06. Maximum water velocity in tubes of a 1-2 shell and tube heat exchanger may be around _____ metres/second.
(A) 1
(B) 10
(C) 20
(D) 30
Answer: Option A

07. For the same heat load and mass flow rate in the tube side of a shell and tube heat exchanger, one may use multipass on the tube side, because it
(A) Decreases the pressure drop
(B) Decreases the outlet temperature of cooling medium
(C) Increases the overall heat transfer coefficient
(D) None of these
Answer: Option C

08. A tank painted with which of the following coloured paints, would heat up maximum by radiation from sun?
(A) Yellow paint
(B) White paint
(C) Black paint
(D) Grey paint
Answer: Option C

09. Walls of a cubical oven are of thickness l, and they are made of material of thermal conductivity k. The temperature inside the oven is 100°C and the inside heat transfer co-efficient is '$3k/l$'. If the wall temperature on the outside is held at 25°C, what is the inside wall temperature in degree centigrade?
(A) 35.5
(B) 43.75
(C) 81.25
(D) 48.25
Answer: Option C

10. Three materials A, B and C of equal thickness and of thermal conductivity of 20, 40 & 60 kcal/hr. m. °C respectively are joined together. The temperature outside of A and C are 30°C and 100°C respectively. The interface between B and C will be at a temperature of _____ °C.
(A) 40
(B) 95
(C) 70
(D) 50
Answer: Option C

11. A graph between _____ is called Wilson plot.
(A) $(1/U)$ Vs. $(1/v^{0.8})$
(B) $(1/v^{0.8})$ Vs. U
(C) $v^{0.8}$ Vs . U
(D) $(1/U)$ Vs. $(1/V)$
Answer: Option A

12. The thermal radiation emitted by a body is proportional to T^n, where T is its absolute temperature. The value of 'n' is exactly 4 for
(A) Black painted bodies only
(B) All bodies
(C) Polished bodies only
(D) A black body
Answer: Option B

13. For a laminar flow of fluid in a circular tube, 'h_1' is the convective heat transfer co-efficient at velocity 'V_1'. If the velocity is reduced by half and assuming the fluid properties are constant, the new convective heat transfer co-efficient is
(A) 1.26 h_1
(B) 0.794 h_1
(C) 0.574 h_1

(D) 1.741 h_1

Answer: Option B

14. Pick out the correct statement.

(A) 1 kcal/hr.m.°C is equal to 1 BTU/hr. ft.°F

(B) In steady state heat conduction, the only property of the substance which determines the temperature distribution, is the thermal conductivity

(C) In unsteady state heat conduction, heat flows in the direction of temperature rise

(D) In heat transfer by forced convection, Grashoff number is very important

Answer: Option B

15. Evaporation by thermo compression results in the

(A) Saving of steam

(B) Realisation of multiple effect economy in a single effect

(C) Both (A) and (B)

(D) None of these

Answer: Option C

16. Fouling factor for a heat exchanger is given by (where, U_1 = heat transfer co-efficient of dirty surface U_2 = heat transfer co-efficient of clean surface).

(A) $U_1 - U_2$

(B) $1/U_1 - 1/U_2$

(C) $1/U_2 - 1/U_1$

(D) $U_2 - U_1$

Answer: Option B

17. Use of transverse baffles in a shell and tube heat exchanger is done to increase the

(A) Rate of heat transfer

(B) Flow velocity

(C) Turbulence of shell side fluid

(D) All (A), (B) and (C)

Answer: Option D

18. All analogy equations connecting friction factor and heat transfer co-efficient apply only to

(A) Wall or skin friction

(B) Form friction

(C) Both (A) and (B)

(D) Turbulent flow

Answer: Option A

19. Which of the following situations can be approximated to a steady state heat transfer system?

(A) A red hot steel slab (having outside surface temperature as 1300°C) exposed to the atmospheric air at 35°C

(B) 10 kg of dry saturated steam at 8 kgf/cm^2 flowing through a short length of stainless steel pipe exposed to atmospheric air at 35°C

(C) Boiling brine kept in open vessel when the bottom surface temperature of the vessel is maintained constant at 180°C

(D) A sub-cooled refrigerant liquid at 8°C flowing at the rate of 6 Kg/minute through a copper pipe exposed to atmospheric air at 35°C

Answer: Option B

20. Reason for operating an evaporator in multiple effects is to secure

(A) Increased steam economy

(B) Decreased steam consumption

(C) Both (A) and (B)

(D) Increased capacity

Answer: Option C

21. Heat transfer by _____ may not necessarily require the presence of a medium.

(A) Conduction

(B) Natural convection

(C) Forced convection

(D) Radiation

Answer: Option D

22. Fluid motion in the natural convection heat transfer between a solid surface and a fluid in contact with it, results from the
    (A) Existence of thermal boundary layer
    (B) Temperature gradient produced due to density difference
    (C) Buoyancy of the bubbles produced at active nucleation site
    (D) None of these
    Answer: Option D

23. Nusselt number is the ratio of the
    (A) Temperature gradient of the wall to that across the entire pipe
    (B) Temperature difference to the temperature gradient at the wall
    (C) Heat flux at the wall to that across the entire pipe
    (D) None of these
    Answer: Option C

24. Critical value of the _____ number governs the transition from laminar to turbulent flow in free convection heat transfer.
    (A) Grashoff
    (B) Reynolds
    (C) Both 'a' & 'b'
    (D) Prandtl & Grashoff
    Answer: Option D

25. Prandtl number is the reciprocal of
    (A) Thermal diffusivity/Momentum diffusivity
    (B) Thermal diffusivity × Momentum
    (C) Thermal diffusivity × Mass diffusivity
    (D) Mass diffusivity × Momentum diffusivity
    Answer: Option A

26. In case of parallel flow heat exchanger, the lowest temperature theoretically attainable by the hot fluid is _____ the outlet temperature of the cold fluid.
    (A) Equal to
    (B) More than
    (C) Less than
    (D) Either more or less than (depending upon the fluid)
    Answer: Option A

27. For a multipass shell and tube heat exchanger, the LMTD correction factor is always
    (A) 1
    (B) > 1
    (C) < 1
    (D) Between 1 & 2
    Answer: Option C

28. Evaporator tubes are generally
    (A) Horizontal
    (B) Vertical
    (C) Inclined
    (D) Random
    Answer: Option B

29. Thermal conductivity of a gas at low density, _____ with increase in temperature.
    (A) Decreases
    (B) Increases
    (C) Remains unchanged
    (D) May increase or decrease; depends on the gas
    Answer: Option B

30. Which of the following is the most widely used heat insulating material for pipelines carrying steam?
    (A) Tar dolomite bricks followed by asbestos
    (B) Fireclay refractory followed by aluminium sheet
    (C) Cotton followed by aluminium foil

(D) 85% magnesia cement and glass wool
Answer: Option D

31. The interchange factor for radiation heat transfer from surface 'x' to surface 'y' in case of an infinite parallel planes with emissivities ε_x & ε_y is given by
(A) $\varepsilon_x + \varepsilon_y$
(B) $\varepsilon_x . \varepsilon_y$
(C) $1/\varepsilon_x + 1/\varepsilon_y$
(D) $(\varepsilon_x + \varepsilon_y)/(\varepsilon_x + \varepsilon_y - \varepsilon_x . \varepsilon_y)$
Answer: Option D

32. If the thermal conductivity of a wall material is independent of temperature, the steady state temperature distribution in the very large thin plane wall having steady, uniform surface temperature follows _____ law.
(A) Parabolic
(B) Hyperbolic
(C) Linear
(D) Logarithmic
Answer: Option A

33. With increase in temperature, the thermal conductivity of a gas
(A) Increases
(B) Decreases
(C) Remain same
(D) May increase or decrease depending on the type of gas
Answer: Option A

34. Grashoff number is given by
(A) $gD^3.\beta.\Delta t\rho^2/\mu^2$
(B) $gD^2\beta\Delta t\rho/\mu^2$
(C) $gD^2\beta\Delta tP^2\mu$
(D) $gD^3\beta\Delta tP^2/\mu$
Answer: Option A

35. Which area is used in case of heat flow by conduction through a cylinder?
(A) Logarithmic mean area
(B) Arithmetic mean area
(C) Geometric mean area
(D) None of these
Answer: Option A

36. Pick out the wrong statement.
(A) Heat transfer from a hot body to cold body by the emission of heat waves is called radiation
(B) Filmwise condensation takes place on non-wettable surfaces
(C) The boiling point of a solution is affected by liquid head as well as boiling point elevation
(D) None of these
Answer: Option B

37. Choose the correct equation.
(A) $Nu = (Re) (Pr) (Gz)$
(B) $Nu = (Re) (Pr) (St)$
(C) $Nu = (Re) (Pr)$
(D) $Nu = (Pr) (St)$
Answer: Option B

38. In a heat exchanger, the rate of heat transfer from the hot fluid to the cold fluid
(A) Varies directly as the area and the LMTD
(B) Directly proportional to LMTD and inversely proportional to the area
(C) Varies as square of the area
(D) None of these
Answer: Option A

39. Pick out the wrong statement.
(A) 'Solvates' are chemical compounds formed by solute with their solvents. When water is the solvent, then it is called a 'hydrate'

(B) In heat exchanger calculations (Δt) weighted is used in place of Δt, when it involves more than one sequence of heating or cooling i.e., desuperheating & condensation or condensation & sub-cooling

(C) Heat transfer co-efficient during nucleate boiling is not influenced by the agitation imparted

(D) In case of short tube vertical evaporators, area of central downtake is about 50 to 100% of the total tube cross-sectional area

Answer: Option C

40. For what value of Prandtl number, $St = f/2$?
   (A) 1.5
   (B) 1
   (C) > 1
   (D) < 1
   Answer: Option B

41. The rate of emission of radiation by a body does not depend upon the
   (A) Wavelength of radiation
   (B) Surface temperature of the body
   (C) Nature of the surface
   (D) Shape and porosity of the body
   Answer: Option D

42. Heat sensitive materials can be concentrated in an evaporator employing
   (A) Vacuum
   (B) High pressure
   (C) High residence time
   (D) None of these
   Answer: Option A

43. In a cooling tower, water becomes cool by
   (A) Loosing sensible heat
   (B) Heat transfer to surroundings
   (C) Vaporisation due to heat loss to air
   (D) Loosing latent heat
   Answer: Option A

44. Conductance is given by (where, x = thickness, A = heat flow area, K = thermal conductivity.)
   (A) x/KA
   (B) KA/x
   (C) K/Ax
   (D) A/Kx
   Answer: Option B

45. Out of the following four assumptions used in the derivation of the equation for LMTD [$LMTD = (\Delta t_1 - \Delta t_2)/\ln(\Delta t_1/\Delta t_2)$], which one is subject to the largest deviation in practice ?
   (A) Constant overall heat transfer co-efficient.
   (B) Constant rate of fluid flow
   (C) Constant specific heat
   (D) No partial phase change in the system
   Answer: Option B

46. LMTD can't be used as such without a correction factor for the
   (A) Multipass heat exchanger
   (B) Baffled heat exchanger
   (C) Condensation of mixed vapour in a condenser
   (D) All (A) (B) and (C)
   Answer: Option D

47. What is the logarithmic mean of r_1 and r_2?
   (A) $(r_1 - r_2)/\ln(r_1/r_2)$
   (B) $(r_1 - r_2)/\ln(r_2/r_1)$
   (C) $(r_2 - r_1)/\ln(r_1/r_2)$
   (D) $(r_1 - r_2)/-\ln(r_1/r_2)$
   Answer: Option A

48. In a heat exchanger with steam outside the tubes, a liquid gets heated to 45°C, when its flow velocity in the tubes is 2 m/s. If the flow velocity is reduced to 1 m/s, other things remaining the same, the temperature of the exit liquid will be
   (A) Less than 45°C
   (B) More than 45°C
   (C) Equal to 45°C
   (D) Initially decreases and remains constant thereafter
   Answer: Option B

49. The Nusselt number for fully developed (both thermally and hydrodynamically) laminar flow through a circular pipe, where the wall heat flux is constant, is
   (A) 2.36
   (B) 4.36
   (C) 120.36
   (D) Dependent on N_{Re} only
   Answer: Option B

50. Heat flux, as defined in heat flow is analogous to _____ in electricity flow.
   (A) Current
   (B) Voltage
   (C) Resistance
   (D) None of these
   Answer: Option A

51. The overall resistance for heat transfer through a series of flat resistance, is the _____ of the resistances.
   (A) Average
   (B) Geometric mean
   (C) Product
   (D) Sum
   Answer: Option D

52. The driving potential for the crystal growth during crystallisation is the _____ of the solution.
   (A) Concentration
   (B) Viscosity
   (C) Super-saturation
   (D) Density
   Answer: Option C

53. Heat transfer co-efficient equation for forced convection, $Nu = 0.023 \, R_e^{0.8} . P_r^n$, is not valid, if the value of
   (A) $n = 0.4$ is used for heating
   (B) $n = 0.3$ is used for cooling
   (C) Reynolds number for the flow involved is > 10000
   (D) Reynolds number for the flow involved is < 2100
   Answer: Option D

54. For flow over a flat plate, the ratio of thermal boundary layer thickness, 'xt' and hydrodynamic boundary layer thickness 'x' is equal to (where, N_{Pr} = Prandtl number)
   (A) N_{Pr}
   (B) $N_{Pr}^{1/3}$
   (C) N_{Pr}^{-1}
   (D) $N_{Pr}^{-1/3}$
   Answer: Option B

55. In a shell and tube heat exchanger, putting a longitudinal baffle across the shell, forces the shell side fluid to pass _____ through the heat exchanger.
   (A) Once
   (B) Twice
   (C) Thrice
   (D) Four times
   Answer: Option B

56. An ejector is used to
   (A) Increase pressure
   (B) Increase temperature
   (C) Remove condensate
   (D) None of these
   Answer: Option D

57. In a forward feed multiple effect evaporator, the pressure is
   (A) Highest in last effect
   (B) Lowest in last effect
   (C) Same in all effects
   (D) Dependent on the number of effects
   Answer: Option B

58. In a laboratory test run, the rate of drying was found to be 0.5×10^{-3} kg/m^2.s, when the moisture content reduced from 0.4 to 0.1 on dry basis. The critical moisture content of the material is 0.08 on a dry basis. A tray dryer is used to dry 100 kg (dry basis) of the same material under identical conditions. The surface area of the material is 0.04 m^2/kg of dry solid. The time required (in seconds) to reduce the moisture content of the solids from 0.3 to 0.2 (dry basis) is
   (A) 2000
   (B) 4000
   (C) 5000
   (D) 6000
   Answer: Option C

59. With increase in temperature, the thermal conductivity of most liquids
   (A) Increases
   (B) Decreases
   (C) Remain same
   (D) First increases upto a certain temperature and then becomes constant
   Answer: Option B

60. Peclet number (Pe) is given by
   (A) $Pe = Re.Pr$
   (B) $Pe = Re/P_r$
   (C) $P_e = P_r/R_e$
   (D) $Pe = Nu.Re$
   Answer: Option A

61. The film co-efficient between condensing vapour and metal wall increases with
   (A) Increasing temperature of the vapour
   (B) Decreasing temperature of the vapour
   (C) Increasing viscosity of the film of condensate
   (D) Increasing temperature drop
   Answer: Option A

62. In Fourier's law, the proportionality constant is called the
   (A) Heat transfer co-efficient
   (B) Thermal diffusivity
   (C) Thermal conductivity
   (D) Stefan-Boltzmann constant
   Answer: Option C

63. The non-dimensional temperature gradient in a liquid at the wall of a pipe is the
   (A) Heat flux
   (B) Nusselt number
   (C) Prandtl number
   (D) Schmidt number
   Answer: Option A

64. When the ratio of the Grashoff number and to the square of Reynolds number is one, the dominant mechanism of heat transfer is:
   (A) Free convection
   (B) Entry length problem in laminar forced conduction (developing thermal boundary layer)

