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JEE

Time: 3 Hours **M.M. 300**

ALL INDIA SKY TEST SERIES

SAARTHAK BATCH – JEE [12th]

Date : 05/11/2023

SYLLABUS

PHYSICS	CHEMISTRY	MATHEMATICS
Full syllabus	**Chemical Kinetic, Halo alkanes & Halo arenes**	**Full Syllabus**

Please read the instructions carefully. You are allotted **5** minutes specifically for this purpose.

INSTRUCTIONS:

1. This Question paper is divided in to three parts Physics, Chemistry and Mathematics each part is further divided into two sections.
   Section –A Contains 20 Questions Section B contains 10 questions. Please ensure that the Questions paper you have received contains **ALL THE QUESTIONS** in each Part.
2. **In Section A all the 20 Questions are compulsory and Section B Contain 10 Question, out of these 10 Questions**, candidates can choose to attempt any 5 Questions.
   Each Question has four choices (A), (B), (C), (D) out of which **only one is correct & Carry 4 marks each 1 mark** will be deducted for each wrong answer.

GENERAL INSTRUCTION

1. Use only **blue/black pen (avoid gel pen)** for darkening the bubble.
2. Indicate the correct answer for each question by filling appropriate bubble in your **OMR** answer sheet.
3. The answer sheet will be checked through computer hence, the answer of the question must be marked by –shading the circles against the question by dark **blue/black pen**
4. Blank papers, Clipboards, Log tables, Slide Rule, Calculator, Cellular Phones Papers and Electronic Gadgets in any form are **not** allowed to be carried inside the examination hall.

Name of the candidate:_____

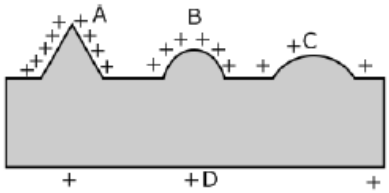
Signature of the candidate: _____**Signature of the invigilator:**_____

PHYSICS

Section - A

Single Choice Question

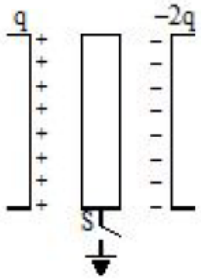
1. In the following figure an isolated charged conductor is shown. The correct statement will be.



(a) $E_A > E_B > E_C > E_D$ (b) $E_A < E_B < E_C < E_D$
(c) $E_A = E_B = E_C = E_D$ (d) $E_B = E_C$ and $E_A > E_D$

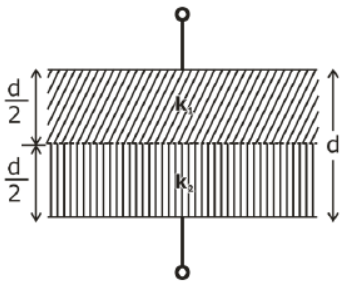
2. There is an electric field E in X – direction. If the work done on moving a charge 0.2 C through a distance of 2m along a line making an angle 60° with the X –axis is 4.0 J, what is the value of E?
(a) $\sqrt{3}N/C$ (b) 4N/C
(c) 5N/C (d) None of these

3. The metal plate on the left in figure carries a charge +q. The metal plate on the right has a charge of – 2q. What charge will flow through S when it is closed, if central plate is initially neutral.



(a) zero (b) – q (c) +q (d) +2q

4. A parallel plate condenser with plate area A and separation d is filled with two dielectric materials as shown in the adjoining figure. The dielectric constant are k_1 and k_2 respectively. The capacitance will be.



(a) $\frac{\varepsilon_o A}{d}(k_1 + k_2)$ (b) $\frac{\varepsilon_o A}{d}\left(\frac{k_1 + k_2}{k_1 k_2}\right)$
(c) $\frac{2\varepsilon_o A}{d}\left(\frac{k_1 k_2}{k_1 + k_2}\right)$ (d) $\frac{2\varepsilon_o A}{d}\left(\frac{k_1 + k_2}{k_1 k_2}\right)$

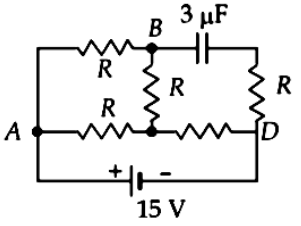
5. A heater coil is cut into two parts of equal length and one of them is used in the heater. The ratio of the heat produced by this half coil to that by the original coil is.
(a) 2 : 1 (b) 1 : 2 (c) 1 : 4 (d) 4 : 1

