

1. A bypass stream for a process is useful because -

- 1) It improves conversion 2) It increases the product yield
~~3) It ensures better control over the process~~ 4) None of these

2. Maximum excess air is required by -

- ~~1) Solid fuels~~ 2) Liquid fuels
 3) Gaseous fuels 4) None of these

3. Assuming that CO_2 obeys perfect gas law, calculate the density of CO_2 (in kg/m^3) at 263°C and 2 atm -

- 1) 1 ~~2) 2~~
 3) 3 4) 4

4. It is desired to compress one mole of air with $r = 1.4$ from initial state at 300 K and 1 bar to final state 300 K and 10 bar. Determine the work done by isothermal compression in kJ/mole.

- ~~1) -5.8~~ 2) -6.2
 3) 5.8 4) 6.2

5. Raoult's Law is applicable to -

- ~~1) Ideal Solution~~ 2) Real Solution
 3) The mixture of water and alcohol 4) Non-ideal gases

6. Pure Carbon is completely burnt in oxygen. The flue gas analysis is 70% CO_2 , 20% CO and 10% O_2 . The percent excess oxygen used is :

- 1) 20 2) 12.5
~~3) 0~~ 4) 10

7. 1000 kgs of wet solids are to be dried from 60% to 20% moisture (by weight). The mass of moisture removed in kgs is:

- 1) 5200 2) 200
 3) 4600 ~~4) 500~~

8. Pure O_2 is mixed with air to produce an enriched air containing 50% volume O_2 . The ratio of moles of air to O_2 used is:

- ~~1) 1.72~~ 2) 0.58
 3) 0.50 4) 0.20

9. Heat absorbed is equal to internal energy for -

- 1) Constant pressure process ~~2) Constant volume process~~
 3) Adiabatic process 4) Polytropic process

10. At the inversion point, Joule - Thomson coefficient is:

- 1) Highly positive 2) Highly negative
 3) Very small ~~4) Zero~~

11. A solid is transformed into its vapour state without passing through the liquid state at -

- 1) Triple point 2) Boiling point
 3) Always ~~4) Below triple point~~

12. One ton of refrigeration is defined as the heat rate corresponding to melting of one ton of ice in -

- 1) 1 Hour
2) 1 Day
3) 1 Minute
4) None of these

13. Activity is defined as -

A.	$\ln \frac{f_i}{f_i^o}$
B.	$\ln \frac{f_i^o}{f}$
C.	$\frac{f_i}{f_i^o}$
D.	None of these

14. The law of thermodynamics which provides basis for measuring thermodynamic property is:

- 1) First law
2) Zeroth law
3) Third law
4) Second law

15. Clausius - Claypeyron equation is applicable in -

- 1) Melting process only
2) Vaporization process only
3) Sublimation process only
4) All of these

16. The change in state involving a decrease in entropy can be spontaneous only if -

- 1) It is Exothermic
2) It is Isenthalpic
3) It takes place isothermally
4) It takes place at constant volume

17. During adiabatic expansion of gas -

- 1) Pressure remains constant
2) Pressure is increased
3) Temperature is decreased
4) None of these

18. At steady state if material balance equation reduces to a relation as what comes in must go out, this relation is true when -

- 1) No Consumption
2) Non accumulation
3) No generation
4) All of these

19. Methane is completely burned with air. The maximum possible volume percent of carbon dioxide (on dry basis) in flue gas is:

- 1) 11.7
2) 21.0
3) 44.0
4) 28.0

20. An evaporator while concentrating an aqueous solution from 10 to 40% solids evaporates 30000 kg of water. The amount of solids handled by the system in kg is :

- 1) 4000
2) 9000
3) 4600
4) 3000

- 1) m/s
2) ~~m²/s~~
3) m³/s
4) None of these

29. In multiple effect evaporator, if the thick liquor is viscous, the feeding should be -

- ☒ 1) Backward ☒ 2) Forward
3) Mixed 4) None of these

30. Fins are provided on heat transferring surface in order to increase -

- ☒ 1) Heat transfer area 2) Thermal conductivity
3) Mechanical strength of the equipment 4) None of these

31. In fluidization using perfect spherical particles, the operating range of fluidization velocity is:

- ☒ 1) Independent of particle size 2) Greater for bigger particle size
☒ 3) Greater for smaller particle size 4) Proportional to the square of particle size

32. All gases above its inversion temperature, in throttling process will show -

- ☒ 1) A heating effect 2) No change in temperature
3) A cooling effect 4) Either (A) or (C)

33. The psychrometric ratio is defined as -

- ☒ 1) hG/Ky 2) Ky/hG
3) $hG/KyCs$ 4) Nsc/Npr

34. Viscous, heat sensitive liquids are concentrated in -

- ☒ 1) Open pan evaporator 2) Long tube vertical evaporators
☒ 3) Agitated film evaporators 4) None of these

35. Which of the following equations is applicable for the flow of fluid through a packed bed for larger Reynold's number?

