**Time: 3 hour**

# CCT - 4 (JEE MAINS)

**DATE: 27.11.2023**
**M. MARKS: 300**

**TOPICS**

**PHYSICS:** FULL SYLLABUS
**CHEMISTRY:** FULL SYLLABUS
**MATHEMATICS:** FULL SYLLABUS

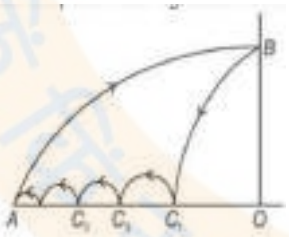
**INSTRUCTIONS**

1. Duration of Test is 3hrs.
2. The Test booklet consists of 90 questions. The maximum marks are 300.
3. There are three parts in the question paper A, B, C consisting of Physics, Chemistry and Mathematics having 30 questions in each part of equal weightage. Each part has two sections.
   **(i) Section-I:** This section contains 20 multiple choice questions which have only one correct answer. Each question carries 4 marks for correct answer and -1 mark for wrong answer.
   **(ii) Section-II:** This section contains 10 questions. In Section II, attempt any five questions out of 10. The answer to each of the questions is a numerical value. Each question carries 4 marks for correct answer and there is no negative marking for wrong answer.

## PHYSICS

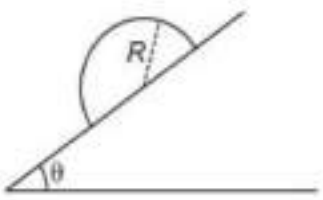
### SECTION – A
### (Single Correct Type)

1. A ball was projected from point $A$ and it hit a vertical wall at point $B$ horizontally. From $B$ the ball flies to point $C_1, C_2, \ldots$ and finally comes back to the point $A$. The coefficient of restitution is $e$ for every collision. Find $e$, if the ball does not bounce up at all when it gets back to the point $A$



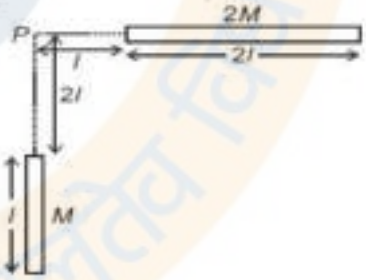

(1) $\frac{\sqrt{2}-1}{2}$ (2) $2-\sqrt{3}$
(3) $\sqrt{2}-1$ (4) $\frac{2}{\sqrt{2}+1}$

2. A uniform hemisphere of radius $R$ is placed on rough inclined plane. The coefficient of the friction between the surfaces is $\mu$. The angle of inclination $(\theta)$ of the plane is increased. The block will




(1) Topple before sliding if $\mu \geq \frac{8}{3}$
(2) Topple before sliding if $\mu \geq \frac{4}{3}$
(3) Slide before toppling if $\mu \geq \frac{8}{3}$
(4) Slide before toppling if $\mu \geq 3$

3. A rod of length $/$ and of mass $M$ and another rod of length $2/$ and mass $2M$ are arranged as shown below in the figure. The magnitude of gravitational field at point $P$ is

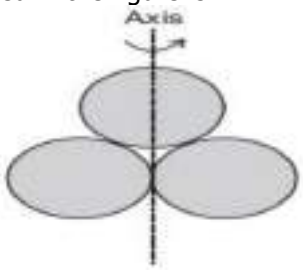



(1) $\frac{\sqrt{5}}{6}\frac{GM}{r^2}$ (2) $\frac{\sqrt{65}}{6}\frac{GM}{l^2}$ (3) $\frac{\sqrt{17}}{6}\frac{GM}{l^2}$ (4) $\frac{3GM}{\sqrt{18}l^2}$

4. In the given arrangement, the pulleys and strings are ideal. The blocks are released from rest and it is found that block $A$ has speed $0.3\ \mathrm{m/s}$ after it has descended through a distance of $1\ \mathrm{m}$. The coefficient of friction $(\mu)$ is $(g = 10\ \mathrm{m/s^2})$

(1) 0.28 (2) 0.12 (3) 0.32 (4) 0.21

5. Three discs each of mass $m$ and radius $R$ are joined in a plane as shown in figure. The radius of gyration of this system about an axis indicated in the figure is

