(CHE)

CHEMICAL ENGINEERING

INSTRUCTIONS TO CANDIDATES

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2. Immediately on opening this Question Paper Booklet, check:
   (a) Whether **200** multiple choice questions are printed (**50** questions in Mathematics, **25** questions in Physics, **25** questions in Chemistry and **100** questions in Engineering)
   (b) In case of any discrepancy immediately exchange the Question paper Booklet of same code by bringing the error to the notice of invigilator.
3. Use of Calculators, Mathematical Tables and Log books is not permitted.
4. **Candidate must ensure that he/she has received the Correct Question Booklet, corresponding to his/her branch of Engineering.**
5. **Candidate should ensure that the booklet Code and the Booklet Serial Number, as it appears on this page is entered at the appropriate place on the OMR Response Sheet by shading the appropriate circles provided therein using H.B. pencil only. Candidate should note that if they fail to enter the Booklet Serial Number and the Booklet Code on the OMR Response Sheet, their Answer Sheet will not be valued.**
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9. Rough work should be done only in the space provided in the Question Paper Booklet.
10. No loose sheets or papers will be allowed in the examination hall.
11. Timings of Test: 10.00 A.M. to 1.00 P.M.
12. Candidate should ensure that he / she enters his / her name and appends signature on the Question paper booklet, leaflet attached to this question paper booklet and also on the OMR Response Sheet in the space provided. Candidate should ensure that the invigilator puts his signature on this question paper booklet, leaflet attached to the question paper booklet and also on the OMR Response Sheet.
13. Before leaving the examination hall candidate should **return both the OMR Response Sheet and the leaflet attached to this question paper booklet** to the invigilator. Failure to return any of the above shall be construed as malpractice in the examination. **Question paper booklet may be retained by the candidate.**
14. This booklet contains a total of **32** pages including Cover page and the pages for Rough Work.

MATHEMATICS

1. If $A=\begin{bmatrix}3 & 0 & 0\\ 0 & 3 & 0\\ 0 & 0 & 3\end{bmatrix}$, then $A^4=$

(1) $3I$ (2) $9I$ (3) $27I$ (4) $81I$

2. If $A=\begin{bmatrix}0 & 2 & 1\\ -2 & 0 & -2\\ -1 & x & 0\end{bmatrix}$ is a skew symmetric matrix, then the value of x is

(1) 1 (2) 2 (3) 3 (4) 4

3. What is the number of all possible matrices with each entry as 0 or 1 if the order of matrices is 3×3

(1) 64 (2) 268 (3) 512 (4) 256

4. If $A=\begin{bmatrix}1 & i & -i\\ i & -i & 1\\ -i & 1 & i\end{bmatrix}$, then $|A|=$

(1) 1 (2) 2 (3) 3 (4) 4

5. The solution of a system of linear equations $2x - y + 3z = 9, x + y + z = 6, x - y + z = 2$ is

(1) $x = -1, y = -2, z = -3$ (2) $x = 3, y = 2, z = 1$

(3) $x = 2, y = 1, z = 3$ (4) $x = 1, y = 2, z = 3$

6. If $\frac{1}{x^2 + a^2} = \frac{A}{x + ai} + \frac{B}{x - ai}$ then A = _____, B = _____.

(1) $\frac{1}{2ai}, -\frac{1}{2ai}$ (2) $-\frac{1}{2ai}, \frac{1}{2ai}$ (3) $\frac{1}{ai}, -\frac{1}{ai}$ (4) $-\frac{1}{ai}, \frac{1}{ai}$

7. If $\frac{2x+4}{(x-1)^3} = \frac{A_1}{(x-1)} + \frac{A_2}{(x-1)^2} + \frac{A_3}{(x-1)^3}$ then $\sum_{r=1}^{3} A_r$ is equal to

(1) A_2 (2) $2A_2$ (3) $4A_2$ (4) $4A_1$

8. The period of the function $f(x) = |\sin x|$ is

(1) π (2) 2π (3) 3π (4) 4π

9. If $A+B=45°$, then $(1-\cot A).(1-\cot B)$ is

(1) 1 (2) 0 (3) 2 (4) -1

10. The value of $\sin 78° + \cos 132°$ is

(1) $\frac{\sqrt{5}+1}{4}$ (2) $\frac{\sqrt{5}+1}{2}$ (3) $\frac{\sqrt{5}-1}{2}$ (4) $\frac{\sqrt{5}-1}{4}$

