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IIT-JEE | NEET | Foundation
JEE

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

ALL INDIA SKY TEST SERIES

TARGET BATCH – IIT - JEE

Date : 05/11 /2023

SYLLABUS

PHYSICS	CHEMISTRY	MATHEMATICS
Rotation, Modern Physics	**Previous + Solution + Hydrocarbon**	**Previous + Application of Derivative**

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:_____

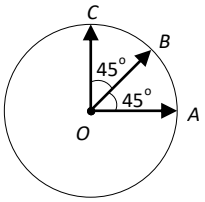
Signature of the candidate: _____**Signature of the invigilator:**_____

PHYSICS

Section - A

Single Choice Question

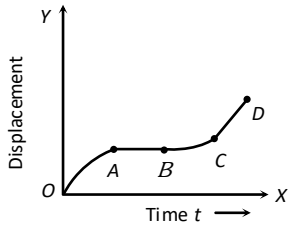
1. Find the resultant of three vectors $\overrightarrow{OA}, \overrightarrow{OB}$ and $\overrightarrow{OC}$ shown in the following figure. Radius of the circle is *R*.



(a) $2R$ (b) $R(1+\sqrt{2})$

(c) $R\sqrt{2}$ (d) $R(\sqrt{2}-1)$

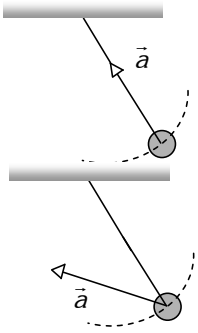
2. The graph between the displacement x and time t for a particle moving in a straight line is shown in figure. During the interval OA, AB, BC and CD, the acceleration of the particle is



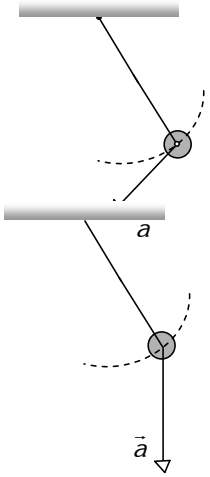
	OA,	AB,	BC,	CD
(a)	+	0	+	+
(b)	–	0	+	0
(c)	+	0	–	+
(d)	–	0	–	0

3. A simple pendulum is oscillating without damping. When the displacement of the bob is less than maximum, its acceleration vector $\vec{a}$ is correctly shown in

(a)



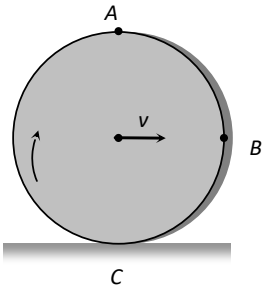
(b)



(c)

(d)

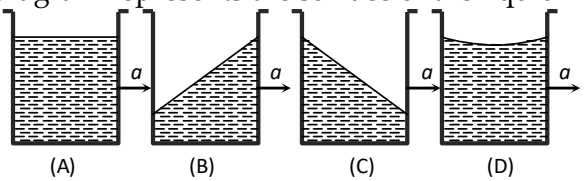
4. A solid disc rolls clockwise without slipping over a horizontal path with a constant speed υ. Then the magnitude of the velocities of points *A*, *B* and *C* (see figure) with respect to a standing observer are respectively



(a) υ, υ and υ (b) $2\upsilon, \sqrt{2}\upsilon$ and zero

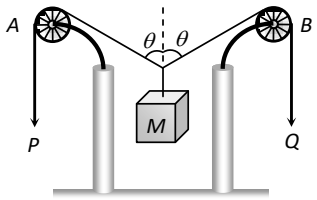
(c) $2\upsilon, 2\upsilon$ and zero (d) $2\upsilon, \sqrt{2}\upsilon$ and $\sqrt{2}\upsilon$

5. A vessel containing water is given a constant acceleration *a* towards the right, along a straight horizontal path. Which of the following diagram represents the surface of the liquid