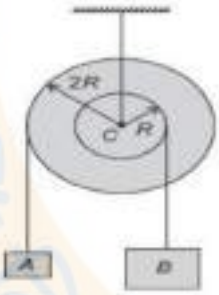



(1) $\sqrt{\frac{7}{12}}R$ (2) $\sqrt{\frac{11}{12}}R$ (3) $\sqrt{\frac{7}{16}}R$ (4) $\sqrt{\frac{5}{6}}R$

6. Three identical particles each of mass $m$ are at the vertices of an equilateral triangle of side length $I$. Two particles are fixed and third particle is released from rest under their gravitational force alone. The maximum speed of third particle in subsequent motion is given by

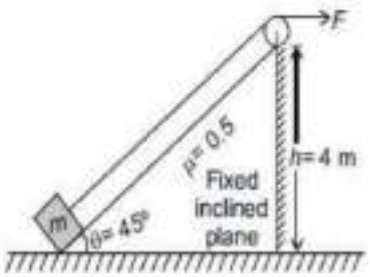
(1) $2\sqrt{\frac{Gm}{l}}$ (2) $\sqrt{\frac{Gm}{l}}$ (3) $\sqrt{\frac{2Gm}{1}}$ (4) $\sqrt{\frac{Gm}{2l}}$

7. In the given arrangement, a spool of moment of inertia $I_c = 4mR^2$ is connected with two blocks $A$ and $B$ of masses $2m$ and $3m$ respectively and released. Assuming there is no slipping anywhere, then the acceleration of block $A$ is



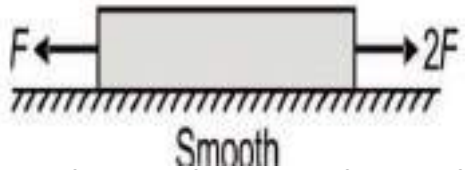

(1) $\frac{g}{5}$ (2) $\frac{2g}{7}$ (3) $\frac{2g}{15}$ (4) $\frac{4g}{13}$

8. A block of mass $m = 4$ kg is placed near the bottom of a rough $(\mu = 0.5)$ inclined plane as shown in figure. The minimum work done by applied force required to raise the block slowly to the top of inclined is $(g = 10\ \mathrm{m/s^2})$




(1) 80 J (2) 160 J (3) 240 J (4) 320 J

9. A uniform rod of mass $M$, length $L$ and crosssectional area $A$ moves under the action of two forces on a smooth surface as shown in figure. If Young's modulus of material of rod is $Y$, then elastic potential energy stored in the rod is

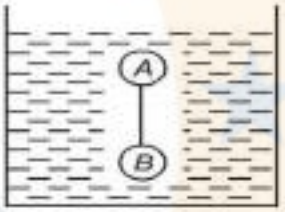



(1) $\frac{7FL^2}{3YA}$ (2) $\frac{3F^2L}{8YA}$ (3) $\frac{7F^2L}{6YA}$ (4) $\frac{13F^2L}{7YA}$

10. An ideal gas whose adiabatic exponent equals $\gamma$ is expanded so that $\Delta Q + \Delta U = 0$. Then the equation of the process in the variables $T$ and $V$ is

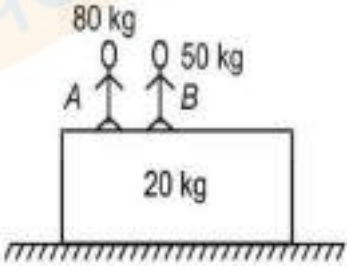
(1) $TV^{\frac{(\gamma-1)}{2}} = C$ (3) $TV^{\frac{(\gamma-1)}{4}} = C$
(2) $TV^{\frac{(\gamma-2)}{2}} = C$ (4) $TV^{\frac{(\gamma-2)}{4}} = C$

11. Two solid spheres $A$ and $B$ of equal volume but different densities, are connected with a string and placed inside a liquid. They are at equilibrium in the position shown in the figure. If the string is cut, then




(1) A may remain at rest
(2) $B$ may remain at rest
(3) A may move upwards with acceleration more than $g$
(4) B may move downwards with acceleration more than $g$

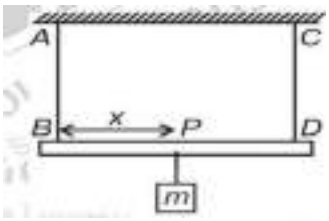
12. Two persons, $A$ of mass $80$ kg and $B$ of mass $50$ kg are standing on a horizontal platform of mass $20$ kg. The platform is on horizontal frictionless surface and is initially at rest




If both $A$ and $B$ jump (horizontally) from platform simultaneously and in same direction with $2$ m/s each, what would be the velocity of centre of mass of the system of persons and platform?