11. If $A+B+C = \pi$, then $\sin 2A + \sin 2B + \sin 2C =$

(1) 4 cosA sinB cosC (2) 4 sinA cosB sinC

(3) 4 cosA cosB cosC (4) 4 sinA sinB sinC

12. The principal solution of $\tan x = 0$ is

(1) $x = n\pi, n \in Z$ (2) $x=0$

(3) $x=(2n+1)\pi/2, n \in Z$ (4) $x = n\pi+\alpha, n \in Z$

13. The value of $\tan^{-1}(2) + \tan^{-1}(3)$ is

(1) $\frac{\pi}{4}$ (2) $\frac{\pi}{2}$ (3) $\frac{\pi}{3}$ (4) $\frac{3\pi}{4}$

14. If the sides of a right angle triangle are in A.P., then the ratio of its sides is

(1) 1:2:3 (2) 2:3:4 (3) 3:4:5 (4) 4:5:6

15. The value of $r.r_1.r_2.r_3$ is

(1) Δ^2 (2) Δ^{-2} (3) Δ^{-3} (4) Δ^4

16. $\frac{1}{r1}+\frac{1}{r2}+\frac{1}{r3}=$

(1) $\frac{1}{r}$ (2) $\frac{1}{2r}$ (3) $\frac{1}{R}$ (4) $\frac{1}{\Delta}$

17. If $a=6, b=5, c=9$, then the value of angle A is

(1) $\cos^{-1}(2/9)$ (2) $\cos^{-1}(2/5)$ (3) $\cos^{-1}(7/9)$ (4) $\cos^{-1}(1/3)$

18. The polar form of complex number $1-i$ is

(1) $\sqrt{2}e^{i\pi/4}$ (2) $\sqrt{2}e^{-i\pi/4}$ (3) $\sqrt{2}e^{i\pi/2}$ (4) $\sqrt{2}e^{-i\pi/2}$

19. If $1, \omega, \omega^2$ be the cube roots of unity, then the value of $2^{\omega}.2^{\omega^2}.2^{\omega^3}$ is

(1) ω (2) ω^2 (3) 1 (4) 0

20. The intercept made on X-axis by the circle $x^2+y^2+2gx+2fy+c=0$ is

(1) $\sqrt{g^2-c}$ (2) $\sqrt{f^2-c}$ (3) $2\sqrt{g^2-c}$ (4) $2\sqrt{f^2-c}$

21. If one end of the diameter of the circle $x^2+y^2-5x-8y+13=0$ is (2, 7), then the other end of the diameter is

(1) (3, 1) (2) (1, 3) (3) (−3, −1) (4) (−1, −3)

22. The radius of the circle $\sqrt{1+m^2}(x^2+y^2)-2cx-2mcy=0$ is
(1) $2c$ (2) $4c$ (3) $c/2$ (4) c

23. The parametric equations of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ are
(1) $x=a\sec\theta, y=b\tan\theta$ (2) $x=b\sin\theta, y=a\cos\theta$
(3) $x=a\cos\theta, y=b\sin\theta$ (4) $x=a\operatorname{cosec}\theta, y=b\cot\theta$

24. The equation of the directrix of the parabola $2x^2=-7y$ is
(1) $8y+7=0$ (2) $8y-7=0$ (3) $7y+8=0$ (4) $8x-7=0$

25. The condition for a straight line $y=mx+c$ to be a tangent to the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ is
(1) $c=a/m$ (2) $c^2=a^2m^2-b^2$ (3) $c^2=a^2m^2+b^2$ (4) $c^2=a/m$

26. $\lim_{x\to 1}\frac{\sqrt{5x-4}-\sqrt{x}}{x-1}$ is
(1) 3 (2) 2 (3) 4 (4) 1

27. $\log i =$
(1) $\pi/2$ (2) $\pi/4$ (3) $i\pi/2$ (4) $i\pi/4$

28. $\frac{d}{dx}[\log_7 X]=$
(1) $\frac{1}{x}$ (2) $X\log_7^e$ (3) $\frac{1}{x}\log_e^7$ (4) $\frac{1}{x}\log_7^e$

29. $\frac{d}{dx}[2\cosh x]=$
(1) $\frac{e^x+e^{-x}}{2}$ (2) $\frac{e^x-e^{-x}}{2}$ (3) e^x+e^{-x} (4) e^x-e^{-x}

30. $\frac{d}{dx}\left[\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)\right]=$

(1) $\frac{1}{1+x^2}$ (2) $\frac{-1}{1+x^2}$ (3) $\frac{2}{1+x^2}$ (4) $\frac{-2}{1+x^2}$

31. If $x = at^2$, $y = 2at$, then $\frac{dy}{dx}=$

(1) $\sqrt{\frac{y}{x}}$ (2) $\sqrt{\frac{x}{a}}$ (3) $\sqrt{\frac{a}{x}}$ (4) $\sqrt{\frac{x}{y}}$

32. The derivative of e^x with respect to $\sqrt{x}$ is

(1) $\frac{2\sqrt{x}}{e^x}$ (2) $2\sqrt{x}\,e^x$ (3) $\frac{e^x}{2\sqrt{x}}$ (4) $\sqrt{x}.e^x$