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

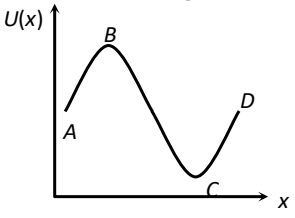
6. In the arrangement shown in figure the ends *P* and *Q* of an unstretchable string move downwards with uniform speed *U*. Pulleys *A* and *B* are fixed. Mass *M* moves upwards with a speed



(a) $2U\cos\theta$ (b) $U\cos\theta$

(c) $\dfrac{2U}{\cos\theta}$ (d) $\dfrac{U}{\cos\theta}$

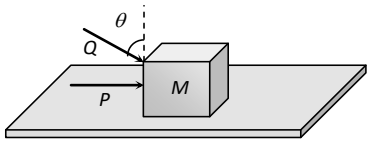
7. The potential energy of a particle varies with distance *x* as shown in the graph.



The force acting on the particle is zero at

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

8. A block of mass m lying on a rough horizontal plane is acted upon by a horizontal force P and another force Q inclined at an angle θ to the vertical. The block will remain in equilibrium, if the coefficient of friction between it and the surface is



(a) $\frac{(P+Q\sin\theta)}{(mg+Q\cos\theta)}$ (b) $\frac{(P\cos\theta+Q)}{(mg-Q\sin\theta)}$

(c) $\frac{(P+Q\cos\theta)}{(mg+Q\sin\theta)}$ (d) $\frac{(P\sin\theta-Q)}{(mg-Q\cos\theta)}$

9. The kinetic energy acquired by a mass m in travelling a certain distance d starting from rest under the action of a constant force is directly proportional to

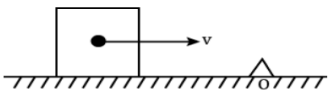
(a) $\sqrt{m}$ (b) Independent of m

(c) $1/\sqrt{m}$ (d) m

10. Two discs of same thickness but of different radii are made of two different materials such that their masses are same. The densities of the materials are in the ratio 1 : 3. The moments of inertia of these discs about the respective axes passing through their centres and perpendicular to their planes will be in the ratio

(a) 1 : 3 (b) 3 : 1 (c) 1 : 9 (d) 9 : 1

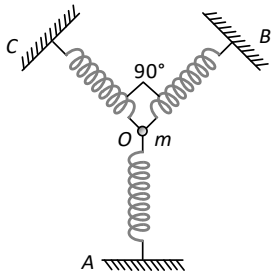
11. A cubical block of side a is moving with velocity v on a horizontal smooth plane as shown. It hits a ridge at point O. The angular speed of the block after it hits O is



(a) $3v/4a$ (b) $3v/2a$

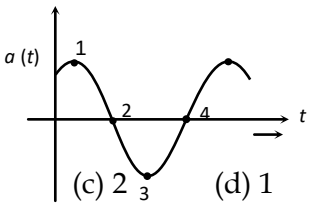
(c) $\frac{\sqrt{3}v}{\sqrt{2}a}$ (d) Zero

12. A particle of mass m is attached to three identical springs A, B and C each of force constant k a shown in figure. If the particle of mass m is pushed slightly against the spring A and released then the time period of oscillations is



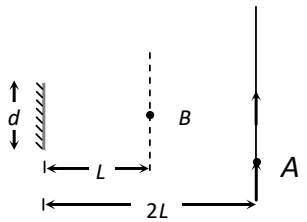
(a) $2\pi\sqrt{\frac{2m}{k}}$ (b) $2\pi\sqrt{\frac{m}{2k}}$ (c) $2\pi\sqrt{\frac{m}{k}}$ (d) $2\pi\sqrt{\frac{m}{3k}}$

13. The acceleration a of a particle undergoing S.H.M. is shown in the figure. Which of the labelled points corresponds to the particle being at $-x_{max}$