6. A bird is flying 3 m above the surface of water. If the bird is diving vertically down with speed = 6 m/s, his apparent velocity as seen by a stationary fish underwater is.
(a) 8 m/s (b) 6 m/s (c) 12 m/s (d) 4 m/s

7. The contrast in the fringes in any interference pattern depends on.
(a) Fringe width
(b) ratio of width of slits
(c) distance between the slits
(d) wavelength

8. Three polaroids are kept coaxially. Angle between the first and third polaroid is 90°. Angle between the first and second polaroid is 60°. If unpolarized light energy incident on the first polaroid is I_o .Light energy that emerges from the system is
(a) zero (b) $\frac{3I_o}{32}$ (c) $\frac{3I_o}{16}$ (d) $\frac{\sqrt{3}I_o}{8}$

9. In the circuit shown, the cell is ideal with emf = 15V, and each resistance is 6Ω. The potential difference (in steady state) across the capacitor is.



(a) 15 V (b) 12 V (c) 9 V (d) zero

10. A charge Q is situated at the center of a cube, the electric flux passed through all the six faces of the cube is.
(a) $\frac{Q}{6\in_o}$ (b) $\frac{Q}{8\in_o}$ (c) $\frac{Q}{\in_o}$ (d) $\frac{Q}{2\in_o}$

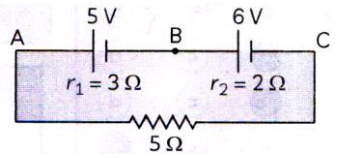
11. Two electrons are moving with the same speed v. One electron enters a region of uniform electric field while the other enters a region of uniform magnetic field, then after sometime if the de-Broglie wavelength of the two are λ_1 and λ_2 then.
(a) $\lambda_1 = \lambda_2$
(b) $\lambda_1 > \lambda_2$
(c) $\lambda_1 < \lambda_2$

(d) λ_1 can do be greater then or less then λ_2

12. A vessel of depth 2h is half filled with a liquid of refractive index $2\sqrt{2}$ and the upper half with another liquid of refractive index $\sqrt{2}$. The liquids are immiscible. The apparent depth of the inner surface of the bottom of vessel will be.

(a) $\frac{h}{\sqrt{2}}$ (b) $\frac{3}{4}h\sqrt{2}$ (c) $\frac{h}{3\sqrt{2}}$ (d) $\frac{h}{2\left(\sqrt{2}+1\right)}$

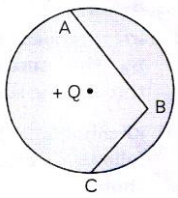
13. Potential difference between A and C is :



(a) 55 V (b) 0.55 V (c) 550 V (d) 5.5 V

14. Inside a magnet, magnetic lines :
(a) do not exist
(b) are from South pole to North pole
(c) are from North pole to South pole
(d) remain scattered

15. A charge +Q is placed at the centre of α dotted circle. Work done in taking charge +q from A to B is W_1 and B to C is W_2. Then.



(a) $W_1 > W_2$ (b) $W_1 < W_2$
(c) $W_1 = W_2$ (d) $W_1 \neq W_2$

16. The de-Broglie wavelength of an electron having kinetic energy E is λ. If the kinetic energy of electron becomes $\frac{E}{4}$, then its de-Broglie wavelength will be

(a) $\sqrt{2}\lambda$ (b) 2λ (c) $\frac{\lambda}{\sqrt{2}}$ (d) $\frac{\lambda}{2}$

17. An $\alpha-$particle, a proton and an electron have the same kinetic energy. Which one of the following is correct in case of their de-Broglie wavelength?