(C) Mixed convection (both free and forced)
(D) Forced convection
Answer: Option C

65. "The ratio of the total emissive power to the absorptivity for all bodies is same at ther-mal equilibrium". This is _____ law.
    (A) Kirchoff's
    (B) Planck's
    (C) Wien's displacement
    (D) Stefan-Boltzmann
    Answer: Option A

66. The units of resistance to heat transfer is
    (A) $J.m^{-2}.K^{-1}$
    (B) $J.m^{-1}.K^{-1}$
    (C) $W.m^{-2}.K^{-1}$
    (D) $W^{-1}m^{2}K$
    Answer: Option D

67. For a liquid in laminar flow through a very long tube, when the exit fluid temperature approaches the wall temperature, the equation to be used is
    (A) $Nu = 0.023\ Re^{0.8}.\ Pr^{0.4}$
    (B) $Nu = (\pi/2)\ Gz$
    (C) $Nu = (2/\pi)\ Gz$
    (D) $Nu = 2Gz^{0.5}$
    Answer: Option C

68. For hot feed, forward feeding as compared to backward feeding results in _____ economy.
    (A) Increased
    (B) Decreased
    (C) No effect on
    (D) None of these
    Answer: Option A

69. Pick out the wrong statement.
    (A) Fluid movement under the influence of buoyant forces resulting from change in density takes place in case of natural convection
    (B) The ratio $N_{Nu}/N_{Re} . N_{pr}$ is called the Stanton number
    (C) The Peclet number is a measure of the ratio of energy transport by convection to that by conduction
    (D) The Colburn jH factor for heat transfer is given by $N_{st}\ N_{pr}$
    Answer: Option D

70. In sub-cooled boiling,
    (A) Temperature of the heating surface is less than the boiling point of the liquid
    (B) Temperature of the heating surface is more than the boiling point of the liquid
    (C) Bubbles from heating surface are absorbed by the mass of the liquid
    (D) Very large vapour space is necessary
    Answer: Option B

71. Which is the best tube arrangement (in a shell and tube heat exchanger) if the fluids are clean and non-fouling?
    (A) Square pitch
    (B) Triangular pitch
    (C) Diagonal square pitch
    (D) None of these
    Answer: Option B

72. Heat transfer by conduction results due to the transfer of free electrons, kinetic energy & vibrational energy from one molecule to another. Conduction heat transfer cannot take place
    (A) Between two bodies in physical contact with each other
    (B) Between two bodies not in physical contact with each other
    (C) From one part of a body to the another part of the same body
    (D) Both 'b' & 'c'

Answer: Option B

73. A multiple effect evaporator as compared to a single effect evaporator of the same capacity has
    (A) Lower heat transfer area
    (B) Lower steam economy
    (C) Higher steam economy
    (D) Higher solute concentration in the product
    Answer: Option C

74. The thickness of condensate layer in filmwise condensation depends on the
    (A) Condensation rate
    (B) Surface configuration
    (C) Liquid flow rate from the surface
    (D) All (A), (B) and (C)
    Answer: Option D

75. With increase in temperature, the total emissivity of conductors
    (A) Increases
    (B) Decreases
    (C) Remain same
    (D) Decreases linearly
    Answer: Option A

76. Steam economy in case of a triple effect evaporator will be
    (A) 1
    (B) < 1
    (C) > 1
    (D) Between 0 and 1
    Answer: Option C

77. Dittus-Boelter equation used for the determination of heat transfer co-efficient is valid
    (A) For fluids in laminar flow
    (B) For fluids in turbulent flow
    (C) When Grashoff number is very important
    (D) For liquid metals
    Answer: Option B

78. In a forward feed multiple effect evaporator unit
    (A) Viscosity of liquid is highest in first effect
    (B) Transfer from effect to effect is done by pumps
    (C) No pump is required to withdraw the product from the last effect
    (D) None of these
    Answer: Option D

79. In a shell and tube heat exchanger, floating head is used for
    (A) Large temperature differentials
    (B) High heat transfer co-efficient
    (C) Low pressure drop
    (D) Less corrosion of tubes
    Answer: Option A

80. The heat transfer co-efficient in film type condensation is _____ that for dropwise condensation.
    (A) Greater than
    (B) Lower than
    (C) Is same as
    (D) Half
    Answer: Option B

81. Resistance to heat flow by conduction is proportional to (where, t & ρ are thickness & density of the material respectively and A = area normal to the direction of heat flow.)
    (A) t
    (B) $1/\rho$
    (C) $1/A$

(D) All (A), (B) & (C)

Answer: Option D

82. Dropwise condensation is promoted on a/an _____ surface.

(A) Glazed

(B) Oily

(C) Coated

(D) Smooth

Answer: Option B

83. Maximum heat transfer rate is obtained in _____ flow.

(A) Laminar

(B) Turbulent

(C) Creeping

(D) Transition region

Answer: Option B

84. Which of the following parameters of the fluid is not very important, while deciding its route in a shell and tube heat exchanger?

(A) Corrosiveness & fouling characteristics

(B) Pressure

(C) Viscosity

(D) Density

Answer: Option D

85. In case of a super-cooled solution, which is on the verge of crystallisation, the free energy of the solution as compared to that of the solid is

(A) More

(B) Less

(C) Same

(D) More or less; depends on the nature of solution

Answer: Option A

86. It is desired to concentrate a 20% salt solution (20 kg of salt in 100 kg of solution) to a 30% salt solution in an evaporator. Consider a feed of 300 kg/min at 30°C. The boiling point of the solution is 110°C, the latent heat of vaporisation is 2100 kJ/kg and the specific heat of the solution is 4 kJ/kg.K. The rate at which the heat has to be supplied in (kJ/min) to the evaporator is

(A) 3.06×10^5

(B) 6.12×10^5

(C) 7.24×10^5

(D) 9.08×10^5

Answer: Option A

87. In a single evaporator system, the steam economy _____ by creating vacuum in the evaporator.

(A) Increases

(B) Decreases

(C) Remain constant

(D) May increase or decrease, depends on the vacuum

Answer: Option A

88. Fqra cold viscous feed, backward feed gives _____ than forward feed.

(A) A higher capacity

(B) A lower capacity

(C) Lower economy

(D) None of these

Answer: Option A

89. $C_p\mu/K$ is termed as the _____ number.

(A) Grashoff

(B) Nusselt

(C) Prandtl

(D) Stanton

Answer: Option C

90. The overall heat transfer co-efficient for a shell and tube heat exchanger for clean surfaces is $U_0 = 400$ W/m^2.K. The fouling factor after one year of operation is found to be $h_{d0} = 2000$ W/m^2.K. The overall heat transfer co-efficient at this time is
    (A) 1200 W/m^2.K
    (B) 894 W/m^2.K
    (C) 333 W/m^2.K
    (D) 287 W/m^2.K
    Answer: Option C

91. The Graetz number is concerned with the
    (A) Mass transfer between a gas and a liquid
    (B) Absorption with chemical reaction
    (C) Heat transfer in turbulent flow
    (D) Heat transfer in laminar flow
    Answer: Option D

92. At what value of Prandtl number, conduction is negligible in the turbulent core of a fluid flowing through a heated pipe?
    (A) 0.5
    (B) < 0.5
    (C) > 0.6
    (D) < 0.1
    Answer: Option C

93. The unit of conductance in SI unit is
    (A) W/m
    (B) W/m^2
    (C) W/°K
    (D) W/m°K
    Answer: Option C

94. Pick out the wrong statement.
    (A) Bubble size increases with the dynamic viscosity of the liquid in case of nucleate pool boiling
    (B) Thermal conductivity of a dry material is more than that of the damp material
    (C) Ratio of its capacity to economy equals the steam consumption in kg/hr in an evaporator
    (D) Vaporisation of organic substances in evaporator mostly causes foam formation
    Answer: Option B

95. Pick out the correct statement.
    (A) Higher is the temperature of the radiating body, higher is the wavelength of radiation
    (B) Logarithmic mean area is used for calculating the heat flow rate through a thick walled cylinder
    (C) The wavelength corresponding to maximum mono-chromatic emissive power increases with rise in temperature
    (D) Solid angle subtended by the finite surface at the radiating element is called the angle of incidence
    Answer: Option B

96. Nucleate boiling is promoted
    (A) On polished surfaces
    (B) On rough surfaces
    (C) In the absence of agitation
    (D) None of these
    Answer: Option B

97. Which of the following has the lowest Prandtl number?
    (A) Molten sodium (a coolant used in fast breeder reactor)
    (B) Water
    (C) Transformer oil
    (D) Dilute H_2SO_4
    Answer: Option A

98. The thermal boundary layer at $N_{Pr} > 1$
    (A) Is thicker than hydrodynamic boundary layer

(B) Is thinner than hydrodynamic boundary layer
(C) And the hydrodynamic boundary layers are identical
(D) Disappears
Answer: Option B

99. In case of a multipass shell and tube heat exchanger, the temperature drop in the fluid
(A) Is inversely proportional to the resistance across which the drop occurs
(B) And the wall are proportional to individual resistances
(C) And the wall is not related
(D) None of these
Answer: Option B

100. Which of the following is directly concerned with the heat transfer?
(A) Strouhal number
(B) Sherwood number
(C) Euler number
(D) Grashoff number
Answer: Option D

101. The capacity of double-effect evaporator is less than half of the capacity of two single effects, each of which is operating over same terminal temperature difference, when the
(A) Solution has an elevation of boiling point
(B) Evaporators operate under vacuum
(C) Evaporators operate at atmospheric pressure
(D) None of these
Answer: Option A

102. The equation, $N_{st} = f/2$, is the _____ analogy.
(A) Colburn
(B) Reynolds
(C) Prandtl
(D) None of these
Answer: Option B

103. Nusselt number is a function of Prandtl number and _____ number of fluid in natural convection heat transfer.
(A) Grashoff
(B) Biot
(C) Stanton
(D) Reynolds
Answer: Option A

104. Forced circulation evaporators are normally used for concentrating liquids having
(A) Scaling characteristics
(B) High viscosity
(C) Both (A) & (B)
(D) Neither (A) nor (B)
Answer: Option C

105. Radiation energy is emitted by all the substances, which are above
(A) 0°K
(B) 0°C
(C) 100°C
(D) Room temperature
Answer: Option A

106. View factor is important in heat transfer by
(A) Steady state conduction
(B) Natural convection
(C) Forced convection
(D) Radiation
Answer: Option D

107. Pick out the wrong statement.
(A) Economy of a multiple effect evaporator is not influenced by the boiling point elevation

(B) Two identical cubes of iron and copper will have the same heat content under the same conditions of temperature

(C) Double pipe heat exchangers are mostly used in the field of refrigeration

(D) Finned tube heat exchangers are suitable for heating air by steam

Answer: Option B

108. 'Duhring's plot' is of use in

(A) Extractive distillation

(B) Evaporation

(C) Leaching

(D) Absorption

Answer: Option B

109. The dimensionless group in mass transfer that is equivalent to Prandtl number in heat transfer is

(A) Nusselt number

(B) Sherwood number

(C) Schmidt number

(D) Stanton number

Answer: Option C

110. Pick out the wrong statement.

(A) In drying a solid containing moisture above the critical moisture content the number of degrees of freedom is 2

(B) Sherwood number in mass transfer corresponds to Nusselt number in heat transfer and Schmidt number to Prandtl number

(C) Forced convection is relatively more effective in increasing the rate of mass transfer, if Schmidt number is larger

(D) Hot gases at moderate pressure are usually in the shell side of shell and tube heat exchangers. At higher pressure, however, it is customary to put gas in the tube side

Answer: Option C

111. Loss of heat from untagged steam pipe to the ambient air is by

(A) Conduction

(B) Convection

(C) Radiation

(D) All (A), (B) & (C)

Answer: Option D

112. In Biot number, the characteristic length used is the ratio of the _____ of the solid.

(A) Volume to surface area

(B) Perimeter to surface area

(C) Surface area to volume

(D) Surface area to perimeter

Answer: Option A

113. Heat flux increases with temperature drop beyond the Leiden frost point in the plot of heat flux vs. temperature drop for a boiling liquid, because

(A) Convection becomes important

(B) Conduction becomes important

(C) Radiation becomes important

(D) Sub-cooled boiling occurs

Answer: Option C

114. Boiling point elevation for a strong and concentrated solution is found by Duhring's rule, which states that at the same pressure, the boiling point of a solution is a linear function of the _____ of pure water.

(A) Boiling point

(B) Dynamic viscosity

(C) Kinematic viscosity

(D) Density

Answer: Option A

115. In case of heat flow by conduction for a cylindrical body with an internal heat source, the nature of temperature distribution is

(A) Linear
(B) Hyperbolic
(C) Parabolic
(D) None of these
Answer: Option C

116. The average heat transfer co-efficient over the entire length of the plate (h_a) and the local heat transfer co-efficient (h_L), in case of heat transfer over a flat plate in laminar zone is related as
(A) $h_a = 0.8h_L$
(B) $h_a = 2h_L$
(C) $h_a = h_L$
(D) $h_a = 5h_L$
Answer: Option B

117. Which has the lowest Prandtl number?
(A) Liquid metal
(B) Aqueous solution
(C) Water
(D) Lube oil
Answer: Option A

118. Stefan-Boltzmann law which describes the radiation heat transfer states that, it is proportional to (where, t = temperature in °C T = absolute temperature in ° K)
(A) t^4
(B) T^4
(C) $1/t^4$
(D) $1/T^4$
Answer: Option B

119. The ratio of velocity head to tube side return loss in case of a multipass shell and tube heat exchanger is
(A) 2
(B) 1/2
(C) 4
(D) 1/4
Answer: Option D

120. The equation, $(N_{St} \times N^{2/3}{}_{Pr}) = f/2$, is the _____ analogy.
(A) Colburn
(B) Reynolds
(C) Prandtl
(D) None of these
Answer: Option A

121. What is the geometric mean of two heat transfer areas A_1 and A_2?
(A) $\sqrt{(A_1 . A_2)}$
(B) $\sqrt{(A_1 + A_2)}$
(C) ½ $\sqrt{(A_1 . A_2)}$
(D) 2 $\sqrt{(A_1 . A_2)}$
Answer: Option A

122. The range of electromagnetic spectrum important in heat transfer by radiation is _____ microns.
(A) 0.38-0.78
(B) 0.5-50
(C) 100-1000
(D) 5-50
Answer: Option B

123. Stefan's block body radiation law can also be derived from _____ law.
(A) Kirchoff's
(B) Planck's
(C) Fourier's
(D) None of these

Answer: Option B

124. Boiling point of a solution according to Duhring's rule is a linear function of the _____ of water.
(A) Boiling point (at the same pressure)
(B) Viscosity
(C) Density
(D) Thermal conductivity
Answer: Option A

125. Sensible heat absorbed by 1 lb of water when it is heated from 32 to 212°F may be around _____ BTU.
(A) 180
(B) 970
(C) 3.97
(D) Data insufficient, can't be predicted
Answer: Option A

126. Prandtl number for most of dry gases is about
(A) 0.001
(B) 0.72
(C) 70
(D) 150
Answer: Option B

127. Pick out the wrong statement.
(A) The emissivity of a surface decreases, if it gets corroded by atmospheric environment
(B) The emissivity of a surface increases with increase in surface roughness
(C) The emissivity of a polished surface is quite low
(D) The emissivity of a non-metallic surface decreases with increase in the temperature
Answer: Option A

128. Extremely large or small volumes of fluids are generally best routed through the shell side of a shell and tube heat exchanger, because of the
(A) Less corrosion problems
(B) Flexibility possible in the baffle arrangement
(C) Low pressure drop
(D) High heat transfer co-efficient
Answer: Option B