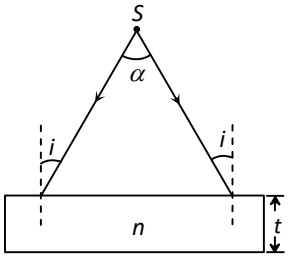
(a) 4 (b) 3 (c) 2 (d) 1

14. A point source of light B is placed at a distance L in front of the centre of a mirror of width d hung vertically on a wall. A man walks in front of the mirror along a line parallel to the mirror at a distance $2L$ from it as shown. The greatest distance over which he can see the image of the light source in the mirror is



(a) $d/2$ (b) d (c) $2d$ (d) $3d$

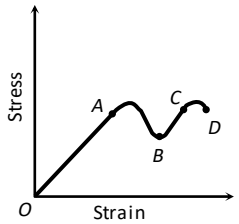
15. A diverging beam of light from a point source S having divergence angle α, falls symmetrically on a glass slab as shown. The angles of incidence of the two extreme rays are equal. If the thickness of the glass slab is t and the refractive index n, then the divergence angle of the emergent beam is



(a) Zero (b) α
(c) $\sin^{-1}(1/n)$ (d) $2\sin^{-1}(1/n)$

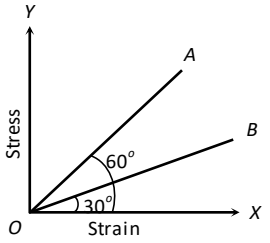
16. Work function of lithium and copper are respectively 2.3 *eV* and 4.0 *eV*. Which one of the metal will be useful for the photoelectric cell working with visible light ? ($h = 6.6 \times 10^{-34}$ *J-s*, $c = 3 \times 10^{8}$ *m/s*)
(a) Lithium (b) Copper
(c) Both (d) None of these

17. A graph is shown between stress and strain for a metal. The part in which Hooke's law holds good is



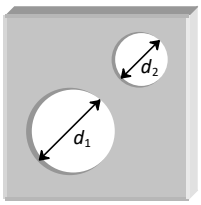
(a) OA (b) AB (c) BC (d) CD

18. The stress versus strain graphs for wires of two materials *A* and *B* are as shown in the figure. If Y_A and Y_B are the Young's modulii of the materials, then



(a) $Y_B = 2Y_A$ (b) $Y_A = Y_B$
(c) $Y_B = 3Y_A$ (d) $Y_A = 3Y_B$

19. Two holes of unequal diameters d_1 and d_2 $(d_1 > d_2)$ are cut in a metal sheet. If the sheet is heated



(a) Both d_1 and d_2 will decrease
(b) Both d_1 and d_2 will increase
(c) d_1 will increase, d_2 will decrease
(d) d_1 will decrease, d_2 will increase

20. In the given reaction

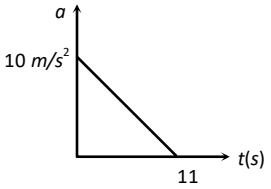
$${}_{z}X^{A} \rightarrow {}_{z+1}Y^{A} \rightarrow {}_{z-1}K^{A-4} \rightarrow {}_{z-1}K^{A-4}$$

Radioactive radiations are emitted in the sequence
(a) α, β, γ (b) β, α, γ
(c) γ, α, β (d) β, γ, α

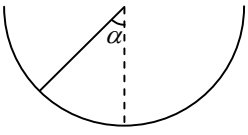
Section - B

Integer Type Questions

21. A particle starts from rest. Its acceleration (a) versus time (t) is as shown in the figure. The maximum speed of the particle will be (in m/s)



22. An insect crawls up a hemispherical surface very slowly (see the figure). The coefficient of friction between the insect and the surface is 1/3. If the line joining the centre of the hemispherical surface to the insect makes an angle α with the vertical, the maximum possible value of $\cot\alpha$ will be-

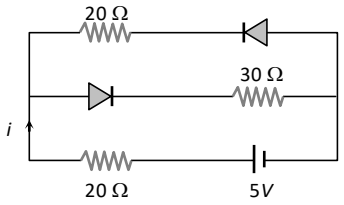


23. A particle of mass M at rest decays into two particles of masses m_1 and m_2, having non-zero velocities. The ratio of the de-Broglie wavelengths of the particles, λ_1 / λ_2 will be -

