KD EDUCATION ACADEMY [9582701166] street no. 21 A-1 block Bengali colony sant nagar burari delhi -110084

Time : 5 Hour

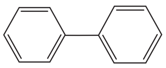
STD 11 Science Chemistry
kd 90+ Ch-9 hydrocarbon

Total Marks : 270

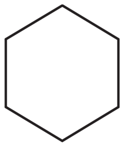
* Choose The Right Answer From The Given Options.[1 Marks Each] [78]

1. In which of the following, all atoms are coplanar?

(A)



(B)



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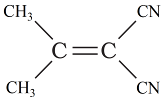


(D)

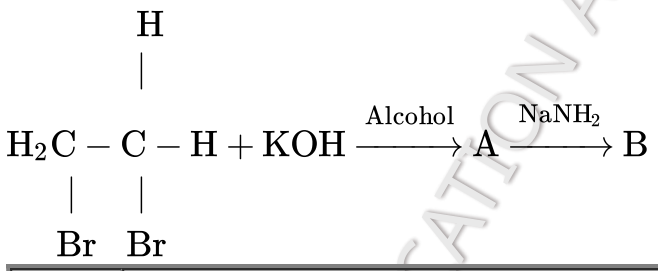
2. The bond order of individual carbon-carbon bonds in benzene is:

(A) One
(B) Two
(C) Between one and two
(D) One and two, alternately

3. Which of the following compounds will exhibit geometrical isomerism?

(A) 2-Phenyl-1-butene.
(B) 1, 1-Diphenyl propane.
(C) 1-Phenyl-2-butene.
(D) 3-phenyle butane.

4. What are A and B in following reaction?



$$\mathrm{H_2C - \overset{\overset{H}{|}}{\underset{\underset{Br}{|}}{C}} - H + KOH \xrightarrow{Alcohol} A \xrightarrow{NaNH_2} B}$$

(with Br under H$_2$C)

	A	B
(a)	$H_2C = CH_2$	$CH \equiv CH$
(b)	$CH_2 = CHBr$	$CH \equiv CH$
(c)	$CH_2 = CHBr$	$CH_2 = CH_2$
(d)	$CH_2 = CH_2$	$CH \equiv CBr$

5. 2.84gms of methyl iodide was completely converted into CH_3MgI and the product was decomposed by the excess of ethanol. The volume of the gaseous hydrocarbon produced at NTP will be________.

(A) 22.4lit.
(B) 2240lit.
(C) 0.448lit.
(D) 224lit.

6. The geometry of ethyne molecule is:

(A) Linear.
(B) Trigonal planar.
(C) Tetrahedral.
(D) Bent.

7. IUPAC name of the first member of alkyne is __________.

(A) Ethene (B) Ethyne (C) Ethane (D) Methane

8. An optically active hydrocarbon (X) on catalytic hydrogenation gives an optically inactive compound (Y), C_6H_{14}. The hydrocarbon (X) is-

(A) 3-methyl-1-pentene (B) 3-methyl-2-pentene

(C) 2-ethyl-1-butene (D) 3-methylcyclopentene

9. Calcium heptane dioate on distillation produces:

(A) Cyclo hexanal (B) Cyclohexene

(C) Cyclohexanone (D) Cyclohexanoic acid

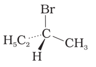
10. Cycloalkanes are isomeric with:

(A) Alkanes (B) Alkenes (C) Alkynes (D) Arenes

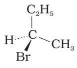
11. The percentage of isomers formed during monobromination of 2,3−dimethyl butane at room temperature relative to 1, 2, 3 H atoms to chlorination is (1.0 : 3.8 : 5.0):

(A) 81% (B) 56% (C) 15% (D) 22%

12. The addition of HBr to 1-butene gives a mixture of products A, B and C



(A)



(B)

$CH_3—CH_2—CH_2—CH_2—Br$

(C)

The mixture consists of:

(A) A and B as major and C as minor products.

(B) B as major, A and C as minor products.

(C) B as minor, A and C as major products.

(D) A and B as minor and C as major products.

13. How many chain isomers can be formed by butane?

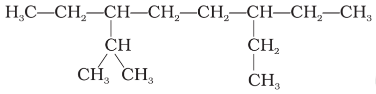
(A) One (B) Three (C) Two (D) Four

14. Which of the following is not a cumulated diene?

(A) Hexa−1, 2−diene (B) Hexa−2, 3−diene

(C) Penta−2, 3−diene (D) Penta−1, 3−diene

15. The correct IUPAC name of the following alkane is:



$H_3C—CH_2—CH(CH(CH_3)_2)—CH_2—CH_2—CH(CH_2CH_3)—CH_2—CH_3$

(A) 3, 6 – Diethyl – 2 – methyloctane. (B) 5 – Isopropyl – 3 – ethyloctane.

(C) 3 – Ethyl – 5 – isopropyloctane. (D) 3 – Isopropyl – 6 – ethyloctane.

16. A direct iodination of benzene is not possible because:

(A) Iodine is an oxidising agent.

(B) Resulting C_6H_5I is reduced to C_6H_6 by HI.

(C) HI is unstable.

(D) The ring gets deactivated.

17. Which of the following exhibit geometrical isomerism?

(A) 2-methylpropene. (B) But-1-ene.

(C) But-2-ene. (D) 2, 3-dibromo-but-2-ene.

18.

Examples of addition reactions include all but one of the following. Which is the odd one out?

(A) Reaction of HBr with but-2-ene.
(B) Combustion of propene.
(C) Reaction of Cl_2 with propene.
(D) Polymerization of ethene.

19. $CH_3-C\equiv C$ MgBr can be prepared by the reaction of _________.

(A) $CH_3-C\equiv C-Br$ with $MgBr_2$
(B) $CH_3-C\equiv CH$ with MgB_2
(C) $CH_2-C\equiv CH$ with KBr and Mg metal
(D) $CH_3-C\equiv CH$ with CH_3MgBr

20. On heating sodium propionate with sodalime the hydrocarbon obtained is:

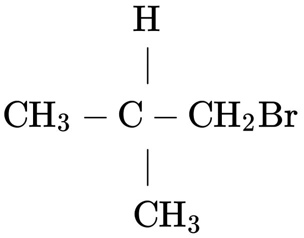
(A) Butane (B) Ethane (C) Propane (D) Ethene

21. In an alkane if the value of n = 19, it is:

(A) Solid
(B) Liquid
(C) Gaseous
(D) None of the above

22. Arrange the following carbanions in order of their decreasing stability.

A.



$$CH_3-\underset{CH_3}{\overset{H}{C}}-CH_2Br$$

B. CH_3-CH_2-Br

C. $CH_3-CH_2-CH_2-Br$

(A) $A > B > C$ (B) $C > B > A$ (C) $B > C > A$ (D) $A > C > B$

23. Which of the following gives propyne on hydrolysis?

(A) Al_4C_3 (B) M_g2C_3 (C) B_4C (D) La_4C_3

24. What is the name of the alkene $H_2C=CH-CH=CH_2$?

(A) 1, 3-butadiene
(B) 1, 3-butanediene
(C) 1, 3-dibutene
(D) 1, 3-dibutadiene

25. The compound formed as a result of oxidation of propyl benzene by hot alkaline $KMnO_4$ is:

(A) Benzoic acid.
(B) 2-phenyl ethanoic acid.
(C) 3-phenyl ethanoic acid.
(D) Acetophenone.

