Question Booklet Alpha Code

Question Booklet Sl. No.

| A |

A

Total Number of Questions : 100   **Time : 90 Minutes**

Maximum Marks : 100

| INSTRUCTIONS TO CANDIDATES |

A

1. The Question Paper will be given in the form of a Question Booklet. There will be four versions of Question Booklets with Question Booklet Alpha Code viz. **A, B, C** & **D**.

2. The Question Booklet Alpha Code will be printed on the top left margin of the facing sheet of the Question Booklet.

3. The Question Booklet Alpha Code allotted to you will be noted in your seating position in the Examination Hall.

4. If you get a Question Booklet where the alpha code does not match to the allotted alpha code in the seating position, please draw the attention of the Invigilator IMMEDIATELY.

5. The Question Booklet Serial Number is printed on the top right margin of the facing sheet. If your Question Booklet is un-numbered, please get it replaced by new Question Booklet with same alpha code.

6. The Question Booklet will be sealed at the middle of the right margin. Candidate should not open the Question Booklet, until the indication is given to start answering.

7. Immediately after the commencement of the examination, the candidate should check that the Question Booklet supplied to him/her contains all the 100 questions in serial order. The Question Booklet does not have unprinted or torn or missing pages and if so he/she should bring it to the notice of the Invigilator and get it replaced by a complete booklet with same alpha code. This is most important.

8. A blank sheet of paper is attached to the Question Booklet. This may be used for rough work.

9. **Please read carefully all the instructions on the reverse of the Answer Sheet before marking your answers.**

10. Each question is provided with four choices **(A), (B), (C)** and **(D)** having one correct answer. Choose the correct answer and darken the bubble corresponding to the question number using Blue or Black Ball Point Pen in the OMR Answer Sheet.

11. **Each correct answer carries 1 mark and for each wrong answer 1/3 mark will be deducted. No negative mark for unattended questions.**

12. No candidate will be allowed to leave the examination hall till the end of the session and without handing over his/her Answer Sheet to the Invigilator. Candidates should ensure that the Invigilator has verified all the entries in the Register Number Coding Sheet and that the Invigilator has affixed his/her signature in the space provided.

13. Strict compliance of instructions is essential. Any malpractice or attempt to commit any kind of malpractice in the Examination will result in the disqualification of the candidate.

1. In a given electrical network, the equations for the currents i_1, i_2, i_3 are $3i_1 + 3i_2 + 2i_3 = 1$ $i_1 + 2i_2 = 4$, $10i_2 + 3i_3 = -2$, the values of i_1 and i_3 are

   A) 2, – 4   B) 1, – 4   C) 2, –1   D) None of these

2. One solution of the system of equations $x + y + z = 1$, $x + 2y + 3z = \mu$, $x + 5y + 9z = \mu^2$ is

   A) (1, 2, – 2)   B) (1, –2, 2)   C) (–1, –2, 2)   D) None of these

3. The rank of the matrix given by the system of equations $3x + y + z = 8$, $2x - 3y - 2z = -5$, $7x + 2y - 5z = 0$ is

   A) 2   B) 3   C) 1   D) None of these

4. If A is matrix of order 5 and det A = 0 then rank of A will be

   A) 5   B) Less than 5
   C) Less than or equal to 5   D) Cannot be determined

5. Let A be a 2×2 real matrix with trace A = – 7 and det A = 6. What is the value of trace A^2 ?

   A) 24   B) 13   C) 37   D) 49

6. The largest eigen value and the corresponding eigen vector of $\begin{bmatrix} 1 & -2 \\ -5 & 4 \end{bmatrix}$ are

   A) -1; (2, –5)   B) -1; (1, 1)   C) 6; (1, 1)   D) 6; (2, –5)

7. If 6 is an eigen value of $A = \begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$, find the eigen values of A – 5I.

   A) 1, 2, –3   B) –1, 2, – 3   C) 1, –2, –3   D) 1, 2, 3

8. The eigen vectors of a 3×3 matrix A corresponding to the eigen values 1, 1, 3 are $\begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$, $\begin{bmatrix} 0 \\ 1 \\ -1 \end{bmatrix}$, $\begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$ respectively. Find A.

