Sl. No.

012064

DICH

Register Number

2012
CHEMICAL TECHNOLOGY

Time Allowed : 3 Hours]

[Maximum Marks : 300

Read the following instructions carefully before you begin to answer the questions.

IMPORTANT INSTRUCTIONS

1. This Booklet has a cover (this page) which should not be opened till the invigilator gives signal to open it at the commencement of the examination. As soon as the signal is received you should tear the right side of the booklet cover carefully to open the booklet. Then proceed to answer the questions.

2. This Question Booklet contains **200** questions.

3. Answer **all** questions.

4. **All** questions carry equal marks.

5. You must write your Register Number in the space provided on the top right side of this page. Do not write anything else on the Question Booklet.

6. An Answer Sheet will be supplied to you separately by the Invigilator to mark the answers. You must write your Name, Register No., Question Booklet Sl. No. and other particulars on side 1 of the Answer Sheet provided, failing which your Answer Sheet will not be evaluated.

7. You will also encode your Register Number, Subject Code, Question Booklet Sl. No. etc., with Blue or Black ink Ball point pen in the space provided on the side 2 of the Answer Sheet. If you do not encode properly or fail to encode the above information, your Answer Sheet will not be evaluated.

8. Each question comprises *four* responses (A), (B), (C) and (D). You are to select ONLY ONE correct response and mark in your Answer Sheet. In case you feel that there are more than one correct response, mark the response which you consider the best. In any case, choose ONLY ONE response for each question. Your total marks will depend on the number of correct responses marked by you in the Answer Sheet.

9. In the Answer Sheet there are **four** brackets [A] [B] [C] and [D] against each question. To answer the questions you are to mark with Ball point pen ONLY ONE bracket of your choice for each question. Select one response for each question in the Question Booklet and mark in the Answer Sheet. If you mark more than one answer for one question, the answer will be treated as wrong. *e.g.* If for any item, (B) is the correct answer, you have to mark as follows :

$$[A] \blacksquare [C] [D]$$

10. You should not remove or tear off any sheet from this Question Booklet. You are not allowed to take this Question Booklet and the Answer Sheet out of the Examination Hall during the examination. After the examination is concluded, you must hand over your Answer Sheet to the Invigilator. You are allowed to take the Question Booklet with you only after the Examination is over.

11. Failure to comply with any of the above instructions will render you liable to such action or penalty as the Commission may decide at their discretion.

12. Do not tick-mark or mark the answers in the Question Booklet.

13. The last sheet of the Question Booklet can be used for Rough Work.

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[Turn over

1. The number of moles in 8·516 g of ammonia is (molecular mass of ammonia is 17·031 amu)

    A) 0·5   B) 1·0

    C) 1·5   D) 2·0.

2. In formation of ammonia process, increase in pressure favours

    A) forward reaction   B) backward reaction

    C) no change   D) none of these.

3. $N_2 (g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$. This equation is an example of

    A) irreversible reaction   B) homogeneous equilibrium

    C) heterogeneous equilibrium   D) none of these.

4. For the reaction $CaCO_3 (s) \rightleftharpoons CaO (s) + CO_2 (g)$, k_p is equal to

    A) p_{CO_2} B) $[CO_2(g)]$

    C) 1   D) $- p_{CO_2}$.

5. In manufacture of ammonia by Haber's process, high pressure

    A) favours the formation of ammonia

    B) suppresses the formation of ammonia

    C) has no effect

    D) decreases and increases.

6. In a chemical equilibrium, the free energy will be

    A) maximum   B) negative

    C) positive   D) minimum.

7. For a reaction $2SO_2 + O_2 \rightleftharpoons 2SO_3$, Δn is

    A) zero   B) 10

    C) infinite   D) negative.

8. The statement "Under the same conditions of temperature and pressure, equal volume of all gases contain the same number of molecules" is known as

   A) Gay-Lussac's law

   B) Avogadro's hypothesis

   C) Boyle's law

   D) Graham's law of diffusion.

9. The number of water molecules present in 0·018 gm of water is 6·023 × ....

   A) 10^{23}

   B) 10^{20}

   C) 10^{26}

   D) 10^{19}.

10. Addition of hydrogen cyanide to a ketone in presence of sodium hydroxide yields

   A) cyanohydrin

   B) aldol

   C) acid

   D) amide.

11. Which of the following products is formed when two moles of ethyl alcohol reacted with phosphorous pentachloride ?

   A) Ethane

   B) Butane

   C) Ethyl chloride

   D) Butyl chloride.

12. Which of the following products is formed, when hydrogen iodide reacts with ethyl alcohol in presence of phosphorus at 423K ?

   A) Ethylene

   B) Propene

   C) Ethane

   D) Propane.

13. With an increase in temperature, the molarity of the solution

   A) decreases

   B) increases

   C) increases & decreases

   D) no change.

14. Normality of a solution is the number of

   A) parts by mass of the solute per hundred parts by mass of solution

   B) parts by volume of solute per hundred parts by volume of solution

   C) gram equivalents of the solute dissolved per litre of the solution

   D) gram equivalents of the solute dissolved in 100 ml of the solution.