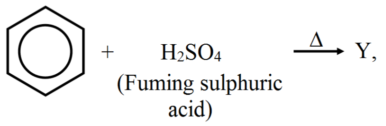
26. X compound reacts with Na to give $CH_3CH_2CH_2CH_3$. The compound X is:

(A) CH_3CH_2OH
(B) CH_3CH_2-Cl
(C) CH_3-CH_3
(D) $CH_3-CH_2-CH_2-CH_2-OH$

27. The degree of unsaturation of the compound formed by the partial hydrogenation of phenol is:

(A) 3 (B) 4 (C) 2 (D) 1

28. In the reaction,



(A) $C_6H_5SO_3H$ (B) C_6H_5OH (C) $C_6H_5SO_2$ (D) C_6H_5CHO

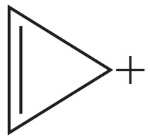
29.

Secondary butyl chloride will undergo alkaline hydrolysis in the polar solvent by the mechanism:

(A) S_N2
(B) S_N1
(C) S_N1 and S_N2
(D) None of the above

30. Four structures are given in options (i) to (iv). Examine them and select the aromatic structures.

(A)



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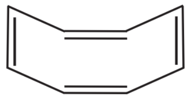
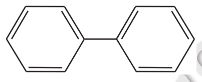


(C)



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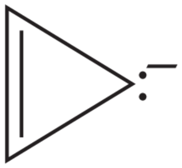
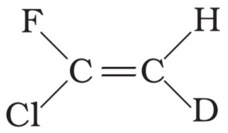


31. Which of the following is Aromatic Hydrocarbon?

(A) C_2H_2
(B) C_3H_8
(C) C_5H_{12}
(D) C_6H_6

32. Which of the following will not show geometrical isomerism?

(A)



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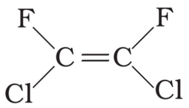

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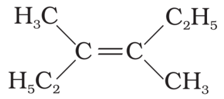
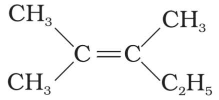


(D)



33. Consider the nitration of benzene using conc. H_2SO_4 and conc. HNO_3. If large amount of $KHSO_4$ is added to mixture, the rate of nitration will be:

(A) Unchanged.
(B) Doubled.
(C) Faster.
(D) Slower.

34. How many isomers are possible in C_4H_8?

(A) 3
(B) 2
(C) 4
(D) 5

35. Which of the following deactivates the benzene ring towards electrophilic substitution and is o/ p directing?

(A) $-\mathrm{Cl}^{\ominus}$
(B) $-OCH_3$
(C) -CHO
(D) All of these.

36. The IUPAC name of $(CH_3)_3C-CH=CH_2$ is:

(A) 1, 1, 1-trimethyl-2-propene
(B) 3, 3, 3-trimethyl-2-propene
(C) 2, 2-dimethyl -3-butene
(D) 3, 3-Dimethyl-1-butene

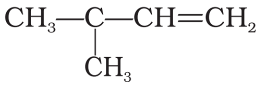
37. Ethylene is a/an:

(A) Saturated hydrocarbon
(B) Alkene
(C) Paraffin
(D) Aromatic compound

38. Which of the following alkenes on ozonolysis give a mixture of ketones only?

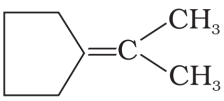
(a) $CH_3-CH=CH-CH_3$

(b)

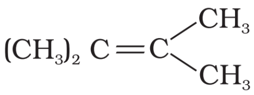


$CH_3-\underset{\displaystyle CH_3}{\underset{|}{C}}-CH=CH_2$

(c)

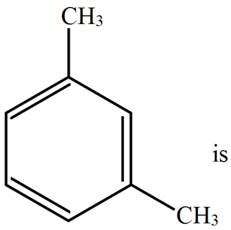


(d)



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

39. The IUPAC name of



is

(A) Dimethylbenzene.
(B) Methyltoluene.
(C) 1, 3-dimethylbenzene.
(D) 1, 4-dimethylbenzene.

40. Which one of the following compounds gives methane on treatment with water?

(A) Al_4C_3
(B) CaC_2
(C) VC
(D) SiC

41. Propene is allowed to react with B_2D_6 and the product is treated with acetic acid. The final product obtained is:

(A) 1-deuteriopropane
(B) 2-deuteriopropane
(C) 1-deuteriopropene
(D) 2-deuteriopropene

42. Which type of isomerism is shown by But-1-yne and cyclobutene?

(A) Ring chain isomerism
(B) Chain isomerism
(C) Position isomerism
(D) Metamerism

43. Which of the following is properly matched?

(A) Kerosene - C_5-C_{10}
(B) Diesel oil - C_5-C_6
(C) Petrol - C_7-C_9
(D) All are correct

44. When cyclohexane is poured on water, it floats because cyclohexane is:

(A) In boat form
(B) In chair form
(C) In crown form
(D) Less dense than water.

45. What happens when calcium carbide is treated with water?

(A) Ethane is formed.
(B) Methane and ethane are formed.
(C) Ethyne is formed.
(D) Ethene and ethyne are formed.

46. Compound A (molecular formula C_5H_{10}) gives only one monochlorinated product. Write the structure of compound A.

(A) 1-pentene
(B) 2-pentene
(C) 1-methyl cyclobutane
(D) Cyclopentane

47. For an electrophilic substitution reaction, the presence of a halogen atom in the benzene ring _______.

(A) Deactivates the ring by inductive effect.

(B) Deactivates the ring by resonance.

(C) Increases the charge density at ortho and para position relative to meta position by resonance.

(D) Directs the incoming electrophile to meta position by increasing the charge density relative to ortho and para position.

48. The C−C bond length of the following molecules is in the order:

(A) $CH_2 > C_2H_4 > C_6H_6 < C_2H_2$
(B) $C_2H_2 < C_2H_4 < C_6H_6 < C_2H_6$
(C) $C_2H_6 < C_2H_2 < C_6H_6 < C_2H_4$
(D) $C_2H_4 < C_2H_6 < C_2H_2 < C_6H_6$

49. Arrange the halogens F_2, Cl_2, Br_2, I_2, in order of their increasing reactivity with alkanes:

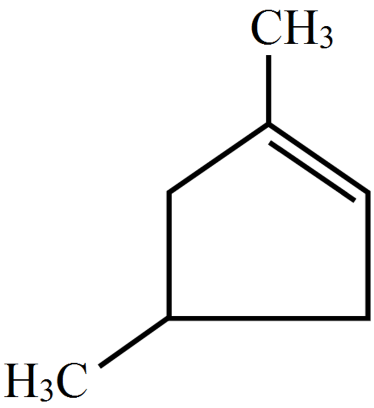
(A) $I_2 < Br_2 < Cl_2 < F_2$.
(B) $Br_2 < Cl_2 < F_2 < I_2$.
(C) $F_2 < Cl_2 < Br_2 < I_2$.
(D) $Br_2 < I_2 < Cl_2 < F_2$.

50. Which of the following organic materials damage DNA of our body?

(A) Tobacco.
(B) Coal.
(C) Petroleum.
(D) All of these.

