SAMPLE PAPERS

JEE PAPER

Maximum Marks: 360

Topics Covered:

Physics : Full Syllabus

Chemistry: Full Syllabus

Mathematics: Full Syllabus

Important Instruction:

1. Use **Blue / Black Ball** point pen only.
2. There are three sections of equal weightage in the question paper A, B, C (**Physics, Chemistry and Mathematics**) having 30 questions each.
3. You are awarded +4 marks for each correct answer and -1 mark for each incorrect answer.
4. Use of calculator and other electronic devices is not allowed during the exam.
5. No extra sheets will be provided for any kind of work.

PART – A (PHYSICS)

1. For a man walking horizontally with speed u, rain appears to hit him vertically down. When he makes his speed 'n' times, rain appears to hit him making an angle θ to the vertical. The original speed of rain is

(a) $u\sqrt{1+(n^2-1)cot^2\theta}$ (b) $u\sqrt{1+(n^2-1)tan^2\theta}$

(c) $u\sqrt{1+(n-1)^2tan^2\theta}$ (d) $u\sqrt{1+(n-1)^2cot^2\theta}$

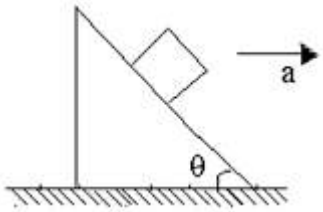
2. The optimum speed of a car is v_0 and maximum permissible speed to avoid slipping is v on a circular track of radius r which is banked at an angle θ_0 if μ is the coefficient of friction and $\alpha = \frac{v_0}{v}$, then $\mu =$

(a) $\frac{\tan\theta+\alpha^2}{\alpha^2\,(tan^2\,\theta+1)}$ (b) $\frac{\tan\theta\,(1-\alpha^2)}{tan^2\,\theta+\alpha^2}$ (c) $\frac{\alpha\tan\alpha}{\alpha+\tan\theta}$ (d) $\frac{\cot\theta(1-\alpha^2)}{\alpha^2\,cot^2\,\theta+1}$

3. A block comes down a stationary inclined plane of angle of inclination $\theta$with a constant velocity. The acceleration with which the incline should be moved towards right horizontally so that the block now moves upwards with constant velocity is

(a) g sin 2θ (b) g cos 2θ

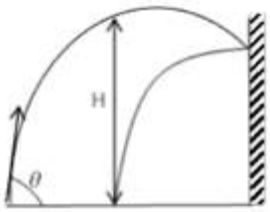
(c) g tan 2θ (d) g cot 2 θ



4. A stone is projected from a horizontal plane. It attains maximum height H and strikes a stationary smooth wall and falls on the ground vertically below the maximum height. Assume the collision to be elastic. The height of the point on the wall where ball will strike is

(a) $\frac{H}{2}$ (b) $\frac{H}{4}$

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



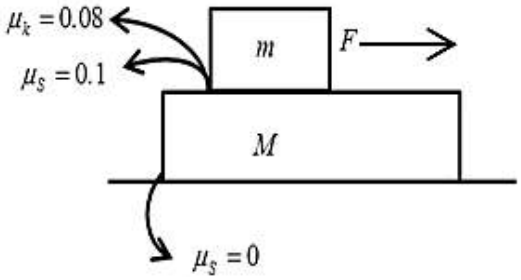
5. F = 4N, m = 2kg, M = 4kg then

(a)Acceleration of M is $4ms^{-2}$

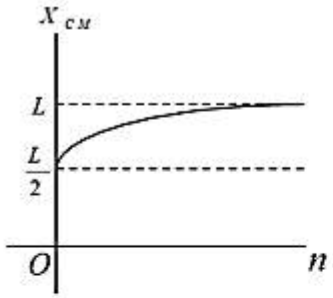
(b) Acceleration of M is $0.4ms^{-2}$

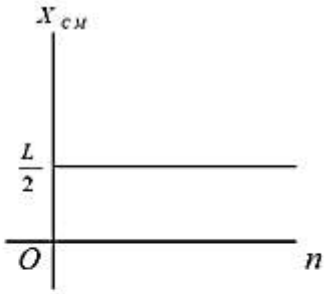
(c) Acceleration of M is zero

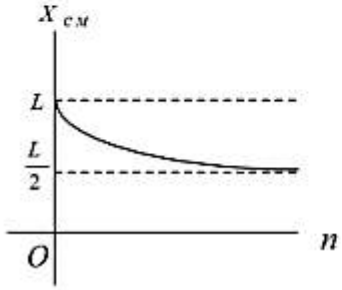
(d) Acceleration of M is 2 ms^{-2}

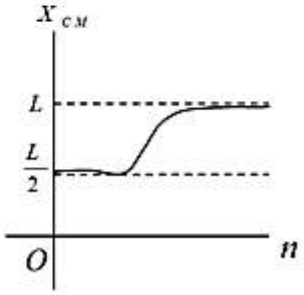


6. A thin rod of length L is lying along the x – axis with its ends at x =0 and x= L. Its linear density (mass/length) Varies with x as $\left(\frac{x}{L}\right)^n$, where k is a constant and n can be zero or any positive number. If the position x_{cm} of the centre of mass of the rod is plotted against n, which of the following graphs best approximates the dependence of x_{cm} on n

