

PROCESS TECHNOLOGY- ORGANIC II

51. Gas phase dehydrogenation of ethyl-benzene to styrene occurs over catalyst based on –

- (a) iron oxide, (b) silica – alumina,
(c) titanium dioxide, (d) sodium silicate,

52. Dehydrogenation of ethyl-benzene to styrene is an endothermic and reversible reaction. The reaction is favored at –

- (a) high temperatures,
(b) low temperatures,
(c) a moderate temperature of around 250⁰C,
(d) low temperature and high pressures,

[Note : Since the reaction is reversible and endothermic, high temperatures are favorable both to the rate of reaction and the position of equilibrium. However, at temperatures above about 6100C, thermal cracking of ethyl-benzene occurs at a significant rate and lowers the yield of styrene. A temperature above 6100C should therefore be avoided in the dehydrogenation reactor]

53. Feed to a dehydrogenation reactor (for manufacture of styrene) is a mixture of ethyl-benzene and steam (why is steam used ?) in the molar ratio of about –

- (a) 1 : 1, (b) 1 : 2, (c) 1 : 4, (d) 1 : 14

[Note : A large excess of steam is used as diluent in order to reduce the thermal cracking of ethyl-benzene to a minimum.]

54. “Perspex” or “Plexiglas” is basically –

- (a) Poly (vinyl chloride) (b) Poly (isobutylene),
(c) Poly (acrylonitrile), (d) Poly (methyl methacrylate)

55. Halcon process was invented by an American Company in 1968 for production of –

- (a) ethylene oxide, (b) acrylonitrile,
(c) propylene oxide, (d) tert-butyl hydroperoxide,

56. Basic raw materials for the production of methyl-isobutyl ketone is/are –

- (a) acetone and ethylene (b) acetaldehyde and ethylene,
(c) propylene and isobutylketone (d) acetone and propylene

57. Which of the following occurs in the Halcon process for the production of propylene oxide ?

- (a) liquid - phase free - radical oxidation,
(b) solid – catalyzed gas – phase oxidation,
(c) melt-catalyzed gas-liquid reaction whereby oxidation occurs,
(d) oxidation by nitric acid in the liquid phase,

58. There are two versions of the Halcon process for production of propylene oxide. The basic difference between the two is that they use different peroxides for per-oxidation of propylene. Now find which of the following peroxides are used in the Halcon process ?

- (a) cumene hydroperoxide, (b) dodecylbenzene hydroperoxide,
(c) ethylbenzene hydroperoxide, (d) none of the foregoing,

59. In the Halcon process for manufacture of propylene oxide, when tert-butyl hydroperoxide is used for per-oxidation of propylene, tert-butyl alcohol is formed as a coproduct along with propylene oxide. When ethyl-benzene hydroperoxide is used for per-oxidation, the co-product formed is –

- (a) carbinol, (b) ethanol,
(c) benzylalcohol, (d) phenylmethylcarbinol,

60. In question no. (59) the compound phenylmethyl carbinol has been mentioned. Phenylmethyl carbinol, on dehydration, gives –

- (a) styrene, (b) L-methyl styrene,
(c) cumene, (d) benzene,

61. Acrylonitrile is produced by “am oxidation” of –

- (a) ethylene, (b) propylene,
(c) isobutylene, (d) styrene,

62. Electrolytic hydrodimerization of acrylonitrile produces :

- (a) hydrocyanic acid, (b) poly (acrylonitrile),
(c) adiponitrile, (d) hexamethylene diamine,

[Note : Adiponitrile is an important intermediate in Nylon 66 production]

63. Propylene, in presence of acidic catalysts like solid phosphoric acid catalysts, yields –

- (a) polymers of propylene, (b) only dimer of propylene,
(c) mainly propylene trimer and tetramer,
(d) all of the foregoing depending on reaction temperature,

64. Propylene, on hydration in presence of acidic ion exchange resin catalyst, produces isopropyl alcohol. This alcohol on dehydrogenation gives –

- (a) propylene oxide, (b) ethylene oxide,
(c) methanol (d) acetone,

65. The major use of propylene tetramer is in the manufacture of –

- (a) surface-active agents, benzene and propylene tetramer reacting to give dodecyl benzene which is subsequently sulfonated to produce dodecylbenzene
(b) plasticizer alcohol by Oxo process,
(c) petroleum additives, (d) solvents used by paint industry,

66. C₄-stream obtained on cracking of naphtha and gas oil consist of the following components : isobutane, isobutene, linear butenes – 1 – butene, in-2-butene and trans-2-butene, n-butane and butadiene. Now butadiene is separated from the other components of the C₄-stream by –

- (a) ordinary distillation, (b) reactive distillation,
(c) azeotropic distillation, (d) extractive distillation,

67. In the extractive distillation process for separation of butadiene from C₄-mixture, a polar solvent that interacts with the conjugated T-electron system of butadiene is employed. Which of the following solvents are commonly used ?