51. Which compound would give 5-keto 2-methyl hexanal upon ozonolysis followed by reaction with $\frac{Zn}{H_2O}$?

(A)



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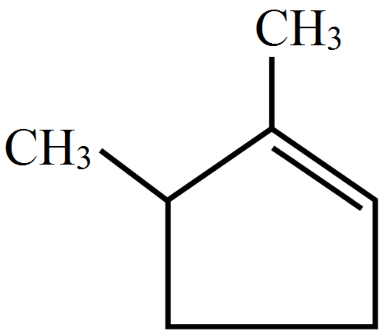

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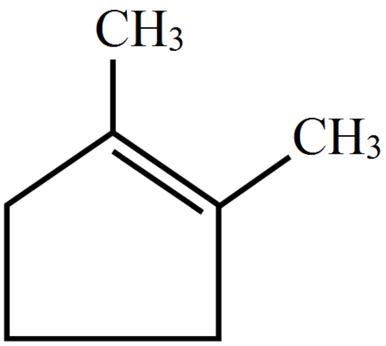
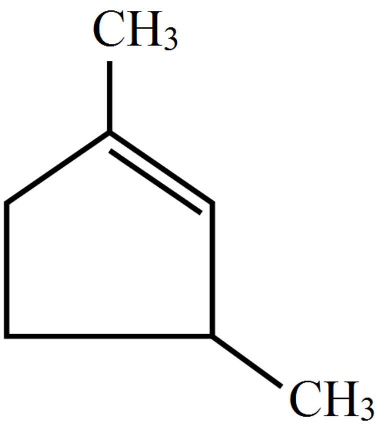


(D)



52. Conformations of ethane in which hydrogen atoms attached to two carbon atoms are closest to each other are known as:

(A) Eclipsed.
(B) Skew boat.
(C) Staggered.
(D) Partially eclipsed.

53. Nitration and chlorination of benzene are:

(A) Nucleophilic and electrophilic substitution respectively.

(B) Electrophilic and nucleophilic substitution respectively.
(C) Electrophilic substitution in both the reactions.
(D) Nucleophilic substitution in both the reactions.

54. Alkynes on reduction with sodium in liquid ammonia forms:
(A) Cis-alkene.
(B) Alkane.
(C) Trans-alkene.
(D) Both (a) and (c).

55. The reaction of Toluene with Cl_2 in presence of $FeCl_3$ predominanly gives:
(A) Benzyle Chloride.
(B) o- & p-chlorotoluene.
(C) m-Chlorotoluene.
(D) Benzoyl chloride.

56. Which content(s) of middle oil separate on cooling?
(A) Naphthalene
(B) Phenol
(C) Benzene
(D) Pyridine

57. The energy barrier to free rotation about carbon carbon bond of ethane is about:
(A) 30kJ mol^{-1}
(B) 3kJ mol^{-1}
(C) 3kcal mol^{-1}
(D) 40kJ mol^{-1}

58. 2-methyl propan-2-ol is obtained by the reaction of X with water in the presence of conc. H_2SO_4. The X is:
(A) 1-methylpropene.
(B) 2, 2-dimethylhexane.
(C) 2-methylpropene.
(D) 2-methylbutane.

59. Name the IUPAC nomenclature of $CH_3-CH_2-CH_2-CH=CH_2$:
(A) 1-Pentene
(B) 2-Propene
(C) 3-Propene
(D) None of these

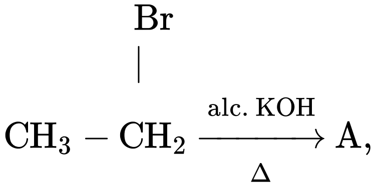
60. Which of the following can be used as the halide (electrophile provider) for Friedel crafts reaction:
(A) Chloro benzene.
(B) Bromo benzene.
(C) Chloro ethane.
(D) Isopropyl chloride.

61. The hydrocarbon obtained by treating sodium ethanoate with soda lime is ________.
(A) Ethane
(B) Methane
(C) Propane
(D) Butane

62. Ethylene is prepared by:
(A) Dehalogenation of chloroform.
(B) Pyrolysis of ethane at 450°C
(C) Dehydration of methanol with Al_2O_3/350°C
(D) Methyl chloride on reduction

63. The highest boiling point is expected for:
(A) Isooctane
(B) n-Octane
(C) 2, 2, 3, 3-Tetramethyl butane
(D) n-Butane

64. In the reaction, A is:



$$CH_3-\overset{\overset{Br}{|}}{CH_2}\xrightarrow[\Delta]{\text{alc. KOH}}A,$$

(A) $CH_2=CH_2$
(B) CH_3CH_3
(C) $CH\equiv CH$
(D) Both (a) and (b)

65. A single substitution of H atom in an alkane of molar mass by 72g/mole on chlorination produces only one product. The alkane is:

(A) n- pentane
(B) 2- methyl butane
(C) 2, 2-dimethyl propane
(D) n- butane

66. The discovery that chlorofluorocarbons initiate a radical -chain reaction that catalytically destroys ozone won the 1995Nobel prize in chemistry Given the initiation step below which of the following reactions is the most likely to serve as one of the propagation steps?

$CCl_2F_2 + hv \rightarrow {}^*CClF_2 + {}^*Cl$

(A) ${}^*Cl + {}^*Cl \rightarrow Cl_2$
(B) ${}^*Cl + O_3 \rightarrow {}^*OCl + O_2$
(C) ${}^*CClF_2 + {}^*Cl \rightarrow CCl_2F_2$
(D) $2{}^*CClF_2 + 2O_3 \rightarrow 2COF_2 + Cl_2 + 2O_2$

67. Ethylbenzene reacts with Cl_2 in sunlight to give:

(A) 1-Chloro-1-phenylethane
(B) 1-Chloro-2-phenylethane
(C) 4-Chloroethylbenzene
(D) 3-Chloroethylbenzene

68. $CH_3CH = CH_2 + HBr$ gives:

(A) $CH_2 = CH - CH_2 - Br$
(B) $CH_3 - CH_2 - CH_2 - Br$
(C) $CH_3CH(Br) - CH_3$
(D) $CH_3 - CH_2 - CH_3$

69. Which one of the following compound will give addition reaction?

(A) CH_4
(B) C_2H_6
(C) C_2H_4
(D) C_3H_8

70. Arrange the following hydrogne halides in order of their decreasing reactivity with propene.

(A) HCl > HBr > HI
(B) HBr > HI > HCl
(C) HI > HI > HCl
(D) HCl > HI > HBr

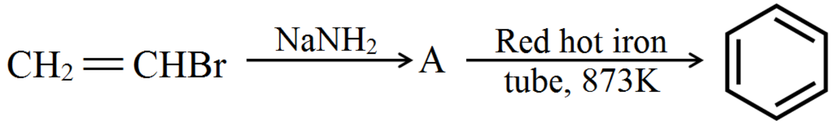
71. Aromatic compounds containing benzene ring are termed as:

(A) Benzene.
(B) Benzenoids.
(C) Benzalene.
(D) All of these.

72. Which of the following reactions of methane is incomplete combustion:

(A) $2CH_4 + O_2 \xrightarrow{Cu/523K/100atm} 2CH_3OH$
(B) $CH_4 + O_2 \xrightarrow{Mo_2O_3} HCHO + H_2O$
(C) $CH_4 + O_2 \longrightarrow C(s) + 2H_2O(l)$
(D) $CH_4 + 2O_2 \longrightarrow CO_2(g) + 2H_2O(l)$

73.