(a) 

(b) 

(c) 

(d) 

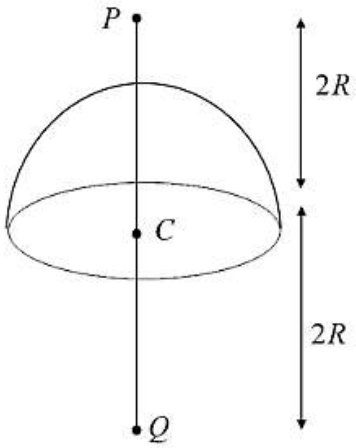
7. Two point masses A of mass M and B of mass 4M are fixed at the ends of a rod of length l and of negligible mass. The rod is set rotating about an axis perpendicular to its length with a uniform angular speed. The work required for rotating the rod will be minimum when the distance of axis of rotation from the mass A is at

(a) $\frac{2}{5}l$ (b) $\frac{8}{5}l$ (c) $\frac{4}{5}l$ (d) $\frac{l}{5}$

8. If gravitational field due to uniform thin hemispherical shell at point P is I, then the magnitude of gravitational field at Q is (Mass of hemisphere is M, radius R).

(a) $\frac{GM}{2R^2} - I$ (b) $\frac{GM}{2R^2} + I$

(c) $\frac{GM}{4R} - I$ (d) 2$I$$-\frac{GM}{2R^2}$



9. A simple pendulum has time period T_1. The point of suspension is now moved upward according to the relation y = kt^2 (k = 1 m/s^2), where y is the vertical displacement. The time period now becomes T_2. The ratio of $\frac{T_1^2}{T_2^2}$ is _____ (g = 10 m/s^2)

(a) 1 (b) 4/5 (c) 5/6 (d) 6/5

10. A spherical solid ball of volume V is made of a material of density ρ_1. It is falling through a liquid of density ρ_2 ($\rho_2 < \rho_1$). Assume that the liquid applies a viscous force on the ball that is proportional to the square of its speed v, i.e., $F_{viscous} = -kv^2 (k > 0)$. The terminal speed of the ball is.

(a) $\sqrt{\frac{Vg(\rho_1-\rho_2)}{k}}$ (b) $\frac{Vg\rho_1}{k}$ (c) $\sqrt{\frac{Vg\rho_1}{k}}$ (d) $\frac{Vg(\rho_1-\rho_2)}{k}$

11. A closed compartment containing a liquid is moving with some acceleration in horizontal direction. Neglecting effect of gravity, the pressure is compartment is _____

(a) same everywhere (b) lower rear side (c) lower in upper side (d) lower in front side

12. An insulated container of two diatomic gases has two chambers separated by an insulting partition. One of the chambers has volume V_1 and contains ideal gas at pressure p_1 and temperature T_1. The other chamber has volume V_2 and contains ideal gas at pressure p_2 and temperature T_2. If the partition is removed without doing any work on the gas, the final equilibrium temperature of the gas in the container will be

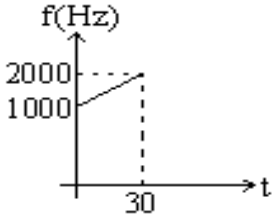
(a) $\frac{T_1T_2(p_1V_1+p_2V_2)}{p_1V_1T_2+p_2V_2T_1}$ (b) $\frac{p_1V_1T_1+p_2V_2T_2}{p_1V_1+p_2V_2}$ (c) $\frac{p_1V_1T_2+p_2V_2T_1}{p_1V_1+p_2V_2}$ (d) $\frac{T_1T_2(p_1V_1+p_2V_2)}{p_1V_1T_1+p_2V_2T_2}$

13. In the experiment to determine speed of sound by resonance tube the difference between first two resonance positions is

(a) One fourth of the wavelength of sound (b) half the wavelength of sound

(c) Three fourth of the wavelength of sound (d) equal to wavelength of sound

14. A detector is released from rest under gravity over a source of sound of frequency $10^3 Hz$. The frequency observed by the detector at time t is plotted in the graph. The speed of sound in air is $(g = 10m/sec^2)$ (solve the problem by using apparent frequency relation, when the observer is moving with constant velocity)



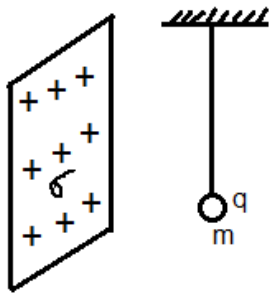
$f_0 =$

(a) 330m/s (b) 350m/s (c) 300m/s (d) 310m/s

15. The pitch of a screw gauge is 0.5 mm and there are 50 divisions on the circular scale. In measuring the thickness of a metal plate, there are five divisions on the pitch scale (or main scale) and 34 division coincides with the reference line. Calculate the thickness of the metal plate.