129. Fresh orange juice contains 12% (by weight) solids and the rest water 90% of the fresh juice is sent to an evaporator to remove water and subsequently mixed with the remaining 10% of fresh juice. The resultant product contains 40% solids. The kg of water removed from 1 kg fresh juice is
(A) 0.4
(B) 0.5
(C) 0.6
(D) 0.7
Answer: Option D

130. The purpose of providing expansion bellows in the shell of tubular exchanger is to
(A) Increase the heating load
(B) Impart structural strength
(C) Account for the uneven expansion of shell and tube bundles
(D) Facilitate increase of shell length, if needed
Answer: Option C

131. An equipment which converts the latent or sensible heat of one fluid into the latent heat of vaporisation of another, is called a
(A) Boiler
(B) Heat exchanger
(C) Recuperator
(D) Regenerator
Answer: Option B

132. Multipass heat exchangers are used

(A) Because of simplicity of fabrication
(B) For low heat load
(C) To obtain higher heat transfer co-efficient and shorter tube
(D) To reduce the pressure drop
Answer: Option C

133. A black body does not _____ radiation.

(A) Absorb or emit
(B) Refract
(C) Reflect
(D) Both (B) & (C)
Answer: Option D

134. It is not recommended to use a 1-2 shell and tube heat exchanger for a particular heat duty, whenever the LMTD correction factor is

(A) > 0.75
(B) < 0.75
(C) < 0.50
(D) < 0.25
Answer: Option B

135. Multiple effect evaporation accounts for

(A) Steam economy
(B) Lower operating costs
(C) Investment economy
(D) None of these
Answer: Option A

136. Finned tube heat exchangers

(A) Give larger area per tube
(B) Use metal fins of low thermal conductivity
(C) Facilitate very large temperature drop through tube wall
(D) Are used for smaller heat load
Answer: Option A

137. Tube expansion allowances exist in _____ heat exchanger.

(A) Multipass fixed tube sheet
(B) U-tube
(C) Single pass fixed tube sheet
(D) None of these
Answer: Option B

138. Fruit juice (a heat sensitive material) can be concentrated in a _____ evaporator.

(A) Long tube
(B) Falling film
(C) High pressure
(D) None of these
Answer: Option B

139. Pick out the wrong statement.

(A) In process heat exchangers, saturated steam is preferred over the superheated steam
(B) The maximum is the emissive power of a surface at a temperature T_1 occurs at a wavelength of λ_1. If the surface temperature is halved, the maximum in the emissive power would occur at a wavelength of $0.5 \lambda_1$
(C) When a vertical plate is heated in infinite air environmental under natural convection conditions, the velocity profile in air, normal to the plate, exhibits a maximum
(D) A body at 925 K emits an energy of $1.42 \times 10^{11} \sigma W/m^2$ (σ is the Stefan-Boltzmann constant) in the wavelength band between 3 μm to 4 μm. The fraction of this energy in the total energy emitted over the entire wavelength range is equal to emissivity
Answer: Option B

140. The Sieder-Tate correlation for heat transfer in turbulent flow in pipe gives $Nu \propto Re^{0.8}$, where, Nu is the Nusselt number and Re is the Reynolds number for the flow. Assuming that this relation is valid, the heat transfer co-efficient varies with the pipe diameter (D) as

(A) $D^{-1.8}$
(B) $D^{-0.2}$
(C) $D^{0.2}$
(D) $D^{1.8}$
Answer: Option B

141. Minimum recommended baffle spacing in a shell and tube heat exchanger is about (where, D = shell diameter).
   (A) 0.2 D
   (B) 0.5 D
   (C) 0.66 D
   (D) 0.80 D
   Answer: Option A

142. For heat flow through very thick walled cylinder, use _____ mean radius.
   (A) Arithmetic
   (B) Logarithmic
   (C) Geometric
   (D) Either (A) or (C)
   Answer: Option B

143. Corrosiveness of steam condensate is due to the presence of
   (A) CO_2
   (B) Dissolved O_2
   (C) Both (A) & (B)
   (D) Neither (A) nor (B)
   Answer: Option C

144. In a shell and tube heat exchanger, the shell side fluid velocity can't be changed by changing the
   (A) Tube layout
   (B) Tube diameter
   (C) Tube pitch
   (D) Number of baffles
   Answer: Option B

145. Solid angle subtended by the finite surface at the radiating element is
   (A) Called the view factor
   (B) Called the angle of vision
   (C) Proportional to the square of the distance between surfaces
   (D) Expressed in terms of radians
   Answer: Option B

146. LMTD for evaporators & condensers for a given terminal parameters & set of conditions for counter-flow is equal to that for parallel flow. In such heat exchangers, with one of the fluids condensing or evaporating, the surface area required is the least in the _____ flow.
   (A) Parallel
   (B) Mixed
   (C) Counter flow
   (D) Same in either 'a', b' or 'c'
   Answer: Option D

147. A sphere of radius 'R_1' is enclosed in a sphere of radius 'R_2'. The view (or shape) factor for radiative heat transfer of the outer sphere with respect to the inner sphere is
   (A) 0
   (B) $R_2/(R_1+R_2)$
   (C) 1
   (D) $(R_1/R_2)^2$
   Answer: Option B

148. The maximum heat transfer co-efficient from steam heating will be attained when the steam is:
   (A) Supersaturated
   (B) Saturated
   (C) Wet

(D) None of these

Answer: Option B

149. One kilogram of water at 0°C is changed to superheated steam of one atm pressure and 300° C. The major heat consumption in the process will be to

(A) Heat the water from 0°C to 100°C

(B) Evaporate the water

(C) To superheat the steam

(D) Data insufficient, can't be predicted

Answer: Option B

150. The film co-efficient is decreased due to the presence of non-condensing gases in the vapors. The film co-efficient of superheated vapor as compared to that of saturated vapor is

(A) More

(B) Less

(C) Some

(D) Either more or less; depends on the nature of vapor

Answer: Option C

151. The characteristic dimensionless groups for heat transfer to a fluid flowing through a pipe in laminar flow are

(A) Re.Gz

(B) Nu, Pr

(C) Nu, Pr, Re

(D) Nu, Gz

Answer: Option D

152. Which of the following has maximum thermal conductivity?

(A) Iron

(B) Coal

(C) Nitrogen

(D) Tar

Answer: Option A

153. In case of heat transfer by conduction in a hollow cylinder, _____ mean area is used to calculate the heat transfer rate.

(A) Geometric

(B) Arithmetic

(C) Logarithmic

(D) Either (A), (B) or (C)

Answer: Option C

154. The absorptivity of a grey body at a given temperature _____ with increasing wavelength of radiation.

(A) Increases

(B) Decreases

(C) Remain constant

(D) May increase or decrease; depends on the material

Answer: Option D

155. Thermal diffusivity of a material

(A) Has the unit m^2 /sec

(B) Is defined as $K/\rho . C_p$

(C) Is the ratio of thermal conductivity to thermal capacity

(D) All (A), (B) and (C)

Answer: Option D

156. Forced circulation evaporators are useful for the concentration of viscous, salting and scale forming liquors. Which of the following is a forced circulation evaporator?

(A) Long vertical evaporator

(B) Horizontal tube evaporator

(C) Agitated film evaporator

(D) Calandria vertical tube evaporator

Answer: Option C

157. Nusselt number is the ratio of the temperature gradient at the wall to
   (A) Temperature difference
   (B) Heat flux
   (C) That across the entire pipe
   (D) None of these
   Answer: Option C

158. Which of the following has the lowest overall heat transfer co-efficient?
   (A) Dowtherm
   (B) Molten sodium
   (C) Water
   (D) Air
   Answer: Option D

159. What is the unit of thermal conductivity?
   (A) Kcal/hr. m^2 °C
   (B) Kcal/hr.m.°C
   (C) Kcal/hr.m
   (D) Kcal/hr. °C
   Answer: Option B

160. Indirect contact heat exchangers are preferred over direct contact heat exchangers, because
   (A) Heat transfer co-efficient are high
   (B) There is no risk of contamination
   (C) There is no mist formation
   (D) Cost of equipment is lower
   Answer: Option B

161. Tubes are held between top and bottom tube sheets in Calandria type evaporator by keeping
   (A) Both the tube sheets fixed
   (B) Both the tube sheets floating
   (C) The top tube sheet floating and bottom tube sheet fixed
   (D) The top tube sheet fixed and the bottom tube-sheet floating
   Answer: Option A

162. Heat transfer by conduction in the turbulent core of a fluid flowing through a heated pipe is negligible, if the value of Prandtl number is
   (A) 0.2
   (B) 0.4
   (C) 0.6
   (D) 0.8
   Answer: Option C

163. What is the emissivity of a black body?
   (A) 0
   (B) 1
   (C) 0.5
   (D) 0.90
   Answer: Option B

164. The actual temperature drop across the heating surface of an evaporator depends on the
   (A) Liquid depth over the heating surface
   (B) Solution being evaporated
   (C) Pressure difference between the steam chest and the vapor space above the boiling liquid
   (D) All (A), (B) and (C)
   Answer: Option D

165. In SI units, thermal conductivity is expressed in
   (A) Watt/m.°K
   (B) Watt/m^2. °K
   (C) Watt/m^2. °K
   (D) Watt/m^4. °K
   Answer: Option A

166. *jH* factor for heat transfer depends upon the _____ number.
(A) Biot
(B) Nusselt
(C) Reynolds
(D) Prandtl
Answer: Option C

167. In pipe flow, heat is transferred from hot wall to the liquid by
(A) Conduction only
(B) Forced convection only
(C) Forced convection and conduction
(D) Free and forced convection
Answer: Option C

168. A perfect black body is a perfect _____ of radiation.
(A) Absorber
(B) Emitter
(C) Both (A) & (B)
(D) Neither (A) nor (B)
Answer: Option C

169. Heat transfer rate described by Fourier's law will decrease, if the _____ increases.
(A) Thermal conductivity
(B) Thickness
(C) Temperature difference
(D) Heat transfer area
Answer: Option B

170. The absorptivity of a body is equal to its emissivity
(A) At a particular temperature
(B) For circular bodies
(C) Under thermal equilibrium
(D) None of these
Answer: Option C

171. In a co-current double pipe heat exchanger used for condensing saturated steam over the inner tube, if the entrance and exit conditions of the coolant are interchanged, then the rate of condensation will
(A) Increase
(B) Decrease
(C) Remain unchanged
(D) Either increase or decrease; depends on the coolant flow rate
Answer: Option C

172. The inner wall of a furnace is at a temperature of 700°C. The composite wall is made of two substances, 10 and 20 cm thick with thermal conductivities of 0.05 and 0.1 $W.m^{-1.°}C^{-1}$ respectively. The ambient air is at 30°C and the heat transfer co-efficient between the outer surface of wall and air is 20 $W.m^{-2}.°C^{-1}$. The rate of heat loss from the outer surface in $W.m^{-2}$ is
(A) 165.4
(B) 167.5
(C) 172.5
(D) 175
Answer: Option A

173. Which one gives the monochromatic emissive power for black body radiation?
(A) Planck's law
(B) Kirchhoff's law
(C) Wien's law
(D) Stefan-Boltzmann law
Answer: Option A

174. If heat transfer rate varies with the time, it is termed as
(A) Forced convection
(B) Steady state conduction

(C) Monochromatic radiation
(D) None of these
Answer: Option D

175. Absorptivity and reflectivity of a perfect black body are respectively
   (A) 1 and 0
   (B) 0 and 1
   (C) 1 and ∞
   (D) 0 and 0.5
   Answer: Option A

176. _____ heat exchanger is used for chilling oil to be dewaxed.
   (A) U-tube
   (B) Double pipe
   (C) Fixed tube
   (D) Floating head
   Answer: Option B

177. Pick out the correct equation.
   (A) $j_H = (St)(Pr)^{2/3} = f/2$
   (B) $j_H = (St)(Pr)^{1/3} = f/2$
   (C) $j_H = (St)^{2/3}(Pr) = f/2$
   (D) $j_H = (St)^{1/3}(Pr) = f/2$
   Answer: Option A

178. It is not preferable to use superheated steam in evaporators, because of its very
   (A) High temperature
   (B) High pressure
   (C) Low film co-efficient
   (D) None of these
   Answer: Option C

179. Water is normally used as a coolant in the heat exchange equipments mainly because of its
   (A) Abundance & high heat capacity
   (B) Low density
   (C) Low viscosity
   (D) High fluidity
   Answer: Option A

180. A single pass air heater is connected to a two pass unit. For the air flow rate and other conditions remaining the same, the film heat transfer co-efficient for air will vary in the ratio of
   (A) 2
   (B) $2^{0.8}$
   (C) $2^{0.2}$
   (D) $2^{0.5}$
   Answer: Option B

181. At constant temperature, the thermal conductivities of gases _____ with rise in pressure.
   (A) Decrease
   (B) Increase
   (C) Remain unchanged
   (D) May increase or decrease; depends on the pressure
   Answer: Option A

182. Stefan-Boltzmann law applies to _____ body.
   (A) Black
   (B) White
   (C) Grey
   (D) Any colour
   Answer: Option A

183. When warm and cold liquids are mixed, the heat transfer is mainly by
   (A) Conduction
   (B) Convection

(C) Radiation
(D) Both (A) & (C)
Answer: Option B

184. A BTU/hr.ft.^{2} °F is equal to
(A) 1 kcal/hr. m^2°C
(B) 4.88 kcal/hr. m.^{2}°C
(C) 1 kcal/hr. m^2.°K
(D) None of these
Answer: Option B

185. Open pan evaporators are preferred to be used, when the solution to be concentrated is
(A) Scaling
(B) Highly viscous
(C) Corrosive
(D) Salty
Answer: Option B

186. A _____ evaporator employs an annular downtake.
(A) Basket type
(B) Horizontal
(C) Long tube vertical
(D) None of these
Answer: Option A

187. The equation, $N_{st} = (f/2)/[1 + 5 (N_{pr} - 1) \sqrt{(f/2)}]$, corresponds to _____ analogy.
(A) Von-Karman
(B) Reynolds
(C) Colburn
(D) Prandtl
Answer: Option D

188. The advantage of using a 1 - 2 shell and tube heat exchanger over a 1 - 1 shell and tube heat exchanger is
(A) Lower tube side pressure drop
(B) Lower shell side pressure drop
(C) Higher tube side heat transfer co-efficient
(D) Higher shell side heat transfer co-efficient
Answer: Option C

189. With increase in temperature, the thermal conductivity of fresh lubricating oil
(A) Increases
(B) Decreases
(C) Remains unchanged
(D) May increase or decrease; depends on its composition
Answer: Option B

190. Vent pipes are provided in a condenser to
(A) Remove non-condensable gases
(B) Purge the condenser
(C) Facilitate easy cleaning of tubes
(D) None of these
Answer: Option A

191. To reduce the tube side pressure drop for the same flow rate, the heat exchanger recommended is
(A) 1-2 heat exchanger
(B) 1-1 heat exchanger
(C) 3-2 heat exchanger
(D) 2-4 heat exchanger
Answer: Option B

192. LMTD for counter-flow and parallel flow heat exchanger will be the same, when the
(A) Cold fluid is heated to a certain temperature by condensing steam (isothermal fluid)
(B) Outlet temperature of both the hot and cold fluid are same

(C) Outlet temperature of hot fluid is less than the outlet temperature of the cold fluid
(D) None of these
Answer: Option A

193. In case of _____ boiling, the liquid temperature is below the saturation temperature and the boiling takes place in the vicinity of the heated surface.
(A) Nucleate
(B) Local
(C) Pool
(D) Saturated
Answer: Option B

194. Steam trap is used to
(A) Condense the steam flowing in the pipeline
(B) Remove water resulting from partial condensation of steam
(C) Stop the supply of steam
(D) None of these
Answer: Option B

195. For _____ Prandtl number values, the heat conduction will be negligible in the buffer zone.
(A) Extremely low
(B) Low
(C) High
(D) No
Answer: Option C

