylene shows **[MP PET 1999]**

(a) Oxidising property (b) Reducing property

(c) Basic property (d) Acidic property

84. Simplest alkyne is represented by **[CPMT 1974]**

(a) CH (b) CH_2

(c) C_2H_2 (d) C_2H_4

85. Which of the following bonds is most acidic

(a) $= C - H$ (b) $-C - H$

(c) $\equiv C - H$ (d) All are equally acidic

86. The hybridisation in methane, ethene and Ethyne respectively is **[CPMT 2003]**

(a) sp^3, sp^2 and sp (b) sp^3, sp, sp^2

(c) sp^2, sp^3 and sp (d) sp^3, sp^2, sp

87. Number of acidic hydrogen atoms in butyne-1 are **[MP PET 1986]**

(a) 2 (b) 3

(c) 1 (d) 4

88. Which of the following shows linear structure **[CPMT 2003]**

(a) Ethane (b) Ethene

(c) Acetylene (d) CCl_4

89. Calcium carbide on reacting with water gives **[CBSE PMT 1991; MP PMT 1993, 94; RPMT 2002; J & K 2005]**

(a) Methane (b) Ethane

(c) Ethene (d) Acetylene

90. Addition of HCN to ethyne in presence of $Ba(CN)_2$ as catalyst gives **[AFMC 1991]**

(a) 1, 1-dicyano ethane (b) Ethyl cyanide

(c) Vinyl cyanide (d) Divinyl cyanide

91. Which compound will react with an aqueous solution of $Ag(NH_3)_2^+OH^-$

(a) $CH_2 = CH_2$ (b) $CH_3 - CH_3$

(c) $CH_3CH_2C \equiv CH$ (d) $CH_3 - C \equiv C - CH_3$

92. Which of the following give H_2 gas with Na **[RPMT 2002]**

(a) CH_4 (b) C_2H_6

(c) C_2H_4 (d) C_2H_2

93. $CH_3 - C \equiv CH \xrightarrow[Zn/H_2O_2]{O_3}$ Product .Product in above reaction is **[RPMT 2003]**

(a) CH_3COOH (b) $HCOOH$

(c) Both (a) and (b) (d) $CH_3CHO + HCHO$

94. The number of $\pi -$ bonds in the product formed by passing acetylene through dilute sulphuric acid containing mercuric sulphate is **[EAMCET 1997]**

(a) Zero **[CPMT 1990]** (b) One

(c) Two (d) Three

95. Which of the following is weakly acidic

(a) $CH_2 = CH_2$ (b) C_6H_6

(c) $CH_3 - C \equiv CH$ (d) $CH_3 - C \equiv C - CH_3$

96. Which of the following reactions is shown by alkynes **[AMU 1984; RPMT 2000]**

(a) Addition (b) Substitution

(c) Polymerization (d) All of these

97. Shortest C–C bond length is present in **[BVP 2004]**

(a) $CH_3 - CH_2 - CH_3$ (b) $CH_3CH_2CH_2CH_3$

(c) $CH_2 = CH - CH = CH_2$ (d) $CH \equiv C - C \equiv CH$

98. Acetylene can be obtained by the reaction **[MH CET 2004]**

(a) $HCOOK \xrightarrow{\text{electrolysis}}$

(b) $CHI_3 + 6Ag + CHI_3 \xrightarrow{\Delta}$

(c) $CH_3CH_2OH \xrightarrow[443^\circ C]{\text{Conc. } H_2SO_4}$

(d) $Be_2C + H_2O \rightarrow$

99. Which of the following used for the conversion of 2-hexyne into trans-2-hexane **[IIT JEE (Screening) 2004]**

(a) $H_2 / Pd / BaSO_4$ (b) H_2, PtO_2

(c) $NaBH_4$ (d) $Li - NH_3 / C_2H_5OH$

100. In which of the following, the bond length between hybridized carbon atom and other carbon atom is minimum

[MH CET 2003]

(a) Propyne (b) Propene

(c) Butane (d) Propane

101. What happens when a mixture of acetylene an hydrogen is passed over heated Lindlar's catalyst

[Kerala PMT 2004; AIIMS 1987]

(a) Ethane and water are formed

(b) Ethylene is formed

(c) Acetylene and ethane are formed

(d) None of these

102. In acetylene molecule, the two carbon atoms are linked by

[KCET 2004]

(a) One sigma bond and two pi bonds

(b) Two sigma bonds and one pi bond

(c) Three sigma bonds

(d) Three pi bonds

103. Which reacts with ammoniacal $AgNO_3$

[Orissa JEE 2005]

(a) Propyne (b) 2-butyne

(c) 1,3-butadiene (d) Pentene

104. $CH \equiv CH \xrightarrow[H_2SO_4]{HgSO_4} \xrightarrow[H_2O]{CH_3MgBr} \xrightarrow{P/Br_2}$

[DPMT 2005]

(a) $CH_3CH(Br)CH_3$ (b) $CH_3CH_2CH_2Br$

(c) $CH_2 = CH - Br$ (d) $BrCH = CH - CH_3$

105. Carbide, which react with water to give propyne is

[Kerala CET 2005]

(a) CaC_2 (b) SiC

(c) Mg_2C_3 (d) Al_4C_3

(e) Be_2C

Aromatic hydrocarbon

1. The function of anhydrous $AlCl_3$ in the Friedel-Craft's reaction is to

[MNR 1986, 1995; Roorkee 1999; BHU 2001; CPMT 2002; MPPET 2001]

(a) Absorb water (b) Absorb HCl

(c) To produce electrophile (d)To produce nucleophile

2. Benzene reacts with CH_3COCl in the presence of $AlCl_3$ to give **[DPMT 1983; CBSE PMT 1991]**

(a) C_6H_5Cl (b) C_6H_5COCl

(c) $C_6H_5CH_3$ (d) $C_6H_5COCH_3$

3. Acylation process is preferred than direct alkylation because (by the Friedel-Craft's reaction)

(a) In alkylation, a poisonous gas is evolved

(b) In alkylation, large amount of heat is evolved

(c) In alkylation, polyalkylated product is formed

(d) Alkylation is very costly

4. Benzene cannot undergo

(a) Substitution (b) Addition

(c) Elimination (d) Oxidation

5. Coaltar is main source of **[DPMT 1984]**

(a) Aromatic compounds

(b) Aliphatic compounds

(c) Cycloalkanes

(d) Heterocyclic compounds

6. Which of the following is not formed by the ozonolysis of *o*-xylene

(a) Glyoxal (b) Ethyl glyoxal

(c) Dimethyl glyoxal (d) Methyl glyoxal

7. The number of σ and π bonds in a molecule of benzene is

[MP PMT/PET 1988; BHU 1995; CPMT 1997]

(a) 6σ and 9π (b) 9σ and 3π

(c) 12σ and 3π (d) 6σ and 6π

8. The ratio of σ and π bonds in benzene is

[CPMT 1991; BHU 1995]

(a) 2 (b) 4

(c) 6 (d) 8

9. Carbon atoms in benzene molecule is inclined at an angle of

[BHU 1985]

(a) 120^o (b) 180^o

(c) $109^o 28'$ (d) 60^o

10. When benzene is treated with excess of Cl_2 in the presence of I_2, the end product is

(a) Monochlorobenzene (b) Trichlorobenzene

(c) Hexachlorobenzene (d) Benzene hexachloride

11. Chemical name of the insecticide gammexene is

[CPMT 1981; MP PET 1995; MP PMT 1996;

CBSE PMT 1999; MP PET 1999]

(a) DDT (b) Benzene hexachloride
(c) Chloral (d) Hexachloroethane

12. Gammexane is obtained from benzene when it reacts with
(a) Br_2 in bright sunlight (in the absence of a catalyst)
(b) Cl_2 in bright sunlight (in the absence of a catalyst)
(c) CH_3Cl in the presence of anhydrous $AlCl_3$
(d) $COCl_2$ in the presence of anhydrous $AlCl_3$

13. Point out the wrong statement in relation to the structure of benzene
(a) It forms only one monosubstitution product
(b) The C - C bond distance in benzene is uniformly $1.397\,\mathring{A}$
(c) It is a resonance hybrid of a number of canonical forms
(d) It has three delocalised π - molecular orbitals

14. Which equation represents an example of Friedel-Craft's reaction **[MNR 1993; CPMT 1996]**
(a) $C_6H_6 + C_2H_5Cl \xrightarrow{AlCl_3} C_6H_5C_2H_5 + HCl$
(b) $C_2H_5OH + HCl \xrightarrow{ZnCl_2} C_2H_5Cl + H_2O$
(c) $C_6H_5Cl + CH_3COCl \xrightarrow{AlCl_3} C_6H_5COCH_3 + Cl_2$
(d) $C_2H_5Br + Mg \xrightarrow{Ether} C_2H_5Mgr$

15. The most stable carbonium ion among the following is
[JIPMER 2002; AFMC 2002]
(a) $C_6H_5\overset{+}{C}HC_6H_5$ (b) $C_6H_5\overset{+}{C}H_2$
(c) $CH_3\overset{+}{C}H_2$ (d) $C_6H_5CH_2\overset{+}{C}H_2$

16. The reaction of toluene with chlorine in presence of ferric chloride gives predominantly **[IIT-JEE 1986; DCE 2000]**
(a) Benzoyl chloride (b) *m*-chlorotoluene
(c) Benzyl chloride (d) *o*- and *p*-chlorotoluenes

17. The product formed when toluene is heated in light with Cl_2 and in absence of halogen carrier is
(a) Benzotrichloride (b) Gammexene
(c) Chlorobenzene (d) None of these

18. Attacking or reactive or electrophilic species in nitration of benzene is **or** In the nitration of benzene with concentrated HNO_3 and H_2SO_4 the attack on ring is made by
[CBSE PMT 1994; MP PET 1996, 2000; Pb. PMT 1998; BHU 2001; BVP 2004; DCE 2003]
(a) NO_2^- (b) NO_2^+
(c) NO_3^- (d) NO_2

19. Which of the following reactions takes place when a mixture of concentrated HNO_3 and H_2SO_4 reacts on benzene at $350\,K$
(a) Sulphonation (b) Nitration
(c) Hydrogenation (d) Dehydration

20. Nitration of benzene by nitric acid and sulphuric acid is
[MNR 1989; CPMT 1990; BCECE 2005]
(a) Electrophilic substitution (b)
(c) Nucleophilic substitution (d) Free radical substitution

21. Necessary conditions for halogenation are **[CPMT 1976]**
(a) Cold and dark
(b) Presence of halogen carrier
(c) Both (a) and (b)
(d) None

22. $C_6H_6 + CH_3Cl \xrightarrow[AlCl_3]{\text{anhydrous}} C_6H_5CH_3 + HCl$
is an example of **[NCERT 1979; CPMT 1974, 85, 90; Bihar CEE 1995; BHU 1979, 2001; MP PET 1995; MP PMT 1995; KCET 1993; EAMCET 1998; AIIMS 1998; CBSE PMT 2000; AFMC 2000; JIPMER 2000]**
(a) Friedel-Craft's reaction (b) Kolbe's synthesis
(c) Wurtz reaction (d) Grignard reaction

23. The reaction of benzene with chlorine in the presence of iron gives **[MP PET 1993]**
(a) Benzene hexachloride (b) Chlorobenzene
(c) Benzyl chloride (d) Benzoyl chloride

24. Benzene was discovered by **[NCERT 1981]**
(a) Ramsay (b) Dalton
(c) Faraday (d) Priestley

25. The correct structure of benzene was proposed by **[CPMT 1972]**
(a) Faraday (b) Davy
(c) Kekule (d) Wohler

26. The centric structure of benzene was proposed by **[CPMT 1982, 83, 89]**
(a) Dewar (b) Ladenberg
(c) Kekule (d) Armstrong and Baeyer

27. The bond order of individual carbon-carbon bonds in benzene is **[IIT-JEE 1981; MP PET 2000]**
(a) One (b) Two
(c) Between one and two (d) One and two, alternately

28. Six carbon atoms of benzene are of
(a) One type (b) Two types
(c) Three types (d) Six types

29. On heating a mixture of sodium benzoate and sodalime, the following is obtained
[CPMT 1990; AIIMS 1996; MP PET 1999; AFMC 1999]
(a) Toluene (b) Phenol
(c) Benzene (d) Benzoic acid

30. Benzene on treatment with a mixture of conc. HNO_3 and conc. H_2SO_4 at $100\,^oC$ gives
(a) Nitrobenzene (b) *m*-dinitrobenzene
(c) *p*-dinitrobenzene (d) *o*-dinitrobenzene

31. What is the end product which is obtained on the nitration of toluene **[MP PMT/PET 1988]**
[CPMT 1985]
(a) *o*-nitrotoluene (b) *p*-nitrotoluene
(c) 2, 4-dinitrotoluene (d) 2, 4, 6-trinitrotoluene

32. Which of the following processes is reversible

(a) Halogenation (b) Sulphonation

(c) Nitration (d) None

33. The attacking (electrophilic) species in sulphonation of benzene is **[RPMT 1997; CPMT 1999, 2002]**

(a) SO_2 (b) SO_3

(c) SO_4^{2-} (d) HSO_3^-

34. Which xylene is most easily sulphonated

(a) Ortho (b) Para

(c) Meta (d) All at the same rate

35. Toluene on oxidation with dilute HNO_3 and alkaline $KMnO_4$ gives **[DPMT 1981]**

(a) Benzaldehyde (b) Phenol

(c) Nitrotoluene (d) Benzoic acid

36. Benzene vapour mixed with air when passed over V_2O_5 catalyst at $775\,K$ gives

[AFMC 1991; CPMT 2001; MP PMT 2003]

(a) Glyoxal (b) Oxalic acid

(c) Maleic anhydride (d) Fumaric acid

37. Most common reactions of benzene (aromatic hydrocarbon) and its derivatives are

[DPMT 1984; MP PMT 1989; AFMC 1997; BHU 1996, 98]

(a) Electrophilic addition reactions

(b) Electrophilic substitution reactions

(c) Nucleophilic addition reactions

(d) Nucleophilic substitution reactions

38. Which is most readily nitrated **[Roorkee 1992]**

(a) Benzene (b) Phenol

(c) Aniline (d) Nitrobenzene

39. *o, p*-directing groups are mostly

(a) Activating groups (b) Deactivating groups

(c) Neutral groups (d) None of these

40. Which among the following is the strongest *o*, *p*-directing group **[CBSE PMT 1989]**

(a) OH (b) Cl

(c) C_6H_5 (d) Br

41. The compound that is most reactive towards electrophilic nitration is

[IIT-JEE 1985; AIIMS 1998; MP PET/PMT 1998]

(a) Toluene (b) Benzene

(c) Benzoic acid (d) Nitrobenzene

42. Amongst the following, the compound that can be most readily sulphonated is

[IIT-JEE 1982; MADT Bihar 1995; KCET 2005]

(a) Benzene (b) Nitrobenzene

(c) Toluene (d) Chlorobenzene

43. Which of the following would be least reactive towards bromine **[NCERT 1981]**

(a) Nitrobenzene (b) Phenol

(c) Anisole (d) Chlorobenzene

44. Amongst the following, the compound that is nitrated with difficulty is

(a) Benzene (b) Nitrobenzene

(c) Toluene (d) Phenol

45. Select the true statement about benzene from amongst the following **[CBSE PMT 1992]**

(a) Because of unsaturation benzene easily undergoes addition reactions

(b) There are two types of C - C bonds in benzene molecule

(c) There is a cyclic delocalisation of π electrons in benzene

(d) Monosubstitution of benzene group gives three isomeric substances

46. Anhydrous $AlCl_3$ is used in the Friedel-Craft's reaction because it is **[CBSE PMT 1991]**

(a) Electron rich

(b) Soluble in ether

(c) Insoluble to chloride and aluminium ions

(d) Electron deficient

47. (i) Chlorobenzene and (ii) benzene hexachloride are obtained from benzene by the reaction of chlorine, in the presence of

(a) (i) Direct sunlight and (ii) anhydrous $AlCl_3$

(b) (i) Sodium hydroxide and (ii) sulphuric acid

(c) (i) Ultraviolet light and (ii) anhydrous $FeCl_3$

(d) (i) Anhydrous $AlCl_3$ and (ii) direct sunlight

48. In Friedel Craft's alkylation, besides $AlCl_3$ the other reactants are **[AFMC 1997; CBSE PMT 1999]**

(a) $C_6H_6 + CH_3Cl$ (b) $C_6H_6 + CH_4$

(c) $C_6H_6 + NH_3$ (d) $C_6H_6 + CH_3COCl$

49. Nitration of benzene is a **[RPMT 1999]**

(a) Electrophilic displacement

(b) Electrophilic addition

(c) Nucleophilic addition

(d) Nucleophilic displacement

50. Benzene shows **[RPMT 1999]**

(a) Substitution (b) Addition

(c) Oxidation (d) All of these

51. Benzene can be obtained in the reaction

[RPET 2000; Bihar MEE 1997]

(a) Ethene + 1, 3-butadiene

(b) Trimerisation of ethyne

(c) Reduction of *PhCHO*

(d) All of these

52. Thiophene and benzene are separated by **[RPET 2000]**

(a) Sulphonation of thiophene

(b) Sulphonation of benzene

(c) Nitration of thiophene

(d) Nitration of benzene

53. Which of the following is a hydrocarbon **[AFMC 1992]**

(a) Urea (b) Benzene

(c) Ammonium cyanate (d) Phenol

54. Aromatic compounds burn with sooty flame because

[BIT 1991]

(a) They have a ring structure of carbon atoms

(b) They have a relatively high percentage of hydrogen

(c) They have a relatively high percentage of carbon

(d) They resist reaction with oxygen of air

55. Among the following compound which one is planar in shape **[MP PMT 2000]**

(a) Methane (b) Acetylene

(c) Benzene (d) Isobutane

56. Among the following statements on the nitration of aromatic compounds, the false one is **[IIT-JEE 1997]**

(a) The rate of nitration of benzene is almost the same as that of hexadeuterobenzene

(b) The rate of nitration of toluene is greater than that of benzene

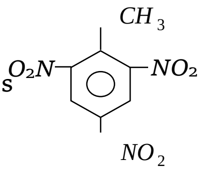
(c) The rate of nitration of benzene is greater than that of hexadeuterobenzene

(d) Nitration is an electrophilic substitution reaction

57. Methyl group attached to benzene can be oxidised to carboxyl group by reacting with **[KCET 1993]**

(a) Fe_2O_3 (b) $AgNO_3$

(c) $KMnO_4$ (d) Cr_2O_3

58. How is  is widely used **[MP PET 2002]**

(a) Insecticide (b) Drug

(c) Explosive (d) Dye

59. The compound 'A' when treated with HNO_3 (in presence of H_2SO_4) gives compound 'B' which is then reduced with Sn and HCl to aniline. The compound 'A' is **[MP PET 2002]**

(a) Toulene (b) Benzene

(c) Ethane (d) Acetamide

60. Which is formed when benzene is heated with chlorine in the presence of sunlight

[CPMT 2000; KCET (Med.) 2000; MP PMT 1993; MP PET 2002 AIIMS 1999]

(a) $C_6H_5CCl_3$ (b) $C_6H_5CHCl_2$

(c) $C_6H_5CH_2Cl_2$ (d) $C_6H_6Cl_6$

61. The compound used as an explosive is

[Kerala (Engg.) 2002; MP PET 2002; MP PMT 1993]

(a) 2,4, 6-tribromoaniline (b)1,3, 5-trinitrobenzene

(c) 2,4, 6-trichlorotoluene (d)1,3, 5-trichlorobenzene

(e) 2,4, 6-trinitrotoluene

62. Adding of Cl_2 to benzene in the presence of $AlCl_3$ is an example of **[Bihar MEE 1996]**

(a) Addition (b) Halogenation

(c) Substitution (d) Elimination

(e) None of these

63. What happens when naphthalene balls are put inside kerosene **[Kerala (Med.) 2002]**

(a) Precipitates (b) Dissolves upon heating

(c) Dissolves easily (d) Does not dissolve

(e) None of these

64. Three fused benzene rings are found in

[Kerala (Engg.) 2002]

(a) Naphthalene (b) Anthracene

(c) Phenanthroline (d) Triphenyl methane

65. Product obtained after nitration of nitrobenzene is

[RPMT 1997]

(a) TNT (b) 1, 3-dinitrobenzene

(c) Picric acid (d) 1, 4-dinitrobenzene

66. After ozonolysis of benzene (not hydrolysis), the product is

[RPMT 1997; CPMT 1997]

(a) Benzene triozonide (b) Glyoxal

(c) Ethanediol (d) All of them

67. Which acid will not form hydrocarbon **[CPMT 1997]**

(a) Cinnamic acid (b) Isothallic acid

(c) Salicylic acid (d) Picric acid

68. Catalytic dehydrogenation of n-haptane in presence of Cr_2O_3 / Al_2O_3 at 750 K gives **[Roorkee 1999]**

(a) iso-heptane (b) 1-heptene

(c) toluene (d) 2, 3-dimethylpentene-1

69. $C_6H_6 \xrightarrow[H_2SO_4]{HNO_3} X \xrightarrow[FeCl_3]{Cl_2} Y$. In the above sequence Y is

[AIIMS 1999]

(a) 1-nitrochloro benzene (b)3-nitrochlorobenzene

(c) 4-nitrochlorobenzene (d)1,2-nitrochlorobenzene

70. Which of the following has lowest knocking property

(a) Olefins (b) Straight chain paraffins

(c) Aromatic hydrocarbons (d)Branched chain paraffins

71. In which of the following, the bond length between carbon and carbon atom is equal **[CPMT 1997]**

(a) 2-butene (b) Benzene

(c) 1-butene (d) 1-propyne

72. Benzene is prepared in laboratory from which one of the following compounds **[MP PMT 1996]**

(a) $C_6N_5N_2Cl$ (b) C_6H_5OH

(c) C_6H_5COONa (d) $C_6H_5SO_3H$

73. Which of the following is not used in Friedel-crafts reaction

[KCET 2000]

(a) Phenyl acetanilide (b) Bromobenzene

(c) Benzene (d) Chlorobenzene

74. In chlorination of benzene, the reactive species is

[MP PET 2000]