(a) 1.84 mm (b) 2.84 mm (c) 0.34 mm (d) 2.5 mm

16. A small charged particle of mass m and charge q is suspended by an insulated thread in front of a very large conducting charged sheet of uniform charge density σ. The angle made by the thread with the vertical in equilibrium is:



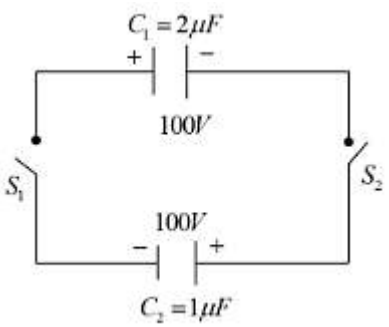
(a) $\tan^{-1}\left(\frac{\sigma q}{2\varepsilon_0 mg}\right)$ (b) $\tan^{-1}\left(\frac{\sigma}{q\varepsilon_0 mg}\right)$

(c) $\tan^{-1}\left(\frac{q}{2\sigma\varepsilon_0 mg}\right)$ (d) zero

17. The maximum velocity of a harmonic oscillator is d and its maximum acceleration is β. Its time period will be

(a) $\frac{\pi\beta}{d}$ (b) $2\pi d\beta$ (c) $\frac{2\pi d}{\beta}$ (d) $\frac{2\pi\beta}{d}$

18. When the switches S_1 *and* S_2 are closed, the initial energy of the system is

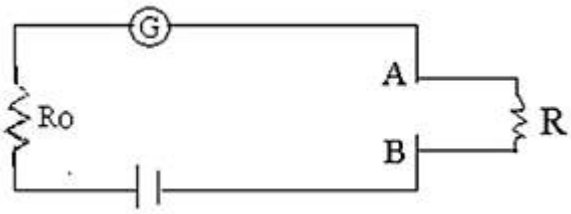


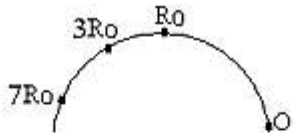
ratio of final energy to the

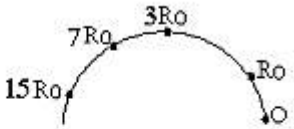
(a) 1 (b) $\frac{1}{2}$

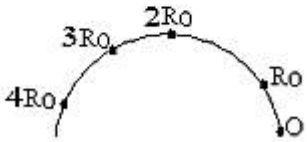
(c) $\frac{1}{9}$ (d) $\frac{1}{4}$

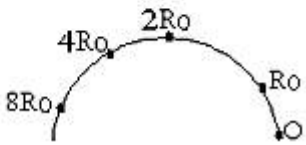
19. Circuit shown in figure is a simple ohm – meter, in which G is a galvanometer (of very small resistance compared to and R_o), R_o is a known resistance and R is the resistance which is to be measured. If A and B are short circuited by resistance less wire, galvanometer gives full scale deflection. Then to read the resistance R directly from galvanometer, its scale would look like



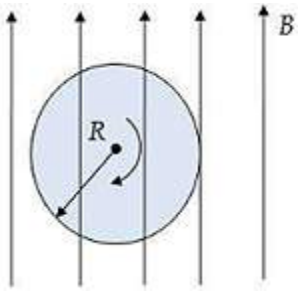
(a) 

(b) 

(c) 

(d) 

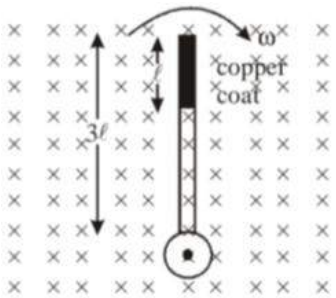
20. A disc of mass m and charge Q is rotating with angular velocity ω about its own axis as shown in the region of magnetic field B which is directed upwards in the plane of disc. The magnetic force experienced by disc is



(a) $2Q\omega BR$ (b) $\frac{\omega BR}{\pi}$

(c) zero (d) $\frac{2\omega BR}{3\pi}$

21. A wooden stick of length 3l is rotated about an end with constant angular velocity ω in a uniform magnetic field B perpendicular to the plane of motion. If the upper one third of its length is coated with copper, the potential difference across the whole length of the stick is