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15. General electronic configuration of d-block elements is

   A) $(n-1)d^{1-10}\,ns^{1,2}$ B) $(n-2)d^{1-10}\,ns^{1,2}$

   C) $(n-2)f^{1-14}(n-1)d^{0-1}\,ns^2$ D) $nd^{1-10}\,ns^{1,2}$.

16. The number of elements in d-block is

   A)   14   B)   12

   C)   18   D)   32.

17. The IUPAC name of Rutherfordium (Rf) is

   A)   unnilpentium   B)   unnilhexium

   C)   unnilquadium   D)   unnilenium.

18. Air is approximately

   A) $\frac{1}{2}$ oxygen and $\frac{4}{5}$ nitrogen by volume

   B) $\frac{1}{5}$ oxygen and $\frac{4}{5}$ nitrogen by volume

   C) $\frac{4}{5}$ oxygen and $\frac{1}{2}$ nitrogen by volume

   D) $\frac{1}{2}$ oxygen and $\frac{1}{2}$ nitrogen by volume.

19. If a container of volume V contains n_1 moles of gas 1, n_2 moles of gas 2 and so on, then the partial pressure of gas 1 is given by

   A) $\dfrac{RT}{Vn_1}$ B) $\dfrac{R}{TVn_1}$

   C) $\dfrac{n_1RT}{V}$ D) $\dfrac{T}{RVn_1}$.

20. Absolute zero is

   A)   273·15 K   B)   373·15 K

   C)   25° C   D)   – 273·15° C.

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21. $-273.15°$ C corresponds to a limiting value of

A)   zero volume   B)   22·5 litres

C)   1000 ml   D)   1000 gm.

22. 5-10-5 fertilizers mean that they contain

A)   only 5% to 10% active fertilizer constituent

B)   5% to 10% filler, carrier of soil conditioner

C)   5%,10%, 5% respectively of N_2, P_2O_5 and K_2O

D)   none of these.

23. The main use of HCl is in the

A)   drilling of petroleum wells and pickling of steel sheets

B)   manufacture of cationic detergent

C)   treatment of spent fuel of nuclear reactor

D)   none of these.

24. Economy of Solvay process depends upon the efficiency of

A)   carbonating tower   B)   ammonia recovery

C)   ammoniation of salt solution   D)   none of these.

25. Contact process for the manufacture of sulphuric acid

A)   yields acid of higher concentration than chamber process

B)   yields acid of lower concentration than chamber process

C)   is obsolete

D)   eliminates absorber.

26. Solvay process is used for the preparation of

A)   soda ash   B) Na_2CO_3

C)   both (A) and (B)   D)   caustic soda.

27. In glass manufacture, the longer the .... period, the better the quality of the glass.

A)   shaping   B)   annealing

C)   melting   D)   sintering.

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28. Which is not a constituent of lacquers ?

   A)   Diluents   B)   Cellulose derivatives

   C)   Pigments   D)   Resins.

29. In paints, drying oil is used as

   A)   film forming constituent   B)   viscosity reducer

   C)   gelling preventer   D)   durability increaser.

30. Among the following pigments, which is not a white pigment ?

   A)   Titanium dioxide   B)   Zinc oxide

   C)   Lithopone   D)   Cadmium sulphide.

31. In optical glass manufacture, which of the following ingredients does not find specific application ?

   A)   Barium compounds   B)   Potassium carbonate

   C)   Red lead oxide   D)   Boric acid.

32. Which of the following parameters is not used to characterise cement ?

   A)   Setting time   B)   Le Chatelier expansion

   C)   Compressive strength   D)   Hardness.

33. Chalking, flaking, peeling refers to failure of

   A)   dyes   B)   paint

   C)   pigments   D)   varnishes.

34. Magnesia content in cement should

   A)   not exceed 5%   B)   not exceed 8%

   C)   exceed 4·5%   D)   none of these.

35. In manufacture of phosphate fertilizers, which of the following problems does not occur ?

   A)   Hydrofluoric acid handling

   B)   Dust pollution

   C)   Formation of hygroscopic calcium nitrate

   D)   Formation of biuret.

36. The content of nitrogen is ammonium sulphate is about

    A) 20% - 21% B) 40% - 45%

    C) 30% - 33% D) 7% - 10%.

37. Production of nitric acid from ammonia consists of two steps

    A) oxidation and stripping B) oxidation and absorption

    C) reduction and absorption D) reduction and evaporation.

38. Which one of the following does not belong to the class of diaphragm cells used for caustic soda production ?

    A) Dow cells B) Hooker cells

    C) Diamond alkali cells D) De Nora cells.

39. In the manufacture of caustic soda by lime-soda process, the reaction is given by

    $$Na_2CO_3 + Ca(OH)_2 \rightleftharpoons 2NaOH + CaCO_3$$

    By application of law of Mass Action, high conversion is obtained when the soda ash solution is

    A) concentrated B) dilute

    C) supersaturated D) saturated.

40. Nylon 6-6 is manufactured from

    A) hexamethylene diamine and adipic acid

    B) aminocaproic acid

    C) amino-undecanoic acid

    D) adipic acid and maleic anhydride.

41. Permanent hardness is due to the presence of

    A) chlorides and sulphides of calcium & magnesium

    B) calcium bicarbonates

    C) magnesium bicarbonates

    D) carbonate of iron.

