A-97

Signature of Invigilator:_____

University of Hyderabad
ENTRANCE EXAMINATION, JUNE 2012
QUESTION PAPER
Ph.D. (ACRHEM)

Marks: 75
Time: 2.00 Hrs.

Hall Ticket No. _____

Please confirm that
(a) This booklet has all 26 pages (including 2 blank pages) printed clearly and numbered
(b) You are given a clean and clear OMR answer sheet.

Read **carefully all** the instructions given below & on the OMR sheet.

1. Please enter your Hall Ticket Number on Page 1 **(this sheet)** of this booklet **without fail.**
2. Please enter your Hall ticket number on the **OMR answer sheet without fail.**
3. All answers are to be marked on the OMR answer sheet following the instructions provided on the OMR answer sheet.
4. **No additional sheets will be provided.** Rough work is to be done in the booklet itself / space provided on pages 25 & 26.
5. **Handover both** the question paper and OMR answer sheet at the end of the examination.
6. Question paper has two parts: **Part-A** and **Part– B.**
7. **Part-A** consists of 25 objective type questions of one mark each. **There is negative marking of 0.33 marks for every wrong answer.** The marks obtained by the candidate in this part will be used for resolving tie cases.
8. **Part-B** consists of three sections **P(26-50), C (51-75), & M (76-100)** each containing 25 questions.
9. One needs to **answer any 25 questions from Part – B.** Each correct answer carries two marks. There is no negative marking in these sections.
10. **In case the number (N) of answered questions is greater than 25, in part – B, then marks per question shall be 50/N.**
11. Non programmable calculators are permitted.
12. All the symbols used in text have their usual meanings.

PART-A

1. A mass m is attached to a spring of stiffness constant k^2 and rests in equilibrium on a frictionless horizontal plane. If the mass is subjected to a impulsive blow p, then its displacement can be described by

(A) $\frac{p}{k^2 m}\sin\left(\sqrt{\frac{k}{m}}t\right)$
(B) $\frac{p}{k\sqrt{m}}\sin\left(\frac{k}{\sqrt{m}}t\right)$
(C) $\frac{p}{k^2 m}\sin\left(\frac{k}{m}t\right)$
(D) $\frac{p}{k\sqrt{m}}\sin\left(\frac{\sqrt{k}}{m}t\right)$

2. The Maxwell's velocity distribution for an ideal gas is proportional to

(A) ω^2
(B) $\omega^2 \exp(-a\omega^2)$
(C) $\omega \exp(-a\omega^2)$
(D) $\omega^2 \exp(-a\omega)$

3. The value of c_p/c_v for diatomic gases such as H_2, O_2, CO is

(A) 5/7
(B) 3/5
(C) 5/3
(D) 7/5

4. A particle moves along the curve, $x = t^3 + 1, y = t^4$ *and* $z = 2t + 5$ where t is time. The component of its velocity at t = 1 sec in the direction $\vec{\imath} + \vec{\jmath} + 3\vec{k}$ is

(A) $\sqrt{11}$
(B) $2\sqrt{2}$
(C) $3\sqrt{3}$
(D) $\sqrt{15}$

5. $\epsilon_{ijk}\epsilon_{pqk}=$

(A) $\delta_{ip}\delta_{jp} - \delta_{iq}\delta_{jp}$
(B) $\delta_{ij}\delta_{jk} - \delta_{pq}\delta_{qk}$
(C) $\delta_{ip}\delta_{jq} - \delta_{kp}\delta_{pq}$
(D) $\delta_{ik}\delta_{jq} - \delta_{kp}\delta_{qj}$

6. If four charges, each of +q are placed at the four corners of a square of edge length l, then the magnitude of the force on any one of the charges due to the other three is approximately

(A) $\frac{q^2}{l^2}$
(B) $\frac{q^2}{3l^2}$
(C) $\frac{2q^2}{l^2}$
(D) $\frac{q^2}{2l^2}$

7. What will be the displacement of a ray through a 100 mm thick plate of index 1.5 which is tilted by 40°?

(A) 25.00°
(B) 25.20°
(C) 25.37°
(D) 25.45°

8. The density of a nucleus with a mass of 1 amu is

(A) 3.6×10^{18} kg/m^3
(B) 2.4×10^{17} kg/m^3
(C) 4.8×10^{17} kg/m^3
(D) 1.2×10^{17} kg/m^3

9. A two port network having a 6 dB loss will give

(A) An output power which is one quarter of the input power
(B) An output power which is one half of the input power
(C) An output voltage which is 0.707of the input voltage
(D) An output power which is 0.707of the input power

10. The value of the Wronskian of the functions f(x) = cos(ωx) ; g(x) = sin(ωx) is

(A) -ω
(B) 2ω
(C) -2ω
(D) ω

11. In Newton-cotes formula, if f(x) is interpolated at equally spaced nodes by a polynomial of degree two, then it represents