(a) $\lambda_\alpha > \lambda_p > \lambda_e$ (b) $\lambda_\alpha < \lambda_p < \lambda_e$
(c) $\lambda_\alpha = \lambda_p = \lambda_e$ (d) $\lambda_\alpha > \lambda_p < \lambda_e$

Kirchhoff's current law is consequence of

(a) conservation of momentum
(b) conservation of charge
(c) conservation of mass
(d) conservation of energy

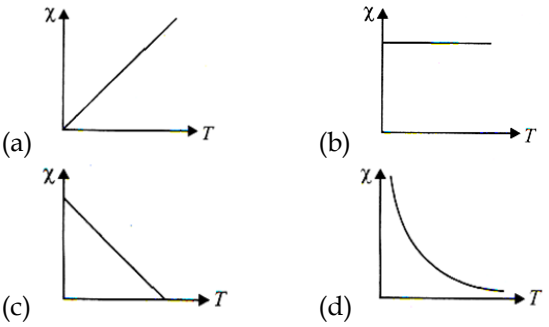
18. F is the force and r is the distance between two charges q. If charges are holved and distance is doubled, then the new force will be.

(a) F/8 (b) F/16 (c) 4F (d) F/4

19. The direction of force acting on a charge particle q, moving with a velocity $\vec{v}$ in a uniform magnetic field $\vec{B}$ is :

(a) Perpendicular to $\vec{v}$ and parallel to $\vec{B}$
(b) Parallel to $\vec{v}$ and perpendicular to $\vec{B}$
(c) Parallel to both $\vec{v}$ and $\vec{B}$
(d) Perpendicular to both $\vec{v}$ and $\vec{B}$

20. The graph between temperature and magnetic susceptibility for a paramagnetic substance is



Section - B

Integer Type Questions

21. A deuteron and a proton moving with equal kinetic energy enter into to a uniform magnetic field at right angle to the field. If r_d and r_p are the radii of their circular paths respectively, then the ratio $\frac{r_d}{r_p}$ will be $\sqrt{x}:1$ where x is

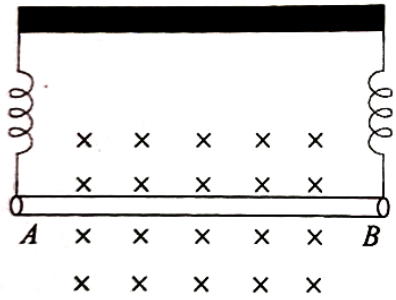
22. A single ionized magnesium atom $(A=24)$ ion is accelerated to kinetic energy 5 keV and is projected perpendicularly into a magnetic field B of the magnitude 0.5 T. The radius of path formed will be_____ cm.

23. Two 10 cm long, straight wires, each carrying a current of 5A are kept parallel to each other. If each wire experienced a force of $10^{-5}N$, then separation between the wires is ___cm

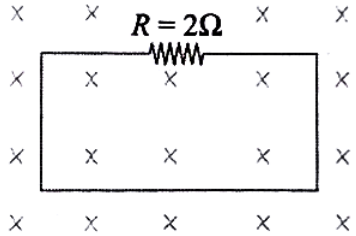
24. A single turn current loop in the shape of a right angle triangle with sides 5 cm, 12 cm, 13 cm. is carrying a current of 2A. The loop is in a uniform magnetic field of magnitude 0.75 T whose direction is parallel to the current in the 13 cm. side of the loop. The magnitude of the magnetic

force x on the 5 cm. side will be $\frac{x}{130}N$. The value of x is _____.

25. A straight wire AB of mass 40 g and length 50 cm is suspended by a pair of flexible leads in uniform magnetic field of magnitude 0.40 T as shown in the figure. The magnitude of the current required in the wire to remove the tension in the supporting leads is_____A.
(Take g = 10 ms^{-2})

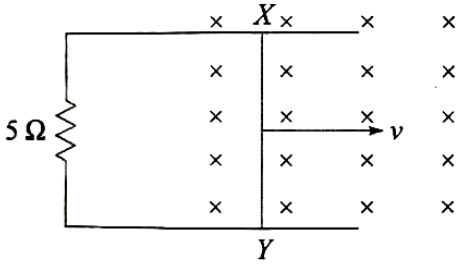


26. In the given figure the magnetic flux through the loop increases according to the relation $\phi_B(t) = 10t^2 + 20t$, where ϕ_B is in milliwebers and t is in seconds.
The magnitude of current through $R = 2\Omega$ resistor at t = 5 s is _____mA



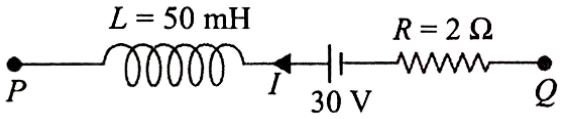
27. A conducting circular loop is placed in X – Y plane in presence of magnetic field $\vec{B} = (3t^3\hat{j} + 3t^2\hat{k})$ in SI unit. If the radius of the loop is 1m, the induced emf in the loop, at time, t = 2 s is $n\pi V$. The value of n is _____

28. A 1m long metal rod XY completes the circuit as shown in figure. The plane of the circuit is perpendicular to the magnetic field of flux density 0.15 T. If the resistance of the circuit is 5Ω, the force needed to move the rod in direction, as indicated, with a constant speed of 4 m/s will be _____ 10^{-3} N.