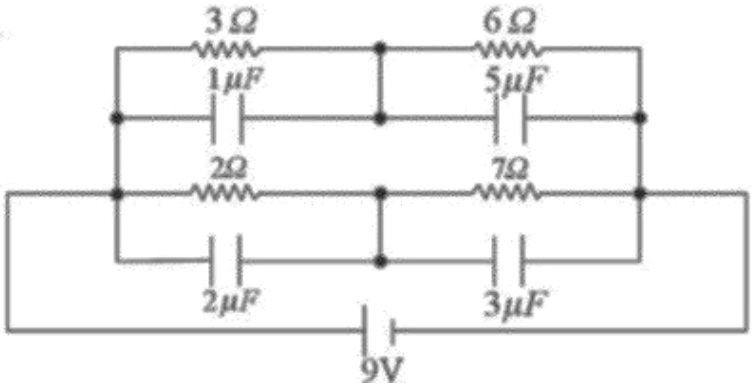
(a) $\frac{9B\omega l^2}{2}$ (b) $\frac{4B\omega l^2}{2}$

(c) $\frac{5B\omega l^2}{2}$ (d) $\frac{B\omega l^2}{2}$

22. A Paramagnetic substance of susceptibility 3×10^{-4} is placed in a magnetic field of $4 \times 10^{-4}\ Am^{-1}$. Then the Intensity of magnetization in the units of Am^{-1} is

(a) 1.33×10^{8} (b) 0.75×10^{-8} (c) 12×10^{-8} (d) 14×10^{-8}

23. In the circuit shown in the Figure charge on 1 μF and 3 μF capacitors respectively is

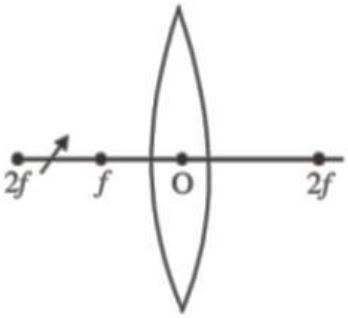


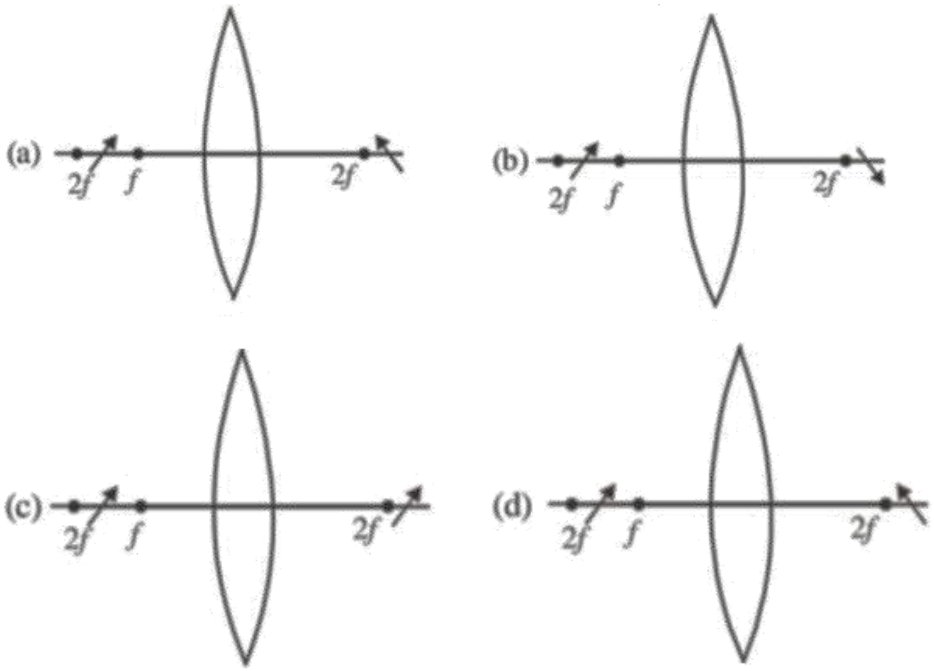
(a) 7μC, 3μC (b) 3μC, 3μC (c) 7μC, 21μC, (d) 3μC, 21μC

24. A working transistor with its three legs marked P, Q and R is tested using a multimeter. No conduction is found between P and Q. By connecting the common (negative) terminal of the multimeter to R and the other (positive) terminal to P or Q, some resistance is seen on the multimeter. Which of the following is true for the transistor?
(a) It is an npn transistor with R as base (b) It is a pnp transistor with R as collector
(c) It is a pnp transistor with R as emitter (d) It is an npn transistor with R as collector

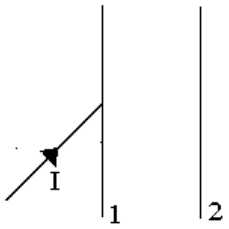
25. Two radioactive materials X_1 and X_2 have decay constant 10 λ and λ respectively. If initially they have same number of nuclei, then ratio of number of nuclei X_1 and X_2 will be 1/e after a time
(a) 1/10 λ (b) 1/11 λ (c) 11/10 λ (d) 1/9 λ

26. The figure shows a straight small object kept in front of a convex lens and moving as shown in the figure. Which among the given options is the right way of representing the motion of its image?