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42. High pressure process uses oxygen as catalyst in the manufacture of

    A) LDPE   B) HDPE

    C) LLDPE   D) XLPE.

43. An additional step in the manufacture of paper from bagasse as compared to that from bamboo is

    A) depithing   B) digestion

    C) bleaching   D) none of these.

44. Cooking conditions in kraft pulp process are

    A) time : 2-5 hrs, temperature : 170°C - 176°C and pressure : 660 - 925 kPa

    B) time : 6-12 hrs, temperature : 125°C - 160°C and pressure : 620 - 755 kPa

    C) time : 36 - 48 minutes, temperature : 160°C - 180°C and pressure : 660 - 1100 kPa

    D) time : 1-2 hrs, temperature : 150°C-160°C and pressure : 600 - 660 kPa.

45. The catalyst used in the manufacture of HDPE by Ziegler process is

    A) chromic oxide

    B) aluminium triethyl combined with titanium tetrachloride

    C) aluminium triethyl combined with titanium dioxide

    D) molybdenum on alumina.

46. Oil is

    A) a mixture of glycerides

    B) a mixture of glycerides of fatty acids

    C) solid at normal temperature

    D) esters of alcohols other than glycerin.

47. Which of the following is not a use of citric acid ?

    A) Cleaning and polishing of iron and steel

    B) In preparation of alkyd resins, paints and lacquers

    C) In printing and textile industries

    D) In manufacture of mayonnaise.

48. The correct order of the tendency of fuel constituents to knock is :

A) aromatics > straight chain paraffins > olefins > branched chain paraffins > cycloparaffins

B) straight chain paraffins > branched chain paraffins > olefins > cycloparaffins > aromatics

C) aromatics > olefins > branched chain paraffins > cycloparaffins > straight chain paraffins

D) branched chain paraffins > cycloparaffins > olefins > aromatics > straight chain paraffins.

49. Which of the following processes yields coke ?

A) Pyrolysis   B) Visbreaking

C) Hydrocracking   D) Delayed coking.

50. Flexible foam (for mattresses) is usually made of

A) polypropylene   B) polyurethane

C) polyvinyl chloride   D) polyamide.

51. Beating the fibres using a Hollander beater makes the paper

A) stronger and uniform   B) more porous

C) less denser   D) less opaque.

52. The characteristic of pulp by sulphate process is

A) dull white colour

B) easy to bleach

C) strong fibres

D) less resistant to mechanical refining.

53. Nylon-6, 6 as compared to Nylon 6 is

A) harder   B) high melting point

C) less abrasive resistant   D) all of these.

54. A detergent is

   A) a catalyst promoter

   B) a surface tension lowering organic chemical

   C) a water softening agent

   D) a corrosion inhibitor.

55. Which of the following is a thermosetting polymer ?

   A) Epoxy resin   B) Polyethylene

   C) PVC   D) Polystyrene.

56. Thermoplastics are formed by

   A) addition polymerization   B) condensation polymerization

   C) copolymerization   D) all of these.

57. The polymer used in heart valves, blood filters, artificial heart etc. is

   A) Polyurethane   B) Polyethylene

   C) Polyvinyl chloride   D) Polyalkyl sulphone.

58. How much rust will be formed (Fe_2O_3, $3H_2O$) when 100 kg of iron have completely rusted away ?

   A) 191 kg   B) 19·1 kg

   C) 190 kg   D) 195 kg.

59. Crystallinity of high dense polyethylene is

   A) 80%   B) 55%

   C) 100%   D) 20%.

60. Example for a detergent is

   A) sodium lauryl sulphate   B) sodium stearate

   C) sodium oleate   D) potassium linoleate.

61. Polymer commonly used for making fibre/cloth is

   A) rubber   B) PVC

   C) nylon   D) bakelite.

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62. The device which converts mechanical energy into electrical energy is

   A)   electric motor   B)   generator

   C)   transformer   D)   electric fan.

63. The purest form of semiconductors is called

   A)   intrinsic semiconductors   B)   normal semiconductors

   C)   extrinsic semiconductors   D)   none of these.

64. In an electrical network, the law stating that "The algebraic sum of currents meeting at any junction at any instant is zero" is

   A)   Kirchhoff's current law   B)   Lenz's law

   C)   Kirchhoff's voltage law   D)   Faraday's first law.

65. Conductance is the reciprocal of

   A)   conductivity   B)   resistance

   C)   specific conductance   D)   specific resistance.

66. DC generator works on the principle of

   A)   Fleming's left hand rule   B)   Electromagnetic induction

   C)   Electromagnetic radiation   D)   Electrolysis.

67. Which is not a terminal of a transistor ?

   A)   Common base   B)   Common projector

   C)   Common emitter   D)   Common collector.

68. Which of the following statements is false ?

   A)   Impurity added to intrinsic semiconductors gives extrinsic semiconductors

   B)   Charge carriers of *P*-type semiconductors are holes

   C)   Charge carriers of *N*-type semiconductors are electrons

   D)   Charge carriers of *N*-type semiconductors are holes.

69. The rising V/I characteristic of a series generator makes it suitable for use as a

   A)   regulator   B)   converter

   C)   booster   D)   amplifier.