33. The equation of the normal to the curve $y = 5x^4$ at the point (1, 5) is

(1) $x + 20y = 99$ (2) $x + 20y = 101$ (3) $x - 20y = 99$ (4) $x - 20y = 101$

34. The angle between the curves $y^2 = 4x$ and $x^2 + y^2 = 5$ is

(1) $\frac{\pi}{4}$ (2) $\tan^{-1}(2)$ (3) $\tan^{-1}(3)$ (4) $\tan^{-1}(4)$

35. If $u = x^3y^3$ then $\frac{\partial^3 u}{\partial x^3}+\frac{\partial^3 u}{\partial y^3}=$

(1) $6\,(x^3+y^3)$ (2) $6\,x^3\,y^3$ (3) $6x^3$ (4) $6y^3$

36. $\int \text{cosec}\, x\, dx=$

(1) $\log(\text{cosec}\, x + \cot x) + C$ (2) $\log(\cot x/2) + C$

(3) $\log(\tan x/2) + C$ (4) $-\text{cosec}\, x.\cot x + C$

37. $\int_0^{\frac{\pi}{2}} \cos^{11} x \, dx =$

(1) $\frac{256}{693}$ (2) $\frac{256\pi}{693}$ (3) $\frac{\pi}{4}$ (4) $\frac{128}{693}$

38. $\int f'(x)[f(x)]^n dx =$

(1) $\frac{[f(x)]^{n-1}}{n-1}+C$ (2) $\frac{[f(x)]^{n+1}}{n+1}+C$ (3) $n[f(x)]^{n-1}+C$ (4) $(n+1)[f(x)]^{n+1}+C$

39. $\int \frac{dx}{(x+7)\sqrt{x+6}} =$

(1) $Tan^{-1}(\sqrt{x+6})+C$ (2) $2Tan^{-1}(\sqrt{x+6})+C$

(3) $Tan^{-1}(x+7)+C$ (4) $2Tan^{-1}(x+7)+C$

40. $\int \tan^{-1} x \, dx =$

(1) $x.Tan^{-1}x+\frac{1}{2}\log(1+x^2)+C$ (2) $\frac{1}{1+x^2}+C$

(3) $x^2.Tan^{-1}x+C$ (4) $x.Tan^{-1}x-\log\sqrt{1+x^2}+C$

41. $\int \frac{dx}{1+e^{-x}} =$

(1) $\log(1+e^{-x})+C$ (2) $\log(1+e^{x})+C$

(3) $e^{-x}+C$ (4) $e^{x}+C$

42. $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} \sin|x| \, dx =$

(1) 0 (2) 1 (3) 2 (4) -1

43. Area under the curve $f(x) = \sin x$ in $[0, \pi]$ is
(1) 4 sq. units (2) 2 sq. units (3) 6 sq. units (4) 8 sq. units

44. The order of $x^3\frac{d^3y}{dx^3} + 2x^2\frac{d^2y}{dx^2} - 3y = x$ is
(1) 1 (2) 4 (3) 3 (4) 2

45. The degree of $\left[\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}} = a\frac{d^2y}{dx^2}$ is
(1) 4 (2) 2 (3) 1 (4) 3

46. The family of straight lines passing through the origin is represented by the differential equation
(1) $ydx + xdy = 0$ (2) $xdy - ydx = 0$ (3) $xdx + ydy = 0$ (4) $xdx - ydy = 0$

47. The differential equitation $\frac{dy}{dx} + \frac{ax + hy + g}{hx + by + f} = 0$ is called
(1) Homogeneous (2) Exact (3) Linear (4) Legender

48. The solution of differential equation $\frac{dy}{dx} = e^{-x^2} - 2xy$ is
(1) $y.e^{-x^2} = x + c$ (2) $ye^x = x + c$ (3) $ye^{x^2} = x + c$ (4) $y = x + c$

49. The complementary function of $(D^3+D^2+D+1)\,y = 10$ is
(1) $C_1\cos x + C_2\sin x + C_3e^{-x}$ (2) $C_1\cos x + C_2\sin x + C_3e^{x}$
(3) $C_1 + C_2\cos x + C_3\sin x$ (4) $(C_1 + C_2x + C_3x^2)\,e^x$

50. Particular Integral of $(D-1)^4y = e^x$ is
(1) x^4e^x (2) $\frac{x^4}{24}e^{-x}$ (3) $\frac{x^4}{12}e^{x}$ (4) $\frac{x^4}{24}e^{x}$

Set Code : T2
Booklet Code : A

PHYSICS

51. Two quantities A and B are related by the relation A/B = m where m is linear mass density and A is force. The dimensions of B will be
(1) same as that of latent heat (2) same as that of pressure
(3) same as that of work (4) same as that of momentum

52. The dimensional formula of capacitance in terms of M, L, T and I is
(1) $[ML^2T^2I^2]$ (2) $[ML^{-2}T^4I^2]$ (3) $[M^{-1}L^3T^3I]$ (4) $[M^{-1}L^{-2}T^4I^2]$