(a) Cl^+ (b) Cl^-

(c) Cl_2 (d) Cl_2^-

75. Which of following having delocalised electron **[BCECE 2005]**

(a) Benzene (b) Cyclohexane

(c) CH_4 (d) C_2H_6

76. Benzene molecule is **[MP PET 2001; Pb. PMT 2004]**

(a) Tetrahedral (b) Planar

(c) Pyramidal (d) Trigonal

77. Pyridine is less basic than triethylamine because **[AIIMS 2005]**

(a) Pyridine has aromatic character

(b) Nitrogen in pyridine is sp^2 hybridized

(c) Pyridine is a cyclic system

(d) In pyridine, lone pair of nitrogen is delocalised

78. Electrophile in the case of chlorination of benzene in the presence of $FeCl_3$ is

(a) Cl^+ (b) Cl^-

(c) Cl (d) $FeCl_3$

79. Which one of the following will undergo meta substitution on monochlorination **[AIIMS 1991]**

(a) Ethoxy ethane (b) Chlorobenzene

(c) Ethyl benzoate (d) Phenol

80. Nitration of toluene takes place at **[NCERT 1990]**

(a) *o*-position (b) *m*-position

(c) *p*-position (d) Both *o*- and *p*-positions

81. Which of the following is not *o, p*—directing group

(a) $-NH_2$ (b) $-OH$

(c) $-X$ (halogens) (d) $-CHO$

82. Benzene can react with **[UPSEAT 2003]**

(a) Br_2 water (b) HNO_3

(c) H_2O (d) CH_3OH

83. The compound 'A' having formula C_8H_{10} (aromatic) which gives 1 mononitro substitute and 3 nitrosubstitute compound is

(a) *m*-Xylene (b) *p*-Xylene

(c) *o*-Xylene (d) Ethyl benzene

84. Catalytic hydrogenation of benzene gives **[AIIMS 1996]**

(a) Xylene (b) Cyclohexane

(c) Benzoic acid (d) Toluene

85. Benzene is obtained from **[CPMT 1996]**

(a) Coaltar (b) Plant

(c) Animal (d) Charcoal

86. The 'middle oil' fraction of coaltar distillation contains **[MP PET 2001]**

(a) Benzene (b) Anthracene

(c) Naphthalene (d) Xylene

87. Lindane can be obtained by reaction of benzene with **[DCE 2000]**

(a) CH_3Cl /anhy. $AlCl_3$ (b) Cl_2 /sunlight

(c) C_2H_5I /anhy. $AlCl_3$ (d) $CH_3COCl / AlCl_3$

88. Which of the following oil is obtained from benzene after fractional distillation of coal tar **[BHU 2004]**

(a) Light oil (b) Heavy oil

(c) Middle oil (d) Anthracene oil

89. Hydrocarbon C_6H_6 decolourise Br_2 water and gives ppt. with ammonical $AgNO_3$ Hydrocarbon can be **[MP PET 2004]**

(a) 1, 3, 5 Cyclohexatriene (b) 1, 5 Hexadiyne

(c) 2, 4 Hexadiyne (d) None

90. Decreasing order of C-C bond length is **[JEE Orissa 2004]**

(a) C_2H_4 (b) C_2H_2

(c) C_6H_6 (d) C_2H_6

(a) IV > III > I > II (b) I > II > IV > III

(c) II > I > IV > III (d) IV > I > III > II

[CBSE PMT 1996]

91. Benzene can be obtained by heating either benzoic acid with *X* or phenol with *Y*. *X* and *Y* are respectively **[KCET 2004]**

(a) Zinc dust and soda lime

(b) Soda lime and zinc dust

(c) Zinc dust and sodium hydroxide

(d) Soda lime and copper

92. Order of reactivity of C_2H_6, C_2H_4 and C_2H_2 is **[MH CET 2004]**

(a) $C_2H_6 > C_2H_4 > C_2H_2$ (b) $C_2H_2 > C_2H_6 > C_2H_4$

(c) $C_2H_2 > C_2H_4 > C_2H_6$ (d) All are equally reactive

93. Which of the following yield both alkane and alkene **[AFMC 2004]**

(a) Kolbe's reaction (b) Williamson's synthesis

(c) Wurtz reaction (d) Sandmeyer reaction

[DPMT 2002]

94. Aromatisation of *n*-heptane by passing over $(Al_2O_3 + Cr_2O_3)$ catalyst at 773 K gives **[DCE 2004]**

(a) Benzene (b) Toluene

(c) Mixture of both (d) Heptylene

95. Amongst the following the most basic compound is **[AIEEE 2005]**

(a) Benzylamine (b) Aniline

(c) Acetanilide (d) *p*-nitroaniline

96. When toluene is treated with $KMnO_4$, what is produced **[AFMC 2005]**

(a) Benzene (b) Chlorobenzene

(c) Benzaldehyde (d) Benzoic acid

97. In presence of light & heat toluene chlorinated & react with aqueous $NaOH$ to give **[Kerala CET 2005]**

(a) *o*-Cresol

(b) *p*-Cresol
(c) Mixture of *o*- Cresol & *p*-Cresol
(d) Benzoic acid
(e) 1, 3, 5 trihydroxy toluene

Critical Thinking

Objective Questions

1. In the case homologous series of alkanes, which one of the following statements is incorrect **[JIPMER 2000]**

(a) The members of the series are isomers of each other
(b) The members of the series have similar chemical properties
(c) The members of the series have the general formula C_nH_{2n+2} ,where *n* is an integer
(d) The difference between any two successive members of the series corresponds to 14 unit of relative atomic mass

2. How many primary, secondary, tertiary and quaternary carbons are present in the following hydrocarbon

$CH_3-CH(CH_3)-C(CH_3)_2-CH_2-CH(CH_3)-CH_2-CH_3$

	Primary	Secondary	Tertiary	Quaternary
(a)	6	2	2	1
(b)	2	6	3	0
(c)	2	4	3	2
(d)	2	2	4	3

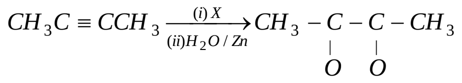
3. The octane number of a sample of petrol is 40. It means that its knocking property is equal to the mixture of **[MP PMT 2003]**

(a) 40% *n*-heptane + 60% *iso*-octane
(b) 40% petrol + 60% *iso*-octane
(c) 60% *n*-heptane + 40% *iso*-octane
(d) 60% petrol + 40% *iso*-octane

4. Formation of 2-butene as major product by dehydration of 2-butanol is according to**[MP PMT 1995]**

(a) Markownikoff rule (b) Saytzeff rule
(c) Peroxide effect (d) Anti-Markownikoff rule

5.



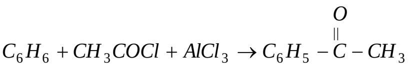
$$CH_3C\equiv CCH_3 \xrightarrow[(ii)H_2O/Zn]{(i)\,X} CH_3-\underset{\underset{O}{|}}{C}-\underset{\underset{O}{|}}{C}-CH_3$$

X in the above reaction is**[CPMT 1985; MP PET 1997; Roorkee Qualifying 1998; DPMT 2001]**

(a) HNO_3 (b) O_2
(c) O_3 (d) $KMnO_4$

6. Which of the following is Friedel-Craft's reaction **[MP PET 1994]**

(a) $C_6H_6+FeCl_3+Cl_2\rightarrow C_6H_5Cl$
(b) $C_6H_5CHO+CH_3CHO+KOH\rightarrow C_6H_5CH=CH-CHO$
(c)



$C_6H_6+CH_3COCl+AlCl_3\rightarrow C_6H_5-\overset{\overset{O}{||}}{C}-CH_3$

(d) $C_6H_5OH+CHCl_3+KOH\longrightarrow$ Salicylaldehyde

7. Condition for maximum yield of C_2H_5Cl is **[IIT-JEE 1986]**

(a) C_2H_6 (excess) $+Cl_2\xrightarrow{\text{UV Light}}$
(b) $C_2H_6 + Cl_2\xrightarrow[\text{Room temp.}]{\text{Dark}}$
(c) $C_2H_6+Cl_2$ (excess) $\xrightarrow{\text{UV Light}}$
(d) $C_2H_6+Cl_2\xrightarrow{\text{UV Light}}$

8. When ethyl alcohol is heated with red phosphorus and *HI*, then which of the following is formed **[Kurukshetra CEE 1998]**

(a) C_2H_6 (b) CH_4
(c) C_3H_8 (d) C_2H_4

9. In the Fischer-Tropsch synthesis of petrol..... and ..... are used as the raw materials **[KCET 1998]**

(a) $H_2;CO$ (b) $CH_4;H_2$
(c) $CH_4;CH_3OH$ (d) $CH_3OH;CO$

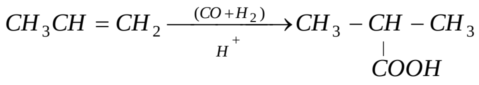
10. Which one of the following reactions is most suitable for the preparation of *n*-propyl benzene**[MP PET/I**

(a) Friedel-Craft's reaction (b) Wurtz reaction
(c) Wurtz-Fittig reaction (d) Grignard reaction

11. Propane cannot be prepared from which reaction **[DCE 2003]**

(a) $CH_3-CH=CH_2\xrightarrow[OH^-]{B_2H_6}$
(b) $CH_3CH_2CH_2I\xrightarrow[P]{HI}$
(c) $CH_3CH_2CH_2Cl\xrightarrow{Na}$
(d) None of these

12. The reaction

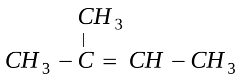


$$CH_3CH=CH_2\xrightarrow[H^+]{(CO+H_2)}CH_3-\underset{\underset{COOH}{|}}{CH}-CH_3$$

is known as

(a) Wurtz reaction (b) Koch reaction
(c) Clemmensen reduction (d) Kolbe's reaction

13. The compound



$CH_3-\overset{\overset{CH_3}{|}}{C}=CH-CH_3$

on reaction with $NaIO_4$ in the presence of $KMnO_4$ gives**[CBSE PMT 200**

(a) $CH_3CHO+CO_2$
(b) CH_3COCH_3

(c) $CH_3COCH_3+CH_3COOH$
(d) $CH_3COCH_3+CH_3CHO$

14. In the reaction :

$$HC\equiv CH+2AgNO_3\xrightarrow{NH_4OH}X+2NH_4NO_3+2H_2O$$

'X' is

(a) Ag_2C (b) Ag_2C_2
(c) AgC (d) $AgOH$

15. Naphthalene is a/an **[AFMC 2004]**

(a) Ionic solid (d) Covalent solid
(c) Metallic solid (d) Molecular solid

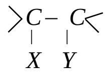
16. Which of the following is not aromatic **[Pb. CET 2000]**

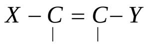
(a) Benzene (b) Naphthalene
(c) Pyridine (d) 1,3,5 heptatriene

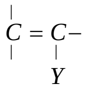
17. Acetylene reacts with HCN in the presence of $Ba(CN)_2$ to yield **[UP SEAT 2004]**

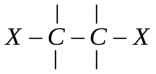
(a) 1, 1-dicyanoethane (b) 1, 2-dicyanoethane
(c) Vinyl cyanide (d) None of these

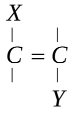
18. Write the products of the addition reaction $>C=C<+XY\rightarrow$ **[Kerala (Med.) 2002]**

(a) 
$\underset{X}{\underset{|}{>C}}-\underset{Y}{\underset{|}{C<}}$

(b) 
$X-\underset{|}{C}=\underset{|}{C}-Y$

(c) 
$\overset{|}{\underset{|}{C}}=\underset{Y}{\underset{|}{C}}-$

(d) 
$X-\overset{|}{\underset{|}{C}}-\overset{|}{\underset{|}{C}}-X$

(e) 
$\overset{X}{\overset{|}{\underset{|}{C}}}=\overset{|}{\underset{Y}{\underset{|}{C}}}$

19. Formation of polyethylene from calcium carbide takes place as follows

$CaC_2+2H_2O\rightarrow Ca(OH)_2+C_2H_2$

$C_2H_2+H_2\rightarrow C_2H_4$

$n(C_2H_4)\rightarrow(-CH_2-CH_2-)_n$

The amount of polyethylene obtained from 64.1 *kg* CaC_2 is **[AIIMS 1997]**

(a) 7 *kg* (b) 14 *kg*
(c) 21 *kg* (d) 28 *kg*

20. Nitrobenzene can be prepared from benzene by using a mixture of conc. HNO_3 and conc. H_2SO_4. In the nitrating mixture, HNO_3 acts as a**[IIT-JEE 1997]**

(a) Base (b) Acid
(c) Reducing agent (d) Catalyst

21. A group which deactivates the benzene ring towards electrophilic substitution but which directs the incoming group principally to the *o*- and *p*-positions is **[Pb. PMT 1998]**

(a) $-NH_2$ (b) $-Cl$
(c) $-NO_2$ (d) $-C_2H_5$

22. Which order is correct for the decreasing reactivity to ring monobromination of the following compounds

$C_6H_5CH_3$,	C_6H_5COOH,	C_6H_6	$C_6H_5NO_2$
I	II	III	IV

(a) $I>II>III>IV$ (b) $I>III>II>IV$
(c) $II>III>IV>I$ (d) $III>I>II>IV$

23. Benzene is obtained by **[DPMT 2002]**

(a) Substitution of three acetylene molecules
(b) Addition of three C_2H_2 molecules
(c) Polymerisation of three C_2H_2 molecules
(d) Condensation of three C_2H_2 molecules

24. Toluene can be oxidised to benzoic acid by**[AIIMS 1999]**

(a) $KMNO_4$ (b) $K_2Cr_2O_7$
(c) H_2SO_4 (d) Both (a) and (b)

25. $CaC_2+H_2O\rightarrow A\xrightarrow{H_2SO_4/HgSO_4}B$. Identify A and B in the given reaction **[CPMT 2000; BVP 2004]**

(a) C_2H_2 and CH_3CHO (b) CH_4 and $HCOOH$
(c) C_2H_4 and CH_3COOH (d) C_2H_2 and CH_3COOH

26. The compound X on reaction with $HgSO_4+H_2SO_4$ gives Y which on oxidation gives acetic acid. X is**[MP PMT**

(a) C_2H_2 (b) C_2H_4
(c) C_3H_4 (d) C_4H_6

27. What is formed when calcium carbide react with heavy water **[CPMT 1999]**

(a) C_2D_2 (b) CaD_2
(c) CaD_2O (d) CD_2

28. The addition of HBr is easiest with **[MP PMT 2000]**

(a) $ClCH_2=CHCl$ (b) $ClCH=CHCl$
(c) $CH_3-CH=CH_2$ (d) $(CH_3)_2C=CH_2$

29. Identify the species X in the reaction :

Propene $+\,O$ (conc. acidic $KMnO_4$) $\rightarrow X+$ Formic acid

(a) Acetone (b) Acetaldehyde
(c) Isopropanol (d) Acetic acid

30. In benzene 1, 3 position is called

(a) Meta (b) Para
(c) Ortho (d) Odd position

31. Which of the following is formed as a result of biological oxidation of benzene in the body of the dog **[Manipal MEE 1995]**

(a) Acrylic acid (b) Cinnamic acid
(c) Maleic acid (d) Gluconic acid

32. When acetylene is reacted with HBr, we get **[CPMT 1979; JIPMER 2002]**

(a) Methyl bromide (b) Ethyl bromide
(c) Ethylene bromide (d) Ethylidene bromide

33. The only *o*, *p*-directing group which is deactivating in nature is

(a) $-NH_2$ (b) $-OH$
(c) $-X$ (halogens) (d) $-R$ (alkyl groups)

34. Which kind of isomerism will butene-2 show

(a) Geometrical (b) Optical

(c) Position (d) None of these

35. In presence of light toluene on reaction with chlorine gives **[RPET 1999]**

(a) Benzoyl chloride (b) Ortho chlorotoluene

(c) Para chloro toluene (d) Benzyl chloride

36. If ethylene, carbon monoxide and water is heated at high temperature, which of the following is formed **[AIIMS 2000]**

(a) $C_4H_8O_2$ (b) C_2H_5COOH

(c) CH_3COOH (d) $CH_2=CH-COOH$

37. Compound C_6H_{12} is an **[AMU 1983]**

(a) Aliphatic saturated compound

(b) Alicyclic compound

(c) Aromatic compound

(d) Heterocyclic compound

38. Identify Z in the following series

$$CH_2=CH_2 \xrightarrow{HBr} X \xrightarrow{Hydrolysis} Y \xrightarrow[I_2\ \text{excess}]{Na_2CO_3} Z$$

[AIIMS 1983; RPMT 1999]

(a) C_2H_5I (b) C_2H_5OH

(c) CHI_3 (d) CH_3CHO

39. n-pentane and iso pentane can be distinguished by **[BVP 2004]**

(a) Br_2 (b) O_3

(c) conc. H_2SO_4 (d) $KMnO_4$

40. $CH\equiv CH+HBr\rightarrow X$, product X is **[Pb. CET 2003]**

(a) Ethylene bromide (b) Vinyl bromide

(c) Bromo ethane (d) Ethyledine bromide

Assertion & Reason

For AIIMS Aspirants

1. Assertion : 1-Butene on reaction with HBr in the presence of a peroxide produces 1-bromo-butane.

Reason : It involves the free radical mechanism. **[IIT-JEE (Screening) 2000]**

2. Assertion : Addition of Br_2 to 1-butene gives two optical isomers.

Reason : The product contains one asymmetric carbon. **[IIT 1998]**

3. Assertion : Cyclobutane is less stable than cyclopentane

Reason : Presence of bent bonds causes "loss of orbital overlap". **[AIIMS 1996]**

4. Assertion : Pyrrole is an aromatic heterocyclic compound.

Reason : It has a cyclic, delocalised 6π electrons. **[AIIMS 1995]**

5. Assertion : CH_4 does not react with Cl_2 in dark.

Reason : Chlorination of CH_4 takes place in sunlight. **[AIIMS 2001]**

6. Assertion : Alkyl benzene is not prepared by Friedel-Crafts alkylation of benzene.

Reason : Alkyl halides are less reactive than acyl halides. **[AIIMS 2003]**

7. Assertion : 2-Bromobutane on reaction with sodium ethoxide in ethanol gives 1-butene as a major product. **[AIIMS 2004]**

Reason : 1-Butene is more stable than 2-butene.

8. Assertion : Styrene on reaction with HBr gives 2-bromo-2- phenyl-ethane.

Reason : Benzyl radical is more stable than alkyl radical. **[AIIMS 2004]**

9. Assertion : Melting point of n-butane is higher than propane.

Reason : It is called oscillation effect.

10. Assertion : Iodination of alkanes is reversible.

Reason : Iodination is carried out in presence of iodic acid.

11. Assertion : Isobutane on oxidation with $KMnO_4$ gives tert-butyl alcohol.

Reason : Oxidising agents have no effect on alkanes.

12. Assertion : Halogenation of alkanes is catalysed by tetraethyl lead.

Reason : Halogenation proceeds through free radical mechanism.

13. Assertion : Neopentane forms only one monosubstituted compound.

Reason : Neopentane has high bond energy.

14. Assertion : Freezing point of neopentane is more than n-pentane.

Reason : Increase in Van der Waals forces increases freezing point.

15. Assertion : Knocking lowers the efficiency of the engine.

Reason : Fuel with minimum knocking property is preferred.

16. Assertion : The presence of Ag^+ enhances the solubility of alkenes in water.

Reason : Alkenes are weakly polar in nature.

17. Assertion : 2-Butanol on heating with H_2SO_4 gives 1-butene and 2-butene.

Reason : Dehydration of 2-butanol follows saytzeff rule.

18. Assertion : Ethene on treating with Br_2 in presence of $NaCl$ forms CH_2ClCH_2Br and CH_2Br-CH_2-Br.

Reason : This addition involves the formation of free radicals.

19. Assertion : Straight chain alkanes have very low octane number.

Reason : Quality of gasoline is measured in terms of octane number.

20. Assertion : Corey-House reaction can be used to prepare both symmetrical and unsymmetrical alkanes.

Reason : The reaction involves the interaction between lithium dialkyl copper with an alkyl halide both of which may contain even or odd number of carbon atoms.

21. Assertion : All the hydrogen atoms in $CH_2=C=CH_2$ lie in one plane.

Reason : All the carbon atoms in it are sp^2 hybridized.

22. Assertion : Propene reacts with HBr in presence of benzoyl peroxide to yield 2-bromopropane.

Reason : In presence of peroxide, the addition of HBr to propene follows ionic mechanism.

23. Assertion : Acetylene reacts with sodamide to evolve H_2 gas.

Reason : Acetylene is a weaker acid than ammonia.

24. Assertion : Aryl halides are less reactive towards substitution of halogen atom.

Reason : Halogens are $o,p-$directing in nature.

25. Assertion : Benzene is a solvent for the Friedel Craft's alkylation of bromobenzene.

Reason : Friedel Craft's reaction is used to introduced on alkyl or acyl group in benzene nucleus.

26. Assertion : Benzene removes a butter stain from a table cloth.

Reason : Butter has an affinity towards benzene.

27. Assertion : Nitration of toluene is easier than benzene.

Reason : The methyl group in toluene is electron-releasing.

28. Assertion : Benzene forms benzene sulphonic acid with fuming H_2SO_4 at high temperature.

Reason : The attacking species is SO_3.

29. Assertion : Activating groups are electron donors.

Reason : Nitroso group is activating group.

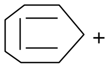
30. Assertion : Benzene reacts with CH_3COCl to give chlorobenzene.

Reason : Chlorination is an electrophilic substitution reaction.

31. Assertion : Conjugated polyenes containing odd number of carbon atoms is known as annulenes.

Reason : General formula of annulenes is $(CH=CH)_n$ where $n=2,3,4$ etc.

32. Assertion : Tropylium cation is aromatic in nature



Reason : The only property that determines its aromatic behaviour is its planar structure.

33. Assertion : [10] Annulene is not aromatic though it contains Huckel number of π-electrons.

Reason : Steric interaction between internal hydrogens makes it non-planar.

34. Assertion : Rates of nitration of benzene and hexadeuterobenzene are different.

Reason : $C-H$ bond is stronger than $C-D$ bond

35. Assertion : Cyclolpentadienyl anion is much more stable than allyl anion.

Reason : Cyclopentadienyl anion is aromatic in character.