(A) Trapzoidal rule
(B) Simpson rule
(C) Three-eight rule
(D) Booles rule

12. ---------- is a recommended method for solving the dual of the following Linear Programming Problem

Max $Z=2x+3y+u-5v+10w$
Subject to
$3x+2y-u+20v\leq 10$
$2x+5y+5u-2v+3w\leq 15$
$x,y,u,v,w\geq 0$ is

(A) Big-M method
(B) Revised Simplex method
(C) Graphical Method
(D) Two Phase method

13. The matrix $\begin{bmatrix} 0 & i \\ -i & 0 \end{bmatrix}$ is

(A) Hermitian
(B) Skew-Hermitian
(C) Skew-symmetric
(D) Symmetric

14. Every group of prime order is

(A) Cyclic
(B) Abelian
(C) Normal group
(D) Non-abelian

15. A type I error is known as a

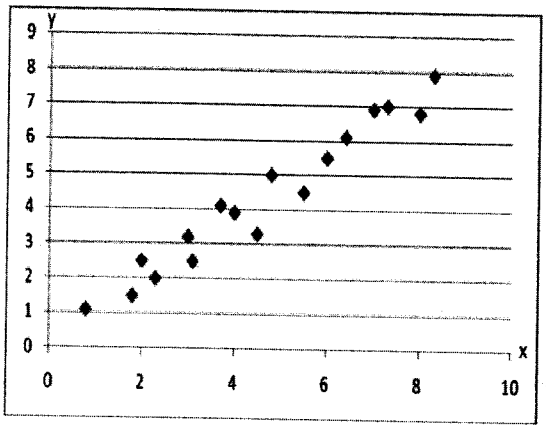
(A) False positive
(B) False negative
(C) Double negative
(D) Positive negative

16. Which of the following statements sounds like a null hypothesis?

a. The coin is not fair
b. There is a correlation in the population
c. There is no difference between male and female incomes in the population
d. The defendant is guilty

(A) c
(B) d
(C) a
(D) b

17. Which statement describes the correlation of the data shown in the graph below?



(A) Strong negative
(B) Strong positive
(C) Weak negative
(D) Weak positive

18. Researchers used a combustion method to analyze a compound used as an antiknock additive in gasoline. A 9.394 mg sample of the compound yielded 31.154 mg of carbon dioxide and 7.977 mg of water in the combustion. The percentage composition of the compound and its empirical formula are

(A) 90.50 % carbon; 9.50 % Hydrogen and the empirical formula is C_4H_5
(B) 9.50 % carbon; 90.50 % Hydrogen and the empirical formula is C_4H_5
(C) 9.50 % carbon; 90.50 % Hydrogen and the empirical formula is C_4H_{10}
(D) 90.50 % carbon; 9.50 % Hydrogen and the empirical formula is C_4H_{10}

19. The density of elemental silver having fcc lattice with unit cell length of 4.086 Å is

(A) 10.5 g/cc
(B) 1.05 g/cc
(C) 105.0 g/cc
(D) 0.105 g/cc

20. Symmetry number of pyridine is

(A) 5
(B) 3
(C) 2
(D) 1

21. An element X of unknown atomic weight forms an oxide with empirical formula XO_2. Given that 5.0 gm of X reacts completely with 4.0 gm of Oxygen, atomic weight of X is

(A) 20
(B) 30
(C) 40
(D) 50

22. Number average molecular weight of a polymer can be determined using following experimental technique;

(A) Nuclear magnetic resonance spectrometer
(B) Gel permeation chromatography
(C) Liquid chromatography hyphenated with mass spectrometer
(D) Quadrupole mass analyzer

23. The molecules, such as phosphorus pentafluoride, in which the "octet (eight electron rule)" is exceeded for the central atom is called

(A) Hypovalent compounds
(B) Hypervalent compounds
(C) Covalent compounds
(D) Inorganic compounds

24. The paramagnetic molecule among the following is

(A) B_2
(B) C_2
(C) N_2
(D) F_2

25. The unstable metallocene in air among the following is

(A) Cp_2Fe
(B) Cp_2Ru
(C) Cp_2Cr
(D) Cp_2Co

PART-B

Physics

26. The partial derivative of a Poisson bracket relation, $\frac{\partial}{\partial t}[u, v]$ *is*

(A) $\left[\frac{\partial u}{\partial t}, \frac{\partial v}{\partial t}\right]$
(B) $\left[\frac{\partial u}{\partial t}, v\right]$
(C) $[uv, vu]$
(D) $\left[\frac{\partial u}{\partial t}, v\right] + \left[u, \frac{\partial v}{\partial t}\right]$

27. Assuming the nuclear potential that binds protons and neutrons in the nucleus of an atom as an infinite square well of width 10 fm, calculate the wavelength of the photon emitted when the proton undergoes a transition from n = 2 to the n = 1.