- (a) methanol/acetonitrile/ furfural/dimethyl formamide/ N-methylpyrrolidone,
(b) acetone/ methyl isobutyl ketone/isopropyl alcohol
(c) acetaldehyde/isobutaldehyde

68. Manufacture of styrene-butadiene rubber (SBR) is one case where butadiene is consumed to a large extent. SBR is used mainly in making –

- (a) carry-bags, (b) toys,
(c) tyres, (d) erasers (for removing pencil marks)

69. Nitrile rubber is a copolymer of –

- (a) butadiene and acetonitrile, (b) butadiene and adiponitrile,
(c) butadiene and acrylonitrile, (d) butadiene, styrene and adiponitrile,

70. The monomer for neoprene, one of the earliest synthetic rubbers, is –

- (a) butadiene, (b) chloroprene,
(c) 1 - butene, (d) propylene,

71. Maleic anhydride can be produced by gas-phase oxidation of –

- (a) n-butenes, (b) isobutene,
(c) ortho-xylene, (d) naphthalene,

72. The main chemical use of n-butenes is in the manufacture of –

- (a) polybutenes, (b) M.T.B.E.
(c) secondary-butylalcohol and methylethyl ketone,
(d) maleic anhydride,

73. Butyl rubber is a copolymer of –

- (a) 1-butene with a small amount of isobutene,
(b) isobutene with a small amount of 2-methylbutadiene (isoprene)
(c) butadiene with a small amount of propylene,
(d) 1-butene with a small amount of butadiene,

74. Which of the following variety of rubber has a very low permeability for gases and finds application in tyre inner tubes?

- a) Neoprene
b) Styrene butadiene rubber
c) Nitrile rubber(copolymer of butadiene and acrylonitrile)
d) Butyl rubber

75. From a C₄ stream consisting of isobutene and linear butanes , isobutene is separated by

- a) fractional distillation

- b) extractive distillation
- c) solvent extraction
- d) selective reaction

76. Methyl tertiary butyl ether produced by an acid catalyzed reaction of methanol with isobutene is

- a) an octane improver of gasoline
- b) a plasticizer
- c) a defoaming reagent
- d) a liquid detergent

77. Aromatic hydrocarbons, such as, benzene, toluene and xylene (BTX), are produced in the USA chiefly by –

- (a) thermal cracking (of gas oil) (b) catalytic cracking,
- (c) catalytic reforming, (d) both (a) and (c),

78. Prior to catalytic reforming naphtha is hydrodesulphurized by a process called ‘hydrodesulphurization’ in order to remove sulfur from it. Why is removal of sulfur essential? Because –

- (a) presence of sulfur in naphtha causes substantial corrosion of the reformer material of construction,
- (b) presence of sulfur promotes formation of ortho-xylene and the yield of benzene is reduced,
- (c) presence of sulfur in naphtha makes reforming catalyst usually active so that coke formation on the surface of the catalyst occurs,
- (d) presence of sulfur poisons reforming catalyst

79. The catalyst used for reforming is a dual-function catalyst consisting of –

- (a) silver supported on silica, (b) iron oxide and potassium oxide,
- (c) platinum, often promoted with rhenium on halogenated-alumina support,
- (d) none of the above

80. Aromatic hydrocarbons are separated from alkanes and cycloalkanes by –

- (a) fractional distillation, (b) solvent extraction,
- (c) adsorption onto activated carbon, (d) azeotropic distillation,

81. Common solvents used for separation of aromatics from a mixture of aromatics, alkanes and cycloalkanes are –

- (a) sulfolane, (b) tert-octyl primary amine,
- (c) methyl isobutyl ketone, (d) tetraethylene glycol,

82.

83. Important reactions occurring in catalytic reforming are –

- (a) dehydrogenation, dehydro isomerization and dehydrocyclization

(b) oxidation, isomerization and cyclization

84. Major reactions occurring in the catalytic reforming process are –

(a) irreversible, (b) reversible,
(c) definitely either of the two above, but nothing much is reported about the reforming reactions in literature; whether the reaction are reversible or irreversible is, therefore, not known. Hence no prediction is possible.

85. Feed to a catalytic reformer is –

(a) hydrocarbon vapor, (b) liquid hydrocarbon and hydrogen gas,
(c) hydrocarbon vapor and nitrogen in a molar ratio of 1: 4,
(d) hydrocarbon vapor and hydrogen in a molar ratio of around 1: 6,

86. Typical operating conditions of a reformer are –

(a) 10 to 35 atm pressure and 450⁰ to 550⁰C temperature,
(b) 0.5 to 1 atm pressure and 450⁰ to 550⁰C temperature,
(c) 125 to 150 atm pressure and 450⁰ to 550⁰C temperature,
(d) 125 to 150 atm pressure and 150⁰ to 225⁰C temperature,

87. Of the reforming reactions, the aromatic – forming reactions (which are accompanied by hydrogen production) are reversible. Elevated pressure and presence of hydrogen in the system should have an adverse effect on the position of equilibrium in the reversible reaction. In spite of this, reforming reactions are conducted under high pressure and in hydrogen atmosphere. Why ?