Answers

Alkane

1	d	2	a	3	a	4	a	5	b
6	c	7	b	8	a	9	d	10	c
11	d	12	a	13	c	14	d	15	b
16	a	17	b	18	d	19	b	20	b
21	b	22	b	23	a	24	b	25	a
26	d	27	c	28	c	29	d	30	c
31	a	32	a	33	d	34	a	35	a
36	a	37	d	38	a	39	d	40	c
41	b	42	d	43	d	44	a	45	b
46	d	47	c	48	d	49	a	50	c
51	d	52	a	53	a	54	c	55	a
56	d	57	b	58	d	59	b	60	a

61	b	62	a	63	b	64	c	65	c
66	b	67	c	68	b	69	d	70	c
71	b	72	a	73	c	74	c	75	b
76	c	77	c	78	c	79	a	80	c
81	c	82	a	83	d	84	a	85	b
86	a	87	a	88	d	89	a	90	a
91	a	92	b	93	c	94	a	95	c
96	b	97	a	98	d	99	a	100	d
101	c	102	a	103	a	104	b	105	d
106	b	107	d	108	c	109	d	110	b
111	a	112	b	113	d	114	b	115	d
116	d	117	d	118	c	119	c	120	c
121	c	122	b	123	a	124	d	125	c
126	a	127	a	128	b	129	b	130	c
131	a	132	a	133	a	134	b	135	b
136	c	137	a	138	c	139	a	140	c
141	a	142	b	143	a	144	c	145	b
146	c	147	d	148	c	149	d	150	b
151	a	152	c	153	a	154	b	155	ab
156	c	157	b	158	a	159	a	160	c
161	e	162	c	163	a	164	c	165	b
166	d	167	d	168	c	169	c	170	c
171	a	172	d	173	b	174	b	175	c

Alkene

1	c	2	b	3	a	4	b	5	a
6	d	7	a	8	d	9	b	10	d
11	d	12	a	13	a	14	c	15	b
16	a	17	d	18	d	19	b	20	c
21	b	22	d	23	c	24	b	25	c
26	a	27	b	28	d	29	d	30	d
31	c	32	d	33	c	34	a	35	c
36	c	37	a	38	b	39	ac	40	b
41	c	42	a	43	c	44	c	45	a
46	c	47	d	48	d	49	a	50	c
51	a	52	d	53	c	54	a	55	b
56	c	57	d	58	a	59	d	60	b
61	c	62	a	63	b	64	b	65	b
66	d	67	c	68	a	69	c	70	c
71	c	72	c	73	c	74	d	75	c
76	d	77	a	78	d	79	c	80	b
81	c	82	d	83	c	84	a	85	c
86	c	87	b	88	a	89	c	90	c
91	b	92	c	93	b	94	b	95	b
96	b	97	a	98	b	99	b	100	b
101	b	102	c	103	c	104	b	105	b
106	a	107	c	108	a	109	a	110	c
111	c	112	a	113	a	114	b	115	d
116	d	117	a	118	a	119	a	120	b
121	b	122	c	123	c	124	b	125	c
126	c	127	b	128	b	129	a	130	a
131	c	132	b,d	133	a	134	b	135	c
136	c	137	c	138	b	139	a	140	d
141	b	142	c	143	d	144	a	145	d
146	a	147	d	148	abc	149	a	150	a
151	a	152	b	153	c	154	b	155	a
156	c	157	b	158	d	159	b	160	c
161	d	162	b	163	b	164	a	165	a
166	a	167	b	168	c	169	b	170	b
171	a	172	c	173	c	174	a		

Alkyne

1	c	2	c	3	c	4	c	5	b
6	a	7	a	8	a	9	d	10	c
11	a	12	c	13	d	14	a	15	a
16	d	17	d	18	b	19	c	20	c
21	d	22	b	23	d	24	c	25	c
26	d	27	a	28	d	29	a	30	d
31	a	32	c	33	c	34	a	35	a
36	a	37	c	38	d	39	c	40	c
41	a	42	c	43	a	44	c	45	b
46	c	47	a	48	a	49	b	50	b
51	d	52	a	53	b	54	a	55	d
56	a	57	c	58	c	59	a	60	d
61	c	62	c	63	d	64	d	65	a
66	c	67	c	68	a	69	b	70	b
71	b	72	c	73	a	74	b	75	d
76	c	77	b	78	d	79	a	80	c
81	a	82	a	83	d	84	c	85	c
86	a	87	c	88	c	89	d	90	c
91	c	92	d	93	c	94	b	95	d
96	d	97	d	98	b	99	d	100	a
101	b	102	a	103	a	104	a	105	c

Aromatic hydrocarbon

1	c	2	d	3	c	4	c	5	a
6	b	7	c	8	b	9	a	10	c
11	b	12	b	13	a	14	a	15	a

16	d	17	a	18	b	19	b	20	a
21	c	22	a	23	b	24	c	25	c
26	d	27	c	28	a	29	c	30	b
31	d	32	b	33	b	34	c	35	d
36	c	37	b	38	b	39	a	40	a
41	a	42	c	43	a	44	b	45	c
46	d	47	d	48	a	49	a	50	d
51	b	52	b	53	b	54	c	55	c
56	c	57	c	58	c	59	b	60	d
61	e	62	c	63	c	64	b	65	b
66	a	67	d	68	c	69	b	70	c
71	b	72	c	73	a	74	a	75	a
76	b	77	d	78	a	79	c	80	d
81	d	82	b	83	b	84	b	85	a
86	c	87	b	88	a	89	d	90	a
91	b	92	c	93	a	94	b	95	a
96	d	97	d						

Critical Thinking Questions

1	a	2	a	3	c	4	b	5	c
6	c	7	a	8	a	9	a	10	c
11	a	12	b	13	d	14	b	15	d
16	d	17	c	18	a	19	d	20	a
21	b	22	b	23	c	24	b	25	a
26	a	27	a	28	d	29	d	30	a
31	b	32	d	33	c	34	a	35	d
36	b	37	b	38	c	39	d	40	b

Assertion and Reason

1	a	2	a	3	c	4	a	5	b
6	b	7	d	8	b	9	b	10	b
11	b	12	e	13	c	14	b	15	b
16	b	17	a	18	c	19	b	20	a
21	d	22	d	23	c	24	b	25	e
26	b	27	a	28	e	29	c	30	e
31	e	32	c	33	a	34	b	35	a

Answers and Solutions

Alkane

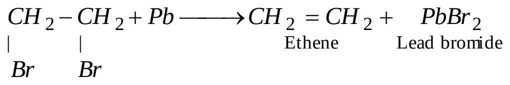
1. (d) C_7H_{16} (C_nH_{2n+2})

3. (a) According to wurtz reaction.

$$2CH_3CH_2CH_2Br + 2Na \xrightarrow{\text{ether}} CH_3(CH_2)_4CH_3 + 2NaBr$$

5. (b) $$\underset{\text{Sodium acetate}}{2CH_3COONa} + 2H_2O \xrightarrow{\text{Electolysis}} CH_3 - CH_3 + 2CO_2 + 2NaOH + H_2$$

6. (c) $$Pb(C_2H_5)_4 \xrightarrow{\text{heat}} Pb + 4\underset{\text{Ethylradical}}{CH_3CH_2}$$



$$\underset{\underset{Br}{|}}{CH_2} - \underset{\underset{Br}{|}}{CH_2} + Pb \longrightarrow \underset{\text{Ethene}}{CH_2 = CH_2} + \underset{\text{Lead bromide}}{PbBr_2}$$

As leaded gasoline burns, lead metal gets deposited in the engine which is removed by adding ethylene dibromide. The lead bromide is volatile and is carried off with the exhaust gases from the engine

9. (d) $$C_2H_5I + 2Na + IC_2H_5 \xrightarrow[\text{Ether}]{\text{Dry}} \underset{\text{Butane}}{C_2H_5 - C_2H_5} + 2NaI$$

10. (c) $$(CH_3)_3CH \xrightarrow{KMnO_4} \underset{\text{tertiary butyl alcohol}}{(CH_3)_3C - OH}$$

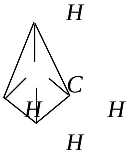
13. (c) $$RCl + 2Na + RCl \xrightarrow[Ether]{Dry} 2NaCl + \underset{\text{Alkane}}{R - R}$$

14. (d) *iso*-octane *i.e.* 2,2,4-trimethyl pentane has highest octane number.

17. (b) With calculated amount of Grignard reagent, acetyl chloride forms ketones.

$$CH_3COCl + XMgCH_3 \rightarrow CH_3COCH_3 + Mg\begin{matrix} Cl \\ X \end{matrix}$$

18. (d) CH_4 is tetrahedral



sp^3 hybridization (tetrahedra l)

22. (b) Ethane is a saturated compound it can not be catalytically hydrogenated.

25. (a) Branched hydrocarbons are more desirable because they are more volatile.

26. (d) $CH_4 \xrightarrow{Cl_2} CH_3Cl \xrightarrow{Cl_2} CH_2Cl_2 \xrightarrow{Cl_2}$ $CHCl_3 \xrightarrow{Cl_2} CCl_4$. Since this reaction takes place by free radical mechanism. Hence, there is a possibility of formation of ethane.

$$\underset{\text{Methyl free radicals}}{\dot{C}H_3 + \dot{C}H_3} \rightarrow \underset{\text{Ethane}}{CH_3 - CH_3}$$

28. (c) $\underset{\text{Aluminium carbide}}{Al_4C_3} + 6H_2O \rightarrow \underset{\text{Methane}}{3CH_4} + 2Al_2O_3$

31. (a) $C_2H_5O\boxed{H + CH_3} - Mg - Br \rightarrow CH_4 + Mg\begin{matrix} Br \\ OC_2H_5 \end{matrix}$

32. (a) $CH_3I + 2H \xrightarrow{Zn/HCl} CH_4 + HI$

$$CH_3I + 2Na + ICH_3 \xrightarrow[\text{Ether}]{\text{Dry}} CH_3 - CH_3 + 2NaI$$

36. (a) Solvent for fat, oil, varnish and rubber

37. (d) Synthetic dyes, drugs, perfumes all are made from coal tar.

38. (a) In alkanes, hybridization is sp^3. Hence bond angle is $109^o.5'$.

39. (d) $2CH_3COONa + 2H_2O \xrightarrow{\text{Electrolysis}}$

$$CH_3 - CH_3 + 2CO_2 + 2NaOH + H_2$$

41. (b) $\underset{\text{Propanoic acid}}{CH_3 - CH_2 - COOH} + 6HI \xrightarrow{\text{Red } P}$

$$\underset{\text{Propane}}{CH_3 - CH_2 - CH_3} + 2H_2O + 3I_2$$

42. (d) $C_2H_5I + 2Na + C_3H_7I \xrightarrow[\text{Ether}]{\text{Dry}} \underset{\text{Pentane}}{C_2H_5 - C_3H_7} + 2NaI$

$$C_2H_5I + 2Na + C_2H_5I \xrightarrow[\text{Ether}]{\text{Dry}} \underset{\text{Butane}}{C_2H_5 - C_2H_5} + 2NaI$$

$$C_3H_7I + 2Na + C_3H_7I \xrightarrow[Ether]{Dry} \underset{\text{Hexane}}{C_3H_7 - C_3H_7} + 2NaI$$

48. (d) Cyclohexane, is immiscible and lighter than water. Hence, floats on the surface of water.

49. (a) Methane is the main component of natural gas.

53. (a) $Pt./Ni$ is used in catalytic reduction of hydrocarbon.

55. (a) Fractional distillation is used because the difference between the boiling point of different component is less.

56. (d) $CH_3 - CH_2 - Cl + \underset{\text{(alc.)}}{KOH} \rightarrow \underset{\text{Ethene}}{CH_2 = CH_2} + KCl + H_2O$

In presence of alc. KOH dehydrohalogenation occur and alkene is formed.

57. (b) Liquefied petroleum gas is a mixture of ethane, propane and butane. The main component is butane.

58. (d) $CH_4 + O_2 \xrightarrow[\text{Limited supply of air}]{\Delta} C + 2H_2O$

It contains 98-99% carbon. It is used in making black ink, paints and shoe polishes.

59. (b) Tetraethyl lead is anti-knocking agent it increases the octane no. of the fuel.

60. (a) *n*-hexane because it is linear therefore strong Vander Waal force.

61. (b) Knocking - Sudden and irregular burning of the fuel mixture causing jerks against the piston and gives rise to violent sound. This is known as knocking.

63. (b) *n*–octane

- Boiling point depends on molecular mass. Greater the molecular mass higher will be the boiling point.
- Boiling point also depends on the structure. If two compounds have same molecular mass then straight chain or linear compound has higher boiling point.

64. (c) $\underset{\text{Potassium acetate}}{2CH_3COOK} + 2H_2O \xrightarrow{\text{Electrolysis}}$

$$\underset{\text{Anode}}{CH_3 - CH_3 + 2CO_2} + \underset{\text{Cathode}}{2KOH + H_2}$$

65. (c) Ethane does not decolourise bromine solution because it is a saturated compound.

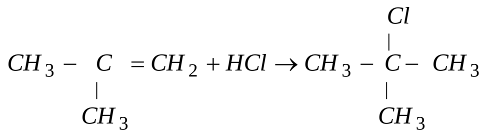
66. (b) $\underset{\text{Sodium acetate}}{CH_3COONa} + NaOH \xrightarrow{CaO} \underset{\text{Methane}}{CH_4} + Na_2CO_3$

68. (b) Octane number is related to the percentage of *iso*-octane since *iso*-octane is 81% hence octane number is 81%.

70. (c) $2CH_3COOK + 2H_2O \xrightarrow{\text{Electrolysis}}$

$$\underbrace{2CO_2 + CH_3 - CH_3}_{\text{Anode}} + \underbrace{2KOH + H_2}_{\text{Cathode}}$$

71. (b)



$$CH_3 - \underset{\substack{| \\ CH_3}}{C} = CH_2 + HCl \rightarrow CH_3 - \underset{\substack{| \\ CH_3}}{\overset{\substack{Cl \\ |}}{C}} - CH_3$$

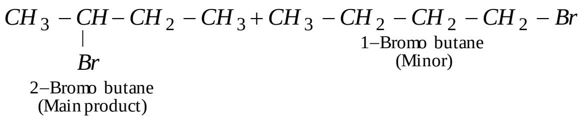
$$CH \equiv CH + HCl \rightarrow CH_2 = CH - Cl \xrightarrow{HCl} CH_3 - CHCl_2$$

72. (a) Boiling point of alkanes increases with the number of carbon atoms because surface area increases which increases the Vander Waal forces.

74. (c) The enthalpy of combustion *i.e.,* ΔH is always negative. It means combustion is an exothermic reaction.

78. (c) $CH_3CH_2COONa + NaOH \xrightarrow{CaO} C_2H_6 + Na_2CO_3$

79. (a) $CH_3-CH_2-CH_2-CH_3+Br_2 \xrightarrow[130^oC]{\text{Light}}$



$$\underset{\substack{\text{2–Bromo butane}\\\text{(Main product)}}}{CH_3-\underset{\substack{|\\Br}}{CH}-CH_2-CH_3} + \underset{\substack{\text{1–Bromo butane}\\\text{(Minor)}}}{CH_3-CH_2-CH_2-CH_2-Br}$$

2-Bromobutane is the main product because 2^o carbonium ion is more stable than 1^o.

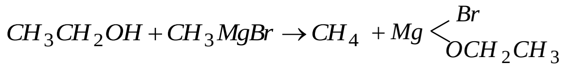
80. (c) $\underset{n\text{–Butane}}{CH_3CH_2CH_2CH_3} \xrightarrow{\text{Cracking}}$

$$CH_4 + CH_3-CH=CH_2$$

83. (d) Anti-knocking properties of fuel increases.

84. (a) $\underset{\substack{\text{Hexane}\\\text{Liquid}}}{C_6H_{14}} \xrightarrow{\Delta} \underset{\text{Butane}}{C_4H_{10}} + \underset{\substack{\text{Ethene}\\\text{Gas}}}{C_2H_2}$

87. (a) Compounds having active hydrogen $(ROH, H_2O, R-NH_2)$ can form alkane when treated with Grignard's reagent



$$CH_3CH_2OH + CH_3MgBr \rightarrow CH_4 + Mg\begin{smallmatrix}Br\\OCH_2CH_3\end{smallmatrix}$$

91. (a) It is not possible to prepare CH_4 by wurtz reaction.

92. (b) Octane number is the percentage by volume of iso-octane in the mixture of iso-octane and *n*-heptane which has the same antiknocking properties as the fuel under examination.

Given fuel (25% *n*-heptane +75% iso-octane) Hence, octane number = 75 (because iso octane is 75%)

93. (c) $CH_3-CH_2-CH_2-Br \xrightarrow[\text{Dehydro halogenation}]{C_2H_5ONa}$

$$CH_3-CH=CH_2+HBr$$

94. (a) % of hydrogen $= \dfrac{\text{Mass of hydrogen}}{\text{Mass of compound}} \times 100$

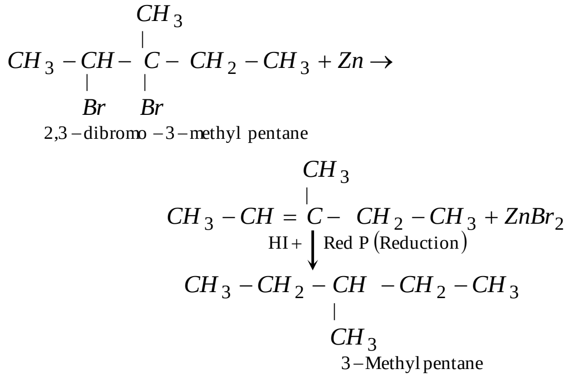
$$CH_4 = \frac{4}{16} \times 100 = 25\%.$$

95. (c) Molecular mass can be obtained by the victor mayer process

$$\text{Molecular mass} = \frac{\text{Weight}}{V\,ml.} \times 22400$$

$$= \frac{11}{5600} \times 22400 = 44$$

97. (a)



$$\underset{\text{2,3 – dibromo – 3 – methyl pentane}}{CH_3-\underset{\substack{|\\Br}}{CH}-\overset{\substack{CH_3\\|}}{\underset{\substack{|\\Br}}{C}}-CH_2-CH_3} + Zn \rightarrow$$

$$CH_3-CH=\overset{\substack{CH_3\\|}}{C}-CH_2-CH_3+ZnBr_2$$

$$\Big\downarrow \text{HI + Red P (Reduction)}$$

$$\underset{\text{3 – Methyl pentane}}{CH_3-CH_2-\underset{\substack{|\\CH_3}}{CH}-CH_2-CH_3}$$

98. (d) Gasoline, kerosene oil, diesel

99. (a) $CH_3-CH_2-COONa \xrightarrow[\Delta]{\text{Soda lime}} CH_3-CH_3$

100. (d) Gasoline or petrol composition $C_7 - C_{12}$.

101. (c) $\underset{\text{Methane}}{CH_4} + 2O_2 \rightarrow CO_2 + 2H_2O$

$\underset{\text{Ethene}}{C_2H_4} + 3O_2 \rightarrow 2CO_2 + 2H_2O$

All hydrocarbons saturated or unsaturated on complete combustion always produce CO_2 and H_2O.

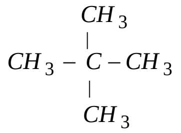
102. (a) Free rotation around carbon–carbon bond takes place easily in alkanes. Now ethane and hexachloroethane both are alkanes. But in hexachloroethane bulky chlorine atom hinders the rotation. Therefore least hindered rotation takes place in ethane.

103. (a) Hydrocarbons on complete oxidation produce CO_2 and water

$$CH_3-CH_3+3\frac{1}{2}O_2 \rightarrow 2CO_2+3H_2O$$

104. (b) $\underset{\text{Decane}}{C_{10}H_{22}} \xrightarrow[\text{Cracking}]{900\,K} \underset{\text{Butane}}{C_4H_8} + \underset{\text{Hexane}}{C_6H_{14}}$

106. (b)



$$CH_3-\overset{\substack{CH_3\\|}}{\underset{\substack{|\\CH_3}}{C}}-CH_3$$

Replaceable hydrogen atoms are present only on 4 primary carbon atoms. Hence, it gives only are monochloro Substituted product.

107. (d) $\underset{\text{Sod. acetate}}{CH_3COONa} + NaOH \xrightarrow{CaO} CH_4 + Na_2CO_3$

$\underset{\text{Iodomethan e}}{CH_3I} + 2H \xrightarrow[\text{Reduction}]{} CH_4 + HI$

$\underset{\text{Aluminiumcarbide}}{Al_4C_3} + 6H_2O \rightarrow 3CH_4 + 2Al_2O_3$

108. (c) Acetylene reacts with ammonical cuprous chloride to form red ppt. of copper acetylide while methane and ethylene do not react (since they do not have acidic hydrogen) They come out from the bottle

$$CH\equiv CH+2[Cu(NH_3)_2]OH \rightarrow$$

$$Cu-C\equiv C-Cu+4NH_3+2H_2O$$

$CH_4 + \text{Ammonical } Cu_2Cl_2 \rightarrow \text{No reaction}$

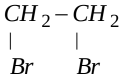
C_2H_4 + Ammonical $Cu_2Cl_2 \rightarrow$ No reaction

110. (b) Alkanes do not give addition reactions because multiple bond is absent.

111. (a) $\underset{\text{Hexane}}{C_6H_{14}} \xrightarrow[\Delta]{Pyrolysis} \underset{\text{Ethene}}{C_2H_4} + \underset{\text{Butane}}{C_4H_{10}}$

113. (d) In gemdihalide both the halogen atoms are present on the same carbon atom while in vicdihalide both the halogen atoms are present on adjacent carbon atoms.

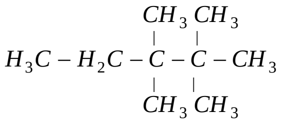
$\underset{\text{Gemdihalide}}{CH_3-CHBr_2}$



$\underset{Br}{CH_2}-\underset{Br}{CH_2}$

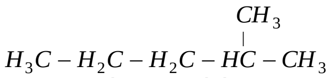
vic-dihalide

114. (b)



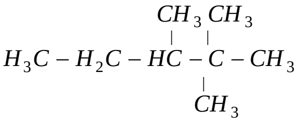
$H_3C-H_2C-\overset{CH_3}{\underset{CH_3}{C}}-\overset{CH_3}{\underset{CH_3}{C}}-CH_3$

2,3,3,3-tetramethylpentane



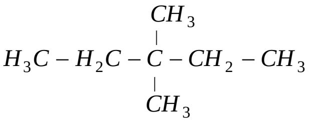
$H_3C-H_2C-H_2C-\overset{CH_3}{HC}-CH_3$

isopropyl group 2-methylpentane



$H_3C-H_2C-\overset{CH_3}{HC}-\overset{CH_3}{\underset{CH_3}{C}}-CH_3$

2, 2, 3-trimethylpentane



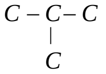
$H_3C-H_2C-\overset{CH_3}{\underset{CH_3}{C}}-CH_2-CH_3$

3, 3-dimethylpentane

116. (d) All-butane, Ethane and Propane are possible in this reaction.

118. (c) Formation of branches in the chain of C atoms

$\underset{\text{straight chain}}{C-C-C-C}$



$C-\underset{C}{C}-C$

Branched chain

119. (c) Chlorination of alkane in photochemical reaction which takes place by free radical mechanism. Free radicals are formed by homolytic bond fission or homolysis.

120. (c) Marsh gas, Natural gas and coal gas contains CH_4 but producer gas is a mixture of CO and N_2

$$\underset{\substack{\text{Coke}\\ \text{Red hot}}}{2C} + \underbrace{O_2 + 4N_2}_{\text{Air}} \rightarrow \underbrace{2CO + 4N_2}_{\text{Producer gas}}$$

123. (a) Fractional distillation is based on the difference in the boiling point of different components.

