Useful Constants:

Rydberg constant = 109737 cm^{-1}; Faraday constant = 96500 C; Planck constant = 6.625×10^{-34} J s; Speed of light = 2.998×10^{8} m s^{-1}; Boltzmann constant = 1.380×10^{-23} J K^{-1}; Gas constant = 8.314 J K^{-1} mol^{-1} = 0.082 L atm K^{-1} mol^{-1} = 1.986 cal K^{-1} mol^{-1}; Mass of electron = 9.109×10^{-31} kg; Mass of proton = 1.672×10^{-27} kg; Charge of electron = 1.6×10^{-19} C; 1 D = 3.336×10^{-30} C m; 1 bar = 10^{5} N m^{-2}; RT/F (at 298.15 K) = 0.0257 V.

PART – A

1. Identify the order of acid strength of CH_3CO_2H, CF_3CO_2H, $NO_2CH_2CO_2H$, and CCl_3CO_2H.

   [A] $CH_3CO_2H < NO_2CH_2CO_2H < CCl_3CO_2H < CF_3CO_2H$

   [B] $CH_3CO_2H < CCl_3CO_2H < NO_2CH_2CO_2H < CF_3CO_2H$

   [C] $CH_3CO_2H < NO_2CH_2CO_2H < CF_3CO_2H < CCl_3CO_2H$

   [D] $CH_3CO_2H > NO_2CH_2CO_2H > CCl_3CO_2H > CF_3CO_2H$

2. Among the following, the molecule having the longest bond length is:

   [A] NO [B] NO^{+}

   [C] NO^{2+} [D] NO^{-}

3. The number of real roots to the pair of equations $x^2 + y^2 = 1$ and $9x^2 + 4y^2 = 36$ is:

   [A] 0 [B] 1

   [C] 2 [D] 3

4. One of the molecules present in turmeric is:

   [A] nicotine [B] curcumin

   [C] quinine [D] piperine

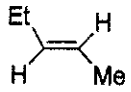
5. The integral $\int_{\pi/4}^{3\pi/4} \frac{dx}{(1+cos(x))} =$

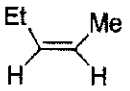
   [A] -2 [B] -1

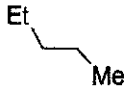
   [C] 4 [D] 2

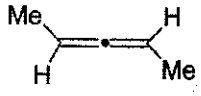
8-9

6. 2-Pentyne on reduction with Na/liq.NH_3 provides:

[A] 

[B] 

[C] 

[D] 

7. In an election there are 10 candidates for 4 seats. The voter may cast vote for $1, 2, 3$ or 4 seats. The total number of ways in which the voter can cast the vote is:

[A] 853 [B] 583

[C] 385 [D] 305

8. A circle is expanding in time; if the rate of increase of its radius is r', the rate of increase of its area is given by:

[A] $r' \times area$ [B] $(r')^2$

[C] $r' \times radius$ [D] $r' \times circumference$

9. A solid cylinder with diameter 3 cm and height 10 cm is flattened into a circular disc with diameter 30 cm. Thickness of the resulting disc is:

[A] 100 cm [B] 1 cm

[C] 1 mm [D] 1 nm

10. Let T_n be the number of all possible triangles formed by joining n non-collinear points. Then, $T_6 - T_5 =$

[A] 10 [B] 8

[C] 5 [D] 7

9-9

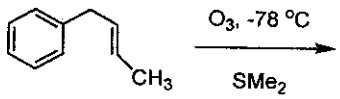
11. The value of the following determinant is:

$$\begin{vmatrix} 2 & 3 & 4 & 5 \\ 3 & 5 & 6 & 9 \\ 7 & -1 & 0 & 2 \\ 3 & 5 & 6 & 9 \end{vmatrix}$$