- ☒ 1) Fanning equation 2) Kozeny - corman equation
☒ 3) Burke - Plummer equation 4) Kremser equation

36. Friction drag is generally larger than the pressure drag in -

- 1) Flow past a sphere ☒ 2) Flow past a cylinder
3) Flow past an airfoil 4) Flow past a thin sheet

37. The continuity equation -

- 1) Express relationship between hydraulic parameters of flow 2) Express the relationship between work & energy
3) Is based on Bernoulli's theorem ☒ 4) Relates the mass rate of flow along a stream

38. The Chilton – Colburn analogy for mass transfer states that -

A.	$N_{st} N_{sc}^{1/3} = \frac{f}{8}$
<input checked="" type="checkbox"/> B.	$N_{st} N_{sc}^{2/3} = \frac{f}{2}$
C.	$N_{st} N_{sc}^{3/2} = \frac{f}{2}$
D.	$N_{st} N_{sc}^{2/3} = \frac{f}{8}$

39. Penetration theory states that the mass transfer coefficient is equal to -
 1) $(D_e t)^{1/2}$ 2) $(D_e/t)^{1/2}$
~~3) $(4 D_e/\pi t)^{1/2}$~~ 4) $(4 D_e/t)^{1/2}$
40. Penetration theory relates average mass transfer coefficient (K) with diffusivity (D) as -
 1) $K \propto D$ ~~2) $K \propto D^{1/2}$~~
 3) $K \propto D^{1.5}$ 4) $K \propto D^2$
41. If the wind is blowing at 10 Km per hour, the dominant heat loss mechanisms between the top cover plate of flat plate solar collector and the ambient air are -
~~1) Convection~~ 2) Radiation
 3) Conduction 4) Convection and Radiation
42. Most suitable conveyor for transportation of sticky materials is :
 1) Apron conveyor 2) Belt conveyor
~~3) Screw conveyor~~ 4) Pneumatic conveyor
43. Separation of materials of the same density based on their sizes by using their different rates of flow is called -
 1) Sorting ~~2) Sizing~~
 3) Flocculation 4) Elutriation
44. The main size reduction operation in ultrafine grinders is :
~~1) Attrition~~ 2) Occulting
 3) Compression 4) Impact
45. For the reaction $A + 2B \rightarrow C + 2D$
 1) $-r_A = -r_B/2$ 2) $-r_A = r_C$
 3) $-r_B = +r_D$ ~~4) All of these~~
46. Assertion (A): If solid particle size is reduced by crushing and grinding the amount of separation increases in leaching operation Reason (R) : The solute contained by solid is surfaced during crushing and grinding
~~1) Both (A) and (R) are true and (R) is the correct reason for A~~ 2) Both (A) and (R) are true and (R) is not the correct reason for A
 3) Both (A) and (R) are false 4) (A) is true but (R) is false
47. The most efficient equipment for removal of sub-micron dust particles from blast furnace gas is :
 1) Venturi atomizer 2) Gravity settling chamber
~~3) Electro static precipitator~~ 4) Cyclone separator

48. Critical speed of a ball mill is given by -

A.	$N_c = \frac{1}{4\pi} \sqrt{\frac{g}{R_1 - R_2}}$
B.	$N_c = \frac{1}{2\pi} \sqrt{\frac{g}{R_1 - R_2}}$
C.	$N_c = \frac{1}{2\pi} \sqrt{\frac{g}{R_1 - R_2}}$
D.	$N_c = \frac{1}{\pi} \sqrt{\frac{R_1 - R_2}{g}}$

Where R_1 and R_2 are the radii of the ball mill and ball respectively

49. According to Bond crushing law, the work required to form particle of size 'D' from very large feed is :

A.	$\alpha (S/V)_p$
B.	$\alpha \sqrt{(S/V)_p}$
C.	$\alpha (S/V)_p^2$
D.	$\alpha (S/V_p)_i$

50. Work Index is defined as :

- ~~1)~~ The gross energy in KWH per ton of feed needed to reduce a large feed to such a size that 80% of product passes through a 100 μ m screen
- 2) The gross energy in KWH per ton of feed needed to reduce a large feed to such a size that 100% of product passes through a 100 μ m screen
- 3) The gross energy in KWH per ton of feed needed to reduce a large feed to such a size that 80% of product passes through a 150 μ m screen
- 4) The gross energy in KWH per ton of feed needed to reduce a large feed to such a size that 100% of product passes through a 150 μ m screen

51. Stokes equation is valid in the Reynold's number range -

- ~~1)~~ 0.01 to 0.1
- 2) 0.1 to 2
- 3) 2 to 10
- 4) 10 to 100

52. For crushing of solids, the Rittinger's law states that the work required for crushing is proportional to -

- ~~1)~~ The new surface created
- 2) The size reduction ratio
- 3) The change in volume due to crushing
- 4) None of these

53. In a gyratory crusher, the size reduction is effected primarily by :

- ~~1)~~ Compression
- 2) Impact
- 3) Attrition
- 4) Cutting action

54. The angle formed by pouring a powder as a heap on a that surface is known as -

- 1) Contact angle
- 2) Angle of nip
- ~~3)~~ Angle of repose
- 4) Critical angle

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55. The sphericity of a cylinder of 1 cm diameter and length 3 cm is :