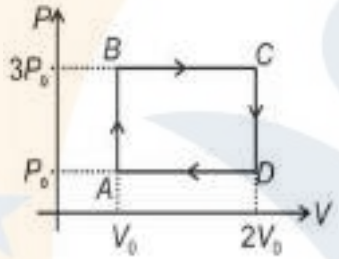
(1) $1.4$ m/s (2) $3.2$ m/s
(3) $2.8$ m/s (4) Zero

13. A massless rod $BD$ (length $= l$ ) is suspended by two identical massless strings $AB$ and $CD$ of equal lengths. A block of mass $m$ is suspended at point $P$. If the fundamental frequency of the left wire is 3 times the fundamental frequency of right wire then determine the value of $x$




(1) $\frac{l}{5}$ (2) $\frac{31}{5}$ (3) $\frac{91}{10}$ (4) $\frac{1}{10}$

14. One mole of an ideal gas $\left(\frac{C_p}{C_v}=\frac{4}{3}\right)$ undergoes a cyclic process $ABCD$, shown by the following indicator diagram. The pressure and volume at certain points have been marked. The temperature of the gas at state $A$ is $T_0$, given by the relation $T_0=\frac{P_0V_0}{R}$




The work done by the gas in one complete cycle is

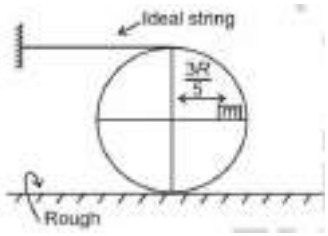
(1) $P_0V_0$ (2) $2P_0V_0$ (3) $3P_0V_0$ (4) $4P_0V_0$

15. Graph between spectral emissive power $(\varepsilon_\lambda)$ and wavelength $\lambda$ for a black body at temperatures $T_1$ K and $T_2$ K as shown in figure


If area of $\varepsilon_\lambda-\lambda$ graph at $T_2$ K is 4 times the area at $T_1$ K, then

(1) $T_1:T_2=1:\sqrt{2}$ (2) $T_1:T_2=1:2$
(3) $\lambda_1:\lambda_2=2:1$ (4) $\lambda_1:\lambda_2=1:\sqrt{2}$

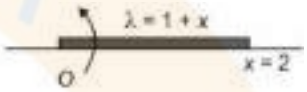
16. Consider a ring of mass $m$ and radius $R$ with four light spokes. A point mass $m$ is placed on one horizontal spoke. (see the figure)




If the shown system is at rest then minimum value of coefficient of friction will be

(1) $\frac{3}{20}$ (2) $\frac{1}{10}$ (3) $\frac{1}{4}$ (4) $\frac{2}{5}$

17. A rod of length $2$ m has uniform crosssection but linear mass density varies as $\lambda=(1+x)$kg/m. It is placed as shown in figure. The moment of inertia of rod about an axis passing through $O$ and perpendicular to rod is ( $x$ is in metre)




(1) $\frac{5}{3}$ kg m$^2$ (2) $\frac{20}{3}$ kg m$^2$
(3) $\frac{3}{5}$ kg m$^2$ (4) $\frac{8}{3}$ kg m$^2$

18. A trolley accelerates uniformly from rest and acquires the speed of $72$ km h$^{-1}$ on moving $200$ m distance, henceforth breaks are applied so that it retards the trolley at a rate which is proportional to the velocity, until its speed is halved, by covering $400$ m distance further. The total time of motion described of the trolley from the start (approximately)

