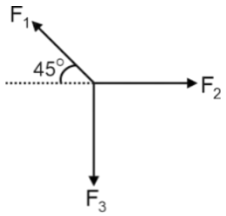
Physics

1. A stone is dropped into a quiet lake and waves move is circles spreading out radially at the speed of 5 cm/s. At the instant when the radius of the circular wave is 8 cm, how fast is the enclosed area increasing?
   (a) $80\,\pi\ cm^2/s$
   (b) $90\,\pi\ cm^2/s$
   (c) $85\,\pi\ cm^2/s$
   (d) $40\,\pi\ cm^2/s$

2. Three forces $\vec{F}_1, \vec{F}_2$ and $\vec{F}_3$ are represented as shown. Each of them is of equal magnitude.



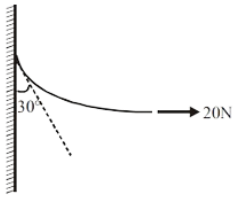
	List-I (Combination)		**List-II (Approximate Direction)**
(P)	$\vec{F}_1 + \vec{F}_2 + \vec{F}_3$	(1)	
(Q)	$\vec{F}_1 - \vec{F}_2 + \vec{F}_3$		
(R)	$\vec{F}_1 - \vec{F}_2 - \vec{F}_3$		
(S)	$\vec{F}_2 - \vec{F}_1 - \vec{F}_3$		

   (a) P-1, Q-2, R-3, S-4
   (b) P-2, Q-1, R-4, S-3
   (c) P-2, Q-3, R-1, S-4
   (d) P-4, Q-1, R-2, S-3

3. If K represents kinetic energy, v velocity and t time and these are chosen as the fundamental units then the dimension of surface tension in terms of K, v and t will be.
   (a) $[Kv^{-2}T^{-2}]$
   (b) $[Kv^2T^2]$
   (c) $[Kv^{-2}T^2]$
   (d) $[KvT^{-1}]$

4. A projectile is given an initial velocity of $(\hat{\imath} + 2\,\hat{\jmath})m/s$. The equation of its path is. $(g = 10\ m/s^2)$.
   (a) $y = 2x - 5x^2$
   (b) $y = x - 5x^2$
   (c) $4y = 2x - 5x^2$
   (d) $y = 2x - 25x^2$

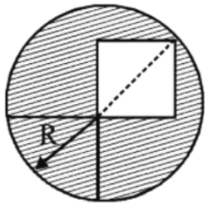
5. One end of a rope is fixed to a vertical wall and the other end is pulled by a horizontal force of 20N. The shape of the flexible rope is shown in figure. The mass of the rope is.



   (a) 2 kg
   (b) 3 kg
   (c) 3.5 kg
   (d) 4.5 kg

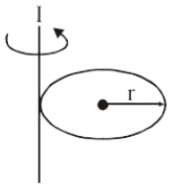
6. For a particle rotating in a vertical circle with uniform speed, the maximum and minimum tension in the string is in the ratio 5 : 3. If the radius of vertical circle is 2 m, the speed of revolving body is. $(g = 10\ m/s^2)$.
   (a) $\sqrt{5}m/s$
   (b) $4\sqrt{5}m/s$
   (c) $5\ m/s$
   (d) $10\ m/s$

7. From a circular disc of radius R, a square is cut out with a radius as its diagonal. The center of mass of remainder part is at a distance (from the center).



(a) $\frac{R}{(4\pi-2)}$
(b) $\frac{R}{2\pi}$
(c) $\frac{R}{(\pi-2)}$
(d) $\frac{R}{(2\pi-2)}$

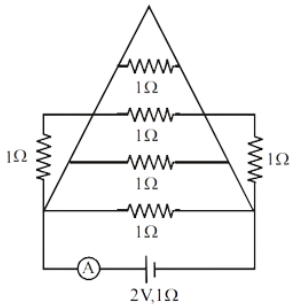
8. A solid sphere of radius R has moment of inertia I about its geometrical axis. It is melted into a disc of radius r and thinness t. If it's moment of inertia about the tangential axis (which is perpendicular to plane of the disc), is also equal to I, then the value of r is equal to.