196. Planck's distribution law is valid for _____ bodies.
(A) Black
(B) White
(C) Coloured
(D) All (A), (B) & (C)
Answer: Option C

197. Electro-magnetic spectrum range, which is important for radiation varies from _____ microns.
(A) 1 to 100
(B) 0.5 to 50
(C) 10 to 100
(D) 100 to 1000
Answer: Option B

198. In a shell and tube heat exchanger, square pitch compared to triangular pitch
(A) Gives a higher shell side pressure drop
(B) Gives a lower shell side pressure drop
(C) Can pack more surface area into a shell of given diameter
(D) None of these
Answer: Option A

199. A body cools down from 75°C to 70°C in 10 minutes. It will cool down from 70° C to 65° C in _____ minutes.
(A) 10
(B) > 10
(C) < 10
(D) Either (B) or (C), depends on the mass of the body
Answer: Option B

200. In a gas-liquid shell and tube heat exchanger, the
(A) Presence of a non-condensable gas decreases the condensing film co-efficient
(B) Gases under high pressure are routed through the tube side, because high pressure gases are corrosive in nature
(C) Gases to be heated/cooled is normally routed through the shell side, because the corrosion caused by the cooling water or steam condensate remain localised to the tubes
(D) All 'a', 'b' & 'c'
Answer: Option D

201. For large heat transfer area requirement, shell and tube heat exchanger is preferred, because it
   (A) Occupies smaller space
   (B) Is more economical
   (C) Is easy to operate and maintain
   (D) All (A), (B) and (C)
   Answer: Option D

202. Terminal point temperature differences between fluids in case of a heat exchanger is termed as
   (A) Approach
   (B) Log mean temperature difference
   (C) Arithmetic mean temperature difference
   (D) Geometric mean temperature difference
   Answer: Option A

203. The Stefan-Boltzmann constant depends on the
   (A) Medium
   (B) Temperature
   (C) Surface
   (D) None of these
   Answer: Option D

204. A composite wall consists of two plates A and B placed in series normal to the flow of heat. The thermal conductivities are k_A and k_B and the specific heat capacities are C_{PA} and C_{PB} for plates A and B respectively. Plate B has twice the thickness of plate A. At steady state, the temperature difference across plate A is greater than that across plate B, when
   (A) $C_{PA} > C_{PB}$
   (B) $C_{PA} < C_{PB}$
   (C) $k_A < 0.5\ k_B$
   (D) $k_A > 2\ k_B$
   Answer: Option C

205. In a shell and tube type heat exchanger, the floating tube bundle heat arrangement is used
   (A) In low range of temperature differences
   (B) In high range of temperature differences
   (C) Because of its low cost
   (D) To prevent corrosion of the tube bundles
   Answer: Option B

206. Overall heat transfer co-efficient of a particular tube is U_1. If the same tube with some dirt deposited on either side has coefficient U_2, then
   (A) $U_1 = U_2$
   (B) $U_2 > U_1$
   (C) $U_1 > U_2$
   (D) $U_1 =$ dirt factor - U_2
   Answer: Option A

207. In forced convection, the Nusselt number is a function of
   (A) Re and Pr
   (B) Re and Gr
   (C) Pr and Gr
   (D) Re and Sc
   Answer: Option A

208. Maximum heat transfer rate is achieved in _____ flow.
   (A) Co-current
   (B) Counter-current
   (C) Turbulent
   (D) Laminar
   Answer: Option C

209. Radiator of an automobile engine is a _____ type of heat exchanger.
   (A) Co-current

(B) Cross-current
(C) Counter-current
(D) Direct contact
Answer: Option D

210. Temperature profile in steady state heat transfer is
 (A) Asymptotic
 (B) Hyperbolic
 (C) Parabolic
 (D) Linear
 Answer: Option D

211. Which of the following parameters is increased by use of finned tube in a multipass shell and tube heat exchanger?
 (A) Tube side pressure drop and the heat transfer rate
 (B) Convective heat transfer co-efficient
 (C) Effective tube surface area for convective heat transfer
 (D) All (A) (B) and (C)
 Answer: Option D

212. A wall has two layers of materials A and B; each made of a different material. Both the layers have the same thickness. The thermal conductivity of material A is twice that of B. Under the equilibrium, the temperature difference across the wall is 36°C. The temperature difference across the layer A is _____ °C.
 (A) 6
 (B) 12
 (C) 18
 (D) 24
 Answer: Option B

213. Value of Nusselt number [$Nu = (hD/k)$] for the heat transfer by conduction from a droplet or a spherical particle to a surrounding stagnant film is
 (A) 0.5
 (B) 2
 (C) 10
 (D) 100
 Answer: Option B

214. Economy of a multiple effect evaporator depends upon the
 (A) Heat balance consideration
 (B) Rate of heat transfer
 (C) Both (A) and (B)
 (D) Neither (A) nor (B)
 Answer: Option A

215. The main purpose of providing fins on heat transfer surface is to increase the
 (A) Temperature gradient
 (B) Mechanical strength of the equipment
 (C) Heat transfer area
 (D) Heat transfer co-efficient
 Answer: Option C

216. Wavelength corresponding to the maximum energy is inversely proportional to the absolute temperature. This is _____ law.
 (A) Stefan's
 (B) Dalton's
 (C) Wien's
 (D) Kirchoff's
 Answer: Option C

217. Trap is used to remove _____ from steam pipe lines.
 (A) Steam
 (B) Condensate
 (C) Non-condensable
 (D) None of these

Answer: Option B

218. Prandtl number is given by
(A) $C_P \mu / a$
(B) hD/k
(C) $C_P \mu / k$
(D) $\mu / h\, C_P$
Answer: Option C

219. Pick out the wrong statement:
(A) With change in temperature, the radiant energy emitted by a black body remains unchanged
(B) Absorptivity of a body approaches unity in case of diffuse reflection
(C) Absorptivity of a perfectly black body is unity
(D) Value of Stefan-Boltzmann constant is 4.876×10^{-8} KCal/m^2.hr.°K^4
Answer: Option A

220. Prandtl number is the ratio of
(A) Momentum diffusivity to mass diffusivity
(B) Momentum diffusivity to thermal diffusivity
(C) Thermal diffusivity to mass diffusivity
(D) Thermal diffusivity to momentum diffusivity
Answer: Option B

221. In the free convection regime of pool boiling, the heat flux is proportional to
(A) $\Delta t^{1/2}$
(B) Δt^2
(C) $\Delta t^{5/4}$
(D) Δt
Answer: Option C

222. Radiation heat losses from satisfactorily insulated high pressure boiler may be about _____ percent.
(A) 1
(B) 7
(C) 18
(D) 26
Answer: Option B

223. When vaporisation takes place through a blanketting film of gas, the phenomenon is termed as _____ boiling.
(A) Pool
(B) Nucleate
(C) Transition
(D) Film
Answer: Option D

224. In SI units, fouling factor is expressed in
(A) m^2°K/W
(B) W/m^2°K
(C) m^2°K
(D) m°K/W
Answer: Option A

225. Kg of liquid evaporated per hour in an evaporator is defined as its
(A) Capacity
(B) Economy
(C) Steam load
(D) None of these
Answer: Option A

226. The left face of a one dimensional slab of thickness 0.2 m is maintained at 80°C and the right face is exposed to air at 30°C. The thermal conductivity of the slab is 1.2 W/m.K and the heat transfer co-efficient from the right face is 10 W/m^2.K. At steady state, the temperature of the right face in °C is
(A) 77.2

(B) 71.2
(C) 63.8
(D) 48.7
Answer: Option D

227. In forced convection, the heat transfer depends on
(A) Re, Pr
(B) Re, Gr
(C) Mainly Gr
(D) Re only
Answer: Option A

228. Agitated film evaporator is suitable for concentrating _____ liquids.
(A) Foaming
(B) Viscous
(C) Very thin
(D) Corrosive
Answer: Option B

229. A composite flat wall of a furnace is made of two materials 'A' and 'B'. The thermal conductivity of 'A' is twice of that of material 'B', while the thickness of layer of 'A' is half that of B. If the temperature at the two sides of the wall are 400 and 1200°K, then the temperature drop (in °K) across the layer of material 'A' is
(A) 125
(B) 133
(C) 150
(D) 160
Answer: Option D

230. Kirchoff's law is applicable to
(A) Monochromatic radiation only
(B) Total radiation only
(C) Both (A) and (B)
(D) Only volumes and not to surfaces
Answer: Option C

231. The radiation heat flux from a heating element at a temperature of 800°C, in a furnace maintained at 300°C is 8 kW/m^2. The flux, when the element temperature is increased to 1000°C for the same furnace temperature is
(A) 11.2 kW/m^2
(B) 12.0 kW/m^2
(C) 14.6 kW/m^2
(D) 16.5 kW/m^2
Answer: Option D

232. With increase in temperature, the thermal conductivity of non-metallic amorphous solids
(A) Decreases
(B) Increases
(C) Remain constant
(D) First decreases upto certain temperature and then increases
Answer: Option B

233. The Dittus-Boelter equation for convective heat transfer [(i.e. $h = 0.023$ (K/D) $(Re)^{0.8}$ $(Pr)^{0.4}$] cannot be used for
(A) Low Reynold's number
(B) Very low Grashoff number
(C) Molten metals
(D) All (A), (B) and (C)
Answer: Option D

234. A black body when hot, emits heat radiation of _____ wavelengths.
(A) Small
(B) Large
(C) All
(D) One fixed

235. Tube pitch is the _____ of tube diameters and the clearances.
 (A) Sum
 (B) Difference
 (C) Ratio
 (D) None of these
 Answer: Option A

236. In Joule's experiment, an insulated container contains 20 kg of water initially at 25°C. It is stirred by an agitator, which is made to turn by a slowly falling body weighing 40 kg through a height of 4 m. The process is repeated 500 times. The acceleration due to gravity is 9.8 ms^{-2}. Neglecting the heat capacity of agitator, the temperature of water (in °C) is
 (A) 40.5
 (B) 34.4
 (C) 26.8
 (D) 25
 Answer: Option B

237. Heat transfer rate per unit area is called
 (A) Thermal conductivity
 (B) Heat flux
 (C) Heat transfer co-efficient
 (D) Thermal diffusivity
 Answer: Option B

238. The unit of heat transfer co-efficient is
 (A) BTU/hr. ft^2°F
 (B) BTU/hr. °F. ft
 (C) BTU/hr. °F
 (D) BTU/hr. ft
 Answer: Option A

239. The thermal efficiency of a reversible heat engine operating between two given thermal reservoirs is 0.4. The device is used either as a refrigerator or as a heat pump between the same reservoirs. Then the coefficient of performance as a refrigerator $(COP)_R$ and the co-efficient of performance as a heat pump $(COP)_{HP}$ are
 (A) $(COP)_R = (COP)_{HP} = 0.6$
 (B) $(COP)_R = 2.5$; $(COP)_{HP} = 1.5$
 (C) $(COP)_R = 1.5$; $(COP)_{HP} = 2.5$
 (D) $(COP)_R = (COP)_{HP} = 2.5$
 Answer: Option C

240. For what value of Prandtl number, the Col-burn analogy is valid?
 (A) 0.06 to 120
 (B) 0.6 to 120
 (C) 1 to 103
 (D) 1 to 50
 Answer: Option B

241. Natural convection is characterised by
 (A) Grashoff number
 (B) Peclet number
 (C) Reynolds number
 (D) Prandtl number
 Answer: Option A

242. Colburn analogy is applicable for the value of Prandtl number from
 (A) 0.001 to 1
 (B) 0.6 to 120
 (C) 0.5 to 5
 (D) 120 to 400
 Answer: Option B

243. A process stream of dilute aqueous solution flowing at the rate of 10 Kg.s^{-1} is to be heated. Steam condensate at 95°C is available for heating purpose, also at a rate of 10 Kg.s^{-1}. A 1 - 1 shell and tube heat exchanger is available. The best arrangement is

    (A) Counter flow with process stream on shell side
    (B) Counter flow with process stream on tube side
    (C) Parallel flow with process stream on shell side
    (D) Parallel flow with process stream on tube side
    Answer: Option A

244. The variation of thermal conductivity of a metal with temperature is often correlated using an expression of the form $K = K_0 + at$, where, K is the thermal conductivity and T is the temperature (in °K). The units of 'a' in SI system will be

    (A) W/m.k
    (B) W/m
    (C) W/m.k^2
    (D) None, 'a' is just a number
    Answer: Option C

245. Heat exchanger tubes are never made of

    (A) Plain carbon steel
    (B) Stainless steel
    (C) Lead
    (D) Copper
    Answer: Option C

246. Presence of a non-condensing gas in a condensing vapour

    (A) Increases the rate of condensation
    (B) Decreases thermal resistance
    (C) Is desirable to increase the film co-efficient
    (D) None of these
    Answer: Option D

247. The critical radius of insulation for cylindrical pipe is (where, h_i = heat transfer coefficient at inside of the pipe)

    (A) K/h_0
    (B) $2K/h_0$
    (C) h_i/K
    (D) $2h_i/K$
    Answer: Option A

248. Multiple effect evaporators are commonly used in the manufacture of

    P. Paper
    Q. Superphosphate
    R. Sugar
    S. Fats
    (A) P and Q
    (B) P and R
    (C) P and S
    (D) R and S
    Answer: Option C

249. In natural convection heat transfer, the correlating parameter is the

    (A) Graetz number
    (B) Eckert number
    (C) Grashoff number
    (D) Bond number
    Answer: Option C

250. Air is to be heated by condensing steam. Two heat exchangers are available (i) a shell and tube heat exchanger and (ii) a finned tube heat exchanger. Tube side heat transfer area are equal in both the cases. The recommended arrangement is

    (A) Finned tube heat exchanger with air inside and steam outside
    (B) Finned tube heat exchanger with air outside and steam inside
    (C) Shell and tube heat exchanger with air inside tubes and steam on shell side
    (D) Shell and tube heat exchanger with air on shell side and steam inside tubes

Answer: Option B

251. In a multiple effect evaporator, the effect of boiling point elevation is to
(A) Reduce the capacity
(B) Reduce the economy
(C) Increase the economy
(D) None of these
Answer: Option A

252. Correction is applied to LMTD for _____ flow.
(A) Parallel
(B) Counter
(C) Cross
(D) None of these
Answer: Option C

253. The heat flux in the nucleate boiling regimes is proportional to (where, ΔT = excess temperature)
(A) $(\Delta T)^2$
(B) $(\Delta T)^4$
(C) $(\Delta T)^3$
(D) $\sqrt{(\Delta T)}$
Answer: Option C

254. Increasing the liquor level in the evaporator results in the
(A) Decreased capacity
(B) Increase in liquor film co-efficient
(C) Decreased effect of hydrostatic head
(D) Increased true temperature drop
Answer: Option A

255. In case of a vertical tube evaporator, with increase in the liquor level, the _____ is increased.
(A) Velocity of circulation
(B) Liquor-film co-efficient
(C) Both (A) and (B)
(D) Neither (A) and (B)
Answer: Option D

256. In case of a shell and tube heat exchanger, the minimum and maximum baffle spacing is respectively (where, D = inside diameter of the shell)
(A) $D/5$ and D
(B) $D/2$ and $2 D$
(C) $D/4$ and $2 D$
(D) D and $2 D$
Answer: Option A

257. Pick out the wrong statement.
(A) The controlling resistance in case of heating of air by condensing steam is in the air film
(B) The log mean temperature difference (LMTD) for counter flow and parallel flow can be theoretically same when any one of the fluids (hot or cold fluid) passes through the heat exchanger at constant temperature
(C) In case of a 1 - 2 shell and tube heat exchanger, the LMTD correction factor value increases sharply, when a temperature cross occurs
(D) Phase change in case of a pure fluid at a given pressure from liquid to vapor or vice-versa occurs at saturation temperature
Answer: Option C

258. Double pipe heat exchangers are used
(A) When heat transfer area required is very high
(B) When heat transfer area required is very low, i.e. (100-200 ft^2).
(C) Because it occupies less floor area
(D) Because it is less costly
Answer: Option B