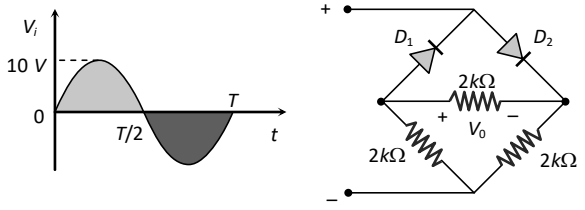
24. Atomic mass number of an element thorium is 232 and its atomic number is 90. The end product of this radioactive element is an isotope of lead (atomic mass 208 and atomic number 82). The number of alpha particles is x and beta particles is y then $\frac{10x}{y}$ will be

25. The half-life of ^{215}At is $100\mu s$. The time taken for the radioactivity of a sample of ^{215}At to decay to $1/16^{th}$ of its initial value is given by $10\ x\ \mu s$, then the value of x is

26. Current in the circuit is given by $\frac{z}{10}$ then the value of z will be



27. In the circuit shown in figure the maximum output voltage V_0 is (in volts)



28. Diameter of a plano–convex lens is 6 *cm* and thickness at the centre is 3 *mm*. If the speed of light in the material of the lens is 2×10^8 *m/sec*, the focal length (in cm) of the lens will be

29. Two simple pendulums whose lengths are 100 *cm* and 121 *cm* are suspended side by side. Their bobs are pulled together and then released. After how many minimum oscillations of the longer pendulum, will the two be in phase again

30. The ionisation potential of H-atom is $13.6V$. When it is excited from ground state by monochromatic radiations of 970.6Å, the number of emission lines will be (according to Bohr's theory)

CHEMISTRY

Section - A

Single Choice Question

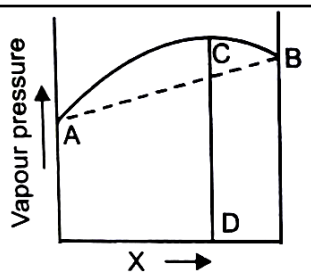
31. The vapour pressure of a pure liquid A is 40 mm Hg at 310 K. The vapour pressure of this liquid in a solution with liquid B is 32 mm Hg, Mole fraction of A in solution is :
(a) 0.8 (b) 0.5 (c) 0.2 (d) 0.4

32. Vapour pressure of C_6H_6 and C_7H_8 mixture of 50^oC is given by P (mm Hg) = 180 X_B + 90, where X_B is the mole fraction of C_6H_6. A solution is prepared by mixing 936 gm benzene and 736 gm toluene what is mole fraction of benzene in vapour phase:
(a) $Y_B = 0.82$ (b) $Y_B = 0.72$
(c) Y_B 0.37 (d) $Y_B = 0.42$

33. Water and ethanol form non-ideal solution with positive deviation from Raoult's law. This solution will have vapour pressure :
(a) equal to vapour pressure of pure water
(b) less than vapour pressure of pure water
(c) more than vapour pressure of pure water
(d) less than vapour pressure of pure ethanol

34. Azeotropes are :
(a) liquid mixtures which distill unchanged in composition
(b) liquids which can mix with each other in all proportions
(c) solids which form solid solutions of definite composition
(d) gases which can be separated

35. The diagram given below is a vapour pressure-composition diagram for a binary solution of A and B. In the solution, (A-B) interaction are :



(a) similar to A – A and B – B interactions
(b) greater than A – A and B – B interactions
(c) smaller than A-A and B-B interactions
(d) unpredictable

36. Calculated the ebullioscopic constant for water. The heat of vaporization is 40.685 kJ mol^{-1} .
(a) 0.512 K Kg mol^{-1} (b) 1.86 K kg mol^{-1}
(c) 5.12 K kg mol^{-1} (d) 3.56 K kg mol^{-1}

