Sr. No.	Question

1. When a compressed gas is allowed to expand through a porous plug at a temperature above its inversion temperature, then
   (A) A fall in temperature is observed
   (B) A rise in temperature is observed
   (C) A rise after an initial fall in temperature is observed
   (D) No change in temperature is noticed

2. Gas A can be liquefied at room temperature by applying pressure but gas B cannot. This reflects
   (A) Critical temperature of B is less than that of A
   (B) Critical temperature of B is greater than that of A
   (C) Critical temperature of both A and B are greater than room temperature
   (D) No conclusion can be drawn on the critical temperature of A and B

3. Clausius-Clapeyron's equation gives the variation of
   (A) Boiling point of liquid with temperature
   (B) Vapour pressure of a liquid with temperature
   (C) Coefficient of viscosity of a liquid with pressure
   (D) Surface tension of a liquid with temperature

4. At any temperature T, the entropy of a solid substance (S_T) is given by the expression
   (A) $C_P dT$
   (B) $C_p/_T$
   (C) $\int_0^T C_p dT \ /_T$
   (D) $(C_p - C_v)/_T$

5. The value of equilibrium constant for an endothermic reaction
   (A) Increases with increases of temperature
   (B) Decreases with increase of temperature
   (C) Is independent of temperature
   (D) Information not sufficient to draw any conclusion

6. Which of the following statement is not correct?
   (A) Fast reactions have low activation energy
   (B) Activation energy of a reaction depends on the chemical nature of reactants and products
   (C) A catalyst increases the rate of reaction by decreasing the activation energy of the reaction
   (D) With increase in temperature, the rate of reaction decreases in case of exothermic reactions

7. Which formula cannot be used to calculate the molar mass of a solute?
   (A) $\frac{K_b \times W_b \times 10^3}{\Delta T_b \times W_A}$
   (B) $\frac{W_B RT}{\pi V}$
   (C) $\frac{\Delta T_b \times W_B \times 10^3}{K_b \times W_A}$
   (D) $\frac{p_A^o \times W_B \times M_A}{(p_A^o - p) \times W_A}$

8. The EMF of the cell, $Zn|Zn^{2+}| \ |Ag^{+}| \ Ag$ is independent of
   (A) The volume of Zn^{2+} and Ag^{+} solutions
   (B) The molarity of Zn^{2+} ions in the solution
   (C) The molarity of Ag^{+} ions in the solution
   (D) Temperature

9. What happens when electric current is passed through aqueous of sodium chloride
(A) O^2 is evolved at cathode (B) O^2 is evolved at anode
(C) pH of the solution gradually decreases (D) pH of the solution gradually increases

10. The dimensions of rate constant for a first order reaction involve
(A) Time and concentration (B) Time only
(C) Concentration only (D) Neither time nor concentration

11. The $t_{1/2}$ of a first order reaction is found to be 2 minutes. The percentage of the reaction left after 360 seconds is
(A) 12.5 (B) 25
(C) 15 (D) 7.5

12. The net energy change in a reversible, cyclic process is
(A) 3/2 RT (B) Zero
(C) Always >0 (D) Always <0

13. The magnetic quantum number for the last electron in the sodium atom (atomic number z=11) is
(A) 3 (B) 2
(C) 1 (D) 0

14. The octahedral molecular shape is associated with ----------hybridisation.
(A) sp^3d (B) sp^3d^2
(C) sp^3d^3 (D) sp^3

15. Which of the following is the strongest acid
(A) Acetic acid (B) Propionic acid
(C) Butanoic acid (D) Chloroacetic acid

16. An example of natural semi conductor is
(A) boron (B) silicon
(C) aluminium (D) phosphorous

17. The ionic strength of a solution containing 0.02 M Na_2SO_4 and 0.01 M $MgCl_2$ is
(A) 0.03 (B) 0.06
(C) 0.09 (D) 0.1