(1) $60$ s (2) $68$ s (3) $48$ s (4) $42$ s

19. An ideal gas undergoes a thermodynamic process in which internal energy of the gas depends on pressure of the gas as $U=aP^4$, where $a$ is a positive constant. Assuming gas to be monoatomic, the molar heat capacity of the gas for given process will be

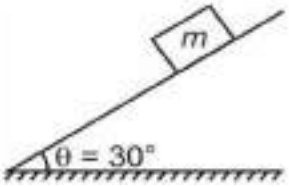
(1) $\frac{3R}{4}$ (2) $\frac{2R}{3}$ (3) $\frac{9R}{4}$ (4) $\frac{4R}{9}$

20. For an SHM oscillator, the amplitude is $5$ cm and its time period is 4 seconds. The minimum time taken by the particle to pass between points which are at distances $4$ cm and $3$ cm from the centre of oscillation on the same side of it will be
(1) 0.13 second (2) 0.18 second
(3) 0.26 second (4) 0.35 second

## SECTION – B
## (Integer/Numerical Type)

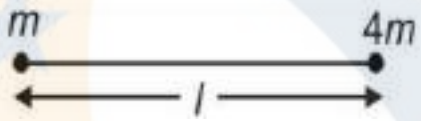
21. A block of mass $m$ is placed over rough inclined plane having inclination $30°$. The coefficient of

friction between the block and inclined plane is 0.75 . The contact force on the block is $\frac{x}{4}$mg. Find the value of $x$



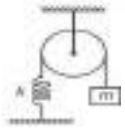

22. The moment of inertia of a system of four rods each of length $\ell$ and mass $M$ making a square about the axis $AA'$ shown in figure is $\frac{kM\ell^2}{3}$. Find the value of $k$.(Axis $AA'$ is in the plane of the square)


23. Two particles having masses $m$ and $4m$ are separated by distance $l$. The distance of centre of mass from $m$ is $x_1$ and $x_2$ is the distance of point (from $m$ ) at which gravitational field intensity is zero. The ratio of $\frac{x_1}{x_2}=\frac{k}{5}$. Find the value of $k$




24. The ratio of time period of oscillation of block in figure 1 and figure 2 is

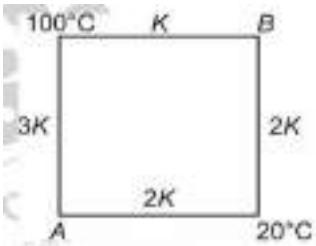
Fig 1



Fig

(Note : All the springs are ideal and surfaces are smooth and pulley is massless)

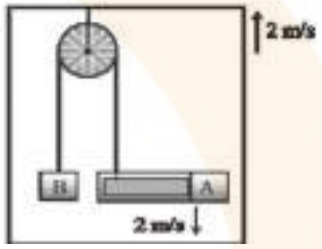
25. Four rods identical in all respect other than their thermal conductivity are joined to form a square loop. The thermal conductivity of rods are shown in the figure. The ratio of temperatures of point $A$ and $B$ (in steady state) is $\frac{k}{35}$. Find the value of $k$.(Other two ends are maintained at $100^\circ C$ and $20^\circ C$ ]




26. A point $P$ is located on the rim of wheel of radius $r = 0.5$ m which rolls without slipping along a horizontal surface then the total distance traversed by the point P in meters between two successive moments it touches the surface.

27. A spherical ball of radius $r$ and density $d$ is dropped from rest in a viscous, fluid having density $\rho$ and coefficient of viscosity is $\eta$. Then the power of gravitational force acting on the ball at a time $t$ after it is dropped is $\frac{x\pi}{27}\frac{d(d-\rho)}{\eta}g^2r^5\left[1-e^{-\frac{9\pi t}{2dr^2}}\right]$.Find $x$.