- ☒ 1) 0.9
- ☐ 2) 0.78
- ☐ 3) 0.6
- ☐ 4) 0.5

56. Most of the Sun's energy results from -

- ☒ 1) Thermo nuclear reactions
- ☐ 2) Chemical reactions
- ☐ 3) Gravity
- ☐ 4) None of these

57. Solar cells convert the sunlight into -

- ☒ 1) Electrical energy
- ☐ 2) Mechanical energy
- ☐ 3) Heat energy
- ☐ 4) Chemical energy

58. At room temperature the theoretical maximum efficiency of a perfect solar cell cannot exceed about -

- ☐ 1) 2%
- ☒ 2) 45%
- ☐ 3) 99%
- ☐ 4) 5%

59. Which of the following windmills run independently to the direction of the wind?

- ☒ 1) Darrieus type
- ☐ 2) Sail type
- ☐ 3) Propeller type
- ☐ 4) Multiblade type

60. Sun radiates energy to the earth -

- ☐ 1) In the form of electro magnetic radiation
- ☐ 2) At a relatively constant ratio of 3.83×10^{26} W
- ☐ 3) 24 hours per day, 365 days of the year
- ☒ 4) All of these

61. The total carbon content in pig iron may be -

- ☐ 1) 0.08 to 0.2%
- ☐ 2) 0.1 to 1.5%
- ☒ 3) 3.0 to 3.5%
- ☐ 4) 16 to 24%

62. Atmospheric corrosion of metals takes place by -

- ☐ 1) Rapid oxidation
- ☒ 2) Slow oxidation
- ☐ 3) Rapid hydration
- ☐ 4) None of these

63. Corrosion resisting properties of cast iron are very much improved by the addition of 12 - 15 percent of -

- ☐ 1) Vanadium
- ☐ 2) Tungsten
- ☒ 3) Silicon
- ☐ 4) Phosphorus

64. Polluting and hazardous industries should have an "Exclusion Zone" with a green belt and public access prohibited around the plant covering a radius of -

- ☐ 1) 100 m
- ☐ 2) 500 Km
- ☒ 3) 1 Km
- ☐ 4) 5 Km

65. Iron sheets are galvanised to -

- ☐ 1) Increase lustre
- ☐ 2) Prevent action of oxygen
- ☒ 3) Prevent action of water
- ☐ 4) Harden the surface

66. Rust of iron is :

- ☐ 1) Powdered iron
- ☐ 2) Ferrous oxide
- ☒ 3) Hydrated ferric oxide
- ☐ 4) None of these

67. Corrosion is prevented or its rate is reduced by -

- ☒ 1) Increasing the resistance between anodic and cathodic area
- 2) Decreasing anodic and cathodic polarization by increasing the diffusion of reactants and products
- 3) Decreasing the resistance between anodic and cathodic areas
- 4) None of these

68. Cast iron is obtained by remelting -

- ☒ 1) Pig iron and pouring into moulds
- 2) Steel and pouring into moulds
- 3) Wrought iron and pouring into moulds
- 4) Iron ore and pouring into moulds

69. Type 304 stainless steel contains -

- ☒ 1) 18% Cr, 8% Ni, 0.08% C (Max)
- 2) 8% Cr, 18% Ni, 0.08% C (Max)
- 3) 6% Cr, 18% Ni, 0.08% C (Max)
- 4) 18% Cr, 36% Ni, 0.08% C (Max)

70. Brass is composed of -

- ☒ 1) Cu - Zn
- 2) Cu - Sn
- 3) Sn - Zn
- 4) Al - Cu

71. An increase in the Carbon content of a steel -

- ☒ 1) Increases its strength
- 2) Decreases its strength
- 3) Increases its ductility
- 4) None of these

72. An increase in the carbide / graphite ratio in cast iron tends to -

- 1) Increase the hardness
- 2) Increase the brittleness
- 3) Decrease the ductility
- ☒ 4) All of these

73. Iron sheets are galvanised to -

- 1) Increase lustre
- 2) Prevent action of organics
- ☒ 3) Prevent action of water and oxygen
- 4) Harden the surface

74. Corrosion -

- 1) Involves exchange of electrons in electrochemical corrosion only
- 2) Involves exchange of electrons in chemical corrosion only
- ☒ 3) Involves exchange of electrons, both in electrochemical and chemical corrosion
- 4) Is a physical phenomenon

75. From the point of view of toxicity, methyl isocyanate (MIC) and phosgene come under the category of -

- 1) Moderately toxic (TLV : 100-1000 ppm)
- 2) Extremely toxic (TLV : 2-10 ppm)
- ☒ 3) Very extremely toxic (TLV : 1 ppm)
- 4) Highly toxic (TLV : 10 - 100 ppm)

76. From the point of view of safety which is preferable?

- ☒ 1) A liquid phase reactor
- 2) A vapour phase reactor
- 3) Either of the above
- 4) None of these

77. Oil fires can be extinguished by -

- ☒ 1) Foam
- 2) Carbon dioxide
- 3) Water
- 4) None of these

78. Minimum safe distance between two liquid fuel tanks is equal to -

- ☒ 1) One - sixth the height of the tank
- 2) One - third the height of the tank
- 3) One - half the height of the tank
- 4) The height of the tank

