FIITJEE

# ALL INDIA TEST SERIES

## FULL TEST – II

## JEE (Main)-2025

## TEST DATE: 05-01-2025

**Time Allotted: 3 Hours** **Maximum Marks: 300**

**General Instructions:**

- The test consists of total 75 questions.
- Each subject (PCM) has 25 questions.
- This question paper contains **Three Parts.**
- **Part-A** is Physics, **Part-B** is Chemistry and **Part-C** is Mathematics.
- Each part has only two sections: **Section-A and Section-B**.

  **Section-A (01 – 20, 26 – 45, 51 – 70)** *contains 60 multiple choice questions which have* ***only one correct answer****. Each question carries* ***+4 marks*** *for correct answer and* ***–1 mark*** *for wrong answer.*

  ***Section-B (21 – 25, 46 – 50, 71 – 75)*** *contains 15 Numerical based questions. The answer to each question is rounded off to the nearest integer value. Each question carries* ***+4 marks*** *for correct answer and* ***–1 mark*** *for wrong answer.*

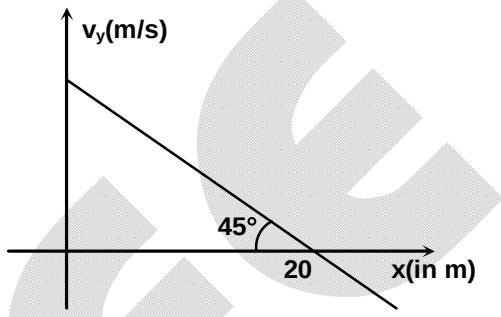
# Physics

## PART – A

### SECTION – A
### (One Options Correct Type)

*This section contains **20 multiple choice questions**. Each question has **four choices** (A), (B), (C) and (D), out of which **ONLY ONE** option is correct.*

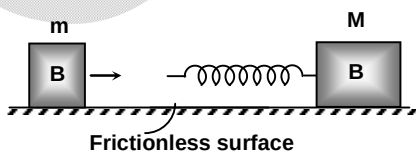
1. A ball is projected from ground making an angle $\theta$ with the horizontal (x-direction). The vertical component of its velocity ($v_y$) changes with its x-coordinate according to the graph a shown in the figure. The angle of projection $\theta$ with horizontal is (Take g = 10 m/s$^2$)




(A) $\tan^{-1}(4)$ (B) $\tan^{-1}(2)$

(C) $\tan^{-1}\left(\frac{1}{4}\right)$ (D) $\tan^{-1}\left(\frac{1}{2}\right)$

2. Two blocks of mass m and M are lying on a smooth table. A spring is attached with the block of mass M. Block of mass m is given a velocity towards the other block. The value of $\frac{M}{m}$ for which the kinetic energy of the system will never fall below one fourth of the initial kinetic energy is




(A) $\frac{M}{m} \le 7$ (B) $\frac{M}{m} \le 3$

(C) $\frac{M}{m} \le 4$ (D) $\frac{M}{m} \le 5$

3. A satellite is moving in a low circular orbit about a planet of mass M and radius R. The radius of the orbit can be taken to be R itself. Then the minimum increase in the speed required so that the satellite could escape from the gravitation pull of planet is

(A) $\sqrt{\frac{2GM}{R}}$ (B) $\sqrt{\frac{GM}{2R}}$

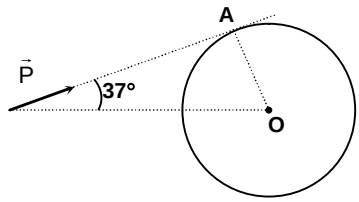
(C) $\sqrt{\frac{GM}{R}}$ (D) $\sqrt{\frac{GM}{R}}(\sqrt{2}-1)$

4. Two charged particle, having same kinetic energy are allowed to pass through a uniform magnetic field perpendicular to the direction of motion. If the ratio of radii of their circular paths is 6 : 5 and their respective charges ratio is 1 : 2. Then the ratio of their masses will be