(a) $\frac{2}{\sqrt{15}}R$
(b) $\frac{2}{\sqrt{5}R}$
(c) $\frac{3}{\sqrt{15}R}$
(d) $\frac{\sqrt{3}}{\sqrt{15}}R$

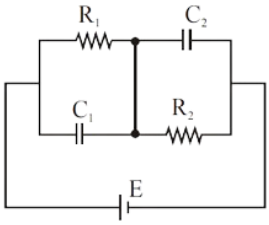
9. Two identical blocks are kept on a frictionless horizontal table and connected by a spring of stiffness 'k' and of natural length ℓ_0 . A total charge Q is distributed on the blocks in a way such that in equilibrium spring elongates by maximum value. If this value is equal to 'x' then value of Q is
(a) $2\ell_0\sqrt{4\pi\varepsilon_0 k(\ell_0+x)}$
(b) $2x\sqrt{4\pi\varepsilon_0 k(\ell_0+x)}$
(c) $2(\ell_0+x)\sqrt{4\pi\varepsilon_0 kx}$
(d) $(\ell_0+x)\sqrt{4\pi\varepsilon_0 kx}$

10. In the circuit shown in Figure the ammeter reads a current.



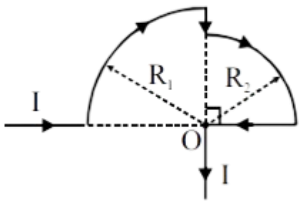
(a) 1 A
(b) 2 A
(c) 0.3 A
(d) 0.2 A

11. For the circuit shown in figure the ratio of energy stored in capacitor (1) to that of in capacitor (2) is.



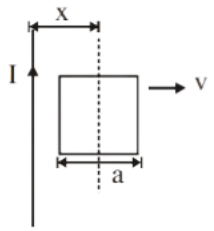
(a) $\frac{R_1C_1}{R_2C_2}$
(b) $\frac{R_1C_2}{R_2C_1}$
(c) $\frac{R_1^2C_1}{R_2^2C_2}$
(d) $\frac{R_1C_1^2}{R_2C_2^2}$

12. In the loop shown, the magnetic induction at the point 'O' is.



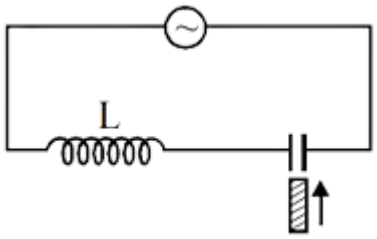
(a) $\frac{\mu_0 I}{8}\left(\frac{R_1-R_2}{R_1R_2}\right)$
(b) $\frac{\mu_0 I}{8}\left(\frac{R_1+R_2}{R_1R_2}\right)$
(c) $\frac{\mu_0 I}{8}\left(\frac{R_1R_2}{R_1+R_2}\right)$
(d) Zero

13. A conducting square frame of side a and a long straight wire carrying current I are located in the same plane as shown in the figure. The frame moves to the right with a constant velocity v. The emf induced in the frame will be proportional to.



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

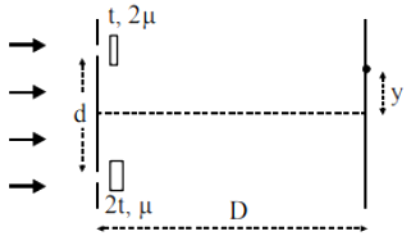
14. The resonant frequency of the L-C circuit is f_0 before insertion of the dielectric of $\varepsilon_r = 4$. After inserting the dielectric, the resonant frequency will be.



(a) $\frac{f_0}{2}$
(b) $2f_0$
(c) $\frac{f_0}{4}$
(d) $4\,f_0$

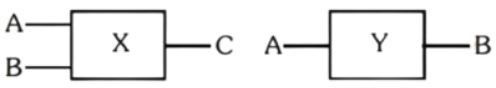
15. A point object on the principal axis at a distance 15 cm in front of a concave mirror of radius of curvature 20 cm has velocity 2 mm/s perpendicular to the principal axis. The velocity of image at that instant will be.
(a) 2 mm/s
(b) 4 mm/s
(c) 8 mm/s
(d) 16 mm/s

16. In the YDSE shown the two slits are covered with thin sheets having thickness t & 2t and refractive index 2μ and μ. Find the position (y) of central maxima.



(a) Zero
(b) $\frac{tD}{d}$
(c) $-\frac{tD}{d}$
(d) None

17. Logic gates X and Y have the following truth tables.



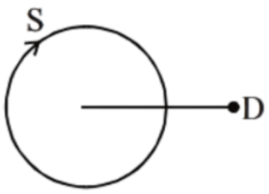
A	B	C
0	0	0
1	0	0
0	1	0
1	1	1

A	B
0	1
1	0

When the output of X is connected to the input Y, the resulting combination is equivalent to.

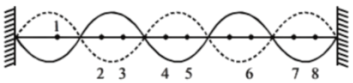
(a) NOR gate
(b) AND gate
(c) NAND gate
(d) OR gate

18. A source of sound moves along a circle of radius 2 m with constant angular velocity 40 radian/ s. Frequency of the source is 300 Hz. A detector is kept at some distance from the circle in the same plane of the circle (as shown in figure). Which of the following is not the possible value of frequency registered by the detector? (Speed of sound = 320 m/s).