(A) 202 fm
(B) 208 fm
(C) 417 nm
(D) 207 nm

28. For Pauli spin matrices, σ_1, σ_2 and σ_3, where $\sigma_1^2 = \sigma_2^2 = \sigma_3^2 = 1$, the product $\sigma_1\sigma_2$ is

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

29. For a function defined as ,

$$f(t) = \begin{cases} 0 & t \leq 0 \\ \sin(t) & 0 < t \leq 2\pi \\ \sin(t) + \cos(t) & t > 2\pi \end{cases}$$

the Laplace transform is

(A) $\frac{1-se^{-2\pi s}}{s^2+1}$
(B) $\frac{1+se^{-2\pi s}}{s^2+1}$
(C) $\frac{1+se^{2\pi s}}{s^2-1}$
(D) $\frac{1+se^{2\pi s}}{s^2+1}$

30. A certain amount of water at 0 °C, is in contact with a reservoir at 100 °C. When the thermal equilibrium is reached, the entropy of the universe, in terms of the heat capacity of the water C is

(A) 0.088 C
(B) 0.044 C
(C) 0.011 C
(D) 0.022 C

31. $\int_0^{\infty} \frac{dx}{(1+x^2)^2} =$

(A) $\frac{\pi}{2}$
(B) $\frac{\pi}{3}$
(C) $\frac{\pi}{6}$
(D) $\frac{\pi}{4}$

32. The value of $\oint_c (cosxsiny - xy)dx + sinxcosydy$, where c is a circle of unit radius is

(A) $\frac{1}{3}$
(B) 0
(C) $\frac{1}{2}$
(D) $\frac{1}{4}$

33. For low attenuation, the most suitable medium is

(A) Coaxial cable
(B) Rectangular waveguide
(C) Circular waveguide
(D) Two conductor copper line

34. In Fraunhofer diffraction pattern due to a slit, a screen is placed 2 m away from the lens to obtain the pattern. If the slit width is 0.2 mm and the first minima lie 5 mm on either side of the central maximum, the wavelength of light is

(A) 800 nm
(B) 600 nm
(C) 400 nm
(D) 500 nm

35. A very long solenoid is wound with a turn density of 1 turn/mm along the length of solenoid (n=1500 turns). The current in the solenoid is 1.5 A. The magnetic field intensity and magnetic flux density, respectively, everywhere in the space are

(A) 1000 A/m, 1.257×10^3 T
(B) 2250 A/m, 2.826×10^3 T
(C) 1500 A/m, 1.5×10^3 T
(D) 1.5 A/m, 1500 T

36. A perpendicularly polarized plane wave originated on earth propagates in air and impinges on the ionosphere. The amplitude of the electric field is 100 V/m, frequency is 3 GHz and angle of incidence is 30°. Assuming air to be perfect dielectric and the ionosphere a perfect conductor at the frequency of the wave, the time averaged power density in air is

(A) $\hat{z}200\sin(13.72\pi x)$
(B) $\hat{y}26.53\sin^2(17.32\pi x)$
(C) $\hat{y}26.53\sin^2(17.32\pi x)$
(D) $0.265\hat{y}1.732\sin(17.32\pi x)$

37. A static charge distribution produces a spherically radial electric field $\vec{E} = A\frac{\exp(-br)}{r^2}\vec{r}$, where A,b >0 are constants. What is the charge distribution?

(A) $A(1-br)\frac{\exp(-br)}{4\pi r^2}$
(B) $\frac{4\pi r^2}{A(1-br)}\exp(-br)$
(C) $A(1-br)\exp(-br)$
(D) $4\pi r^2\exp(-br)$

38. An empty perspex (refractive index = 1.6) box (10 m long) is placed in the path of a laser beam. What will be the transmission if width of the box wall is 10 mm?

