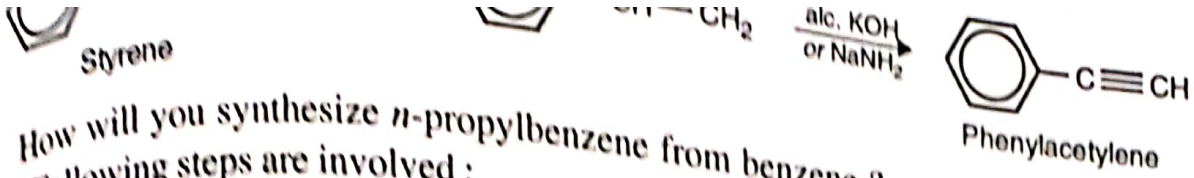
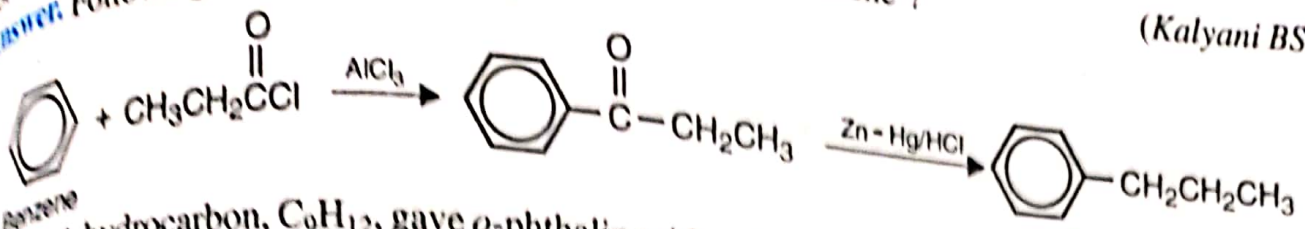


43. How will you synthesize *n*-propylbenzene from benzene ?

(Kalyani BSc, 2015)

Answer. Following steps are involved :



44. A hydrocarbon, C_9H_{12}, gave *o*-phthalic acid as the only organic product of oxidation. What is the structure and name of the hydrocarbon ?

Answer. The hydrocarbon is *o*-ethyltoluene.

45. A secondary alcohol (*A*), C_3H_8O, reacted with thionyl chloride to give compound (*B*), C_3H_7Cl. Compound (*B*) reacted with benzene in the presence of aluminium chloride to form (*C*), C_9H_{12}. Identify (*A*), (*B*), (*C*) and write equations for all the reactions.

Answer. (*A*) = Isopropyl alcohol

(*B*) = Isopropyl chloride

(*C*) = Cumene

Multiple Choice Questions

1. Which of the following is an *incorrect* description of benzene ?
   (*a*) The CCC bond angles are all equal to 120°.
   (*b*) The molecule is planar.
   (*c*) The molecule is a 6-membered ring which contains alternating single and double carbon-carbon bonds.
   (*d*) The molecule can be drawn as a resonance hybrid of two Kekule structures.

Answer. (*c*)

2. Which of the following statements are *false* about benzene ?
   (*a*) It is a planar molecule with bond angles 120°.
   (*b*) It is immiscible with water forming the lower layer.
   (*c*) It can be converted into cyclohexane by hydrogenation at 200°C in the presence of Ni catalyst.
   (*d*) It reacts with ethyl chloride in the presence of aluminium chloride to form ethylbenzene.

Answer. (*b*)

3. Which statement about the structure of benzene is *not* true ?
   (*a*) The two Kekule structures of benzene are in equilibrium.
   (*b*) The carbon-carbon bond lengths in benzene are greater than the carbon-carbon double bonds in aliphatic compounds.

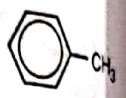
(c) The molecular geometry of benzene is best described as planar.
(d) The stability of benzene ring is much greater than the stability of 1,3,5-cycloheptatriene.

Answer. (a). Neither of the two Kekule structures for benzene has been isolated. No equilibrium exists between these two structures because they are resonance structures, differing only in the positions of electrons.

4. The carbon atoms in a benzene ring are :
(a) *sp* hybridized
(b) sp^3 hybridized
(c) sp^2 hybridized
(d) None of these

Answer. (c)

5. Which of the following compounds uses only sp^2 hybridized carbons for bond formation ?

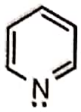
(a)  (b)  (c)  (d) 

Answer. (b)

6. The C–C bond length in benzene is
(a) greater than the C–C bond length in ethane.
(b) shorter than the C–C bond length in ethylene.
(c) Same as that of C–C bond length in ethylene.
(d) intermediate between C–C bond length in ethane and C–C bond length in ethylene.

Answer. (d)

7. Which of the following compounds is aromatic ?

(a)  (b)  (c)  (d) 

Answer. (b). Use the concept of aromaticity and Huckel rule to arrive at the correct answer.