29. A 20 cm long metallic rod is rotated with 210 rpm about an axis normal to the rod passing through its one end. The order end of the rod is in contact with a circular metallic ring. A constant and uniform magnetic field 0.2 T parallel to the axis exists everywhere. The emf developed between the centre and the ring is_____ mV. Take $\pi = \frac{22}{7}$

30. A part of a complete circuit is shown in the figure. At some instant, the value of current I is 1 A and it is decreasing at a rate of $10^2\,As^{-1}$. The value of the potential difference $V_p - V_o$ (in volts) at that instant is_____



CHEMISTRY

Section - A

Single Choice Question

31. For a reaction Rate = k [acetone]$^{3/2}$ then unit of rate constant and rate of reaction respectively is :
(a) (mol $L^{-1}s^{-1}$), (mol$^{-1/2}$ $L^{1/1}s^{-1}$)
(b) (mol$^{-1/2}$ $L^{1/2}s^{-1}$), mol $L^{-1}s^{-1}$)
(c) (mol$^{1/2}$ $L^{1/2}s^{-1}$), (mol $L^{-1}s^{-1}$)
(d) (mol Ls^{-1}), (mol$^{1/2}L^{1/2}s^{-1}$)

32. The instantaneous rate of disappearance of the MnO_4^- ion in the following reaction is $4.56\times10^{-3}\,Ms^{-1}$.
$2MnO_4^- + 10I^- + 16H^+ \rightarrow 2Mn^{2+} + 5I_2 + 8H_2O$
The rate of appearance of I_2 is :
(a) $1.14\times10^{-3}\,Ms^{-1}$ (b) $5.7\times10^{-3}\,Ms^{-1}$
(c) $4.56\times10^{-4}\,Ms^{-1}$ (d) $1.14\times10^{-2}\,Ms^{-1}$

33. In the following reaction : $xA \rightleftharpoons yB$
$$\log\left[-\frac{d[A]}{dt}\right] = \log\left[\frac{d[B]}{dt}\right] + 0.3$$
Where –ve sign indicates rate of disappearance of the reactant. Thus, x : y is :
(a) 1 : 2 (b) 2 : 1 (c) 3 : 1 (d) 3 : 10

34. Consider the chemical reaction
$N_2 + 3H_2 \rightleftharpoons 2NH_3$. The rate of this reaction can be expressed in terms of time derivative of concentration of N_2, H_2 or NH_3. Identify the correct relationship amongst the rate expression:
(a) $\text{rate} = -\frac{d[N_2]}{dt} = -\frac{1}{3}\frac{d[H_2]}{dt} = \frac{1}{2}\frac{d[NH_3]}{dt}$

(b) $\text{rate} = -\frac{d[N_2]}{dt} = -\frac{3d[H_2]}{dt} = \frac{2d[NH_3]}{dt}$

(c) $\text{rate} = -\frac{d[N_2]}{dt} = \frac{1}{3}\frac{d[H_2]}{dt} = \frac{1}{2}\frac{d[NH_3]}{dt}$

(d) $\text{rate} = -\frac{d[N_2]}{dt} = \frac{-d[H_2]}{dt} = \frac{d[NH_3]}{dt}$

35. In the elementary reaction $2A + B \rightarrow A_2B$, If the concentration of A is doubled and that of B is halved, then the rate of the reaction will :
(a) increase 2 times (b) increase 4 times
(c) decrease 2 times (d) remain the same

36. Select the rate law the corresponds to the data shown for the following reaction $A + B \rightleftharpoons C$

Expt. No.	$[A]_0$	$[B]_0$	Initial rate
1.	0.012	0.035	0.10
2.	0.024	0.070	0.80
3.	0.024	0.035	0.10
4.	0.012	0.070	0.80