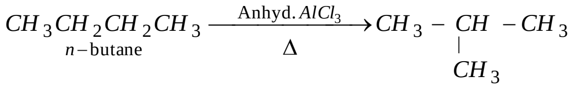
124. (d) Tetraethyl lead (TEL) is an anti-knocking compounds when mixed with petrol tend to improve the octane no. and therefore, decreases the knocking in the cylinder of the combustion engine.

128. (b) Petrol sample 30% *n*-heptane + 70% *iso*-octane since *iso*-octane is 70%. Hence, octane no. is 70.

131. (a) $\underset{\text{Propene}}{CH_3-CH=CH_2} + H_2 \xrightarrow[300^oC]{Ni} \underset{\text{Propane}}{CH_3-CH_2-CH_3}$

132. (a) As the number of branches increases, surface area decreases, due to which Vander Waal forces of attraction decreases. Hence, boiling point also decreases.

135. (b)



$\underset{n-\text{butane}}{CH_3CH_2CH_2CH_3} \xrightarrow[\Delta]{\text{Anhyd.} AlCl_3} CH_3-\underset{CH_3}{CH}-CH_3$

iso butane

136. (c) $CH_3-CH_2-Br + \underset{\text{alk}}{KOH} \xrightarrow{\text{Dehydrohalogenation}}$

$CH_2=CH_2 + KBr + H_2O$

In alcoholic KOH alkoxide ions (RO^-) are present which is a strong base. They abstract proton from β-carbon of alkyl halide and favours elimination reaction

$\underset{\text{Alcohol}}{ROH} + KOH \rightarrow \underset{\text{Potassium alkoxide}}{ROK + H_2O}$

$ROK \rightarrow \underset{\text{Alkoxideion}}{RO^-} + K^+$

$RO^- + H-\overset{\beta}{CH_2}-\overset{\alpha}{CH_2}-Br \rightarrow ROH + CH_2=CH_2 + Br$

137. (a) $Al_4C_3 + 6H_2O \rightarrow \underset{\text{Methane}}{3CH_4} + 2Al_2O_3$

138. (c) In C_2H_6, $C-C$ bond length is 1.54Å.

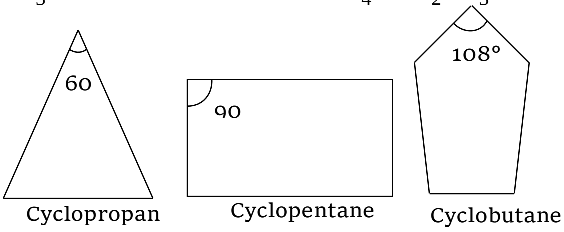
139.

(a)

$R-COOK + 2H_2O \xrightarrow{\text{Electrolysis}} \underset{\text{Alkane}}{R-R} + CO_2 + 2KOH + H_2$

142. (b) $CH_3COONa + NaOH \xrightarrow{CaO} CH_4 + Na_2CO_3$

143. (a)

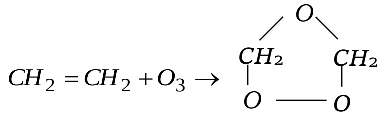


Cyclopropane with a bond angle of 60^o is very strained and hence very reactive.

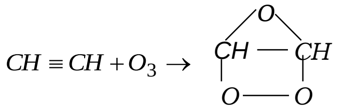
145. (b) Marsh gas mainly consists of methane.

146. (c) $CH_3-Cl + 2H \xrightarrow{Zn/HCl} CH_4 + HCl$

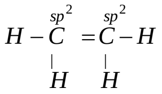
149. (d) Propane is a saturated compound. Ozonide is formed only by alkenes or alkynes



Ethene ozoniele



Ethyne ozonide

150. (b) 
$\overset{sp^2}{\underset{H}{\underset{|}{H-C}}}=\overset{sp^2}{\underset{H}{\underset{|}{C}}}-H$ sp^2-hybridisation (trigonal planar).

151. (a) $Ag-C\equiv C-Ag+2HCl\rightarrow CH\equiv CH+2AgCl$

152. (c) Wurtz reaction

$$C_2H_5-I+2Na+I-C_2H_5\xrightarrow[\text{Ether}]{\text{Dry}}\underset{\text{Butane}}{C_2H_5-C_2H_5}+2NaI$$

154. (b) All the $C-C$ bond are single bonds. Hence sp^3-hybridization and tetrahedral structure.

155. (a.b) $CH_3MgI+CH_3-CH_2-NH_2\rightarrow$

$CH_4+CH_3CH_2NHMgI$

$CH_3MgI+C_2H_5OH\rightarrow CH_4+C_2H_5OMgI$

Alkyl group of Grignard's reagent is involved in the formation of alkane.

159. (a) General formula of alkane C_nH_{2n+2} (n = no. of atoms).

160. (c) $CH_3Br+H_2\xrightarrow{LiAlH_4}CH_4$ (methane)

$\xrightarrow{Na}CH_3-CH_3$ (Ethane)

161. (e) Photochemical chlorination of alkane take place by free radical mechanism which are possible by Homolysis of C – C bond

$Cl_2\xrightarrow{hv}Cl^\bullet+Cl^\bullet$

$CH_3-CH_3+Cl^\bullet\rightarrow CH_3Cl^\bullet+\dot{C}H_3$

163. (a) Producer gas – CO and N_2

164. (c) Among alkanes, boiling point increase with increasing molecular weight. For isomeric alkanes straight chain alkanes have higher boiling point than the branched alkanes.

165. (b) Graphite is a good conductor of heat of electricity.

166. (d) Among the isomeric alkanes, the normal isomer has a higher boiling point than the branched chain isomer. The greater the branching of the chain, the lower is the boiling point. The n-alkane have larger surface area in comparison to branched chain isomer (as the shape approaches that of a sphere in the branched chain isomers). Thus, intermolecular forces are weaker in branched chain isomers, there fore they have lower point in comparision to straight chain isomers.

167. (d) The octane numbers of Fuel can be improved by increasing the percentage of branched chain alkanes, alkenes and aromatic hydrocarbon. Thus octane number can be changed by isomerisation (reforming), alkylation and aromatisation (cyclisation) etc.

168. (c) The approximate composition of gasoline is C_6-C_{11} at boiling point 70-200°C and is used in motor fuel, dry cleaning, petrol gas etc.

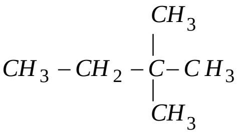
169. (c) $CH_4+O_2\rightarrow CO_2+2H_2O$

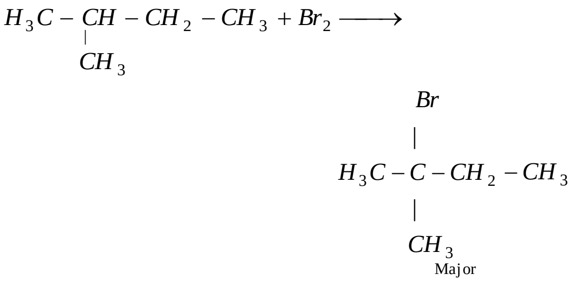
170. **(c)** Straight chain olefins has highest knocking.

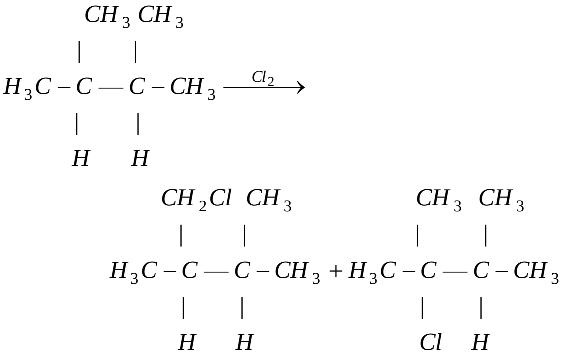
171. (a) $Al_4C_3+12H_2O\rightarrow 3CH_4+4Al(OH)_3$

$CaC_2+2H_2O\rightarrow C_2H_2+Ca(OH)_2$

172. (d) Except 2,2 dimethyl butane rest compound contain 5 carbon i.e., pantane while 2,2 dimethyl butane contain 6 carbon i.e., Hexane


$$CH_3-CH_2-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_3$$

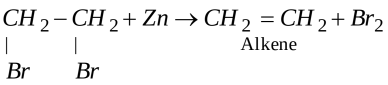
173. (b) 
$$H_3C-\underset{\underset{CH_3}{|}}{CH}-CH_2-CH_3+Br_2\longrightarrow \underset{\text{Major}}{H_3C-\overset{\overset{Br}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_2-CH_3}$$

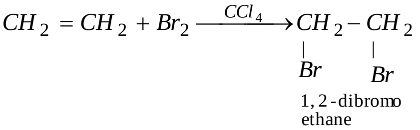
174. (b) 
$$H_3C-\overset{\overset{CH_3}{|}}{\underset{\underset{H}{|}}{C}}-\overset{\overset{CH_3}{|}}{\underset{\underset{H}{|}}{C}}-CH_3\xrightarrow{Cl_2}$$
$$H_3C-\overset{\overset{CH_2Cl}{|}}{\underset{\underset{H}{|}}{C}}-\overset{\overset{CH_3}{|}}{\underset{\underset{H}{|}}{C}}-CH_3+H_3C-\overset{\overset{CH_3}{|}}{\underset{\underset{Cl}{|}}{C}}-\overset{\overset{CH_3}{|}}{\underset{\underset{H}{|}}{C}}-CH_3$$

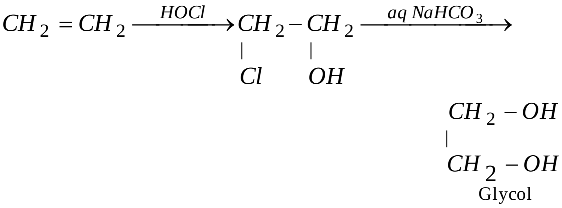
175. (c) $C_2H_5Cl+H_2\xrightarrow{Pd/C}C_2H_6+HCl$

This reaction is used for the preparation of pure alkanes.

Alkene

2. (b) 
$$\underset{\underset{Br}{|}}{CH_2}-\underset{\underset{Br}{|}}{CH_2}+Zn\rightarrow \underset{\text{Alkene}}{CH_2=CH_2}+Br_2$$

3. (a) 
$$CH_2=CH_2+Br_2\xrightarrow{CCl_4}\underset{\text{1, 2-dibromo ethane}}{\underset{\underset{Br}{|}}{CH_2}-\underset{\underset{Br}{|}}{CH_2}}$$

4. (b) 
$$CH_2=CH_2\xrightarrow{HOCl}\underset{\underset{Cl}{|}}{CH_2}-\underset{\underset{OH}{|}}{CH_2}\xrightarrow{aq\ NaHCO_3}\underset{\text{Glycol}}{\begin{matrix}CH_2-OH\\|\\CH_2-OH\end{matrix}}$$

5. (a) Alkenes are unsaturated hydrocarbon having double bond so generally gives addition reaction.

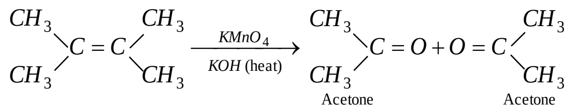
6. (d) According to markownikoff's rule.

7.

(a)

$$CH_3-CH_2-OH \xrightarrow[160-170°C]{Conc.\ H_2SO_4} CH_2=CH_2+H_2O$$

8. (d)



10. (d) $C_2H_5I+alc.KOH\rightarrow C_2H_4+KI+H_2O$

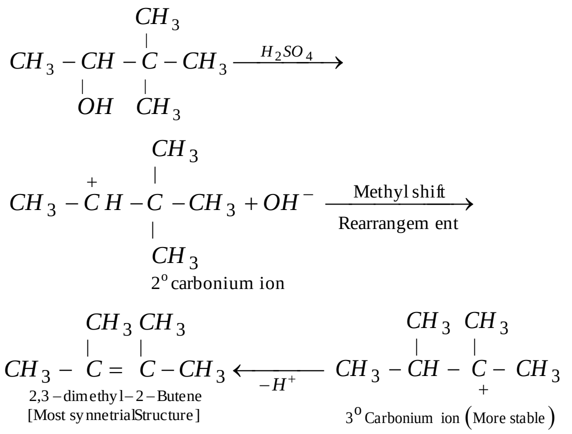
12. (a) $CH_3-CH_2-Br+KOH\rightarrow CH_2=CH_2+KBr+H_2O$

13. (a) Methane can not be obtained by Sabatier and Sendern's reaction because in this the product obtained contain minimum two carbon atoms.

$$CH_2=CH_2+H_2\xrightarrow{Ni}CH_3-CH_3$$

$$CH\equiv CH+2H_2\xrightarrow{Ni}CH_3-CH_3$$

14. (c)



$$CH_3-\underset{OH}{CH}-\overset{CH_3}{\underset{CH_3}{C}}-CH_3\xrightarrow{H_2SO_4}$$

$$CH_3-\overset{+}{C}H-\overset{CH_3}{\underset{CH_3}{C}}-CH_3+OH^-\xrightarrow[\text{Rearrangem ent}]{\text{Methyl shift}}$$

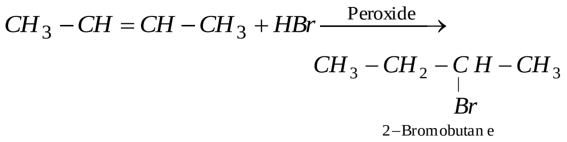
2° carbonium ion

$$CH_3-\overset{CH_3}{C}=\overset{CH_3}{C}-CH_3\xleftarrow{-H^+}CH_3-\overset{CH_3}{CH}-\overset{CH_3}{\underset{+}{C}}-CH_3$$

2,3-dimethyl-2-Butene [Most synnetrial Structure]

3° Carbonium ion (More stable)

20. (c)

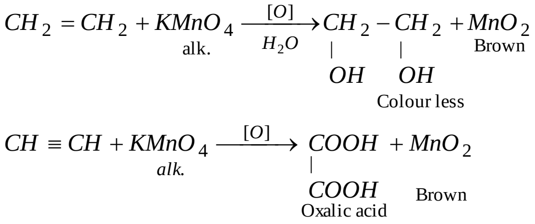


$$CH_3-CH=CH-CH_3+HBr\xrightarrow{\text{Peroxide}}CH_3-CH_2-\underset{Br}{C}H-CH_3$$

2-Bromobutane

Anti-markownikoff's rule is not applicable to symmetrical alkenes.

21. (b)



$$CH_2=CH_2+\underset{\text{alk.}}{KMnO_4}\xrightarrow[H_2O]{[O]}\underset{OH}{CH_2}-\underset{OH}{CH_2}+\underset{\text{Brown}}{MnO_2}$$

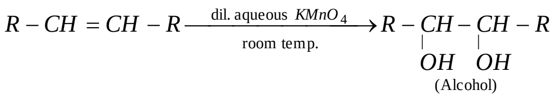
Colour less

$$CH\equiv CH+\underset{alk.}{KMnO_4}\xrightarrow{[O]}\underset{\text{Oxalic acid}}{\begin{matrix}COOH\\|\\COOH\end{matrix}}+\underset{\text{Brown}}{MnO_2}$$

22. (d) Octane number increases in the order Straight chain alkanes < Branched chain alkanes < Olefins < Cyclo alkanes < Aromatic compounds

Since, straight chain alkane has minimum octane number. Hence, it produces maximum knocking.

23. (c)

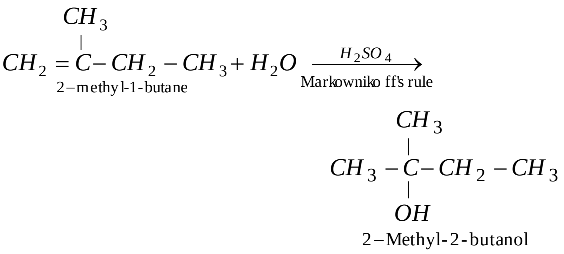


$$R-CH=CH-R\xrightarrow[\text{room temp.}]{\text{dil. aqueous } KMnO_4}R-\underset{OH}{CH}-\underset{OH}{CH}-R$$

(Alcohol)

$$R-CH=CH-R\xrightarrow[\text{heat}]{\text{Conc. }KMnO_4}R-COOH+R-COOH$$

24. (b)

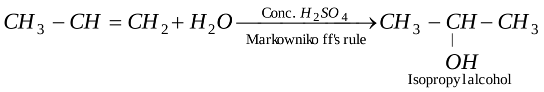


$$CH_2=\overset{CH_3}{C}-CH_2-CH_3+H_2O\xrightarrow[\text{Markowniko ffs rule}]{H_2SO_4}CH_3-\overset{CH_3}{\underset{OH}{C}}-CH_2-CH_3$$

2-methyl-1-butane

2-Methyl-2-butanol

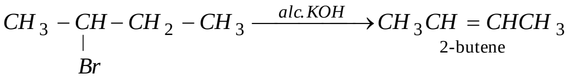
27. (b)



$$CH_3-CH=CH_2+H_2O\xrightarrow[\text{Markowniko ffs rule}]{\text{Conc. }H_2SO_4}CH_3-\underset{OH}{CH}-CH_3$$

Isopropyl alcohol

32. (d)

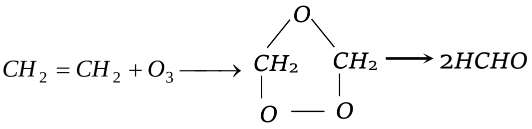


$$CH_3-\underset{Br}{CH}-CH_2-CH_3\xrightarrow{alc.KOH}CH_3CH=CHCH_3$$

2-butene

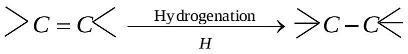
The reaction is dehydrohalogenation.

34. (a)

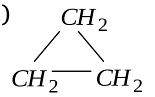


35. (c) Oil are unsaturated esters which are converted into fats by saturating it by catalytic hydrogenation.

36. (c)

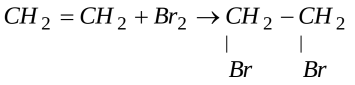


37. (a)



Cyclo Propane

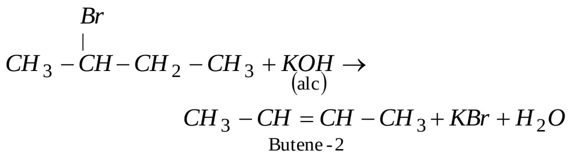
38. (b) e.g.



$$CH_2=CH_2+Br_2\rightarrow\underset{Br}{CH_2}-\underset{Br}{CH_2}$$

Half of the double bond is broken. It means π bond is broken while sigma bond is retained also two new $C-Br$ bonds are formed.

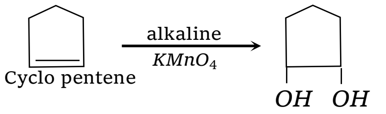
40. (b)



$$CH_3-\overset{Br}{CH}-CH_2-CH_3+\underset{(alc)}{KOH}\rightarrow CH_3-CH=CH-CH_3+KBr+H_2O$$

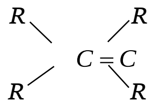
Butene-2

41. (c)



cis 1, 2-cyclopentanediol

42. (a) We know that greater the number of alkyl groups attached to double bonded carbon atoms, more stable is the alkene. Therefore most stable is $R_2C=CR_2$



43. (c) $CH_2=CH_2+2[O]\xrightarrow{KMnO_4}\underset{\text{Formaldehy de}}{HCHO+HCHO}$

44. (c) Paraffins are non-polar compounds. The intermolecular forces are weak Vander Waal's forces. As the molecular mass increases Vander Waal's forces increases. Hence boiling point increases.

45. (a) $\underset{Br}{\underset{|}{CH_2}}-\underset{Br}{\underset{|}{CH_2}}+Zn\rightarrow ZnBr_2+CH_2=CH_2$

46. (c) $CH_3CH_2I+KOH(alc)\rightarrow CH_2=CH_2+KI+H_2O$

$$CH_2=CH_2+\underset{\text{Alk.Pink}}{KMnO_4}\xrightarrow{H_2O}\underset{\text{Colourless}}{\underset{OH}{\underset{|}{CH_2}}-\underset{OH}{\underset{|}{CH_2}}}+MnO_2$$

47. (d) $CH_2=CH-Br\xrightarrow{HBr}CH_3-CH{<}\begin{smallmatrix}Br\\Br\end{smallmatrix}$

According to Markownikoff's rule *H* atom or positive part goes to that carbon atom which is more hydrogenated.

48. (d) $CH_3-CH_2-Br+\underset{(alc)}{KOH}\rightarrow\underset{\text{Ethene}}{CH_2=CH_2}+KBr+H_2O$

49. (a) $CH_3-CH_2-OH\xrightarrow[\text{Dehydration}]{\text{Conc. }H_2SO_4}CH_2=CH_2+H_2O$

50. (c) Electrophillic addition reactions are shown by alkenes or alkynes in these reactions attacking species is electrophiles

$$CH_3-CH=CH_2+H^+\xrightarrow{\text{Slow}}\underset{2^o\text{ carbonium ion}}{CH_3-\overset{+}{C}H-CH_3}$$

$$CH_3-\overset{+}{C}H-CH_3+Br^-\xrightarrow{\text{Fast}}\underset{\text{2-Bromo propane}}{CH_3-\underset{Br}{\underset{|}{CH}}-CH_3}$$

51.

(a) $CH_3CH_2CH_2Cl+KOH\rightarrow$

$CH_3-CH=CH_2+KCl+H_2O$

$$CH_3-\underset{Cl}{\underset{|}{CH}}-CH_3+KOH\rightarrow CH_3-CH=CH_2+KCl+H_2O$$

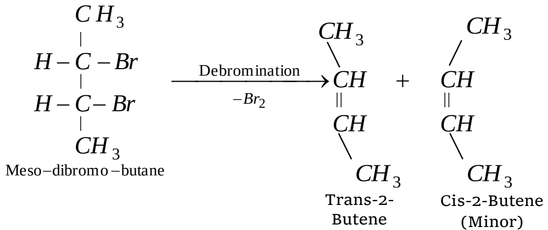
52. (d) $\underset{\text{Ethene}}{CH_2=CH_2}\xrightarrow{\text{Cold.alk.}KMnO_4}\underset{\text{Ethyleneglycol}}{\underset{OH}{\underset{|}{CH_2}}-\underset{OH}{\underset{|}{CH_2}}}$

53. (c) Ethane and Methane does not decolourise $KMnO_4$ and does not react with ammonical cuprous chloride. Acetylene decolourise $KMnO_4$ solution and also gives red ppt. with ammonical cuprous chloride. On the other hand ethene decolourize $KMnO_4$ solution but does not react with ammonical cuprous chloride.