   A) $\begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$ B) $\begin{bmatrix} 2 & 0 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$ C) $\begin{bmatrix} -2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$ D) $\begin{bmatrix} 2 & 1 & 0 \\ 1 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

A

9. Value of $\lim\limits_{t\to\infty} \dfrac{e^t + t^2}{e^t - t}$

   A) 2   B) −2   C) −1   D) 1

10. Let $f(t) = \begin{cases} t-2, & t < 0 \\ t^2, & 0 \le t \le 1 \\ 2t, & t > 2 \end{cases}$ then the values of

   i. $\lim\limits_{t\to 0} f(t)$

   ii. $\lim\limits_{t\to 1} f(t)$

   iii. $\lim\limits_{t\to 2} f(t)$ are

   A) −2, 1, 4   B) 0, 1, 4

   C) Does not exist, 1, 4   D) −2, 1, does not exist

11. The interval in which G(1) lies when $G'(t) = \dfrac{1}{3-t^2}$ and G(0) = 1 is

   A) $\left[\dfrac{4}{3}, \dfrac{3}{2}\right]$ B) $\left[\dfrac{1}{3}, \dfrac{1}{2}\right]$ C) $\left[\dfrac{4}{3}, \dfrac{1}{2}\right]$ D) None of the above

12. $\int_{c_1}^{c_2} f(x)\ dx$ is numerically equal to the

   A) area bounded by x = f(y) from c_1 to c_2

   B) area bounded by y = f(x) from c_2 to c_1

   C) area bounded by y = f(x), the x − axis and the ordinates at c_1 and c_2

   D) area bounded by y = f(x), the y − axis and the ordinates at c_1 and c_2

13. The rate of change of $z = x^2 \cos xy$ with respect to x at the point (0.5, π) is

   A) $\dfrac{\pi}{4}$ B) $\dfrac{-\pi}{4}$ C) $\dfrac{\pi}{2}$ D) $\dfrac{-\pi}{2}$

14. The celsius temperature in a region in space is given by $T(x, y, z) = 2x^2 - xyz$. A particle is moving in this region and its position at time t is given by $x = 2t^2$, $y = 3t$, $z = -t^2$ where time is measured in seconds and distance in meters. How fast is the temperature experienced by the particle changing in degrees celsius per second when particle is at the point P(8, 6, − 4) ?

   A) 368   B) 496

   C) 736   D) None of the above

A

15. The local linear approximation at the point (x_0, y_0, z_0) of $f(x, y, z) = x^2 - xy + 3$ sin z is given by $L(x, y, z) = 3x - 2y + 3z - 2$. Determine (x_0, y_0, z_0).

    A) $(1, 1, 0)$ B) $(2, 1, 0)$ C) $(3/2, 1, 0)$ D) $(1, 1, 1)$

16. The value of $\dfrac{\partial u}{\partial x}$ at $(x, y, z) = \left(\dfrac{\pi}{4}, \dfrac{1}{2}, -\dfrac{1}{2}\right)$ for $u = e^{qr} \sin^{-1} p$, $p = \sin x$, $q = z^2 \ln y$, $r = \dfrac{1}{z}$

    A) $\sqrt{2}\left(1 + \dfrac{\pi}{4} \ln 2\right)$ B) $\sqrt{2}\left(1 - \dfrac{\pi}{4} \ln 2\right)$ C) $\dfrac{1}{\sqrt{2}}$ D) $\dfrac{1}{\sqrt{2}}\left(1 + \dfrac{\pi}{4} \ln 2\right)$

17. Change in value of $f = \dfrac{x+y}{xy}$ from $P(-1, -2)$ to $Q = (-1.02, -2.04)$ is

    A) 0.02   B) 0.01   C) 0.03   D) 0.04

18. The value of the integral $\displaystyle\int_0^1 \int_{4x}^4 e^{-y^2}\, dy\, dx$ is

    A) $\dfrac{1 - e^{16}}{8}$ B) $\dfrac{1 - e^{-16}}{4}$ C) $\dfrac{1 - e^{-16}}{8}$ D) None of these

19. $\displaystyle\int_1^2 \int_z^2 \int_0^{y\sqrt{3}} \dfrac{y}{x^2 + y^2}\, dx\, dy\, dz =$