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79. The factor which contributes most for the accidents in chemical industry is :

- 1) Inadequate design/layout
- 2) Equipment failure
- 3) Improper operating procedures
- 4) Unknown causes

80. The safe distance of population centre from a plant processing a hazardous chemical of lethal concentration of $10^3 - 10^4$ ppm is:

- 1) 5 Km
- 2) 10 Km
- 3) 15 Km
- 4) 25 Km

81. Which is a detergent in the following ?

- 1) Fatty acids
- 2) Fatty alcohols
- 3) Alkyl Benzene Sulphonates
- 4) Fatty esters

82. Electro dialysis used -

- 1) In the manufacture of sodium hydroxide
- 2) In the manufacture of sulphuric acid
- 3) Refining of gasoline
- 4) Refining of beet sugar

83. Liquefied petroleum gas (LPG) contains mostly -

- 1) Methane and Ethane
- 2) Propane and Butane
- 3) Ethylene and Hydrogen
- 4) None of these

84. Oil is :

- 1) Ester of alcohols other than glycerin
- 2) A mixture of glycerides
- 3) A mixture of glycerides of fatty acids
- 4) None of these

85. Epoxy resins come under the category of -

- 1) Thermoplastic
- 2) Thermosetting
- 3) Oil soluble or oil modified
- 4) Protein substances

86. Styrene - Butadiene rubber is commercially manufactured by -

- 1) Bulk polymerization
- 2) Suspension polymerization
- 3) Solution polymerization
- 4) Emulsion polymerization

87. Type of high refractive index glass used in optical instruments is:

- 1) Pyrex glass
- 2) Flint glass
- 3) Crookes glass
- 4) None of these

88. Massacuits is a terminology used in -

- 1) Paint industry
- 2) Oil hydrogenation industry
- 3) Soap industry
- 4) Sugar industry

89. Fermentation is adversely affected by -

- 1) Presence of air
- 2) Absence of air
- 3) High concentration (Substrate inhibition)
- 4) Presence of ammonium salts

90. Styrene is produced from ethyl benzene by the process of -

- 1) Dehydrogenation
- 2) Oxidation
- 3) Alkylation
- 4) Dehydration

91. The material used to give blue coloration to glass is:

- 1) NiO
- 2) CaO
- 3) FeSO_4
- 4) CdS

92. The principle source of cellulose for making paper is :

- ☒ 1) Wood
- 2) Corn stalk
- 3) Bhabbar grass
- 4) Rough waste of textile industry

93. Plasticisers are added to paints to -

- 1) Make it corrosion resistant
- 2) Make glossy surface
- ☒ 3) Give elasticity & prevent cracking of the film
- 4) Increase atmospheric oxidation

94. Which nutrient in fertilizer makes the plant stems stronger and increases branching?

- 1) Nitrogen
- ☒ 2) Phosphorus
- 3) Potassium
- 4) Calcium

95. Formation of Ammonium carbonate by reaction of NH_3 with CO_2 is a/an _____ reaction.

- 1) Catalytic
- ☒ 2) Exothermic
- 3) Endothermic
- 4) Reversible

96. Nitro lime is :

- 1) Calcium nitrate
- ☒ 2) Calcium ammonium nitrate
- 3) A mixture of nitric acid and lime
- 4) A mixture of ammonium nitrate and calcium nitrate

97. In an ammonia plant, the purge off is essential to -

- 1) Maintain inert gas concentration within a limit
- 2) Remove excess poisonous gases
- ☒ 3) Maintain $\text{H}_2:\text{N}_2$ at 3:1
- 4) Remove uncondensed ammonia vapour

98. High aniline point of diesel indicates that it -

- 1) Is highly aromatic
- 2) Has a large ignition delay
- ☒ 3) Is highly paraffinic
- 4) Has a low diesel index

99. Which oil is preferred for paint manufacture?

- ☒ 1) Drying oil
- 2) Non-drying oil
- 3) Semi - drying oil
- 4) Saturated oil

100. Which is a high grade pulp?

- 1) Rag pulp
- 2) Mechanical pulp
- ☒ 3) Sulphate pulp
- 4) Sulphite pulp

101. The function of solenoid valve is based on the principle -

- 1) PID - controller
- 2) PI - controller
- 3) PD - controller
- ☒ 4) On - off controller

102. The time constant of a first order system with resistance R and capacitance C is :

- 1) $R+C$
- 2) $R-C$
- ☒ 3) RC
- 4) $1/RC$

103. The response curve for a step input signal from a reactor is called -

- 1) E curve
- 2) C curve
- ☒ 3) F curve
- 4) I curve

104. The transfer function of transfer lag is given as -

- 1) e^{-tdS} 2) e^{tdS}
3) $e^{td/S}$ 4) $e^{S/td}$

105. For critically damped second - order response, damping coefficient is:

- 1) Equal to one 2) Less than one
3) Greater than one 4) Equal to zero

106. The roots of the numerator polynomial of a transfer function are known as -

- 1) Zeros 2) Poles
3) Corner frequency 4) Crossover frequency

107. The amplification factor (R) of the high -gain amplifier is of the order of -

- 1) 10^{-5} to 10^{-8} 2) 10^{-1} to 10^{-4}
3) 10 4) 10^5 to 10^8

108. Time lag of second order instrument is :

A.	$\left(\frac{1}{\omega}\right) \tan^{-1}(\omega T)$
B.	T
C.	$\left(\frac{1}{\omega}\right) \tan^{-1}\left(\frac{2\varepsilon\omega T}{1 - \omega^2 T^2}\right)$
D.	$\tan^{-1}\left(\frac{2\varepsilon\omega T}{1 - \omega^2 T^2}\right)$