37. If n moles of a solute are dissolved in *w* gm of water. If K_f is the molal depression constant of water, the freezing point of the solution (^oC) will be :
(a) $\frac{1000K_f \times n}{w}$ (b) $-\frac{1000K_f \times n}{w}$
(c) $\frac{1000K_f \times w}{n}$ (d) $-\frac{1000K_f \times w}{n}$

38. When one mole of an ideal gas absorbs 80 kJ heat and gas is expanded from 2 L to 10 L at constant pressure of 25 bar. What is ΔU of gas in the process ?
(a) 100 KJ (b) 280 KJ
(c) 60 kJ (d) 120 kJ

39. A monoatomic gas $\left(C_v = \frac{3R}{2}\right)$ is allowed to expand adiabatically and reversibly from initial volume of 8L at 300 K to a final volume V_2 at 75 K. V_2 is :
(a) 8 L (b) 64L (c) 50 L (d) 4 L

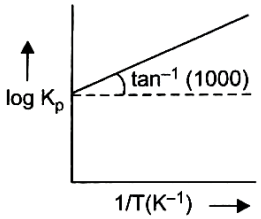
40. A pressure $A \rightarrow B$ is difficult to occur directly instead it takes place in three successive steps.

$C \rightarrow D$ $\Delta S(A \rightarrow C) = 50$ e.u.
$\uparrow$ $\downarrow$ $\Delta S(C \rightarrow D) = 30$ e.u.
A B $\Delta S(B \rightarrow D) = 20$ e.u.

Where e.u. is entropy unit.
Then the entropy change for the process $\Delta S(A \rightarrow B)$ is :
(a) +100 e.u. (b) -60 e.u.
(c) -100 e. u. (d) +60 e.u.

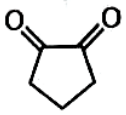
41. The entropy will usually increase when :
I. a molecule is broken into two or more smaller molecules.
II. a reaction occurs that results in an increase in the number of moles of gas .
III. a solid changes to a liquid.
IV. a liquid changes to a gas.
(a) I only (b) III only
(c) IV only (d) I, II, III, and IV

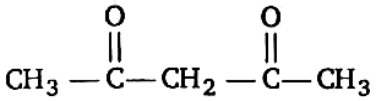
42. Following graph for the reaction is given. What is enthalpy of reaction $(\Delta_r H^o)$?

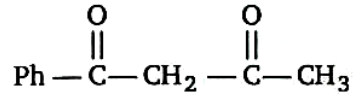


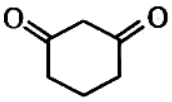
(a) -4.606 cal (b) +4.606 cal
(c) -4.606 kcal (d) -2 kcal

43. Maximum number of α-hydrogen that are present to form enol :

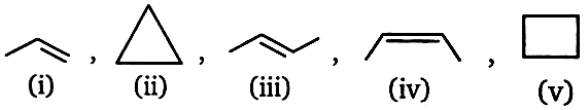
(a) 

(b) 

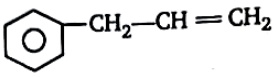
(c) 

(d) 

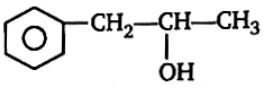
44. Which of the following pair represent ring chain isomerism?

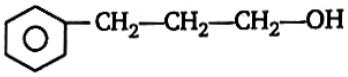


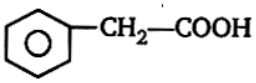
(a) (i,iii)
(b) (ii,v), (iii, iv)
(c) (i,ii), (iii, iv), (iv, v)
(d) (i, ii), (iii, v), (iv, v)

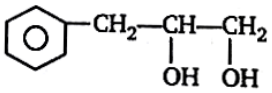
45. 