54. (a) $CH_2=CH_2+H\overset{-}{O}\overset{+}{Cl}\rightarrow\underset{\text{1-Chloro-2-hydroxy ethane}}{\underset{OH}{\underset{|}{\overset{2}{CH_2}}}-\underset{Cl}{\underset{|}{\overset{1}{CH_2}}}}$

55. (b) $\underset{\text{(ethylene)}}{n(CH_2=CH_2)}\xrightarrow[\text{high pressure}]{400^oC}\underset{\text{(polyethylene)}}{(-CH_2-CH_2-)_n}$

57. (d)



Trans-2-butene is more stable than its *cis* isomer.

58. (a) $ClCH_2-CH_2-CH_2-CH_3\xrightarrow{alc.KOH}$

$$\underset{\text{1-butene}}{CH_2=CH-CH_2-CH_3}$$

59. (d) $CH_3CH_2CH=CHCH_3\xrightarrow[Zn/H_2O]{O_3}\underset{\text{Propanal}}{CH_3CH_2CHO}+\underset{\text{Ethanal}}{CHOCH_3}$

61. (c) $\underset{\text{Propadiene}}{\underset{sp^2}{CH_3}=\underset{sp}{C}=\underset{sp^2}{CH_2}}$

Propadiene has both *sp* and sp^2-hybridized carbon atoms.

62. (a) $C_2H_4+Cl_2\xrightarrow{CCl_4}\underset{\text{Ethelene Chloride}}{Cl-CH_2-CH_2-Cl}$

64. (b) Paraffins or alkanes are non-polar compounds. Hence soluble in benzene.

65. (b) $CH_3-CH=CH_2+HCl\xrightarrow{Peroxide}CH_3-\underset{Cl}{\underset{|}{CH}}-CH_3$

Peroxide rule is applicable only to HBr.

66. (d) $CH_3-CH=CH_2+HI\xrightarrow{\text{Peroxide}}CH_3-CH_2-CH_2I$

69. (c) $CH_3-\underset{H}{\underset{|}{CH}}-\underset{Cl}{\underset{|}{CH}}-\underset{H}{\underset{|}{CH_2}}\xrightarrow[-HCl]{alc.NaOH}$

$$CH_3CH=CH-CH_3$$

73. (c) $CH_3-CH=CH-CH_2-CH_3$ it decolourizes $KMnO_4$ solution because double bond is present.

77. (a) $CH_2=CH-CH_2-C\equiv CH+Br_2\rightarrow$

$$CH_2=CH-CH_2-\underset{Br}{\underset{|}{C}}=\underset{Br}{\underset{|}{CH}}$$

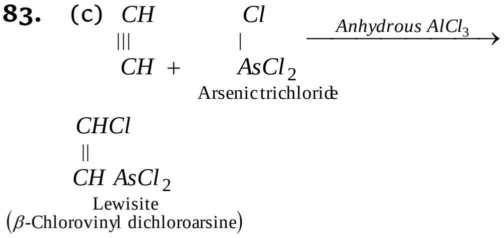
78. (d) $CH_3COCH_3+PCl_5\rightarrow CH_3-CCl_2-CH_3+POCl_3$

80. (b) $3R-CH=CH_2+\frac{1}{2}B_2H_6\xrightarrow[\text{Ether}]{\text{Dry}}(R-CH_2CH_2)_3B$

$$\begin{matrix}OH^-\\H_2O\end{matrix}\Big\downarrow H_2O_2$$

$$\underset{\text{Alcohol}}{3R-CH_2CH_2OH}$$

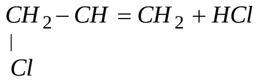
83. (c)



$$\begin{matrix}CH\\|||\\CH\end{matrix}+\underset{\text{Arsenictrichloride}}{\begin{matrix}Cl\\|\\AsCl_2\end{matrix}}\xrightarrow{Anhydrous\ AlCl_3}\underset{\text{Lewisite}\ (\beta\text{-Chlorovinyl dichloroarsine})}{\begin{matrix}CHCl\\||\\CH\ AsCl_2\end{matrix}}$$

Lewisite is more poisonous than mustard gas and was used in world war -II.

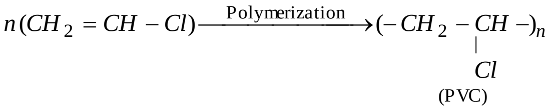
84. (a) $CH_3-CH=CH_2+Cl_2\xrightarrow{500^oC}$



$\underset{\underset{Cl}{|}}{CH_2}-CH=CH_2+HCl$

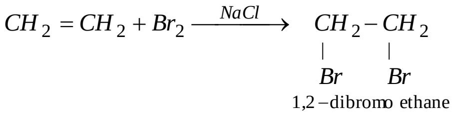
This reaction is called allylic halogenation reaction because halogenation occurs at the allylic position of an alkene

85. (c)

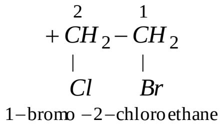


$n(CH_2=CH-Cl)\xrightarrow{\text{Polymerization}}(-CH_2-\underset{\underset{Cl}{|}}{CH}-)_n$ (PVC)

86. (c)

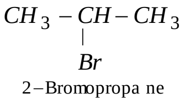


$CH_2=CH_2+Br_2\xrightarrow{NaCl}\underset{\text{1,2-dibromo ethane}}{\underset{\underset{Br}{|}}{CH_2}-\underset{\underset{Br}{|}}{CH_2}}$



$+\underset{\text{1-bromo-2-chloroethane}}{\underset{\underset{Cl}{|}}{\overset{2}{CH_2}}-\underset{\underset{Br}{|}}{\overset{1}{CH_2}}}$

87. (b) $CH_3-CH=CH_2+HBr\xrightarrow[\text{Markownikoff rule}]{}$

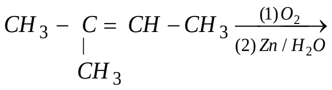


$\underset{\text{2-Bromopropane}}{CH_3-\underset{\underset{Br}{|}}{CH}-CH_3}$

88. (a) $CH_3-CH=CH_2+HBr\xrightarrow{\text{Peroxide}}$

$CH_3-CH_2-CH_2-Br$

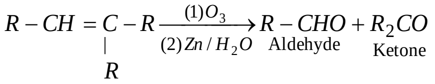
89. (c)



$CH_3-\underset{\underset{CH_3}{|}}{C}=CH-CH_3\xrightarrow[(2)\,Zn/H_2O]{(1)\,O_2}$

$\underset{\text{Ketone}}{CH_3COCH_3}+\underset{\text{Aldehyde}}{CHOCH_3}$

90. (c)



$R-CH=\underset{\underset{R}{|}}{C}-R\xrightarrow[(2)\,Zn/H_2O]{(1)\,O_3}\underset{\text{Aldehyde}}{R-CHO}+\underset{\text{Ketone}}{R_2CO}$

92. (c) $CH_3-CH_2-OH\xrightarrow[H_2SO_4]{\text{Conc.}}CH_2=CH_2+H_2O$

93. (b) $\underset{\text{Ethyl Chloride}}{CH_3-CH_2-Cl}\xrightarrow{\text{alc. }KOH}\underset{\text{Alkene}}{CH_2=CH_2}+KCl+H_2O$

94. (b) Olefin because double bond is present.

95. (b) In $CH_2\overset{\pi}{\underset{\sigma}{=}}CH_2$ double bond consist of one σ and one π bond

96. (b) $\underset{\text{Alkylhalide}}{R-CH_2-CH_2-X}\xrightarrow[\text{alc. }KOH]{\text{Elimination}}$

$\underset{\text{Alkene}}{R-CH=CH_2}+\underset{\text{Halogen acid}}{HX}$

97. (a) $CH_3-CH_2-CH_2-CH_3\xrightarrow[475\,K]{H_2SO_4}$

$\underset{\text{More symmetrical (major product)}}{CH_3-CH=CH-CH_3}$

$CH_3-CH_2-CH_2-CH_3\xrightarrow[475\,K]{H_2SO_4}$

$\underset{\text{Less symmetrical or unsymmetrical (minor product)}}{CH_2=CH-CH_2-CH_3}$

It is based on Saytzeff's rule. According to this more symmetrical or more alkylated alkene predominates.

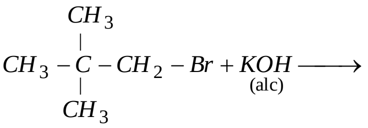
98. (b) $CH_3-CH_2-CH_2-OH\xrightarrow{PCl_3}$

$\underset{\text{propylchloride}}{\underset{(a)}{CH_3-CH_2-CH_2-Cl}}\xrightarrow{\text{Alc.}KOH}\underset{\text{Propene}}{\underset{(b)}{CH_3-CH=CH_2}}$

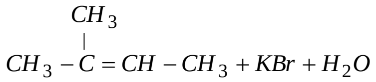
99. (b) $\underset{n-\text{Propyl bromide}}{CH_3-CH_2-CH_2-Br}+KOH\xrightarrow{C_2H_5OH}$

$\underset{\text{Propene}}{CH_3-CH=CH_2}+KBr+H_2O$

100. (b)

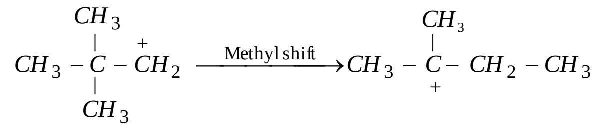


$CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_2-Br+\underset{(alc)}{KOH}\longrightarrow$



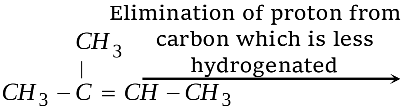
$CH_3-\overset{\overset{CH_3}{|}}{C}=CH-CH_3+KBr+H_2O$

In this reaction 1^o carbonium ion is formed which rearranges to form 3^o carbonium ion from which base obstruct proton. Hence 2-methyl-2-butene is formed as a main product.



$CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-\overset{+}{C}H_2\xrightarrow{\text{Methyl shift}}CH_3-\overset{\overset{CH_3}{|}}{\underset{+}{C}}-CH_2-CH_3$

1^o carbonium less stable



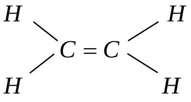
$\xrightarrow{\text{Elimination of proton from }\beta\text{ carbon which is less hydrogenated}}$

$CH_3-\overset{\overset{CH_3}{|}}{C}=CH-CH_3$

2-Methyl-2-Butene

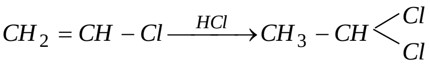
101. (b) Alkyne > Alkene > Alkane

102. (c)



Ethylene sp^2-hybridization; Shape = Planar.

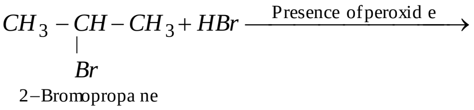
104. (b)



$CH_2=CH-Cl\xrightarrow{HCl}CH_3-CH\begin{matrix}Cl\\Cl\end{matrix}$

According to Markownikoff's rule H atom of the reagent goes to that carbon atom which is more hydrogenated.

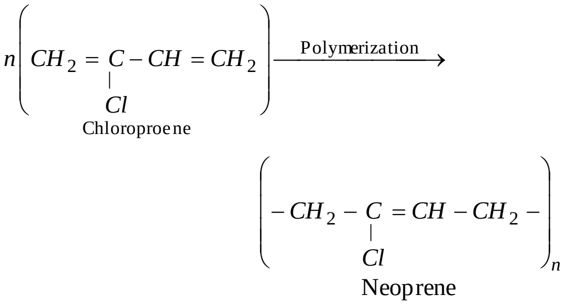
105. (b) $CH_3-CH=CH_2+HBr\xrightarrow{\text{Markownikoffs rule}}$



$\underset{\text{2-Bromopropane}}{CH_3-\underset{\underset{Br}{|}}{CH}-CH_3}+HBr\xrightarrow{\text{Presence of peroxide}}$

$\underset{\text{1-Bromopropane}}{CH_3-CH_2-CH_2-Br}$

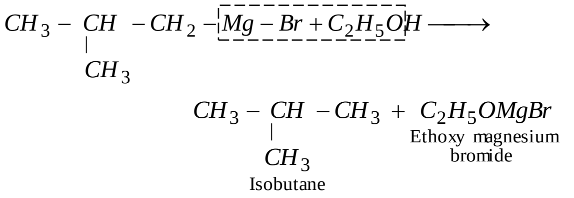
106. (a) Peroxide rule is applicable only to HBr and not for HCl, HF and HI.

109. (a)


$$n\left(CH_2=\underset{Cl}{\underset{|}{C}}-CH=CH_2\right)\xrightarrow{\text{Polymerization}}\left(-CH_2-\underset{Cl}{\underset{|}{C}}=CH-CH_2-\right)_n$$

Chloroproene

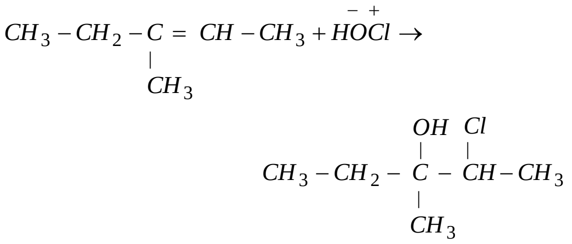
Neoprene

110. (c)


$$CH_3-\underset{CH_3}{\underset{|}{CH}}-CH_2-\boxed{Mg-Br+C_2H_5O}H\longrightarrow CH_3-\underset{CH_3}{\underset{|}{CH}}-CH_3+C_2H_5OMgBr$$

Isobutane

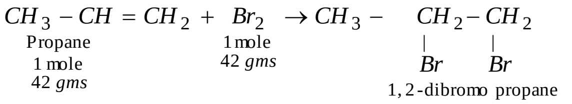
Ethoxy magnesium bromide

111. (c)


$$CH_3-CH_2-\underset{CH_3}{\underset{|}{C}}=CH-CH_3+\overset{-}{HO}\overset{+}{Cl}\to CH_3-CH_2-\underset{CH_3}{\underset{|}{\overset{OH}{\overset{|}{C}}}}-\overset{Cl}{\overset{|}{CH}}-CH_3$$

Addition takes place according to Markownikoff's rule in which Cl^+ goes to that carbon atom which is more hydrogenated.

112. (a) In case of ethene double bond is present. Hence, addition reactions occur easily.

113. (a)


$$\underset{\substack{\text{Propane}\\1\text{ mole}\\42\ gms}}{CH_3-CH=CH_2}+\underset{\substack{1\text{ mole}\\42\ gms}}{Br_2}\to CH_3-\underset{Br}{\underset{|}{CH_2}}-\underset{Br}{\underset{|}{CH_2}}$$

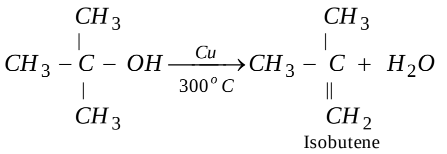
1, 2-dibromo propane

∵ 42 *gms* of propene reacts with 160 *gms* of bromine.

∴ 21*gms* of propene $\frac{160}{42}\times 21=80\ gms$.

114. (b) Butadiene $CH_2=CH-CH=CH_2$

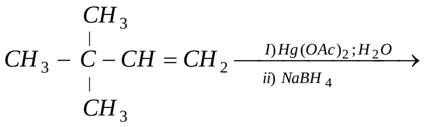
A single bond separated by two double bonds is known as conjugated double bond.

115. (d)


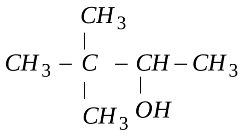
$$CH_3-\underset{CH_3}{\underset{|}{\overset{CH_3}{\overset{|}{C}}}}-OH\xrightarrow[300^oC]{Cu}CH_3-\underset{CH_2}{\underset{\|}{\overset{CH_3}{\overset{|}{C}}}}+H_2O$$

Isobutene

117. (a) Cyclic hydrocarbon in which all the carbon atoms are present in the same plane is benzene. In this $C-C$ bond length is 1.39Å which is more than $1.34A^o$ but less than 1.54Å. Hence bond angle is 120^o with sp^2 hybridization.

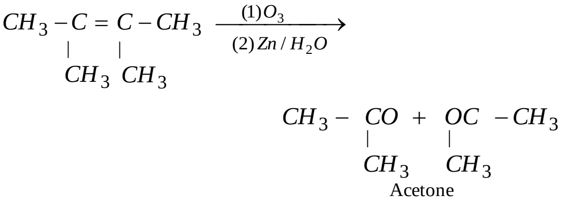
119. (a)


$$CH_3-\underset{CH_3}{\underset{|}{\overset{CH_3}{\overset{|}{C}}}}-CH=CH_2\xrightarrow[ii)\ NaBH_4]{I)\ Hg(OAc)_2;H_2O}$$



$$CH_3-\underset{CH_3}{\underset{|}{\overset{CH_3}{\overset{|}{C}}}}-\underset{OH}{\underset{|}{CH}}-CH_3$$

120. (b) C_3H_6 is an alkene therefore decolourizes alkaline $KMnO_4$ solution.

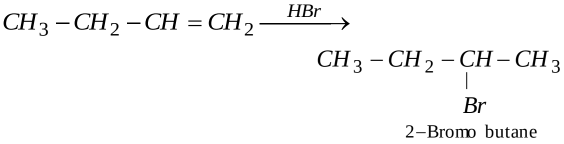
123. (c)


$$CH_3-\underset{CH_3}{\underset{|}{C}}=\underset{CH_3}{\underset{|}{C}}-CH_3\xrightarrow[(2)\,Zn/H_2O]{(1)\,O_3}CH_3-\underset{CH_3}{\underset{|}{CO}}+\underset{CH_3}{\underset{|}{OC}}-CH_3$$

Acetone

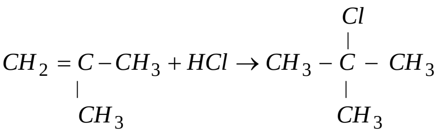
124. (b) $CH_3-CH=CH-CHO\xrightarrow[KMnO_4]{Acidic}$

$CH_3-CH=CH-COOH$

127. (b)


$$CH_3-CH_2-CH=CH_2\xrightarrow{HBr}CH_3-CH_2-\underset{Br}{\underset{|}{CH}}-CH_3$$

2–Bromo butane

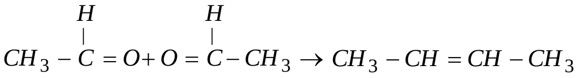
128. (b)


$$CH_2=\underset{CH_3}{\underset{|}{C}}-CH_3+HCl\to CH_3-\underset{CH_3}{\underset{|}{\overset{Cl}{\overset{|}{C}}}}-CH_3$$

2-chloro-2-methyl propane

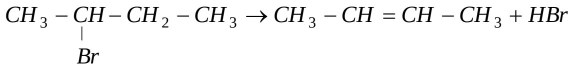
129. (a) Ozonolysis is useful in locating the position of a double bond in an alkene. The double bond is obtained by joining the carbon atoms of the two carbonyl compounds. For example

Let the product of ozonolysis be two molecules of ethanal.



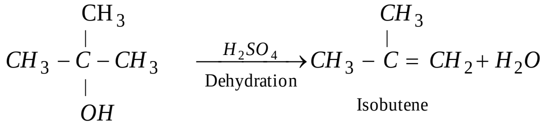
$$CH_3-\overset{H}{\overset{|}{C}}=O+O=\overset{H}{\overset{|}{C}}-CH_3\to CH_3-CH=CH-CH_3$$

2–Butene

131. (c)


$$CH_3-\underset{Br}{\underset{|}{CH}}-CH_2-CH_3\to CH_3-CH=CH-CH_3+HBr$$

2–Bromo butane

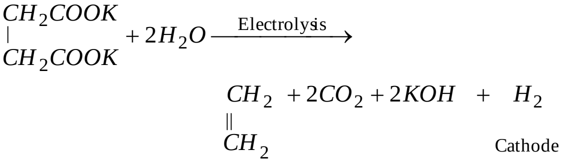
134. (b)


$$CH_3-\underset{OH}{\underset{|}{\overset{CH_3}{\overset{|}{C}}}}-CH_3\xrightarrow[\text{Dehydration}]{H_2SO_4}CH_3-\overset{CH_3}{\overset{|}{C}}=CH_2+H_2O$$

2Methyl-2-hydroxy propane

Isobutene

135. (c) $\underset{\text{Ethene}}{CH_2=CH_2}+H_2\xrightarrow[300^o]{Ni}\underset{\text{Ethane}}{CH_3-CH_3}$

136. (c)


$$\begin{array}{l}CH_2COOK\\|\\CH_2COOK\end{array}+2H_2O\xrightarrow{\text{Electrolysis}}\underset{CH_2}{\underset{\|}{CH_2}}+2CO_2+2KOH+H_2$$

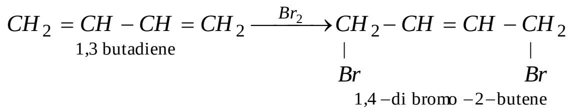
Anode

Cathode

137. (c) $CH_2=CH_2+H_2\xrightarrow[300^oC]{Ni}CH_3-CH_3$

Ethylene does not give precipitate with ammonical silver nitrate solution because it does not have acidic hydrogen.

139. (a)



$$\underset{\text{1,3 butadiene}}{CH_2=CH-CH=CH_2}\xrightarrow{Br_2}\underset{\text{1,4 – di bromo – 2 – butene}}{\underset{Br}{CH_2}-CH=CH-\underset{Br}{CH_2}}$$

143. (d) *Pd* acts as catalyst.

144. (a) $CH-CH=CH_2+HBr\xrightarrow{\text{peroxide}}\underset{n-\text{propyl bromide}}{CH_3-CH_2-CH_2-Br}$

In presence of peroxide addition takes place according to Anti Markownikoff's rule and hydrogen atom goes to that carbon atom which is less hydrogenated.

145. (d) $\underset{\text{Ethanol}}{CH_3-CH_2-OH}+\underset{Conc.}{H_2SO_4}\xrightarrow{110^o C}\underset{\text{Ethylhydrogen sulphate}}{CH_3CH_2HSO_4}$

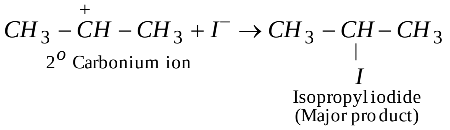
146. (a) $CH_2=CH_2\xrightarrow[2)Zn/H_2O]{1)O_3}HCHO+\underset{\text{Formaldehy de}}{HCHO}$

147. (d) C_2H_4, C_3H_6 and C_4H_8 all an alkene. Therefore they discharge the red colour of bromine.