[A] -27 [B] 0

[C] 1 [D] 27

12. Identify the products obtained from the following reaction:



[A] 3-phenylpropane-1,2-diol and methanol

[B] 2-phenylethanal and ethanol

[C] acetic acid and 2-phenylacetic acid

[D] 2-phenylethanal and ethanal

13. Which one of the following is an unusual base pairing in nucleic acids?

[A] A-T [B] G-T

[C] G-C [D] A-U

14. The amino acid that directly participates in the biosynthesis of heme is:

[A] glycine [B] methionine

[C] aspartate [D] tryptophan

15. A triangle with vertices $(4, 0)$, $(-1, -1)$ and $(3, 5)$ is:

[A] isosceles and not right angled [B] right angled but not isosceles

[C] isosceles and right angled [D] neither right angled nor isosceles

8-9

16. The graph of equation of $2x^2 + 2y^2 - 4x + y + 1 = 0$ is a:

[A] circle with center $(1, -\frac{1}{4})$ and radius $\frac{3}{4}$

[B] circle with center $(-\frac{1}{4}, 1)$ and radius $\frac{9}{16}$

[C] parabola with vertex at $(1, -\frac{1}{4})$

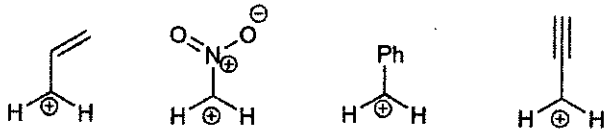
[D] parabola with vertex at $(-\frac{1}{4}, 1)$

17. If the point of intersection of the lines, $4ax + 2ay + c = 0$ and $5bx + 2by + d = 0$ lies in the fourth quadrant and is equidistant from the two axes (a, b, c and d are non-zero numbers), then:

[A] $3bc - 2ad = 0$ [B] $2bc - 3ad = 0$

[C] $2bc + 3ad = 0$ [D] $3bc + 2ad = 0$

18. Arrange the following intermediates in the decreasing order of their stability:



I II III IV

[A] II> IV > I > III [B] I > IIII > IV > II

[C] III > I > IV > II [D] III > II > I > IV

19. Excess acidity caused by acid rain to the soil can be neutralized by:

[A] addition of more fertilizer [B] removal of acidified soil

[C] addition of Cs_2CO_3 [D] addition of lime

20. Half-life of ^{14}C is 5730 years. The fraction of ^{14}C that remains in a 50,000 years old sample is:

[A] 2.36×10^{-3} [B] 0.36×10^{-3}

[C] 1.36×10^{-3} [D] 3.36×10^{-3}

9-9

21. The integral, $\int x \ln(x)\, dx =$

[A] $\frac{x^2}{2} + x\left(\ln(x) - \frac{1}{2}\right) + const.$

[B] $\frac{x \ln(x)}{2} + const.$

[C] $\frac{x^2}{2}\left(\ln(x) + \frac{1}{2}\right) + const.$

[D] $\frac{x^2}{2}\left(\ln(x) - \frac{1}{2}\right) + const.$

22. The molecule possessing non-zero dipole moment is:

[A] CCl_4

[B] XeF_4

[C] SF_4

[D] PCl_5

23. The hybridization of sulfur (as per VSEPR theory) in SF_4 molecule is:

[A] sp^2

[B] sp^3d^2

[C] sp^3d

[D] sp^3

24. Zinc uranyl acetate and Nessler's reagent are used in the confirmatory test of the following cations:

[A] K^+ and NH_4^+, respectively

[B] Cs^+ and NH_4^+, respectively

[C] Na^+ and NH_4^+, respectively

[D] NH_4^+ and Na^+, respectively

25. The pK_a value of hydrofluoric acid is 3.2. The approximate degree of dissociation of 0.35 M solution of hydrofluoric acid is:

[A] 1.2%

[B] 2.4%

[C] 4.2%

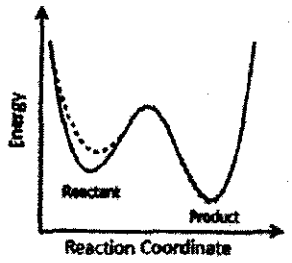
[D] 12%

Q-9

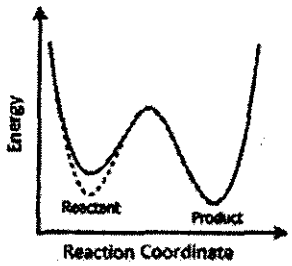
PART-B

26. The energy diagram that correctly corresponds to an enzyme catalyzed reaction is:

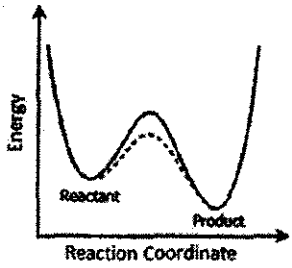
[A]



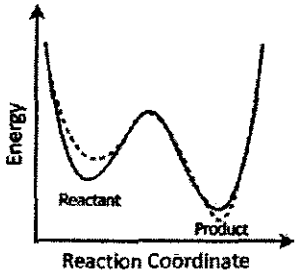
[B]