    A) $\dfrac{\pi}{3}$ B) $\dfrac{\pi}{6}$ C) $\dfrac{\pi}{12}$ D) $\dfrac{\pi}{8}$

20. Area of the region enclosed between the parabola $x^2 = 2y$ and the line $y = 2x$ is

    A) $\dfrac{16}{3}$ B) $\dfrac{8}{3}$ C) $\dfrac{15}{6}$ D) None of the above

21. The degree of the differential equation $x\dfrac{dx}{dy} + \dfrac{dy}{dx} = y$ is

    A) 1   B) 2   C) 3   D) 4

22. The solution of the differential equation $x\dfrac{dy}{dx} - y = 0$, $y(1) = 4$ represents

    A) Straight line   B) Parabola   C) Circle   D) Ellipse

23. A solution of the linear differential equation $\dfrac{d^2y}{dx^2} + 3\dfrac{dy}{dx} + 2y = 0$, $y(0) = 3$, $y(1) = \dfrac{1}{e^2} + \dfrac{2}{e}$ is

    A) $y(x) = e^{-2x} + 2e^{-x}$ B) $y(x) = 2e^{-2x} + 2e^{-x}$
    C) $y(x) = e^{-2x} + e^{-x}$ D) $y(x) = 2e^{-2x} + e^{-x}$

24. Which of the following is a solution to the Cauchy Euler differential equation

    $x^2\dfrac{d^2y}{dx^2} + x\dfrac{dy}{dx} - 9y = 0$, $x > 0$?

    A) e^{3x} B) $\log 3x$ C) $3x$ D) $\dfrac{1}{x^3}$

A

25. The mean of a set of numbers is 54. If 5 is added to each of the members in the set, the mean of the new set is
    A) 59   B) 54   C) 49   D) 50

26. The two lines of regressions are $3x + 5y = 11$ and $15x + y = 10$. The correlation coefficient is
    A) $\dfrac{-3}{5}$ B) $\dfrac{1}{5}$ C) $\dfrac{-1}{5}$ D) $\dfrac{3}{5}$

27. The probability density function of a continuous random variable X is $f(x) = \begin{cases} e^{-x}, & x \geq 0 \\ 0, & x < 0 \end{cases}$. The cumulative probability function F(1) is
    A) $1 - e^{-1}$ B) e^{-1} C) e   D) 1

28. Let X be a random variable where E(X) is the expectation of X and V(X) is the variance of X. If A and B are arbitrary constants, which of the following statement is/are correct ?
    i. $E(AX + B) = AE(X) + B$
    ii. $V(AX + B) = AV(X) + B$
    iii. $E(AX + B) = AE(X)$
    iv. $V(AX + B) = A^2 V(X)$
    A) Only i and ii   B) Only iii and iv   C) Only i and iv   D) Only ii and iii

29. The probability density function of a random variable X is given by
    $f(x) = \begin{cases} 0.5, & 0 \leq x \leq 2 \\ 0, & \text{otherwise} \end{cases}$. Which of the following probabilities are correct ?
    i. $P(X < 1) = 0.5$
    ii. $P(X > 1) = 1$
    iii. $P(X < 0.5) = 0.25$
    iv. $P(X > 0.5) = 0.5$
    A) Only i and ii   B) Only iii and iv   C) Only i and iii   D) Only ii and iii

30. Let X be a random variable follows binomial distribution b(x ; n, p) with mean 8 and variance 2. The probability of success p is
    A) $\dfrac{1}{4}$ B) $\dfrac{3}{4}$ C) $\dfrac{1}{2}$ D) $\dfrac{2}{3}$

31. A continuous random variable X follows exponential distribution $f(x) = \lambda e^{-\lambda x}$, $0 \leq x < \infty$, $\lambda > 0$. Which of the following condition is true ?
    A) The mean of the distribution is λ B) The mean of the distribution is $\dfrac{1}{\lambda}$
    C) The variance of the distribution is λ^2 D) The variance of the distribution is $\dfrac{1}{\lambda}$

A

32. If X and Y are two random variables follows normal distribution with
    $P(X \le -2) = P(Y \ge 2)$. The means of X and Y are –1 and 1 respectively. If the
    standard deviation of X is 1, then the standard deviation of Y is
    A) –1   B) 1   C) –2   D) 2

33. The probability mass function P(X) of the Poisson distribution satisfies
    $P(X = 0) = P(X = 1)$. The variance is
    A) 2   B) 1   C) 10   D) –1