Here, A refers to:

(A) $CH \equiv CH$
(B) $CH_3 - C \equiv CH$
(C) $CH_3 - CH_3$
(D) $CH \equiv C - NH_2$

74. The major product formed when 3, 3-dimethyl butan-2-ol is heated with concentrated sulphuric acid is:

(A) 2, 3-dimethylbut-1-ene
(B) 2, 3-dimethylbut-2-ene
(C) 3, 3-dimethylbut-1-ene

(D) Cis and trans-isomers of 2, 3-dimethylbut-1-ene

75. The IUPAC name of given compound is: $CH_3-C{\equiv}C-C(CH_3)_2-CH_3$

(A) 4, 4-dimethyl-2-heptene-5-yne
(B) 4, 4-dimethyl-2-heptene-6-yne
(C) 4, 4-dimethyl-5-heptene-2-yne
(D) None of these

76. Phenyl magnesium bromide reacts with methanol to give:

(A) Benzene.
(B) Toluene.
(C) Phenol.
(D) Arisole.

77. Monochlorination of ethylbenzene ($PhCH_2CH_3$) with Cl_2 under heat produces ________.

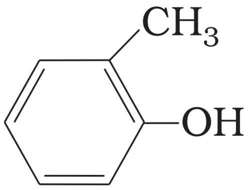
(A) $PhCH_2CH_2Cl$
(B) $PhCHClCH_3$
(C) Both (a) and (b) in equal amounts
(D) None of (b) and less of (a)

78. Among the following, which hydrocarbon is not produced by Wurtz reaction?

(A) Methane.
(B) Ethane.
(C) Propane.
(D) All given options can be prepared.

* Answer The Following Questions In One Sentence.[1 Marks Each] [20]

79. Write IUPAC names of the following compound:



80. Write IUPAC names of the products obtained by the ozonolysis of the following compound:
Pent-2-ene.

81. Write IUPAC names of the products obtained by the ozonolysis of the following compound:
3,4-Dimethylhept-3-ene.

82. Why is addition reaction of bromine to benzene difficult?

83. Give the structural formula of 4-tert, butyl-4-ethyl-2, 2, 5-tetra methyl hexane.

84. Bring out the following conversion ethane to ethene.

85. Convert ethyne to propyne.

86. Why eclipsed and staggered forms of ethane cannot be isolated at room temperature?

87. Name the reagent used in the following changes

$$CH_3-CH_2-CH_2-CH_2-C\equiv C-CH_2-CH_2-CH_2$$
$$-CH_3\overset{?}{\rightarrow}CH_3-CH_2-CH_2-CH_2-$$
$$C=C-CH_2-CH_2-CH_2-CH_3$$
$$|\quad\ \ |$$
$$H\quad H$$

88. In which of the following pair both angle strain and torsional strain is present?

a. Cyclopropane, Cyclobutane
b. Cyclopropane, Cyclohexane

c. Cyclobutane, Cyclohexane
d. Cyclohexane, Cyclopentane

89. Arrange the three isomers of pentane in increasing order of their boiling points.

90. Identify the structure of A and B;

$$CH_3 - CH_2COOH \xrightarrow{\text{KOH}} A \xrightarrow{\text{Kolbe's electrolysis}} B$$

$$CH_3 - CH_2COOH \xrightarrow{\text{KOH}} \underset{A}{CH_3CH_2COO^-K^+}$$

$$\xrightarrow{\text{Kolbe's electrolysis}} \underset{B}{CH_3CH_2CH_2CH_3}$$

91. Draw the Newman's projection formula of the staggered form of 1, 2-dichloroethane.

92. Convert methane to ethane.

93. Write an equation of the reaction of propyne with water in the presence of H_2SO_4 and $HgSO_4$. Show the intermediate.

94. Why is dipole moment of trans-1, 2-dichloroethene zero?

95. Convert 1-bromopropane to 2-bromopropane.

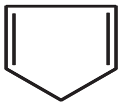
96. Why do alkenes prefer to undergo electrophilic addition reaction while arenes prefer electrophilic substitution reactions? Explain.

97. Alkynes on reduction with sodium in liquid ammonia form trans alkenes. Will the butene thus formed on reduction of 2-butyne show the geometrical isomerism?

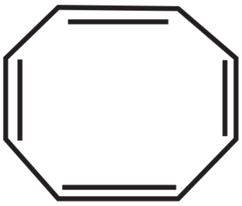
98. Give the structure of the alkene (C_4H_8) which adds on HBr in the presence and in absence of peroxide to give the same product, C_4H_9Br.

*** Given Section consists of questions of 2 marks each. [28]**

99. Explain why the following system are not aromatic?

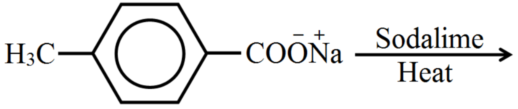


100. Explain why the following system are not aromatic?

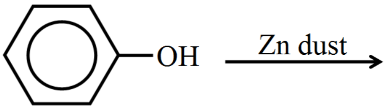


101. Complete the following:

(i)



(ii)

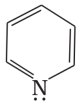


102. An alkyl bromide (X) react with sodium metal dissolved in anhydrous ether to form 4, 5-diethyl octane. Identify 'X'.

103. The ring systems having following characteristics are aromatic.

- i. Planar ring containing conjugated π bonds.
- ii. Complete delocalisation of the $\pi-$electrons in ring system i.e. each atom in the ring has unhybridised p-orbital, and
- iii. Presence of $(4n + 2)\pi-$electrons in the ring where n is an integer (n = 0, 1, 2, ...) [Huckel rule].

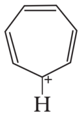
Using this information classify the following compounds as aromatic/ nonaromatic.


(A)

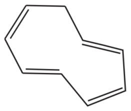

(B)


(C)


(D)


(E)


(F)


(G)

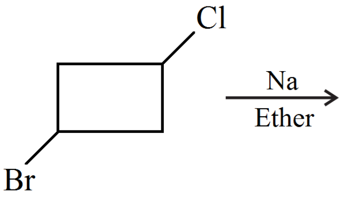
104. Complete the following reactions:

i. $$(CH_3)_2C = CH - CH_3 \xrightarrow[\text{heat}]{KMnO_4/KOH}$$

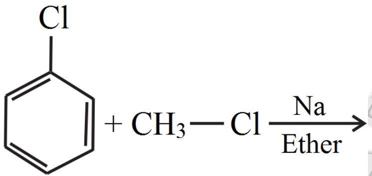
ii. $$(CH_3)_2C = CH - CH_3 \xrightarrow{\text{cold } KMnO_4/KOH}$$

105. Complete:

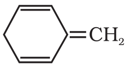
i.



ii.



106. Explain why the following systems are not aromatic?



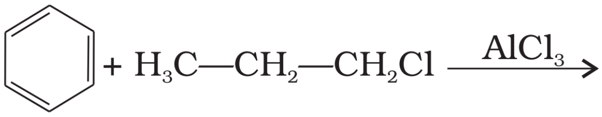
107. What happens when 1, 2-Dibromo ethane reacts with excess of alc. KOH?

108. Complete the following reactions.

i. $$\text{Iso-propyl bromide} \xrightarrow[\text{Heat}]{\text{Alc. KOH}} A \xrightarrow[\text{Peroxide}]{HBr} B$$

ii. $$\text{n-propyl alcohol} \xrightarrow[443K]{\text{Conc. } H_2SO_4} A \xrightarrow[\text{Heat}]{O_2,\ Ag} B$$

109. What will be the product obtained as a result of the following reaction and why?



110. What happens when:

   i. Bromoethane is treated with zinc and hydrochloric acid?
   ii. Hydrogen is passed into 2-bromopropane in the presence of palladium?

111. Write the structures and names of products obtained in the reactions of sodium with a mixture of 1-iodo-2-methylpropane and 2-iodopropane.