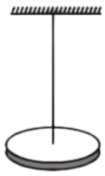
(a) 250 Hz
(b) 360 Hz
(c) 396 Hz
(d) 220 Hz

19. A stretched string is vibrating in its 5th harmonic as shown. Consider a particle 1 (figure). At an instant this particle is at mean positions and is moving towards its negative extreme. Which of the following set of particles, are in same phase with particle 1.



(a) 2, 4 , 7
(b) 3, 5, 6
(c) 5, 7, 8
(d) 2, 4, 6

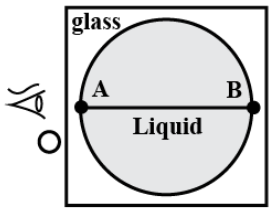
20. The moment of inertia of the disc used in a torsional pendulum about the suspension wire is $0.2\,kg-m^2$. It oscillated with a period of 2 sec. Another disc is placed over the first one and the time period of system becomes 4 sec, find the moment of inertia of the second disc.



(a) 0.8
(b) 0.6
(c) 0.4
(d) 0.2

INTEGER TYPE

21. The observer O' sees the distance AB as infinitely large. If refractive index of liquid is μ_1 and that of glass is μ_2, then $\frac{\mu_1}{\mu_2}$ is.

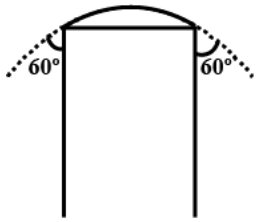


22. The coefficient of apparent expansion of a liquid when determined using two different vessels A and B are γ_1 and γ_2 respectively. If the coefficient of linear expansion of the vessel A is α_1, the coefficient of linear expansion of the vessel B is given by $\frac{a\gamma_1+b\gamma_2+c\alpha_1}{d}, then \quad (a+b+c+d) =$.....

23. A black body emits 10 watt per cm^{-2} at $427°C$. The sun radiates 10^5 watt per cm^2 . Then what is the temperature of the sun (in K) is.....

24. A soap bubble is being blown on a tube of radius 1 cm. The surface tension of the sap solution is $0.05\frac{N}{m}$ and the bubble makes an angle of 60° with the tube as shown. The excess of pressure (in Pa)

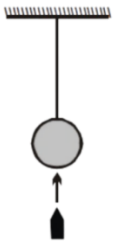
over the atmospheric pressure in the tube is.



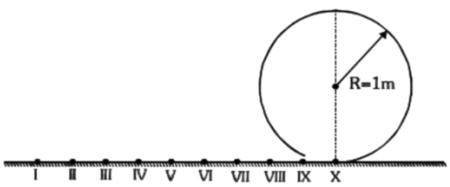
25. A car weighs 1800 Kg. the distance between its front and back axles is 1.8 m. Its center of gravity is 1.05 m behind the front axle, Force exerted (in N) by the level ground on each front wheel is.

26. A necklace weight 50 g in air but it weighs 46 g in water assume that copper is mixed with gold to prepare the necklace. Find how much copper (in g) is present in it. (Specific gravity of gold is 20 and that of copper is 10).

27. A bullet of mass 50 g is fired from below into the bob of mass 450 g of a long simple pendulum as shown in Figure. The bullet stays inside the bob and the bob rises through a vertical height 1.8 m. What was the speed of bullet (in m/s) when it striked the bob?



28. There are 10 small identical elastic balls placed at rest on a smooth horizontal surface as shown in figure. Find the least velocity (in m/s) which should be provided to the first ball such that 10th ball completes the circle. [$g = 9.8\ m/s^2$].



29. The electron in hydrogen atom in a sample is in 5^{th} excited state then the number of different spectrum lines obtained in its emission spectrum will be…….

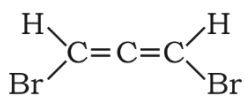
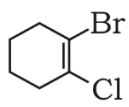
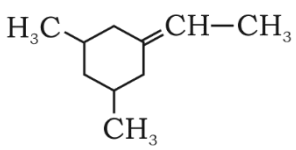
30. An experiment takes 10 minutes to raise the temperature of water in a container from $0°C$ to $100°C$ and another 55 minutes to convert it totally into steam by a heater supplying heat at a uniform rate. Neglecting the specific heat of the container and taking specific heat of water to be $1\ cal/g\,°C$, the heat of vapourization according to this experiment will come out to be……. cal/g

31. For a reaction, $A(s) + 2B^+ \longrightarrow A^{2+} + 2B(s)$ K_C has bee found to be 10^{12}. The $E°_{cell}$ is:
(a) 0.354 V
(b) 0.708 V
(c) 0.0098 V
(d) 1.36 V

