

Chemical Technology/Process Technology (Organic I sheet)

1. Petrochemicals are chemicals

- a) obtained from petroleum and natural gas and made on large scale
- b) used for tertiary oil recovery
- c) added to crude petroleum for processing before it is fed to the distillation column for refining
- d) added to gasoline and other fuels in order to improve their properties

2. In terms of tonnage, percentage of total organic chemicals manufactured at present based on Petroleum and natural gas, is around –

- (a) 50, (b) 70, (c) 80, (d) 95,

3. It is generally agreed that the development of petrochemical industry started in the year

- (a) 1900, (b) 1920, (c) 1930, (d) 1942,

When the Standard Oil Company of New Jersey, USA, started manufacturing isopropyl alcohol from propylene.

4. Massive developments in scale of operation and in process technology in petrochemical industry occurred in –

- (a) 1930s, (b) 1940s,
- (c) 1950s, (d) 1960s,

5. Crude oil is made up mainly of –

- (a) alkanes, cycloalkanes and aromatics
- (b) alkanes, aldehydes and ketones
- (c) alkanes, alkenes and alkynes

6. Naphthenes are the same as –

- (a) branched alkanes, (b) cycloalkanes,
- (c) alkenes, (d) alkynes,

7. Cycloalkanes present in crude oil contain :

- (a) only four membered ring compounds,
- (b) only five membered ring compounds,
- (c) only five and six membered ring compounds,
- (d) none of the foregoing,

8. Dry natural gas contains mainly –

- (a) methane (plus small amount other components)
- (b) ethane, (c) propane, (d) butane,

9. Wet natural gas contains substantial amount of –

- (a) ethane (b)propane
- (c) butane (d) all of the above

10. The gas fields are usually

- (a) usually dry (b) usually wet,

11. The first major operation in petroleum refining is fractional distillation of crude oil whereby the different petroleum fractions as given below are obtained. In terms of boiling point range

(i) which one is the lightest fraction?

(ii) which fraction comes before naphtha?

(iii) which fraction comes before gas oil?.

- (a) light gasoline, (b) kerosene,
- (c) light gases, (d) Naphtha,

- (e) Atmospheric residue, (f) gas oil,
12. Light gasoline has an approximate boiling point range of –
(a) 20 to 75 °C, (b) 75 to 200 °C,
(c) 200 to 250 °C, (d) 250 to 350 °C,
13. In petrochemical industry, any petroleum fraction having an approximate boiling point range between 20 °C and 200 °C which is used as a feedstock is called –
(a) kerosene, (b) gas oil,
(c) naphtha, (d) none of the foregoing,
14. Naphtha having an approximate boiling point range of 20 °C to 200 °C contain compounds having –
(a) 1 to 6 carbon atoms, (b) 4 to 12 carbon atoms,
(c) 8 to 16 carbon atoms, (d) 16 carbon atoms and higher,
15. A good quality gasoline should have correct volatility characteristics and correct burning characteristics. Correct burning characteristics are expressed by –
(a) aniline point, (b) cetane number,
(c) octane number, (d) none of the foregoing,
16. Fuels required by most modern car engines should have an octane number in the range between –
(a) 50 and 60, (b) 65 and 75,
(c) 80 and 85, (d) 90 and 98,
17. In petrochemical industry, thermal cracking or steam cracking process is used to produce mainly –
(a) ethane, (b) ethylene,
(c) benzene, (d) styrene,
18. The steam reforming process employed in petrochemical industry produces mainly --
(a) benzene, toluene and xylene, (b) n-butenes, butadiene and styrene,
(c) carbon monoxide and hydrogen, (d) carbon dioxide and ethylene,
19. Which of the following processes is employed in petrochemical industry to produce benzene, toluene and xylene (BTX) ?
(a) thermal cracking, (b) catalytic reforming,
(c) steam reforming, (d) catalytic cracking,
20. Main feed stocks used for the manufacture of ethylene by thermal cracking process are –
(a) ethane, propane (b) naphtha and gas oil
(c) butane to a minor extent, (d) all of the foregoing,
21. In petrochemical industry thermal cracking of hydrocarbons to produce ethylene is accomplished in cracking furnace and the feed to the cracking furnace is a mixture of –
(a) hydrocarbon and nitrogen which acts as an inert diluent,
(b) hydrocarbon and carbon dioxide which acts as an inert diluent,
(c) hydrocarbon and steam which acts as an inert diluent,
(d) hydrocarbon and air which acts as an inert diluent,
22. As the molecular weight of the hydrocarbon feed to the cracking furnace increases (from ethane to gas oil), the proportion of steam in the feed –
(a) decreases, (b) increases,
(b) remains unchanged (at a constant value),
23. Modern thermal crackers (used for manufacture of ethylene) have capacities in the

range of –

- (a) 5000 to 10000 tones per annum, (b) 25000 to 50000 tones per annum,
(c) 50000 to 100000 tones per annum, (d) 200000 to 650000 tones per annum,