(a) Rate = $k[B]^3$ (b) Rate = $k[B]^4$
(c) Rate = $k[A][B]^3$ (d) Rate = $k[A]^2[B]^2$

37. The reaction, $X + 2Y + Z \rightleftharpoons N$ occurs by the following mechanism
(i) $X + Y \rightleftharpoons M$ (very rapid equilibrium)
(ii) $M + Z \rightleftharpoons O$ (slow)
(iii) $O + Y \rightleftharpoons N$ (very fast)
What is the rate law for this reaction ?
(a) Rate = k[Z]
(b) Rate = $k[X][Y]^2[Z]$
(c) Rate = k[N]
(d) Rate = k[X][Y][Z]

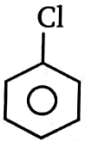
38. For the following electrochemical cell at 298 K, $Pt(s)|H_2(g)1\text{ bar}|H^+(aq.1M)||M^{4+}(aq.),M^{2+}(aq.)|Pt(s)$

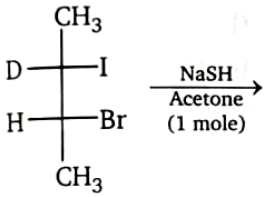
E_{cell} = 0.092 V when $\frac{[M^{2+}(aq.)]}{[M^{4+}(aq.)]} = 10^x$

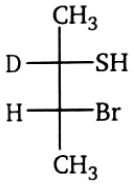
Given : $E^o_{M^{4+}/M^{2+}} = 0.151V; 2.303\frac{RT}{F} = 0.059V$

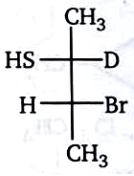
The value of x is :
(a) -2 (b) -1 (c) 1 (d) 2

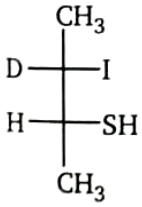
39. The resistance of a N/10 KCl solution is $245\,\Omega$. Calculate the equivalent conductance of the solution if the electrodes in the cell are 4 cm apart and each having an area of 7.0 cm^2:
(a) 23.32S cm^2eq^{-1} (b) 23.23S m^2eq^{-1}
(c) 2.332S $cm^2\ eq^{-1}$ (d) None of these

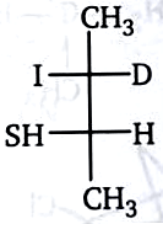
40. Among the following which will be most reactive S_{N^2} reaction ?
(a) $CH_3 - CH_2 - Cl$ (b) $CH_2 = CH - Cl$
(c)  (d) $CH_3 - F$



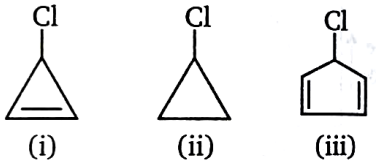
41.
(a) 

(b) 

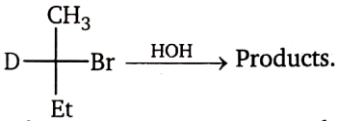
(c) 

(d) 

42. Order of rate of reaction with $AgNO_3$ or rate of S_{N^1}



(a) i > iii > ii (b) ii > iii > i
(c) i > ii > iii (d) iii > i > ii

43. 

(If 98% recemisation takes place)
Find out the correct statement about the reaction.
(a) Among the products 49% S and 49% R configuration containing molecules are present.
(b) Among the products 50% S and 50% R configuration containing molecules are present.
(c) Among the products 49% S and 51% R configuration containing molecules are present.
(d) Among the products 51% S and 49% R configuration containing molecules are present.