32. Which of these reactions is Correct?
(a) $Cl^- + Br_2 \longrightarrow Br^- + Cl_2$
(b) Mohr's salt $\xrightarrow{\text{NaOH so ln.}}$ $NH_3\uparrow(g)$
(c) $K_2Cr_2O_7$ solution $\xrightarrow{SO_3}$ Green colour solution
(d) $FeCl_2 \xrightarrow{NaOH}$ (ppt. coloured) $\xrightarrow{\text{Excess NaOH}}$ Soluble complex

33. The hypothetical complex chloro diaquatriammine cobalt (III) chloride can be represented as:
(a) $[CoCl(NH_3)_3(H_2O)_2]Cl_2$
(b) $[Co(NH_3)_3(H_2O)Cl_3]$
(c) $[Co(NH_3)_3(H_2O)_2Cl]$
(d) $[Co(NH_3)_3(H_2O)_3]Cl_3$

34. An endothermic reaction A ⟶ B have an activation energy 15 kcal/mol and the heat of the reaction is 5 kcal/mol. The activation energy of the reaction B ⟶ A is:
(a) 20 kcal/mol
(b) 15 kcal/mol
(c) 10 kcal/mol
(d) Zero

35. Which of the following compound can show geometrical isomerism?
(a) $CH_3 - HC = CH_2$
(b) 
(c) 
(d) 

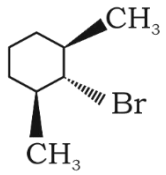
36. Phenol associates in benzene is
$C_6H_5OH \rightleftharpoons \frac{1}{2}(C_6H_5OH)_2$
If degree of association of phenol is 40%. Van't Hoff factor is:
(a) 1
(b) 0.8
(c) 1.4
(d) 0.6

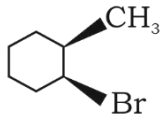
37. 5 moles of an ideal gas expand reversibly from a volume of 8 dm^3 to 80 dm^3 at a temperature of 27 °C. The change in entropy is:
(a) 41.57 JK^{-1}
(b) −95.73 JK^{-1}
(c) 95.73 JK^{-1}
(d) −41.57 JK^{-1}

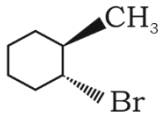
38. When 1.0 mL of dil. HCl acid is added to 100 mL of a buffer solution of pH 4.0. The pH of the solution
(a) Becomes 7
(b) Does not change
(c) Becomes 2
(d) Becomes 10

39. Ionisation enthalpy ($\Delta_i H_l$ kJ mol^{-1}) for the elements of Group 13 follows the order.
(a) B > Al > Ga > In > Tl
(b) B < Al < Ga < In < Tl
(c) B < Al > Ga < In > Tl
(d) B > Al < Ga > In < Tl

40. **Statement I:** CrO_3 reacts with HCl to form chromyl chloride gas.
Statement II: Chromyl chloride (CrO_2Cl_2) has tetrahedral shape.
(a) Both Statement I and Statement II are true and Statement II is the correct explanation of Statement I.
(b) Both Statement I and Statement II are true and Statement II is not the correct explanation of Statement I.
(c) Statement I is true but Statement II is false.
(d) Statement I is false and Statement II is true.

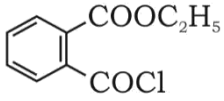
41. I. 

II. 

III. 

Ease of β-dehydrobromination among these substrates under the treatment of strong base will be in the order as:

(a) I > II > III
(b) III > II > I
(c) II > I > III
(d) II > III > I

42. The IUAC name of  is:

(a) 2-Chlorocarbonyl ethylbenzoate
(b) 2-Carboxyethyl benzoyl chloride
(c) Ethyl-2-(chlorocarbonyl) benzoate
(d) Ethyl-1-(chlorocarbonyl) benzoate

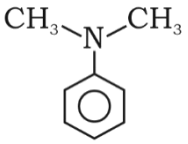
43. K_2MnO_4 is unstable in aqueous solution and the green solution obtained is changed into purple colouration Incorrect statement regarding the above change is.

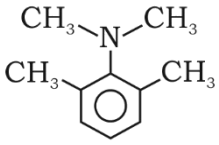
(a) It is a disproportionation reaction
(b) It produces $KMnO_4$
(c) It produces brown precipitate of hydrated MnO_2
(d) K_2MnO_4 stable in acidic medium

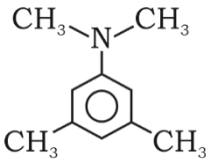
44. Which one of the following compounds will give HVZ reaction?