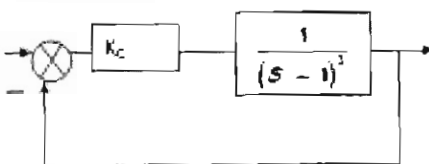
109. Ordinary mercury in glass thermometer without any covering on air gap is an example of -

- 1) First order system 2) Over damped second order system
3) Under damped second order system 4) Multiple first order systems

110. Silicon carbide is :

- 1) An adhesive 2) An abrasive
3) A type of glass 4) Brittle

111. In the control system shown in figure :



What is the characteristic equation ?

- A. $s^2 + 3s^2 + 3s + 1 = 0$
B. $s^2 + 3s^2 + 3s + 1 + K_c = 0$
C. $3s^2 + 3s + 1 + K_c = 0$
D. $s^2 + 3s + 1 + K_c = 0$

- 1) Ionosphere
3) Stratosphere

122. Chloramines are used in water treatment -

- ☒ 1) For disinfection
- 2) For taste removal
- 3) For colour removal
- 4) For organic removal

123. The chemical most commonly used to speed sedimentation of sewage is :

- 1) Sulphuric acid
- ☒ 2) Lime
- 3) Copper Sulphate
- 4) Sodium permanganate

124. Which of the following pollutant has high residence time in the atmosphere ?

- 1) SO_2
- ☒ 2) CO
- 3) H_2S
- 4) None of these

125. Which of the following is a secondary pollutant ?

- 1) Sulphur dioxide
- 2) Carbon monoxide
- ☒ 3) Peroxy acetyl nitrate
- 4) None of these

126. Smoke is a mixture of air and of very fine particles formed by combustion or other chemical process in the size range of -

- 1) 100 - 1000 μm
- 2) 10 - 100 μm
- 3) 1 - 10 μm
- ☒ 4) 0.01 - 2 μm

127. The biochemical treatment of sewage effluent is essentially a process of -

- 1) Reduction
- ☒ 2) Oxidation
- 3) Dehydration
- 4) Alkalinization

128. In declining balance method of depreciation calculation, the -

- 1) Value of the asset decreases linearly with time
- 2) Annual cost of depreciation is same every year
- ☒ 3) Annual depreciation is the fixed percentage of the property value at the beginning of the particular year
- 4) None of these

129. Bar chart is helpful in -

- ☒ 1) Efficient utilization of manpower and machines
- 2) Preparing production schedule
- 3) Efficient dispatching of products
- 4) Inventory control

130. Factory manufacturing cost is the sum of direct production cost -

- 1) Fixed charges and plant overhead cost
- 2) Plant overhead cost
- 3) Plant overhead cost and administrative expenses
- ☒ 4) None of these

131. A plant operating at 40% capacity has net sales of Rs. 1,10,000, variable costs of Rs.60000. If a capacity of 48% is required to show a profit, then the annual fixed costs in rupees is :

- ☒ 1) 60,000
- 2) 50,000
- 3) 20,000
- 4) 25,000

132. If 'C' is the cost of the equipment, s = salvage, n = service life, p = constant percentage, then in constant percentage method of depreciation, the book value after n years would be -

- 1) $C(1-p)^n$
- ☒ 2) s
- 3) Both
- 4) None of these

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133. In the straight line method for determining depreciation, it is assumed that the value of the property -

- 1) Decreases exponentially with time
- 2) Decreases logarithmically with time
- ☒ 3) Decreases linearly with time
- 4) Remains constant with time

134. What is the present value of an income stream which provides Rs.2000 a year for the first five years and Rs.3000 a year forever thereafter, if the interest rate is 10% ?

- 1) 22,350
- 2) 23,450
- ☒ 3) 26,320
- 4) 31,302

135. A process requires pure water which is produced by distillation. The installed cost of the unit is Rs.4000 and the operating costs are Rs.0.5 per 1000 litres of water produced with 8400 hours per year operation and 10 years life, and 6% interest rate. Find the present worth of installation for a water duty of 1000 gal/hr ?

- 1) 25,000
- 2) 29,000
- 3) 30,000
- ☒ 4) 35,000

136. Which of the following is/are direct production costs? P) Raw materials Q) Operating labour R) Depreciation

- 1) P only
- 2) Q only
- ☒ 3) P and Q
- 4) P, Q, R

137. Depreciation calculated by which of the following methods is maximum?

- ☒ 1) Diminishing balance method
- 2) Straight line method
- 3) Sum of the years digit method
- 4) Sinking fund method

138. New - manufacturing capital investment is:

- ☒ 1) Offsite plus indirect costs
- 2) Offsite costs
- 3) Onsite costs
- 4) Onsite plus offsite costs

139.