44. In the isoelectronic series of metal carbonyl, the CO bond strength is expected to increase in the order :
(a) $[Mn(CO)_6]^+ < [Cr(CO)_6] < [V(CO)_6]^-$
(b) $[V(CO)_6]^- < [Cr(CO)_6] < [Mn(CO)_6]^+$
(c) $[V(CO)_6]^- < [Mn(CO)_6]^+ < [Cr(CO)_6]$
(d) $[Cr(CO)_6] < [Mn(CO)_6]^+ < [V(CO)_6]^-$

45. The colour of the coordination compounds depends on the crystal field splitting. What will be the correct order of absorption of wavelength of light in the visible region, for the complexes, $[Co(NH_3)_6]^{3+}, [Co(CN)_6]^{3-}$ $[Co(H_2O)_6]^{3+}$
(a) $[Co(H_2O)_6]^{3+} > [Co(CN)_6]^{3-} > [Co(NH_3)_6]^{3+}$
(b) $[Co(NH_3)_6]^{3+} > [Co(H_2O)_6]^{3+} > [Co(CN)_6]^{3-}$
(c) $[Co(H_2O)_6]^{3+} > [Co(NH_3)_6]^{3+} > [Co(CN)_6]^{3-}$
(d) $[Co(CN)_6]^{-3} > [Co(NH_3)_6]^{+3} > [Co(H_2O)_6]^{+3}$

46. Which of the following gives the maximum number of isomers ?
(a) $[Fe(NH_3)_4Br_2]$ (b) $[Ni(en)(NH_3)_4]^{2+}$
(c) $[Ni(C_2O_4)(en)_2]$ (d) $[Cr(ONO)_2(NH_3)_4]^+$

47. $FeSO_4$ solution give brown colour ring in testing nitrates or nitrites. This is :
(a) $[Fe(H_2O)_5NO]^{2+}$ (b) $[Fe(H_2O)_5(NO)_2]^{2+}$
(c) $[Fe(H_2O)_4(NO)_2]^{2+}$ (d) $[Fe(H_2O)_4NO]^{2+}$

48. Copper sulphate solution reacts with KCN to give :
(a) $Cu(CN)_2$ (b) CuCN
(c) $K_2[Cu(CN)_4]$ (d) $K_3[Cu(CN)_4]$

49. $MnO_4^- + NO + H^+ \rightarrow (X) + (Y); (X)$ and (Y) are :
(a) $X = Mn^{3+}, Y = NO_3^-$
(b) $X = Mn^{2+}, Y = NO_3^-$
(c) $X = MnO_2, Y = NO_2^-$
(d) $X = Mn^{2+}, Y = NO_2$

50. Hypochlorous acid readily decomposes into :
(a) Cl_2, H_2 and O_2 (b) HCl and H_2O
(c) HCl and O_2 (d) Cl_2, HCl and O_2

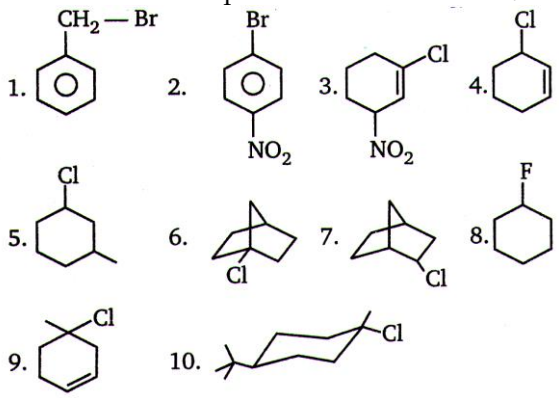
SECTION - B

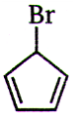
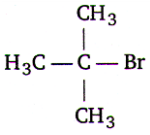
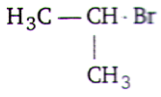
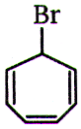
Integer Type Questions

51. The reduction potential of hydrogen electrode when placed in a buffer solution is found to be – 0.413V. The pH of the buffer is:

52. When a current of 0.25 A is passed through molten MCl_x for half an hour, 0.45 g of metal M is deposited at cathode. Calculate x (Given : atomic weight of M = 193)

53. The number of compounds do not shown S_N2 .



54. How many of the following substrates will react faster when compared with 1-bromopropane towards S_N1 reaction in similar condition ?
(i) $CH_3 - CH = CH - Br$
(ii) $CH_2 = CH - CH_2Br$
(iii) $CH_3 - Br$
(iv) $C_6H_5CH_2Br$
(v) C_6H_5Br
(vi) 
(vii) 
(viii) 
(ix) 

55. Among the complex ions,
$[Co(NH_2 - CH_2 - CH_2 - NH_2)_2Cl_2]^+$,
$[CrCl_2(C_2O_4)_2]^{3-}, [Fe(H_2O)_4(OH)_2]^+$
$[Fe(NH_3)_2(CN)_4]^-$,
$[Co(NH_2 - CH_2 - CH_2 - NH_2)_2(NH_3)Cl]^{2+}$ and
$[Co(NH_3)_4(H_2O)Cl]^{2+}$ the number of complex ion (s) that show(s) cis-trans isomerism is :

56. Europium is stable as Eu^{+x} as it has half-filled electronic configuration.
Value of x + n
n = no. of unpaired electrons in Eu^{+x} is.