259. Sensible heat of hot industrial flue gases cannot be recovered by a/an
(A) Economiser
(B) Regenerator
(C) Ceramic recuperator
(D) None of these
Answer: Option D

260. A body is called grey if the monochromatic emissivity of the body is
(A) Zero
(B) Unity
(C) Same for all wavelengths
(D) Different for all wavelengths
Answer: Option C

261. A 10 cm dia steam pipe, carrying steam at 180°C, is covered with an insulation (conductivity = 0.6 W/m.°C). It losses heat to the surroundings at 30°C. Assume a heat transfer co-efficient of 0.8 W/m².°C for heat transfer from surface to the surroundings. Neglect wall resistance of the pipe and film resistance of steam. If the insulation thickness is 2 cms, the rate of heat loss from this insulated pipe will be
(A) Greater than that for un-insulated steam pipe
(B) Less than that of the un-insulated steam pipe
(C) Equal to that of the un-insulated steam pipe
(D) Less than the steam pipe with 5 cms insulation
Answer: Option B

262. While the total emissivity of a perfect black body is unity, the same for a real body is
(A) 0
(B) 1
(C) > 1
(D) Between 0 and 1
Answer: Option D

263. In an interphase heat transfer process, the equilibrium state corresponds to equality of temperature in the two phases, while the condition for equilibrium in an interphase mass transfer process is equality of
(A) Concentrations
(B) Chemical potentials
(C) Activity co-efficients
(D) Mass transfer co-efficients
Answer: Option A

264. Crystal size in a continuous crystalliser depends upon the
(A) Rate of heat transfer
(B) Degree of turbulence
(C) Degree of super-saturation
(D) All (A), (B) and (C)
Answer: Option D

265. The critical radius 'r' of insulation on a pipe is given by
(A) $r = 2k/h$
(B) $r = k/h$
(C) $r = k/2h$
(D) $r = h/k$
Answer: Option B

266. Boiling of milk in an open vessel is an example of _____ boiling.
(A) Film
(B) Sub-cooled
(C) Saturated nucleate
(D) None of these
Answer: Option A

267. In an extended surface heat exchanger, fluid having lower co-efficient
(A) Flows through the tube
(B) Flows outside the tubes

(C) Can flow either inside or outside the tubes
(D) Should not be used as it gives very high pressure drop
Answer: Option B

268. Black liquor generated during paper manufacture is concentrated in a
(A) Single effect evaporator
(B) Single effect evaporator followed by a crystalliser
(C) Multiple effect evaporator
(D) Multiple effect evaporators followed by a crystalliser
Answer: Option C

269. What is Nusselt number?
(A) $C_P. \mu/k$
(B) hD/k
(C) $h. C_P/\mu$
(D) $C_P. \mu/h$
Answer: Option B

270. If h_1 = inner film co-efficient and $/h_2$ = outer film co-efficient, then the overall heat transfer co-efficient is
(A) Always less than h_1
(B) Always between h_1 and h_2
(C) Always higher than h_2
(D) Dependent on metal resistance
Answer: Option B

271. 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 temperatures of hot and cold fluids
Answer: Option C

272. Convective heat transfer, in which heat is transferred by movement of warmed matter is described by
(A) Fourier's law
(B) Newton's law of cooling
(C) Fick's law
(D) None of these
Answer: Option B

273. For a cold dilute feed to produce thick viscous liquor, backward feeding as compared to forward feeding results in
(A) Increased economy
(B) Decreased economy
(C) Lower capacity
(D) No effect on economy
Answer: Option A

274. Which of the following has the minimum absorptivity?
(A) Aluminium foil
(B) Coal dust
(C) Refractory bricks
(D) Iron plates
Answer: Option A

275. Hot water (0.01 m^3 /min) enters the tube side of a counter current shell and tube heat exchanger at 80°C and leaves at 50°C. Cold oil (0.05 m^3/min) of density 800 kg/m^3 and specific heat of 2 kJ/kg.K enters at 20°C. The log mean temperature difference in °C is approximately
(A) 32
(B) 37
(C) 45
(D) 50
Answer: Option A

276. In a forward feed multiple effect, the pressure build up will be
  (A) Least at the inlet of the first effect
  (B) Least at the outlet of the last effect
  (C) Highest at the inlet of the last effect
  (D) Highest at the outlet of the last effect
  Answer: Option B

277. Graetz number is given by
  (A) mC_p/kL
  (B) kL/mC_p
  (C) $mC_p/k\mu$
  (D) $k\mu/mC_p$
  Answer: Option A

278. Thermal diffusivity is given by
  (A) $k/\rho C_p$
  (B) $\rho C_p/k$
  (C) $\mu C_p/a$
  (D) μ/hC_p
  Answer: Option A
Explanation:
Thermal diffusivity $= k/\rho C_p$
Where, k is thermal conductivity (W/(mK))
        ρ is density (kg/m^3)
        C_p is specific heat capacity (J/(kgK))

279. The rate of heat transfer is a product of overall heat transfer co-efficient, the difference in temperature and the
  (A) Heating volume
  (B) Heat transfer area
  (C) Nusselt number
  (D) None of these
  Answer: Option B

280. Reynold's analogy states that
  (A) $N_{st} \ \alpha \ f$
  (B) $N_{st} \ \alpha \ N_{Re}$
  (C) $N_{Nu} \ \alpha \ f$
  (D) $N_{Re} \ \alpha \ f$
  Answer: Option A

281. In case of a vertical tube evaporator, with increase in the liquor level, the
  (A) Capacity of the evaporator is decreased
  (B) Capacity of the evaporator is increased
  (C) True temperature drop increases
  (D) Both (B) and (C)
  Answer: Option A

282. Which of the following has the minimum thermal conductivity?
  (A) Nitrogen
  (B) Steel
  (C) Carbon black
  (D) Tar
  Answer: Option A

283. Low thermal conductivity of heat insulating materials is due to its
  (A) Dense structure
  (B) High proportion of air space
  (C) High specific heat
  (D) None of these
  Answer: Option B

284. For an ideal black body
  (A) Absorptivity = 1
  (B) Reflectivity = 1

(C) Emissivity = 0
(D) Transmissivity = 1
Answer: Option A

285. In a liquid-liquid heat exchanger, for the same process temperature, the ratio of the LMTD in parallel flow to the LMTD in counter flow is always
(A) < 1
(B) > 1
(C) 1
(D) ∞
Answer: Option A

286. For concentrating an aqueous solution of a material like anhydrous Na2SO4, whose solubility decreases with rise in temperature, the most suitable evaporator is a _____ evaporator.
(A) High pressure
(B) Vacuum
(C) Backward feed
(D) None of these
Answer: Option B

287. Small scale evaporation is done in a
(A) Heat exchanger
(B) Condenser
(C) Multiple effect evaporator
(D) Steam jacketed kettle
Answer: Option D

288. Leidenfrost point is a term concerned with the
(A) Condensation of the saturated vapor on a cold surface
(B) Concentration of a corrosive solution by evaporation
(C) Heat transfer between two highly viscous liquids
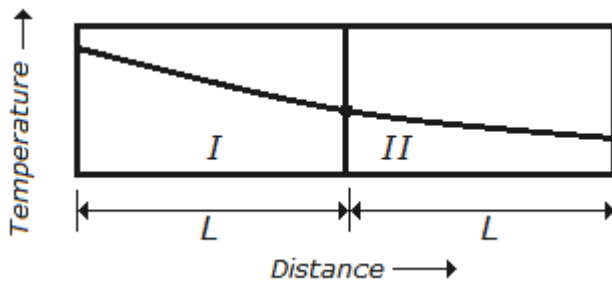(D) Boiling of a liquid on a hot surface
Answer: Option D

289. In a single effect evaporator, the economy is
(A) 1
(B) < 1
(C) > 1
(D) None of these
Answer: Option B

290. At steady state the temperature variation in a plane wall, made of two different solids I & II is shown below: The thermal conductivity of material 'I'

(A) Is smaller than that of II
(B) Is greater than that of II
(C) Is equal to that of II
(D) Can be greater than or smaller than that of II
Answer: Option A

291. Mode of heat transfer involved in the cooling of air cooled internal combustion engine is
(A) Conduction
(B) Natural convection
(C) Forced convection
(D) None of these
Answer: Option B

292. Which of the following is not used as a medium for high temperature heating ?
 (A) Dowtherm
 (B) Mercury
 (C) Liquid metal (e.g. molten sodium)
 (D) Fused salts (e.g., an eutectic mixture of 53% KNO_3, 40% $NaNO_2$ and 7% $NaNO_3$)
 Answer: Option B

293. In counter flow compared to parallel flow,
 (A) LMTD is greater
 (B) Less surface area is required for a given heat transfer rate
 (C) Both (A) and (B)
 (D) More surface area is required for a given heat transfer rate
 Answer: Option C

294. The inside heat transfer co-efficient in case of turbulent flow of liquid in the tube side in a 1-2 shell and tube heat exchanger is increased by _____ times, when the number of tube passes is increased to 8.
 (A) $2^{0.8}$
 (B) $4^{0.8}$
 (C) $4^{0.4}$
 (D) $2^{0.4}$
 Answer: Option B

295. Heat exchangers operating, when the asymptotic range is reached,
 (A) Provide very large heat transfer co-efficient
 (B) Results in making part of the heating surface inactive
 (C) Results in abruptly increased velocity
 (D) None of these
 Answer: Option B

296. In regenerative air preheater (as practised in heating of coke ovens), the heat is transferred
 (A) Through a metallic wall
 (B) By direct contact of hot flue gas with air
 (C) By heating an intermediate material (like chequor bricks) and then heating the air from this hot material
 (D) None of these
 Answer: Option C

297. In case of evaporators, liquid entrainment results primarily due to
 (A) High vacuum in the evaporator
 (B) High evaporation rate
 (C) Foaming of the solution
 (D) High heat transfer rate
 Answer: Option C

298. A multiple effect evaporator has a capacity to process 4000 kg of solid caustic soda per day, when it is concentrating from 10% to 25% solids. The water evaporated in kg per day is
 (A) 6000
 (B) 24000
 (C) 60000
 (D) 48000
 Answer: Option B

299. Asymptotic conditions is reached, when for a fluid flowing in laminar flow through a long tube
 (A) Exit-fluid temperature > wall temperature
 (B) Exit fluid temperature < wall temperature
 (C) Exit fluid temperature = wall temperature
 (D) Graetz number > 100
 Answer: Option C

300. The Nusselt number for fully developed (both thermally and hydrodynamically) laminar flow through a circular pipe whose surface temperature remains constant is
 (A) 1.66

(B) 88.66
(C) 3.66
(D) Dependent on N_{Re} only
Answer: Option C

301. Economy of a multiple effect evaporator is not influenced much by the
(A) Boiling point elevations
(B) Temperature of the feed
(C) Rate of heat transfer
(D) Ratio of the weight of the thin liquor to thick liquor
Answer: Option A

302. For evaporation of viscous solution in a multiple effect evaporator, the preferred feeding scheme is
(A) Forward
(B) Backward
(C) Parallel
(D) None of these
Answer: Option B

303. What is the absorptivity of a black body?
(A) 1
(B) 0
(C) 0.78
(D) 0.95
Answer: Option A

304. Multiple effect evaporators ar used to
(A) Increase the steam economy & decrease the capacity
(B) Increase the steam economy & the capacity
(C) Decrease the steam economy & the capacity
(D) Decrease the steam economy & increase the capacity
Answer: Option B

305. The average heat transfer co-efficient for laminar film condensation on vertical surface is inversely proportional to (where, ΔT = Temperature drop across condensate film)
(A) $(\Delta T)^2$
(B) $\sqrt{(\Delta T)}$
(C) $(\Delta T)^{1/4}$
(D) $(\Delta T)^{3/2}$
Answer: Option C

306. Heat transfer co-efficient (h_1) for liquids increases with
(A) Increasing temperature
(B) Decreasing temperature
(C) Decreasing Reynolds number
(D) None of these
Answer: Option A

307. Which characteristic of a fluid is not important in deciding its route in a shell and tube heat exchanger?
(A) Corrosiveness
(B) Fouling characteristic
(C) Viscosity
(D) None of these
Answer: Option D

308. Steady state one dimensional heat flow by conduction as given by Fourier's low does not assume that
(A) There is no internal heat generation
(B) Boundary surfaces are isothermal
(C) Material is anisotropic
(D) Constant temperature gradient exists
Answer: Option C

309. 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
  (A) 4000
  (B) 9000
  (C) 4600
  (D) 3000
  Answer: Option A

310. A backward feed multiple effect evaporator is better than forward feed for concentrating cold feed, because it provides
  (A) Higher economy
  (B) Lower capacity
  (C) Both (A) & (B)
  (D) Lower economy
  Answer: Option A

311. Analogy between mass and heat transfer is not applicable in case of
  (A) Same velocity profile or equal eddy diffusivities
  (B) Thermal or pressure mass diffusion
  (C) Viscous heating or chemical reaction
  (D) Both (B) and (C)
  Answer: Option D

312. 1000 Kg of liquid at 30°C in a well stirred vessel has to be heated to 120°C, using immersed coils carrying condensing steam at 150°C. The area of the steam coils is 1.2 m^2 and the overall heat transfer co-efficient to the liquid is 1500 W/m^2.°C. Assuming negligible heat loss to the surrounding and specific heat capacity of the liquid to be 4 kJ/kg.°C, the time taken for the liquid to reach desired temperature will be
  (A) 15 min
  (B) 22 min
  (C) 44 min
  (D) 51 min
  Answer: Option D

313. The critical radius of insulation for a spherical shell is (where, K = thermal conductivity of insulating material h_0 = heat transfer coefficient at the outer surface)
  (A) K/h_0
  (B) $2K/h_0$
  (C) h_0/K
  (D) $h_0/2K$
  Answer: Option B

314. Heat waves
  (A) Cannot pass through vacuum
  (B) Travel in straight line
  (C) Can be reflected by a mirror
  (D) Both (B) and (C)
  Answer: Option D

315. Out of 100 kcal/second of incident radiant energy on the surface of a thermally transparent body, 300 kcal/second is reflected back. If the transmissivity of the body is 0.25, the emissivity of the surface will be
  (A) 0.35
  (B) 0.45
  (C) 0.55
  (D) 0.85
  Answer: Option B

316. If air (a non-condensing gas) is present in a condensing vapor stream, it will _____ the condensation rate of vapor.
  (A) Increase
  (B) Decrease
  (C) Not affect
  (D) Increase the condensing film co-efficient as well as
  Answer: Option B

317. The most conducive surface for dropwise condensation to occur is the _____ surface.
   (A) Coated
   (B) Oily
   (C) Glazed & polished
   (D) Smooth
   Answer: Option B

318. For a perfectly transparent surface (like gases), the
   (A) Absorptivity = 0
   (B) Transmissivity = 1
   (C) Reflectivity = 0
   (D) All (A), (B) & (C)
   Answer: Option B

319. Shell side pressure drop in a shell and tube heat exchanger does not depend upon the
   (A) Baffle spacing & shell diameter
   (B) Tube diameter & pitch
   (C) Viscosity, density & mass velocity of shell side fluid
   (D) None of these
   Answer: Option D

320. A fluid is flowing inside the inner tube of a double pipe heat exchanger with diameter 'd'. For a fixed mass flow rate, the tube side heat transfer co-efficient for turbulent flow conditions is proportional to
   (A) $d^{0.8}$
   (B) $d^{-0.2}$
   (C) d^{1}
   (D) $d^{1.8}$
   Answer: Option B

321. In evaporators, lowering the feed temperature
   (A) Increases the heating area required
   (B) Reduces the economy
   (C) Both (A) and (B)
   (D) Decreases the heating area required
   Answer: Option C