70.   In a DC generator, the main function of compensating winding is to

A)   assist in commutation

B)   reduce demagnetising effect of armature reaction.

C)   reduce distorting effect of armature reaction

D)   eliminate reactance voltage.

71.   The *emf* generated within the armature of a DC generator is given by

A) $E_b = N\phi$ B) $E_b = V - I_a R_a$

C) $E_g = \dfrac{\phi ZNP}{60A}$ D) $E_g = V + I_a R_a$.

72.   The experimental law for the hysteresis loss of a magnetic material was found by

A)   Newton   B)   Faraday

C)   Lenz   D)   Steinmetz.

73.   The steel make alloy sheet is most suited for making transformer cores because of its

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A)   low hysteresis loss and low permeability

B)   high hysteresis loss

C)   high permeability and low hysteresis loss

D)   high permeability.

74.   Permeance of a magnetic circuit is given by the reciprocal of its

A)   reluctance   B)   permeability

C)   flux density   D)   air density.

75.   The *emf* induced in a coil depends on

A)   the number of its turns   B)   the change of flux linked in it

C)   the time taken to change the flux   D)   all of these.

76.   The electrostatic potential inside a positively charged sphere is

A)   maximum   B)   minimum

C)   zero   D)   constant.

77. Kilo-watt hour is the unit of

   A)   energy   B)   power

   C)   force   D)   stress.

78. The cost of running 2 kW heater for 10 hours at 50 paise/kWh is

   A)   Rs. 5   B)   Rs. 10

   C)   Re. 1   D)   Rs. 2.

79. According to the commonly used sign convention for voltages

   A)   a fall in voltage is considered positive

   B)   a rise in voltage is considered positive

   C)   IR drop is taken as negative

   D)   battery EMF's are taken as positive.

80. A simple potentiometer is correctly called a

   A)   current divider   B)   voltage stabilizer

   C)   variable resistor   D)   voltage divider.

81. Which of the following materials has nearly zero temperature coefficient of resistance ?

   A)   Copper   B)   Carbon

   C)   Manganin   D)   Mica.

82. The Law of Demand is the outcome of the

   A)   Law of Diminishing Marginal Utility

   B)   Law of Equimarginal Utility

   C)   Law of Consumption

   D)   Law of Maximum Satisfaction.

83. In .... buyers and sellers belong to a small local area.

   A)   Family Market   B)   National Market

   C)   World Market   D)   Local Market.

84. Social Welfare is the guiding factor of the economic activity in

A) Market economy   B) Socialist economy

C) Traditional economy   D) Mixed economy.

85. Production in simple terms means

A) innovative activity   B) destruction of utility

C) absorption of utility   D) creation of utility.

86. The Supply curve shifts in its entire length to the right because of

A) increased production

B) increase in its price

C) increase in subsidies for the product

D) the exit of few firms.

87. When Demand curve is vertical, it presents

A) perfectly elastic demand   B) perfectly inelastic demand

C) elastic demand   D) inelastic demand.

88. The quantum of utility derived depends on the

A) need of the individual   B) mental make up of the consumer

C) social desirability   D) intensity of desire.

89. The Supply curve shifts to its left because of

A) increase in subsidies for the product

B) number of producers in the industry

C) factors outside the economic sphere

D) fall in supply without a change in price.

90. Wants change with

A) two or more commodities   B) person to person

C) time, place and person   D) the destruction of utility.

91. To sell what could be produced is

A) consumer orientation   B) marketing orientation

C) product orientation   D) management orientation.

92. Consumption is the

A) creation of utility   B) destruction of utility

C) result of production   D) stimulant for production.

93. The father of Economics is

A) Adam Smith   B) Lionel Robbins

C) Paul A. Samuelson   D) Alfred Marshall.

94. The major gas causing greenhouse effect is

A) CO_2 B) H_2S

C) SO_3 D) none of these.

95. 2000 kg of wet solid containing 70% solid is dried to get a final product of 99% solids. The amount of water removed from wet solid is

A) 1414·14 kg   B) 585·80 kg

C) 600 kg   D) none of these.

96. Ozone depletion in the upper atmosphere has been caused predominantly in recent years by the release of CFCs. CFC denotes

A) Concentrated Fluorine Chemicals   B) Concentrated Fine Chemicals

C) Chloroflurocarbons   D) Chlorinated Fixed Carbon.

97. The gas which has reddish-brown colour with pungent suffocating odour is

A) NO   B) NO_2

C) SO_2 D) CO.

98. Packing comes under

A) administrative expenses   B) plant overhead cost

C) distribution & marketing expenses   D) none of these.

99. Building, process and auxiliary comes under

A) Indirect Cost   B) Direct Cost

C) Working Capital   D) Fixed Capital Investment.

100. Manufacturing cost is

    A)   direct production costs + fixed charges + plant overhead costs

    B)   direct production costs + administrative expenses

    C)   direct production costs + distribution and marketing expenses

    D)   direct production costs + general expenses.

101. In a certain process, one needs fluid flow in a given direction and the valve is to open or close by the fluid pressure. Which of the following valves permits fluid flow in one direction only ?

    A)   Gate valve   B)   Globe valve

    C)   Check valve   D)   Ball valve.