53. If l, m and n are the direction cosines of a vector, then
(1) $l + m + n = 1$ (2) $l^2 + m^2 + n^2 = 1$ (3) $\frac{1}{l}+\frac{1}{m}+\frac{1}{n}=1$ (4) $lmn = 1$

54. The angle between i+j and j+k is
(1) 0° (2) 90° (3) 45° (4) 60°

55. A particle is moving eastwards with a velocity of 5 ms^{-1}. In 10 seconds the velocity changes to 5 ms^{-1} northwards. The average acceleration in this time is
(1) $\frac{1}{\sqrt{2}}$ ms^{-2} towards north-west (2) zero
(3) $\frac{1}{2}$ ms^{-2} towards north (4) $\frac{1}{\sqrt{2}}$ ms^{-2} towards north-east

56. The linear momentum of a particle varies with time t as $p = a+bt+ct^2$ which of the following is correct?
(1) Force varies with time in a quadratic manner.
(2) Force is time-dependent.
(3) The velocity of the particle is proportional to time.
(4) The displacement of the particle is proportional to t.

57. A shell of mass m moving with a velocity v suddenly explodes into two pieces. One part of mass $m/4$ remains stationary. The velocity of the other part is
(1) v (2) $2v$ (3) $3v/4$ (4) $4v/3$

58. The velocity of a freely falling body after 2s is
(1) 9.8 ms^{-1} (2) 10.2 ms^{-1} (3) 18.6 ms^{-1} (4) 19.6 ms^{-1}

59. A large number of bullets are fired in all directions with the same speed u. The maximum area on the ground on which these bullets will spread is

(1) $\frac{\pi u^2}{g^2}$ (2) $\frac{\pi u^4}{g^2}$ (3) $\frac{\pi u^2}{g^4}$ (4) $\frac{\pi u}{g^4}$

60. The minimum stopping distance for a car of mass m, moving with a speed v along a level road, if the coefficient of friction between the tyres and the road is μ, will be

(1) $\frac{v^2}{2\mu g}$ (2) $\frac{v^2}{\mu g}$ (3) $\frac{v^2}{4\mu g}$ (4) $\frac{v}{2\mu g}$

61. When a bicycle is in motion, the force of friction excreted by the ground on the two wheels is such that it acts
(1) In the backward direction on the front wheel and in the forward direction on the rear wheel
(2) In the forward direction on the front wheel and in the backward direction on the rear wheel
(3) In the backward direction on both the front and the rear wheels
(4) In the forward direction on both the front and the rear wheels

62. In a perfectly inelastic collision, the two bodies
(1) strike and explode (2) explode without striking
(3) implode and explode (4) combine and move together

63. Under the action of a constant force, a particle is experiencing a constant acceleration, then the power is
(1) zero (2) positive
(3) negative (4) increasing uniformly with time

64. Consider the following two statements:

A : Linear momentum of a system of particles is zero.

B : Kinetic energy of a system of particles is zero.

Then

(1) A implies B & B implies A (2) A does not imply B & B does not imply A

(3) A implies B but B does not imply A (4) A does not imply B but B implies A

65. An engine develops 10 kW of power. How much time will it take to lift a mass of 200 kg to a height of 40 m? (Given $g = 10\ ms^{-2}$)

(1) 4s (2) 5s (3) 8s (4) 10s

66. If a spring has time period T, and is cut into n equal parts, then the time period will be

(1) $T\sqrt{n}$ (2) $\frac{T}{\sqrt{n}}$ (3) nT (4) T

67. When temperature increases, the frequency of a tuning fork

(1) increases

(2) decreases

(3) remains same

(4) increases or decreases depending on the materials

68. If a simple harmonic motion is represented by $\frac{d^2x}{dt^2} + \alpha x = 0$, its time period is

(1) $2\pi\sqrt{\alpha}$ (2) $2\pi\alpha$ (3) $\frac{2\pi}{\sqrt{\alpha}}$ (4) $\frac{2\pi}{\alpha}$

69. A cinema hall has volume of 7500 m^3. It is required to have reverberation time of 1.5 seconds. The total absorption in the hall should be

(1) 850 w-m^2 (2) 82.50 w-m^2 (3) 8.250 w-m^2 (4) 0.825 w-m^2

70. To absorb the sound in a hall which of the following are used
(1) Glasses, stores
(2) Carpets, curtains
(3) Polished surfaces
(4) Platforms

71. If N represents avagadro's number, then the number of molecules in 6 gm of hydrogen at NTP is
(1) 2N (2) 3N (3) N (4) N/6

72. The mean translational kinetic energy of a perfect gas molecule at the temperature T K is
(1) $\frac{1}{2}kT$ (2) kT (3) $\frac{3}{2}kT$ (4) $2kT$

73. The amount of heat given to a body which raises its temperature by 1°C
(1) water equivalent
(2) thermal heat capacity
(3) specific heat
(4) temperature gradient