34. The standard deviation of uniformly distributed random variable defined in the interval
    [1, 2] is
    A) $\dfrac{1}{\sqrt{12}}$ B) $\dfrac{1}{\sqrt{3}}$ C) $\dfrac{5}{\sqrt{12}}$ D) $\dfrac{7}{\sqrt{12}}$

35. A random variable X is uniformly distributed over [0, 2] and another random variable Y
    is uniformly distributed over [0, 3]. If X and Y are independent, then $P(\max (X, Y) > 1)$ is
    A) $\dfrac{1}{6}$ B) $\dfrac{1}{3}$ C) $\dfrac{5}{6}$ D) $\dfrac{2}{3}$

36. Let X be a normal random variable with mean 1 and variance 4. The probability
    $P(X < 0)$ is
    A) 0.5   B) greater than 0 but less than 0.5
    C) greater than 0.5 but less than 1   D) 1

37. Newton-Raphson iteration formula for finding $\sqrt{N}$, where N > 0 is

    A) $x_{n+1} = \dfrac{2x_n^2 + N}{2x_n}$ B) $x_{n+1} = \dfrac{2x_n^2 + N}{x_n}$ C) $x_{n+1} = \dfrac{x_n^2 + N}{x_n}$ D) $x_{n+1} = \dfrac{x_n^2 + N}{2x_n}$

38. The value of the function f(x) for different values of x are $f(1) = -1$, $f(2) = -1$, $f(3) = 1$
    and $f(4) = 5$. Then f(x) attains
    A) Minimum value at x = 1.5   B) Maximum value at x = 1.5
    C) Maximum value at x = 2.5   D) Minimum value at x = 2.5

39. Consider the following statements.
    i. Lagranges interpolation formula is applicable only when arguments are
       equispaced.
    ii. Newton's forward interpolation formula is applicable only when arguments are
       equispaced.

    Which of the above is/are correct ?
    A) i only   B) ii only
    C) Both i and ii   D) Neither i nor ii

A   -7-

40. Consider the integral $I = \int_0^6 x^2\,dx$ and J is the value of the integral computed using Simpson's one third rule by dividing the interval into 6 equal subintervals, then |I − J| is

    A) 0
    B) belongs to (0, 5)
    C) belongs to (5, 10)
    D) 10

41. The ratio of Einstein's coefficients at spontaneous emission of radiation and stimulated emission of radiation varies with the frequency 'v' of the incident radiation as

    A) v^{-3}
    B) v
    C) $v^{\frac{3}{2}}$
    D) v^3

42. The energy of laser pulse in a ruby laser of wavelength 662 nm is _____ (Given, Planck's constant = 6.62×10^{-34} J.s, velocity of light = 3×10^8 m/s)

    A) 0.3×10^{-19} J
    B) 3×10^{-19} J
    C) 30×10^{-19} J
    D) 3×10^{-18} J

43. The wavelength of He-Ne laser is

    A) 6328 nm
    B) 632.8 Å
    C) 632.8 nm
    D) 623.8 nm

44. A Nd: YAG laser emits light of wavelength 1054 nm. The duration of pulses is 10 ns. The coherence length is

    A) 0.3 m
    B) 3 m
    C) 3 nm
    D) 3 Å

45. Polymer optical fibre of diameter 1 mm with high purity polymethyl methacrylate (PMMA) core of refractive index 1.54 and fluorinated polymer cladding of refractive index 1.456 are commercially available with a numerical aperture (NA) of 0.50. The acceptance angle of the fibre is

    A) 21°
    B) 30°
    C) 45°
    D) 60°

46. When the launch end of a multimode step index fibre of 200 μm/ 230 μm (core-cladding) diameter is immersed in water,

    A) the numerical aperture decreases and acceptance angle increases
    B) the numerical aperture increases and acceptance angle decreases
    C) the acceptance angle increases and numerical aperture also increases
    D) none of the above

47. The V-number of a multimode step-index fibre is 60. The number of modes guided through the fibre will be

    A) 900
    B) 1800
    C) 90
    D) 180

A

48. In optical fibre technology, an optical fibre whose core has a refractive index that decreases with increasing radial distance from the fibre axis is known as
    A) single mode step-index fibre
    B) multimode step-index fibre
    C) graded-index fibre
    D) all of the above