102. In potential flow, wall drag is

    A)   infinite   B)   zero

    C)   finite and non-zero   D)   none of these.

103. Under otherwise uniform conditions, the Fanning friction factor for a rough pipe is

    A)   smaller than that for a smooth pipe

    B)   greater than that of a smooth pipe

    C)   equal to that for a smooth pipe

    D)   not a function of Reynolds number.

104. For laminar flow of Newtonian fluids in pipes, the ratio of average velocity to maximum velocity is equal to

    A)   0·5   B)   1·0

    C)   1·5   D)   2·0.

105. The equation of continuity applies to

    A)   incompressible fluids

    B)   compressible fluids

    C)   highly viscous fluids

    D)   both incompressible and compressible fluids.

106. Viscosity of gas

  A) decreases with an increase in temperature

  B) increases with an increase in temperature

  C) remains unaffected with change in temperature

  D) increases with an increase in pressure.

107. A fluid is called Newtonian when the shear stress versus shear strain plot is

  A) linear and passes through origin

  B) linear but has an intercept

  C) exponential and passes through the origin

  D) a rectangular hyperbola.

108. A fluid is a substance that

  A) permanently resists distortion

  B) does not permanently resist distortion

  C) has a definite density which is constant under all circumstances

  D) has a density which cannot be accurately determined.

109. The equivalent length of pipe is expressed as number of pipe diameter and

  A) number of velocity head
  B) number of pressure head

  C) number of potential head
  D) all of these.

110. The roughness factor of pipe is the ratio of the length of the surface roughness to

  A) outside pipe diameter
  B) inside pipe diameter

  C) volume of pipe
  D) surface area of pipe.

111. One poise is equal to

  A) $0.01 \, N.S/m^2$
  B) $0.1 \, N.S/m^2$

  C) $1 \, N.S/m^2$
  D) none of these.

112. A centrifugal pump is designed to deliver

  A) low discharge at high heads

  B) large discharge at low heads

  C) in between low and large discharges

  D) all of these.

113. In the equation $\dfrac{\Delta u^2}{2\alpha} + g\Delta z + \int v\,dp + w_s + F = 0$, if the flow is turbulent, the kinetic energy factor α is

   A)   0·5   B)   1

   C)   0   D)   none of these.

114. Which evaporator is used for the production of condensed milk ?

   A)   Long tube vertical type evaporator

   B)   Forced circulation evaporator

   C)   Open-pan solar evaporator

   D)   None of these.

115. Characteristic curve for centrifugal pump plotted against volumetric flow rate, efficiency, and head as a function of discharge rate is

Volumetric flow rate ⟶

   A)   power input, efficiency, head   B)   head, efficiency, power input

   C)   efficiency, power input, head   D)   power input, head, efficiency.

116. With increase in shear rate, apparent viscosity of pseudoplastic fluid

   A)   decreases

   B)   increases

   C)   may increase or decrease depending on the magnitude of shear rate

   D)   none of these.

117. Euler's equation of motion is a statement expressing

   A)   conservation of mass   B)   conservation of energy

   C)   Newton's 1st law of motion   D)   Newton's 2nd law of motion.

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118. Each term of Bernoulli's equation represents total energy per unit

    A)   mass   B)   volume

    C)   specific weight   D)   none of these.

119. The type of fluid which is not characterised by power law is

    A)   Bingham   B)   Pseudoplastic

    C)   Newtonian   D)   Dilatant.

120. As per Newton's law of viscosity shear stress is proportional to (viscosity = μ)

    A) μ B) $\dfrac{1}{\mu}$

    C) μ^2 D) $\dfrac{1}{\mu^2}$.

121. What is the absorptivity of a black body ?

    A)   0   B)   1

    C)   0·78   D)   0·95.

122. Dropwise condensation occurs in

    A)   clean and dirt free surfaces   B)   contaminated cooling surfaces

    C)   smooth clean surfaces   D)   polished surfaces.

123. In the equation $Q = UA\Delta T$, ΔT is

    A)   geometric mean temperature difference

    B)   arithmetic mean temperature difference

    C)   logarithmic mean temperature difference

    D)   the difference of average bulk temperature in hot and cold fluids.

124. Prandtl number is the reciprocal of

    A)   thermal diffusivity / momentum diffusivity

    B)   thermal diffusivity × momentum diffusivity

    C)   thermal diffusivity × mass diffusivity constant

    D)   mass diffusivity × momentum diffusivity.

125. What is the logarithmic mean of r_1 and r_2 ?

A) $\dfrac{r_1 - r_2}{\ln \dfrac{r_1}{r_2}}$

B) $\dfrac{r_1 - r_2}{\ln \dfrac{r_2}{r_1}}$

C) $\dfrac{r_2 - r_1}{\ln \dfrac{r_1}{r_2}}$

D) $\dfrac{r_1 - r_2}{-\ln \dfrac{r_1}{r_2}}$

126. Fourier's law of heat transfer applies to

   A) convection

   B) radiation

   C) conduction

   D) all of these.

127. In backward operation of multiple effect evaporators

   A) feed is fed in the middle effect and concentrated product is taken out from the last effect

   B) feed is fed in the middle effect and product is discharged from the first effect

   C) feed is fed in the last effect and product is taken out from the first effect

   D) feed is fed in the first effect and product is drawn from the last effect.

