TECHNO INDIA GROUP PUBLIC SCHOOLS

Dt. 11-10-2025

JEE (Main)-XII

Monthly Mock Test - 4 (October-2025)

Time Allowed: **3 hours** Maximum Marks: **300**

General Instructions:

1. There are three subjects in the question paper consisting of Physics (Q. no. 1 to 25), Chemistry (Q, no. 26 to 50), and Mathematics (Q. no. 51 to 75).
2. Each subject is divided into two sections. Section A consists of 20 multiple-choice questions & Section B consists of 5 numerical value-type questions.
3. There will be only one correct choice in the given four choices in Section A. For each question for Section A, 4 marks will be awarded for correct choice, 1 mark will be deducted for incorrect choice questions and zero marks will be awarded for not attempted questions.
4. For Section B questions, 4 marks will be awarded for correct choice, 1 mark will be deducted for incorrect choice questions and zero marks will be awarded for not attempted questions.
5. Any textual, printed, or written material, mobile phones, calculator etc. is not allowed for the students appearing for the test.
6. All calculations/written work should be done in the rough sheet, provided with the Question Paper.

Space For Rough Works

PHYSICS

Section—A
(Single Option Correct Type)

1. An instantaneous displacement current of 1A can be set up by changing the potential difference across the parallel plates capacitor ($1.0\ \mu F$) at the rate of $\frac{dV}{dt}$.

here $\frac{dV}{dt}$ is

① $10^6\ Vs^{-1}$ ② $10^3\ Vs^{-1}$ ③ $10^2\ Vs^{-1}$ ④ $10^1\ Vs^{-1}$

2. An electromagnetic wave passes through space and its equation is given by $E = E_0 \sin(\omega t - kx)$ where E is electric field. Energy density of electromagnetic wave in space is

① $\frac{1}{2}\epsilon_0 E_0^2$ ② $\frac{1}{4}\epsilon_0 E_0^2$ ③ $\epsilon_0 E_0^2$ ④ $2\epsilon_0 E_0^2$

3. The pressure exerted by an electromagnetic wave of intensity I (watts/m^2) on a nonreflecting surface is [c is the velocity of light]

① Ic ② Ic^2 ③ I/c ④ I/c^2

4. A lens made of glass whose index of refraction is 1.60 has a focal length of +20 cm in air. Its focal length in water, whose refractive index is 1.33, will be

① three times longer than in air ② two times longer than in air
③ same as in air ④ data insufficient

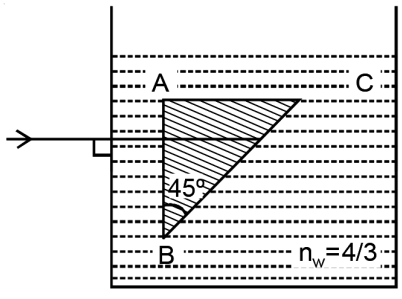
5. An eye specialist prescribes spectacles having combination of convex lens of focal length 40 cm in contact with a concave lens of focal length 25 cm. The power of this lens combination in diopters is

① + 1.5 ② – 1.5 ③ + 6.67 ④ – 6.67

6. When an object is kept at a distance of 30 cm from a concave mirror, the image is formed at a distance of 10 cm from the mirror. If the object is moved with a speed of 9 cms^{-1}, the speed (in cms^{-1}) with which image moves at that instant in (cm/s)

① 2 ② 1 ③ 0 ④ $\frac{1}{2}$

7. A triangular prism of glass is inside water. A ray, incident normally, on one of the faces, is totally reflected from face BC. Then the minimum refractive index of glass is



① $\frac{\sqrt{3}}{2}$ ② $\frac{5}{3}$ ③ $\frac{2\sqrt{2}}{5}$ ④ $\frac{4\sqrt{2}}{3}$

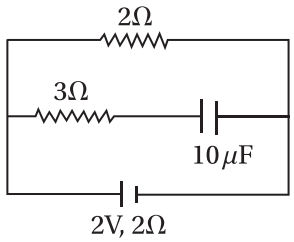
8. The focal lengths of objective lens and eye lens of a Galilean telescope are respectively 30 cm and 3.0 cm telescope produces virtual, erect image of an object situated far away from it at least distance of distinct vision from the eye lens. In this condition, the magnifying power of the Galilean telescope should be :

① + 11.2 ② – 11.2 ③ – 8.8 ④ + 8.8

9. Flux ϕ (in weber) in a closed circuit of resistance 10 Ω varies with time t (in second) according to equation $\phi = 8t^2 - 8t$. The induced current at time t = 0.25 s, is