322. Heat transfer co-efficient (h) for a fluid flowing inside a clean pipe is given by
$h = 0.023 \, (K/D) \, (DV\rho/\mu)^{0.8} \, (C_P.\mu/k)^{0.4}$. This is valid for the value of N_{Re} equal to
   (A) < 2100
   (B) 2100-4000
   (C) > 4000
   (D) > 10000
   Answer: Option D

323. In case of vertical tube evaporator, with increase in liquor level, the overall heat transfer co-efficient
   (A) Increases
   (B) Decreases
   (C) Is not affected
   (D) May increase or decrease; depends on the feed
   Answer: Option B

324. The ratio of kinematic viscosity to thermal diffusivity is called the _____ number.
   (A) Peclet
   (B) Prandtl
   (C) Stanton
   (D) Nusselt
   Answer: Option B

325. Intermittent tube cleaning is possible to be done in case of a _____ evaporator.
   (A) Basket type
   (B) Horizontal tube
   (C) Calandria

(D) None of these

Answer: Option A

326. Vibrations in the tubes of a shell and tube heat exchanger is induced due to the
(A) Flow of fluid on the tube and shell sides
(B) Oscillations in the flow of shell/tube sides fluid
(C) Vibrations transmitted through piping and/or supports due to external reasons
(D) All (A), (B) and (C)

Answer: Option D

327. Pick out the wrong statement.
(A) Orifice baffles are never used in a shell and tube heat exchanger
(B) Pressure drop on the shell side of a heat exchanger depends upon tube pitch also
(C) In a horizontal tube evaporator, surface blanketing by air is avoided
(D) Split ring type and pull through type floating heads are two commonly used floating heads is heat exchangers

Answer: Option A

328. What is the steam economy in case of a single effect evaporator system?
(A) 1
(B) > 1
(C) < 1
(D) 0.1

Answer: Option C

329. Overall heat transfer co-efficient for cooling of hydrocarbons by water is about
(A) 50 -100 Kcal/hr.m^2.°C
(B) 50 -100 W/m^2.°K
(C) 50 -100 BTU/hr. ft.^{2}°F
(D) 1000 - 1500 BTU/hr. ft.^{2}°F

Answer: Option C

330. For turbulent flow in a tube, the heat transfer co-efficient is obtained from the Dittus-Boelter correlation. If the tube diameter is halved and the flow rate is doubled, then the heat transfer co-efficient will change by a factor of
(A) 1
(B) 1.74
(C) 6.1
(D) 37

Answer: Option C

331. For small temperature difference, the heat transfer rate as per Newton's law of cooling is proportional to (where, Δt = excess temperature)
(A) Δt
(B) Δt^2
(C) Δt^3
(D) $\sqrt{(\Delta t)}$

Answer: Option A

332. Baffles in the shell side of a shell and tube heat exchanger
(A) Increase the cross-section of the shell side liquid
(B) Force the liquid to flow parallel to the bank
(C) Increase the shell side heat transfer co-efficient
(D) Decrease the shell side heat transfer co-efficient

Answer: Option C

333. The ratio of total radiating power to the absorptivity of the body depends upon the _____ as per Kirchoff's law.
(A) Wavelength of radiation
(B) Nature of the body
(C) Temperature of the body
(D) None of these

Answer: Option C

334. _____ chart is known as transient heat conduction chart.

(A) Dirhing's
(B) Heisler's
(C) Mollier's
(D) Cox
Answer: Option A

335. Steam side heat transfer co-efficient in an evaporator is in the range of _____ kcal/hr.m²°C.
(A) 10-50
(B) 100-500
(C) 1000-1500
(D) 5000-15000
Answer: Option D

336. Controlling heat transfer film co-efficient is the one, which offers _____ resistance to heat transfer.
(A) No
(B) The least
(C) The largest
(D) Lower
Answer: Option C

337. The main function of baffles provided in a shell and tube heat exchanger is to
(A) Facilitate the cleaning of outer tube surface
(B) Enhance turbulence
(C) Hold the tubes in position
(D) All 'a', 'b' & 'c'
Answer: Option B

338. Pick out the wrong statement:
(A) The capacity of an evaporator is reduced by the boiling point elevation
(B) Corrosive liquid is normally passed through the tubes in a shell and tube heat exchanger
(C) Steam jet ejector is used for vapor compression in a thermal recompression evaporator
(D) Heat sensitive materials should be concentrated in high pressure evaporators
Answer: Option D

339. Boiling point elevation of an ideal solution
(A) Increases rapidly with temperature rise
(B) Decreases rapidly with temperature rise
(C) In independent of pressure
(D) Both (B) and (C)
Answer: Option A

340. Which of the following is concerned with both heat and mass transfer?
(A) Lewis relationship
(B) Nusselt number
(C) Kutateladze number
(D) Froude number
Answer: Option A

341. The thermal radiative flux from a surface of emissivity = 0.4 is 22.68 kW/m². The approximate surface temperature (K) is
(Stefan-Boltzmann constant = 5.67×10^{-8} W/m².K⁴)
(A) 1000
(B) 727
(C) 800
(D) 1200
Answer: Option A

342. Duhring's rule is important in solving problems on
(A) Distillation
(B) Crystallisation
(C) Evaporation
(D) Humidification
Answer: Option C

343. Which is the most suitable for the concentration of foamy & frothy liquors?
   (A) Agitated film evaporator
   (B) Long tube vertical evaporator
   (C) Open pan evaporator
   (D) None of these
   Answer: Option B

344. Heat transfer by radiation between two bodies at T_1 & T_2 and in an ambient temperature of T_a°C depends on
   (A) $T_1 - T_2$
   (B) $T_1 - T_a$
   (C) $T_2 - T_a$
   (D) None of these
   Answer: Option D

345. Air is best heated with steam in a heat exchanger of
   (A) Plate type
   (B) Double pipe type with fin on steam side
   (C) Double pipe type with fin on air side
   (D) Shell and tube type
   Answer: Option C

346. The film thickness for laminar film condensation on vertical surface _____ from top to bottom.
   (A) Cumulatively increases
   (B) Cumulatively decreases
   (C) Remain constant
   (D) And the surface conductance increase
   Answer: Option A

347. A metal wire of 0.01 m dia and thermal conductivity 200 W/m.K is exposed to a fluid stream with a convective heat transfer coefficient of 100 W/m^2.K. The Biot number is
   (A) 5.6
   (B) 0.025
   (C) 3.5
   (D) 0.0035
   Answer: Option B

348. _____ paint has the minimum absorption co-efficient.
   (A) Black
   (B) White lead
   (C) Grey
   (D) Light cream
   Answer: Option B

349. The value of Stefan-Boltzmann constant in SI unit is
   (A) 5.6697×10^{-8} W/m^2.°K^4
   (B) 0.1714×10^{-8} W/m^2.°K^4
   (C) 5.6697×10^{-8} kcal/m^2. °K^4
   (D) 0.1714×10^{-8} kcal/m^2. °K^4
   Answer: Option A

350. For shell and tube heat exchanger, with increasing heat transfer area, the purchased cost per unit heat transfer area
   (A) Increases
   (B) Decreases
   (C) Remain constant
   (D) Passes through a maxima
   Answer: Option D

351. What is the thermal conductivity of a perfect heat insulator?
   (A) Zero
   (B) One
   (C) ∞

(D) Between 0 and ∞

Answer: Option A

352. Mode of heat transfer in which the fluid moves under the influence of changes in fluid pressure produced by external work is called

(A) Radiation

(B) Natural convection

(C) Forced convection

(D) Conduction

Answer: Option C

353. The ratio of momentum diffusivity to thermal diffusivity is the _____ number.

(A) Prandtl

(B) Nusselt

(C) Stanton

(D) Grashoff

Answer: Option A

354. Steam traps are provided in steam carrying pipelines to

(A) Condense steam

(B) Release excess steam pressure by bleeding steam

(C) Remove condensate and inert gases

(D) None of these

Answer: Option C

355. A metal ball of radius 0.1 m at a uniform temperature of 90°C is left in air at 30°C. The density and the specific heat of the metal are 3000 kg/m³ and 0.4 kJ/kg.K respectively. The heat transfer co-efficient is 50 W/m².K Neglecting the temperature gradients inside the ball, the time taken (in hours) for the ball to cool to 60°C is

(A) 555

(B) 55.5

(C) 0.55

(D) 0.15

Answer: Option D

356. Kirchoff's law applies to _____ radiation.

(A) Total

(B) Monochromatic

(C) Both (A) & (B)

(D) Neither (A) nor (B)

Answer: Option C

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

(A) Viscosity

(B) Density

(C) Thermal conductivity

(D) Heat capacity

Answer: Option B

358. Log mean temperature difference (LMTD) cannot be used, if

(A) Heat transfer co-efficient over the entire heat exchanger is not constant

(B) There exists an unsteady state

(C) The heat capacity is not constant and there is a phase change

(D) None of these

Answer: Option D

359. The rate of heat transfer from a vertical plate by natural convection depends upon the temperature differences (ΔT) between wall and outside bulk. The proportionality is given as

(A) $(\Delta T)^{1/4}$

(B) $(\Delta T)^{1/2}$

(C) $(\Delta T)^{5/4}$

(D) $(\Delta T)^{3/4}$

Answer: Option D

360. Pick out the wrong statement.
(A) In case of heat transfer by purely forced convection, $G_R/R_e^2 \leq 1$
(B) The equivalent diameter of heat transfer for a duct of square cross-section (having each side as 'x') is equal to $4x$
(C) Distillation process is not the same as evaporation
(D) The effectiveness of nucleate boiling depends basically on the ease with which the bubbles are formed and detached from the heating surface

Answer: Option B

361. If average heat transfer co-efficient is h_a and the local coefficient at the end of the plate is h_l then in case of heat transfer to a fluid flowing over a flat plate, heated over its entire length
(A) $h_a = h_l$
(B) $h_a = 2h_l$
(C) $h_a = 0.5 \, h_l$
(D) $h_a = 0.75 \, h_l$

Answer: Option B

362. In a parallel flow heat exchanger, if the outlet temperature of hot and cold fluids are the same, then the log mean temperature difference (LMTD) is
(A) Minimum
(B) Maximum
(C) Zero
(D) Infinity

Answer: Option C

363. Harmonic mean temperature difference is given by
(A) $\sqrt{(\Delta T_1 . \Delta T_2)}$
(B) $2 \, (\Delta T_1 . \Delta T_2)/(\Delta T_1 + \Delta T_2)$
(C) $2 \, (\Delta T_1 . \Delta T_2)/(\Delta T_1 - \Delta T_2)$
(D) $(\Delta T_1 - \Delta T_2)/(\Delta T_1 . \Delta T_2)$

Answer: Option B

364. Bulk of the convective heat transfer resistance from a hot tube surface to the fluid flowing in it, is
(A) In the central core of the fluid
(B) Uniformly distributed throughout the fluid
(C) Mainly confined to a thin film of fluid near the surface
(D) None of these

Answer: Option C

365. 200 kg of solids (on dry basis) is subjected to a drying process for a period of 5000 seconds. The drying occurs in the constant rate period with the drying rate as, $N_c = 0.5 \times 10^{-3}$ kg/m^2.s. The initial moisture content of the solid is 0.2 kg moisture/kg dry solid. The interfacial area available for drying is 4 m^2/1000 kg of dry solid. The moisture content at the end of the drying period is (in kg moisture/kg dry solid).
(A) 0.5
(B) 0.05
(C) 0.1
(D) 0.15

Answer: Option C

366. If Prandtl number is greater than the Schmidt number, then the
(A) Thermal boundary layer lies inside the concentration boundary layer
(B) Concentration boundary layer lies inside the thermal boundary layer
(C) Thermal & concentration boundary layers are of equal thickness
(D) Hydrodynamic (i.e., momentum) boundary layer is thicker than the other two

Answer: Option A

367. Fourier's law of heat conduction applies to _____ surfaces.
(A) Isothermal
(B) Non-isothermal
(C) Both (A) and (B)
(D) Neither (A) and (B)

Answer: Option C

368. Thermal diffusivity is the most important in heat transfer by
  (A) Conduction
  (B) Radiation
  (C) Condensation
  (D) Natural convection
  Answer: Option A

369. Which of the following is generally considered as opaque surface towards radiations?
  (A) Gases
  (B) Solids
  (C) Liquids
  (D) Both (B) and (C)
  Answer: Option D

370. LMTD correction factor which is to be applied for a cross-flow heat exchanger increases with increase in the number of shell passes. Its value for a single pass cross flow heat exchanger is
  (A) 0
  (B) 1
  (C) > 1
  (D) < 1
  Answer: Option D

371. Steam is to be condensed in a shell and tube heat exchanger, 5 m long with a shell diameter of 1 m. Cooling water is to be used for removing the heat. Heat transfer co-efficient for the cooling water, whether on shell side or tube side is the same. The best arrangement is
  (A) Vertical heat exchanger with steam on tube side
  (B) Vertical heat exchanger with steam on shell side
  (C) Horizontal heat exchanger with steam on tube side
  (D) Horizontal heat exchanger with steam on shell side
  Answer: Option B

372. The statement that "maximum wavelength of radiation is inversely proportional to the temperature" is _____ law.
  (A) Stefan-Boltzmann's
  (B) Planck's
  (C) Wien's displacement
  (D) None of these
  Answer: Option C

373. The steam ejector is used to
  (A) Remove condensate from the steam pipelines
  (B) Create vacuum
  (C) Superheat the steam
  (D) None of these
  Answer: Option B

374. Among liquids, water has a comparatively high value of thermal conductivity, due to its
  (A) Low density
  (B) High viscosity
  (C) Partial ionisation
  (D) Dense structure
  Answer: Option C

375. Heat flux is the time rate of heat transfer per unit
  (A) Length
  (B) Area
  (C) Volume
  (D) None of these
  Answer: Option B

376. In which mode of heat transfer, the Biot number is important?
  (A) Transient heat conduction
  (B) Natural convection
  (C) Forced convection

(D) Radiation
Answer: Option A

377. The actual temperature drop across the heating surface in an evaporator depends on the
(A) Feed
(B) Depth of liquid over heating surface
(C) Pressure difference between steam chest and vapour space
(D) All (A), (B) and (C)
Answer: Option D

378. A diathermanous substance _____ the thermal radiation completely.
(A) Absorbs
(B) Reflects
(C) Transmits
(D) None of these
Answer: Option C

379. Extended heat transfer surface like fins are used to increase the heat transfer rate. Fin efficiency is defined as the ratio of heat transferred across the fin surface to the theoretical heat transfer across an equal area held at the
(A) Surrounding temperature
(B) Average temperature of the fin
(C) Temperature of the fin end
(D) Constant temperature equal to that of the base
Answer: Option D

380. Boiling point elevation of a solution of NaOH
(A) Increases rapidly with temperature rise
(B) Is almost independent of temperature
(C) Is almost independent of pressure
(D) Both (B) and (C)
Answer: Option D

381. Thermal conductivity of a conducting solid material depends upon its
(A) Temperature
(B) Porosity
(C) Both (A) & (B)
(D) Neither (A) nor (B)
Answer: Option C

382. Radiant energy received by a body is proportional to (where, d = the distance between the object emitting radiation and that receiving it.)
(A) $\sqrt{d}$
(B) d
(C) d^2
(D) $d^{1.5}$
Answer: Option C

383. Pick out the wrong statement.
(A) Reciprocal of the resistance to heat flow is called thermal conductance
(B) Unit of thermal conductance is W/°K
(C) Thermal conductance of a wall of thickness 'L', thermal conductivity 'k' and heat flow area 'A' is kL/A
(D) None of these
Answer: Option C

384. Overall thermal resistance for conductive heat transfer through a series of flat resistances is equal to the
(A) Maximum resistance in the series
(B) Sum of all resistances
(C) Average of all resistances
(D) Minimum resistance presents in the series
Answer: Option B

385. When vaporisation takes place directly at the heating surface, it is called

(A) Film boiling
(B) Nucleate boiling
(C) Vapour binding
(D) None of these
Answer: Option B