74. During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its absolute temperature. The ratio *Cp/Cv* for gas is
(1) $\frac{3}{2}$ (2) $\frac{4}{3}$ (3) 2 (4) $\frac{5}{3}$

75. Cladding in the optical fiber is mainly used to
(1) to protect the fiber from mechanical stresses
(2) to protect the fiber from corrosion
(3) to protect the fiber from mechanical strength
(4) to protect the fiber from electromagnetic guidance

Set Code : T2

Booklet Code : A

CHEMISTRY

76. The valency electronic configuration of Phosphorous atom (At.No. 15) is
(1) $3s^2\ 3p^3$ (2) $3s^1\ 3p^3\ 3d^1$ (3) $3s^2\ 3p^2\ 3d^1$ (4) $3s^1\ 3p^2\ 3d^2$

77. An element 'A' of At.No.12 combines with an element 'B' of At.No.17. The compound formed is
(1) covalent AB (2) ionic AB_2 (3) covalent AB_2 (4) ionic AB

78. The number of neutrons present in the atom of $_{56}Ba^{137}$ is
(1) 56 (2) 137 (3) 193 (4) 81

79. Hydrogen bonding in water molecule is responsible for
(1) decrease in its freezing point (2) increase in its degree of ionization
(3) increase in its boiling point (4) decrease in its boiling point

80. In the HCl molecule, the bonding between hydrogen and chlorine is
(1) purely covalent (2) purely ionic (3) polar covalent (4) complex coordinate

81. Potassium metal and potassium ions
(1) both react with water (2) have the same number of protons
(3) both react with chlorine gas (4) have the same electronic configuration

82. 5.85 gms of sodium chloride were dissolved in water and the solution made upto 100 ml in a standard flask. 10 ml of this solution were pipetted out into another flask and made up with distilled water into 100 ml of solution. The concentration of the sodium chloride solution now is
(1) 0.1 M (2) 1.0 M (3) 0.5 M (4) 0.25 M

83. Concentration of a 1.0 M solution of phosphoric acid in water is
(1) 0.33 N (2) 1.0 N (3) 2.0 N (4) 3.0 N

84. Which of the following is a Lewis acid?
(1) Ammonia (2) Berylium chloride
(3) Boron trifluoride (4) Magnesium oxide

85. Which of the following constitutes the components of a buffer solution?
(1) Potassium chloride and potassium hydroxide
(2) Sodium acetate and acetic acid
(3) Magnesium sulphate and sulphuric acid
(4) Calcium chloride and calcium acetate

86. Which of the following is an electrolyte?
(1) Acetic acid (2) Glucose (3) Urea (4) Pyridine

87. Calculate the Standard emf of the cell, $Cd/Cd^{+2}//Cu^{+2}/Cu$ given that $E^0\ Cd/Cd^{+2} = 0.44V$ and $E^0\ Cu/Cu^{+2} = (-)\ 0.34$ V.
(1) (–) 1.0 V (2) 1.0 V (3) (–) 0.78 V (4) 0.78 V

88. A solution of nickel chloride was electrolysed using Platinum electrodes. After electrolysis,
(1) nickel will be deposited on the anode (2) Cl_2 gas will be liberated at the cathode
(3) H_2 gas will be liberated at the anode (4) nickel will be deposited on the cathode

89. Which of the following metals will undergo oxidation fastest?
(1) Cu (2) Li (3) Zinc (4) Iron

90. Which of the following cannot be used for the sterilization of drinking water?
(1) Ozone (2) Calcium Oxychloride
(3) Potassium Chloride (4) Chlorine water

91. A water sample showed it to contain 1.20 mg/litre of magnesium sulphate. Then, its hardness in terms of calcium carbonate equivalent is
(1) 1.0 ppm (2) 1.20 ppm (3) 0.60 ppm (4) 2.40 ppm

92. Soda used in the L-S process for softening of water is, Chemically.
(1) sodium bicarbonate (2) sodium carbonate decahydrate
(3) sodium carbonate (4) sodium hydroxide (40%)

93. The process of cementation with zinc powder is known as
(1) sherardizing (2) zincing (3) metal cladding (4) electroplating

94. Carrosion of a metal is fastest in
(1) rain-water (2) acidulated water (3) distilled water (4) de-ionised water

95. Which of the following is a thermoset polymer?
(1) Polystyrene (2) PVC
(3) Polythene (4) Urea-formaldehyde resin

96. Chemically, neoprene is
(1) polyvinyl benzene (2) polyacetylene
(3) polychloroprene (4) poly-1,3-butadiene

97. Vulcanization involves heating of raw rubber with
(1) selenium element (2) elemental sulphur
(3) a mixture of Se and elemental sulphur (4) a mixture of selenium and sulphur dioxide

98. Petrol largely contains
(1) a mixture of unsaturated hydrocarbons C_5 - C_8
(2) a mixture of benzene, toluene and xylene
(3) a mixture of saturated hydrocarbons C_{12} - C_{14}
(4) a mixture of saturated hydrocarbons C_6 - C_8