[C]



[D]



—— Non catalytic
----- Enzyme catalytic

27. Intermediate involved in the Reimer-Tiemann reaction is:

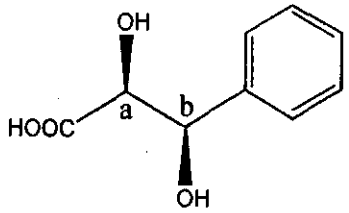
[A] carbene

[B] carbanion

[C] free radical

[D] carbocation

28. Absolute stereochemistry of the following compound is:



[A] a- (*S*) b- (*R*)

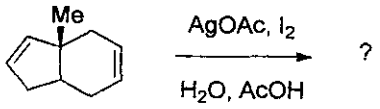
[B] a- (*R*), b- (*R*)

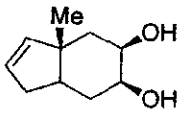
[C] a- (*S*) b- (*S*)

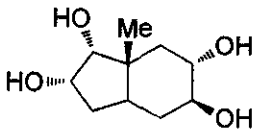
[D] a- (*R*), b- (*S*)

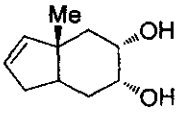
9-9

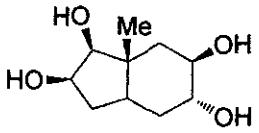
29. The major product obtained in the following transformation is:



[A] 

[B] 

[C] 

[D] 

30. Which one of the following reactions involves both oxidation and reduction processes?

[A] Robinson Annulation

[B] Claisen condensation

[C] Cannizaro reaction

[D] Perkin condensation

31. Contact angle of a liquid with glass wall of a capillary tube of length 10 cm is 90°. When the capillary tube is dipped vertically in the liquid, the liquid level in the capillary tube:

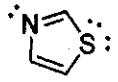
[A] increases

[B] decreases

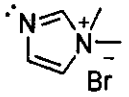
[C] remains same

[D] overflows out

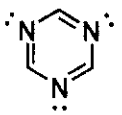
32. According to Hückel rule, which one of the following is not an aromatic compound?



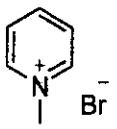
[A]



[B]



[C]



[D]

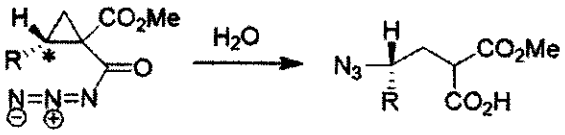
8-9

33. The rate of effusion of O_2 is 1.0 mL s^{-1} at 300 K and 1.0 atm pressure. Under the same conditions, the rate of effusion (in mL s^{-1}) of H_2 is close to:

[A] 1.0 [B] 4.0

[C] 8.0 [D] 16.0

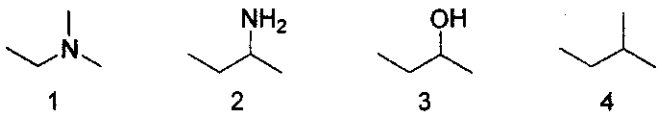
34. The stereochemical change at the reaction centre (C*) in the following ring-opening reaction is (R=Methyl):



[A] inversion [B] retention

[C] racemisation [D] double inversion

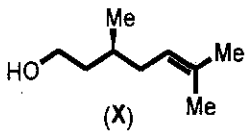
35. The decreasing order of boiling points of the following compounds is:



[A] 1>2>3>4 [B] 2>3>1>4

[C] 3>2>1>4 [D] 1>3>2>4

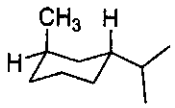
36. Ozonolysis of a given molecule (X) provides the product Y and acetone. The IUPAC name of Y is:



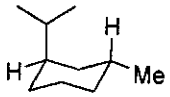
[A] (*S*)-5-hydroxy-3-methylpentanal [B] (*R*)-5-hydroxy-3-methylpentanol

[C] (*R*)-5-hydroxy-3-methylpentanal [D] (*S*)-3,6-dimethylhept-5-en-1-ol

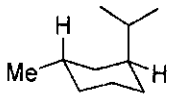
37. The most stable conformation of (1*R*,3*R*)-1-isopropyl-3-methylcyclohexane is:



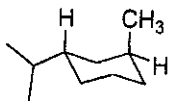
[A]



[B]



[C]

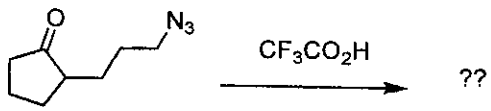


[D]

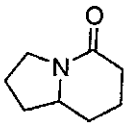
38. In the non-aqueous solvent BrF_3, the nature of SbF_5 is:

[A] basic
[B] acidic
[C] neutral
[D] mildly basic

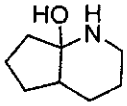
39. The product obtained in the following reaction is:



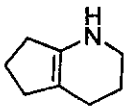
[A]



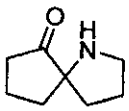
[B]



[C]



[D]



40. ClF_3 molecule is:

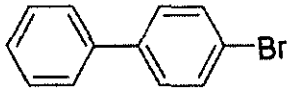
[A] T-shaped
[B] trigonal planar
[C] trigonal bipyramidal
[D] square planar

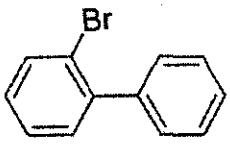
41. The paramagnetic species among the following is:

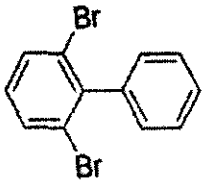
[A] N_2O
[B] NO_2
[C] NO_3^-
[D] N_2O_4

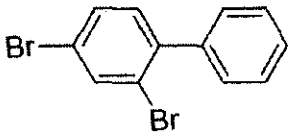
Q-9

42. The major product formed in the following reaction is:

[A] 

[B] 

[C] 

[D] 

43. Two gases have the same value of van der Waals gas constant *'a'* but different *'b'* values. The more compressible of the two gases is:

[A] the gas with lower *'b'* value.

[B] the gas with higher *'b'* value.

[C] both are equally compressible.

[D] cannot be predicted.

44. Among the complexes (i) $[Ni(CN)_4]^{2-}$, (ii) $[Fe(CO)_5]$, (iii) $[CuCl_5]^{3-}$ and (iv) $[PtCl_6]^{2-}$ the ones that obey the 18-electron rule are:

[A] (i) and (ii) [B] (i) and (iii)

[C] (iii) and (iv) [D] (ii) and (iv)

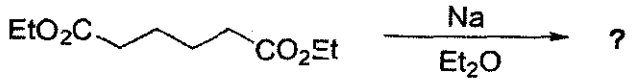
45. Penicillin contains:

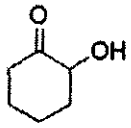
[A] β-lactone unit [B] β-lactam unit

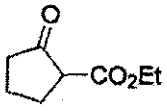
[C] γ-lactone unit [D] γ -lactam unit

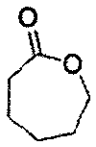
Q-9

46. The major product formed in the following reaction is:



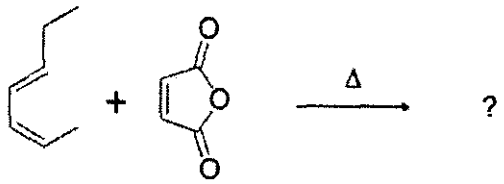
[A] 

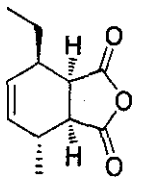
[B] 

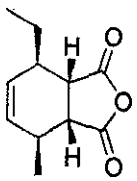
[C] 

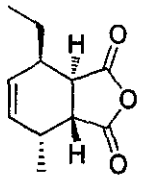
[D] 

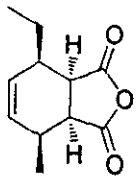
47. The major product obtained in the following transformation is:



[A] 

[B] 

[C] 

[D] 

48. Reaction of dichromate anion with iodide in acid medium gives:

[A] Cr^{3+}, iodine and water

[B] Cr^{3+}, iodate and water

[C] Cr^{3+}, iodate and oxygen

[D] Cr^{2+}, iodide and water

8-9

49. Carbon-based free radical intermediates are stabilized by

[A] electron donating groups

[B] both electron donating and withdrawing groups

[C] electron withdrawing groups

[D] neutral substituents

50. The reaction that involves the formation of both C-C and C-O bonds is:

[A] Diels-Alder reaction

[B] Darzen's glycidic ester condensation

[C] Aldol reaction

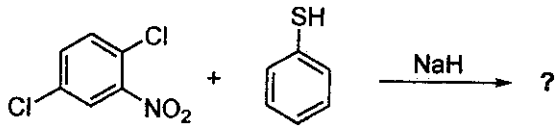
[D] Beckmann rearrangement

51. A complex of formula $[MA_2B_2]X_2$ is found to have no geometrical isomers. Both A and B are monodentate ligands and X is a halogen. The structure of the complex is:

[A] tetrahedral [B] square-planar

[C] square-pyramidal [D] octahedral

52. The product formed in the following reaction is:



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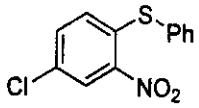

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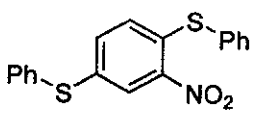

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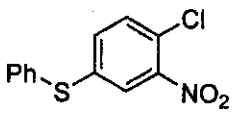

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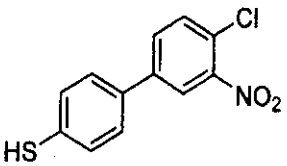


8-9

53. The number of electrons involved in the following balanced redox reaction is:

$$2\ MnO_4^-(aq) + 10\ Br^-(aq) + 16\ H^+(aq) \rightarrow 2Mn^{2+}(aq) + 5\ Br_2(aq) + 8H_2O(l)$$

[A] 2 [B] 4

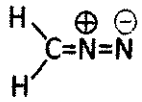
[C] 5 [D] 10

54. Names of O_2^-, O_2^{2-}, O_2^+ are respectively:

[A] superoxide, peroxide and dioxygenyl [B] peroxide, superoxide and dioxygenyl

[C] superoxide, dioxygenyl and peroxide [D] dioxygenyl, peroxide, and superoxide

55. The hybridization of carbon, central nitrogen, and terminal nitrogen in the following resonance structure of diazomethane are respectively :



[A] sp^2, sp, sp [B] sp^3, sp^2, sp

[C] sp^2, sp^2, sp [D] sp^3, sp, sp

56. The number of OH and P=O groups present in triphosphoric acid are respectively:

[A] 3 and 5 [B] 5 and 3

[C] 2 and 5 [D] 3 and 3

57. Among BrO_4^-, SiF_4, TeF_4, ICl_4^-, the species isostructural to xenon tetrafluoride are (is):

[A] BrO_4^- and ICl_4^- [B] TeF_4 and ICl_4^-

[C] Only ICl_4^- [D] SiF_4 and TeF_4

8-9

58. Assuming an octahedral geometry the number of geometrical isomers that are possible in $[PF_3Cl_3]^-$ and $[PF_2Cl_4]^-$ are:

[A] 2, 2 [B] 2, 3

[C] 3, 2 [D] 4, 2

59. Among the following pair of diatomic molecules, choose the one where the bonding $\sigma(2p)$ orbital is lower in energy than the $\pi(2p)$ orbitals.

[A] O_2 and F_2 [B] O_2 and B_2

[C] C_2 and O_2 [D] F_2 and B_2

60. Among the following complexes, the pair which shows ionization isomerism is:

i. $[Co(NH_3)_4(H_2O)Cl]Br_2$ and $[Co(NH_3)_4Br_2]Cl{\cdot}H_2O$

ii. $[Co(NH_3)_4(H_2O)Cl]Cl_2$ and $[Co(NH_3)_4Cl_2]Cl{\cdot}H_2O$

iii. $[(ON)Ru(NO)_4(OH)]^{2-}$ and $[(NO)Ru(NO)_4(OH)]^{2-}$

iv. $[Co(en)_3][Cr(CN)_6]$ and $[Cr(en)_3][Co(CN)_6]$

[A] i [B] ii

[C] iii [D] iv

61. The most abundant transition metal in earth crust is:

[A] aluminium [B] copper

[C] iron [D] calcium

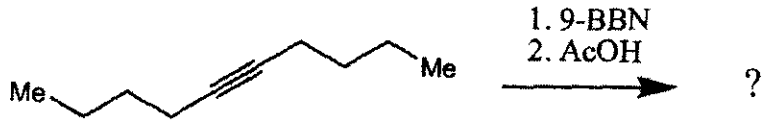
62. If the vectors $\boldsymbol{a} = \boldsymbol{i} - \boldsymbol{j} + 2\boldsymbol{k}$, $\boldsymbol{b} = 2\boldsymbol{i} + 4\boldsymbol{j} + \boldsymbol{k}$ and $\boldsymbol{c} = p\boldsymbol{i} + \boldsymbol{j} + q\boldsymbol{k}$ are mutually orthogonal, then (p, q) is:

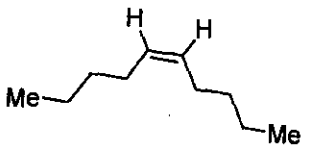
[A] $(2, -3)$ [B] $(-2, 3)$

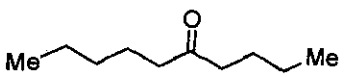
[C] $(-3, 2)$ [D] $(3, -2)$

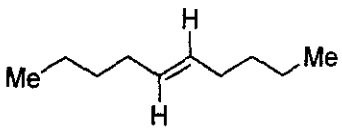
8-9

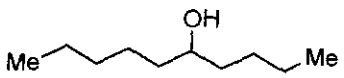
63. The most appropriate product obtained in the following reaction is:



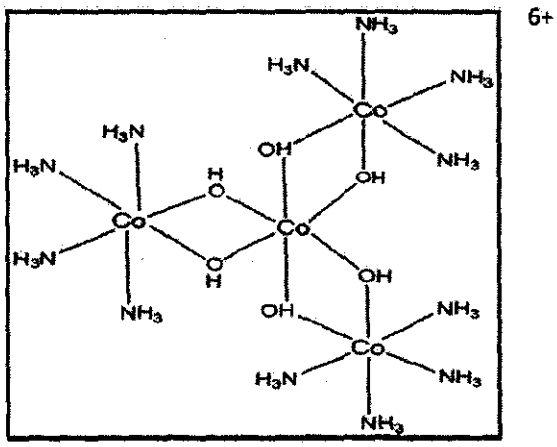
[A] 

[B] 

[C] 

[D] 

64. The correct IUPAC name of the following complex cation is:



[A] tris[tetraammine-μ-dihydroxocobalt(III)]cobalt(III) ion

[B] tris(μ-dihydroxotetraamminecobalt)cobalt(6+) ion

[C] tris(tetraamminecobalt-hexahydroxo)cobalt(6+) ion

[D] tetra(tetraamminehexahydroxo)cobalt(6+) ion

Q-9

65. Metal 'M_1' reacts with cyanide ion in the presence of air to form the complex anion $M_1(CN)_2^-$, which gives back 'M_1' upon treatment with 'M_2'. M_1 and M_2 are respectively:

[A] silver and copper
[B] copper and zinc
[C] gold and zinc
[D] gold and silver

66. If $x^m y^n = (x+y)^{(m+n)}$, then $dy/dx =$

[A] x/y
[B] xy
[C] $(m+n)y/x$
[D] y/x

67. The fractional surface coverage (θ) in dissociative adsorption of a gas is (K= equilibrium constant for adsorption-desorption, P = pressure of gas):

[A] $\theta = \dfrac{KP}{1+KP}$
[B] $\theta = \dfrac{KP^2}{1+KP^2}$
[C] $\theta = \dfrac{(KP)^{1/2}}{1+(KP)^{1/2}}$
[D] $\theta = \dfrac{(KP)^2}{1+(KP)^2}$

68. A mixture contains equal number of polymer molecules with molecular weights 20,000 and 40,000. The number average molar mass of the mixture (in amu) is:

[A] 30,000
[B] 25,000
[C] 35,000
[D] 42,000

69. A vessel contains a mixture of helium (He) and methane (CH_4). The ratio of the root mean square speed of the He atoms to that of the CH_4 molecules is:

[A] 1
[B] 2
[C] 4
[D] 16

Q-9

70. The fragment which is *isolobal* to $Fe(CO)_4$ is:

[A] CH_2 [B] CH_3

[C] CH_4 [D] CH

71. The spin only magnetic moment (in Bohr Magneton) of high-spin Mn^{3+} ion is

[A] 1.73 [B] 3.88

[C] 2.83 [D] 4.90

72. The n^{th} derivative of $\ln(x)$, where $n>1$, is:

[A] $\frac{(-1)^{n-1}(n-1)!}{x^n}$ [B] $\frac{(-1)^n(n-1)!}{x^n}$

[C] $\frac{(n-1)!}{x^n}$ [D] $\frac{(-1)^{n-1}n!}{x^n}$

73. The metal ions present in Chlorophyll and vitamin B_{12} are respectively:

[A] Fe and Co [B] Fe and Mg

[C] Co and Mg [D] Mg and Co

74. Match the following:

[1]	HgS	(a)	Pyrolusite
[2]	MnO_2	(b)	Chalcopyrite
[3]	$CuFeS_2$	(c)	Ilmenite
[4]	$FeTiO_3$	(d)	Cassiterite
[5]	SnO_2	(e)	Cinnabar