112. Convert Acetylene to Propylene.

*** Given Section consists of questions of 3 marks each. [66]**

113. 2 Arrange the following set of compounds in order of their decreasing relative reactivity with an electrophile, E^+.
Toluene, p-H_3C-C_6H_4-NO_2 , p-O_2N-C_6H_4-NO_2.

114. For the following compound, write structural formulas and IUPAC names for all possible isomers having the number of double or triple bond as indicated:
C_5H_8 (one triple bond).

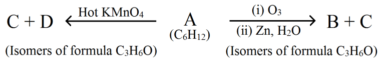
115. How will you convert benzene into:
p-nitrobromobenzene.

116. For the following compound, write structural formulas and IUPAC names for all possible isomers having the number of double or triple bond as indicated:
C_4H_8 (one double bond).

117. Suggest the name of a Lewis acid other than anhydrous aluminium chloride which can be used during ethylation of benzene.

118. 2 Arrange the following set of compounds in order of their decreasing relative reactivity with an electrophile, E^+.
Chlorobenzene, 2,4-dinitrochlorobenzene, p-nitrochlorobenzene.

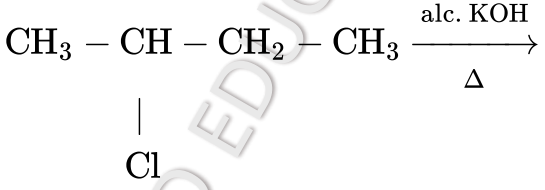
119. Give the structures of A and B.



$$\underset{\text{(Isomers of formula } C_3H_6O)}{C + D} \xleftarrow{\text{Hot } KMnO_4} \underset{(C_6H_{12})}{A} \xrightarrow[\text{(ii) Zn, } H_2O]{\text{(i) } O_3} \underset{\text{(Isomers of formula } C_3H_6O)}{B + C}$$

120. Complete the following reactions:

   i. $CH_3 - CH = CH_2 + HBr \xrightarrow{\text{Peroxide}} ?$
   ii. $CH_3 - Cl + Na \xrightarrow{\text{Dry ether}} ?$
   iii.



$$CH_3 - \underset{\underset{Cl}{|}}{CH} - CH_2 - CH_3 \xrightarrow[\Delta]{\text{alc. KOH}}$$

121. Complete the reactions:

   i. $CH_3CH_2CH_3 + HNO_3 \xrightarrow{\text{Vapour phase}}$
   ii. $CH_4 + O_2 \xrightarrow[723-773K]{\text{Copper tube}}$
   iii. $C_2H_5\ CO\overset{-}{O}\overset{+}{Na} + NaOH \xrightarrow{CaO}$

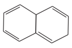
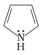
122. $$\text{Pent-1-yne} \xrightarrow[\text{(ii) } CH_3-I]{\text{(i) } NaNH_2/NH_3} A \xrightarrow[\text{Lindlar's catalyst}]{H_2} B \xrightarrow{Br_2} \text{'C'}$$

Identify A, B and C compounds and give their reactions.

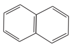
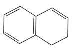
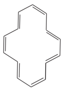
123. Convert:

i. Ethylene to Nitrobenzene.
ii. Write short note on Markovnikov's Rule.

124. Which of the following compounds are aromatic according to Huckel’s rule?

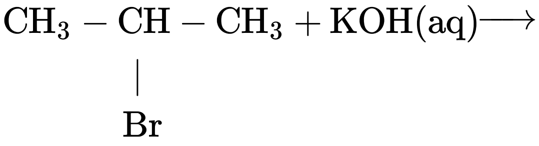
(A) 
(B) 

(C) 

(D) 
(E) 
(F) 

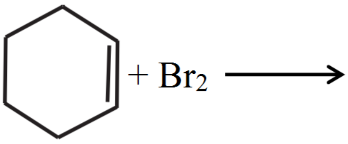
125. For the following reactions, complete and Identify the type of reactions:

i. $CH_3-CH_2-CH_2Br+KOH(alc.)\longrightarrow$

ii. 

$CH_3-\underset{\underset{Br}{|}}{CH}-CH_3+KOH(aq)\longrightarrow$

iii.



126. An alkyl halide (X) of formula $C_3H_{13}Cl$ on treatment with alcoholic KOH or potassium tert-butoxide gives two isomeric alkenes Yand $Z(C_6H_{12})$. Both alkenes on hydrogenation give 2, 3-dimethylbutane. Predict the structure of X, Y and Z.

127. Give the reactions involved in the preparation of propane from the following:

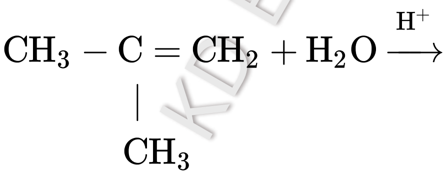
i. $CH_3-CH=CH_2$
ii. $CH_3-CH_2-CH_2Cl$
iii. $CH_3CH_2CH_2COO^-Na^+$

128. An alkyl halide 'A' of formula $C_6H_{13}Cl$ on treatment with alcoholic KOH gives two isomeric alkenes 'B' and 'C' with molecular formula C_6H_{12}. Both alkenes on hydrogenation give 2, 3-dimethyl butane. Predict the structure of ‘A’, 'B' and 'C'.

129. Arrange 2, 2-dimethylbutane, 3-methylpentane and n-hexane in increasing order of their boiling point.

130.

a. Name a compound that will be required to obtain butane using Kolbe's electrolytic method.
b. Why does benzene show electrophilic substitution easily?
c. Complete the following:



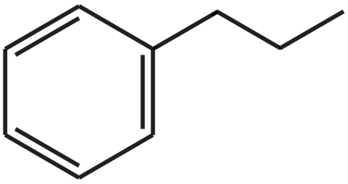
$CH_3-\underset{\underset{CH_3}{|}}{C}=CH_2+H_2O\xrightarrow{H^+}$

131. Write chemical reactions of:

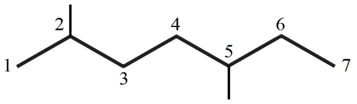
i. Wurtz-Fittig reaction.
ii. Kolbe's electrolytic method.
iii. B-Elimination reaction.

132. Write IUPAC names of the following:

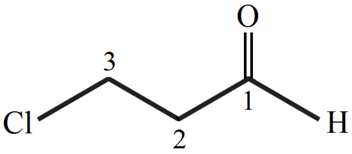
a.



b.



c.



133. An alkane has a molecular mass of 72. Give all the possible structural isomers along with their IUPAC names.

134. i. How will you convert benzene into:
   a. Acetophenone?
   b. m-nitrochlorobenzene?

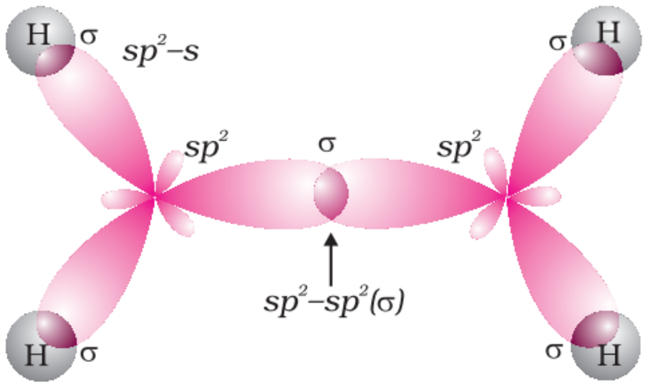
ii. Write the structures of products obtained by ozonolysis of pent-2-ene.