99. Which of the following gases is largely responsible for acid-rain?
(1) SO_2 & NO_2 (2) CO_2 & water vapour
(3) CO_2 & N_2 (4) N_2 & CO_2

100. BOD stands for
(1) Biogenetic Oxygen Demand (2) Biometric Oxygen Demand
(3) Biological Oxygen Demand (4) Biospecific Oxygen Demand

Set Code : T2
Booklet Code : A

CHEMICAL ENGINEERING

101. The property of metals or alloys which describes its ability to be drawn into wires is known as
(1) tenacity (2) ductility
(3) porosity (4) malleability

102. Stainless steel, in addition to iron and carbon contains
(1) aluminium (2) zinc (3) lead (4) chromium

103. Which of the following has maximum melting point?
(1) wrought iron (2) white cast iron
(3) steel (4) grey cast iron

104. The process of protection of iron by coating with zinc is called
(1) tempering (2) galvanizing
(3) nitriding (4) smelting

105. The most commonly used resin for making reinforced plastic is
(1) unsaturated polyester (2) polypropylene
(3) polyurethane (4) nylon-6

106. Presence of manganese in alloy steel improves its
(1) corrosion resistance (2) cutting ability
(3) abrasion resistance and toughness (4) elasticity and creep resistance

107. Equal weights of methane and oxygen are mixed in a empty reactor at 25°C. The fraction of total pressure exerted by the oxygen is
(1) 1/3 (2) 1/2 (3) 3/2 (4) $\frac{1}{2}\times\frac{273}{298}$

123. The major constituent in black liquor is

(1) sodium carbonate (2) sodium sulphate

(3) silica (4) iron oxide

124. Contact process for the manufacture of sulphuric acid yields

(1) 80% H_2SO_4 only (2) 98% H_2SO_4 and higher

(3) 95% H_2SO_4 only (4) 90% H_2SO_4 only

125. The constituents of water gas are

(1) CO and H_2O (2) CO_2 and N_2

(3) CO and H_2 (4) CO and N_2

126. The principal raw materials for the manufacture of soda ash by Solvay process are

(1) limestone and potassium chloride (2) dolomite and sodium hydroxide

(3) limestone, brine and coal (4) coal and caustic soda

127. Clinker is the mass obtained by heating

(1) powdered limestone and clay (2) gypsum

(3) dolomite (4) sand, limestone and washing soda

128. When temporary hard water is boiled, one of the substances formed is

(1) calcium bicarbonate (2) calcium sulphate

(3) hydrogen chloride (4) carbon dioxide

129. Nitric acid is manufactured by catalytic oxidation of ammonia. This process is called

(1) Solvay process (2) Haber's process

(3) Ostwald's process (4) Bosch process

130. Varnish does not contain

(1) pigment (2) thinner

(3) dryer (4) anti skinning agent

131. Catalyst used in oxidation of ammonia is

(1) Platinum-Beryllium (2) Platinum-Rhodium

(3) Cobalt-Molybdenum (4) Platinum-Molybdenum

132. Fluids which show an apparent increase in viscosity with time are called

(1) rheopectic (2) thixotropic (3) ideal fluids (4) newtonian fluids

133. Bernoulli's theorem deals with the law of conservation of

(1) energy (2) mass

(3) momentum (4) gravity

134. Pitot tube is used to measure

(1) local velocity at a point (2) volumetric flow rate

(3) average velocity (4) pressure at a point

135. Stoke (St) is the unit of kinematic viscosity and one stoke is equal to

(1) $1 m^2/s$ (2) $1 ft^2/s$ (3) $1 cm^2/s$ (4) $1 mm^2/s$

136. For laminar flow in a pipe, the value of kinetic energy correction factor (α) is

(1) 1 (2) 1.01 (3) 1.33 (4) 2

137. Which of the following equations is applicable for the flow of fluid through packed bed?

(1) Hagen-Poiseuille equation (2) Kremser equation

(3) Nikuradse equation (4) Ergun equation

138. Which of the following pumps is preferred for pumping slurries?
(1) Gear pump (2) Lobe pump
(3) Screw pump (4) Centrifugal pump

139. Minimum porosity for fluidization is
(1) that corresponding to static bed
(2) that corresponding to completely fluidized bed
(3) the porosity of the bed when true fluidization begins
(4) less than that of the static bed

140. For turbulent flow in smooth pipe of diameter D, the transition length is taken as
(1) 0.05 D (2) 50 D (3) 150 D (4) 0.5 D

141. Which one of the four factors would cause heat transfer rate by conduction to decrease, if the value of that factor were increased?
(1) temperature difference (2) thermal conductivity
(3) area (4) thickness