27. A narrow monochromatic beam of light of intensity I is incident on a glass plate as shown in figure. Another identical glass plate is kept parallel to it. Each glass plate reflects 25% of the light incident on it and transmits the remaining. Then the ratio of the maximum to minimum intensities in the interference pattern formed by the two beams obtained after one reflection at each plate is approximately.



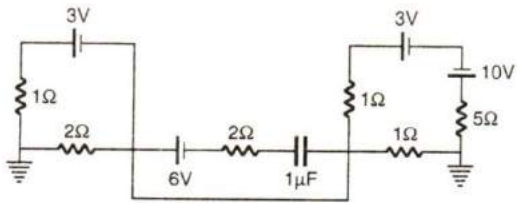
(a) 7 : 1 (b) 49 : 1
(c) 4 : 1 (d) 16 : 9

28. **Assertion :** When charges are shared between any two bodies, no charge is really lost, but some loss of energy does occur
Reason : Some energy disappears in the form of heat, sparking etc.

Choose the most appropriate correct option:

(A) Both Assertion and Reason are true and Reason is correct explanation of Assertion.
(B) Both Assertion and Reason are true but Reason is not the correct explanation of assertion.
(C) Assertion is true but Reason is false.
(D) Assertion is false but Reason is true.

29. For the circuit shown in the figure, determine the charge of capacitor is steady state :



(a) $4\mu C$ (b) $6\mu C$
(c) $1\mu C$ (d) Zero

30. **Assertion :** A proton and an α – particle are projected with the same kinetic energy at right angle to a

uniform magnetic field, then the $\alpha -$ particle will move along a circular path of smaller radius than the proton.

Reason : $Bqv = \frac{mv^2}{r}$ holds good for the charged particle moving in a circular path in a uniform magnetic field.

Choose the most appropriate correct option:

(A) Both Assertion and Reason are true and Reason is correct explanation of Assertion.
(B) Both Assertion and Reason are true but Reason is not the correct explanation of assertion.
(C) Assertion is true but Reason is false.
(D) Assertion is false but Reason is true.

PART – B (CHEMISTRY)

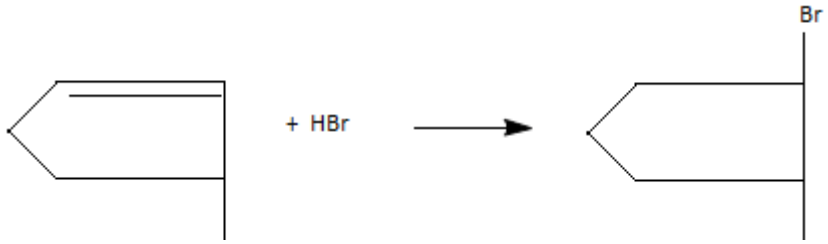
31. The percentage of lime in Portland Cement is approximately
(a) 20 – 25% (b) 30 – 40% (c) 60 – 65% (d) 40 – 50%

32. Boron when heated with carbon forms
(a) B_4C (b) BC_4 (c) B_4C_3 (d) B_2C_3

33. Chromatography was discovered by
(a) Kekule (b) Pauling (c) Rutherford (d) Tswett

34. Molecular mass of volatile substance may be obtained by
(a) Beilstein method (b) Lassaigne method (c) Victor meyer's method (d) Liebig's method

35. The reaction

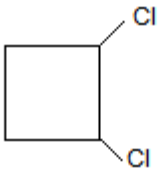


is an example of
(a) Nucleophilic substitution (b) Electrophilic addition
(c) Elimination reaction (d) Nucleophilic addition

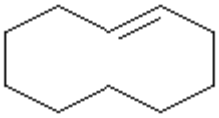
36. Sublimation can't be used for the purification of
(a) benzoic acid (b) camphor (c) Urea (d) naphthalene

37. The C – H bond distance is longest in
(a) C_2H_2 (b) C_2H_4 (c) C_2H_6 (d) $C_2H_2Br_2$

38. Which will form geometrical isomers

(a) 

(b) $CH_3CH = NOH$

(b) 

(d) All of these

39. Enol form is more stable in
(a) CH_3CHO (b) CH_3COCH_3 (c) $CH_3COCH_2COOC_2H_5$ (d) Cyclohexanone

40. $CH_3CH_2CH_3 \xrightarrow{400-600^0C} X + Y$ $X\ and\ Y\ are$
(a) Hydrogen, methane (b) methane, ethylene
(c) Hydrogen, ethylene (d) ethylene, ethane