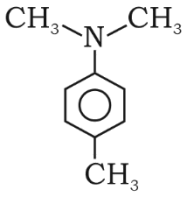
(a) Benzoic acid
(b) Formic acid
(c) 2,2-Dimethyl propanoic acid
(d) 2-Methylpropanoic acid

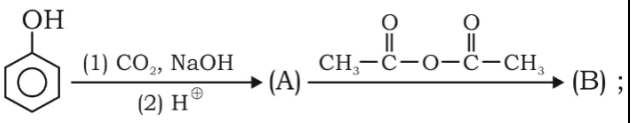
45. In which of the following lone pair of nitrogen is not involved in resonance?

(a) 

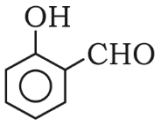
(b) 

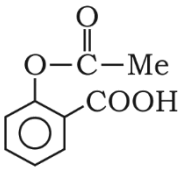
(c) 

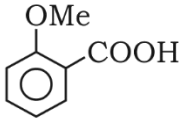
(d) 

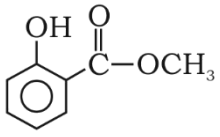
46.  ;

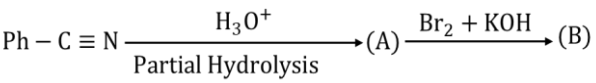
Aspirin Product (B) is :

(a) 

(b) 

(c) 

(d) 

47. 

Product (B) is:

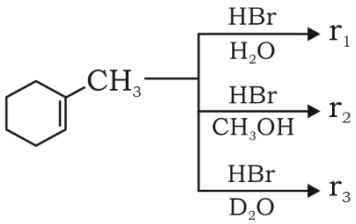
(a) $Ph - CH_2 - NH_2$

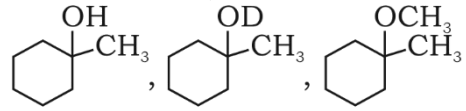
(b) $Ph - OH$

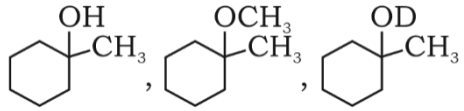
(c) $Ph - NH_2$

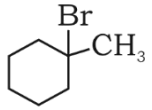
(d) $Ph - CH_3$

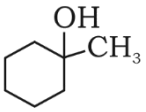
48. Major product obtained in the following reaction r_1, r_2 and r_3 in respectively is:



(a) 

(b) 

(c)  in all reaction

(d)  in all reaction

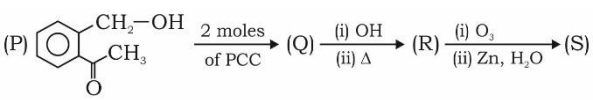
49. Which of the following reactions could not be explained on the basis of open chain structure of glucose?

(a) Pentaacetate of glucose does not react with NH_2OH

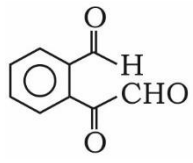
(b) Glucose on prolonged heating with HI gives *n*-hexane

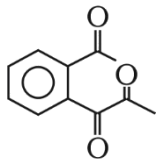
(c) Glucose on oxidation with bromine water forms gluconic acid

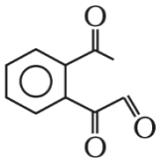
(d) With acetic anhydride glucose gives pentaacetate

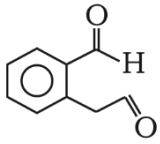
50. 

The structure of compound S will be:

(a) 

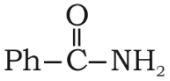
(b) 

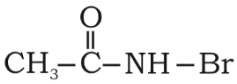
(c) 

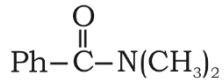
(d) 

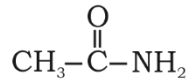
51. The ratio of lone pairs in XeF_2 molecule and the lone pairs on its central atom is _____.

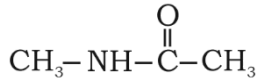
52. How many compounds among the following undergo Hoffmann Bromamide degradation reaction?

(A) 

(B) 

(C) 

(D) 

(E) 

(F) $(CH_3)_2CHCONH_2$

53. Find the number of planes of symmetry in CCl_4 molecule.

54. How many anions will give coloured volatile product when react with conc. H_2SO_4 on reaction with following given anions.