128. Which of the following is not true about a double-pipe heat exchanger ?

   A) Flows are co-current or counter-current

   B) Differential expansion is absent

   C) Used when the required surface area is very large

   D) Simplest type of heat exchanger.

129. Overall heat transfer coefficient, U is related to conductive resistances, R_{cd} and conductive resistances, R_{cv} by

   A) $U = \dfrac{1}{\sum R_{cd} + \sum R_{cv}}$

   B) $\dfrac{1}{U} = \dfrac{1}{\sum R_{cd} + \sum R_{cv}}$

   C) $U = \dfrac{1}{\sum R_{cd} - \sum R_{cv}}$

   D) $U = \sum R_{cd} + \sum R_{cv}$.

130. In natural convection, which of the following is true ?

A) $Pr = f(Re, Gr)$
B) $Nu = f(Re, Pr)$
C) $Nu = f(Gr, Pr)$
D) $Nu = f(Re, St)$.

131. In steady state thermal conduction, the heat flux is given by

A) Fick's law
B) Newton's law
C) Fourier's law
D) Knudsen's law.

132. The rate of heat loss through a wall of red brick ($k = 0.70$ W/mK), of area 20 m², with 0.25 m thickness, if the wall temperatures are at 100°C and 30° C, is

A) 3920 W
B) 3920 kW
C) 392 W
D) 392 kW.

133. Which heat exchanger is used in paraffin-wax plants and in petrochemical plants for crystallization ?

A) Double pipe heat exchanger
B) Scraped surface heat exchanger
C) Plate type heat exchanger
D) All of these.

134. The value of Stefan-Boltzmann constant in SI unit is

A) 5.6697×10^{-8} W/m²K⁴
B) 5.6697×10^{-8} kcal/m²K⁴
C) 0.1714×10^{-8} W/m²K⁴
D) 0.1714×10^{-8} kcal/m²K⁴.

135. Which of the following is correct ?

A) Driving force = Rate × Resistance
B) Rate = Driving force × Resistance
C) Resistance = Driving force × Rate
D) Rate = Resistance / Driving force.

136. The heat lost per m² of surface area for a wall of 254 mm thick, where the inside temperature is 352.7 K and outside temperature is 297.1 K is (thermal conductivity is 0.048 W/m K)

A) 100 W/m²
B) 105.1 W/m²
C) 200 W/m²
D) 150 W/m².

137. Heat transfer equipment used to liquefy vapours by removing their latent heats are called

   A)   evaporators   B)   condensers

   C)   heat exchangers   D)   all of these.

138. The most economical absorption factor will be in the range of

   A)   5 - 10   B)   1·25 - 2

   C)   0·1 - 1   D)   none of these.

139. The overall heat transfer coefficient is generally low for fluids having

   A)   high thermal conductivity   B)   low thermal conductivity

   C)   constant thermal conductivity   D)   none of these.

140. Heat transfer occurs by natural convection because change in temperature causes difference in

   A)   viscosity   B)   density

   C)   thermal conductivity   D)   heat capacity.

141. As the product size from a ball mill decreases

   A)   the capacity and power requirement of the mill increases

   B)   the capacity increases, but the power requirement decreases

   C)   the capacity and power requirement of the mill decrease

   D)   the capacity decreases, but the power requirement increases.

142. When a ball mill rotates at a speed higher than the critical speed, its efficiency is

   A)   maximum   B)   minimum

   C)   optimum   D)   none of these.

143. Tyler standard screen are based on the opening

   A)   200 mesh screen   B)   400 mesh screen

   C)   300 mesh screen   D)   500 mesh screen.

144. If specific cake resistance is independent of pressure in a filtration process, then the cake is

A) incompressible

B) compressible

C) both compressible and incompressible

D) none of these.

145. Energy requirement (per unit mass of material crushed / ground) is highest for

A) Jaw crusher   B) Rod mill

C) Ball mill   D) Fluid energy mill.

146. Equivalent diameter of a particle is the diameter of sphere having the same

A) ratio of surface to volume as the actual volume

B) volume of the particles

C) ratio of volume to surface of the particle

D) none of these.

147. Ball mill is used for

A) fine grinding   B) crushing

C) coarse grinding   D) attrition.

148. In roll crushers

A) both the rolls have same diameter

B) are related towards each other

C) run either at same or different speeds

D) all of these.

149. Which of the following statements does not apply for plate and frame filter press ?

A) Intermittent in operation

B) Very less labour requirement

C) Maintenance cost is low

D) Large filtering area on a small floor space.

150. According to the Tyler standard screen scale, each successive screen has its mesh and wire dia so adjusted that the linear sizes of the openings in any two successive screens have the ratio of

A)   1 : 2   B) $1 : \sqrt{2}$

C) $1 : 2^2$ D) $1 : \sqrt{3}$.

151. Which of the following statements about the ball mill is not true ?

A)   The mill may be used wet or dry

B)   The mill can be used with inert atmosphere for grinding explosive materials

C)   It may be used for batch or continuous operation

D)   It can be used to grind only soft materials.

152. Jaw crushers and gyratory crushers employ predominantly

A)   impact force   B)   shear force

C)   attrition force   D)   compressive force.