142. Thermal conductivity is minimum for
(1) asphalt (2) water
(3) petroleum coke (4) air

143. In forced convection, fluid moves under the influence of
(1) changes in fluid pressure produced by external work
(2) buoyant forces arising from changes in density
(3) elastic forces
(4) surface tension forces

144. The Graetz number is associated with
(1) heat transfer by radiation (2) heat transfer in laminar flow
(3) heat transfer in turbulent flow (4) mass transfer operations

145. Drop-wise condensation usually occurs on
(1) smooth surface (2) oily surface
(3) coated surface (4) glazed surface

146. The presence of small amounts of non-condensing gas in a condensing vapor
(1) greatly increases the rate of condensation
(2) seriously reduces the rate of condensation
(3) does not affect the rate of condensation
(4) increases the condensing film coefficient

147. The heat flux in the free convection regime of pool boiling varies as the
(1) ΔT^3 (2) $\Delta T^{5/4}$ (3) ΔT^2 (4) $\Delta T^{1/4}$

148. In a single effect evaporation, to evaporate 1 lb of water from a solution calls for
(1) 1 to 1.3lb of steam (2) 1.5 to 2 lb steam
(3) 2 to 2.5 lb of steam (4) 0.5 to 0.8 lb of steam

149. The total emissivity of a real surface is
(1) less than zero (2) greater than one
(3) equal to one (4) greater than zero but less than one

150. The units of fouling factor are
(1) $m^2.K/W$ (2) $W/(m^2.K)$ (3) m.K/W (4) m^2K^4/W

151. Crushing efficiency of a size reduction equipment ranges between
(1) 0.1 to 2% (2) 10 to 20% (3) 40 to 50% (4) 70 to 80%

152. Which of the following screens has the maximum capacity?
(1) Grizzlies (2) Trommels
(3) Vibrating screen (4) Stationery screen

153. In a ball mill most of the reductin is done by
(1) slow compression (2) cutting
(3) attrition (4) impact

154. In a rotary-drum filter, the fractional submergence of the drum in the slurry is about
(1) 0.03 (2) 0.30 (3) 0.90 (4) 0.15

155. Industrially, the process of sedimentation is conducted on a large scale in equipment called
(1) sorting classifiers (2) cyclones
(3) thickeners (4) filters

156. The speed, in rpm, of a continuous rotary vacuum filter may be
(1) 1 (2) 100 (3) 1000 (4) 10000

157. Froth flotation is most suitable for treating
(1) iron ores (2) sulphide ores
(3) quartzite (4) nitride ores

158. The most efficient equipment for removal of sub-micron dust particles form blast furnace gas is
(1) venturi scrubber (2) gravity settling chamber
(3) electrostatic precipitator (4) cyclone separator

159. Change of state, e.g. freezing, melting, evaporation and condensation, is an
(1) adiabatic process (2) isobaric process
(3) isothermal process (4) isochoric process

160. Mathematical statement of second law of thermodynamics is
(1) $\Delta S = 0$ (2) $\Delta S > 0$ (3) $\Delta S < 0$ (4) $\Delta S \geq 0$

161. The variation of heat of reaction with temperature at constant pressure or at constant volume is known as

(1) Kirchoff's law (2) Fourier's law (3) Laplace law (4) Hess's law

162. The principal of refrigeration is based on

(1) Zeroth law of thermodynamics (2) first law of thermodynamics
(3) second law of thermodynamics (4) thrid law of thermodynamics

163. A gas is termed an ideal gas if it obeys the gas equation PV = RT. When do you expect a gas to show deviation from ideality?

(1) At high pressures and low temperatures
(2) At low pressures and low temperatures
(3) At high pressures and high temperatures
(4) At low pressures and high temperatures

164. From Arrhenius law a plot ln k versus 1/T gives a straight line with a slope of (-E/R). The units of E/R are

(1) K (2) cal (3) cal/K (4) K/cal

165. The rate constant of any reaction depends on

(1) the temperature of the system (2) the time of reaction
(3) the extent of reaction (4) the initial concentration of the reactants

166. A catalyst is a substance which

(1) increases the equilibrium concentration of the product
(2) changes the equilibrium constant of the reaction
(3) shortens the time to reach equilibrium
(4) supplies energy to the reaction

167. If the time required to change the concentration of reactant to half its original value is independent of the initial concentration, the order of the reaction is

(1) zero (2) one (3) two (4) three

168. The irreversible reaction is simply the special case of the reversible reaction if

(1) the concentration of the reactant at equilibrium conditions is zero
(2) the fractional conversion of the reactant at equilibrium conditions is zero
(3) the equilibrium constant is zero
(4) the equilibrium constant is one

169. The steady state temperature reached by a small amount of liquid evaporating into a large amount of unsaturated vapor-gas mixture is called

(1) dry-bulb temperature
(2) dew point
(3) wet-bulb temperature
(4) bubble point

170. Relative volatility, α, for a binary system

(1) decreases with increase in pressure
(2) increases with increase in pressure
(3) increases with increase in temperature at constant pressure
(4) has no significance in distillation operation