① 1.2 A ② 0.2 A ③ 0.4 A ④ 1.6 A

10. In steady state, the charge on the capacitor of capacitance 10 μF connected as shown in the figure is

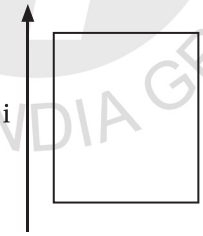


① 20 μC ② 10 μC ③ 15 μC ④ Zero

11. A 50 V dc power supply is used to charge a battery of eight lead accumulators, each of emf 2 V and internal resistance 1/8 Ω. The charging current also runs a motor connected in series with the battery. The resistance of the motor is 5 Ω and the steady current supply is 4 A. Total power lost due to heat production is x watt, where x is

① 80 ② 16 ③ 96 ④ 64

12. A square loop is placed near a long straight current carrying wire as shown. Match the following table



(i)	If current is increased	(a)	Induced current in loop is clockwise
(ii)	If current is decreased	(b)	Induced current in loop is anticlockwise
(iii)	If loop is moved away from the wire	(c)	Wire will attract the loop
(iv)	If loop is moved towards the wire	(d)	Wire will repel the loop

① (i) → (b), (d); (ii) → (a), (c); (iii) → (a), (c); (iv) → (b), (d)

② (i) → (a), (b); (ii) → (a), (c); (iii) → (b), (c); (iv) → (b), (d)

③ (i) → (b), (d); (ii) → (a), (d); (iii) → (b), (c); (iv) → (c), (d)

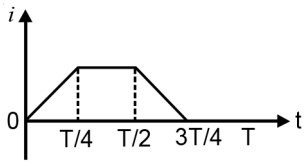
④ (i) → (a), (d); (ii) → (b), (c); (iii) → (c), (d); (iv) → (a), (c)

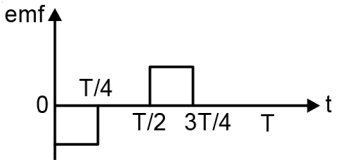
13. A square of side l lies in the YZ plane in a region where the magnetic field is given by

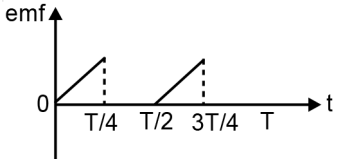
$\vec{B} = B_0(5\hat{i} + 3\hat{j} - 6\hat{k})$, where B_0 is constant. The flux passing through the square is

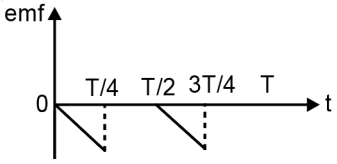
① $3B_0l^2$ ② $5B_0l^2$ ③ $6B_0l^2$ ④ $2\sqrt{15}B_0l^2$

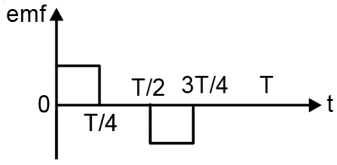
14. The current i in a coil varies with time as shown in the figure. The variation of induced emf with time would be



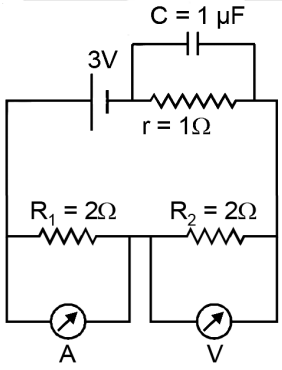
① 

② 

③ 

④ 

15. In the circuit shown in figure, ammeter A and voltmeter V are ideal.



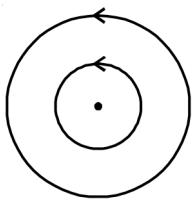
① The reading of ammeter is 0.6 A

② The reading of voltmeter is 1.2 V

③ The charge stored in capacitor is 1 μC

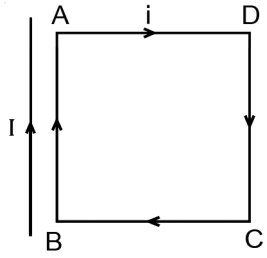
④ The rate of heating in R_1 is 1 W

16. A piece of a uniform wire is bent into a circular loop of radius 'R' and carries a current 'I'. The magnetic field at the centre of the loop is 'B'. Another piece of the same wire of same length is now bent into a double loop. If the two loops are coplanar, concentric and both carry the equal current I in the same direction, the magnetic field at their centre will be