41. The best method to prepare cyclohexene from cyclohexanol is by using
(a) $conc.HCl + ZnCl_2$ (b) $conc.H_3PO_4$ (c) HBr (d) $conc.HCl$

42. Piezoelectric crystals are used in
(a) TV (b) radio (c) Freeze (d) Record player

43. The volume of water to be added to 100 cm^3 of 0.5N H_2SO_4 to get decinormal concentration is
(a) $400\ cm^3$ (b) $500\ cm^3$ (c) $450\ cm^3$ (d) $100\ cm^3$

44. What is the freezing point of a 10% (by weight) solution of CH_3OH in water?
(a) 90^0C (b) 10^0C (c) 6.45^0C (d) -6.45^0C

45. On passing 3A of electricity for 50 min, 1.8 g metal deposits. The Equivalent mass of metal is
(a) 9.3 (b) 19.3 (c) 38.3 (d) 39.9

46. An ion with mass number 5b contains 3 units of positive charge and 30.4% more neutrons than electrons. The ion is
(a) $^{56}_{28}Ni^{3+}$ (b) $^{56}_{26}Fe^{3+}$ (c) $^{56}_{27}Co^{3+}$ (d) $^{56}_{24}Cr^{3+}$

47. The ratio of the ionization energy of H and Be^{3+} is
(a) 1 : 1 (b) 1 : 3 (c) 1 : 9 (d) 1 : 16

48. Which of the following hydrides has the least boiling point?
(a) H_2S (b) H_2O (c) H_2Se (d) H_2Te

49. Number of nodal planes in π^* 2px orbital are
(a) 1 (b) 2 (c) 3 (d) zero

50. In a reaction, Normal Egg → hard boiled egg, ΔS is

(a) O (b) + Ve (c) – Ve (d) None

51. Heat liberated when 100 ml of 1 N NaOH is neutralized by 300 ml of 1N HCl is
(a) 22.92 KJ (b) 17.19 KJ (c) 11.46 KJ (d) 5.73 KJ

52. A gas bulb is filled with NO_2 gas and immersed in an ice bath at 0^0C which becomes colourless after sometimes. This colourless gas will be
(a) NO_2 (b) N_2O (c) N_2O_4 (d) N_2O_5

53. An Aqueous solution of Rochelle's salt is
(a) Neutral (b) Acidic (c) basic (d) Not Hydrolyzed

54. 20 ml of 0.5 NHCl and 35 ml of 0.1 N NaOH are mixed. The resulting solution will be
(a) Basic (b) Neutral
(c) turns methyl orange red (d) Turns phenolphthalein solution pink

55. $1\ \text{s cm}^{-1}$ is equal to
(a) $100\ \text{S m}^{-1}$ (b) $10\ \text{S m}^{-1}$ (c) $0.01\ \text{Sm}^{-1}$ (d) $1\ \text{Sm}^{-1}$

56. Colloidal solution of cellulose nitrate in alcohol is called
(a) Purple of cassius (b) Colloidion (c) Argyrol (d) Aquadag

57. Which of the following electrolyte will have maximum flocculation value for Fe(OH)_3 sol?
(a) NaCl (b) Na_2S (c) $(\text{NH}_4)_3\text{PO}_4$ (d) K_2SO_4

58. On burning hydrogen in air, the colour of the flame is
(a) green (b) Yellow (c) Red (d) light bluish

59. Which of the following is used as a source of O_2 in space capsules, submarines etc.
(a) K_2O (b) Na_2O_2 (c) Li_2O (d) Na_2O

60. Which of the following is a cyclic oxo acid?
(a) $\text{H}_3\text{P}_3\text{O}_9$ (b) $\text{H}_4\text{P}_2\text{O}_6$ (c) $\text{H}_4\text{P}_2\text{O}_7$ (d) $\text{H}_5\text{P}_5\text{O}_{15}$

PART – C (MATHEMATICS)

61. The range of the function f(x) = cos[x] for $-\frac{\pi}{2} < x < \frac{\pi}{2}$ contains {[•] denotes G.I.F}
(a) {– 1, 1, 0} (b) {cos 1, 1, cos 2} (c) {cos 1, –cos 1, 1} (d) [–1, 1]

62. If $w = \cos\left(\frac{\pi}{n}\right) + i \sin\left(\frac{\pi}{n}\right)$, then value of $1 + w + w^2 + \ldots . + w^{n-1}$ is
(a) 1 + i (b) $1 + i \tan\left(\frac{\pi}{2n}\right)$ (c) $1 + i \cot\left(\frac{\pi}{2n}\right)$ (d) none of these

63. Suppose $a^2 = 5a - 8$ and $b^2 = 5b - 8$, then equation whose roots are $\frac{a}{b}$ and $\frac{b}{a}$ is
(a) $6x^2 - 5x - 6 = 0$ (b) $8x^2 - 9x + 8 = 0$ (c) $9x^2 - 8x + 9 = 0$ (d) $8x^2 + 9x + 8 = 0$