(a) Because high pressure and presence of hydrogen gives good selectivity for benzene,
(b) Because high partial pressure of hydrogen reduces coke formation on the reforming catalyst,
(c) Because high partial pressure of hydrogen eliminates coke formation on the catalyst entirely and the catalyst regeneration step is no longer necessary, thereby causing a large saving in the operational cost,
(d) Vapors of hydrocarbons are easily flammable. Presence of hydrogen and high operating pressure maintain an inert atmosphere within the reformer. Any untoward accident due to flame and explosion can thus be avoided.

88. Reforming catalysts get deactivated because of coke deposition on the surface. Catalyst regeneration is accomplished by –

(a) washing the catalyst with an organic solvent and subsequently drying it by hot air,
(b) grinding the deactivated catalyst, separating carbon from the catalyst by floatation and then remaking the catalyst,
(c) simply burning off the coke deposited on the catalyst surface,

89. Of the isomeric xylenes, which one is of least importance (from user point of view) ?

(a) ortho – xylene, (b) meta – xylene,

(c) para – xylene,

(d) all are of equal importance,

90. Para – xylene can be separated from a mixture of meta and para – xylenes by –

(a) fractional distillation and solvent extraction

(b) fractional crystallization and selective adsorption

91. Is there any process now operating which isomerizes m - xylene to produce o – and p – xylenes ?

(a) No such process is operating, no research work has been done in the area also,

(b) Some research has been done in this area; but no break through has been achieved so far,

(c) There is a liquid-phase process, but the process has been so expensive that it has not been exploited commercially,

(d) There is a vapor phase process using a silica – alumina catalyst operating at about 550⁰C. Such a process is operating also.

92. Reformate from a catalytic reformer will have an octane number –

(a) higher than that of the feed hydrocarbon,

(b) lower than that of the feed hydrocarbon,

(c) approximately equal to that of the feed hydrocarbon,

(d) that cannot be predicted without additional information.

93. During catalytic reforming, any sulfur and nitrogen – bearing compounds present are converted to H₂S and NH₃. H₂S occupies the Pt-sites of the reforming catalyst, and deactivates the catalyst. Sulfur-compounds are, therefore, removed from naphtha prior to catalytic reforming. Do you think it is necessary to remove nitrogen also from naphtha before reforming is done ?

(a) No, NH₃ does not interact with reforming catalyst, its removal, therefore, is not necessary,

(b) Presence of improves the catalytic activity. Removal of nitrogen from naphtha is, therefore, counterproductive from the point of view of ease of reforming.

(c) Yes, NH₃ being basic, interacts with the acid-sites of the reforming catalyst and thus deactivates the catalyst. Removal of nitrogen from naphtha prior to reforming is, therefore, essential.

94. Which of the following xylenes, on oxidation, produces phthalic anhydride ?

(a) ortho–xylene,

(b) meta-xylene,

(c) para-xylene,

(d) none of the above; the starting material for production of phthalic anhydride by oxidation is ethyl-benzene.

95. Cyclohexane is made by catalytic hydrogenation of

(a) acetylene,

(b) ethylene,

(c) benzene,

(d) phenol,

96. The reaction, benzene to cyclohexane, is reversible. High equilibrium conversion of benzene to cyclohexane is favored by –

- (a) low temperature and high hydrogen partial pressure
- (b) high temperature and low hydrogen partial pressure and

97. Cyclohexanol is produced commercially by –

- (a) hydrogenation of cyclohexanone, (b) oxidation of cyclohexane,
- (c) oxidation of benzene, (d) decomposition of benzoic acid,

98. Cyclohexanol & cyclohexanone, produced commercially by oxidation of cyclohexane are

- (a) used in the manufacture of nylon intermediates,
- (b) used in the manufacture of terylene intermediates,
- (c) used in the manufacture of poly carbonates,
- (d) used in the manufacture of alkyd resins,

99. Cyclohexanol/cyclohexanone mixture, on oxidation with nitric acid, produces --

- (a) benzoic acid, (b) terephthalic acid,
- (c) adipic acid, (d) none of the foregoing,

100. Adipic acid, on reaction with ammonia in presence of a dehydrating catalyst, produces –

- (a) ethylene diamine, (b) caprolactam,
- (c) hexamethylene diamine, (d) adiponitrile,

51a, 52a, 53d, 54d, 55c, 56d, 57a, 58c, 59d, 60a, 61b,
62c, 63c, 64d, 65b, 66b, 67a, 68c, 69c, 70b, 71a, 72c,
73b, 74d, 75d, 76a, 77c, 78d, 79c, 80b, 81a, 82b, 83a,
84b, 85c, 86a, 87b, 88c, 89b, 90b, 91d, 92a, 93c, 94a,
95c, 96a, 97b, 98a, 99c, 100d.

❖ For Full Book, corrections and information. You may contact at:

The Gate Coach
www.thegatecoach.com
delhi.tgc@gmail.com
(+91) 9818652587 , 9873452122