(A) 90%
(B) 80%
(C) 70%
(D) 60%

39. In a lattice with two atoms per primitive cell the atoms are separated by a distance a. The phonon frequencies of the optical and acoustic branches are respectively

(A) Inversely proportional to the masses and directly proportional to a
(B) Inversely proportional to a and directly proportional to masses
(C) Directly proportional to a
(D) Independent of a and directly proportional to a

40. If the energy levels of a free electron of mass 'm' in two dimensions, X,Y in a strong magnetic field H normal to the XY plane are given by $\mu_B H(2l+1)$,where $\mu_B = e\hbar/2mc$ and l is a quantum number which takes integral values, then the area of electron orbit in the k space is

(A) $\frac{2\pi eH}{\hbar c}(l+\frac{1}{2})$
(B) $\frac{2\pi eH}{\hbar c}(l-\frac{1}{2})$
(C) $\frac{2\pi eH}{\hbar c}$
(D) $\frac{2\pi eH}{\hbar c}(2l+1)$

41. The inclusion of fine structure leads to the energy levels of hydrogen atom to

(A) $\frac{-13.6}{n^2}\left[1+\frac{\alpha^2}{n^2}\right]$
(B) $\frac{-13.6}{n^2}\left[1-\frac{\alpha^2}{n^2}\right]$
(C) $\frac{-13.6}{n^2}\left[1+\frac{\alpha^2}{n^2}\left(\frac{n}{j+\frac{1}{2}}-\frac{3}{4}\right)\right]$
(D) $\frac{-13.6}{n^2}\left[1-\frac{\alpha^2}{n^2}\left(\frac{n}{j+\frac{1}{2}}+\frac{3}{4}\right)\right]$

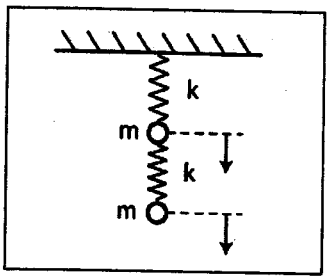
42. If a triangular waveform voltage is applied across a capacitor, then the waveform of current is

(A) Triangular
(B) Trapezoidal
(C) Sinusoidal
(D) Rectangular

43. The ramp voltage at the output of an op-amp integrator

(A) Increases or decreases at a linear rate
(B) Increases or decreases exponentially
(C) Is always increasing and never decreasing
(D) Is constant

44. Two equal masses are connected as shown below with identical mass less springs. Considering only vertical motion, the frequencies of normal modes of the system are



(A) $\sqrt{\frac{(2\pm\sqrt{8})k}{2m}}$

(B) $\sqrt{\frac{(1\pm\sqrt{3})k}{2m}}$

(C) $\sqrt{\frac{(3\pm\sqrt{5})k}{2m}}$

(D) $\sqrt{\frac{(9\pm\sqrt{7})k}{2m}}$

45. When the two resistors A and B were connected in parallel, there was a 20% error in measurement of the overall resistance. If A=500±50Ω and error in B was 400 Ω, the value of B is

(A) 0.5 kΩ
(B) 5 kΩ
(C) 1 kΩ
(D) 10 kΩ

46. Find the amount of energy released due to the fission of 1 gram of U^{235}.

(A) 1.23×10^{10} J
(B) 8.21×10^{10} J
(C) 5.61×10^{10} J
(D) 3.82×10^{10} J

47. Calculate the binding energy of $_{28}Ni^{64}$ (63.928 mu).

(A) 0.603 mu
(B) 0.532 mu
(C) 0.232 mu
(D) 0.878 mu

48. Consider a *hypothetical* He atom in which the two electrons are replaced by two identical spin 1 particles of negative charge. For this atom what is the degeneracy of the ground state? (Neglect spin-dependent forces).

(A) 16
(B) 10
(C) 6
(D) 26

49. The average speed of an electron in the first Bohr orbit of an atom with atomic number Z, in the units of velocity of light, is

(A) $Z^{0.5}$
(B) Z
(C) Z/137
(D) 137Z

50. Find the polarization $\vec{P}$ in a dielectric medium with $\varepsilon_r = 2.8$ if $\vec{D} = 3.0 \times 10^{-7}\ \hat{a}\ C/m^2$.

(A) $2.33 \times 10^{-7}\ \hat{a}\ C/m^2$
(B) $5.83 \times 10^{-7}\ \hat{a}\ C/m^2$
(C) $1.33 \times 10^{-7}\ \hat{a}\ C/m^2$
(D) $1.93 \times 10^{-7}\ \hat{a}\ C/m^2$

Chemistry

51. Time derivative of $\langle p_x \rangle$ is (V refers to potential energy)

(A) $-\nabla V$
(B) V
(C) $-V$
(D) ∇p_x

52. The charge on 0.4 mol of electron equals to

(A) -5.79×10^4 C
(B) -0.4 C
(C) -4.8×10^4 C
(D) -3.86×10^4 C

53. A three-fold increase of pressure causes a --------- of the equilibrium constant of N_2 (g) + $3H_2$ (g) $\rightarrow$ $2NH_3$ (g) reaction

(A) three-fold increase
(B) three-fold decrease
(C) nine-fold increase
(D) nine-fold decrease

54. 1.0 gm of steam at 100° C and 4.0 gm of ice at 0° C are mixed in a thermally insulated container. The final temperature of the mixture is closest to