① 3B ② 4B ③ 5B ④ 6B

17. A rectangular loop carrying a current 'i' is situated near a long straight wire such that the wire is parallel to one of the sides of the loop. If a steady current I is established in the wire as shown in figure, the loop will



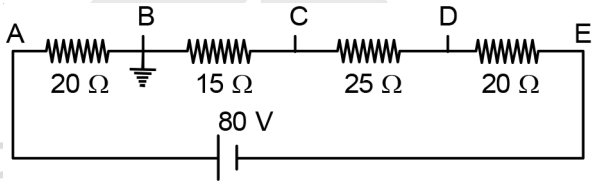
① Rotate about an axis parallel to the wire ② Move away from the wire

③ Move towards the wire ④ Remain stationary

18. An electron is moving with linear momentum $3.2 \times 10^{-2}4$ kg ms^{-1}, enters a magnetic field of 2×10^{-4} T at right angles to it. The electron trajectory is a circle of radius

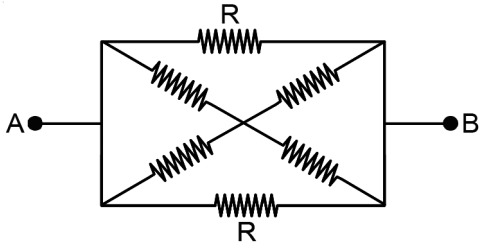
① 5 cm ② 10 cm ③ 15 cm ④ 20 cm

19. Figure shows a circuit in which the potential difference across the resistances are given in the diagram. If point B is grounded, the potential at point D will be



① 10 V ② –10 V ③ 40 V ④ – 40 V

20. Six resistors each of resistance R are connected as shown in figure. What is the effective resistance between points A and B ?



① $\frac{R}{3}$ ② R ③ 3R ④ 6R

Section—B
(Numerical Answer Type)

21. A plane electromagnetic wave with frequency of 30 MHz travels in free space. At particular point in space and time, electric field is 6 V/m. The magnetic field at this point will be $x \times 10^{-8}$ T. The value of x is _____.

22. Orange light of wavelength 6000×10^{-10} m illuminates a single slit of width 0.6×10^{-4} m. The maximum possible number of diffraction minima produced on both sides of the central maximum is _____.

23. When radiation of wavelength λ is used to illuminate a metallic surface, the stopping potential is V. When the same surface is illuminated with radiation of wavelength 3λ, the stopping potential is $\frac{V}{4}$. If the threshold wavelength for the metallic surface is $n\lambda$ then value of n will be _____.

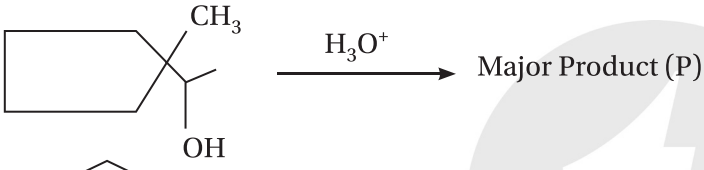
24. Two concentric coils each of radius 2π cm are placed at right angles to each other. Currents of 3A and 4A are flowing in two coils. The magnetic field induction at the centre of the coils is $2.5\ K \times 10^{-5}$ Wb/m^2. The value of K is _____.

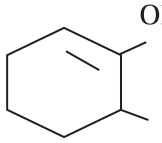
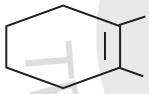
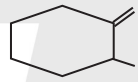
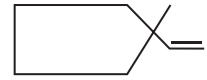
25. A current is increasing at a rate of 4 As^{-1} through a coil of inductance 2 H. When the current is 2 A, the energy stored in the inductor per unit time is n watt. The value of n is _____.

CHEMISTRY

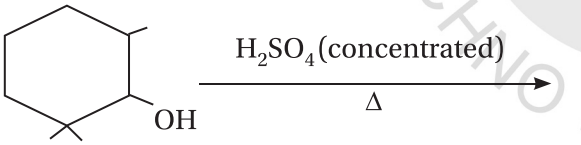
Section—A
(Single Option Correct Type)

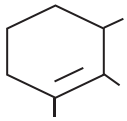
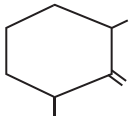
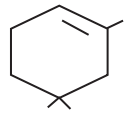
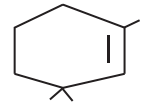
26. Find the major product for the following reaction :