* Case study based questions [8]

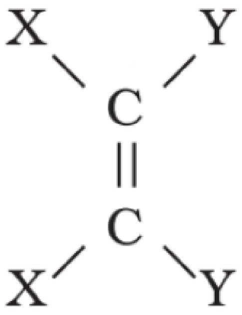
135. Read the passage given below and answer the following questions from 1 to 5.

Alkenes are unsaturated hydrocarbons containing at least one double bond. What should be the general formula of alkenes? If there is one double bond between two carbon atoms in alkenes, they must possess two hydrogen atoms less than alkanes. Hence, general formula for alkenes is C_nH_{2n}. Alkenes are also known as olefins (oil forming) since the first member, ethylene or ethene (C_2H_4) was found to form an oily liquid on reaction with chlorine.

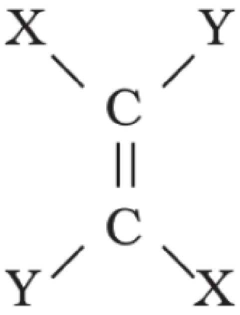
Structure of Double Bond Carbon-carbon double bond in alkenes consists of one strong sigma (σ) bond (bond enthalpy about 397 kJ mol$^{-1)}$ due to head-on overlapping of sp^2 hybridised orbitals and one weak pi π bond (bond enthalpy about 284 kJ mol^{-1}) obtained by lateral or sideways overlapping of the two 2p orbitals of the two carbon atoms. The double bond is shorter in bond length (134 pm) than the C–C single bond (154 pm). You have already read that the pi (π) bond is a weaker bond due to poor sideways overlapping between the two 2p orbitals. Thus, the presence of the pi (π)bond makes alkenes behave as sources of loosely held mobile electrons. Therefore, alkenes are easily attacked by reagents or compounds which are in search of electrons. Such reagents are called electrophilic reagents. The presence of weaker(π)-bond makes alkenes unstable molecules in comparison to alkanes and thus, alkenes can be changed into single bond compounds by combining with the electrophilic reagents. Strength of the double bond (bond enthalpy, 681 kJ mol^{-1}) is greater than that of a carbon-carbon single bond in ethane (bond enthalpy, 348 kJ mol^{-1}). Orbital diagrams of ethene molecule are shown in Figure.



Geometrical isomerism: Doubly bonded Carbon atoms have to satisfy the remaining two Valences by joining with two atoms or groups. If the two atoms or groups attached to each Carbon atom are different, they can be Represented by YX C = C XY like structure. YX C = C XY can be represented in space in the Following two ways:

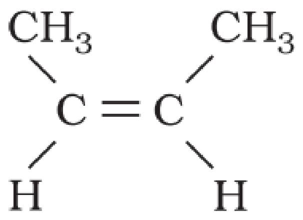


(a)

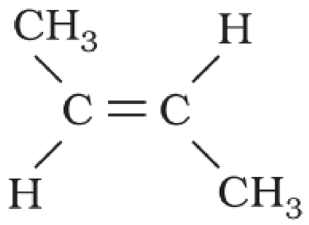


(b)

In (a), the two identical atoms i.e., both the X or both the Y lie on the same side of the Double bond but in (b) the two X or two Y lie Across the double bond or on the opposite Sides of the double bond. This results in Different geometry of (a) and (b) i.e. disposition Of atoms or groups in space in the two Arrangements is different. Therefore, they are Stereoisomers. They would have the same Geometry if atoms or groups around C = C bond Can be rotated but rotation around C = C bond Is not free. It is restricted. For understanding This concept, take two pieces of strong Cardboards and join them with the help of two Nails. Hold one cardboard in your one hand And try to rotate the other. Can you really rotate The other cardboard ? The answer is no. The Rotation is restricted. This illustrates that the Restricted rotation of atoms or groups around The doubly bonded carbon atoms gives rise to Different geometries of such compounds. The Stereoisomers of this type are called Geometrical isomers. The isomer of the type (a), in which two identical atoms or groups lie On the same side of the double bond is called Cis isomer and the other isomer of the type (b), in which identical atoms or groups lie on The opposite sides of the double bond is called Trans isomer. Thus cis and trans isomers Have the same structure but have different Configuration (arrangement of atoms or groups In space). Due to different arrangement of Atoms or groups in space, these isomers differ In their properties like melting point, boiling Point, dipole moment, solubility etc. Geometrical or cis-trans isomers of but-2-ene Are represented below:

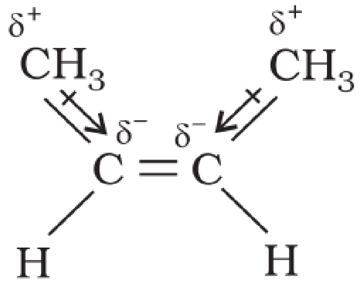


cis-But-2-ene
(b.p. 277 K)

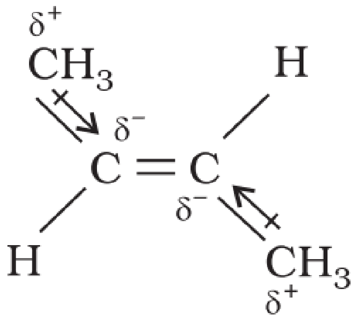


trans-But-2-ene
(b.p. 274 K)

Cis form of alkene is found to be more polar Than the trans form. For example, dipole Moment of cis - but - 2-ene is 0.33 Debye, Whereas, dipole moment of the trans form Is almost zero or it can be said that trans - but - 2 -ene is non-polar. This can be understood by drawing geometries of the two forms as given below from which it is clear that in the trans - but - 2 -ene, the two methyl groups are in opposite directions, Therefore, dipole moments of C - CH_3 bonds cancel, thus making the trans form non-polar.



cis-But-2-ene
(μ = 0.33D)

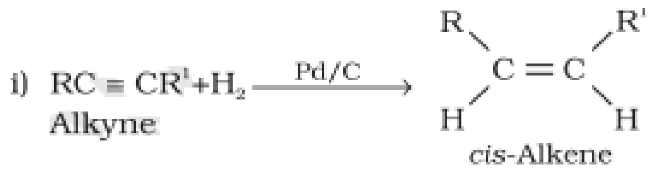


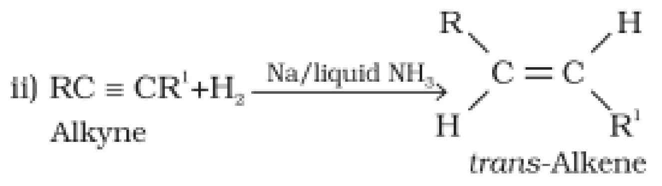
trans-But-2-ene
(μ = 0)

In the case of solids, it is observed that the trans isomer has higher melting point than the cis form. Geometrical or cis-trans isomerism is also shown by alkenes of the types XYC = CXZ and XYC = CZW

Preparation – From alkynes: Alkynes on partial reduction with calculated amount of dihydrogen in the presence of palladised charcoal partially deactivated with poisons like sulphur

compounds or quinoline give alkenes. Partially deactivated palladised charcoal is known as Lindlar’s catalyst. Alkenes thus obtained are having cis geometry. However, alkynes on reduction with sodium in liquid ammonia form trans alkenes.