(A) 100° C
(B) 64° C
(C) 0° C
(D) 50° C

55. 4.5g of PCl_5 on vaporization occupied a volume of 1700 cc at 1 atm and 227° C. The degree of dissociation of PCl_5 is

(A) 92.1 %
(B) 100%
(C) 89.2%
(D) 91.2%

56. In a nuclear magnetic resonance (NMR) spectrum, a proton has resonance 90 Hz downfield from the resonance frequency of standard reference compound tetramethylsilane (TMS) when the field strength is 1.41 Tesla (14,100 Gauss) and the oscillator frequency is 60 MHz. The shift (in Hertz) if the field strength is increased to 2.82 Tesla and oscillator frequency to 120 MHz and the chemical shift (in parts per million, δ scale) are

(A) 120 Hz and 1.5 ppm
(B) 90 Hz and 1.5 ppm
(C) 180 Hz and 1.5 ppm
(D) 120 Hz and 2.82 ppm

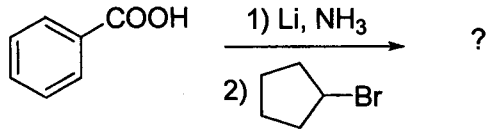
57. The ratio of spacings of 100, 110 and 111 planes of a bcc lattice is

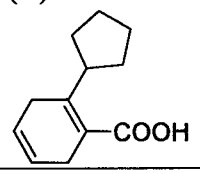
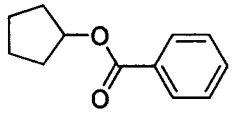
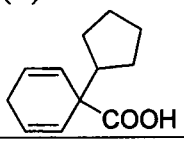
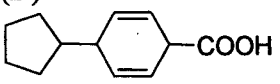
(A) 1 : 0.707 : 0.577
(B) 1 : 0.707 : 1.154
(C) 1 : 1.414 : 0.577
(D) 1 : 0.707 : 1.414

58. 100g of benzene is mixed with 100g of toluene at 20° C and 1 atmosphere pressure. Assuming the ideal behavior the entropy of mixing is

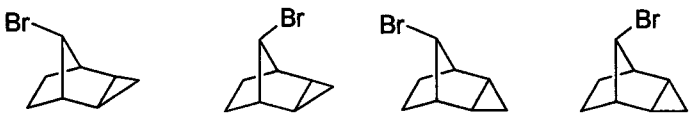
(A) 3.24 cal/K
(B) 5.0 cal/K
(C) 5.76 cal/K
(D) 2.34 cal/K

59. Predict the product in the following reaction.



(A) 	(B) 
(C) 	(D) 

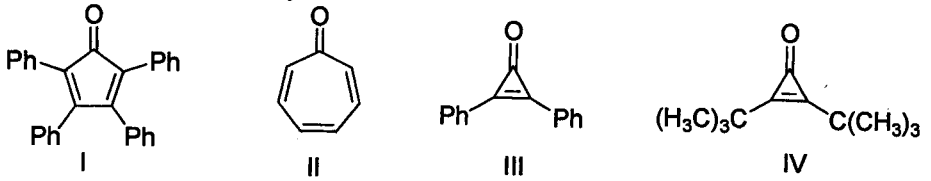
60. The relative trend in rates of the solvolysis of the following compounds is.



exo-anti I *exo-syn* II *endo-anti* III *endo-syn* IV

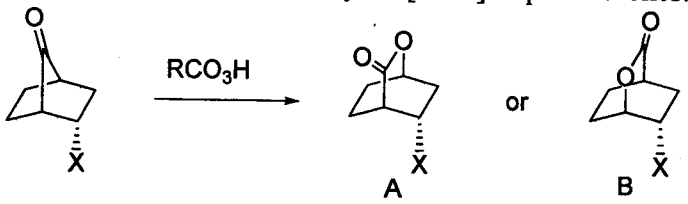
(A) I > III > IV > II
(B) II > III > IV > I
(C) III > II > IV > I
(D) IV > III > I > II

61. The relative strength of the hydrogen bonding of hydrogen donor such as phenol with the following substituted cyclenones is.



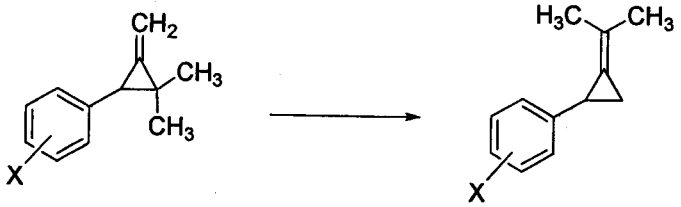
(A) IV > III > II > I
(B) II > III > IV > I
(C) II > III > IV > I
(D) IV > II > III > I

62. Which of the following substituent produce A with better selectivity for the Baeyer - Villiger oxidation of *endo*-substituted bicyclo-[2.2.1]-heptane-7-ones.