18. Balmer series consists of lines in the spectral range
(A) 100-180 nm (B) 230-340 nm
(C) 400-700 nm (D) 900-1100 nm

19. Aluminium chloride is a/an
(A) Lewis acid (B) Lewis base
(C) Bronsted-Lowry acid (D) Arrhenius acid

20. The pH of 10^{-8} N HCl is approximately
(A) 8 (B) 7.02
(C) 7 (D) 6.96

21. Covalent character of the bond is maximum in the case of
(A) LiCl (B) NaCl
(C) KCl (D) $CaCl_2$

22. This species generally act as Bronsted acid and base
(A) HSO_4^- (B) Na^2CO_3
(C) NH_3 (D) OH^-

23. This serves as a differentiating solvent for HCl, H_2SO_4 and HNO_3

(A) Liquid NH_3 (B) H_2O

(C) Liquid CH_3COOH (D) C_6H_6

24. Silicon carbide widely used as an abrasive called carborundum belongs to the class of carbides known as

(A) Ionic carbides (B) Interstitial carbides

(C) Covalent carbides (D) Silicates

25. Which of the following statement concerning probability density (Ψ^2) and radial distribution function ($4\pi r^2\Psi^2$) for s-orbital of H-like species is correct?

(A) Ψ^2 is minimum at nucleus but $4\pi r^2\Psi^2$ is maximum at nucleus

(B) Ψ^2 is maximum at nucleus but $4\pi r^2\Psi^2$ is minimum at nucleus

(C) Both Ψ^2 and $4\pi r^2\Psi^2$ are maximum at nucleus

(D) Both Ψ^2 and $4\pi r^2\Psi^2$ are minimum at nucleus

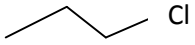
26. Which conformer among the following is most unstable

(A) (a,e) 1,2 – dimethyl cyclohexane (B) (a,e) 1,3 – dimethyl cyclohexane

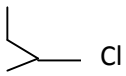
(C) (a,a) 1,3 - dimethylcyclohexane (D) (a,a) 1,4 - dimethylcyclohexane

27. Which of the following compounds readily undergoes S_N1 reactions owing to the stability of its cartonium ion

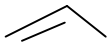
(A)



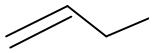
(B)



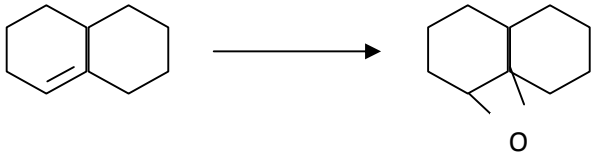
(C)



(D)



28. Which reagent effects the following conversion?



(A) m- chloroperbenzoic acid (B) Acetic anhydride

(C) $NaOH/Br_2$ (D) Acetic acid

29. 1. Consider the following photochemical reactions:

$$H_2 + Cl_2 \xrightarrow[4000Å]{h\nu} 2\,HCl$$

and

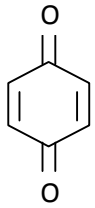
$$H_2 + Br_2 \xrightarrow[5100Å]{h\nu} 2HBr$$

These reactions are the examples of which of the following?

(A) Reactions of high and low quantum yields, respectively
(B) Reactions of low and high quantum yields, respectively
(C) Reactions of quantum yields equal to one
(D) Reactions of equal quantum yields but not equal to one

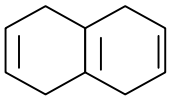
30. Which molecule is anti-aromatic among the following:

(A)

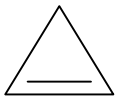


(B)

(C)



(D)



31. Acid strength of oxo-acids of halogens is in order

(A) HOI >HOBr>HOCl> HOF
(B) HOF >HOCl>HOBr> HOI
(C) HOCl>HOBr> HOI > HOF
(D) HOI > HOF >HOBr>HOCl

32. Teflon is synthesized by

(A) Free radical polymerization of tetrafluoro ethylene (C_2F_4)
(B) Condensation of hexane -1, 6- diamine and adipic acid
(C) Condensation of E-amino caproic acid
(D) Polymerization of Cyano ethylene

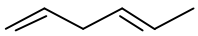
33. High resolution 'HNMR spectrum of 1,3 – dichloropropane has _____ signals.