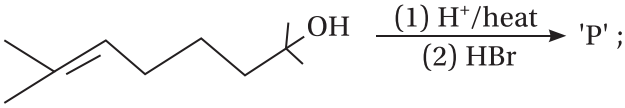
① 
② 
③ 
④ 

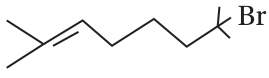
27. Find out the major product from the following reaction :

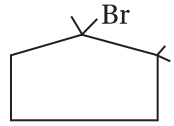


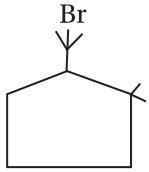
① 
② 
③ 
④ 

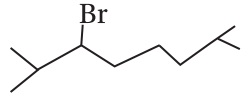
28. The major product (P) in the given reaction is :



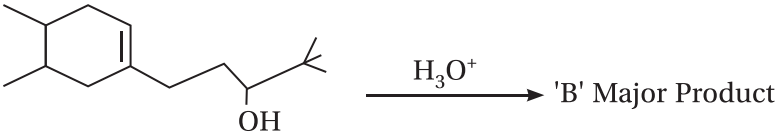
① 

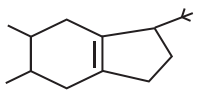
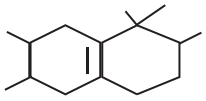
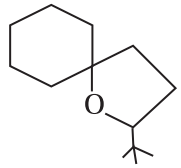
② 

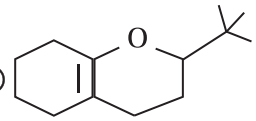
③ 

④ 

29. in the following reaction, 'B' is :



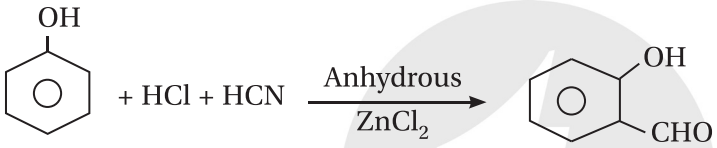
① 
② 
③ 

④ 

30. A compound 'X' when treated with phthalic anhydride in presence of concentrated H_2SO_4 yields 'Y'. 'Y' is used as an acid/base indicator. 'X' and 'Y' are respectively :

① Carbolic acid, phenolphthalein
② Anisole, methyl orange
③ Salicyldehyde, phenolphathalein
④ toludine, phenolphthalein

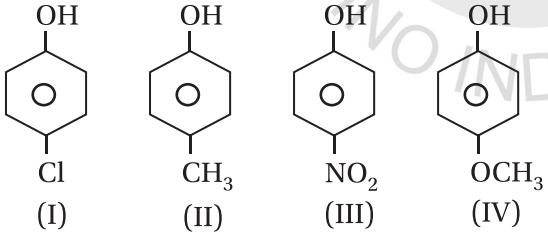
31. The following reaction :



is known as :

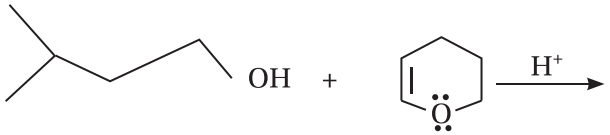
① perkin reaction
② Gatterman-Koch formylation
③ kolbes reaction
④ Gatterman reaction

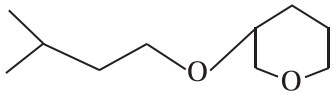
32. Arrange the following compounds in order of decreasing acidity :

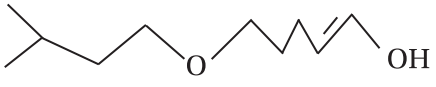


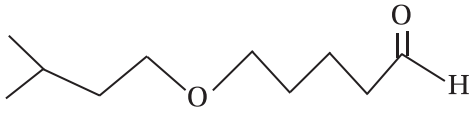
① II > IV > I > III
② II > III > IV
③ III > I > II > IV
④ IV > III > I > II

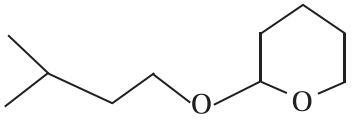
33. The major product formed in the following reaction is :



① 

② 

③ 

④ 

Assertion and Reason : (Q. 34 – 35)

Directions: Read the following questions and choose any one of the following four responses.

a. Assertion and Reason both are correct and Reason is the correct explanation of Assertion.
b. Assertion and Reason both are correct and Reason is not the correct explanation of Assertion.
c. Assertion is correct but Reason is wrong.
d. Assertion is wrong but Reason is correct.