(A) Ph
(B) *p*-$NO_2C_6H_4$
(C) CN
(D) p-$CH_3OC_6H_4$

63. The rate of decreasing order of thermal rearrangement of 3-aryl-2,2-dimethylmethylene-cyclopropanes as a function of aryl substituents follows the order.

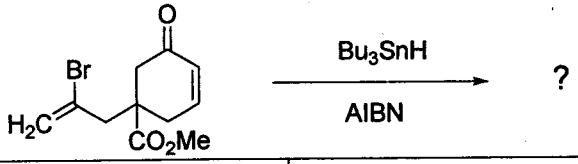


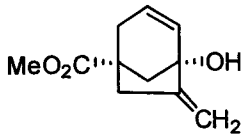
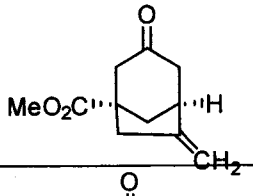
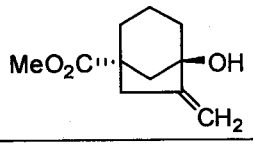
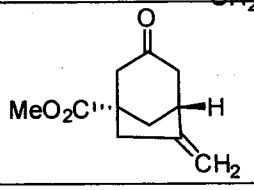
(A) 4-NMe_2, 4-CN, 4-OCH_3, 3-CF_3
(B) 4-CN, 4-NMe_2, 4-OCH_3, 3-CF_3
(C) 4-OCH_3, 4-NMe_2, 4-CN, 3-CF_3
(D) 3-CF_3, 4-CN, 4-OCH_3, 4-NMe_2

64. The number of isomers of a compound with formula MA_2X_2, where M is the central atom, is?

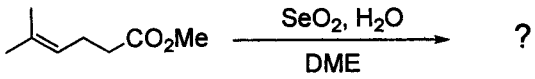
(A) 1
(B) 2
(C) 3
(D) 4

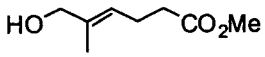
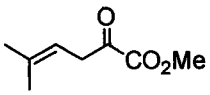
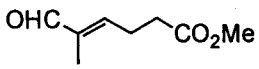
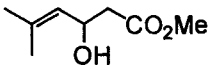
65. Predict the product in the following reaction.



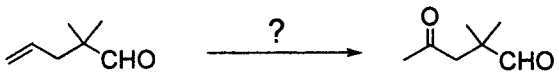
(A) 	(C) 
B) 	D) 

66. The product obtained in the following transformation is



A) 	C) 
B) 	D) 

67. The reagent required for the following reaction is

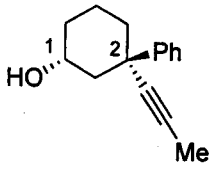


(A) Cr_2O_3
(B) i) BH_3, H_2O_2, ii) Cr_2O_3
(C) $Pd(OAc)_2$, CuCl, O_2
(D) i) H_2SO_4, ii) Cr_2O_3

68. In the manganese mediated oxidation of water to molecular oxygen, Mn undergoes several change in its oxidation state except

(A) +2
(B) +3
(C) +4
(D) +6

69. The configuration of the centers 1 and 2 in the following molecule is



(A) (1S, 2S)
(B) (1S, 2R)
(C) (1R, 2S)
(D) (1R, 2R)

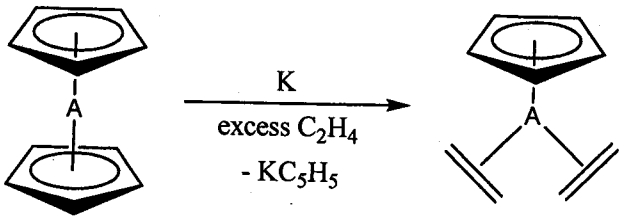
70. The incorrect statement regarding lanthanides is

(A) Display broad absorption bands
(B) +3 oxidation state is common
(C) Unusual reduction in size of cations
(D) Ions behave as hard acids

71. Arrange the following in the decreasing order of Rh-C bond lengths: $Rh(CO)Cl(PPh_3)_2$, $Rh(CO)Cl(PEt_3)_2$, $Rh(CO)Cl[P(C_6F_5)_3]_2$

(A) $Rh(CO)Cl(PPh_3)_2 > Rh(CO)Cl(PEt_3)_2 > Rh(CO)Cl[P(C_6F_5)_3]_2$
(B) $Rh(CO)Cl(PPh_3)_2 > Rh(CO)Cl[P(C_6F_5)_3]_2 > Rh(CO)Cl(PEt_3)_2$,
(C) $Rh(CO)Cl[P(C_6F_5)_3]_2 > Rh(CO)Cl(PPh_3)_2 > Rh(CO)Cl(PEt_3)_2$
(D) $Rh(CO)Cl(PEt_3)_2 > Rh(CO)Cl(PPh_3)_2 > Rh(CO)Cl[P(C_6F_5)_3]_2$