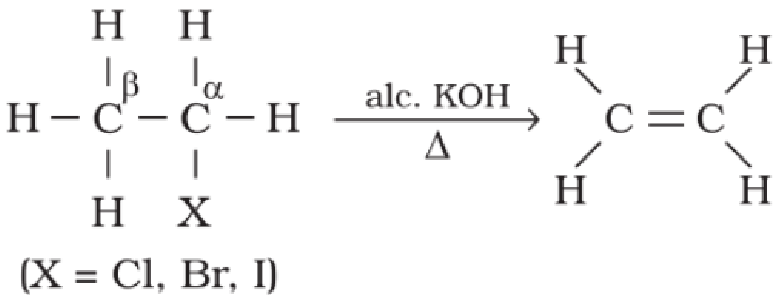




iii) $CH\equiv CH + H_2 \xrightarrow{Pd/C} CH_2=CH_2$ (13.32)
Ethyne Ethene

iv) $CH_3-C\equiv CH + H_2 \xrightarrow{Pd/C} CH_3-CH=CH_2$
Propyne Propene

From alkyl halides: Alkyl halides (R-X) on heating with alcoholic potash (potassium hydroxide dissolved in alcohol, say, ethanol) eliminate one molecule of halogen acid to form alkenes. This reaction is known as dehydrohalogenation i.e., removal of halogen acid. This is example of β—elimination reaction, since hydrogen atom is eliminated from the β carbon atom (carbon atom next to the carbon to which halogen is attached).



Nature of halogen atom and the alkyl group determine rate of the reaction. It is observed that for halogens, the rate is: iodine > bromine > chlorine, while for alkyl groups it is: tert > secondary > primary.

Physical properties Alkenes as a class resemble alkanes in physical properties, except in types of isomerism and difference in polar nature. The first three members are gases, the next fourteen are liquids and the higher ones are solids. Ethene is a colourless gas with a faint sweet smell. All other alkenes are colourless and odourless, insoluble in water but fairly soluble in non- polar solvents like benzene, petroleum ether. They show a regular increase in boiling point with increase in size i.e., every –CH_2 group added increases boiling point by 20–30 K. Like alkanes, straight chain alkenes have higher boiling point than isomeric branched chain compounds.

i. The first three members of alkenes are …?
   a. Gases
   b. Liquids

c. Solids
d. None of above

ii. General formula for alkenes is ....?
a. C_nH_{2n+1}
b. C_nH_{2n}
c. C_nH_{2n-1}
d. C_nH_{2n+2}

iii. The colour of ethene gas is ...?
a. Red
b. White
c. Pale Green
d. None of above

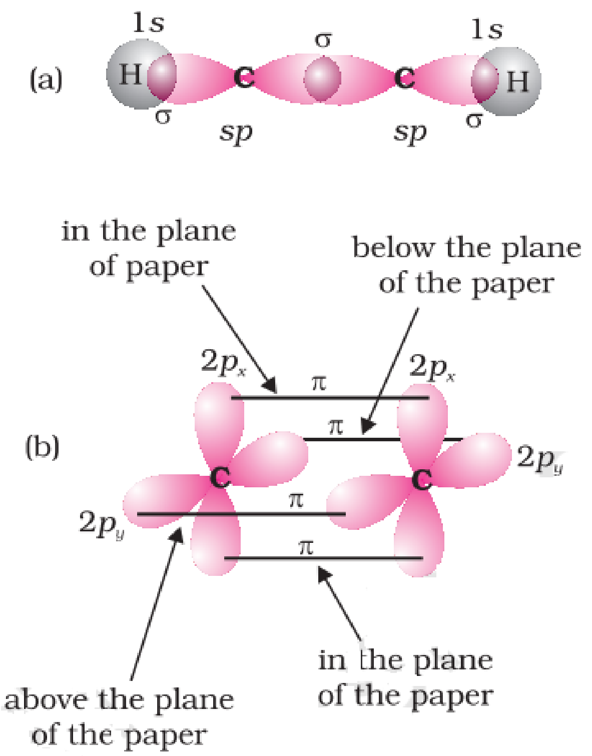
iv. The bond length of carbon carbon double bond is ... pm ?
a. 154
b. 143
c. 134
d. 120

v. Alkenes are also knows as ...?
a. Olefines
b. Paraffines
c. Oleofines
d. Paracetofines

136. Read the passage given below and answer the following questions from 1 to 5.

Alkynes– Like alkenes, alkynes are also unsaturated hydrocarbons. They contain at least one triple bond between two carbon atoms. The number of hydrogen atoms is still less in alkynes as compared to alkenes or alkanes. Their general formula is C_nH_{2n-2}. The first stable member of alkyne series is ethyne which is popularly known as acetylene. Acetylene is used for arc welding purposes in the form of oxyacetylene flame obtained by mixing acetylene with oxygen gas. Alkynes are starting materials for a large number of organic compounds. Hence, it is interesting to study this class of organic compounds.

Structure of Triple Bond Ethyne is the simplest molecule of alkyne series. Structure of ethyne is shown in Figure. Each carbon atom of ethyne has two sp hybridised orbitals. Carbon-carbon sigma (σ) bond is obtained by the head-on overlapping of the two sp hybridised orbitals of the two carbon atoms. The remaining sp hybridised orbital of each carbon atom undergoes overlapping along the internuclear axis with the 1s orbital of each of the two hydrogen atoms forming two C-H sigma bonds. H-C-C bond angle is of 180°.



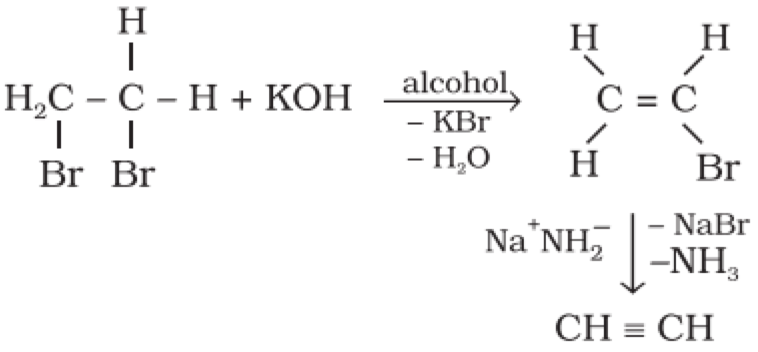
Each carbon has two unhybridised p orbitals which are perpendicular to each other as well as to the plane of the C - C sigma bond. The 2p orbitals of one carbon atom are parallel to the 2p orbitals of the other carbon atom, which undergo lateral or sideways overlapping to form two pi (π) bonds between two carbon atoms. Thus ethyne molecule consists of one C – C σ bond, two C – H σ bonds and two C – C π bonds. The strength of C ≡ C bond (bond enthalpy 823 kJ mol^{-1}) is more than those of C = C bond (bond enthalpy 681 kJ mol^{-1}) and C – C bond (bond enthalpy 348 kJ mol^{-1}). The C ≡ C bond length is shorter (120 pm) than those of C = C (133 pm) and C – C (154 pm). Electron cloud between two carbon atoms is cylindrically symmetrical about the internuclear axis. Thus, ethyne is a linear molecule.

Preparation – From calcium carbide: On industrial scale, ethyne is prepared by treating calcium carbide with water. Calcium carbide is prepared by heating quick lime with coke. Quick lime can be obtained by heating limestone as shown in the following reactions:

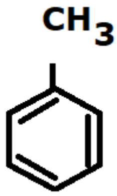
$$CaO + 3C \longrightarrow \underset{\text{Calcium carbide}}{CaC_2} + CO$$

$$CaC_2 + 2H_2O \rightarrow Ca(OH)_2 + C_2H_2$$

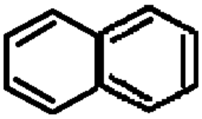
From vicinal dihalides: Vicinal dihalides on treatment with alcoholic potassium hydroxide undergo dehydrohalogenation. One molecule of hydrogen halide is eliminated to form alkenyl halide which on treatment with sodamide gives alkyne.