CH_3COO^-, Cl^-, Br^-, S^{2-}, SO_3^{2-}, BO_3^{3-}, NO_2^-, $C_2O_4^{2-}$, I^-, NO_3^-

55. The number of electrons required to balance the following equation,
$NO_3^- + 4H^+ + e^- \longrightarrow 2H_2O + NO$ is:

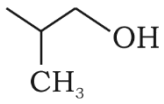
56. 4.5 mol each of hydrogen and iodine heated in a sealed 10-litre vessel. At equilibrium, 3 mol of HI were found. The equilibrium constant for $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ is:

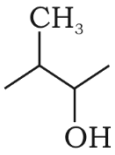
57. If 9.9 eV energy is supplied to H atom, the number of spectral lines emitted is equal to:

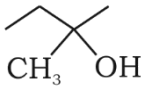
58. 20.0 g of a magnesium carbonate sample decomposes on heating to give carbon dioxide and 8.0 g of magnesium oxide. The percentage purity of magnesium carbonate in the sample would be (At. wt.: Mg = 24)

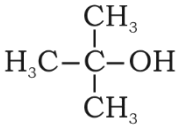
59. Find the number of unpaired electrons in the t_{2g} set of d-orbital in the $[Mn(H_2O)_6]^{2+}$

60. How many alcohols among the following give immediate turbidity with lucas reagent?

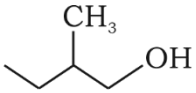
(A) 

(B) 

(C) 

(D) 

(E) 

(F) 

61. The range of the function $f(x) = \sqrt{4-x^2} + \sqrt{x^2-1}$ is
(a) $[\sqrt{3}, \sqrt{7}]$
(b) $[\sqrt{3}, \sqrt{5}]$
(c) $[\sqrt{2}, \sqrt{3}]$
(d) $[\sqrt{3}, \sqrt{6}]$

62. If the variable line $y = kx + 2h$ is tangent to an ellipse $2x^2 + 3y^2 = 6$, then locus of $P(h,k)$ is a conic C whose eccentricity equals
(a) $\frac{\sqrt{5}}{2}$
(b) $\sqrt{\frac{7}{3}}$
(c) $\frac{\sqrt{7}}{3}$
(d) $\sqrt{2}$

63. The number of solution(s) of the equation $z^2 = 4z + |z|^2 + \frac{16}{|z|^3}$ is
(a) 0
(b) 1
(c) 2
(d) 3

64. The area of the region bounded by the curve $C: y = \frac{x+1}{x^2+1}$ and the line $L: y = 1$, is
(a) $1 - \frac{1}{2}\ln 2 + \frac{\pi}{4}$
(b) $\ln 2 - \frac{\pi}{4} + 1$
(c) $\frac{1}{2}\ln 2 + \frac{\pi}{4} - 1$
(d) $\ln 2 - \frac{\pi}{2} + 1$

65. The solution set of inequality $(\cot^{-1} x)(\tan^{-1} x) + \left(2 - \frac{\pi}{2}\right)\cot^{-1} x - 3\tan^{-1} x - 3\left(2 - \frac{\pi}{2}\right) > 0$, is
(a) $x \in (\tan 2, \tan 3)$
(b) $x \in (\cot 3, \cot 2)$
(c) $x \in (-\infty, \tan 2) \cup (\tan 3, \infty)$
(d) $x \in (-\infty, \cot 3) \cup (\cot 2, \infty)$

66. Number of solutions of the equation $\tan x + \sec x = 2\cos x$ in $(-\pi, 2\pi)$, is
(a) 1
(b) 2
(c) 3
(d) 4

67. Inside the unit circle $S = \{(x,y) | x^2 + y^2 = 1\}$ there are three smaller circles of radius equals to a, tangent to each other and to S. The value of a equals
(a) $\sqrt{2}(\sqrt{2} - 1)$
(b) $\sqrt{3}(2 - \sqrt{3})$
(c) $\sqrt{2}(2 - \sqrt{3})$
(d) $\sqrt{2}(2 - \sqrt{3})$

68. If [x] and {x} denotes respectively, the greatest integer function less than or equal to x and fractional part function, then the number of real x, satisfying the equation (x – 2)[x] = {x} – 1, is
(a) 0
(b) 1
(c) 2
(d) Infinite

69. If $g(x) = \int_1^x e^{t^2}\, dt$ then the value of $\int_3^{x^3} e^{t^2}\, dt$ equals
(a) $g(x^3) - g(3)$
(b) $g(x^3) + g(3)$
(c) $g(x^3) - 3$
(d) $g(x^3) - 3g(x)$

70. For $\theta \in \left(0, \frac{\pi}{2}\right)$, the value of definite integral $\int_0^\theta \ln(1 + \tan\theta \tan x)\, dx$ is equal to
(a) $\theta \ln(\sec\theta)$
(b) $\theta \ln(\operatorname{cosec}\theta)$
(c) $\frac{\theta \ln 2}{2}$
(d) $2\theta \ln \sec\theta$