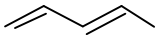
(A) One triplet and one quintet
(B) One triplet and one quartet
(C) One triplet and two doublets
(D) Two triplets and one quartet

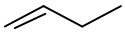
34. Which heterocyclic compound is least aromatic among the following?

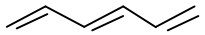
(A) Furan
(B) Pyrrole
(C) Thiophene
(D) Pyridine

35. Which compound will show the longest wavelength maxima in its UV spectrum?

(A) 

(B) 

(C) 

(D) 

36. The 2+ → 0+ transition is a ____ transition:

(A) Electric dipole
(B) Magnetic dipole
(C) Magnetic quadrupole
(D) Electric quadrupole

37. After 72 hours, the quantity of a sample of $^{24}_{11}$Na is found to be 3.125% of the original sample quantity. Determine the half-life of the sample (in hrs).

(A) 3
(B) 4.5
(C) 9
(D) 18

38. Obtain the threshold energy (in Mev) for the reaction : $^{209}_{83}Bi\left(p,{}^{2}_{1}H\right)^{208}_{83}Bi$ [Some useful data: (Masses)p = 938 Mev, ^{209}Bi = 208.980394 u; ^{208}Bi = 207.979731 u; ^{2}H=2.014102 u]

(A) 6.01842
(B) 6.04743
(C) 6.05987
(D) 6.089765

39. From meson theory of nuclear forces, the potential energy of interaction between two nucleons is proportional to

(A) $C.\frac{e^{r/R}}{r}$
(B) $-C.\frac{e^{-r/R}}{r}$
(C) $C.\frac{e^{R/r}}{r}$
(D) $-C.\frac{-R/r}{r}$

40. If the observed total angular momentum of the deuteron 'l' has a magnitude 1, then based on this data alone, the orbital angular momentum 'l' can take values:

(A) 0,1,2
(B) 0,2
(C) 0
(D) 0.1

41. The Uranium series with parent $^{238}_{92}U$ decays by emission of $8\alpha \; and \; 6\beta$ particles. The end product has Z & A

(A) 82 & 208
(B) 82 & 206
(C) 84 & 208
(D) 84 & 206

42. The detector that can measure the energy of gamma rays is

(A) GM counter
(B) Ionization chamber
(C) Scintillation detector
(D) Cloud chamber

43. The angular momentum and party of $^{17}_{8}O$ nucleus in the ground state according to the shell model is

(A) 0^+ (B) $\frac{1}{2}^-$

(C) $\frac{3}{2}^+$ (D) $\frac{5}{2}^+$

44. All baryons are made up of

(A) Quark and an anti-quark combination (B) 2 quarks combination

(C) 3 quark combination (D) 3 ante-quark combination

45. A cyclotron is operated at an oscillator frequency of 12 MHz and has a dee radius of 53 cm. The magnitude of the magnetic field required to accelerate protons, whose mass is 1.67 $x10^{-27}$ kg is

(A) 0.8 T (B) 1.0 T

(C) 1.6 T (D) 2.0 T

46. An oscillator always needs an amplifier with

(A) Positive feedback (B) Negative feedback

(C) Both types of feedback (D) An LC tank circuit

47. Compared to a bipolar transistor, the JFET has

(A) Greater voltage gain (B) Much more input impedance

(C) Less input impedance (D) None of these

48. A variable Wien bridge oscillator is to be designed to produce an output that can be adjusted from 100Hz to 1KHz. the capacitors used in the circuit are 0.01 μF each. What value of resistance is to be used in the circuit?