34. **Assertion (A) :** Synthesis of ethyl phenyl ether may be achieved by williamson

Reason (R) : Reaction of bromobenzene with sodium ethoxide yields phenyl ether.

① a ② b ③ c ④ d

35. **Assertion (A) :** Zeise's salt contain C_2H_4 molecule as one of the ligands.

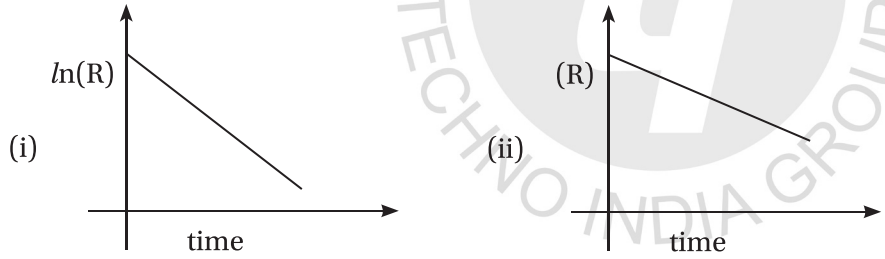
Reason (R) : Zeise's salt is an organometallic compound.

① a ② b ③ c ④ d

36. The density of a solution prepared by dissolving 120 g of urea (mol. mass = 60 u] in 1000 g water is 1.15 g/mL. The molarity of this solution is :

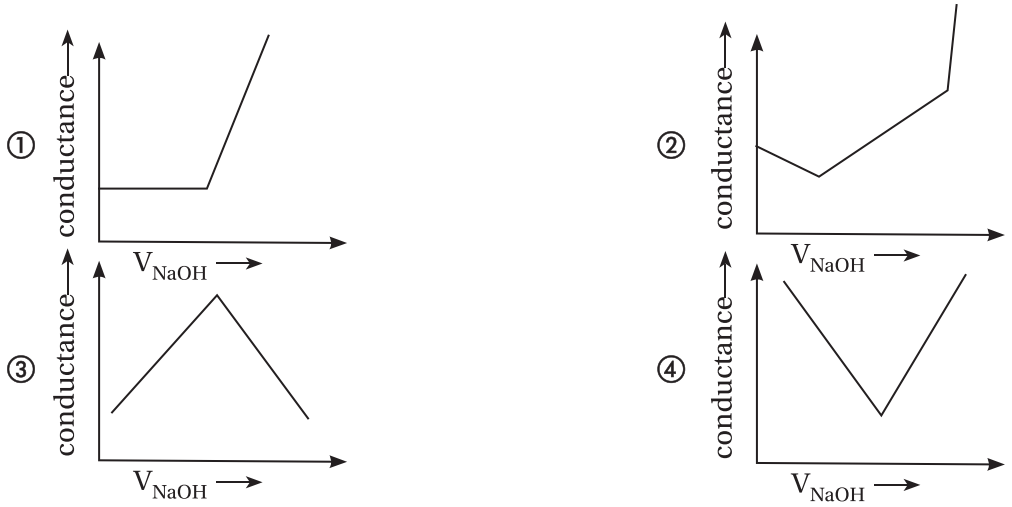
① 0.50 M ② 1.78 M ③ 1.02 M ④ 2.05 M

37. The given plots represents the variation of concentration of a reactant, R with time for two different reactions (i) and (ii). The respective orders of the reactions are :

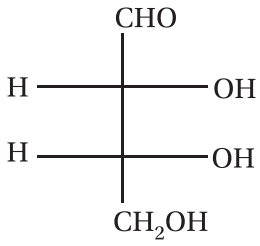


① 1, 0 ② 1, 1 ③ 0, 1 ④ 0, 2

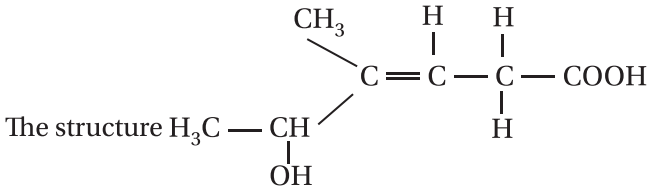
38. Choose the correct representation of conductometric titration of benzoic acid vs sodium hydroxide.