49. A light emitting diode is made of GaAsP having a band gap of 1.91 eV. The wavelength of radiation emitted is
    A) 649.2 nm
    B) 0.649 nm
    C) 649.2 μm
    D) 649.2Å

50. From the I-V characteristic curve of a silicon solar cell current at maximum power point I_m = 3.50 A; voltage at maximum power point V_m = 0.50 V. The short circuit current is 3.50 A and the open circuit voltage is 0.60 V. The fill factor of the solar cell is
    A) 0.38%
    B) 38.3%
    C) 1.2%
    D) 83.3%

51. Which of the following best describes avalanche breakdown in a PN junction ?
    A) Occurs due to thermal vibrations
    B) Result of high level of doping concentration
    C) Caused by high electric field ionizing atoms in the depletion region
    D) Happens when a high forward voltage

52. Pure silicon at 550 K has an intrinsic electron and hole concentration of 1×10^{16} m^{-3}. When doped with indium, the hole concentration increases to 4×10^{22} m^{-3}. What type of semiconductor is the doped material ?
    A) Intrinsic semiconductor with electron concentration 2.5×10^9 m^{-3}
    B) n-type semiconductor with hole concentration 4×10^{22} m^{-3}
    C) p-type semiconductor with electron concentration 2.5×10^9 m^{-3}
    D) p-type semiconductor with electron concentration 4×10^9 m^{-3}

53. Which material is commonly used for manufacturing Zener diodes ?
    A) Silicon
    B) Gallium arsenide
    C) Germanium
    D) Copper

54. The Meissner effect refers to
    A) The expulsion of electric fields from a superconductor below transition temperature
    B) The expulsion of magnetic fields from a superconductor below the critical temperature
    C) The rise in electrical conductivity below the critical temperature
    D) The resistance change in superconducting materials as they are cooled

A

55. Which statement is not correct about the Cooper pair ?
    A) The two electrons in a Cooper pair have opposite spins and opposite momenta
    B) The two electrons in a Cooper pair have opposite spins and same momenta
    C) The overall this pair show a bosonic behavior
    D) Interaction of two electrons mediated through a phonon

56. When Germanium is doped with Aluminum, what type of semiconductor is formed ?
    A) Intrinsic Semiconductor   B) N-Type Semiconductor
    C) P-Type Semiconductor   D) Insulator

57. Potential difference must be applied across a Josephson junction to emit electromagnetic radiation at a frequency of 1209 terahertz (THz) is approximately
    A) 0.483 V   B) 0.603 V   C) 0.725 V   D) 2.5 V

58. The critical temperature of a superconductor in the absence of a magnetic field is T_c. At what temperature will the critical magnetic field reach three-fourths of its value at 0 K ?
    A) $T = 3/4T_c$ B) $T = 1/4T_c$ C) $T=1/2T_c$ D) $T = T_c$

59. Why are germanium diodes preferred as temperature sensors at low temperatures compared to silicon diodes ? Which statement is not correct ?
    A) Lower Forward Voltage Drop   B) Faster Response Time
    C) Lower Reverse Leakage Current   D) More Robust and Durable

60. How does the Fermi level behave in a PN junction when forward bias is applied ?
    A) The Fermi level bends upwards on both sides of the junction
    B) The Fermi level remains unchanged across the junction
    C) The Fermi level bends downwards on the P-side and upwards on the N-side
    D) The Fermi level bends upwards on the P-side and downwards on the N-side

61. What type of wave is typically used in industrial non-destructive testing ?
    A) Audible waves   B) Ultrasonic waves
    C) Hypersonic waves   D) Infrasonic waves

62. Which of the following applications is associated with infrasonic waves ?
    A) Medical imaging   B) Satellite communication systems
    C) Seismic activity monitoring   D) Cleaning and material characterisation

63. The intensity of the sound wave is increased to 100 times, calculate the change in its decibel level.
    A) 1 dB   B) 10 dB   C) 20 dB   D) 50 dB

A

64. A SONAR system uses ultrasonic waves with a frequency of 20 kHz. If the speed of sound in water is 1500 m/s, calculate the wavelength of the wave.
    A) 0.75 m   B) 0.075 m   C) 13.33 m   D) 3000 m