28. In the figure shown, the velocity of lift is $2$ m/s while string is winding on the motor shaft with velocity $2$ m/s and block $A$ is moving downwards with a velocity of $2$ m/s, the velocity of block $B$ in m/s is-




29. Two blocks A and B of equal mass m are connected through a massless string and arranged as shown in figure. Friction is absent everywhere. When the system is released from rest, then find the tension in string. Where m is $2$ kg. $(g = 10\ m/s^2)$


30. A rectangular block of copper $(K = 0.9)$ of thickness $10$ cm and area of cross section $20$ cm$^2$ has one of its faces maintained at a constant temperature of $100^\circ C$ while the opposite face is in contact with ice at $0^\circ C$. If there is no loss of heat, the amount of ice that melts in 20 minutes is $-$kg

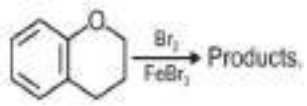
## CHEMISTRY

### SECTION – A
### (Single Correct Type)

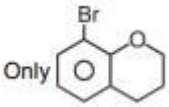
31. $250$ mL of $KHC_2O_4$ required $100$ mL of $0.1M$ $KMnO_4$ solution in acidic medium for complete oxidation. If the same $250$ mL of $KHC_2O_4$ is neutralised completely using $0.2MKOH$ solution,

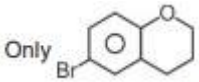
then the volume of KOH solution (in mL ) used is

(1) 100 mL (2) 50 mL
(3) 125 mL (4) 150 mL

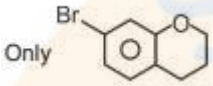
32. 


Products of given reaction is/are

(1) 


(2) 


(3) Mixture of (1) and (2)

(4) Only 


33. At $20^{\circ}C$, the concentration of $Ag^{+}$ions in a saturated solution of $Ag_2CrO_4$ is $1.5 \times 10^{-4}$ mol/L. The solubility product of $Ag_2CrO_4$ at $20^{\circ}C$ will be

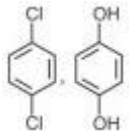
(1) $2.25 \times 10^{-8}$ (2) $1.687 \times 10^{-12}$
(3) $1.658 \times 10^{-13}$ (4) $13.5 \times 10^{-16}$

34. The correct order of increasing s-character (in percentage) in the hybrid orbitals of central atom in following molecules/ions is

(I) $CO_3^{2-}$ (II) $XeF_4$ (III) $l_3^-$
(IV) $NH_3$ (V) $NO_2^+$

(1) II < III < IV < I < V
(2) II < IV < III < V < I
(3) III < II < I < V < IV
(4) II < IV < III < I < V

35. In which pair the dipole moment of first species is greater than second?

(1) $NH_3, NF_3$
(2) $BF_3, BCl_3$
(3) trans-but-2-ene, cis-but-2-ene
(4) 


36. Two mole of an ideal monoatomic gas expands isothermally and reversibly from 10 L to 50 L at $27^{\circ}C$. From the following select the correct option (Use $\ln 5 = 1.6$, notation have their usual meaning)

(1) $W = -0.96kcal$
(2) $\Delta S_{Total} = -3.2cal/K$
(3) $\Delta S_{sys} = 6.4cal/K$
(4) $q_{sys} = -0.96kcal$

37. The Prussian blue colour obtained during the test of nitrogen by Lassaigne's test is due to the formation of

(1) $Fe_4[Fe(CN)_6]_3$ (2) $Na_3[Fe(CN)_6]$
(3) $Fe_3[Fe(CN)_6]_2$ (4) $Na_4[Fe(CN)_5NOS]$

38. If the radius of first Bohr orbit for hydrogen atom is $x$, then de-Broglie wavelength of electron in $4^{th}$ orbit of H atom is nearly

(1) $\pi x$ (2) $2\pi x$ (3) $6\pi x$ (4) $8\pi x$

39. $A + 2\ B \rightleftharpoons 2C + D$
The initial conc. of $B$ is 1.5 times the initial conc. of $A$. At equilibrium, conc. of $A$ is equal to B. The equilibrium constant $K_c$ is

(1) 2 (2) 8 (3) 4 (4) 9

40. The ionic radii of $Fe^{2+}$ and $Fe^{3+}$ are x and yrespectively the correct relationship between x and $y$ is

( $x > y$ (2) $x < y$
(3) $x = y$ (4) can't be predicted

41. Bond order of $CO^+$and $N_2^+$are respectively

(1) 3.5 and 2.5 (2) 2.5 and 2.5
(3) 3 and 2.5 (4) 2.5 and 3

42. An open vessel at $27^{\circ}C$ contains 28 grams of $H_2$. Its temperature increases upto $127^{\circ}C$. What fraction of moles of $H_2$ gas escapes out of vessel?