153. Extruders are used for mixing extensively in

A)   plastic industry   B)   alkali industry

C)   fertilizer industry   D)   petroleum industry.

154. Which of the following is not a function of the filter medium ?

A)   Support for the filter cake

B)   Offer resistance to the flow of filtrate

C)   Resistant to the corrosive action of the fluid

D)   Mechanically strong.

155. Which of the following is a possible value of the one angle of nip of a roll crusher ?

A)   5°   B)   20°

C)   50°   D)   75°.

156. Standard screen always have

A)   rectangular aperture   B)   triangular aperture

C)   square aperture   D)   circular aperture.

157. According to Rittinger's law, crushing efficiency

    A)   depends on the feed size

    B)   depends on the product size

    C)   depends on both feed and product sizes

    D)   is constant and for a particular machine and feed material is independent of the feed and product size.

158. A rotary drum filter is

    A)   a continuous vacuum filter   B)   a discontinuous pressure filter

    C)   a continuous pressure filter   D)   none of these.

159. The compressibility coefficient for an incompressible sludge is

    A)   1·0   B)   0·2

    C)   0·8   D)   0.

160. In SI system the specific cake resistance has a unit of

    A)   m/s   B)   kg/s

    C) m^3 / s   D)   m/kg.

161. Which of the following methods will come under mechanical separation ?

    A)   Drying   B)   Distillation

    C)   Evaporation   D)   Sedimentation.

162. The rate of diffusion is high for

    A)   solids   B)   liquids

    C)   gases or vapours   D)   colloidal solution.

163. Which is not the dimension of individual mass transfer coefficient ?

    A) $\dfrac{\text{Moles transferred}}{\text{Area time mole fraction}}$ B) $\dfrac{\text{Moles transferred}}{\text{Area time pressure}}$

    C) $\dfrac{\text{Moles transferred}}{\text{Area time concentration}}$ D) $\dfrac{\text{Moles transferred}}{\text{Area time temperature}}$

164. Positive deviation from ideality gives

    A)   alloy mixtures   B)   maximum boiling mixtures

    C)   maximum boiling azeotropes   D)   minimum boiling mixtures.

165. In a ternary liquid system where one pair (A and B) is partially soluble, above the critical solution temperature,

    A)   A and B dissolve completely   B)   A precipitates out

    C)   C separates out   D)   the mixture forms three layers.

166. An ideal binary liquid mixture obeys

    A)   Henry's law   B)   Raoult's law

    C)   Boyle's law   D)   Dalton's law.

167. Which of the following driers operates in batches ?

    A)   Spray drier   B)   Tray drier

    C)   Rotary drier   D)   Tunnel drier.

168. In McCabe-Thiele method, if the feed is a boiling liquid, q-line will be

    A)   vertical   B)   horizontal

    C)   with a positive slope   D)   with a negative slope.

169. In drying, Leidenfrost point means

    A)   equilibrium moisture content   B)   free moisture content

    C)   internal moisture content   D)   critical moisture content.

170. A mixture of benzene and toluene boils at 95° C under a pressure of 101·3 kPa. At 95°C, the vapour pressures of benzene and toluene are 155·56 kPa and 63·98 kPa respectively. The composition of the boiling liquid is

    A)   40·75 mole % toluene   B)   26·15 mole % toluene

    C)   40·75 mole % benzene   D)   59·25 mole % benzene.

171. The temperature of air in a room is 40°C and the total pressure is 101·3 kPa abs. Air contains water vapour with a partial pressure $p_A = 3·74$ kPa. The absolute humidity is

    A)   0·0238   B)   0·0386

    C)   0·049   D)   0·0037.

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[Turn over

172. Supersaturation is achieved by

    A)   cooling a solution through indirect heat exchange

    B)   evaporation of part of solvent

    C)   adding new substance which reduces the solubility of original solute

    D)   all of these.

173. Molecular diffusion is due to

    A)   thermal motion of the molecules   B)   potential energy of the molecules

    C)   activation energy of the molecules D)   none of these.

174. Rayleigh equation applies to

    A)   differential distillation   B)   flash vaporisation

    C)   equilibrium distillation   D)   molecular distillation.

175. For a binary mixture with low relative volatility

    A)   use steam distillation

    B)   use molecular distillation

    C)   use high pressure distillation

    D)   an azeotrope may be formed during distillation.

176. Which of the following curves represent a minimum boiling azeotrope ?

x = liquid composition

    A)   *A*   B)   *B*

    C)   *C*   D)   *D*.

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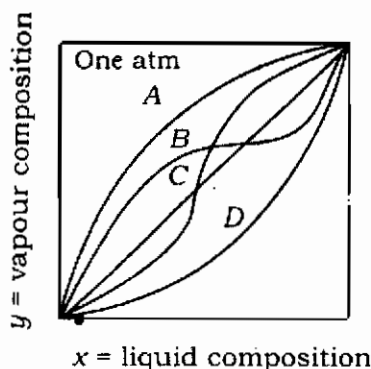
177. Very tall packed towers are divided into series of beds to

  A) reduce the overall pressure drop   B) avoid channelling

  C) avoid flooding   D) none of these.