71. If r, s are the roots of $a_0 + a_1 x + a_2 x^2 = 0$ $(a_0, a_1, a_2 \in R \text{ and } a_2 \neq 0)$, then the equality $a_0 + a_1 x + a_2 x^2 = a_0\left(1 - \frac{x}{r}\right)\left(1 - \frac{x}{s}\right)$ holds
(a) For all values of $x, a_0 \neq 0$
(b) Only when $x = 0$
(c) only when $x = r$ or $x = s$
(d) Only when $x = r$ or $x = s$, $a_0 \neq 0$

72. The position vectors of vertices of ΔABC are $(1,-2), (-7,6)$ and $\left(\frac{11}{5}, \frac{2}{5}\right)$

respectively. The measure of the interior angle A of the triangle is
(a) Acute and lies in $(75°, 90°)$
(b) Acute and lies in $(60°, 75°)$
(c) Acute and lies in $(45°, 60°)$
(d) Obtuse

73. Consider the graphs of $y = Ax^2$ and $y^2 + 3 = x^2 + 4y$, where A is a positive constant and $x, y \in R$. Number of points in which the two graphs intersect, is
(a) Exactly 4
(b) Exactly 2
(c) At least 2 but the number of points varies for different positive values of A.
(d) Zero for atleast one positive A.

74. If $a^{22} + b^2 + c^2 + ab + bc + ca \leq 0, a, b, c \in R$ then value of the determinant $\begin{vmatrix} (a+b+2)^2 & a^2+b^2 & 1 \\ 1 & (b+c+2)^2 & b^2+c^2 \\ c^2+a^2 & 1 & (c+a+2)^2 \end{vmatrix}$
(a) 65
(b) $a^2 + b^2 + c^2 + 31$
(c) $4(a^2 + b^2 + c^2)$
(d) 0

75. Let $f'(x) = e^{x^2}$ and $f(0) = 10$ and $A < f(1) < B$ can be concluded from the Mean Value Theorem then largest value of (A – B) equals
(a) e
(b) 1 – e
(c) e – 1
(d) 1 + e

76. Water is dropped at the rate of $2m^3/sec$. Into a cone of semi-vertical angle 45°. The rate at which periphery of water surface changes when height of the water in the cone is 2 meter, is
(a) 2 m/sec.
(b) 1 m/sec.
(c) 3 m/sec.
(d) 4 m/sec.

77. Let S denote sum of the series $\frac{3}{2^3} + \frac{4}{2^4 \cdot 3} + \frac{5}{2^6 \cdot 3} + \frac{6}{2^7 \cdot 5} + \cdots \infty$. Compute the value of S^{-1}.
(a) 8
(b) 6
(c) 4
(d) 2

78. Two loaded dice each have the property that 2 or 4 is three times as likely to appear as 1, 3, 5 or 6 on each roll. When two such dice are rolled, the probability of obtaining a total of 7, is
(a) 1/8
(b) 1/7
(c) 7/50
(d) 7/25

79. A line passes through the point $A(\hat{\imath} + 2\hat{\jmath} + 3\hat{k})$ and is parallel to the vector $\vec{V} = (\hat{\imath} + \hat{\jmath} + \hat{k})$. The shortest distance from the origin, of the line is
(a) $\sqrt{2}$
(b) $\sqrt{4}$
(c) $\sqrt{5}$
(d) $\sqrt{6}$

80. If z is a complex number satisfying the equation $|z - (1 + i)|^2 = 2$ and $\omega = \frac{2}{Z}$, then the locus traced by $'\omega'$ in the complex plane is
(a) $x - y - 1 = 0$
(b) $x + y - 1 = 0$
(c) $x - y + 1 = 0$
(d) $x + y + 1 = 0$

81. Let a and b be positive numbers not equal to 1 and $\frac{3\pi}{2} < \theta < 2\pi$. If $a^{\tan\theta} > b^{\tan\theta} > 1$, then which one of the following is always **TRUE** ?
(a) a > b > 1
(b) a < b < 1
(c) b < a < 1
(d) b > a > 1

82. If the equation $(x^2 + a|x| + a + 1)(x^2 + (a+1)|x| + a) = 0$ has no real root, the range of values of $'a'$ is
(a) (0, 1)
(b) $(\infty, 0)$
(c) $(0, \infty)$
(d) $(-1, 0)$

83. The area of the triangular region in the first quadrant bounded on the right by the y-axis, bounded above by the line $7x + 4y = 168$ and bounded below by the line $5x + 3y = 121$, is
(a) $50/3$
(b) $52/3$
(c) $53/3$
(d) 17