8. Characteristic reactions of aromatic hydrocarbons are initiated by
(a) Electrophiles
(b) Nucleophiles
(c) Free radicals
(d) Uncharged molecules

Answer. (a)

9. Phenol on distillation with Zinc dust gives
(a) Phenylzinc
(b) Benzene
(c) Cyclohexanone
(d) Benzoic acid

Answer. (b)

10. Which of the following statements is *false* about toluene ?
(a) can be prepared by treating benzene with methyl chloride in the presence of $AlCl_3$.
(b) is converted to benzoic acid on refluxing with acidic $KMnO_4$ solution.
(c) on refluxing with concentrated H_2SO_4 gives a mixture of *ortho* and *para* toluenesulfonic acid.
(d) can be nitrated with concentrated nitric acid to give a mixture of *ortho* and *meta* nitrotoluene.

Answer. (d)

11. Which of the following reagents will react with methyl group rather than the benzene ring in methylbenzene ?
(a) Chlorine in the presence of uv light
(b) CH_3Cl in the presence of $AlCl_3$
(c) CH_3COCl in the presence of $AlCl_3$
(d) Hydrogen in the presence of nickel

Answer. (a)

12. Which of the following can be made by the action of CH_3Cl on benzene in the presence of aluminium chloride ?
(a) Ethylbenzene
(b) *o*-Xylene
(c) Chlrobenzene
(d) *m*-Xylene

Answer. (b)

13. For reactions of ethylbenzene, the ethyl group is considered :
(a) *ortho* director
(b) *ortho-para* director
(c) *meta* director
(d) *ortho-meta* director

Answer. (b)

14. Toluene reacts with bromine in the presence of uv light to give
(a) *m*-Bromotoluene (b) Benzyl bromide
(c) *o*-Bromotoluene (d) Benzoyl bromide

Answer. (b)

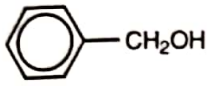
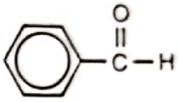
15. Toluene reacts with chlorine in the presence of $AlCl_3$ to give
(a) *o*-Chlorotoluene (b) *o*- plus *p*-Chlorotoluene
(c) *m*-Chlorotoluene (d) *o*- plus *m*-Chlorotoluene

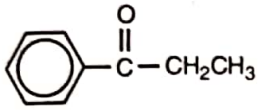
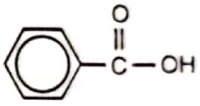
Answer. (b)

16. Toluene undergoes oxidation to give
(a) Benzyl alcohol (b) Quinone
(c) Benzaldehyde (d) Benzoic acid

Answer. (d)

17. Ethylbenzene undergoes oxidation with acidic potassium dichromate to give

(a)  (b) 

(c)  (d) 

Answer. (d)

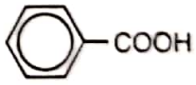
18. Oxidation of cumene with acidic $K_2Cr_2O_7$ gives
(a) Phenylacetic acid (b) Benzaldehyde
(c) Benzyl alcohol (d) Benzoic acid

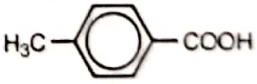
Answer. (d)

19. Oxidation of toluene with chromyl chloride gives benzaldehyde. This reaction is known as
(a) Perkin reaction (b) Benzoin condensation
(c) Etard's reaction (d) Ozonolysis

Answer. (c)

20. Oxidation of *p*-xylene with acidic potassium dichromate gives

(a)  (b) 

(c)  (d) 

Answer. (a)

21. Cresols on distillation with zinc dust gives
(a) *o*-Xylene (b) Benzene
(c) *o*- plus *p*-Xylene (d) Toluene

Answer. (d)

22. Benzene undergoes substitution reaction more easily than addition reaction because
(a) it has a cyclic structure (b) it has three double bonds
(c) it has six hydrogen atoms (d) there is delocalization of electrons

Answer. (d)

23. Benzene reacts with concentrated HNO_3 in the presence of concentrated H_2SO_4 to give nitrobenzene. This reaction is an example of
(a) Electrophilic addition (b) Nucleophilic addition
(c) Electrophilic substitution (d) Nucleophilic substitution

Answer. (c)

24. Which of the following agents is used in order to make benzene react with concentrated nitric acid to give nitrobenzene ?
(a) Concentrated H_2SO_4 (b) $FeCl_3$ catalyst
(c) Lindlar's catalyst (d) Ultraviolet light

Answer. (a)

25. Which of the following agents is used in order to make benzene react with acetyl chloride to give acetophenone ?

(*a*) Ultraviolet light
(*b*) $AlCl_3$ catalyst
(*c*) Platinum catalyst
(*d*) Al_2O_3 catalyst

Answer. (*b*)

26. Which of the following agents is used in order to make benzene react with bromine to give bromobenzene ?

(*a*) Ultraviolet light
(*b*) Fe catalyst
(*c*) Nickel catalyst
(*d*) Al_2O_3 catalyst