(1) $\frac{1}{8}$ (2) $\frac{1}{4}$ (3) $\frac{2}{3}$ (4) $\frac{3}{4}$

43. IUPAC nomenclature of the given organic compound will be;

(1) 2, 3,6-Trimethylbicyclo [3. 1.1] hept-2-ene
(2) 2, 5-Dimethyl bicyclo [3. 1. 1] hept-4-ene
(3) 2,6,6-Trimethylbicyclo [3.2.2] hept-4-ene
(4) 2,6,6-Trimethylbicyclo [3.1.1] hept-2-ene

44. The molarity of 20ml of 10 $VH_2O_2$ is

(1) 0.45M (2) 0.89M
(3) 1.33M (4) 11.2M

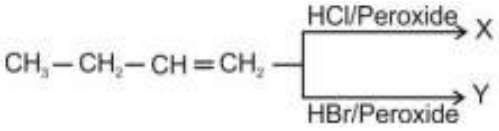
45. For the reaction

$$CH_3 - CH_2 - CH = CH_2 \xrightarrow{Br_2/CCl_4} x \xrightarrow{2NaNH_2/\Delta} y$$
(P)

The incorrect statement is

(1) y has same degree of unsaturation as that of reactant $(P)$
(2) $x$ is formed by anti-addition
(3) $pK_a$ of $y$ is less than that of reactant (P)
(4) $x$ is vicinal di-halide

46. Consider the following reactions




If $X$ and $Y$ represents the major product of the respective reaction then select the correct statement.
(1) Both $X$ and $Y$ are formed by radical mechanism
(2) $X$ is formed by radical mechanism while $Y$ is formed by ionic mechanism
(3) Both $X$ and $Y$ are $2^{\circ}$-alkyl halide
(4) $X$ is $2^{\circ}$ - alkyl halide while $y$ is $1^{\circ}$-alkyl halide

47. The equivalent mass of $Na_2\ S_2O_3$ (molar mass $= M$ ) when it reacts with $I_2$ in acidic medium is
(1) $M$ (2) $\frac{M}{8}$ (3) $\frac{M}{2}$ (4) $\frac{M}{4}$

48. $S_8(s) + 12OH^-(aq) \rightarrow 4\ S^{-2}(aq) + 2\ S_2O_3^{-2} + 6H_2O(l)$ belongs to which class of redox reactions?
(1) Combination reaction
(2) Decomposition reaction
(3) Disproportionation reaction
(4) Displacement reaction

49. How many spectral lines are emitted from a sample of hydrogen gaseous atoms when electrons present in $n^{th}$ energy level return to ground state?
(1) $n(n+2)$ (2) $\frac{n(n-1)}{2n}$
(3) $\frac{n(n-1)}{2}$ (4) $\frac{n(n+2)}{2}$

50. $CFCl_3$ is responsible for the decomposition of ozone to oxygen. Which of the following species reacts with ozone to form dioxygen?
(1) $Cl_2$ (2) $Cl^-$ (3) $Cl^{\circ}$ (4) $F^-$

## SECTION – B
## (Integer/Numerical Type )

51. Consider the following data:
$\Delta H_f^{\circ}(CO_2, g) = -390\ kJ/mol$
$\Delta H_f^{\circ}(H_2O, l) = -290\ kJ/mol$
$\Delta H_c^{\circ}(C_2H_4O, g) = -1400\ kJ/mol$
The magnitude of standard heat of formation of $C_2H_4O(g)$ is (in $kJ/mol$ )[f-formation and c-combustion]

52. X ml of 10 volume $H_2O_2$ solution are required that decolourise $200ml$ of $2\ NKMnO_4$ solution in acidic medium. The value of $\frac{X}{4}$ is

53. Calculate the moles of calcium oxide required to react with $568\ g$ of $P_4O_{10}$.

54. Oxidation state of $Xe$ in $Ba_2XeO_6$ is

55 The bond energy of $N \equiv N, N = N, O = O$ and $N = O$ are $946,418,498$ and $607\ kJ/mole$ and $\Delta H_f^{\circ}$ of $N_2O = 82\ kJ/mol$. The magnitude of resonance energy of $N_2O$ is (in $kJ/mol$ )