72. The following reaction of the first row transition metal containing metallocene having η^5-Cp ligands lead to stable products. Identify the transition metal 'A' in the compound



(A) Fe
(B) Co
(C) Ni
(D) W

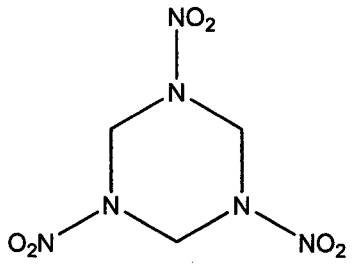
73. The compound pentaerythrol tetranitrate $[C(CH_2ONO_2)_4]$ is burned to release - 1831.0 kJ/mol^{-1} of energy. Then the heat of explosion of pentaerythrol tetranitrate is

(A) + 1831.0 $kJmol^{-1}$
(B) - 183100.0 $kJmol^{-1}$
(C) - 5794 $kJmol^{-1}$
(D) + 5794 $kJmol^{-1}$

74. Ground state term for V^{2+} and Ni^{2+} ions are:

(A) ^4F, ^3F
(B) ^3F, ^4F
(C) ^4F, ^5D
(D) ^2D, ^3F

75. One mole of the compound shown below is burned completely to release CO_2, H_2O and N_2 according to the balanced chemical reaction.



Then the oxygen balance of the compound is;

(A) + 21.6 %
(B) - 21.6 %
(C) 100 %
(D) - 78.4 %

Mathematics

76. The Sturm-Louville problem given by $y'' - y' + \lambda y = 0, y(0) = 0 = y(L)$ has its eigen vectors given by

A	B	C	D
$y_n = e^{\frac{x}{2}} \sin \frac{n\pi}{L} x$	$y_n = e^{\frac{x}{2}} \cos \frac{n\pi}{L} x$	$y_n = e^{x} \cos \frac{n\pi}{L} x$	$y_n = e^{x} \sin \frac{n\pi}{L} x$

77. f(z) = z cosec z , at z= ∞ has

A	B	C	D
Non-isolated essential singularity	Isolated essential singularity	Essential singularity	Simple pole

78. The differential equation (ax+by)dx+(kx+ly)dy = 0 is exact if (a, b, k, l are constants)

A	B	C	D
b=2k $ax^2+2kxy+ly^2=c$	b=2k $ay^2+2kxy+lx^2=c$	b=k $ax^2+2kxy+ly^2=c$	$b \neq k$ $ax^2+2kxy+ly^2=c$

79. The n^{th} differences of a polynomial of n^{th} degree are

A	B	C	D
Constant	Zero	Variable	None of these

80. The function y = |logx| is

A	B	C	D
Discontinous at x = 1	Differentiable at x = 1	Not differentiable at x = 1	Continous at x = 1

81. Evaluate $f(z)=\int_c \frac{\cos \pi z}{z^2-1}dz$ where C is a rectangle with vertices $2\pm i,-2\pm i$

A	B	C	D
$4\pi i$	$4\pi i$	0	4π

82. The eigen values for the Sturm-Louville problem $y''+\lambda y=0, y(0)=0, y'(1)=0$ are

A	B	C	D
$[\frac{n\pi}{2}]^2$	$[(2n+1)\frac{\pi}{2}]^2$	$n\pi$	$2n\pi$

83. Let X be a random variable with the probability density function

$$f(x)=\begin{cases}0.75(1-x^2), x\in[-1,1]\\ 0, otherwise\end{cases}$$

The probability distribution function F(x) is given by

A	B	C	D
$0.5+0.75x-0.25x^3$, $x\in(-1,1]$	$0.75x-0.25x^3$, $x\in(-1,1]$	$0.5-0.25x^2$, $x\in(-1,1]$	$0.5x^2-0.25x^3$, $x\in(-1,1]$

84. If the inter-arrival time is exponential with mean $1/\lambda$, then the number of arrivals in (0,t) is

A	B	C	D
Poisson distributed	Binomial distributed	Exponential distributed	None of these

85. The derivative of $f(x)=x^2\text{Sin}(1/x)$ is

A	B	C	D
continuous	not continuous	does not exist	continuously differentiable

86. Basic matrix or a part of the Basic matrix which produces a Non-Basic feasible solution for the following Linear Programming Problem is _____