57. Total number of 3d-series transition elements contain either $3d^1$ or $4s^1$ orbital in their ground state electronic configuration.

58. How many of the given chemicals liberates dinitrogen on heating
$NH_4NO_2, NaN_3, (NH_4)_2Cr_2O_7, Pb(NO_3)_2, Ba(N_3)_2$

59. The vapour pressure of water at room temperature is lowered by 5% by dissolving a slute in it, approximate molality of its solution is : (write your answer in nearest integer)

60. The van't Hoff factor (i) for a dilute solution of $K_3[Fe(CN)_6]$ is (assuming 100% ionisation) :

MATHEMATICS

Section - A

Single Choice Question

61. If ω is a complex cube root of unity, then the value of the determinant $\begin{vmatrix} 1 & \omega & \omega+1 \\ \omega+1 & 1 & \omega \\ \omega & \omega+1 & 1 \end{vmatrix}$ is
(a) 0 (b) ω (c) 2 (d) 4

62. In a third order determinant, each element of the first column consists of sum of two terms, each element of the second column consists of sum of three terms and each element of the third column consists of sum of four terms. Then it can be decomposed into n determinants, where n has the value
(a) 1 (b) 9 (c) 16 (d) 24

63. If $A=\begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & -1 \\ 3 & -1 & 1 \end{bmatrix}$, then
(a) $A^3+3A^2+A-9I_3=0$
(b) $A^3-3A^2+A+9I_3=0$
(c) $A^3+3A^2-A+9I_3=0$
(d) $A^3-3A^2-A+9I_3=0$

64. If $A=\begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$, then $adj\, A =$
(a) A (b) I
(c) O (d) A^2

65. The function $f: R \to R$ defined by $f(x)=(x-1)(x-2)(x-3)$ is
(a) One-one but not onto
(b) Onto but not one-one
(c) Both one-one and onto
(d) Neither one-one nor onto

66. Let $g(x)=1+x-[x]$ and $f(x)=\begin{cases} -1, & x<0 \\ 0, & x=0 \\ 1, & x>0 \end{cases}$,
then for all x, $f(g(x))$ is equal to
(a) x (b) 1
(c) $f(x)$ (d) $g(x)$

67. If $f(x)=\sqrt{\dfrac{x-\sin x}{x+\cos^2 x}}$, then $\lim\limits_{x\to\infty} f(x)$ is
(a) 0 (b) ∞
(c) 1 (d) Not exist

68. If $f(x)=\begin{cases} \sin x & , x\neq n\pi \\ 0 & , other\ wise \end{cases}, n\in Z$
$g(x)=\begin{cases} x^2+1 & , x\neq 0,2 \\ 4 & , x=0 \\ 5 & , x=2 \end{cases}$, then $\lim\limits_{x\to 0} g\{f(x)\} =$
(a) 1 (b) 0 (c) $\dfrac{1}{2}$ (d) $\dfrac{1}{4}$

69. Let $f(x)=\dfrac{\sqrt{1+\sin x}-\sqrt{1-\sin x}}{x}$ the value which should be assigned to f at $x=0$ so that it is continuous everywhere is
(a) $\dfrac{1}{2}$ (b) –2 (c) 2 (d) 1

70. Which of the following is differentiable at $x=0$
(a) $\cos(|x|)+|x|$ (b) $\cos(|x|)-|x|$
(c) $\sin(|x|)+|x|$ (d) $\sin(|x|)-|x|$

71. On the interval [0, 1] the function $x^{25}(1-x)^{75}$ takes its maximum value at the point
(a) 0 (b) $\dfrac{1}{2}$ (c) $\dfrac{1}{3}$ (d) $\dfrac{1}{4}$

72. The maximum area of the rectangle that can be inscribed in a circle of radius r is
(a) πr^2 (b) r^2 (c) $\dfrac{\pi r^2}{4}$ (d) $2r^2$