24. Thermal cracking involves –

- (a) free radical chain reactions predominantly,
(b) reactions involving carbocations,
(c) reactions which are photochemical in nature,
(d) reactions nature of which has hitherto not been known,

25. Under otherwise uniform conditions yield of ethylene from a thermal cracker will be

- (a) lower than that obtained from a catalytic cracker,
(b) equal than that obtained from a catalytic cracker,
(c) higher than that obtained from a catalytic cracker,
(d) none of the above; thermal cracking and catalytic cracking are two distinctly different processes involving different fundamental cracking reactions. Performance wise the two processes can never be compared.

26. Catalytic cracking involves –

- (a) free radical chain reactions as in thermal cracking,
(b) reactions involving carbocations,
(c) reactions involving carbanions,
(d) reactions chemistry of which still remains unknown.

27. Under otherwise uniform conditions, branched chain alkanes and cycloalkanes, on thermal cracking, will yield –

- (a) higher amount of ethylene compared to the straight chain alkanes,
(b) almost the same amount of ethylene compared to the straight chain alkanes,
(c) lower amount of ethylene compared to the straight chain alkanes,
(d) ethylene and other products; the amount of ethylene produced cannot be compared with the amount of ethylene produced from straight-chain alkane feed simply because such a comparison does not exist in literature and there is no method by which ;such an information; can be obtained theoretically.

28. You know thermal cracking involves free radical chain reactions. Now in order to achieve highest yield of ethylene from a thermal cracker which of the following reactions will you try to promote ?

- (a) B-scission reaction, (b) chain transfer reactions,
(c) chain termination reactions, (d) all of the foregoing,

29. In reactions involved in thermal cracking process chain transfer and chain termination reactions are bimolecular whereas B-scission reactions are unimolecular. In order to increase the yield of ethylene, the rates of chain transfer and chain termination reactions should be reduced relative to the rates of B-scission reactions and this may be achieved by carrying out thermal cracking at reduced pressure. Thermal crackers or cracking furnaces, however, are not operated at reduced absolute pressure because of safety considerations. Instead the hydrocarbon partial pressure in the cracking furnace is maintained at a low value by using –

- (a) steam as a diluent, (b) nitrogen as a diluent,
(c) CO₂ as a diluent, (d) helium as a diluent,

30. Why cracking furnaces are not operated at reduced absolute pressure ?

- (a) Because creating and maintaining reduced pressure in the furnace is a

problem,

- (b) If leakage occurs, air could be sucked into the cracking tubes and an explosive mixture could be formed.
- (c) The rate of cracking is too large to be managed,
- (d) Severe carbon formation occurs and this carbon gets deposited on the furnace tubes causing fouling.

31. The most important outlet for ethylene is the manufacture of –

- (a) ethylene oxide, (b) styrene,
- (c) vinyl chloride, (d) polyethylene,

32. Ethylene production capacity in the USA in 1990 was around –

- (a) 20 billion lb, (b) 31 billion lb,
- (c) 41 billion lb, (d) 55 billion lb,

33. By 1997 ethylene production capacity in the USA will cross –

- (a) 43 billion lb mark, (b) 50 billion lb mark,
- (c) 60 billion lb mark, (d) 73 billion lb mark,

34. Ethylene demand in Asia in the year 1992 was around –

- (a) 10 billion lb, (b) 20 billion lb
- (c) 30 billion lb, (d) 40 billion lb,

35. World ethylene demand in the year 1992 was around –

- (a) 80 billion lb, (b) 100 billion lb,
- (c) 136 billion lb, (d) 197 billion lb,

36. By 1997 Asian ethylene demand will jump to approximately –

- (a) 36 billion lb, (b) 45 billion lb,
- (c) 55 billion lb, (d) 65 billion lb,

37. Which of the following polymers of ethylene was introduced into the market in the late 1970s ?

- (a) low density polyethylene (LDPE), (b) high density polyethylene (HDPE),
- (c) linear low density polyethylene (LLDPE), (d) none of the foregoing,