149. (a) $HI\to H^+ + I^-$

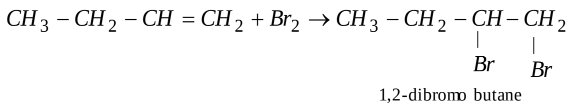
$$CH_3-CH=CH_2+H^+\to$$

$$\underset{\substack{\text{(Minor)}\\1^o\text{ Carbonium ion}\\\text{(Less stable)}}}{CH_3-CH_2-\overset{+}{C}H_2}+\underset{\substack{\text{(Major)}\\2^o\text{ Carbonium ion}\\\text{(More stable)}}}{CH_3-\overset{+}{C}H-CH_3}$$



$$\underset{2^o\text{ Carbonium ion}}{CH_3-\overset{+}{C}H-CH_3}+I^-\to\underset{\substack{\text{Isopropyl iodide}\\\text{(Major product)}}}{CH_3-\underset{I}{CH}-CH_3}$$

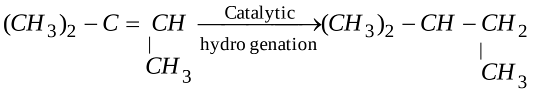
150. (a)



$$CH_3-CH_2-CH=CH_2+Br_2\to\underset{\text{1,2-dibromo butane}}{CH_3-CH_2-\underset{Br}{CH}-\underset{Br}{CH_2}}$$

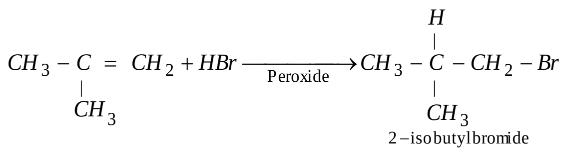
151. (a) $CH_2=CH_2\xrightarrow[(2)Zn/H_2O]{(1)O_3}HCHO+HCHO$

153. (c)



$$(CH_3)_2-C=\underset{CH_3}{CH}\xrightarrow[\text{hydro genation}]{\text{Catalytic}}(CH_3)_2-CH-\underset{CH_3}{CH_2}$$

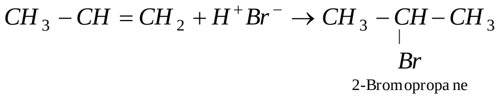
154. (b)



$$CH_3-\underset{CH_3}{C}=CH_2+HBr\xrightarrow[\text{Peroxide}]{}\underset{2-\text{isobutyl bromide}}{CH_3-\overset{H}{\underset{CH_3}{C}}-CH_2-Br}$$

155. (a) $\overset{sp^2}{CH_2}=\overset{sp^2}{CH}-\overset{sp}{C}\equiv\overset{sp}{CH}$

156. (c)



$$CH_3-CH=CH_2+H^+Br^-\to\underset{\text{2-Bromopropa ne}}{CH_3-\underset{Br}{CH}-CH_3}$$

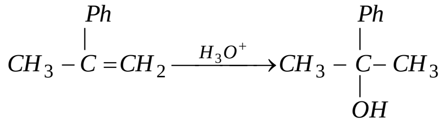
157. (b) Reaction is of dehydration

$$C_2H_5OH\xrightarrow{\text{Conc. }H_2SO_4}CH_2=CH_2$$

158. (d) $CH_3-CH=CH-CH_2-CH_3$ will be the most stable because greater the number of alkyl groups attached to double bonded carbon atoms, more stable is the alkene.

159. (b) Markownikoff's rule can not be applied for symmetrical alkene.

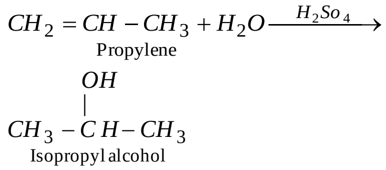
160. (c)



$$CH_3-\overset{Ph}{C}=CH_2\xrightarrow{H_3O^+}CH_3-\overset{Ph}{\underset{OH}{C}}-CH_3$$

161. (d) Solution of bromine in carbon tetrachloride is used to test for unsaturation of alkene. Red colour of bromine disappears due to the formation of colourless dibromo ethane $(C_2H_4Br_2)$.

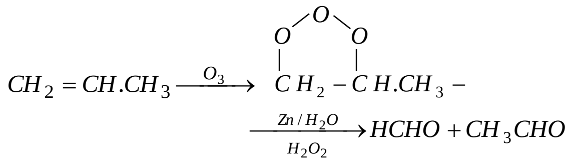
162. (b)



$$\underset{\text{Propylene}}{CH_2=CH-CH_3}+H_2O\xrightarrow{H_2So_4}\underset{\text{Isopropyl alcohol}}{CH_3-\overset{OH}{C}H-CH_3}$$

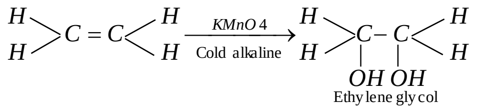
Thus in this reaction isopropyl alcohol is formed.

163. (b) Propene gives formaldehyde and acetaldehyde on ozonolysis.



$$CH_2=CH.CH_3\xrightarrow{O_3}CH_2-CH.CH_3-\xrightarrow[H_2O_2]{Zn/H_2O}HCHO+CH_3CHO$$

164. (a) When ethylene is treated with cold alkaline *KMnO*4 , ethylene glycol is formed.



$$\begin{matrix}H\\H\end{matrix}\!\!>C=C<\!\!\begin{matrix}H\\H\end{matrix}\xrightarrow[\text{Cold alkaline}]{KMnO\,4}\underset{\text{Ethylene glycol}}{\begin{matrix}H\\H\end{matrix}\!\!>\underset{OH}{C}-\underset{OH}{C}<\!\!\begin{matrix}H\\H\end{matrix}}$$

165. (a) $C_6H_6+H_2C=CH_2\xrightarrow[95^\circ\text{ pressure}]{AlCl_3.HI}C_6H_5CH_2CH_3$

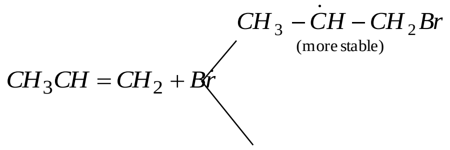
166. (a) Markownikoff as well as anti-Markownikoff's rule is valid only for unsymmetrical alkenes.

167. (b) The formation of *n*-propyl bromide in presence of peroxide can be explained as follows.

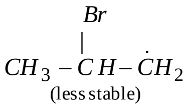
Step-1: Peroxide undergo fission to give free radicals $R-O-O-R\to2-R-\dot{O}$

Step-2 : *HBr* combines with free radical to form bromine free radical $R-\dot{O}+HBr\to R-OH+\dot{Br}$

Step-3 : $\dot{Br}$ attacks the double bond of the alkene to form a more stable free radical



$$CH_3CH=CH_2+\dot{Br}\to\underset{\text{(more stable)}}{CH_3-\dot{C}H-CH_2Br}$$



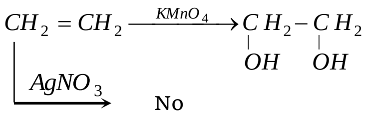
$$\underset{\text{(less stable)}}{CH_3-\overset{\overset{Br}{|}}{C}H-\dot{C}H_2}$$

Step-4 : More stable free radical attacks the HBr

$$CH_3-\dot{C}H-CH_2-Br+HBr\rightarrow \underset{\text{n-propyl bromide}}{CH_3CH_2CH_2Br}+B\dot{r}$$

Step-5 : $B\dot{r}+B\dot{r}\rightarrow Br_2$

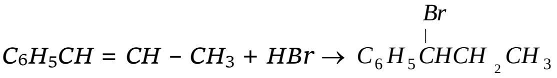
168. (c)



$$CH_2=CH_2\xrightarrow{KMnO_4}\underset{OH}{\underset{|}{C}H_2}-\underset{OH}{\underset{|}{C}H_2}$$

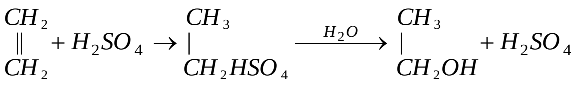
$$CH_2=CH_2\xrightarrow{AgNO_3}\text{No}$$

169. (b) According to Markownikoff's rule, the negative part of the unsymmetrical reagent adds to less hydrogenated (more substituted) carbon atom of the double bond.



$$C_6H_5CH=CH-CH_3+HBr\rightarrow C_6H_5\overset{\overset{Br}{|}}{C}HCH_2CH_3$$

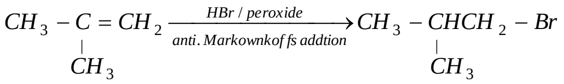
171. (a)



$$\begin{matrix}CH_2\\ \|\\ CH_2\end{matrix}+H_2SO_4\rightarrow\begin{matrix}CH_3\\ |\\ CH_2HSO_4\end{matrix}\xrightarrow{H_2O}\begin{matrix}CH_3\\ |\\ CH_2OH\end{matrix}+H_2SO_4$$

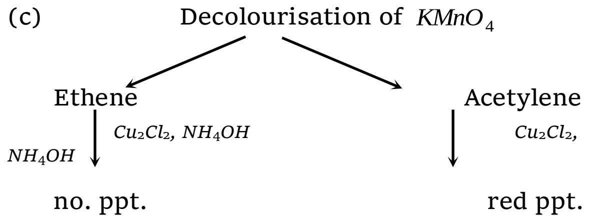
Except ethyl alcohol, no other primary alcohol can be prepared by this method as the addition of H_2SO_4 follows Markownikoff's rule. Generally secondary and tertiary alcohols are obtained.

172. (c)

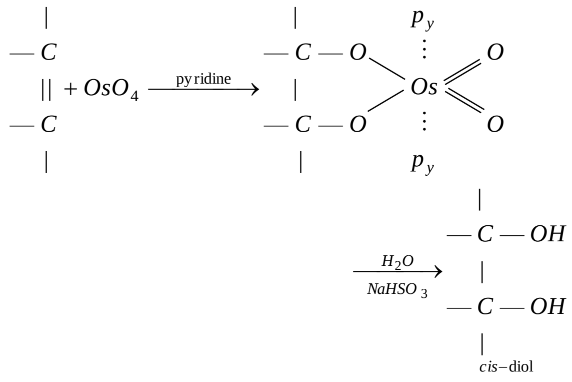


$$CH_3-\underset{CH_3}{\underset{|}{C}}=CH_2\xrightarrow[\text{anti. Markownkoff's addtion}]{HBr\,/\,peroxide}CH_3-\underset{CH_3}{\underset{|}{C}}HCH_2-Br$$

173. (c)



174. (a)



$$\begin{matrix}|\\ -C\\ \|\\ -C\\ |\end{matrix}+OsO_4\xrightarrow{\text{pyridine}}\ \cdots\ \xrightarrow[NaHSO_3]{H_2O}\begin{matrix}|\\ -C-OH\\ |\\ -C-OH\\ |\end{matrix}$$

cis–diol

Alkyne

1. (c) $2CH\equiv CH+5O_2\rightarrow 4CO_2+2H_2O\ \ \Delta H=-1300\ KJ$

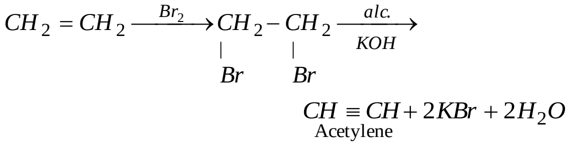
The combustion of acetylene is highly exothermic and the heat produced during the combustion can be used for welding purposes in the form of oxy acetylene flame.

2. (c) $CaC_2+2H_2O\rightarrow Ca(OH)_2+C_2H_2$

$$CH\equiv CH+2[Ag(NH_3)_2]OH\rightarrow \underset{\text{White ppt.}}{Ag-C\equiv C-Ag}+4\,NH_3+2H_2O$$

3. (c) $CH_3-CH_2-C\equiv CH\xrightarrow[\text{alk. }KMnO_4]{\text{Cold}}CH_3CH_2COOH+CO_2$

4. (c) $CH_3-COOH\xrightarrow{LiAlH_4}CH_3-CH_2-OH\xrightarrow[443\ K]{H^+}$

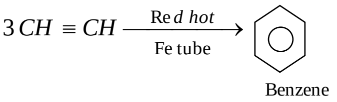


$$CH_2=CH_2\xrightarrow{Br_2}\underset{Br}{\underset{|}{C}H_2}-\underset{Br}{\underset{|}{C}H_2}\xrightarrow[KOH]{alc.}\underset{\text{Acetylene}}{CH\equiv CH}+2KBr+2H_2O$$

5. (b) $\underset{1.20\,A^o}{C\equiv C}<\underset{1.34\,A^o}{C=C}<\underset{1.54\,A^o}{C-C}$

6. (a) $HC\equiv\overset{sp}{C}-\overset{sp^2}{C}H=CH_2$

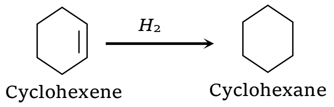
7. (a)

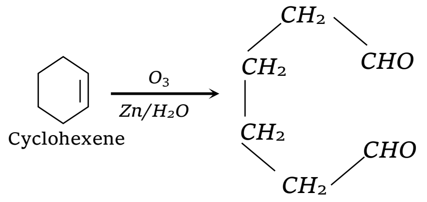


$$3CH\equiv CH\xrightarrow[\text{Fe tube}]{\text{Red hot}}$$

Benzene

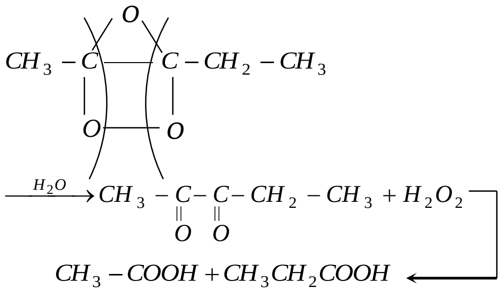
10. (c)





11. (a) $HC\equiv CH+AsCl_3\longrightarrow \underset{\substack{\text{2-chlorovinyl dichloroarsine}\\ \text{(Lewsite)}}}{ClHC=CH\ AsCl_2}$

12. (c) $CH_3-C\equiv C-CH_2-CH_3\xrightarrow{O_3}$



$$\xrightarrow{H_2O}CH_3-\underset{O}{\underset{\|}{C}}-\underset{O}{\underset{\|}{C}}-CH_2-CH_3+H_2O_2\rightarrow CH_3-COOH+CH_3CH_2COOH$$

14. (a) $-C\equiv C-$ is most reactive because *sp*-hybridization.

16.

(d)

$$CH\equiv CH\xrightarrow{NaNH_2}CH\equiv C^-Na^+\xrightarrow[-NaI]{CH_3I}CH\equiv C-CH_3$$

$$\underset{\text{Pent}-2-\text{yne}}{C_2H_5-C\equiv C-CH_3}\xleftarrow[-NaI]{C_2H_5I}Na^+C^-\equiv C-CH_3$$

17. (d) $CH_3-C\equiv CH+H_2O\xrightarrow{H_2SO_4\,/\,HgSO_4}$

$$\underset{\text{Propanone}}{CH_3-\underset{\underset{O}{\|}}{C}-CH_3}\xleftarrow{\text{Toutomaris m}}\left[\underset{\text{Prop}-1-\text{ene }2-\text{ol}}{CH_3-\overset{\overset{OH}{|}}{C}=CH_2}\right]$$

18. (b) $CH\equiv CH+HCl\rightarrow CH_2=CH-Cl\xrightarrow{HCl}$

$$\underset{1-\text{di}-\text{chloroethane}}{CH_3-CH{<}\begin{matrix}Cl\\Cl\end{matrix}}$$

19. (c) $CaC_2\xrightarrow{H_2O}\underset{\text{Acetylene}}{HC\equiv CH}\xrightarrow[Hg^{+2}]{Dil.\,H_2SO_4}\underset{\text{Acetaldelyde}}{CH_3CHO}$

$$\xrightarrow[H_2]{Ni}\underset{\text{Ethylalcohol}}{CH_3CH_2-OH}$$

20. (c) $R-CH_2-CCl_2-R\xrightarrow{KOH+C_2H_5OH}$

$$R-C\equiv C-R+2HCl$$

This reaction is an example of dehydrohalogenation Hence, alcoholic KOH is used as a reagent.

21. (d) $\begin{matrix}CH-COOK\\|||\\CH-COOK\end{matrix}+2H_2O\xrightarrow{\text{Electrolysis}}$

$$\underbrace{\begin{matrix}CH\\|||\\CH\end{matrix}}_{\text{Anode}}+2CO_2+2KOH+\underbrace{H_2}_{\text{Cathode}}$$

$CaC_2+2H_2O\rightarrow Ca(OH)_2+CH\equiv CH$

$\underset{\underset{Br}{|}}{CH_2}-\underset{\underset{Br}{|}}{CH_2}+2KOH\rightarrow CH\equiv CH+2KBr+2H_2O$

22. (b) $\begin{matrix}CH-COOK\\||\\CH-COOK\end{matrix}+2H_2O\xrightarrow{Electrolysis}\begin{matrix}CH\\|||\\CH\end{matrix}+2CO_2$

$$+2KOH+H_2$$

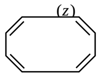
$\begin{matrix}CH_2-COONa\\|\\CH_2COONa\end{matrix}+2H_2O\xrightarrow{Electrolysis}$

$$\begin{matrix}CH_2\\||\\CH_2\end{matrix}+2CO_2+2NaOH+H_2$$

23. (d) $\underset{\text{Propyne}}{CH_3-C\equiv C-H}+\underset{\text{Ammonical}}{AgNO_3}\rightarrow\underset{\text{Siver salt of Propyne}}{CH_3-C\equiv C-Ag}$

24. (c) $CH\equiv CH\xrightarrow[H_2SO_4]{H_2O/Hg^{2+}}\underset{(x)}{H_3C-\overset{\overset{O}{||}}{C}-H}\xrightarrow{LiAlH_4}$

$\underset{(y)}{CH_3-CH_2-OH}\xrightarrow{P_4/Br_2}\underset{(z)}{C_2H_5Br}$

25. (c) $4CH\equiv CH\xrightarrow[Pressure]{Ni(CN)_2}$ 

Cyclo

26. (d) Ethyne have acidic hydrogen to form salt.

27. (a)

$$\underset{1-\text{Butyne}}{CH_3-CH_2-C\equiv CH}+2Br_2\rightarrow CH_3-CH_2-\underset{\underset{Br}{|}}{\overset{\overset{Br}{|}}{C}}-\underset{\underset{Br}{|}}{\overset{\overset{Br}{|}}{C}}-H$$

Since the molecule takes 2 moles of Br_2. Therefore it is alkyne. Also it gives white *ppt* with Tollen's reagent therefore acidic H is present. Hence it is 1-Butyne.

28. (d) $2CH\equiv CH+2Na\rightarrow 2CH\equiv C^-Na^++H_2$

29. (a) $CH_3\equiv CH+\underset{(\text{Ammonical})}{AgNO_3}\rightarrow\underset{\text{Whiteppt.}}{Ag-C\equiv C-Ag}$

$CH_3\equiv CH+\underset{(\text{Ammonical})}{CuCl_2}\rightarrow\underset{\text{Red ppt.}}{Cu-C\equiv C-Cu}$

32. (c) $sp-sp>sp^2-sp^2>sp^3-sp^3$

Order of bond strength

33. (c) Ethylene and Benzene

120° 120°

sp^2 sp^2

34. (a) $CH_3-CH_2-C\equiv CH\xrightarrow[H_2SO_4]{HgSO_4,60^oC}CH_3-CH_2-\overset{\overset{O}{||}}{C}-CH_3$

35. (a) $CH\equiv CH+NaNH_2\rightarrow CH\equiv C^-Na^++NH_3$

36. (a) $CH\equiv CH+2Br_2\xrightarrow{CCl_4}\underset{\underset{Br}{|}}{\overset{\overset{Br}{|}}{CH}}-\underset{\underset{Br}{|}}{\overset{\overset{Br}{|}}{CH}}$

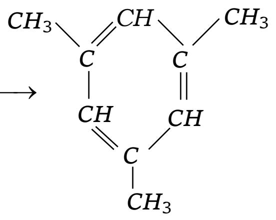
$CH\equiv CH+NH_4OH+AgNO_3\rightarrow\underset{\substack{\text{Di-silver acetylide}\\\text{white ppt.}}}{Ag-C\equiv C-Ag}$

38. (d) C_2H_2 and C_3H_4 are homologue because they differ by $-CH_2$ group. Both have triple bond in their molecule.

39. (c) $CH\equiv CH+HCl\xrightarrow{HgCl_2}\underset{\text{Vinylchloride}}{CH_2=CH-Cl}$

40. (c) $CH_3-C\equiv CH+H_2O\xrightarrow[1\%\,HgSO_4]{40\%\,H_2SO_4}$

$CH_3-\underset{\underset{OH}{|}}{C}=CH_2\xrightarrow{\text{Rearrangem ent}}\underset{\text{Acetone}}{CH_3-\underset{\underset{O}{||}}{C}-CH_3}$

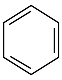
41. (a) $3CH_3-C\equiv CH\longrightarrow$ 

Mesitylene or 1,3,5–trimethyl benzene

42. (c) $2NH_4OH+Cu_2Cl_2\rightarrow 2CuOH+2NH_4Cl$

$NH_4OH+CuOH\rightarrow\underset{\substack{\text{Diammine copper}\\(I)\text{hydroxide}}}{[Cu(NH_3)_2]OH}$

$$2[Cu(NH_3)_2]OH + HC \equiv CH \rightarrow \underset{\text{copper acetylide Red ppt.}}{Cu - C \equiv C - Cu} + 4NH_3 + 2H_2O$$

43. (a) $3CH \equiv CH \xrightarrow[AlCl_3]{\text{Hot } Cu \text{ tube}}$ 

Benzene

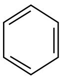
44. (c) $\underset{\text{Acetylene}}{CH \equiv CH} \xrightarrow{KMnO_4} \underset{\text{Oxalic acid}}{COOH - COOH}$

45. (b) $CH \equiv CH + H_2O \xrightarrow[1\% \, HgSO_4]{40\% \, H_2SO_4} CH_3 - CHO$

46. (c) Acetylene reacts with ammonical cuprous chloride to give brown *ppt* where as ethylene does not give this reaction.

47. (a) $Ag(NH_3)_2^+$ gives white *ppt* with terminal alkynes.

50. (b) Bond length decreases with increase in number of bonds.