(A) 15.9 K to 159 K (B) 159 K

(C) 15.9 K (D) Any value of R

49. The feedback signal in a(n) _____ oscillator is derived from the capacitive voltage divider in the LC circuit.

(A) Wein bridge (B) Armstrong

(C) Colpitts (D) Hartley

50. A bridge rectifier with a capacitor input filter has an input voltage of 240 $V_{rms.}$. If the step-down transformer has a turns ratio of 8: 1, what is the output voltage? (ignore diode drops)

(A) 30 V_{rms} (B) 42 V

(C) 60 V (D) 84 V

51. The Common – Collector configuration has a _____ input impedance and a _____ output impedance.

(A) Low, high (B) High, low

(C) Low, low (D) High, high

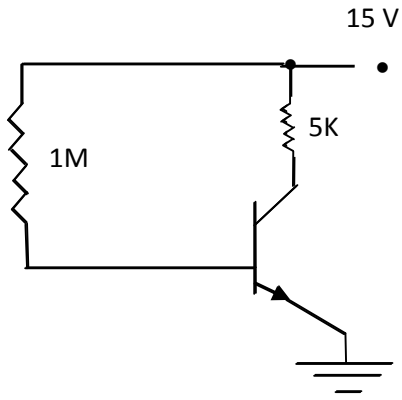
52. The PIV across a non-conducting diode in a Full wave rectifier circuit equals approximately

(A) Peak value of the secondary voltage
(B) Twice the peak value of the secondary voltage
(C) Half the peak value of the secondary voltage
(D) Four times the peak value of the secondary voltage

53. As compared to a silicon rectifier diode an LED has a

(A) Lower forward voltage and lower breakdown voltage
(B) Lower forward voltage and higher breakdown voltage
(C) Higher forward voltage and lower breakdown voltage
(D) Higher forward voltage and higher breakdown voltage

54. The two ends of the load line for the following circuit are (in V, mA)



(A) (15, 0) & (0, 3)
(B) (0, 0) & (15, 0)
(C) (3, 0) & (0, 15)
(D) (0, 3) &(15, 3)

55. If the load resistance in a zener regulator circuit decreases, the zener current

(A) Decreases
(B) Increases
(C) Remains the same
(D) Equals the load current

56. Miller indices of a plane parallel to x and z – axes are

(A) (100)
(B) (010)
(C) (001)
(D) (101)

57. The average energy of an atomic oscillator is given by

(A) hv
(B) $\frac{hv}{e^{hv/kt}-1}$
(C) $\frac{hv}{e^{-hv/kt}-1}$
(D) $\frac{hv}{(e^{-hv/kt}-1)^2}$

58. For a non-dispersive medium

(A) $\omega = vk$
(B) $\omega = vk^2$
(C) $\omega = vk^3$
(D) $\omega = vk^n\ (n \neq 1)$

59. $If\ a = b \neq c\ and\ \alpha = \beta = y = 90^0, the\ crystal\ system\ is$

(A) triclinic (B) tetragonal
(C) hexagonal (D) monoclinic

60. Bravais lattice for diamond structure is

(A) sc (B) bcc
(C) fcc (D) hcp

61. The distance between the adjacent atomic planes in $CaCO_3$ is 0.3 nm. The smallest angle of Bragg scattering for 0.03 nm X- ray is

(A) 0^0 (B) 2.9^0
(C) 5.8^0 (D) 90^0

62. Phonon is the quantum of

(A) electromagnetic wave (B) elastic wave
(C) gravitational wave (D) deBroglie wave

63. The reciprocal lattice to direct simple cubic lattice is

(A) simple cubic (B) Body centered cubic
(C) face centered cubic (D) base centered cubic

64. The Fermi energy of a metal is 1.4eV, the Fermi temperature of the metal is approximately

(A) 1.6×10^3 K (B) 1.6×10^4 K
(C) 1.6×10^5 K (D) 1.6×10^6 K

65. A superconductor is a _____ material

(A) diamagnetic (B) paramagnetic
(C) ferromagnetic (D) ferrimagnetic

66. The values of a for which {(1,a,1),(a,1,1),(1,1,a)} in R^3 are linearly independent in $R^3$are:

(A) 0,1 (B) 1,-2
(C) 1,2 (D) all values except 1 and -2

67. Which of below are true regarding solution of following linear system of equations

$2x-y+z=2,$
$x+2y-z=3$
$3x+y+2z=-1$

(A) No Solution (B) Unique solution
(C) Infinite solutions (D) x=0, y=0, z=0

68. Numerical Derivative of f (0.4) using Central Difference formula from below data:

(0.3,7.38910),(0.4,7.4633),(0.5,7.5383),(0.6,7.6141),(0.7,7.6906) equals

(A) 0 (B) 371
(C) 746 (D) None of above

69. The differential equation $(A x + B y) dx + (C x + D y) dy = 0$ is exact , if and only if

(A) $A = C$ (B) $A = D$

(C) $B = C$ (D) $B = D$

70. Which one of the following is the integrating factor for the linear differential equation $\frac{dy}{dx} + P(x)\, y = Q(x)$:

(A) $P(x)\, e^{\int x}$ (B) $Q(x)\, e^{\int x}$

(C) $e^{\int P(x)\, dx}$ (D) $e^{\int Q(x)\, dx}$

71. Which of the following statements is NOT equivalent to the statement, "There exists either a computer scientist or a mathematician who knows both discrete math and Bioscience."

(A) There exists a person who is a computer scientist and who knows both discrete math and Bioscience or there exists a person who is a mathematician and who knows both discrete math and Bioscience.

(B) There exists a person who is a computer scientist or there exists a person who is a mathematician who knows discrete math or who knows Bioscience.

(C) There exists a person who is a computer scientist and who knows both discrete math and Bioscience or there exists a mathematician who knows both discrete math and Bioscience.

(D) There exists a computer scientist who knows both discrete math and Bioscience or there exists a person who is a mathematician who knows both discrete math and Bioscience.

72. The values of k for which $f(x)=(1-k)k^x$ can serve as probability distribution of a random variable which takes countable infinite values 0,1,2,3……

(A) $k>1$ (B) $0<k<1$

(C) $k<0$ (D) $k=1$

73. A teacher gives a 20 point test to 10 students. The marks are 18, 15, 12, 6, 8, 2, 3, 5, 20, 10. Find the percentile rank of a score of 12.

(A) 65% (B) 45%

(C) 68% (D) 70%

74. Mean, Median and standard deviation for data set 10, 60, 50, 30, 40, 20 are given by

(A) 35,35,17 (B) 34,34,17.1

(C) 30,34,19 (D) 35,35,17.1

75. If a student randomly guesses 5 multiple choice questions each having 5 choices, the probability that student gets exactly 3 right answers is given by

(A) 0.04 (B) 0.05

(C) 0.01 (D) 0.02

76. A rare but serious disease found in 0.01% of a certain population. A test has been developed that will become +ve for 98% of those who have the disease and be +ve only for 3% of those who don't have the disease. Probability that a person tested as +ve does not have the disease is given by

(A) 0.997 (B) 0.917
(C) 0.003 (D) 0.100

77. If A & B are independent, then following are true

(A) A & B' are independent (B) A' & B are independent.

(C) A' & B' are independent. (D) All of above are true

78. Rank of the matrix $\begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 2 & 1 \end{bmatrix}$ is :

(A) 2 (B) 1
(C) 3 (D) 0

79. Classify the following ordinary differential equation: $e^x dy/dx+3y=x^2y$

(A) Separable and not linear (B) Linear and not separable
(C) Both separable and linear (D) Neither separable nor linear

80. General solution of 2nd ordinary differential eqaution $4y^{(2)}+9y=0$ is given by (where C1 and C2 are arbitrary constants):

a)

(A) $y= C_1 e^t + C_2 e^{-t}$ (B) $y= C_1 e^{2t} + C_2 e^{-t}$

(C) $y= C_1 Cos(t)+ C_2Sin(t)$ (D) $y= C_1 Cos(3t/2)+ C_2Sin(3t/2)$

81. Consider 2nd order ordinary differential equation $y^{(2)}+2y^{(1)}-8y=0$. Suppose derivatives are taken with respect to variable t. The values of r for which the given differential equation has the solution of the form $y=e^{rt}$ are:

(A) $2, -4$ (B) $2, 4$
(C) $-2, 4$ (D) $-2, -4$

82. The slope of the tangent line to the graph of f at x = 4, given that $f(x) = -x^2+4*sqrt(x)$ is

(A) -8 (B) -10
(C) -9 (D) -7

83. The value of x where the function $f(x)= x^3 -9x^2 + 24x + 4$ has a local maximum is

(A) 2 (B) 1
(C) -2 (D) -1

84. The values of A and B so that function f defined by $f(x) = 2x^2$ for $x <= 2$ and $f(x) = A x + B$ for $x > 2$ is differentiable at x = 2 are