56. Number of water molecules per formula of Epsom salt is

57. If ethyl benzene is monochlorinated, how many different products (excluding stereoisomers) would be obtained?

58. Find number of electrons in phosphorous $(_{15}P)$ which have angular momentum equal to $\frac{h}{\sqrt{2\pi}}$

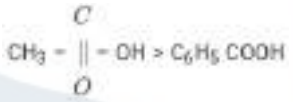
59. Number of grams of bromine that will completely react with $5.0\ g$ of pent-1-ene is $\times 10^{-2}\ g$. (Atomic mass of $Br = 80\ g/mol$ [Nearest integer]

60. How many has correct order of acidic strength?

Phenol $< H_2O$

$CH \equiv CH > H_2O$

$NH_3 > Ph_3CH$




# MATHEMATICS

## SECTION – A
## (Single Correct Type)

61. If the equations $ax^2 + 2bx + 3c = 0$ and $3x^2 + 8x + 15 = 0$ have a common root, where $a, b, c$ are the lengths of sides of a triangle $ABC$, then $(\sin^2 A + \sin^2 B + \sin^2 C)$ is equal to
(1) 1 (2) $\frac{3}{2}$ (3) $\frac{5}{2}$ (4) 2

62. Triangles are formed by joining the vertices of a regular polygon of 20 sides. The probability that no side of the polygon is a side of the triangle, is
(1) $\frac{25}{57}$ (2) $\frac{30}{57}$ (3) $\frac{35}{57}$ (4) $\frac{40}{57}$

63. The value of $\lim_{n\to\infty} \sum_{r=1}^{n} \frac{r}{r^4+r^2+1}$ is equal to
(1) Zero (2) $\frac{1}{3}$ (3) $\frac{1}{2}$ (4) 1

64. The focus of the parabola $(y-3)^2 = 8(x+2)$ is

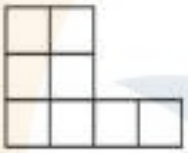
(1) $(2,0)$ (2) $(0,3)$ (3) $(0,2)$ (4) $(3,0)$

65. The centres of the circles $x^2+y^2=1, x^2+y^2+6x-2y-1=0$ and $x^2+y^2-12x+4y-1=0$ are
(1) The vertices of an equilateral triangle
(2) The vertices of a right-angled triangle
(3) The vertices of an isosceles triangle
(4) Collinear

66. The normal to the rectangular hyperbola $xy=4$ at the point $t_1$ meets the curve again at the point $t_2$. Then the value of ${t_1}^3 t_2$ is
(1) 1 (2) 2 (3) -2 (4) -1

67. The locus of the point representing the complex number $z$ for which $|z+10i|^2-|z-10i|^2=20$, is (where $i=\sqrt{-1}$ )
(1) A circle (2) A straight line
(3) A parabola (4) A hyperbola

68. The number of ways in which the letters of the word RAMESH can be placed in the squares of the given figure so that no row remains empty, is



(1) 17280 (2) 18720
(3) 15840 (4) 14400

69. The sum of the series ${}^{2020}C_0-{}^{2020}C_1+{}^{2020}C_2-{}^{2020}C_3+\cdots+{}^{2020}C_{1010}$ is
(1) $\frac{1}{2}{}^{2020}C_{1010}$ (2) ${}^{2020}C_{1010}$
(3) Zero (4) $\frac{-1}{2}{}^{2020}C_{1010}$

70. If $\sum_{i=1}^{9}(x_i-5)=9$ and $\sum_{i=1}^{9}(x_i-5)^2=45$, then the standard deviation of the nine items $x_1, x_2, \ldots, x_9$ is
(1) 2 (2) 3 (3) 4 (4) 9

71. The domain of $f(x)=e^{\sin(x-[x])}+[x]\cos\left(\frac{\pi}{[x+1]}\right)$, where $[\cdot]$ represents greatest integer function, is
(1) $R$ (2) $R-[-1,0]$
(3) $R-[0,1]$ (4) $R-[-1,0)$

72. If $1+\cos\alpha+\cos^2\alpha+\cos^3\alpha+\cdots+\infty=2-\sqrt{2}$, $(\pi<\alpha<2\pi)$, then the value of $\alpha$ is
(1) $\frac{5\pi}{4}$ (2) $\frac{7\pi}{4}$ (3) $\frac{4\pi}{3}$ (4) $\frac{5\pi}{3}$