39. Which of the following is absolute configuration of carbon 2 and 3 respectively ?

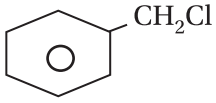


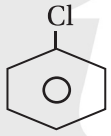
① 2R, 3R ② 2S, 3S ③ 2R, 3S ④ 3S, 2R

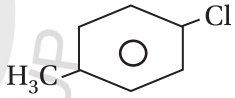
40. The structure  show

① Optical isomerism only ② Tantomerism and geometrical isomerism
③ Geometrical and optical isomerism ④ Geometrical only.

41. Which of the following will be the least reactive towards nucleophilic substitution?

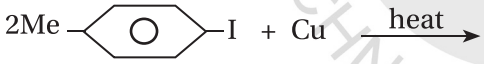
① 

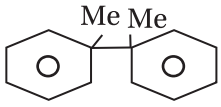
② 

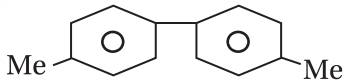
③ 

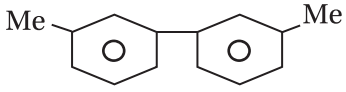
④ C_2H_5Cl

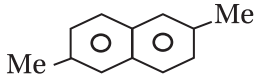
42. The product in the reaction is :

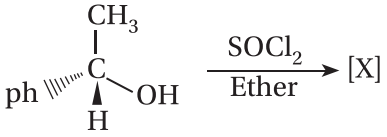


① 

② 

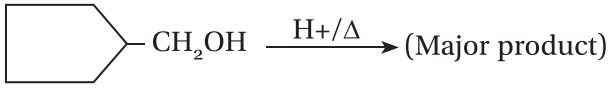
③ 

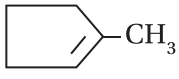
④ 

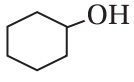
43. 

Compound [X] is obtained with

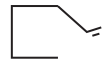
① Retention of configuration ② Inversion of configuration
③ Racemic mixture ④ All of these

44. 

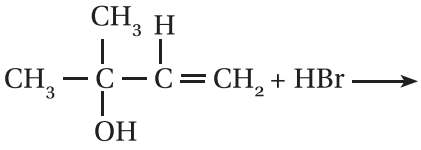
① 

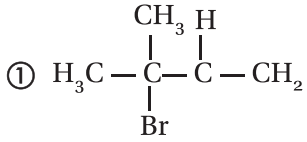
② 

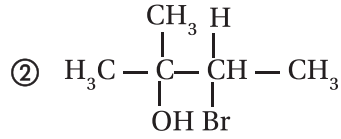
③ 

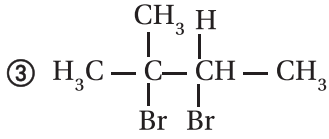
④ 

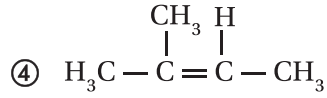
45. The major product formed in the reaction is :



① 

② 

③ 

④ 

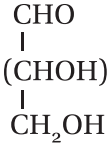
Section—B
(Numerical Answer Type)

46. The limiting molar conductivities of NaI, $NaNO_3$ and $AgNO_3$ are 12.7, 12.0 and 13.3 m s $m^2(mol)^{-1}$, respectively at 25°c. The limiting molar conductivity of Ag I at this temperature is _____ m s $m^2(mole)^{-1}$.

47. The resistance of conductivity cell containing 0.01 M KCl solution at 298 k is 1750 Ω. If the conductivity of 0.01 M KCl solution at 298 k is 0.152×10^{-3} s cm^{-1}, then the cell constant of the conductivity cell _____ × 10^{-3} cm^{-1}.

48. An exothermic reaction X → Y has an activation energy 30 K J $(mole)^{-1}$. If energy change ΔE during the reaction is –20 K J, then the activation energy for the reverse reaction in K J is _____ .

49. The rate constant of a reaction increases by five times in increase in temperature from 27°c to 52°c. The value of activation energy in KJ $(mole)^{-1}$ is _____ . (Nearest integer) [R = 8.314 $J(K)^{-1}(mole)^{-1}$]

50. Find out number of moles of HIO_4 that will react with following compounds  _____ .

MATHEMATICS

Section—A
(Single Option Correct Type)

51. Let $y = y(x)$ be the solution of the differential equation $\left(x^2+1\right)y' - 2xy = \left(x^4+2x^2+1\right)\cos x$, $y(0) = 1$. Then $\int_{-3}^{3} y(x)dx$ is