Answer. (*b*)

27. In the Friedel-Craft acetylation of an aromatic ring, the role of the $AlCl_3$ is to

(*a*) Form a $CH_3-\overset{\overset{O}{\|}}{\underset{+}{C}}$ ion.
(*b*) Function as a Lewis base
(*c*) Chlorinate the aromatic ring
(*d*) Withdraw electrons from the aromatic ring

Answer. (*a*)

28. The electrophile which is considered to be the active agent in the nitration of benzene is

(*a*) NO_2^- (*b*) NO^+ (*c*) NO_2^+ (*d*) HNO_2^+

Answer. (*c*)

29. In chlorination of benzene, $FeCl_3$ is used to generate

(*a*) Cl^- (*b*) Cl^+ (*c*) Cl_2 (*d*) HCl

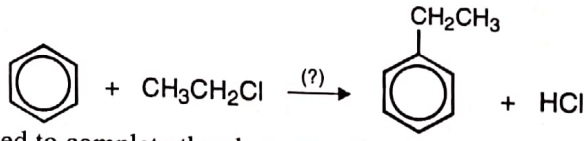
Answer. (*b*)

30. In sulfonation of benzene, the attacking species is

(*a*) H^+ (*b*) SO_2 (*c*) SO_3 (*d*) HSO_4^-

Answer. (*c*)

31. Consider the following reaction :



The catalyst used to complete the above reaction is

(*a*) $LiAlH_4$ (*b*) $AlCl_3$ (*c*) Na (*d*) KOH

Answer. (*b*)

32. Benzene reacts with H_2 at 150°C at 30 atm in the presence of Ni catalyst to give

(*a*) Cyclohexane
(*b*) Cyclohexene
(*c*) *n*-Hexane
(*d*) No reaction occurs

Answer. (*a*)

33. Benzene reacts with chlorine in the presence of $FeCl_3$ catalyst to form

(*a*) Hexachlorobenzene
(*b*) Chlorobenzene
(*c*) Hexachlorocyclohexane
(*d*) Benzyl chloride

Answer. (*b*)

34. Benzene reacts with acetic anhydride in the presence of $AlCl_3$ to form

(*a*) Acetophenone
(*b*) Benzophenone
(*c*) Phenylacetic acid
(*d*) Phenyl acetate

Answer. (*a*)

35. Benzene reacts with benzoyl chloride in the presence of anhydrous aluminium chloride to form

(*a*) Benzyl chloride
(*b*) Benzaldehyde
(*c*) Benzal chloride
(*d*) Benzophenone

Answer. (*d*)

36. Benzene undergoes Friedel-Crafts reaction with isopropyl alcohol in the presence of H_2SO_4 catalyst to give

(*a*) *n*-Propylbenzene
(*b*) Benzophenone
(*c*) Isopropylbenzene
(*d*) Nothing happens

Answer. (*c*)

37. Benzene reacts with propene in the presence of H_2SO_4 catalyst to give
(a) *n*-Propylbenzene (b) Benzophenone
(c) Cumene (d) Nothing happens

Answer. (c)

38. Ozonolysis of benzene gives
(a) Formic acid (b) Glyoxal
(c) Formaldehyde (d) Glycine

Answer. (b)

39. Gammexane is
(a) Hexachloroethane (b) DDT
(c) Hexachlorocyclohexane (d) TNT

Answer. (c)

40. Under what reaction conditions does the electrophilic chlorination of aromatic compounds usually occur ?
(a) $Cl_2, AlCl_3$ (b) Cl_2, H_2O (c) Cl_2, CCl_4 (d) NaCl, H_2O

Answer. (a)

41. Which of the following is an *incorrect* statement about the bromination of benzene by Br_2 and $FeBr_3$?
(a) $FeBr_3$ functions to increase the electrophilicity of Br_2.
(b) Formation of the sigma complex is the rate-determining step of the mechanism.
(c) The carbanionic intermediate is resonance stabilized.
(d) There are two carbon-containing intermediates in the mechanism.

Answer. (c)

42. Which of the following is the best choice of reagents to effect the electrophilic iodination of an aromatic ring ?
(a) KI, acetone (b) I_2, CH_3CN (c) KI, HNO_3 (d) I_2, HNO_3

Answer. (d)

43. Which of the following is another name for cyclobutadiene ?
(a) [2]annulene (b) [4]annulene (c) [6]annulene (d) Antibenzene

Answer. (b)

44. What is the major difference between an *antiaromatic* and *aromatic* compound ?
(a) Antiaromatic compounds have at least one sp^3 hybridized atom in the ring
(b) Antiaromatic compounds can assume a chair-like structure while aromatic compounds are nearly flat
(c) Aromatic compounds cannot have a charged atom in the structure
(d) Only aromatic compounds follow Huckle's rule.

Answer. (d)