On mercuration demercueration produces the major product:

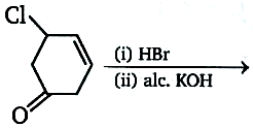
(a) 

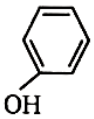
(b) 

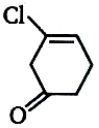
(c) 

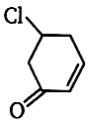
(d) 

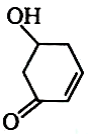
46. The major product of the following reactions is :



(a) 

(b) 

(c) 

(d) 

47. Which one of the following alkenes when treated with HCl yields majorly an anti-Markownikoff product ?

(a) $F_3C-CH=CH_2$ (b) $Cl-CH=CH_2$

(c) $CH_3O-CH=CH_2$ (d) $H_2N-CH=CH_2$

48. The major product of the following reaction is

$$CH_3C\equiv CH \xrightarrow[(ii)\,DI]{(i)\,DCl(1equiv.)}$$

(a) $CH_3CD(Cl)CHD(I)$ (b) $CH_3CD_2CH(Cl)(I)$

(c) $CH_3CD(I)CHD(Cl)$ (d) $CH_3C(I)(Cl)CHD_2$

49. Match the complexes in Column I with their properties listed in Column II

	Column I		Column II
(A)	$[Co(NH_3)_4(H_2O)_2]Cl_2$	(p)	Geometrical isomers
(B)	$[Pt(NH_3)_2Cl_2]$	(q)	Paramagnetic
(C)	$[Co(H_2O)_5Cl]Cl$	(r)	Diamagnetic
(D)	$[Ni(H_2O)_6]Cl_2$	(s)	Metal ion with +2 oxidation state

(a) $A\to p,q,s;B\to q,s;C\to p,r,s;D\to q,r$

(b) $A\to p,q,s;B\to p,r,s;C\to q,s;D\to q,r$

(c) $A\to p,r,s;B\to p,q,s;C\to q,s;D\to q,r$

(d) $A\to p;B\to q,r\ C\to q,s;D\to q,r$

50. Which one of the following high-spin complexes has the largest, CFSE (Crystal field stabilization energy)

(a) $[Mn(H_2O)_6]^{2+}$ (b) $[Cr(H_2O_6)]^{2+}$

(c) $[Mn(H_2O)_6]^{3+}$ (d) $[Cr(H_2O)_6]^{3+}$

SECTION - B

Integer Type Questions

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

52. When one mole of salt AB is dissolved in water at 300K, 3.7 kJ of heat is absorbed, ΔS of the process is -8.3 kJ. What is the value of ΔS for the dissolution process in J/K ?

53. The enthalpies of atomization of $CH_4(g)$ and $C_2H_6(g)$ are respectively 400 kJ mol^{-1} and 670 kJ mol^{-1}. The value of ΔH_{C-C} would be :

54. The value of $\log_{10}$ K for a reaction $A\rightleftharpoons B$ is (Given : $\Delta_rH^o_{298K}=-54.04\,kJ\,mol^{-1}$, $\Delta_rS^o_{298K}=10JK^{-1}mol^{-1}$, and R = 8.314 JK^{-1} mol^{-1})

55. For the following reversible reaction

$$N_2O_4(a)\rightleftharpoons 2NO_2(g)$$

Initially 5 moles each of N_2O_4 and NO_2 are taken at a temperature of 298 K and a pressure of 20 bar.

(Given: $\Delta G^o_f(N_2O_4)=100kJ/mol.$, $\Delta G^o_f(NO_2)=50kJ/mol$

Calculate ΔG^o of the reaction.

56. Total number of geometrical isomers for the complex $[RhCl(CO)(PPh_3)(NH_3)]$ is :

57. 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 :

58. Among $[Ni(CO)_4], [NiCl_4]^{2-}, [Co(NH_3)_4Cl_2]Cl$, $Na_3[CoF_6], Na_2O_2$ and CsO_2 the total number of paramagnetic compounds is :

59. Consider the following complex $[Co(NH_3)_5CO_3]ClO_4$. The coordination number (x), oxidation number (y) number of d-electrons (z) and number of unpaired d-electrons (w) on the metal are respectively

$x + y + z + w = ?$

60. Which of the following complexes are more stable due to sidgwick rule. ?

(a) $Fe(CO)_5$ (b) $Co_2(CO)_8$

(c) $Fe(C_5H_5)_2$ (d) $[K_3Fe(CN)_6]$

(e) $Fe(NO)_2(CO)_2$ (d) $[CoF_6]^{4-}$

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 $f(x) = \begin{cases} \sin x & , x \neq n\pi \\ 0 & , other\ wise \end{cases}, n \in Z$