① 36 ② 24 ③ 18 ④ 30

52. If a curve $y = y(x)$ passes through the point $\left(1, \frac{\pi}{2}\right)$ and satisfies the differential equation $\left(7x^4 \cot y - e^x \operatorname{cosec} y\right)\frac{dx}{dy} = x^5$, $x \geq 1$, then at $x = 2$, the value of $\cos y$ is :

① $\frac{2e^2+e}{64}$ ② $\frac{2e^2-e}{64}$ ③ $\frac{2e^2-e}{128}$ ④ $\frac{2e^2+e}{128}$

53. Let the angle θ, $0 < \theta < \frac{\pi}{2}$ between two unit vectors $\hat{a}$ and $\hat{b}$ be $\sin^{-1}\left(\frac{\sqrt{65}}{9}\right)$. If the vector $\vec{c} = 3\hat{a} + 6\hat{b} + 9\left(\hat{a} \times \hat{b}\right)$, then the value of $9\left(\vec{c} \cdot \hat{a}\right) - 3\left(\vec{c} \cdot \hat{b}\right)$ is

① 31 ② 29 ③ 24 ④ 27

54. Let $\vec{a} = 2\hat{i} - \hat{j} + 3\hat{k}$, $\vec{b} = 3\hat{i} - 5\hat{j} + \hat{k}$ and $\vec{c}$ be a vector such that $\vec{a} \times \vec{c} = \vec{a} \times \vec{b} = \vec{c} \times \vec{b}$ and $(\vec{a} + \vec{c}) \cdot \left(\vec{b} + \vec{c}\right) = 168$. Then the maximum value of $|\vec{c}|^2$ is :

① 77 ② 154 ③ 308 ④ 462

55. Let f be a differentiable function on $\mathbb{R}$ such that $f(2) = 1$, $f'(2) = 4$. Let $\lim\limits_{x \to 0} \left(f(2+x)\right)^{3/x} = e^{\alpha}$. Then the number of times the curve $y = 4x^3 - 4x^2 - 4(\alpha - 7)x - \alpha$ meets x-axis is :

① 3 ② 1 ③ 2 ④ 0

56. If $y(x) = \begin{vmatrix} \sin x & \cos x & \sin x + \cos x + 1 \\ 27 & 28 & 27 \\ 1 & 1 & 1 \end{vmatrix}$, $x \in \mathbb{R}$, then $\frac{d^2y}{dx^2} + y$ is equal to

① 28 ② 27 ③ –1 ④ 1

57. For $\alpha, \beta \in \mathbb{R}$ and a natural number n, let $A_r = \begin{vmatrix} r & 1 & \frac{n^2}{2} + \alpha \\ 2r & 2 & n^2 - \beta \\ 3r-2 & 3 & \frac{n(3n-1)}{2} \end{vmatrix}$. Then $2A_{10} - A_8$ is

① $4\alpha + 2\beta$ ② 0 ③ $2n$ ④ $2\alpha + 4\beta$

58. Let for $A = \begin{bmatrix} 1 & 2 & 3 \\ \alpha & 3 & 1 \\ 1 & 1 & 2 \end{bmatrix}$, $|A| = 2$. If $\left|2\operatorname{adj}\left(2\operatorname{adj}(2A)\right)\right| = 32^n$, then $3n + \alpha$ is equal to

① 11 ② 9 ③ 12 ④ 10

59. Let a rectangle $ABCD$ of sides 2 and 4 be inscribed in another rectangle $PQRS$ such that the vertices of the rectangle $ABCD$ lie on the sides of the rectangle $PQRS$. Let a and b be the sides of the rectangle $PQRS$ when its area is maximum. Then $(a + b)^2$ is equal to :

① 64 ② 80 ③ 60 ④ 72

60. If the angle made by the tangent at the point (x_0, y_0) on the curve $x = 12(t + \sin t \cos t)$, $y = 12(1 + \sin t)^2$, $0 < t < \frac{\pi}{2}$, with the positive x-axis is $\frac{\pi}{3}$, then y_0 is equal to :

① $6\left(3+2\sqrt{2}\right)$ ② $3\left(7+4\sqrt{3}\right)$ ③ 27 ④ 48

61. If $\int e^x \left(\frac{x\sin^{-1}x}{\sqrt{1-x^2}} + \frac{\sin^{-1}x}{\left(1-x^2\right)^{3/2}} + \frac{x}{1-x^2} \right) dx = g(x) + C$, where C is the constant of integration, then $g\left(\frac{1}{2}\right)$ equals :