84. If p_1, p_2 are the roots of the quadratic equation $ax^2 + bx + c = 0$ and q_1, q_2 are the roots of the quadratic equation $cx^2 + bx + a = 0 (a, b, c \in R)$ such that p_1, q_1, p_2, q_2 are in A.P. of distinct terms, that $a + c - 1$ equals
(a) -1
(b) 1
(c) $1/2$
(d) 2

85. The locus of the middle point of the chord of the circle $x^2 + y^2 = 1$ such that the segment of the chord on the parabola $y = x^2 - x$ subtends a right angle at the origin, is a circle whose centre and radius respectively are
(a) (1, 1) and $\sqrt{2}$
(b) (1, 1) and 2
(c) $\left(\frac{1}{2}, \frac{1}{2}\right)$ and $\frac{1}{2}$
(d) $\left(\frac{1}{2}, \frac{1}{2}\right)$ and $\frac{1}{\sqrt{2}}$

86. If the roots of the equation $x^2 + 6x + 1 = 0$ are real and distinct and they differ by at most 4, then the sum of all possible integral value(s) of l, is
(a) 16
(b) 26
(c) 36
(d) 35

87. A convex polygon has 44 diagonals. The polygon is
(a) 9 sided
(b) 10 sided
(c) 11 sided
(d) 12 sided

88. A class has three teachers, Mr. P, Ms. Q and Mrs. R and six students A, B,C,D,E,F. Number of ways in which they can be seated in a line of 9 chairs, if between any two teachers there are exactly two students, is k(6!) then the value of k is
(a) 18
(b) 12
(c) 24
(d) 6

89. Sixteen players $S_1, S_2, S_3, \ldots, S_{16}$ play in a tournament. Number of ways in which they can be grouped into eight pairs so that S_1 and S_2 are in different groups, is equal to
(a) $\frac{(14)!}{2^6 \cdot 6!}$
(b) $\frac{(15)!}{2^7 \cdot 7!}$
(c) $\frac{(14)!}{2^7 \cdot 6!}$
(d) $\frac{(14)!}{2^6 \cdot 7!}$

90. Find the minimum value of the expression $E = |z|^2 + |z - 3|^2 + |z - 6!|^2$ (where $z = x + iy, x, y \in R$).
(a) 10
(b) 20
(c) 30
(d) 40

Answer Key

S1. Ans. (a)

S2. Ans. (c)

S3. Ans. (a)

S4. Ans. (a)

S5. Ans. (c)

S6. Ans. (b)

S7. Ans. (a)

S8. Ans. (a)

S9. Ans. (c)

S10. Ans. (b)

S11. Ans. (c)

S12. Ans. (b)

S13. Ans. (d)

S14. Ans. (a)

S15. Ans. (c)

S16. Ans. (b)

S17. Ans. (c)

S18. Ans. (d)

S19. Ans. (c)

S20. Ans. (b)

S21. Ans. (2)

S22. Ans. (6)

S23. Ans. (7000)

S24. Ans. (10)

S25. Ans. (3675)

S26. Ans. (30)

S27. Ans. (60)

S28. Ans. (7)

S29. Ans. (15)

S30. Ans. (550)

S31. Ans. (a)

S32. Ans. (b)

S33. Ans. (a)

S34. Ans. (c)

S35. Ans. (d)

S36. Ans. (b)

S37. Ans. (c)

S38. Ans. (b)

S39. Ans. (d)

S40. Ans. (b)

S41. Ans. (d)

S42. Ans. (c)

S43. Ans. (d)

S44. Ans. (d)

S45. Ans. (b)

S46. Ans. (b)

S47. Ans. (c)

S48. Ans. (b)

S49. Ans. (a)

S50. Ans. (a)

S51. Ans. 3

S52. Ans. 4

S53. Ans. 6

S54. Ans. 4

S55. Ans. 3

S56. Ans. 1

S57. Ans. Zero

S58. Ans. 84

S59. Ans. 3

S60. Ans. 2

S61. Ans. (d)

S62. Ans. (b)

S63. Ans. (b)

S64. Ans. (c)

S65. Ans. (b)

S66. Ans. (b)

S67. Ans. (b)

S68. Ans. (d)

S69. Ans. (a)

S70. Ans. (a)

S71. Ans. (a)

S72. Ans. (a)

S73. Ans. (a)

S74. Ans. (a)

S75. Ans. (b)

S76. Ans. (b)

S77. Ans. (d)

S78. Ans. (c)

S79. Ans. (a)

S80. Ans. (a)

S81. Ans. (b)

S82. Ans. (c)

S83. Ans. (a)

S84. Ans. (a)

S85. Ans. (d)

S86. Ans. (b)

S87. Ans. (c)

S88. Ans. (a)

S89. Ans. (a)

S90. Ans. (c)