386. Prandtl and Reynolds analogy are same, when Prandtl number is
(A) 0.5
(B) 1
(C) > 2
(D) 1.5
Answer: Option B

387. As per Kirchoff's law, the ratio of the total radiating power to the absorptivity of a body depends on the
(A) Temperature of the body only
(B) Wavelength of monochromatic radiation
(C) Both (A) and (B)
(D) Nature of material of body
Answer: Option A

388. Arithmetic mean area can be used in heat transfer problem to calculate the heat flow by conduction through a cylinder which is
(A) Thin walled having the value of A_o A_i/< 2
(B) Thick walled
(C) Having the value of $A_o/A_i > 2$
(D) Both (B) and (C)
Answer: Option A

389. Fourier's law applies to the heat transfer by
(A) Convection
(B) Radiation
(C) Conduction
(D) All (A), (B) & (C)
Answer: Option C

390. jH factor for heat transfer is not a function of the _____ number.
(A) Reynolds
(B) Nusselt
(C) Grashoff
(D) Both (B) & (C)
Answer: Option D

391. The heat transfer by radiation from a mild steel surface is to be reduced by reducing the emissivity of the surface. This can be best achieved by
(A) Painting the surface black
(B) Painting the surface white (with aluminium paint)
(C) Giving the surface a mirror finish
(D) Roughening the surface
Answer: Option B

392. In a heat exchanger, one transfer unit means
(A) A section of the exchanger in which change in temperature of one stream equals the average driving force in the section
(B) The size of the exchanger in which heat transfer rate is 1 kcal/hr
(C) Both (A) and (B)
(D) None of these
Answer: Option A

393. Heat produced when a steady state current, I passes through an electrical conductor having resistance, 'R' is
(A) IR
(B) I^2R
(C) IR^2
(D) I^2R^2

Answer: Option B

394. A 2-4 heat exchanger involves
(A) Only counter-flow of fluids
(B) Only parallel-flow of fluids
(C) Both counter and parallel-flow of the fluids
(D) Smaller pressure drop compared to 1-2 exchanger
Answer: Option C

395. In a multipass shell and tube heat exchanger, tube side return pressure loss is equal to _____ the velocity head.
(A) Twice
(B) Four times
(C) Square root of
(D) Square of
Answer: Option B

396. In a shell and tube heat exchanger, the height of 25 percent cut baffles is equal to (where, D = inside diameter of shell).
(A) 0.25 D
(B) 0.50 D
(C) 0.75 D
(D) None of these
Answer: Option C

397. The heat flux (from outside to inside) across an insulating wall with thermal conductivity, K = 0.04 W/m.°K and thickness 0.16m is 10 W/m^2. The temperature of the inside wall is - 5°C. The outside wall temperature is
(A) 25°C
(B) 30°C
(C) 35°C
(D) 40°C
Answer: Option C

398. Latent heat absorbed by 1 lb of water at 212°F, when it is changed to steam at 212°F, may be around _____ BTU.
(A) 180
(B) 970
(C) 3.97
(D) None of these
Answer: Option A

399. Dittus-Boelter equation cannot be used for molten metals mainly due to its very low
(A) Prandtl number
(B) Grashoff number
(C) Thermal conductivity
(D) Viscosity
Answer: Option A

400. Baffle spacing
(A) Is not the same as baffle pitch
(B) Should be less than one fifth the diameter of the shell
(C) Should be less than the inside diameter of the shell
(D) None of these
Answer: Option C

401. Steam consumption in kg/hr in case of an evaporator is given by (where, C & E are capacity the economy of the evaporator respectively).
(A) C/E
(B) E/C
(C) CE
(D) $1/CE$
Answer: Option A

402. The local surface conductance for laminar film condensation on vertical surface is (where, t = film thickness)
  (A) $\propto t$
  (B) $\propto 1/t$
  (C) $\propto \sqrt{t}$
  (D) Independent of 't'
  Answer: Option B

403. Which of the following is unimportant in forced convection?
  (A) Reynolds number
  (B) Prandtl number
  (C) Grashoff number
  (D) None of these
  Answer: Option C

404. The purpose of floating head in a heat exchanger is to
  (A) Avoid buckling of tubes
  (B) Provide support for tubes
  (C) Decrease the pressure drop
  (D) Facilitate its lengthening, if needed
  Answer: Option A

405. Convective heat transfer co-efficient in case of fluid flowing in tubes is not affected by the tube length/diameter ratio, if the flow is in the _____ zone.
  (A) Laminar
  (B) Transition
  (C) Both 'a' & 'b'
  (D) Highly turbulent
  Answer: Option D

406. Mechanical recompression evaporation is used in the production of
  (A) Alcohol
  (B) Distilled water
  (C) Salt
  (D) Fruits jam
  Answer: Option B

407. Pick out the wrong statement.
  (A) Swenson-Walker crystalliser is a batch crystalliser
  (B) Super saturation of the solution is the driving potential for a crystal growth
  (C) The liquor left after the removal of crystals from a solution is called mother liquor
  (D) The first stage of crystal formation is called nucleation
  Answer: Option A

408. The outlet temperature of cooling water in a heat exchanger is generally not allowed to exceed above 50°C in industrial practice mainly to avoid
  (A) Its evaporation loss
  (B) Excessive corrosion
  (C) Uneconomic LMTD
  (D) Decrease in heat exchanger efficiency
  Answer: Option B

409. The number of kg vaporised per kg of steam fed to the evaporator is defined as
  (A) Capacity
  (B) Rate of evaporation
  (C) Economy
  (D) Rate of vaporisation
  Answer: Option C

410. The Fourier number (defined as $a.t/L^2$) is used in the analysis of problem involving heat transfer by
  (A) Forced convection
  (B) Natural convection
  (C) Transient conduction
  (D) Steady state conduction

Answer: Option C

411. Vacuum is generally maintained in the vapour space of an evaporator mainly to
   (A) Get economical temperature difference by using moderate pressure steam
   (B) Facilitate forward feeding in multiple effect evaporation
   (C) Concentrate heat sensitive materials
   (D) Achieve very high concentration of the final product
   Answer: Option A

412. Three solid objects of the same material and of equal mass-a sphere, a cylinder (length = diameter) and a cube are at 500°C initially. These are dropped in a quenching bath containing a large volume of cooling oil each attaining the bath temperature eventually. The time required for 90% change in temperature is the smallest for
   (A) Cube
   (B) Cylinder
   (C) Sphere
   (D) Equal for all the three
   Answer: Option A

413. With increase in porosity, the thermal conductivity of a solid substance
   (A) Increases
   (B) Decreases
   (C) Remains unchanged
   (D) May increase or decrease; depends on the solid
   Answer: Option B

414. Which of the following forced convection heat transfer equation accounts for the liquid viscosity effect for viscous liquids?
   (A) Dittus-Boelter equation
   (B) Sieder-Tate equation
   (C) Nusselt equation
   (D) None of these
   Answer: Option B

415. Which type of heat exchanger is preferred for heavy heat loads?
   (A) Double pipe
   (B) Plate fine
   (C) Series and parallel set of shell and tube
   (D) None of these
   Answer: Option C

416. For condensation of pure vapors, if the heat transfer co-efficients in filmwise and drop-wise condensation are respectively h_f and h_d, then
   (A) $h_f = h_d$
   (B) $h_f > h_d$
   (C) $h_f < h_d$
   (D) h_f could be greater or smaller than h_d
   Answer: Option C

417. The unit of heat transfer co-efficient in SI unit is
   (A) $J/M^{2}°K$
   (B) $W/m^{2}°K$
   (C) $W/m°K$
   (D) $J/m°K$
   Answer: Option B

418. Heat transfer in the laminar sub-layer in case of a liquid flowing through a pipe, is mostly by
   (A) Eddies current
   (B) Conduction
   (C) Convection
   (D) None of these
   Answer: Option B

419. If the baffle spacing in a shell and tube heat exchanger increases, then the Reynolds number of the shell side fluid
   (A) Remains unchanged
   (B) Increases
   (C) Increases or decreases depending on number of shell passes
   (D) Decreases
   Answer: Option D

420. _____ heat exchanger is the most suitable, when the temperature of shell side fluid is much higher than that of tube side.
   (A) Single pass, fixed tube sheet
   (B) U-tube
   (C) Three pass, fixed tube sheet
   (D) None of these
   Answer: Option B

421. Fouling factor
   (A) Is a dimensionless quantity
   (B) Does not provide a safety factor for design
   (C) Accounts for additional resistances to heat flow
   (D) None of these
   Answer: Option C

422. Evaporation of 1kg of water from a solution in a single effect evaporator requires about _____ kg of steam.
   (A) 0.4 - 0.6
   (B) 1-1.3
   (C) 1.8-2
   (D) 2 - 2.4
   Answer: Option B

423. As the difference between the wall temperature and bulk temperature increases, the boiling heat transfer co-efficient
   (A) Continues to increase
   (B) Continues to decrease
   (C) Goes through a minimum
   (D) Goes through a maximum
   Answer: Option C

424. Thermal conductivities of most of the liquids _____ with rise in temperature.
   (A) Increases
   (B) Decreases
   (C) Remains unchanged
   (D) May increase or decrease; depends on the liquid
   Answer: Option B

425. The equivalent diameter for pressure drop is _____ that for heat transfer.
   (A) Smaller than
   (B) Greater than
   (C) Equal to
   (D) Not related with
   Answer: Option A

426. The purpose of providing a 'catchall' in the vapor line of an evaporator is to
   (A) Create vacuum
   (B) Regulate the vapor flow
   (C) Vent the non-condensable gases
   (D) Arrest the entrained liquid
   Answer: Option D

427. Which of the following accessories is provided in the vapor line of an evaporator for removing the entrained liquid?
   (A) Bleed point
   (B) Vent
   (C) Catchall

(D) Baffle
Answer: Option C

428. Removal of _____ heat is involved in the condensation of a vapor under saturated conditions.
(A) Super
(B) Sensible
(C) Latent
(D) Both (B) & (C)
Answer: Option B

429. In a heat exchanger, floating head is provided to
(A) Facilitate cleaning of the exchanger
(B) Increase the heat transfer area
(C) Relieve stresses caused by thermal expansion
(D) Increase log mean temperature gradient
Answer: Option C

430. The energy radiated from a surface Q at absolute temperature T is related as
(A) $Q \propto T^2$
(B) $Q \propto T^4$
(C) $Q \propto T^3$
(D) None of these
Answer: Option B

431. Electromagnetic radiations propagate in vacuum with a velocity of _____ metre/second.
(A) 3×10^5
(B) 3×10^8
(C) 3×10^{10}
(D) 3×10^{12}
Answer: Option B

432. Absorptivity of a perfect black body is unity. Which of the following has maximum absorptivity?
(A) Aluminium foil
(B) Refractory bricks
(C) Iron plate
(D) Coke breeze
Answer: Option D

433. With the increase of temperature, the Col-burn jH factor
(A) Increases
(B) Decreases
(C) Remains unchanged
(D) May increase or decrease; depending on temperature
Answer: Option A

434. Crystallisation of solids from a homogeneous solution is a/an _____ process.
(A) Exothermic
(B) Mildly endothermic
(C) Highly endothermic
(D) None of these
Answer: Option A

435. Pick out the wrong statement.
(A) Heat transfer by radiation cannot occur across an absolute volume
(B) In case of a shell and tube heat exchanger, the pressure drop through the shell is proportional to the number of times the fluid crosses the bundle between baffles
(C) Propagation velocity for travel of heat radiation through vacuum is equal to the velocity of the light
(D) The amount of heat involved in the condensation or vaporisation of 1 kg of a fluid is the same
Answer: Option A

436. Steam condensate is recovered by steam traps and recycled for use as boiler feed water, because of its low
(A) Hardness
(B) Dissolved solids content
(C) Suspended solids content
(D) All (A), (B) and (C)
Answer: Option D

437. In case of a multipass shell and tube heat exchanger, providing a baffle on the shell side _____ the heat transfer rate.
(A) Increases
(B) Decreases
(C) Does not affect
(D) May increase or decrease, depends on the type of baffle
Answer: Option A

438. _____ paint has the maximum absorption coefficient.
(A) Black
(B) Yellow
(C) White
(D) Grey
Answer: Option A

439. The advantage of backward feed multiple effect evaporators over forward feed units is that
(A) Heat sensitive material can be handled
(B) There is no additional cost of pumping
(C) Most concentrated liquid is at highest temperature
(D) Equal heat transfer co-efficients exist in various effects
Answer: Option C

440. Baffles are provided in heat exchangers to increase the
(A) Fouling factor
(B) Heat transfer area
(C) Heat transfer co-efficient
(D) Heat transfer rate
Answer: Option C

441. Film boiling is usually not desired in commercial equipments, because
(A) The heat transfer rate is low in view of the large temperature drop
(B) It is difficult to maintain
(C) It is not economic
(D) None of these
Answer: Option A

442. Pick out the wrong statement.
(A) Superheated steam is preferably not used for process heating because of its low heat transfer film co-efficient
(B) In a shell and tube heat exchanger, the shell pressure drop is maximum for orifice baffles
(C) S.I. unit of fouling factor is Watt/m^2.°K
(D) Longitudinal fins are used in extended surface heat exchangers, when the direction of fluid flow is parallel to the axis of the tube
Answer: Option C

443. A dephlegmator is a
(A) Total condenser
(B) Vacuum evaporator
(C) Partial condenser
(D) Double pipe heat exchanger
Answer: Option C

444. Prandtl and Reynold's analogies are identical for Prandtl number value of
(A) 0
(B) 0.5
(C) 1
(D) 5

Answer: Option C

445. Reynold's analogy states that (where, *St* = Stanton number *f* = friction factor)
(A) $St = f/2$
(B) $St = f/4$
(C) $St = 4f$
(D) $St = f^{1/2}$
Answer: Option A

446. The rate of heat transfer through a pipe wall is given by, $q = 2\pi k (T_i - T_0)/ln (r_i/r_0)$. For cylinder of very thin wall, *q* can be approximated by
(A) $q = [2\pi k (T_i + T_0)/2]/ln (r_i/r_0)$
(B) $q = 2\pi r_i k (T_i - T_0)/(r_0/r_i)$
(C) $q = 2\pi k (T_i - T_0)/(r_0/r_i)$
(D) $q = 2\pi k (T_i - T_0)/[(r_0 + r_i)/2]$
Answer: Option D

447. Heat transfer by natural convection is enhanced in system with
(A) High viscosity
(B) High co-efficient of thermal expansion
(C) Low temperature gradients
(D) Low density change with temperature
Answer: Option B

448. If a single tube pass heat exchanger is converted to two pass, then for the same flow rate, the pressure drop per unit length in tube side will
(A) Increase by 1.8 times
(B) Decrease by 2^2
(C) Increase by 2^{16}
(D) Remain unchanged
Answer: Option C

449. At what value of Prandtl number, the hydrodynamic and thermal boundary layers of a fluid flowing over a heated plate will be identical?
(A) 1
(B) < 1
(C) > 1
(D) None of these
Answer: Option A

450. A measure of the extent to which viscous heating is important relative to the heat flow resulting from the impressed temperature difference is represented by the _____ number.
(A) Condensation
(B) Grashoff
(C) Stanton
(D) Brinkman
Answer: Option D

451. Heat flux through several resistances in series in analogous to the current flowing through several
(A) Resistances in parallel
(B) Capacitors in series
(C) Resistances in series
(D) None of these
Answer: Option C

452. Heat transfer efficiency leading of energy conservation in a heat exchanger can be achieved by
(A) Keeping the heat transfer surface clean
(B) Enhancing the fluid pumping rate
(C) Increasing the tube length
(D) None of these
Answer: Option A