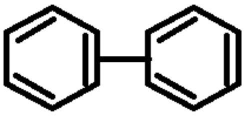
Benzene



Toluene

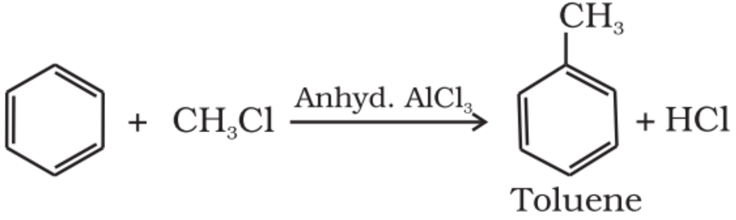


Napththalene



Biphenyl

Aromatic hydrocarbon- These hydrocarbons are also known as ‘arenes’. Since most of them possess pleasant odour, the class of compounds was named as ‘aromatic compounds’. Most of such compounds were found to contain benzene ring. Benzene ring is highly unsaturated but in a majority of reactions of aromatic compounds, the unsaturation of benzene ring is retained. However, there are examples of aromatic hydrocarbons which do not contain a benzene ring but instead contain other highly unsaturated ring. Aromatic compounds containing benzene ring are known as benzenoids and those not containing a benzene ring are known as non-benzenoids. Some examples of arenes are given below:



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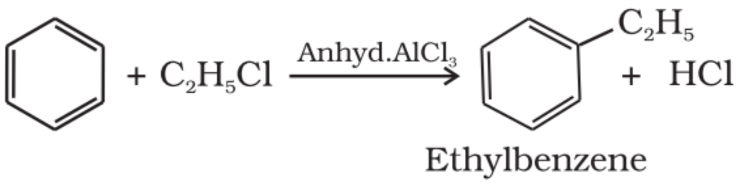
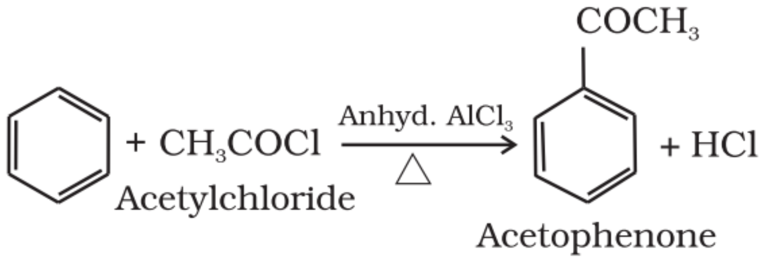
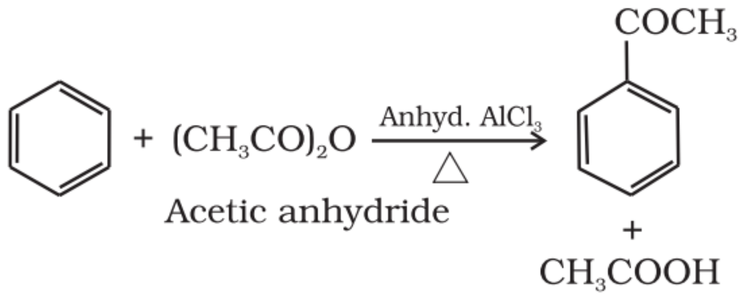


Friedel-Crafts alkylation reaction: When benzene is treated with an alkyl halide in the presence of anhydrous aluminium chloride, alkylbenene is formed.

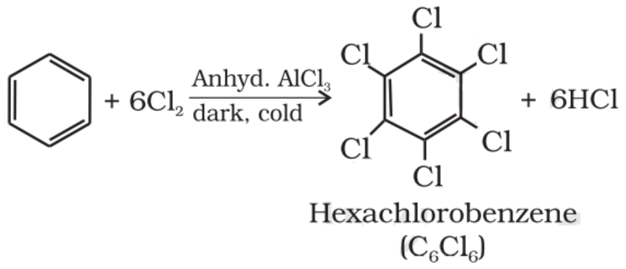
Friedel-Crafts acylation reaction: The reaction of benzene with an acyl halide or acid anhydride in the presence of Lewis acids ($AlCl_3$) yields acyl benzene.



(13.77)



If excess of electrophilic reagent is used, further substitution reaction may take place in which other hydrogen atoms of benzene ring may also be successively replaced by the electrophile. For example, benzene on treatment with excess of chlorine in the presence of anhydrous $AlCl_3$ can be chlorinated to hexachlorobenzene (C_6Cl_6)



i. The general formula of Alkynes is ...?
   a. C_nH_{2n-2}
   b. C_nH_{2n-2}
   c. C_nH_{2n-2}
   d. C_nH_{2n-2}

ii. Calcium carbide is prepared by heating quick lime with ...?
   a. Backing soda
   b. Coke
   c. Carbide
   d. Salt

iii. Vicinal dihalides on treatment with alcoholic potassium hydroxide undergo ...?
   a. Dehydrogenation.
   b. Hydrohalogenation.
   c. Dehydrohalogenation
   d. Dehalogenation.

iv. The bond enthalpy of C ≡ C is ...?
   a. 523 kJ mol
   b. 623 kJ mol
   c. 723 kJ mol
   d. 823 kJ mol

v. The C ≡ C bond length is ...?

a. 1200 pm
b. 620 pm
c. 240 pm
d. 120 pm

* **Given Section consists of questions of 5 marks each.** **[70]**

137. 8 Arrange benzene, n-hexane and ethyne in decreasing order of acidic behaviour. Also give reason for this behaviour.

138. What are the necessary conditions for any system to be aromatic?

139. Write chemical equations for combustion reaction of the following hydrocarbons:
    i. Butane.
    ii. Pentene.
    iii. Hexyne.
    iv. Toluene.

140. Out of benzene, m-dinitrobenzene and toluene which will undergo nitration most easily and why?

141. Why is benzene extra ordinarily stable though it contains three double bonds?

142. 4 In the alkane $H_3C\text{-}CH_2\text{-}C(CH_3\ )_2\text{-}CH_2\text{-}CH(CH_3)_2$, identify 1°,2°,3° carbon atoms and give the number of H atoms bonded to each one of these.

143. Write down the products of ozonolysis of 1,2-dimethylbenzene (o-xylene). How does the result support Kekulé structure for benzene?

144. Why is Wurtz reaction not preferred for the preparation of alkanes containing odd number of carbon atoms? Illustrate your answer by taking one example.

145. Draw the cis and trans structures of hex-2-ene. Which isomer will have higher b.p. and why?

146. 6 An alkene 'A' contains three C-C, eight C–H σ bonds and one C–C π bond. ‘A’ on ozonolysis gives two moles of an aldehyde of molar mass 44 u. Write IUPAC name of 'A'.

147. How do you account for the formation of ethane during chlorination of methane?

148. An alkene 'A' on ozonolysis gives a mixture of ethanal and pentan-3-one. Write structure and IUPAC name of 'A'.

149. Propanal and pentan-3-one are the ozonolysis products of an alkene? What is the structural formula of the alkene?

150. Addition of HBr to propene yields 2-bromopropane, while in the presence of benzoyl peroxide, the same reaction yields 1-bromopropane. Explain and give mechanism.

----- one minute can't change your life but utilisation of every minute definitely change your life -----