(A) 8, 8 (B) 8, -8
(C) $-8, -8$ (D) -8, 8

85. The approximation of sin(1) obtained by Taylor's series approximation upto 5^{th} degree about x=0 for sin(x) is given by:

(A) $1 - ½ + 1/24$ (B) $1 + ½ + 1/24$

(C) $1 - 1/6 + 1/120$ (D) $1 + ½ + 1/120$

86. The Maclaurian series for $1/(1-x)$ is $1+x+x^2+x^3+\ldots\ldots\ldots\ldots$
The power series for $x^2/(1-x^2)$ is given by:

(A) $x+x^2+x^3+\ldots\ldots\ldots$ (B) $x^2+x^4+x^6+\ldots\ldots\ldots$

(C) $x^3+x^6+x^9+\ldots\ldots\ldots$ (D) $1+x^2+x^4+x^6+\ldots\ldots\ldots$

87. If Arithmetic mean of a set of n data points is 106.6 where n=8, then Harmonic mean of given data

(A) 0.8502 (B) 0.8510

(C) 0.8528 (D) 0.0850

88. Relationship among the averages

(A) HM ≥GM ≥AM (B) AM≥GM≥HM

(C) GM ≤HM ≤AM (D) AM ≥HM <GM

89. A race car is travelling on a straight track at a velocity of 80 meters per second when the brakes are applied at time t=0 seconds. From time t=0 to the moment the race car stops, the acceleration of the race car is given by $a(t) = -6t^2 - t$ meters per second per second. During this time period, how far does the race car travel?

(A) 188.229m (B) 198.766m

(C) 260.042m (D) 267.089m

90. A function fis continuous on the closed interval [2,5] with f(2)=17 and f(5)=17. Which of the following additional conditions guarantees that there is a number cin the open interval (2,5) such that $f^{(1)}(c)=0$?

(A) No additional conditions are necessary. (B) fhas a relative extrema on the open interval (2,5)

(C) fis differentiable on the open interval (2,5) (D) finite integral of f between 2 and 5 exists.

91. An ice sculpture in the form of a sphere melts in such a way that it maintains its spherical shape. The volume of the sphere is decreasing at a constant rate of 2πcubic meters per hour. At what rate, in square meters per hour, is the surface area of the sphere decreasing at the moment when the radius is 5 meters?

(A) $4\pi/5$ (B) 40π

(C) 80π (D) 100π

92. Sequence defined by $a_n = \ln(2n^3+2) - \ln(5n^3+2n^2+4)$ converges to

(A) 0 (B) ln(2/5)

(C) $-\ln(2/5)$ (D) 2/5

93. The sum of series $\sum_{n=2}^{\infty} \frac{6}{n(n+3)}$ is given by

(A) 0 (B) 13/2

(C) 5/3 (D) 13/6

94. The area of region between the graph of $y=x^2$ and $y=-x$ from x=0 to x=2?
(A) 2/3 (B) 8/3
(C) 4 (D) 14/3

95. An equation of line tangent to graph of y=x+cos(x) at the point (0,1) is
(A) y=2x+1 (B) y=x+1
(C) y=x (D) y=x−1

96. National Science Day is celebrated on:
(A) 5 June (B) 21June
(C) 28 February (D) 16 October

97. Which among the following monsoon is mainly responsible for rains in India?
(A) South-East (B) North-West
(C) South-West (D) North-East

98. Which gas is generally used in cold stores?
(A) Ethylene (B) Oxygen
(C) Methane (D) Acetelene

99. Growing of coconut, black pepper and ginger simultaneously in the same field is an example of:
(A) Relay cropping (B) Intercropping
(C) Multiple cropping (D) Multistoried cropping

100. In pulses, limiting amino acids is:
(A) Methionine (B) Valine
(C) Lysine (D) Cystein