55. (d) $3\underset{\text{Ethyne}}{HC \equiv CH} \xrightarrow{\text{Red}}$ 

Benzene

56. (a) Reaction of acetic acid with acetylene is catalysed by Hg^{2+} salts.

$$HC \equiv CH \xrightarrow[Hg(OOCCH_3)_2]{CH_3COOH} \underset{\text{vinylacetate}}{CH_2 = CHOOCCH_3}$$

$$\xrightarrow[Hg(OOCCH_3)_2]{CH_3COOH} \underset{\text{ethylidene diacetate}}{CH_3 - CH(OOCCH_3)_2}$$

57. (c) $2C + H_2 \xrightarrow{Electricarc} CH \equiv CH$

58. (c) $CH \equiv CH \xrightarrow[1\% \, HgSO_4]{40\% \, H_2SO_4} \underset{\text{Vinylalcohol}}{CH_2 = CH - OH}$

$$\xrightarrow{\text{Rearrangement}} \underset{\text{Acetaldehyde}}{CH_3 - CHO}$$

59. (a) $2CH \equiv CH + 2Na \rightarrow 2CH \equiv C^-Na^+ + H_2$

Reaction with sodium metal shows that hydrogen is acidic.

63. (d) In $CH \equiv CH$ triple bond consists of one σ and two π bonds.

65. (a) Nucleophiles and alkalies normally do not react with acetylene. Thus $NaOH$ does not react.

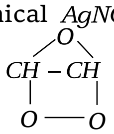
66. (c) $HC \equiv CH + 2HOCl \rightarrow [CHCl_2 - CH(OH)_2] \xrightarrow{-H_2O} \underset{\text{Dichloroacetal dehyde}}{CHCl_2 - CHO}$

69. (b) $CH_3 - CH = CH - C \equiv C - H$. Acidic hydrogen ($H$ atom attached to triple bond) is present therefore it gives reaction with ammoniacal $AgNO_3$.

70. (b) $CH \equiv CH + H_2O \xrightarrow[1\% \, HgSO_4]{40\% \, H_2SO_4} CH_2 = CHOH \rightarrow CH_3CHO$

71. (b) $CH_3C \equiv CH + 2HBr \longrightarrow CH_3 - \underset{Br}{\overset{Br}{C}} - CH_3$

72. (c) $CH_3 - C \equiv C - CH_3$, 2-butyne does not have acidic hydrogen. Hence, does not give white ppt. with ammonical $AgNO_3$ solution.

73. (a) $(CH \equiv CH) \xrightarrow[NaOH]{O_3}$  $\xrightarrow{Hydrolysis}$

$$\underset{\text{Glyoxal}}{CHO - CHO} \xrightarrow[CH_3COOH]{Zn} \underset{CH_2 - OH}{CH_2 - OH}$$

77. (b) $\underset{CH_2Br}{CH_2Br} + 2KOH \text{ (alcoholic)} \xrightarrow{\Delta} CH \equiv CH + 2KBr + 2H_2O$

78. (d) All are alkenes but 2-butyne is not.

80. (c) Reduction of alkynes with liquid NH_3/Li gives trans alkenes.

82. (a) Ethyne reacts with ammonical $AgNO_3$ to give white ppt of silver acetylide while ethane and ethene do not react because acidic hydrogen is absent.

83. (d) Acidic property because H atoms are replaced by Silver metal atoms.

87. (c) The hydrogen atom which is attached to triple bond is acidic.

88. (c) In acetylene both carbons are *sp*-hybridised so it has linear structure.

89. (d) $CaC_2 + 2H_2O \rightarrow \underset{\text{Acetylene}}{CH \equiv CH} + Ca(OH)_2$

90. (c) $CH \equiv CH + HCN \xrightarrow{Ba(CN)_2} \underset{\text{Vinylcyanide}}{CH_2 = CH - C \equiv N}$

91. (c) Because $CH_3CH_2 - C \equiv CH$ has one acidic hydrogen.

92. (d) $CH \equiv CH + 2Na \xrightarrow{Liq. NH_3} C.Na \equiv C.Na + H_2$

94. (b) $CH \equiv CH + H_2O \xrightarrow[HgSO_4]{dil. H_2SO_4} CH_2 = C - OH \rightarrow CH_3 - \underset{O}{\underset{\|}{C}} - H$

95. (d) $CH_3 - C \equiv C - CH_3$ has not acidic character.

96. (d) Addition – $CH \equiv CH + 3H_2 \xrightarrow{Ni} CH_3 - CH_3$

Substitution –

$$CH \equiv CH + Na \longrightarrow CH \equiv C^-Na^+ + \frac{1}{2}H_2$$

Polymerization –

$$3CH \equiv CH \xrightarrow[\text{Polymerization}]{\text{hot } Cu \text{ tube}} \underset{\text{Benzene}}{C_6H_6}$$

97. (d) Bond length decrease with increase in Bond order. Hence triple bonded carbon has minimum bond length.

$C - C$ bond length = 1.54 Å

$C = C$ bond length = 1.33 Å

$C \equiv C$ bond length = 1.22 Å

98. (b) Acetylene can be obtained by the reaction of silver and chloroform (or iodo form)

$$2CHI_3 + 6Ag \xrightarrow{\Delta} \underset{\text{acetylene}}{C_2H_2} + 6AgI$$

99. (d) The partial reduction of alkynes by active metal in liquid ammonia takes place through trans vinylic anion which ultimately produces trans alkene.

100. (a) We know that $C - C$ bond length = 1.54 A, $C = C$ bond length =1.34A and $C \equiv C$ bond length = 1.20A. Since propyne has triple bond; there fore it has minimum bond length.

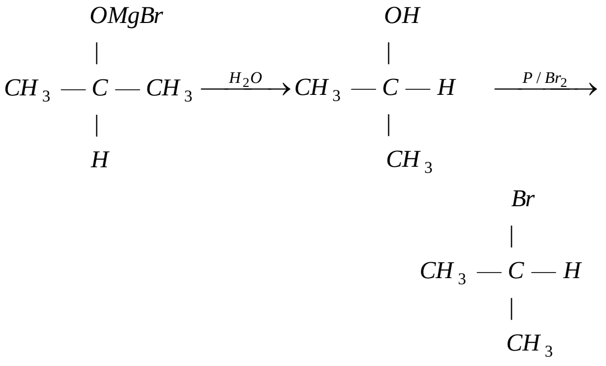
101. (b) $\underset{\text{Acetylene}}{CH \equiv CH} + H_2 \xrightarrow[\text{Catalyst pd. } BaSO_4]{\text{Lindlar}} \underset{\text{Ethylene}}{CH_2 = CH_2}$

102. (a) $HC\overset{\pi}{\underset{\pi}{\sigma \equiv}}CH$ one sigma and two π bond

103. (a) Propyne reacts with ammoniacal $AgNO_3$ due to presence of acidic hydrogen atom.

$$CH_3C \equiv CH + AgNO_3 + NH_4OH \rightarrow$$
$$CH_3C \equiv CAg + NH_4NO_3 + H_2O$$

104. (a) $CH \equiv CH \xrightarrow[H_2SO_4]{HgSO_4} CH_3CHO \xrightarrow{CH_3MgBr}$

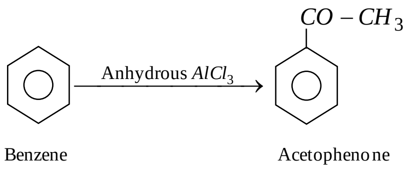


$$CH_3-\overset{OMgBr}{\underset{H}{C}}-CH_3 \xrightarrow{H_2O} CH_3-\overset{OH}{\underset{CH_3}{C}}-H \xrightarrow{P/Br_2} CH_3-\overset{Br}{\underset{CH_3}{C}}-H$$

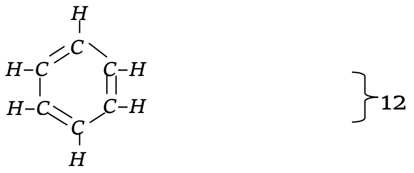
105. (c) $Mg_2C_3 + 4H_2O \rightarrow CH_3C \equiv CH + 2Mg(OH)_2$

Aromatic Hydrocarbon

2. (d)



5. (a) Coal tar is a main source of aromatic hydrocarbons like benzene, naphthalene, anthracene, phenol etc



7. (c)

$C - C\pi$ bonds $= 3$

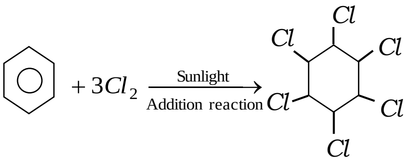
$C - C\sigma$ bonds $= 6$

$C - H\sigma$ bonds $= 6$

Hence $12\,\sigma$ and $3\,\pi$ bonds

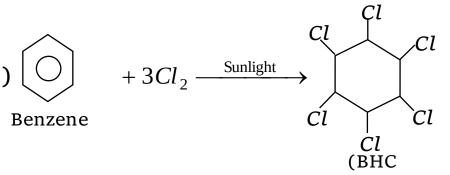
8. (b) Ratio $= \dfrac{\sigma \text{ bonds}}{\pi \text{ bonds}} = \dfrac{12}{3} = 4$

11. (b)



(BHC)

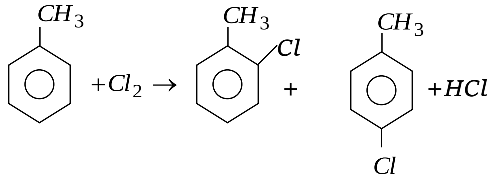
12. (b)



14. (a) $C_6H_6 + C_2H_5Cl \xrightarrow{AlCl_3} C_6H_5 - C_2H_5 + HCl$

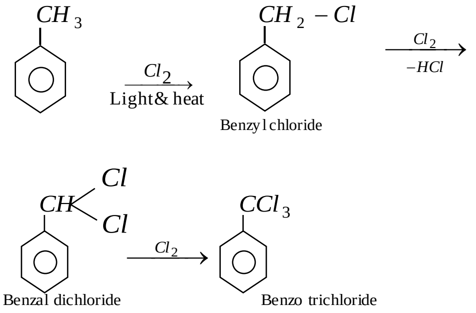
15. (a) $C_6H_5\overset{+}{CH}C_6H_5$ is the most stable carbonium ion due to resonance.

16. (d)



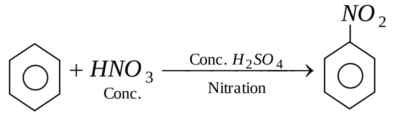
o- and *p*-chlorotoluene

17. (a)



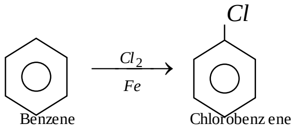
18. (b) $HO - NO_2 + H^+HSO_4^- \rightarrow H_2O + \underset{\substack{\text{Nitroniumion} \\ \text{(attacking species)}}}{NO_2^+} + HSO_4^-$

19. (b)

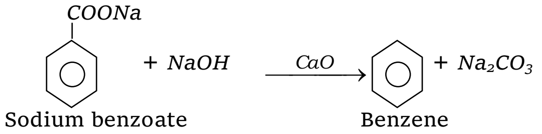


22. (a) $C_6H_6 + CH_3Cl \xrightarrow[AlCl_3]{\text{anhyd.}} C_6H_5CH_3 + HCl$, it is a Friedel-craft's reaction.

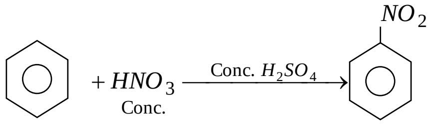
23. (b)



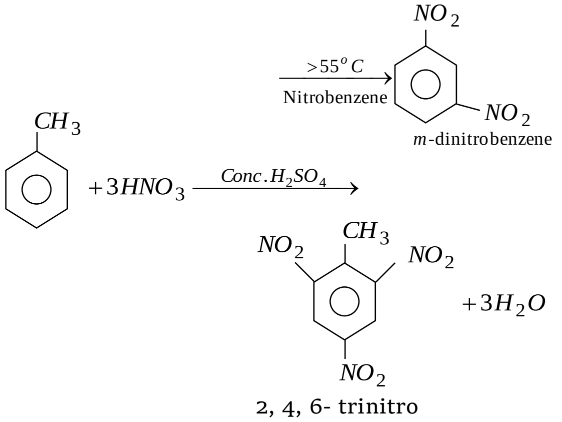
29. (c)



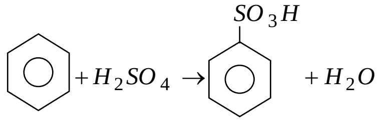
30. (b)



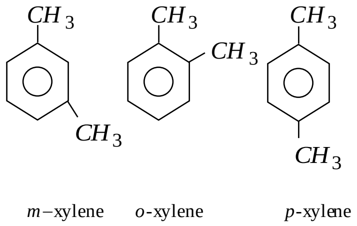
31. (d)



32. (b)

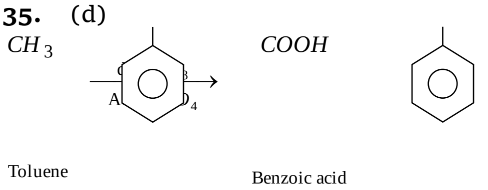


34. (c)

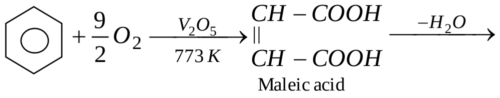


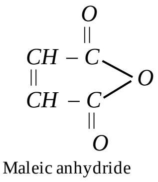
m-xylene is most easily sulphonated because *O* and *P* both positions are free with respect to methyl group.

35. (d)



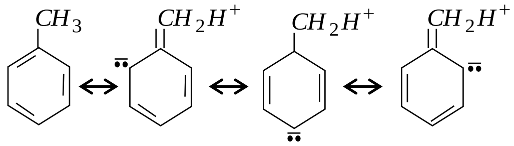
36. (c)



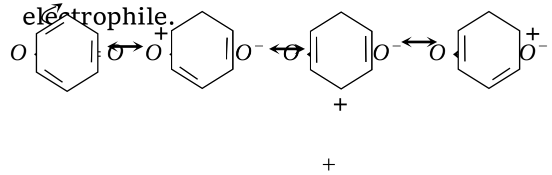


38. (b) Phenol is most easily nitrated.

41. (a)



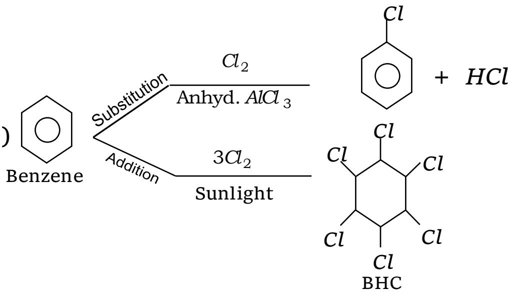
43. (a) Nitrobenzene is least reactive towards bromine because of presence of $-NO_2$ group decreases electron density at *o* and *p* positions and hence attack of electrophile on the benzene nucleus is difficult because + *ve* charge on *o* and *p* position repel the incoming electrophile.



46. (d) $AlCl_3$ is an electron deficient compound. It generates electrophile in the reaction

$$CH_3Cl + AlCl_3 \rightarrow \underset{\text{Electrophile}}{CH_3^+} + AlCl_4^-$$

47. (d)



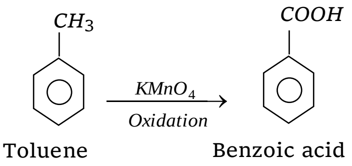
51. (b) Benzene can be obtained by polymerisation of acetylene.

53. (b) Benzene C_6H_6 is made up of hydrogen and carbon only.

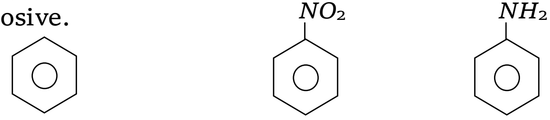
54. (c) They have a relatively high percentage of carbon

55. (c) All 6 carbons of Benzene are sp^2-hybridised so it is planar.

57. (c)



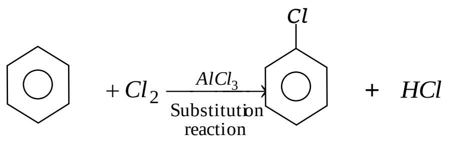
58. (c) 2,4,6-Trinitro toluene (TNT) is used as explosive.



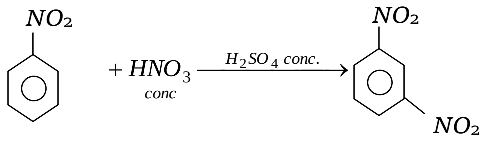
59. (b) $\xrightarrow{HNO_3+H_2SO_4}$ $\xrightarrow[\text{Reduction}]{Sn/HCl}$

61. (e) TNT is used as an explosive.

62. (c)

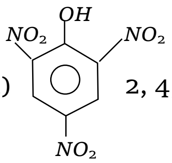


65. (b)



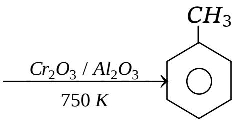
1,3-dinitrobenzene or *m* -

67. (d)

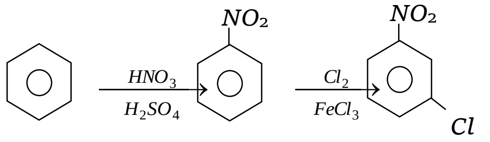


2, 4, 6 trinitrophenol (Picric acid)

68. (c) *n*-heptane



69. (b)



3-nitrochloro

71. (b) In benzene due to resonance all the carbon–carbon bond lengths are equal 1.39Å which is between $C-C(1.54\text{ Å})$ and $C=C(1.34\text{ Å})$

72. (c) $\underset{\text{Sodium benzoate}}{C_6H_5COONa}+NaOH\xrightarrow{CaO}\underset{\text{Benzene}}{C_6H_6}+Na_2CO_3$

73. (a) Friedel-Craft's reaction involves the introduction of an alkyl or acyl group into benzene ring in the presence of a catalyst. The presence of an electron withdrawing group in the ring hinders the reaction. Therefore phenyl acetanilide is not used.

74. (a) Halogenation is initiated by free redical.

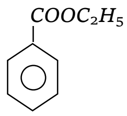
76. (b) In benzene all the six carbon atoms are present in the same plane. All the carbon atoms are sp^2 hybridized. Hence, it is a planar molecule.

77. (d) Basicity of amines is due to availability of an unshared pair (lone pair) of electrons on nitrogen. This lone pair of electrons is available for the formation of a new bond with a proton or Lewis acid.

Pyridine is less basic than triethylamine because lone pair of nitrogen in pyridine is delocalised.

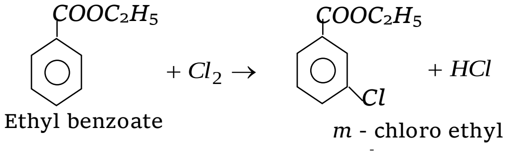
78. (a) In chlorination electrophile is Cl^+ (chloronium ions).

79. (c)



Ethyl benzoate

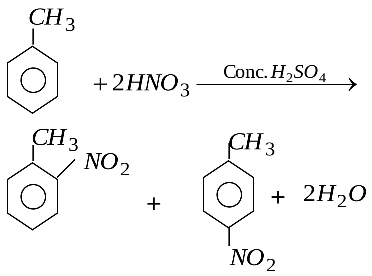
$-COOH$ group is meta directing group hence, ethyl benzoate undergo meta substitution.



Ethyl benzoate

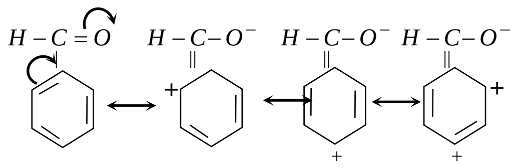
m - chloro ethyl

80. (d)2



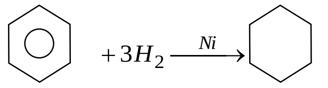
o- and *p*- nitro toluene

81. (d)



Presence of $-CHO$ decrease electron density at *o* to *p* positions. Hence, attack of an electrophile occurs at *m*-position. therefore it is meta directing group.

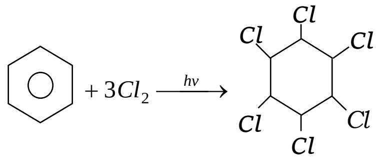
84. (b)



Benzene

Cyclohexane

87. (b)



BHC

88. (a) Benzene on fractional distillation gives light oil [It is lighter than water and hence called as light oil]

89. (d) Because Ammonical $AgNO_3$ reduce $C\equiv CH$ bond of yne.

90. (a) Bond length $\propto \frac{1}{\text{Bond order}}$

Bond order = $\frac{\text{Bonding}-\text{ antibondin g electron}}{2}$

Bond order is highest for C_2H_6 so it has minimum bond strength.

91. (b) $C_6H_5COOH + \underset{(x)}{NaOH} \to C_6H_5COONa + H_2O$

$$\xrightarrow{NaOH} C_6H_6 + Na_2CO_3$$

$$C_6H_5OH + \underset{(y)}{Zn} \xrightarrow{distill} C_6H_6 + ZnO$$

92. (c) Unsaturated hydrocarbons are more reactive than saturated hydrocarbons. Among ethyne (C_2H_2) and ethene (C_2H_4) the later is more reactive as $C \equiv C$ triple bond is quite strong bond and therefore ethyne generally require catalysts (like Hg^{2+} etc) in its reactions.

93. (a) **Kolbe's methods** – Electrolysis of a concentrated aqueous solution of either sodium or potassium salts of saturated mono carboxylic acids yields higher alkanes at anode.

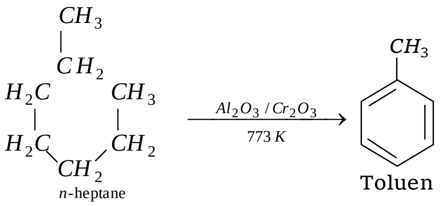
$CH_3COONa \rightleftharpoons CH_3COO^- + Na+$

Anode : $2CH_3COO^- \xrightarrow{-2e^-} CH_3-CH_3+2CO_2$

Cathode : $2Na^+ + 2e^- \to 2Na$

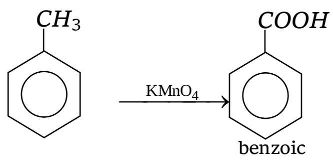
$2Na + 2H_2O \to 2NaOH + H_2$

94. (b)

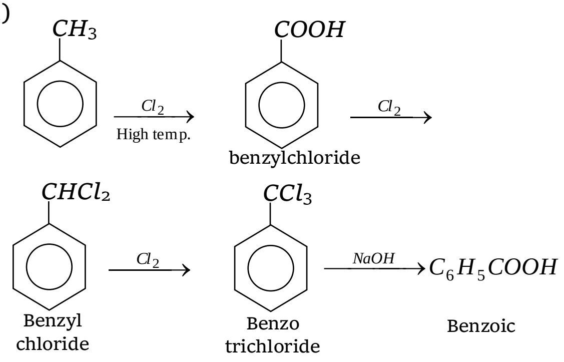


95. (a) $-NH_2$ group is not linked with benzene ring.