65. Calculate the reverberation time for a concert hall of volume 5000 m^3 with a sound absorption of 500 sabins.
    A) 1.61 sec   B) 3.22 sec   C) 1 sec   D) 0.8 sec

66. Reverberation time refers to the duration it takes for the sound intensity to decrease by _____ after the sound source has stopped emitting.
    A) 10 dB   B) 20 dB   C) 40 dB   D) 60 dB

67. Ultrasonics is used in pulsed Doppler imaging to measure
    A) Bone density   B) Blood flow velocity
    C) Muscle strength   D) Oxygen saturation

68. What is the unit of sound absorption ?
    A) Decibel   B) Sabin   C) Hertz   D) Watt

69. In which of the following mediums do acoustic waves (sound waves) travel the fastest ?
    A) Air   B) Water   C) Steel   D) Vacuum

70. The time taken for an ultrasonic wave to return to the SONAR after reflection from the ocean floor is 6 seconds. If the speed of sound in water is 1500 m/s, the depth of the ocean is
    A) 3000 m   B) 4500 m   C) 6000 m   D) 9000 m

71. Which one of the following has two of its dimensions outside the nanometric range and one is within the nano range ?
    i. Nano films
    ii. Nano wires
    iii. Nano fibers
    iv. Nano tubes
    A) Only iv   B) Only iii   C) Only ii   D) Only i

72. To which class of nanomaterials does the CNT, graphene and fullerene belong
    i. Organic based
    ii. Inorganic based
    iii. Carbon based
    iv. None of the above
    A) iii   B) iv   C) ii   D) i

A

73. A green colored glass has
    i. cobalt oxide
    ii. chromic oxide
    iii. cadmium sulfide
    A) i   B) iii   C) ii   D) i and iii

74. Which of the following glass is shatter proof ?
    i. Borosilicate glass
    ii. Photochromic glass
    iii. Safety glass
    iv. Soda glass
    A) i   B) iii   C) iv   D) ii

75. The proportion of which of the following constituent is regulated to avoid disintegration of cement ?
    i. lime
    ii. iron oxide
    iii. alumina
    iv. sulfur trioxide
    A) iv   B) iii   C) i   D) ii

76. Which of the following is an argillaceous raw material for the manufacture of Portland cement ?
    i. Limestone
    ii. Coal
    iii. Clay
    iv. Gypsum
    A) i   B) ii   C) iv   D) iii

77. The strength of Kevlar is due to
    i. Hydrogen bonding between carbonyl group and NH center
    ii. Electrostatic forces
    iii. Aromatic stacking interaction between adjacent strands
    A) i and ii   B) i and iii   C) ii alone   D) ii and iii

78. The base present in DNA but absent in RNA is
    i. Adenine
    ii. Guanine
    iii. Thymine
    iv. Cytosine
    A) iii   B) i   C) ii   D) iv

79. In conducting polymers, doping can be done because they have
    i. low ionization potential
    ii. high electron affinity
    iii. high ionization potential
    iv. low electron affinity
    A) i and iv   B) ii and iii   C) iii and iv   D) i and ii

80. The hybridization of carbon in polyacetylene is
    i. sp
    ii. sp^2
    iii. sp^3
    A) i   B) iii   C) ii   D) i and ii

81. Among the given molecules which is IR active ?
    A) H_2O B) O_2 C) N_2 D) H_2

82. IR spectrum of CO_2 exhibits two characteristic bands at 2349 and 667 cm^{-1} which corresponds to
    A) Symmetric stretching and asymmetric stretching respectively
    B) Asymmetric stretching and bending vibrations respectively
    C) Bending vibrations and asymmetric stretching respectively
    D) Symmetric stretching and bending vibrations respectively

83. The higher λ_{max} shown by 1, 3, 5-hexatriene compared to 1, 3-butadiene is due to the presence of
    A) Triple bonds
    B) Three double bonds which are in conjugation
    C) Two double bonds which are in conjugation
    D) Linear structure

84. A dye solution of concentration 0.06M displayed an absorbance of 0.06 at 470 nm while the test solution of same dye recorded an absorbance of 0.02 under the same experimental conditions.
    Calculate the unknown concentration of the test solution.
    A) 0.01 M   B) 0.02 M   C) 0.2 M   D) 0.1 M