453. For a counter current heat exchanger with $T^i_h = 80°C$, $T°_c = 60°C$, $T°_h = 50°C$ and $T^i_c = 30°C$, and the temperature difference between the two streams being the same everywhere along Z, the direction of flow of hot fluid. The temperature profile should satisfy

(A) $d^2T/dZ^2 > 0$
(B) $d^2T/dZ^2 = 0$
(C) $d^2T/dZ^2 < 0$
(D) $dT/dZ = 0$
Answer: Option B

454. Which is the most suitable for the concert-ration of highly concentrated solution?

(A) Open pan evaporation
(B) Long tube vertical evaporator
(C) Agitated film evaporator
(D) None of these
Answer: Option A

455. For gases, the thermal conductivity increases with temperature rise. For liquids, with increase in concentration, its thermal conductivity generally

(A) Decreases
(B) Increases
(C) Remains unchanged
(D) Increases exponentially
Answer: Option A

456. A hot liquid is kept in a big room. The logarithm of the numerical value of the temperature difference between the liquid and the room is plotted against time. The plot will be very nearly a/an

(A) Ellipse
(B) Straight line
(C) Parabola
(D) Circular arc
Answer: Option B

457. With increase in the distance between the heat source and the object receiving the heat, the radiation heat transfer

(A) Decreases
(B) Increases
(C) Increases exponentially
(D) Remain unaffected
Answer: Option A

458. Prandtl number is the ratio of

(A) Mass diffusivity to thermal diffusivity
(B) Momentum diffusivity to thermal diffusivity
(C) Thermal diffusivity to mass diffusivity
(D) Thermal diffusivity to momentum diffusivity
Answer: Option B

459. Double pipe heat exchangers are preferably useful, when

(A) High viscosity liquid is to be cooled
(B) Requirement of heat transfer area is low
(C) Overall heat transfer co-efficient is very high
(D) A corrosive liquid is to be heated
Answer: Option B

460. A hot body will radiate heat most rapidly, if its surface is

(A) White & rough
(B) Black & rough
(C) White & polished
(D) Black & polished
Answer: Option B

461. Rate of heat transfer by vaporisation from pools of water is affected by the

(A) Nature of heating surface and distribution of bubbles
(B) Surface tension of water

(C) Viscosity of water
(D) All (A), (B) and (C)
Answer: Option D

462. Thickness of thermal boundary layer is more compared to that of hydrodynamic boundary layer, when the value of Prandtl number is
(A) 1
(B) < 1
(C) > 1
(D) > 5
Answer: Option B

463. The purpose of providing bleed points in the evaporator is to
(A) Admit the feed
(B) Remove the product
(C) Facilitate removal of non-condensable gases
(D) Create vacuum
Answer: Option C

464. Choose the most important factor on which the heat conducted through a wall in a unit time will depend on?
(A) Thickness of the wall
(B) Area of the wall perpendicular to heat flow
(C) Material of the wall
(D) Temperature difference between the two surfaces of the wall
Answer: Option D

465. With increase in temperature, the thermal conductivity of steel
(A) Increases
(B) Decreases
(C) Remains unchanged
(D) Increases exponentially
Answer: Option B

466. Film boiling occurs at _____ pressure.
(A) Atmospheric
(B) Sub-atmospheric
(C) Negative
(D) Very high
Answer: Option D

467. In a shell and tube heat exchanger, the tube side heat transfer co-efficient just at the entrance of the tube is
(A) Infinity
(B) Zero
(C) Same as average heat transfer co-efficient for tube side
(D) None of these
Answer: Option A

468. At *Pr* > 1, conduction in an ordinary fluid flowing through a heated pipe is limited to the
(A) Buffer zone
(B) Turbulent core
(C) Both (A) and (B)
(D) Viscous sub-layer
Answer: Option D

469. Which of the following is the most controlling factor for the rate of bubble detachment from the hot solid surface?
(A) Liquid density
(B) Liquid viscosity
(C) Hot surface temperature
(D) Interfacial tension
Answer: Option D

470. 'Fouling factor' used in the design of a multipass shell and tube heat exchanger is a

(A) Non-dimensional factor
(B) Factor of safety
(C) Conversion factor for individual film heat transfer co-efficient to overall heat transfer co-efficient
(D) None of these
Answer: Option B

471. Radiation heat transfer rates does not depend upon the
(A) Type of absorbing surface
(B) Distance between the heat source and the object receiving the heat
(C) Surface area and temperature of the heat source
(D) None of these
Answer: Option D

472. Economy of an evaporator is influenced by the
(A) Steam pressure
(B) Feed temperature
(C) Number of effect
(D) Both (B) & (C)
Answer: Option D

473. If all the conditions and dimensions are same, then the ratio of velocity through the tubes of a double pass heat exchanger to that through the single pass heat exchanger is
(A) 1
(B) 2
(C) 1/2
(D) 4
Answer: Option B

474. Circulation pump is located below the evaporator to
(A) Avoid cavitation
(B) Avoid frequent priming
(C) Create more suction head
(D) None of these
Answer: Option C

475. Which of the following is not concerned with the heat transfer?
(A) Brinkman number
(B) Stanton number
(C) Schmidt number
(D) Peclet number
Answer: Option C

476. Which of the following has the highest thermal conductivity?
(A) Brick
(B) Air
(C) Water
(D) Silver
Answer: Option D

477. _____ equation relates the thermal conductivity of a solid to its temperature.
(A) Antoine
(B) Kopp's
(C) Lee's
(D) Kistyakowsky
Answer: Option C

478. A hollow sphere and a solid sphere of the same material and equal radii are heated to the same temperature. In this case,
(A) The cooling rate will be the same for the two spheres and hence the two spheres will have equal temperatures at any instant
(B) Both the spheres will emit equal amount of radiation per unit time in the beginning
(C) Both will absorb equal amount of radiation from the surrounding in the beginning
(D) Both (B) & (C)
Answer: Option D

479. Unsteady state heat conduction occurs, when
 (A) Temperature distribution is independent of time
 (B) Temperature distribution is dependent on time
 (C) Heat flows in one direction only
 (D) Three dimensional heat flow is concerned
 Answer: Option B

480. A _____ surface has the maximum thermal emissivity out of the following.
 (A) Black & smooth
 (B) Black & rough
 (C) White & smooth
 (D) White & rough
 Answer: Option B

481. For specified tube outside diameter, higher BWG means higher
 (A) Tube thickness
 (B) Cross-sectional area
 (C) Weight per unit length
 (D) None of these
 Answer: Option B

482. 1 BTU/hr.ft.°F is equal to _____ kcal/hr. m.°C.
 (A) 1.49
 (B) 1
 (C) 4.88
 (D) None of these
 Answer: Option A

483. A long iron rod initially at a temperature of 20°C has one end dipped in boiling water (100°C) at time, $t = 0$. The curved surface of the rod is insulated so that heat conduction is one dimensional in the axial direction. The temperature at a distance 100 mm from the dipped end becomes 40°C at time, $t = 200$ s. The same temperature is achieved at a distance of 200 mm from the dipped end at time
 (A) $t = 283$ s
 (B) $t = 356$ s
 (C) $t = 400$ s
 (D) $t = 800$ s
 Answer: Option D

484. Multiple effect evaporation is generally recommended, when the
 (A) Large scale evaporation of liquor is needed
 (B) Corrosive liquids are to be concentrated
 (C) Fuel is cheaply available
 (D) Evaporation on small scale is to be done
 Answer: Option A

485. Value of Prandtl number for water ranges from
 (A) 1 to 2
 (B) 5 to 10
 (C) 100 to 500
 (D) 1000 to 2000
 Answer: Option B

486. Which of the following is correct?
 (A) Rate = Driving force × Resistance
 (B) Driving force = Rate × Resistance
 (C) Resistance = Driving force × Rate
 (D) Rate = Resistance/Driving force
 Answer: Option B

487. For a fluid flowing in an annulus space, the wetted perimeter for heat transfer and pressure drop are
 (A) Same
 (B) Different

(C) Never different
(D) Linearly related
Answer: Option B

488. Steam is routed through the tube in case of a _____ evaporator.
(A) Basket type
(B) Horizontal tube
(C) Short tube vertical
(D) Long tube vertical
Answer: Option B

489. 1000 kg of wet solids are to be dried from 60% to 20% moisture (by weight). The mass of moisture removed in kg is
(A) 520
(B) 200
(C) 400
(D) 500
Answer: Option C

490. The sum of reflectivity and absorptivity for an opaque body is equal to
(A) 0.5
(B) 1
(C) 0
(D) 2
Answer: Option B

491. Dropwise condensation occurs on _____ surfaces.
(A) Clean and dirt free
(B) Smooth clean
(C) Contaminated cooling
(D) Polished
Answer: Option C

492. In a backward feed multiple effect evaporator
(A) Feed is introduced in the first effect
(B) Feed flows from low pressure to high pressure
(C) No pumps are required between successive effects
(D) None of these
Answer: Option B

493. Conduction occurs in the buffer zone for a fluid flowing through a heated pipe, only when Prandtl number is
(A) 0.1
(B) > 1
(C) < 1
(D) 1
Answer: Option A

494. For a given ambient air temperature with increase in the thickness of insulation of a hot cylindrical pipe, the rate of heat loss from the surface would
(A) Decrease
(B) Increase
(C) First decrease and then increase
(D) First increase and then decrease
Answer: Option D

495. In thermal radiation for a black body (where, ε is emissivity and α is absorptivity)
(A) $\alpha = 1; \varepsilon \neq 1$
(B) $\alpha \neq 1, \varepsilon = 1$
(C) $\alpha \neq 1, \varepsilon \neq 1$
(D) $\alpha = 1; \varepsilon = 1$
Answer: Option D

496. The type of liquor circulation system to be ' employed in evaporators (viz. natural or forced circulation) is determined mainly by the _____ of the liquid.

(A) Viscosity
(B) Density
(C) Thermal conductivity
(D) Corrosive nature
Answer: Option A

497. Nusselt number (for forced convection heat transfer) is a function of the _____ number.
(A) Prandtl
(B) Reynolds
(C) Both (A) & (B)
(D) Neither (A) nor (B)
Answer: Option C

498. In case of _____ boiling, the bubbles formed on a submerged hot surface get absorbed in the mass of the liquid.
(A) Nucleate
(B) Pool
(C) Low pressure
(D) None of these
Answer: Option B

499. The separation of liquid droplets from the vapor is done by a/an _____, in the evaporators.
(A) Steam ejector
(B) Entrainment separator
(C) Compressor
(D) Vacuum pump
Answer: Option B

500. For the same heat transfer area and the terminal conditions, the ratio of the capacities of a single effect evaporator to a triple effect evaporator is
(A) 3
(B) 0.33
(C) 1
(D) 1.33
Answer: Option C

501. A dilute aqueous solution is to be concentrated in an evaporator system. High pressure steam is available. Multiple effect evaporator system is employed, because
(A) Total heat transfer area of all the effects is -less than that in a single effect evaporator system
(B) Total amount of vapor produced per Kg of feed steam in a multiple effect system is much higher than in a single effect
(C) Boiling point elevation in a single effect system is much higher than that in any effect in a multi-effect system
(D) Heat transfer co-efficient in a single effect is much lower than that in any effect in a multi-effect system
Answer: Option B

502. In a boiling curve, the peak heat flux is called the _____ point.
(A) Nusselt
(B) Leidenfrost
(C) Boiling
(D) Burnout
Answer: Option D

503. Film condensation is promoted on a/an _____ surface.
(A) Oily
(B) Coated
(C) Clean & smooth
(D) Dirty
Answer: Option C

504. The equivalent diameter for the annulus of a double pipe heat exchanger, whose inner pipe has fins on the outside is _____ compared to the same size pipes without fins.

(A) More
(B) Less
(C) Same
(D) Unpredictable
Answer: Option B

505. The wavelength at which the maximum monochromatic emissive power occurs for a black body, is (where, T = absolute temperature of the black body).
(A) αT
(B) $\alpha \times 1/T$
(C) $\alpha\, T^4$
(D) Independent of T
Answer: Option B

506. In a 1-1 concurrent heat exchanger, if the tube side fluid outlet temperature is equal to the shell side fluid outlet temperature, then the LMTD is
(A) ∞
(B) 0
(C) Equal to the difference between hot and cold fluids inlet temperature
(D) Equal to the difference between hot fluid inlet temperature and cold fluid outlet temperature
Answer: Option B

507. According to Reynolds analogy, Stanton number is equal to (where, f = Fanning friction factor)
(A) $2f$
(B) f
(C) $f/2$
(D) $f/4$
Answer: Option C

508. Grashoff number, which is defined as $g\,.\,\beta\,(T_s - T_\infty)\,\rho^2\,.\,L^3/\mu^2$, is proportional to the ratio of buoyancy force to _____ force.
(A) Viscous
(B) Elastic
(C) Inertial
(D) None of these
Answer: Option A

509. In forced circulation, the heating element is injected
(A) Internally
(B) Externally
(C) Both (A) and (A)
(D) Neither (A) nor (B)
Answer: Option A

510. If the thermal conductivity of a wall material is independent of temperature, the steady state temperature distribution in the very large thin plane wall having steady, uniform surface temperature follows _____ law.
(A) Hyperbolic
(B) Parabolic
(C) Linear
(D) Logarithmic
Answer: Option C

511. Pick out the wrong statement.
(A) The condensing film co-efficient is about 3 times lower for vertical condenser as compared to the equivalent horizontal condenser for identical situation
(B) Film co-efficient for vaporisation decreases as a result of vapor binding
(C) In industrial practice, sub-cooling of condensate is required, when the condensate is a volatile liquid and is to be transferred for storage
(D) Overall heat transfer co-efficient in a heat exchanger is controlled by the value of the film co-efficient, which is higher
Answer: Option D

512. Viscous & heat sensitive liquids are concentrated in _____ evaporators.

(A) Open pan
(B) Long tube
(C) Agitated film
(D) None of these
Answer: Option C

513. When does the heat generated by fluid friction becomes appreciable compared to the heat transferred between the fluids?
(A) At high fluid velocity
(B) At low velocity
(C) When fluid flows past a smooth surface
(D) None of these
Answer: Option A

514. During crystallisation, formation of crystal can occur in _____ solution only.
(A) Saturated
(B) Supersaturated
(C) Under-saturated
(D) All (A), (B) and (C)
Answer: Option B

515. Condensing film co-efficient for steam on horizontal tubes ranges from 5000 to 15000 Kcal/hr.m^2.°C. Condensation of vapor is carried out inside the tube in a shell and tube heat exchanger, when the
(A) Higher condensing film co-efficient is desired
(B) Condensate is corrosive in nature
(C) Lower pressure drop through the exchanger is desired
(D) Temperature of the incoming vapor is very high
Answer: Option B

516. Viscosity of gases _____ with increase in temperature.
(A) Increase very rapidly
(B) Increase slowly
(C) Decrease slowly
(D) Remain unaffected
Answer: Option B

517. In case of surface condensers, a straight line is obtained on plotting $1/U$ vs. _____ on an ordinary graph paper.
(A) $1/\bar{V}^{-0.8}$
(B) $\bar{V}^{-0.8}$
(C) $\bar{V}^{-2}$
(D) $1/\bar{V}^{-2}$
Answer: Option A

518. A cube, sphere & a thin circular plate (all having same mass and made of same material) are all heated to 300°C and allowed to cool in natural air. Which one will cool the slowest?
(A) Cube
(B) Plate
(C) Sphere
(D) All will cool at the same rate
Answer: Option C

519. A steel sphere of radius 0.1 m at 400°K is immersed in an oil at 300°K. If the centre of the sphere reaches 350°K in 20 minutes, how long will it take for a 0.05 m radius steel sphere to reach the same temperature (at the centre) under identical conditions? Assume that the conductive heat transfer co-efficient is infinitely large.
(A) 5 minutes
(B) 10 minutes
(C) 20 minutes
(D) 40 minutes
Answer: Option A

520. At what value of Prandtl number, the hydrodynamic and thermal boundary layers are identical?