If 'i' is the interest rate, then $\frac{i}{(1+i)^n - 1}$ is called -

- | | |
|--|-------------------------|
| A. | Capital recovery factor |
| <input checked="" type="checkbox"/> B. | Sinking fund factor |
| C. | Present worth factor |
| D. | None of these |

140. Solvent used in extractive distillation -

- 1) Alters the relative volatility of the original compound
- 2) Is of low volatility
- 3) Must form no azeotrope with the original substance
- ☒ 4) All of these

141. In solvent extraction of oil, rate of extraction -

- ☒ 1) Increases with decrease of thickness of the flakes
- ☐ 2) Increases with the increasing flake size keeping the flake thickness constant
- ☐ 3) Increases considerably with the rise of temperature
- ☐ 4) Decreases as the moisture content of flakes increases

142. NTU can be considered as a -

- ☐ 1) Performance concept of the equipment
- ☒ 2) Measure of approach to ideality
- ☐ 3) Measure of difficulty of separation
- ☐ 4) Measure of departure from ideality

143. In binary distillation, the separation of the components is easier if the relative volatility (α) is :

- ☒ 1) $\alpha \gg 1$
- ☐ 2) $\alpha \ll 1$
- ☐ 3) $\alpha = 1$
- ☐ 4) None of these

144. In distillation column design, the McCabe - Thiele process is inadequate and Ponchon - Savarit procedure is needed when -

- ☐ 1) Saturated feed is not used
- ☐ 2) An azeotrope forms
- ☒ 3) The latent heats of vaporization of the more and less volatile components are greatly different
- ☐ 4) A total condenser is used.

145. Decoction refers to -

- ☒ 1) Use of solvent at its boiling temperature
- ☐ 2) Use of solvent as a vapour
- ☐ 3) Use of cold solvent
- ☐ 4) None of these

146. Absorption factor is :

- ☐ 1) mG/L
- ☒ 2) L/mG
- ☐ 3) G/mL
- ☐ 4) G/m

147. Cox chart is used in the design of -

- ☒ 1) Distillation column
- ☐ 2) Condenser
- ☐ 3) Heat exchanger
- ☐ 4) Crystallizer

148. Flash distillation is used at a large scale in -

- ☐ 1) Sulphuric acid manufacture
- ☐ 2) Ammonia synthesis
- ☒ 3) Petroleum refining
- ☐ 4) Phenol - formaldehyde resins

149. The humidity of a stream or mass of gas may be found by measuring -

- ☐ 1) Dew point
- ☐ 2) Wet bulb temperature
- ☐ 3) By direct absorption methods
- ☒ 4) All of these

150. The stripping factor is defined as -

- ☐ 1) The product of slopes of the operating line and equilibrium curve
- ☐ 2) The reciprocal of the product of slopes of the operating line and equilibrium curve
- ☒ 3) The ratio of the slope of the operating line to the slope of the equilibrium curve
- ☐ 4) The ratio of the slope of the equilibrium curve to the slope of the operating line

151. Most distillation columns are designed for reflux ratio between -

- ☐ 1) 3 to 5 times R_{min}
- ☒ 2) 1.2 to 1.7 times R_{min}
- ☐ 3) 2 to 10 times R_{min}
- ☐ 4) 0.2 to 0.7 times R_{min}

152. Which of the following method assumes constant molar vaporisation and overflow?

- 1) McCabe - Thiele method
2) Ponchon - Savarit method
3) Enthalpy concentration method
4) Plate absorption column

153. If the selectivity of the solvent used in liquid - liquid extraction is unity ?

- 1) Any degree of separation of solute is possible
2) Only little amount of solute may be separated
3) No separation is possible
4) None of these

154. Match the following

List - I	List - II
a. $\frac{\mu}{\rho D_{AB}}$	1. Sherwood number
b. $\frac{K_f d}{D_{AB}}$	2. Grashof number
c. $\frac{g \Delta \rho}{l} \left(\frac{\rho}{\mu} \right)$	3. Schmidt number
d. $\frac{\sigma \sqrt{\rho}}{\mu}$	4. Reynold's number

	a	b	c	d
A.	1	2	3	4
B.	3	2	1	4
C.	2	4	1	3
D.	3	1	2	4

155. Desorption is also known as -

- 1) Leaching
2) Extraction
3) Stripping
4) Elutriation

156. Flooding results is :

- 1) Low efficiency
2) High efficiency
3) High gas velocity
4) None of these

157. Chemisorption is :

- 1) Same as 'Van der Waals' adsorption
2) Characterised by adsorption of heat
3) An irreversible process
4) A reversible process

158. Increased temperature increases the rate of extraction in solid liquid systems due to -

- 1) Increased liquid viscosity and decreased diffusivity
2) Increased liquid viscosity and increased diffusivity
3) Decreased liquid viscosity and decreased diffusivity
4) Decreased liquid viscosity and increased diffusivity

159. For adsorption, the adsorbent requirement (where n is Fraindlich index) (P) $n < 1$ (Q) $n > 1$ (R) $n = 1$ increasing order follows -

- 1) $P > Q > R$
2) $P > R > Q$
3) $R > P > Q$
4) $R > Q > P$

160. Consider a feed $C_{AO} = 100$, $C_{BO} = 100$, $C_{inert} = 100$ to a steady flow reaction. The isothermal gas phase reaction is $A + 3B \rightarrow 6R$. What are the values of ϵ_A and ϵ_B ?