178. Wetted wall tower experiment determines

  A) molal diffusivity   B) volumetric coefficient

  C) mass transfer coefficient   D) none of these.

179. Co-current absorbers are usually used when the gas to be dissolved in the liquid is

  A) sparingly soluble   B) highly soluble

  C) a pure substance   D) a mixture.

180. If G is an insoluble gas stream and L is a non-volatile solvent in liquid stream, then the slope of the operating line for the absorber is

  A) L/G B) G/L

  C) always < 1   D) none of these.

181. Proximate analysis of coal gives

  A) carbon, hydrogen and ash

  B) volatile matter, moisture, ash and fixed carbon

  C) carbon, hydrogen, sulphur and nitrogen

  D) volatile matter, moisture, nitrogen and carbon.

182. The chemical formula for rust is

  A) $Fe_2O_3 . x H_2O$ B) Fe_2O_3

  C) $Fe_3O_4 . x H_2O$ D) Fe_3O_4.

183. The average molecular weight of air is

  A) 25   B) 27

  C) 30   D) 29.

184. 1 torr is equivalent to

  A) 1 mm Hg   B) 1 pascal

  C) 1 atm   D) 1 mm water column.

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[Turn over

185. 1 BTU is equivalent to

A) 252 cal
B) 0·252 cal
C) 1 kcal
D) 252 kcal.

186. The specific gravity of liquid is the ratio of its density to the density of

A) air
B) water
C) liquid
D) none of these.

187. The value of R in $\dfrac{m^3\ mm\ Hg}{mol.K}$ is

A) $6·2364 \times 10^{-2}$
B) 1·987
C) 8·314
D) 10·73.

188. A wet substance containing 25% water on dry basis, is dried to 2·5% water on dry basis. The amount of water removed in percentage is

A) 90%
B) 75%
C) 10%
D) 60%.

189. If the heat capacity is given by $C_p = a + bT$, where C_p is in kJ/k mol.K and T is in K

A) the constants a and b are dimensionless constant

B) both a and b have dimensions kJ/k mol.K

C) the dimension of a is kJ/k mol.K and that of b is kJ/k mol

D) the dimension of a is kJ/k mol.K and that of b is kJ/k mol.K^2.

190. $N_2 + 3H_2 \rightarrow 2NH_3$. In the ammonia converter, mixture of N_2 and H_2 containing 20% N_2 by volume is sent to the converter. The limiting reactant is

A) N_2
B) H_2
C) NH_3
D) N_2 or H_2.

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191. 100 kg coal containing 66% C, 15% O_2, 19% ash by weight is burned in air. How many moles of air are theoretically required by 100 kg coal ?

A)   23·95   B)   5·5

C)   26·19   D)   38.

192. For real gases, the partial volume and pure component volume will be

A)   same   B)   different

C)   may be same or different   D)   none of these.

193. In SO_3 production, 100 k mol of SO_2 and 200 k mol of O_2 are fed to reactor. The product contains 80 k mol of SO_3. The per cent conversion of SO_2 is

A)   80   B)   100

C)   50   D)   40.

194. An aqueous solution of triethanolamine (TEA) contains 50% TEA by wt. The density of solution is 1·05 kg/L. The molecular wt. of TEA is 149. The molality of solution is

A)   335·6 M   B)   0·3524 M

C)   35·24 M   D)   3·524 M.

195. A plot of boiling point of solution against boiling point of pure water at same pressure for a given concentration is known as

A)   Dühring's rule   B)   heat of solution

C)   Trouton's rule   D)   none of these.

196. The heat of combustion data for the following reactions are :

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l) \quad \Delta H° = -890·4 \text{ kJ}$$

$$C(s) + O_2(g) \rightarrow CO_2(g) \quad \Delta H° = -393·51 \text{ kJ}$$

$$H_2(g) + \frac{1}{2}O_2(l) \rightarrow H_2O(l) \quad \Delta H° = -285·84 \text{ kJ}$$

The heat of formation of methane is

A)   −74·79 kJ   B)   −285·84 kJ

C)   −393·51 kJ   D)   −890·4 kJ.

197. In a chemical process, per cent yield is

A) $\dfrac{\text{moles of the feed unreacted}}{\text{moles of the feed charged}} \times 100$

B) $\dfrac{\text{moles of the feed reacted}}{\text{moles of the feed charged}} \times 100$

C) $\dfrac{\text{moles of the reactant converted to the desired product}}{\text{total moles of the reactant fed to the process}} \times 100$

D) $\dfrac{\text{moles of the reactant converted to desired product}}{\text{total moles of the reactant converted}} \times 100$.

198. In a gas-liquid contact system, for dilute mixtures, the equilibrium compositions on both the phases are given by

A) Raoult's law   B) Henry's law

C) Hess's law   D) Fick's law.

199. In an absorption column, the absorption factor is the ratio of the slopes of the

A) operating line to equilibrium line

B) equilibrium line to operating line

C) tangent of the equilibrium line to operating line

D) tangent of the operating line to equilibrium line.

200. The gas which constitutes the maximum to the heating value of natural gas is

A) CO   B) CO_2

C) H_2 D) CH_4.

(SPACE FOR ROUGH WORK)

(SPACE FOR ROUGH WORK)

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