$g(x) = \begin{cases} x^2 + 1 & , \quad x \neq 0, 2 \\ 4 & , \quad x = 0 \\ 5 & , \quad x = 2 \end{cases}$, then $\lim\limits_{x\to 0} g\{f(x)\} =$

(a) 1 (b) 0

(c) $\frac{1}{2}$ (d) $\frac{1}{4}$

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) $\frac{1}{2}$ (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) $\frac{1}{2}$ (c) $\frac{1}{3}$ (d) $\frac{1}{4}$

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) $\frac{\pi r^2}{4}$ (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. Let z be a complex number such that $\left|\frac{z-i}{z+2i}\right|=1$ and $|z|=\frac{5}{2}$. Then the value of $|z+3i|$ is

(a) $\sqrt{10}$ (b) $\frac{7}{2}$ (c) $\frac{15}{4}$ (d) $2\sqrt{3}$

76. Let p, q $\in$ R. If $2-\sqrt{3}$ is a root of the quadratic equation, $x^2 + px + q = 0$, then

(a) $q^2+4p+14=0$ (b) $p^2-4p-12=0$

(c) $q^2-4p-16=0$ (d) $p^2-4p+12=0$

77. The number of integral values of m for which the quadratic expression, $(1 + 2m)\ x^2 - 2(1+3m)x + 4\ (1 + m)$, $x \in R$, is always positive is

(a) 8 (b) 7 (c) 3 (d) 6

78. If the term independent of x in the expansion of $\left(\frac{3}{2}x^2-\frac{1}{3x}\right)^9$ is k, then 18 k is equal to

(a) 5 (b) 9 (c) 7 (d) 11

79. If the coefficients of the three successive terms in the binomial expansion of $(1 + x)^n$ are in the ratio 1 : 7 : 42, then the first of these terms in the expansion is

(a) 6th (b) 7th (c) 8th (d) 9th

80. Let the sum of the first three terms of an A.P. be 39 and the sum of its last four terms be 178. If the first term of this A.P. is 10, then the median of the A.P. is

(a) 26.5 (b) 28 (c) 29.5 (d) 31

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 $f: R \to R$ 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 $f(x)=\begin{cases}x+2, & x<0\\ x^2, & x\ge 0\end{cases}$ 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 $3x^4+4x^3-12x^2+4=0$ _____.

85. Let $a_1, a_2, a_3, \ldots a_n, \ldots$ be in A.P. If $a_3 + a_7 + a_{11} + a_{15} = 72$, and the sum of its first 17 terms is equal to k then $\frac{k}{6}$ is .

86. Let $a, b, \in$R, $b \neq 0$. Define a function

$$f(x)=\begin{cases}a\sin\frac{\pi}{2}(x-1), & \text{for } x\le 0\\ \frac{\tan 2x-\sin 2x}{bx^3}, & \text{for } x>0\end{cases}$$

If f is continuous at x = 0, then 10 – ab is equal to _____.

87. The maximum area (in sq. units) of a rectangle having it base on the x-axis and its other two vertices on the parabola, y = 12 – x^2 such that the rectangle lies inside the parabola, is

88. Let M and m be respectively the absolute maximum and the absolute minimum value of the function, $f(x)=2x^3-9x^2+12x+5$ in the interval [0, 3]. Then M – m is equal to

89. Let AD and BC be two vertical poles at A and B respectively on a horizontal ground. If AD = 8 m, BC = 11 m and AB = 10 m; then the distance (in meters) of a point M on AB from the point A such that $MD^2 + MC^2$ is minimum is _____.

90. The minimum value of α for which the equation $\frac{4}{\sin x}+\frac{1}{1-\sin x}=\alpha$ has at least one solution in $\left(0,\frac{\pi}{2}\right)$ is _____.