- 1) 1/2, 1/2
2) 1/2, 1/3
3) 1/3, 1/2
4) 1/5, 1/3

161. For a mixed flow reactor operating at a steady state the rate of reaction is given by -

- | | |
|---------------|--------------------------------------|
| A. | $\frac{F_{AO}}{V} - \frac{dC_A}{dt}$ |
| B. | $\frac{F_{AO}}{V} + \frac{dC_A}{dt}$ |
| C. | $\frac{F_{AO} X_A}{V}$ |
| D. | $\frac{-dC_A}{dt}$ |

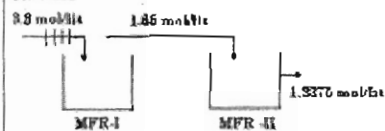
162. The units of frequency factor in Arrhenius equation -

- 1) Are the same as those of the rate constant 2) Depends on the order of the reaction
- 3) Depends on the temperature, pressure of the reaction 4) Are cycles per unit time

163. Liquid A decomposes by first order kinetics in a batch reactor. Conversion is 50% of A in a 5 minutes run. How much longer would it take to reach 75% conversion ?

- 1) 2.5 2) 7.5
- ~~3) 10~~ 4) 15

164. A chemical reaction is carried out in two MFR in series. The volume of first reactor is 1.5 times of second reactor. The temperature of reactors are such that the rate constant in the first reactor is 1.5 times the rate constant in the second reactor -



What is the order of the reaction?

- | | |
|---------------|---|
| A. | 0 |
| B. | 1 |
| C. | 2 |
| D. | 3 |

165. A batch adiabatic reactor at a initial temperature of 373 K is being used for the reaction $A \rightarrow B$. Assume heat of reaction is -1 kJ/mole at 373 K and the heat capacity of both A and B to be constant and equal to 50 J/mol. K. The temperature rise after a conversion of 50% will be -

- 1) 5°C ~~2) 10°C~~
- 3) 20°C 4) 100°C

167. For the reaction $\text{H}_2 + \text{Cl}_2 \xrightarrow{\text{Sunlight}} 2\text{HCl}$
the order of the reaction is :

A. 0
B. 1
C. 2
D. 3

1) CSTR 2) Plug flow reactor
3) A plug flow reactor followed by CSTR 4) CSTR followed by a plug flow reactor

1) 0
3) <1

1) A plug flow reactor in series 2) A plug flow reactor in parallel
3) More CSTR's in series 4) More CSTR's in parallel

1) Increase 2) Decrease
3) Remain same 4) Uncertain

1) 1
3) Infinity
2) 0
4) 100

173. A endothermic second order reaction is carried out in an adiabatic plug flow reactor. The rate of heat generation is:

- ~~1) Maximum at the inlet of the reactor~~ 2) Maximum at the exit of the reactor
3) Maximum at the center of the reactor 4) Constant throughout the reactor

174. The conversion X_A and residence time data are collected for a zero order liquid phase reaction in a stirred tank reactor. Which of the following will be a straight?

- ~~1) X_A vs t~~ 2) X_A vs t /t
3) $X_A/(1-X_A)$ vs t 4) $X_A(1-X_A)$ vs t

175. The dimensions of rate constant for reaction $3A \rightarrow B$ are lit/gmol min. The reaction order is :

- 1) 0 2) 1
~~3) 2~~ 4) 3

176. The conversion for a first order reaction $A \rightarrow B$ in a CSTR is 50%. If another CSTR same volume is connected in series then % conversion at the exit of the second reactor will be -

- 1) 60 ~~2) 75~~
3) 90 4) 100

177. On doubling the concentration of the reactant the ratio of reaction triples. Find the order of the reaction.

- 1) 1 ~~2) 1.6~~
3) 2 4) 2.25

178. For an isothermal second order aqueous phase reaction $A \rightarrow B$ the ratio of the time required for 90% conversion to time required for 45% conversion ?

- 1) 2 2) 4
~~3) 11~~ 4) 22

179. For a first order reaction (reversible) $A \leftrightarrow R$. If equilibrium constant $K = 3$ the equilibrium conversion is:

- 1) 0.33 2) 0.5
~~3) 0.75~~ 4) 1

180.