38. LDPE is manufactured by free radical polymerization of ethylene : reaction temperatures are in the range of 800C to 3000C and pressures are in the range of 1000 to 3000 atm. Initiator used in the polymerization reaction is –

- (a) dodecyl mercaptans, (b) ethylene oxide or fluorine,
- (c) oxygen or an organic peroxide, (d) none of the foregoing,

39. Linear low density polyethylene is made by co-polymerizing ethylene with small amount of

- (a) propylene, (b) isobutene,
- (c) isoamylene, (d) 1-alkenes such as 1-butene or 1-hexene,

40. High density polyethylene (HDPE) is produced by a process –

- (a) similar to that used for the production of LDPE,
- (b) Called co-ordination or Ziegler polymerization,
- (c) called Clans process, (d) called Halcon process,

41. Catalyst systems introduced by Ziegler consist of –

- (a) HF – BF₃ combination,
- (b) HF – AlCl₃ mixture,
- (c) complexes formed from aluminum alkyls and transition metal halides, typically (C₂H₅)₃Al and TiCl₄.

- (d) none of the foregoing,
42. Which of the following ethylene polymers will you recommend for making buckets and washing-up bowls ?
- (a) LDPE, (b) HDPE, (c) Linear LDPE,
(d) none of the foregoing; I will recommend polystyrene for the said purpose
43. Ethylene oxide is produced by oxidation of ethylene by air or oxygen at temperatures in the range of 2500 to 3300C in presence of a catalyst which is –
- (a) silver on a solid support such as alumina or silicon carbide,
(b) copper on r – alumina, (c) finely divided nickel,
(d) platinum on carbon,
44. The most important use of ethylene oxide (EO) is in the manufacture of –
- (a) Ethanol amines by reaction of EO with NH_3 .
(b) Ethylene glycol by reaction of EO with water.
(c) Non-ionic surface-active agents by reaction of EO with alcohols, phenols, and/or amines,
(d) None of the above; it is chiefly used as a sterilant for plastic materials in hospitals,
45. The major uses of ethylene glycol are –
- (a) as antifreeze agents in automobiles and as a raw material in the manufacture of poly (ethyleneterephthalate)
(b) as a plasticizer
(c) as an antioxidant (d) all of the above
46. Raw materials for the production of styrene are –
- (a) benzene and ethylene, (b) toluene and propylene,
(c) toluene and ethanol, (d) m-xylene and ethylene,
47. You know styrene readily polymerizes; now in order to inhibit polymerization of styrene which of the following chemicals is usually added to it and at what concentration level ?
- (a) dioctylphthalate; 50 ppm, (b) p-tert-butylcatechol; to ppm,
(c) acetic acid; 5 ppm, (d) hydroquinone; 100 ppm,
48. Ethylation of benzene (to produce ethylbenzene) is conducted either in liquid phase or in vapor phase. The liquid phase process is conducted at temperatures ranging from about 800C to 1300C and pressures from normal atmospheric to about 9 atm. The catalyst employed in the liquid phase ethylation of benzene is –
- (a) zeolite,
(b) solid phosphoric acid,
(c) super-acidic Nafion NR 50,
(d) aluminum chloride promoted by either hydrogen chloride or ethylchloride
49. The gas phase process for ethylation of benzene, called Mobil – Badger process, carried out at about 4200C and 12 to 20 atm pressure employs as catalyst –
- (a) r – alumina, (b) macroporous cation exchange resin,
(c) zeolites, (d) dispersed platinum on a porous carbon support,
50. The main problem in the liquid phase process for ethylation of benzene is that –
- (a) the yield of ethyl-benzene is very low,
(b) the quality of the product is poor,
(c) the reaction mixture is very corrosive and this makes plant construction and

maintenance difficult,
(d) all of the foregoing,

Answers

1a,2d,3b,4d,5a,6b,7c,8a,9d,10a,11c,11ia,11iiib,12a,13c,14b,15c,16d,17b,18c,19b,20d
21c,22b,23d,24a,25c,26b,27c,28a,29a,30b,31d,32c,33b,34c,35c,36b,37c,38c,39d,40b,41c
42b,43a,44b,45a,46a,47c,48d,49c,50c.