64. If x ∈ R and n ∈ I, then the determinant $\Delta = \begin{vmatrix} sin(n\pi) & \sin x - \cos x & \log\tan x \\ \cos x - \sin x & \cos\left[(2n+1)\frac{\pi}{2}\right] & \log\cot x \\ \log\cot x & \log\tan x & \tan(n\pi) \end{vmatrix}$

(a) 0 (b) log tan x – log cot x (c) $\tan\left(\frac{\pi}{4} - x\right)$ (d) $\sin\left(\frac{\pi}{4} - x\right)$

65. If for a matrix A, |A| = 6 and adj A = $\begin{bmatrix} 1 & -2 & 4 \\ 4 & 1 & 1 \\ -1 & k & 0 \end{bmatrix}$ then k is equal to

(a) 0 (b) 1 (c) 2 (d) – 1

66. A code word of length 4 consists two distinct constants in the English alphabet followed by two digits from 1 to 9, with repetition allowed in digits. If the number of code, words so formed ending with an even digit is 432k, then k is equal to

(a) 5 (b) 49 (c) 35 (d) 7

67. For a positive integer n, if the mean of the binomial coefficients in the expansion of $(a + b)^{2n-3}$ is 16, then n is equal to

(a) 5 (b) 7 (c) 9 (d) 4

68. Let a, b and c be distinct real numbers. If a, b, c are in geometric progression and a + b + c = xb then x lies in the set

(a) (1, 3) (b) (–1, 0) ∪ (1, 2) (c) (–∞,–1) ∪ (3, ∞) (d) (0, 1)

69. If for some real number a, $\lim_{x \to 0} \frac{\sin 2x + a\sin x}{x^3}$ exists then the limit is equal to

(a) – 2 (b) – 1 (c) 1 (d) 2

70. If $x = \sin^{-1} t$ and $y = \log(1 - t^2)$; then $\left.\frac{d^2y}{dx^2}\right|_{t=1/2}$ is

(a) $-\frac{8}{3}$ (b) $\frac{8}{3}$ (c) $\frac{3}{4}$ (d) $-\frac{3}{4}$

71. A curve passes through the point (2, 0) and the slope of the tangent at any point (x, y) is $x^2 - 2x$ for all value of x. The point of maximum ordinate on the curve is

(a) $\left(0, \frac{4}{3}\right)$ (b) $\left(0, \frac{2}{3}\right)$ (c) $\left(1, \frac{2}{3}\right)$ (d) $\left(2, \frac{4}{3}\right)$

72. If m is the slope of a tangent to the curve $e^{2y} = 1 + 4x^2$ then

(a) $|m| \leq 1$ (b) $|m| > 1$ (c) $|m| \geq 1$ (d) $|m| < 1$

73. The value of $\sqrt{2}\int \frac{\sin x\, dx}{\sin\left(x - \frac{\pi}{4}\right)}$ is

(a) x + log $\left|cos\left(x - \frac{\pi}{4}\right)\right|$ + c (b) x – log $\left|cos\left(x - \frac{\pi}{4}\right)\right|$ + c

(c) x + log $\left|sin\left(x-\frac{\pi}{4}\right)\right|$ + c (d) x – log $\left|cos\left(x+\frac{\pi}{4}\right)\right|$ + c

74. For x > 0, let f(x) = $\int_1^x \frac{\log t}{1+t}$ dt. Then f(x) + f $\left(\frac{1}{x}\right)$ is equal to

(a) $\frac{1}{4}$ log(x)^2 (b) $\frac{1}{2}$ (log x)^2 (c) log x (d) $\frac{1}{4}$ (log x)^2

75. If y(x) is the solution of the differential equation (x + 2) $\frac{dy}{dx}$ = x^2 + 4x – 9, x ≠ 2 and y(0) = 0, then y(–4) is equal to
(a) 0 (b) 1 (c) – 1 (d) 2

76. If the point of intersection of the lines 2px + 3qy + r = 0 and px – 2qy – 2r = 0 lies strictly in the fourth quadrant and is equidistant from the two axes, then
(a) 5p + 4q = 0 (b) 4p – 5q = 0 (c) 4p + 5q = 0 (d) 5p – 4q = 0

77. The number of integer values of k for which the equation x^2 + y^2 + (k – 1)x – ky + 5 = 0 represent a circle whose radius cannot exceed 3, is
(a) 10 (b) 11 (c) 4 (d) 5

78. The equation of a tangent to the parabola y^2 = 8x is y = x + 2. The point on this line from which the other tangent to the parabola is perpendicular to the given tangent is
(a) (–1, 1) (b) (0, 2) (c) (2, 4) (d) (–2, 0)