The inverse of the matrix $\begin{pmatrix} 1 & -1 \\ -1 & -1 \end{pmatrix}$ is:	
A.	Does not exist
B.	$\begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}$
C.	$\begin{pmatrix} 0.5 & -0.5 \\ -0.5 & -0.5 \end{pmatrix}$
D.	$\begin{pmatrix} -0.5 & 0.5 \\ 0.5 & 0.5 \end{pmatrix}$

181. The value of $(1+i)^8$, where $I = \sqrt{-1}$ is :

- 1) $8+4i$ 2) $8-4i$
~~3) 16~~ 4) 8

182. The system of equations :

1) Has no unique solution

2) Has only one solution

3) Has only two solutions

~~4) Has infinite solutions~~

183. The integrating factor for the differential equations:

$$(\cos^2 x) \frac{dy}{dx} + y = \tan x, \text{ is:}$$

~~A. $e^{\tan x}$~~

B. $\cos 2x$

C. $e^{-\tan x}$

D. $\sin 2x$

184. For an even function $f(x)$,

A. $\int_{-a}^a f(x) dx = 0$

B. $\int_{-a}^a f(-x) dx = 0$

C. $f(x) = -f(-x)$

~~D. $f(x) = f(-x)$~~

185. General solution of $\frac{dy}{dx} + \frac{y}{x} = x^2$ is:

A. $xy + \frac{x^4}{4} = C$

~~B. $xy = \frac{x^4}{4} + C$~~

C. $xy + \frac{x^4}{4} = Cx$

D. None of these

186. For $y = 1 - x + x^2$, optimum value of y is:

~~1) $3/4$~~

2) $-3/4$

3) Zero

4) None of these

187. The necessary and sufficient condition for the differential equation of the form $M(x, y)dx + N(x, y)dy = 0$ to be exact is :

A.	$M=N$
B.	$\frac{\partial M}{\partial x} = \frac{\partial N}{\partial y}$
C.	$\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$
D.	$\frac{\partial^2 M}{\partial x^2} = \frac{\partial^2 N}{\partial y^2}$

188. The transfer function for a first order process with time delay is :

A.	$\frac{e^{T_d s}}{(Ts + 1)}$
B.	$\frac{e^{-T_d s}}{Ts + 1}$
C.	$\frac{1}{(Ts + 1)(T_d s + 1)}$
D.	$\frac{T_d s}{(Ts + 1)}$

189. The one dimensional heat conduction partial differential equation $\partial T / \partial t = \partial^2 T / \partial x^2$ is:

1) Parabolic	2) Hyperbolic
3) Elliptic	4) Mixed

190. The values of the function $f(x)$ are tabulated below :

x	0	1	2	3
f(x)	1	2	1	10

Using Newton's forward difference formula, the cubic polynomial that can be fitted to the above data is :

A.	$2x^3 + 7x^2 - 6x + 2$
B.	$2x^3 + 7x^2 - 6x - 2$
C.	$x^3 + 7x^2 - 6x^2 + 1$
D.	$2x^3 - 7x^2 + 6x + 1$

191.

Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using (0, 6) interval into six parts each of width $w=1$ by Trapezoidal rule –

A. 1.4018

~~B. 1.4108~~

C. 2.4018

D. 1.804

192. Use Crout's method to find out the x, y, z values for the equations given below: $x + 2y + 2z = 1$ $2x + 2y + 3z = 3$ $x - y + 3z = 5$

1) $x=1, y=1, z=1$

2) $x=1, y=-1, z=-1$

3) $x=-1, y=-1, z=-1$

~~4) $x=1, y=-1, z=1$~~

193.

Evaluate $\Delta \tan^{-1}x$

~~A. $\tan^{-1} \left[\frac{1 + hx + x^2}{h} \right]$~~

B. $\tan^{-1} \left[\frac{-1 + hx + x^2}{h} \right]$

C. $\tan^{-1} \left[\frac{h}{1 + hx + x^2} \right]$

D. $\tan^{-1} \left[\frac{-h}{1 + hx + x^2} \right]$

194.

The integrating factor of

$$(1 - x^2) \frac{dy}{dx} - xy = 1$$

A. -x

B. $\frac{x}{1 - x^2}$

~~C. $\sqrt{1 - x^2}$~~

D. $\frac{1}{\sqrt{1 - x^2}}$

195.

The auxiliary equation of

$$(x^2 D^2 + 3xD + 1)y = \frac{1}{1 \cdot x} \text{ is:}$$

☒ A. $m^2 + 2m + 1 = 0$

B. $m^2 + 3m + 1 = 0$

C. $m^2 + 4m + 1 = 0$

D. None of these

196.

The integrating factor of $y(1+xy)dx + x(1-xy)dy = 0$ is:

☒ A. $\frac{1}{x^2 y^2}$

B. $x^2 y^2$

C. $\frac{1}{2x^2 y^3}$

D. None of these

197. If $F = (x + 2y + \lambda z)i + (2x - 3y - z)j + (4x - y + 2z)k$ is an irrotation vector then λ is:

1) 2

2) 3

☒ 3) 4

4) 0

198. The greatest value of the directional derivative of $\Phi = x^2 yz$ at $(1, 4, 1)$ is:

1) 3

2) 6

☒ 3) 9

4) 12

199.

If C is the circle $x^2 + y^2 = 4$ then

$$\int_C (3x + 4y)dx + (2x - 3y)dy$$

☒ A. 8π

B. -8π

C. 4π

D. -4π

200. Continuous shell temperature measurement in a liquid - liquid heat exchanger is

done by a -

- | | |
|---------------------------------|--------------------------------|
| 1) Thermocouple | 2) Resistance thermometer |
| 3) Mercury in glass thermometer | 4) Vapour pressure thermometer |