① $\frac{\pi}{6}\sqrt{\frac{e}{3}}$ ② $\frac{\pi}{6}\sqrt{\frac{e}{2}}$ ③ $\frac{\pi}{4}\sqrt{\frac{e}{3}}$ ④ $\frac{\pi}{4}\sqrt{\frac{e}{2}}$

62. The integral $\int \frac{\left(x^8 - x^2\right)dx}{\left(x^{12}+3x^6+1\right)\tan^{-1}\left(x^3+\frac{1}{x^3}\right)}$ is equal to :

① $\log_e\left(\left|\tan^{-1}\left(x^3+\frac{1}{x^3}\right)\right|\right)^{1/3} + C$ ② $\log_e\left(\left|\tan^{-1}\left(x^3+\frac{1}{x^3}\right)\right|\right) + C$

③ $\log_e\left(\left|\tan^{-1}\left(x^3+\frac{1}{x^3}\right)\right|\right)^{1/2} + C$ ④ $\log_e\left(\left|\tan^{-1}\left(x^3+\frac{1}{x^3}\right)\right|\right)^{3} + C$

63. The integral $\int_0^{\pi} \frac{8x\,dx}{4\cos^2 x + \sin^2 x}$ is equal to

① $2\pi^2$ ② $4\pi^2$ ③ π^2 ④ $\frac{3\pi^2}{2}$

64. Let (a, b) be the point of intersection of the curve $x^2 = 2y$ and the straight line $y - 2x - 6 = 0$ in the second quadrant. Then the integral $I = \int_a^b \frac{9x^2}{1+5^x}dx$ is equal to :

① 27 ② 18 ③ 24 ④ 21

65. The area of the region $\left\{(x,y): 0 \le x \le \frac{9}{4},\quad 0 \le y \le 1,\quad x \ge 3y,\quad x + y \ge 2\right\}$ is

① $\frac{11}{32}$ ② $\frac{35}{96}$ ③ $\frac{37}{96}$ ④ $\frac{13}{32}$

66. Let the straight line $x = b$ divides the area enclosed by $y = (1 - x)^2$, $y = 0$, and $x = 0$ into two parts R_1 $(0 \le x \le b)$ and R_2 $(b \le x \le 1)$ such that $R_1 - R_2 = \frac{1}{4}$. Then b equals

① $\frac{3}{4}$ ② $\frac{1}{2}$ ③ $\frac{1}{3}$ ④ $\frac{1}{4}$

67. The area bounded by the parabola $y = (x + 1)^2$ and $y = (x - 1)^2$ and the line $y = 1/4$ is

① 4 sq. units ② 1/6 sq. units ③ 4/3 sq. units ④ 1/3 sq. units

68. If the area of the region bounded by the curves $y = 4 - \frac{x^2}{4}$ and $y = \frac{x-4}{2}$ is equal to α, then 6α equals

① 210 ② 250 ③ 240 ④ 220

69. Let $f(x)$ be a positive function and $I_1 = \int_{-\frac{1}{2}}^{1} 2x f(2x(1-2x))dx$ and $I_2 = \int_{-1}^{2} f(x(1-x))dx$. Then the value of $\frac{I_2}{I_1}$ is equal to _____.

① 12 ② 9 ③ 6 ④ 4

70. Let $f(x) = \int_0^x t\left(t^2 - 9t + 20\right)dt,\ 1 \le x \le 5$. If the range of f is $[\alpha, \beta]$, then $4(\alpha + \beta)$ equals.

① 253 ② 157 ③ 154 ④ 125

Section—B
(Numerical Answer Type)

71. If $\lim\limits_{t\to 0}\left(\int_0^1 (3x+5)^t\,dx\right)^{\frac{1}{t}} = \frac{\alpha}{5e}\left(\frac{8}{5}\right)^{\frac{2}{3}}$, then α is equal to _____.

72. If the area of the larger portion bounded between the curves $x^2 + y^2 = 25$ and $y = |x - 1|$ is $\frac{1}{4}(b\pi + c)$, $b, c \in \mathbb{N}$, then $b + c$ is equal to _____.

73. The number of singular matrices of order 2, whose elements are from the set {2, 3, 6, 9}, is _____.

74. Let $f(x) = \sum_{k=1}^{10} kx^k,\ x \in \mathbb{R}$. If $2f(2) + f'(2) = 119(2)^n + 1$ then n is equal to _____.

75. If $\int \frac{1}{\sqrt[5]{(x-1)^4(x+3)^6}}dx = A\left(\frac{\alpha x - 1}{\beta x + 3}\right)^B + C$, where C is the constant of integration, then the value of $\alpha + \beta + 20AB$ is _____.