79. The line 2x + y = 3 intersects the ellipse 4x^2 + y^2 = 5 at two points. The tangents to the ellipse at these two points intersect at the point
(a) $\left(\frac{5}{6}, \frac{5}{3}\right)$ (b) $\left(\frac{5}{6}, \frac{5}{6}\right)$ (c) $\left(\frac{5}{3}, \frac{5}{6}\right)$ (d) $\left(\frac{5}{3}, \frac{5}{3}\right)$

80. If the line $\frac{x-2}{3} = \frac{y-1}{-5} = \frac{z+2}{2}$ lies in the plane x + 3y – ∝ z + β = 0. Then (α, β) equals
(a) (5, –15) (b) (–5, 5) (c) (6, –17) (d) (–6, 7)

81. In a triangle ABC, right angled at the vertex A, if the position vectors of A, B and C are respectively 3i + j – k, –i + 3j + pk and 5i + qj – 4k then the point (p, q) lies on a line
(a) making an obtuse with the positive direction of x-axis
(b) parallel to x-axis
(c) parallel to y-axis
(d) making an acute angle with the positive direction of x-axis

82. If 12 distinct balls are to be placed in 3 identical boxes, then the probability that one of the boxes contains exactly 3 balls is
(a) $\frac{55}{3}\left(\frac{2}{3}\right)^{11}$ (b) 55 $\left(\frac{2}{3}\right)^{10}$ (c) 220 $\left(\frac{1}{3}\right)^{12}$ (d) 22 $\left(\frac{1}{3}\right)^{11}$

83. Let $\frac{3\pi}{4} < \theta < \pi$ and $\sqrt{2\cot\theta + \frac{1}{sin^2\theta}}$ = K – cot θ, then K equals
(a) – 1 (b) 0 (c) $\frac{1}{2}$ (d) 1

84. The possible values of $\theta \in (0, \pi)$ such that $\sin(\theta) + \sin(4\theta) + \sin(7\theta) = 0$ are

(a) $\frac{\pi}{4}, \frac{5\pi}{12}, \frac{\pi}{12}, \frac{2\pi}{3}, \frac{3\pi}{4}, \frac{8\pi}{9}$ (b) $\frac{2\pi}{9}, \frac{\pi}{4}, \frac{\pi}{2}, \frac{2\pi}{3}, \frac{3\pi}{4}, \frac{35\pi}{36}$

(c) $\frac{2\pi}{9}, \frac{\pi}{4}, \frac{\pi}{2}, \frac{2\pi}{3}, \frac{3\pi}{4}, \frac{8\pi}{9}$ (d) $\frac{2\pi}{9}, \frac{\pi}{4}, \frac{4\pi}{9}, \frac{\pi}{2}, \frac{3\pi}{4}, \frac{8\pi}{9}$

85. If $\cos^{-1} x + \cos^{-1} y = \frac{\pi}{2}$ and $\tan^{-1} x - \tan^{-1} y = 0$ then $x^2 + xy + y^2$ is equal to

(a) 0 (b) $\frac{1}{\sqrt{2}}$ (c) $\frac{3}{2}$ (d) $\frac{1}{8}$

86. The negation of $A \rightarrow (A \vee \sim B)$ is

(a) a tautology (b) equivalent to $(A \vee \sim B) \rightarrow A$ (c) equivalent to $(A \wedge \sim B) \rightarrow A$ (d) a fallacy

87. If the angles of elevation of the top of a tower from three collinear points, A, B and C, on a line leading to the foot of the tower, are 30°, 45° and 60° respectively, then the ratio AB : BC is

(a) $\sqrt{3} : 1$ (b) $\sqrt{3} : \sqrt{2}$ (c) $1 : \sqrt{3}$ (d) 2 : 3

88. Let $g(x) = \int_0^x f(t)\, dt$ and f(x) satisfies the equation $f(x + y) = f(x) + f(y) + 2xy - 1$ for all $x, y \in R$ and $f'(0) = 2$ then

(a) g increases on $(0, \infty)$ and decreases on $(-\infty, -0)$ (b) g increases on $(0, \infty)$

(c) g decreases on $(0, \infty)$ and decreases on $(-\infty, 0)$ (d) g decreases on $(-\infty, \infty)$

89. A circle passes through (–2, 4) and touches the y-axis at (0, 2). Which one of the following equations can represent a diameter of this circle?

(a) $2x - 3y + 10 = 0$ (b) $3x + 4y - 3 = 0$ (c) $4x + 5y - 6 = 0$ (d) $5x + 2y + 4 = 0$

90. If A and B are two events such that $P(A \cup B)' = \frac{1}{6}$, $P(A \cap B) = \frac{1}{4}$ and $P(A') = \frac{1}{4}$, then events A and B are

(a) independently but not equally likely (b) mutually exclusive and independent

(c) equally likely and mutually exclusive (d) equally likely but not independent