Minimize $z=-2x-3y-4z$

Subject to $3x+2y+z\leq 10$

$2x+5y+3z\leq 15$ $x,y,z\geq 0$

A	B	C	D
$\begin{bmatrix}3 & 1\\ 2 & 0\end{bmatrix}$	$\begin{bmatrix}3 & 0\\ 2 & 1\end{bmatrix}$	$\begin{bmatrix}2 & 1\\ 5 & 0\end{bmatrix}$	$\begin{bmatrix}2 & 3\\ 5 & 2\end{bmatrix}$

87. Let D be the demand for a newspaper per day. Let it follow the following distribution. Suppose the purchase price is Rs 3/-, selling price is Rs 5/-, loss is Rs 1/- per paper for the returned paper and goodwill Rs 2/- per paper if demand is not met. Find the expected profit if it is decided to carry 20 news papers.

Demand D	10	15	20	25	30	35	40
Probability	0.05	0.2	0.4	0.2	0.05	0.05	0.05

A	B	C	D
22	32	42	52

88. For the continuity of the function given by $f(x)=\begin{cases} ax+1 & x\leq \pi/2 \\ \sin x+b & x>\pi/2 \end{cases}$ b should be equal to

A	B	C	D
$b=\pi a$	$b=2\pi a$	$b=\frac{\pi a}{2}$	$b=1$

89. The solution of the partial differential equation $2\frac{\partial^2 z}{\partial x^2}+5\frac{\partial^2 z}{\partial x\partial y}+2\frac{\partial^2 z}{\partial y^2}=0$ is

A	B	C	D
$z=\phi(2y-x)$	$z=\psi(y-2x)$	$z=\phi(y-x)+\psi(y-2x)$	$z=\phi(y-x)+\psi(y+x)$

90. If the regression coefficient of X on Y is -1/6 and that of Y on X is -3/2, what is the correlation coefficient between X and Y?

A	B	C	D
0.5	-0.5	0.25	-0.75

91. Find the values of λ for which the equations
$(\lambda-1)x+(3\lambda+1)y+2\lambda z=0$
$(\lambda-1)x+(4\lambda-2)y+(\lambda+3)z=0$
$2x+(3\lambda+1)y+3(\lambda-1)z=0$ are consistent.

A	B	C	D
0,1,2	0,2,3	0,1,1	0,3,3

92. The series $\left\{\frac{e^{n\pi i/4}}{n}\right\}$ is

A	B	C	D
Unbounded	Bounded	Divergent	None of these

93. If one pair of roots of $x^4+2x^3-5x^2+6x+2$ are $-2\pm\sqrt{3}$, other roots are

A	B	C	D
$-1\pm i$	$-2\pm i$	$2\pm i$	$1\pm i$

94. The mean and variance of b(x: n,p) are 4 and 4/3. What is the probability of getting 2 successes?

A	B	C	D
40	20/243	20/423	1/243

95. Suppose you independently play a game 4 times. Each time you play, the probability of winning is 1/2. Denote by X the number of games you win (out of the 4 games you play). Denote by $p_X(x)$ the probability mass function of X. Then, when X={0,1,2,3,4}: $p_X(x)$ is

A	B	C	D
$\frac{1}{8}\frac{12}{x!(4-x!)}$	$\frac{1}{8}\frac{12}{x!(4-x)!}$	$\frac{1}{8}\frac{12}{x!(4-x!)}(\frac{1}{2})^4$	$\frac{1}{8}\frac{12}{x!(4-x)!}(\frac{1}{2})^4$

96. Consider a Bernoulli random variable X, with support {0,1} and probability mass function

$$p_X(x) = \begin{cases} p & \text{if } x = 1 \\ 1-p & \text{if } x = 0 \\ 0 & \text{if } x \notin R_X \end{cases}$$

The variance is:

A	B	C	D
p(1-p)	$p^2(1-p^2)$	$p(1-p^2)$	$p^2(1-p)$

97. The regular singular point of the differential equation
$(x-1)^2(x+3)y''+(2x+1)y'-y=0$

A	B	C	D
x = 1, -3	x = -3	x = 3	x = -1

98. Let X1, X2,....Xn be a random sample form a population with pdf f(x) and cdf F(x). Then the distribution of Y=F(X(i)), where X(i) is the i^{th} order statistics, is

A	B	C	D
Normal	Uniform	Beta Type I	Beta Type II

99. The Barycentric coordinate system for representing a point in a R^n needs _____

A	B	C	D
n vectors which generate R^n	n+1 vectors which generate R^n	n+2 vectors which generate R^n	n+3 vectors which generate R^n

100. Let ABC be a triangle and AD be the altitude on XY plain. The coordinates of A is (2,3) and the gradient of BC is –(1/3). Then the equation of AD is_____

A	B	C	D
3x-y-2=0	3x-y-14=0	x-3y+2=0	x+3y-14=0