73. Which of the following propositions is a contradiction?
(1) $(\sim p\vee\sim q)\vee(p\vee\sim q)$
(2) $(p\to q)\vee(p\wedge\sim q)$
(3) $(\sim p\wedge q)\wedge(\sim q)$
(4) $(\sim p\wedge q)\vee(\sim q)$

74. The point $A$ is symmetric to $B(4,-1)$ with respect to the bisector of the first quadrant then $AB$ is equal to
(1) 5 units (2) $4\sqrt{5}$ units
(3) $5\sqrt{2}$ units (4) $2\sqrt{5}$ units

75. Let $p$ and $q$ be two statements. Amongst the following, the statement that is equivalent to $p\to q$, is
(1) $p\wedge\sim q$ (2) $\sim p\wedge q$
(3) $\sim p\vee q$ (4) $p\vee\sim q$

76. If $A$ and $B$ are the vertices of the triangle $ABC$ and are given by $(2,5)$ and $(4,-11)$ respectively, and $C$ moves along the line $L\equiv -9x+7y+4=0$, then the locus of the centroid of the triangle $ABC$ is
(1) $9x+7y-8=0$
(2) $27x+21y-8=0$
(3) $7x-9y-8=0$
(4) $27x-21y=100$

77. The equation of the curve whose parametric equation is $x=2t-3$ and $y=4t^2-1$, is given by
(1) $y^2+6x-y+8=0$
(2) $x^2+6x-y+8=0$
(3) $x^2+y^2-6x-y-8=0$
(4) $x^2+y^2-6x+y-8=0$

78. The equation $\frac{x^2}{16-k}+\frac{y^2}{k-9}=1$ represents an ellipse if
(1) $k<9$ (2) $k>16$
(3) $k\in(9,16)-\left\{\frac{25}{2}\right\}$
(4) $k\in(-16,-9)-\left\{-\frac{25}{2}\right\}$

79. Let $\alpha,\beta$ be real and $z$ be a non-real complex number. If $z^2+\alpha z+\beta=0$ has two distinct roots on line $\mathrm{Re}(z)=1$, then it is necessary that
(1) $\beta\in(-1,0)$ (2) $|\beta|=1$
(3) $\beta\in(1,\infty)$ (4) $\beta\in(0,1)$

80. The value of $\lim_{x\to\infty}\left(\frac{x+5}{x-7}\right)^x$ is
(1) $e^{12}$ (2) $e^{-12}$ (3) 12 (4) -12

## SECTION – B
## (Integer/Numerical Type)

81. If the product of the roots of the equation $x^2-3kx+2e^{2\ln k}-1=0$ is 7 , then the roots of the equation are real for $k$ equal to

82. Total number of ways of selecting 10 balls out of unlimited number of white, red, blue and green balls given that balls of each colour are identical, is $11P$ then value of $P$ is

83. A fair die is rolled 5 times. The probability of getting third 6 in fifth throw is $\lambda$ then value of $6^4.\lambda$ is

84. If $n$ is the number of solutions of equation $|\cot x| = \cot x + \frac{1}{\sin x}; (0 < x < 2\pi)$, then $n$ equals

85. Variance of the following data $6,8,10,16,14$, $12,18,24,22,20$ is equal to

86. If $2\sin\theta + 3\cos\theta = 3$. Then $3\sin\theta - 2\cos\theta = k, (k > 0)$, then find out value of $k$.

87. The minimum and maximum distances of a point $(1,2)$ from the ellipse $4x^2 + 9y^2 + 8x - 36y + 4 = 0$ are $\lambda$ and $m$ then find the value of $(\lambda + m)^{m/\lambda} - (\lambda m + m^{\lambda})$

88. Sum of squares of modulus of all the complex numbers $z$ satisfying $\bar{z} = iz^2 + z^2 - z$ is equal to

89. The expression $(0.05)^{\log_{\sqrt{20}}(0.\overline{1})}$ is a perfect square of the natural number

90. In how many different ways can five boys and five girls form a circle such that the boys and girls are alternate?