96. (d)



97. (d)

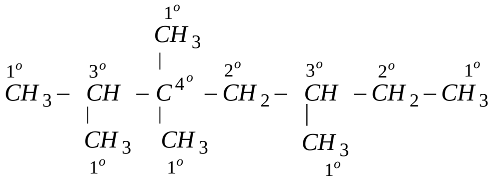


Critical Thinking Question

1. (a) The difference between any two successive members of the homologous series $-CH_2-$ *i.e.*, the molecular weight of every two adjacent members differ by 14.

$(CH_2 = 12 + 2 = 14)$

2. (a)



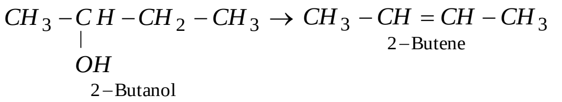
$$\overset{1^o}{CH_3}-\underset{\underset{1^o}{CH_3}}{\overset{3^o}{CH}}-\overset{\overset{1^o}{CH_3}}{\underset{\underset{1^o}{CH_3}}{C^{4^o}}}-\overset{2^o}{CH_2}-\underset{\underset{1^o}{CH_3}}{\overset{3^o}{CH}}-\overset{2^o}{CH_2}-\overset{1^o}{CH_3}$$

$1^o \Rightarrow$ Primary 6, $2^o \Rightarrow$ Secondary 2

$3^o \Rightarrow$ Tertiary 2, $4^o \Rightarrow$ Quanternar y1

3. (c) Octane number of fuel is the percentage of *iso*- octane in mixture.

4. (b)

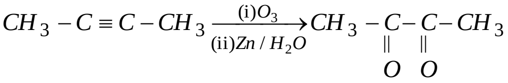


$$\underset{\text{2-Butanol}}{CH_3-\underset{OH}{CH}-CH_2-CH_3} \to \underset{\text{2-Butene}}{CH_3-CH=CH-CH_3}$$

$+H_2O$

According to this rule H atom goes from that β – carbon which is less hydrogenated.

5. (c)



$$CH_3-C\equiv C-CH_3 \xrightarrow[(ii)Zn/H_2O]{(i)O_3} CH_3-\underset{O}{\underset{\|}{C}}-\underset{O}{\underset{\|}{C}}-CH_3$$

6. (c) Friedel-craft's reaction

$$\underset{\text{Acetylchloride}}{CH_3COCl} + \underset{\text{Benzene}}{C_6H_6} \xrightarrow{\text{anhydrous } AlCl_3} \underset{\text{Acetophenone}}{CH_3COC_6H_5} + HCl$$

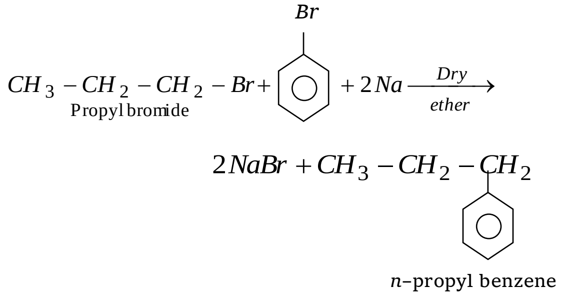
7. (a) $C_2H_6(\text{excess}) + Cl_2 \xrightarrow{U.V.Light} \underset{\substack{\text{Ethylchloride}\\ \text{(Major product)}}}{C_2H_5Cl} + HCl$

8. (a) $\underset{\text{Ethylalcohol}}{CH_3CH_2-OH} + 2HI \xrightarrow{Red\ P} \underset{\text{Ethane}}{CH_3-CH_3} + H_2O + I_2$

9. (a) Fischer-Tropsch process –

$$\underbrace{CO + H_2}_{\text{Water gas}} + \underset{\text{Excess}}{H_2} \xrightarrow[\text{heat}]{\text{CO or Ni}} \underset{\text{(Petrol)}}{\text{Mixture of hydrocarbons}} + H_2O$$

10. (c)

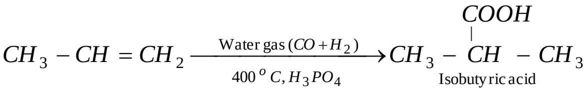


11. (a) Hydroboration of alkenes followed by hydrolysis in basic medium yield alcohols and not the alkanes.

$$R-CH=CH_2 \xrightarrow{B_2H_6} (R-CH_2-CH_2)_3-B$$

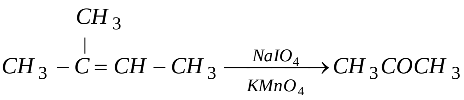
$$\xrightarrow{OH^-} R-CH_2-CH_2OH$$

12. (b) Koch reaction : (Carboxylation of Alkene)



$$CH_3-CH=CH_2 \xrightarrow[400^oC,\ H_3PO_4]{\text{Water gas }(CO+H_2)} \underset{\text{Isobutyric acid}}{CH_3-\overset{\overset{COOH}{|}}{CH}-CH_3}$$

13. (d)



$$CH_3-\overset{\overset{CH_3}{|}}{C}=CH-CH_3 \xrightarrow[KMnO_4]{NaIO_4} CH_3COCH_3$$

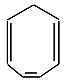
$+CH_3CHO$

14. (b) $HC\equiv CH+2AgNO_3\xrightarrow{NH_4OH}$

$Ag-C\equiv C-Ag+2NH_4NO_3+2H_2O$

15. (d) Naphthalene is a molecular solid. If the crystals contains only individuals atoms; as in solid argon or krypton or if they are composed of non polar molecules as in naphthalene, the only attraction between the molecules are the London forces.

16. (d) A compound is said to be aromatic if it is planar and there is complete delocalization of π electrons, which is only possilble if it is a conjugated cyclic system and number of electrons used in delocalization is $(4n+2)$. 1, 3, 5 heptatriene is not an aromatic compound because complete delocalization of π electrons, is not possible in it.



1, 3, 5

17. (c) $\underset{\text{Acetylene}}{CH\equiv CH}+HCN\xrightarrow{Ba(CN)_2}\underset{\text{Vinylcyanide}}{CH_2=CHCN}$

18. (a) Addition reaction means addition on double bond.

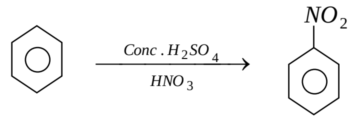
19. (d) $\underset{64\,g}{CaC_2}+2H_2O\rightarrow Ca(OH)_2+C_2H_2$

$C_2H_2+H_2\rightarrow \underset{28\,g}{C_2H_4}$

64g of CaC_2 gives 28g of ethylene

$\therefore$ 64kg of CaC_2 will give 28kg of polyethylene

20. (a)

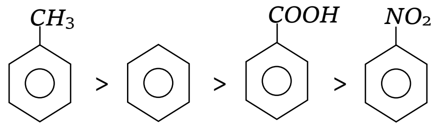


Nitro benzene

21. (b) Electron accepting groups which make the substitution difficult are known of deactivating groups. the group or substituent already present on the ring also decides the position of incoming group.

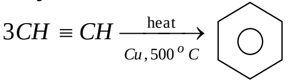
ortho and para directing groups are as follow $-CH_3, C_2H_5(-R), -NH_2, -OH$, halogens, (Cl, Br, I)

22. (b)

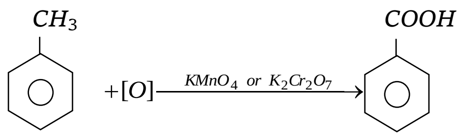


Toluene Benzene Benzoic acid Nitro Benzene

23. (c) Polymerisation



24. (b)



25. (a) Wohler reaction :

$$CaC_2+2H_2O\longrightarrow C_2H_2+Ca(OH)_2$$

$$\underset{\text{Acetylene}}{C_2H_2}\xrightarrow[60^oC]{dil.\,H_2SO_4\,/\,HgSO_4}\underset{\text{Unstable}}{[CH_2=CHOH]}\rightarrow\underset{\text{Acetaldehyde}}{CH_3CHO}$$

26. (a)

$$\underset{\text{Ethyne}}{CH\equiv CH}+H_2O\xrightarrow[H_2SO_4]{HgSO_4}\underset{\text{Vinylalcohol}}{CH_2=CH-OH}\xrightarrow{KMnO_4}$$

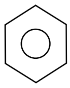
$$CH_3CHO\xrightarrow{\text{Oxidation}}\underset{\text{Acetic acid}}{CH_3COOH}$$

27. (a) $\underset{\text{calcium carbide}}{CaC_2}+\underset{\text{heary water}}{2D_2O}\longrightarrow C_2D_2+Ca(OD)_2$

28. (d) It is a unsymmetrical olefin. In such cases addition of $H-X$ is governed by 'Markownikoff's rule'

29. (d) $CH_3-CH=CH_2\xrightarrow[\text{Acidic}KMnO_4]{\text{Conc.}}CH_3COOH+HCOOH$

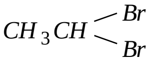
30. (a)



1, 2 or 1, 6 = *ortho*
1, 3 or 1, 5 = *meta*
1, 4 = *para*.

31. (b) Biological oxidation of benzene gives cinnamic acid.

32. (d) $CH\equiv CH\xrightarrow{HBr}CH_2=CH-Br\xrightarrow{HBr}$



$$\underset{\text{Ethylidenedibromide}}{CH_3CH\begin{matrix}\diagup Br\\ \diagdown Br\end{matrix}}$$

33. (c) Electron accepting groups which make the substitution difficult are known or deactivating groups.

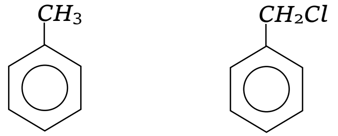
o. p. directing groups are as follow :

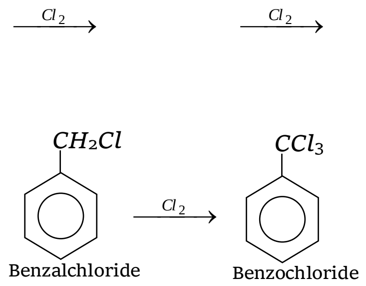
$-CH_3, C_2H_5(-R), -NH_2, -OH$, halogens (Cl, Br, I).

34. (a) 2-butene shows geometrical isomerism.

$$\underset{\text{cis-Butene -2}}{\begin{matrix}H-C-CH_3\\ \|\\ H-C-CH_3\end{matrix}}\qquad\underset{\text{trans-Butene -2}}{\begin{matrix}H-C-CH_3\\ \|\\ CH_3-C-H\end{matrix}}$$

35. (d) Sidechain chlorination and bromination is favoured by high temperature, light and in absence of halogen carrier.



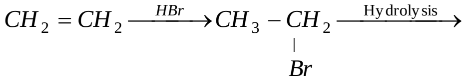


Benzalchloride　　Benzochloride

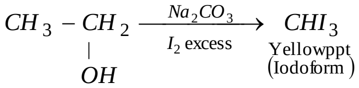
36. (b) $C_2H_4 + CO + H_2O \xrightarrow{\text{Ligh temp.}} C_2H_5 - COOH$
$\underset{\text{Ethylene}}{}$ $\underset{\text{Propionic acid}}{}$

37. (b) Cyclohexane C_6H_{12} is alicyclic compound.

38. (c)



$$CH_2 = CH_2 \xrightarrow{HBr} \underset{\substack{| \\ Br}}{CH_3 - CH_2} \xrightarrow{\text{Hydrolysis}}$$

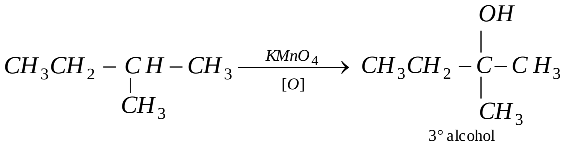


$$\underset{\substack{| \\ OH}}{CH_3 - CH_2} \xrightarrow[I_2 \text{ excess}]{Na_2CO_3} \underset{\substack{\text{Yellowppt} \\ (\text{Iodoform})}}{CHI_3}$$

39. (d) On oxidation, with $KMnO_4$, they give different alcohols

$$\underset{n \text{ pentane}}{CH_3CH_2CH_2CH_2CH_3} \xrightarrow[{[O]}]{KMnO_4}$$

$$\underset{1^\circ \text{ alcohol}}{CH_3CH_2CH_2CH_2CHOH_2}$$



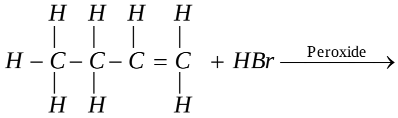
$$CH_3CH_2 - \underset{\substack{| \\ CH_3}}{CH} - CH_3 \xrightarrow[{[O]}]{KMnO_4} CH_3CH_2 - \overset{\substack{OH \\ |}}{\underset{\substack{| \\ CH_3}}{C}} - CH_3$$

3° alcohol

40. (b) $\underset{\text{Acetylene}}{CH \equiv CH} + HBr \rightarrow \underset{\text{Vinyl bromide}}{CH_2 = CHBr}$

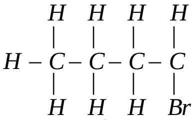
Assertion & Reason

1. (a) This reaction is followed by against of Markownikoff rule



$$H - \overset{\substack{H \\ |}}{\underset{\substack{| \\ H}}{C}} - \overset{\substack{H \\ |}}{\underset{\substack{| \\ H}}{C}} - \overset{\substack{H \\ |}}{C} = \overset{\substack{H \\ |}}{\underset{\substack{| \\ H}}{C}} + HBr \xrightarrow{\text{Peroxide}}$$

1 Butene

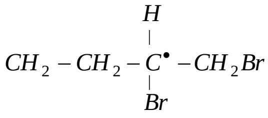


$$H - \overset{\substack{H \\ |}}{\underset{\substack{| \\ H}}{C}} - \overset{\substack{H \\ |}}{\underset{\substack{| \\ H}}{C}} - \overset{\substack{H \\ |}}{\underset{\substack{| \\ H}}{C}} - \overset{\substack{H \\ |}}{\underset{\substack{| \\ Br}}{C}}$$

1 Bromo butane

In this reaction anti Markownikoff's addition is explained on the basis of the fact that in the presence of peroxide the addition takes place Via a free radical mechanism rather than the ionic mechanism.

2. (a) $\underset{\text{1 Butene}}{CH_3 - CH_2 - CH = CH_2} + Br_2 \rightarrow$



$$CH_2 - CH_2 - \overset{\substack{H \\ |}}{\underset{\substack{| \\ Br}}{C^\bullet}} - CH_2Br$$

1,2 dibromobutane

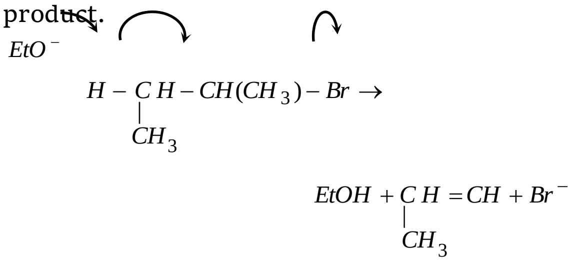
4. (a) Pyrrole is a heterocyclic compound having five membered ring. It has 6π electrons. As 4π electrons in the ring and 2π electrons donated by nitrogen atom present in the ring.

5. (b) The assertion that chlorination of CH_4 does not take place in dark is correct because it is a free radical reaction and free radicals are obtained in presence of sun light.

6. (b) The alkyl benzene is not prepared by Friedel Craft's alkylation of benzene because the monoalkyl product formed undergo alkylation to produce polyalkylated benzene.

The reason that alkyl halides are less reactive than acyl halides is also correct but this is not the correct explanation of assertion.

7. (d) 2-bromobutane on reaction with sodium ethoxide in ethanol gives 2-butene as a major product.



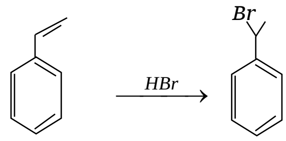
$$EtO^- \quad H - \underset{\substack{| \\ CH_3}}{CH} - CH(CH_3) - Br \rightarrow$$

$$EtOH + \underset{\substack{| \\ CH_3}}{CH} = CH + Br^-$$

This is according to saytzeff's rule i.e. the Predominant product is the most substituted alkene, i.e. are carrying the largest number of alkyl substituents of hydrogen is eliminated preferentially from the carbon atom joined to the least number of hydrogen atoms.

2-butene is more stable than 1-butene due to presence of large number of hyperconjugating structures in 2-butene.

8. (b) HBr adds to the double bond of the styrene forming 1-bromo-1-phenylethane.



Styren

This is an example of elimination-addition reaction.

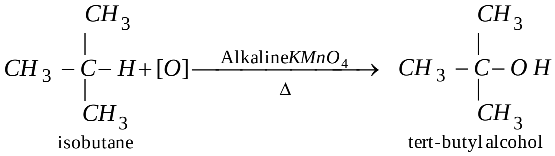
Note : Here given assertion is wrong.

9. (b) Alkanes with odd carbon atoms have their and carbon atom on the same side of the molecule and in even carbon atom alkane, the end carbon atom on opposite side. Thus alkanes with even carbon atoms are packed closely in crystal lattice to permit greater intermolecular attractions and hence higher melting point.

10. (b) Iodination is reversible since formed *HI* is a strong reducing agent and reduces the alkyl iodide back to alkane.

$$CH_4 + I_2 \rightleftharpoons CH_3I + HI$$

11. (b) Normally oxidising agents have no effect on alkanes. However, alkanes containing a tertiary hydrogen atom can be oxidised by oxidising agents such as $KMnO_4$ to the corresponding alcohols. For example,



$$CH_3-\underset{CH_3}{\overset{CH_3}{\overset{|}{\underset{|}{C}}}}-H+[O]\xrightarrow[\Delta]{\text{Alkaline}KMnO_4} CH_3-\underset{CH_3}{\overset{CH_3}{\overset{|}{\underset{|}{C}}}}-OH$$

isobutane　　　tert-butyl alcohol

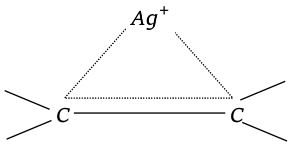
12. (e) Halogenation of alkanes is catalysed by radical initiators like benzoyl peroxide.

13. (c) Neopentane has four identical methyl groups attached on 4° carbon atom and thus only one product is possible during monosubstitution.

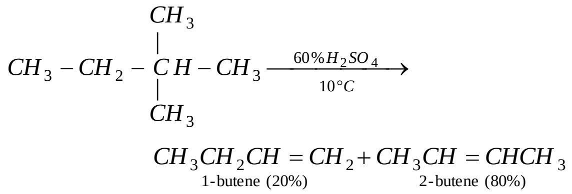
14. (b) Neopentane is more symmetric than *n*-pentane and it is expected to show more stable crystal lattice than that of *n*-pentane and thus have high melting point.

15. (b) Knocking involves the production of metallic sound due to irregular burning of the fuel. This irregular burning lowers the efficiency of the engine.

16. (b) Ag^+ coordinates with the alkene by $p\pi - d\pi$ bonding giving an ion and the solubility increases.



17. (a) In the dehydration of secondary and tertiary alcohols. When there is a possibility of formation of two isomers. The hydrogen atom is preferentially eliminated from the adjacent carbon atom with the fewer number of hydrogen atoms. This is Saytzeff's rule.

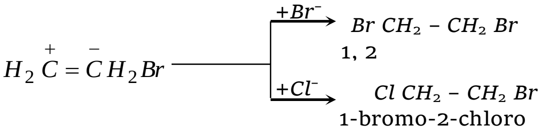


$$CH_3-CH_2-\underset{CH_3}{\overset{CH_3}{\overset{|}{\underset{|}{C}}}}H-CH_3\xrightarrow[10°C]{60\%H_2SO_4}$$

$$\underset{\text{1-butene (20\%)}}{CH_3CH_2CH=CH_2}+\underset{\text{2-butene (80\%)}}{CH_3CH=CHCH_3}$$

18. (c) The addition of Br_2 follows ionic mechanism

$$H_2C=CH_2\xrightarrow[NaCl\rightarrow Na^++Cl^-]{+Br_2(\overset{\delta^+}{Br}-\overset{\delta^-}{Br})}H_2\overset{+}{C}=\overset{-}{C}H_2\xrightarrow{+\overset{+}{Br}}$$



$$H_2\overset{+}{C}=\overset{-}{C}H_2Br\xrightarrow{+Br^-}Br\,CH_2-CH_2\,Br$$

1, 2

$$H_2\overset{+}{C}=\overset{-}{C}H_2Br\xrightarrow{+Cl^-}Cl\,CH_2-CH_2\,Br$$

1-bromo-2-chloro

19. (b) Straight chain alkanes have very low octane number because as the length of the chain increases, octane number further decreases.

21. (d) The two hydrogen atoms on first carbon and the two *H*-atoms on the third carbon atom lie in perpendicular planes. The central carbon atom is *sp*-hybridized while terminal carbon atoms are sp^2-hybridized.

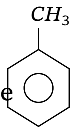
22. (d) Propene reacts with *HBr* in presence of benzoyl peroxide to give 1-bromopropane. In presence of peroxide, the addition of *HBr* to propane occurs by free radical mechanism.

24. (b) Arylhalide shows resonance stabilization and thus resistant to substitution reaction.

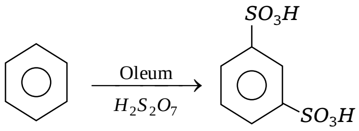
25. (e) During alkylation of bromobenzene, if benzene is used as solvent, alkylation of benzene will take place because benzene is more reactive for S_E reactions than bromo benzene, benzene is not used as a solvent for this reaction.

26. (b) Benzene is a polar solvent Butter is composed of organic compounds of low polarity. So it gets dissolved in benzene.

27. (a)

In toluene , the $-CH_3$ group is electron Pushing. It is an activating group. By its+I effect, $-CH_3$ group activates the benzene ring at ortho and para position relative to it. Due to increased activity towards electrophilitic substitution toluene can be more easily nitrated than benzene.

28. (e) With fuming H_2SO_4 or oleum (conc. $H_2SO_4 + SO_3$) at high temperature benzene forms *m*-benzene disulphonic acid.



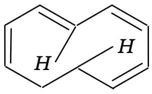
m-Benzene disulphonic

29. (c) Like halogens, the nitroso group $(-N=O)$ is also deactivating but *o*, *p*-directing. It is deactivating because *O* is more electronegative than *N* and hence No group as whole withdraws electrons from the benzene ring.

31. (e) Completely conjugated polyenes containing even number of carbon atoms is known as annulenes.

32. (c) $(4n+2)\pi$ electrons and planar structure are the essential conditions for aromaticity.

33. (a)



Due to severe non-bonded interactions between the internal hydrogen (as shown in figure), the ring assumes non-planar geometry.