85. In a broad temperature range, the TG profile of compound 1 exhibited a significant weight loss, while compound 2 showed no changes. Which of the following statement is correct about the above TG profiles ?
    A) Compound 1 is undergoing dehydration and compound 2 is thermally stable
    B) Compound 1 is undergoing a phase change and compound 2 is thermally stable
    C) Compound 1 is thermally stable and compound 2 is undergoing dehydration
    D) Both compound 1 and 2 are thermally stable

A

86. In scanning electron microscopy, information regarding composition of a material can be obtained by analysing
    A) Primary electrons
    B) Secondary electrons
    C) Back scattered electrons
    D) Auger electrons

87. In a TLC experiment of a sample, two spots are appeared at 2.1 cm (X) and 4 cm (Y) from the base line. Which of the following statement is correct regarding the nature of the compound ?
    A) X is more polar compared to Y
    B) X is less polar compared to Y
    C) Both X and Y are of same polarity
    D) Polarity cannot be predicted using TLC

88. Which of the following applications cannot be effectively performed using Gas Chromatography (GC) ?
    A) Analysing the extent of air pollution
    B) Quantify the ethyl alcohol content in blood samples
    C) Analysing the composition of hydrocarbon fuels
    D) Separation and quantification of non-volatile proteins, peptides etc.

89. The glass transition temperature of a polymer can be determined by
    A) Thermogravimetric analysis
    B) Differential thermal analysis
    C) Scanning electron microscopy
    D) Column chromatography

90. In HPLC, components in a mixture is separated by
    A) Difference in adsorption coefficients
    B) Difference in vapour pressure
    C) Difference in absorption coefficients
    D) None of the above

91. Which of the following gases has the highest Global Warming Potential (GWP) ?
    A) CO_2
    B) N_2O
    C) CFC
    D) CH_4

92. Which of the following statement is correct about photochemical smog ?
    A) It is formed due to the presence of oxides of sulphur
    B) It is oxidizing in nature
    C) It is formed in the early mornings of winter months
    D) It is also known as the London smog

93. Which of the following pairs is an example for fissile nuclides ?
    A) U^{235} and Pu^{239}
    B) U^{238} and Th^{232}
    C) U^{235} and Th^{232}
    D) U^{238} and Pu^{239}

94. Identify the correct increasing order of coal ranks
    A) Peat, bituminous coal, lignite and anthracite
    B) Lignite, peat, anthracite and bituminous coal
    C) Anthracite, bituminous coal, lignite and peat
    D) Peat, lignite, bituminous coal and anthracite

95. Which of the following statement is/are correct ?
    i. Waste water from electroplating industry is highly toxic due to the presence of metal cyanides.
    ii. Waste water from textile industry has low biological oxygen demand.
    iii. Waste water from petrochemical industry contains inorganic and organic sulphur compounds.
    A) Only i and ii
    B) Only ii and iii
    C) Only i and iii
    D) All of the above (i, ii and iii)

96. Example for an electrolyte used in lithium-ion cell is
    A) Lithium cobalt oxide
    B) Lithium hexafluorophosphate
    C) Lithium iron phosphate
    D) Lithiated graphite

97. Which of the following statement about hydrogen-oxygen fuel cell is/are correct ?
    i. Hydrogen gas is oxidized at the anode to produce H^+ ions.
    ii. KOH or phosphoric acid can be used as the electrolyte.
    iii. It is a galvanic cell where the reactants are supplied from outside rather than forming an integral part of the cell.
    A) Only i and ii
    B) Only ii and iii
    C) Only i and iii
    D) All of the above (i, ii and iii)

98. Which among the following is an anerobic method involved in waste water treatment ?
    A) Activated sludge process
    B) Tricking filter method
    C) Coagulation
    D) UASB process

99. 'Wet' natural gas contains
    A) Methane and higher hydrocarbons
    B) Methane and other lower hydrocarbons
    C) Methane and hydrogen sulphide
    D) Methane and water

100. Which of the following statement is not correct regarding ion exchange process ?
    A) Cation exchangers are generally functionalized with acid groups
    B) Efficiency of the process is reduced if the water is turbid
    C) Water is first passed through anion exchanger and then through cation exchanger
    D) Dowex-50 is a cation exchange resin

A

Space for Rough Work