[A] (1)-(e), (2)-(a), (3)-(b), (4)-(c), (5)-(d)

[B] (1)-(e), (2)-(c), (3)-(a), (4)-(d), (5)-(b)

[C] (1)-(b), (2)-(a), (3)-(e), (4)-(c), (5)-(d)

[D] (1)-(c), (2)-(d), (3)-(b), (4)-(a), (5)-(e)

8-9

75. The square of the matrix $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$ is:

[A] $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ [B] $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

[C] $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$ [D] $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$

76. The crystal field stabilization of tetrahedral $[CoBr_4]^{2-}$ is:

[A] $4/9\Delta_t$ [B] $6/9\Delta_t$

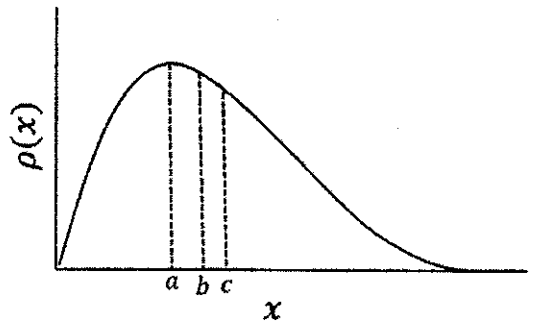
[C] $4/5\Delta_t$ [D] $6/5\Delta_t$

77. If the parabola, $y = 4x^2 + 3$ is rotated by -90° (anticlockwise 90°) about the origin, the resulting function is:

[A] $y = 4x^2 - 3$ [B] $x = -4y^2 - 3$

[C] $y = -4x^2 - 3$ [D] $x = 4y^2 - 3$

78. In the probability density distribution given below, a, b and c respectively represent:



[A] mode, mean and median [B] median, mode and mean

[C] mode, median and mean [D] mean, mode, median

79. If, $cos\ \varphi - sin\ \varphi = \sqrt{2}\ sin\ \varphi$, then $cos\ \varphi + sin\ \varphi =$

[A] $-\sqrt{2}\ sin\ \varphi$ [B] $\sqrt{2}\ cosec\ \varphi$

[C] $\sqrt{2}\ cos\ \varphi$ [D] $\sqrt{2}\ tan\ \varphi$

8-9

80. When two dice are thrown simultaneously, the probability of obtaining 4 as the total is:

[A] 1/36 [B] 3/36

[C] 5/36 [D] 7/36

81. The plane that is perpendicular to the (110) plane in a simple cubic lattice is:

[A] (010) [B] (001)

[C] (101) [D] (011)

82. The limiting molar conductivity of NaOH, NaF and NH_4F are 24.8, 10.5 and 12.5 mS m^2 mol^{-1}, respectively. The limiting molar conductivity (in mS m^2 mol^{-1}) of NH_4OH is:

[A] 27.1 [B] 22.5

[C] 17.8 [D] 16.4

83. The exact differential among the following for a perfect gas (where P, T and R are pressure, temperature and gas constant, respectively) is:

[A] $\frac{P}{RT}dT + RdP$ [B] $RPdT + RTdP$

[C] $\frac{RP}{T}dT + \frac{RT}{P}dP$ [D] $RdT + \frac{RT}{P}dP$

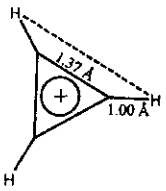
84. A real gas behaves more like an ideal gas at:

[A] low pressure and high temperature [B] high pressure and high temperature

[C] low pressure and low temperature [D] high pressure and low temperature

Q-9

85. In the cyclopropenium ion, the C-C and C-H bond lengths are respectively 1.37 Å and 1.00 Å. The non-bonded H---H distance (in Å) is:



[A] 2.24 [B] 2.74

[C] 3.10 [D] 3.37

86. The three quantum numbers (n, l, and m) of the unpaired electron of copper atom in its ground state are:

[A] $(4, 0, 0)$ [B] $(4, 1, 0)$

[C] $(3, 2, 0)$ [D] $(3, 2, -2)$

87. The ratio of the osmotic pressures of two solutions A and B (P_A/P_B) is 1.2. If the depression of freezing point of solution A is 0.3 K, the depression in the freezing point of B at the same temperature (in Kelvin) is close to:

[A] 0.36 [B] 0.43

[C] 0.50 [D] 0.29

88. At 298 K the standard free energy change (ΔG^o, in kJ mol^{-1}) for the cell reaction $Cu^{2+}(aq) + Zn(s) \rightarrow Cu(s) + Zn^{2+}(aq)$ is:

$[E^0_{Cu^{2+}/Cu} = 0.339\ \text{V}$ and $E^0_{Zn^{2+}/Zn} = -0.762\ \text{V}]$

[A] $+106$ [B] $+212$

[C] -106 [D] -212

Q-9

89. The saturated vapour pressures of two liquids A and B are respectively 50 kPa and 20 kPa at 30°C; they are completely miscible and form ideal mixture. The vapour pressure (in kPa) of a mixture of 2 moles of A and 3 mols of B at 30°C is:

[A] 25 [B] 32

[C] 35 [D] 70

90. When Cu K_α X-ray with wavelength $\lambda = 1.54$ Å is used, the diffraction from the (3 2 0) plane of a crystal occurs at, $2\theta = 45.6^\circ$. If Mo K_α X-ray with $\lambda = 0.71$ Å is used, diffraction from the (3 2 0) plane will be found at $2\theta =$

[A] 20.6° [B] 21.6°

[C] 22.8° [D] 57.2°

91. The equilibrium constant for $A_2 \leftrightharpoons 2A$ is 2.0 at 30°C. The mole fraction of A at equilibrium at the same temperature is:

[A] 0.25 [B] 0.50

[C] 0.67 [D] 0.80

92. The entropy change (in cal K^{-1}) in the isothermal reversible expansion of one mole of a perfect gas from 7.6 to 2.9 atm at 300 K is:

[A] 0.826 [B] 1.328

[C] 1.907 [D] 3.061

93. For the gas phase reaction, $H_2O + CH_4 = CO + 3H_2$, if $K_c = 3.8 \times 10^{-3}$ M^2 at 1000 K, the K_p (atm^2) is:

[A] 16 [B] 26

[C] 12 [D] 14

8-9

94. The decomposition reaction $2H_2O_2$ (aq) $\rightarrow$ $2H_2O$ (l) + O_2 (g) is first order in H_2O_2 with a rate constant 1.8×10^{-5} s^{-1} at 300 K. If the initial concentration of H_2O_2 is 0.3 M, the concentration (in M) after 4 h is:

[A] 0.12 [B] 0.06

[C] 0.23 [D] 0.18

95. In a gas phase reaction, $A \rightarrow products$, depending on the initial pressure, p_0, the rate, r is found to change as shown in the table. Order of the reaction is:

p_0 / atm	1	2	4
r / atm s^{-1}	6	17	48

[A] 0 [B] 1

[C] 1.5 [D] 2

96. The change in the internal energy of a gas is equal to the heat supplied. The correct statement among the following is:

[A] the gas is expanded isothermally

[B] the process is carried out at constant volume

[C] the gas is expanded under constant pressure

[D] the process is carried out irreversibly

97. When a capillary tube with a cross sectional area a is dipped into a liquid, the liquid rises to a height of 15 cm. If another tube with cross sectional area $2a$ is dipped, the rise of the liquid in this tube will be:

[A] 10.6 cm [B] 15 cm

[C] 7.5 cm [D] 21.3 cm

Q-9

98. The number of possible lines in the emission spectrum of hydrogen atom from the principal quantum level $n = 7$ to $n = 3$ is:

[A] 10 [B] 9

[C] 8 [D] 7

99. The wavelength of a certain line in Balmer series is observed to be 4341 Å, it corresponds to an emission from the state with principal quantum number:

[A] 20 [B] 15

[C] 10 [D] 5

100. The speed of an electron in the first Bohr orbit of hydrogen is x, then the speed of the electron in He^+ in the second orbit is:

[A] $x/2$ [B] x

[C] $2x$ [D] $4x$

8-9