171. At minium reflux ratio the operating cost of a distillation column is

(1) maximum (2) optimum (3) minimum (4) infinite

172. For all useful liquid-liquid extraction operations the selectivity of solvent must be

(1) more than zero (2) more than one
(3) less than one (4) less than or equal to one

173. At fixed temperature, the solubility of gases in solvent
(1) remains constant with change in pressure
(2) decreases with increase in pressure
(3) increases with increase in pressure
(4) decreases exponentially with increase in pressure

174. Vegetable oils are recovered from oil seeds by leaching with
(1) hot sulphuric acid (2) cold water
(3) nitric acid (4) hexane

175. The ratio of momentum diffusivity to mass diffusivity is known as
(1) Schmidt number (2) Sherwood number
(3) Lewis number (4) Stanton number

176. Which one of the cooling tower is most efficient?
(1) Chimney type natural draft cooling tower
(2) Atmospheric circulation type cooling tower
(3) Induced draft cooling tower.
(4) Forced draft cooling tower

177. Granular or crystalline material can be dried in
(1) tray dryer (2) rotary dryer
(3) screen-conveyor dryer (4) screw-conveyor dryer

178. Swenson-Walker crystallizer is a
(1) continuous unit (2) batch unit
(3) semi-batch unit (4) cooling (adiabatic)-cum-evaporation device

179. Which one of the following is a static characteristic of instruments?
(1) Fidelity (2) Time lag (3) Dynamic error (4) Reproducibility

180. Which of the following is most suitable to measure a temperature of 2000°C?
(1) Ordinary mercury-in-glass thermometer
(2) Platinum resistance thermometer
(3) Radiation pyrometer
(4) Constant-volume hydrogen thermometer

181. Offset is zero for
(1) P-controller only
(2) P-D controller only
(3) P- and P-D controllers
(4) P-I and P-I-D controllers only

182. On-off control is a special case of
(1) proportional control
(2) proportional-integral control
(3) proportional-derivative control
(4) proportional-integral-derivative control

183. Absolute pressure is measured by
(1) a bourdon gauge
(2) an aneroid barometer
(3) a differential manometer
(4) a vacuum gauge

184. Response of a linear control system for a change in set point is called
(1) frequency response
(2) transient response
(3) servo problem
(4) regulator problem

185. Degree to which an instrument indicates the changes in measured variable withou dynamic error is called
(1) speed of response
(2) reproducibility of instrument
(3) fidelity
(4) its static characteristics

186. Step response of a first-order system is
(1) under damped
(2) critically damped
(3) over damped
(4) undamped

187. Solar radiation flux is often reported in Langleys per year. The unit of Langley is equal to
(1) 1 cal/cm^2 (2) 1 Btu/ft^2 (3) 1 j/m^2 (4) 1 Btu/in^2

188. Conversion efficiencies for silicon cells (i.e., solar cells) range between
(1) 10 and 15% (2) 30 and 35%
(3) 90 and 95% (4) 95% and 99%

189. The function of a windmill is to extract energy from the wind and to produce
(1) mechanical energy (2) thermal energy
(3) electrical energy (4) chemical energy

190. The maximum power available in the wind is directly proportional to the velocity of the wind raised to the power
(1) 1 (2) 2 (3) 3 (4) 4

191. Liquefied petroleum gas (LPG) is a
(1) primary liquid fuel (2) primary gaseous fuel
(3) secondary gaseous fuel (4) secondary liquid fuel

192. Which of the following isotope is a raw material for the production of Pu^{239} nuclear fuel?
(1) U^{238} (2) U^{235} (3) U^{233} (4) U^{234}

193. The quality of a good fuel is
(1) high calorific (2) low cost
(3) easily available (4) no ash

194. Which one of the following is the most severe air pollutant?
(1) SO_2 (2) NO_X (3) CO (4) CH_4

Set Code : T2
Booklet Code : A

195. Thermal power plants are the major source of
(1) SO_2 pollutants
(2) ammonia pollutants
(3) NO_X pollutants
(4) phosgene pollutants

196. The fire of electrical equipments can be extinguished with the use of
(1) soda-acid extinguisher
(2) carbon dioxide extinguisher
(3) foam extinguisher
(4) antifreeze extinguisher

197. Fire is a proper combination of
(1) fuel and oxidizing material
(2) fuel and oxygen
(3) fuel, oxygen and temperature
(4) oxidizing material and air

198. Well ventilated wooden shed can be used to store
(1) oxidizing materials
(2) flammable liquids
(3) acids
(4) compressed gases

199. The biochemical treatment of sewage effluents is essentially a process of
(1) reduction
(2) oxidation
(3) dehydration
(4) alkalinization

200. Which one of the following chemical is present in the form of inorganic impurity in water pollution?
(1) Proteins (2) Fats (3) Salts of metals (4) Carbohydrates