73. The function $f(x)=x^3-3x^2-24x+5$ is an increasing function in the interval given below
(a) $(-\infty,-2)\cup(4,\infty)$ (b) $(-2,\infty)$
(c) $(-2,4)$ (d) $(-\infty,4)$

74. The function $f(x)=2\log(x-2)-x^2+4x+1$ increases in the interval
(a) (1, 2) (b) (2, 3)
(c) $(-\infty,-1)$ (d) (2, 4)

75. $\int e^x.\left(\frac{1+\sin x}{1+\cos x}\right)dx$ is equal to

(a) $e^x.\tan\left(\frac{x}{2}\right)+C$ (b) $e^x.\cot\left(\frac{x}{2}\right)+C$

(c) $e^x.\tan x+C$ (d) $e^x.\cot x+C$

76. $\int\frac{x\tan^{-1}x\,dx}{(1+x^2)^{3/2}}$

(a) $\frac{x+\tan^{-1}x}{\sqrt{1+x^2}}+c$ (b) $\frac{x-\tan^{-1}x}{\sqrt{1+x^2}}+c$

(c) $\frac{\tan^{-1}x-x}{\sqrt{1+x^2}}+c$ (d) None of these

77. $\int_0^{\pi/3}\frac{\cos x}{3+4\sin x}dx=$

(a) $\frac{1}{4}\log\left(\frac{3+2\sqrt{3}}{2}\right)$ (b) $\frac{1}{2}\log\left(\frac{3+2\sqrt{3}}{2}\right)$

(c) $\frac{1}{3}\log\left(\frac{3+2\sqrt{3}}{2}\right)$ (d) None of these

78. $\int_0^{\pi/2}\frac{dx}{a^2\cos^2x+b^2\sin^2x}$ is equal to

(a) πab (b) π^2ab (c) $\frac{\pi}{ab}$ (d) $\frac{\pi}{2ab}$

79. If $\int_{\log 2}^{x}\frac{1}{\sqrt{e^x-1}}dx=\frac{\pi}{6}$, then x is equal to

(a) e^2 (b) 1/e

(c) $\log 4$ (d) N.O.T.

80. $\int_8^{15}\frac{dx}{(x-3)\sqrt{x+1}}=$

(a) $\frac{1}{2}\log\frac{5}{3}$ (b) $\frac{1}{3}\log\frac{5}{3}$

(c) $\int_{1/e}^{e}|\log x|\,dx=$ (d) $\frac{1}{5}\log\frac{3}{5}$

SECTION - B

Integer Type Questions

81. If $A=\begin{bmatrix}5a & -b\\ 3 & 2\end{bmatrix}$ and A adj A = AA^T, then 5a + b is equal to

82. Let a function f: R→R be defined as

$$f(x)=\begin{cases}\sin x-e^x & \text{if } x\le 0\\ a+[-x] & \text{if } 0<x<1\\ 2x-b & \text{if } x\ge 1\end{cases}$$

where $[x]$ is the greatest integer less than or equal to x. If f is continuous on R, then $(a + b)$ is equal to

83. Let the functions $f: R\to R$ and $g: R\to R$ be defined as

$$f(x)=\begin{cases}x+2, & x<0\\ x^2, & x\ge 0\end{cases}\text{ and }g(x)=\begin{cases}x^3, & x<1\\ 3x-2, & x\ge 1\end{cases}$$

Then, the number of points in R where $(fog)(x)$ is NOT differentiable is equal to

84. The number of distinct real roots of the equation $3x^4+4x^3-12x^2+4=0$ is _____

85. The value of the integral $\int_{-1}^{1}\log(x+\sqrt{x^2+1})\,dx$ is

86. If $\int_1^2\frac{dx}{(x^2-2x+4)^{3/2}}=\frac{k}{k+5}$, then k is equal to

87. The integral $\int_2^4\frac{\log x^2}{\log x^2+\log(36-12x+x^2)}dx$ is equal to

88. $\int_{\pi}^{10\pi}|\sin x|\,dx$ is

89. The value of $\int_{-2}^{2}|3x^2-3x-6|\,dx$ is ____

90. The area of the region bounded by the parabola $(y-2)^2=(x-1)$, the tangent to it at the point whose ordinate is 3 and the x-axis is