(A) 8 : 25 (B) 9 : 25

(C) 25 : 7 (D) 6 : 25

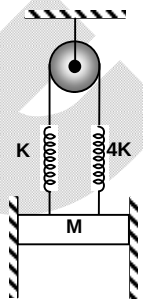
5. A short electric dipole of dipole moment P is placed near a neutral conducting sphere of radius R as shown in the figure. The electric potential at point A on the surface of sphere. $\left[K = \frac{1}{4\pi\varepsilon_0}\right]$




(A) $\frac{30KP}{125R^2}$ (B) $\frac{125KP}{30R^2}$

(C) $\frac{36KP}{125R^2}$ (D) $\frac{125KP}{36R^2}$

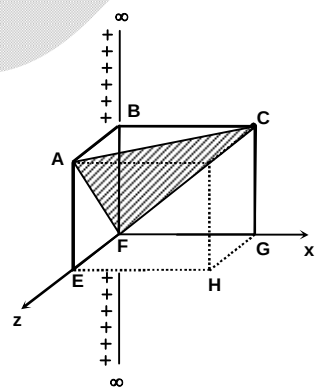
6. A block of mass M is suspended with the help of two light springs and light inextensible string that passes over an ideal pulley. Force constant of the spring are K and 4K respectively as shown. (walls are frictionless). The time period for small oscillations is




(A) $\pi\sqrt{\frac{5M}{K}}$ (B) $\frac{\pi}{2}\sqrt{\frac{5M}{K}}$

(C) $\pi\sqrt{\frac{M}{5K}}$ (D) $\pi\sqrt{\frac{2M}{5K}}$

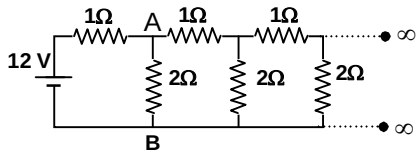
7. A long straight wire having linear charge density $\lambda$ passing through the edge of a cube of side length 'a' as shown in the figure. The electric flux through the triangular plane AFC is




(A) zero (B) $\frac{\lambda a}{4\varepsilon_0}$

(C) $\frac{\lambda a}{2\varepsilon_0}$ (D) $\frac{\lambda a}{8\varepsilon_0}$

8. Figure shows an infinite ladder network of resistances. The current that passes through the branch AB.




(A) 6A (B) 2A

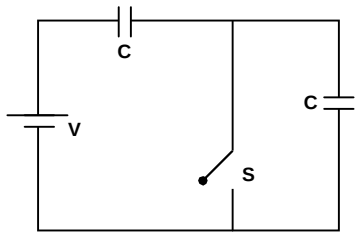
(C) 3A (D) 4A

9. If M is the mass of water rises in a capillary tube of radius 'r' then the mass of water which will rise in a capillary tube radius '4r' is

(A) M (B) 4M

(C) $\frac{M}{2}$ (D) 2M

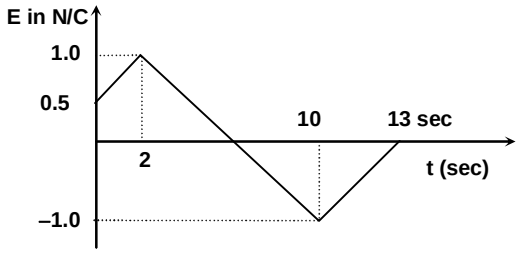
10. In the circuit shown, find heat dissipated in the circuit after switch is closed (Initially switch is open)




(A) $\frac{CV^2}{3}$ (B) $\frac{CV^2}{6}$

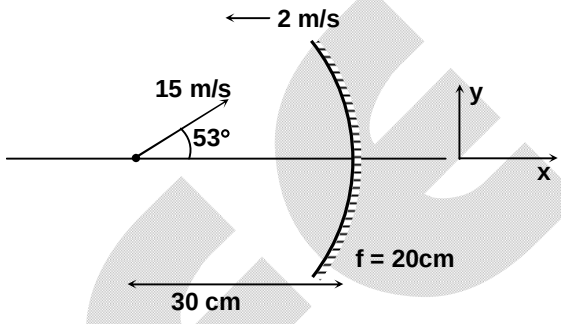
(C) $\frac{CV^2}{12}$ (D) $\frac{CV^2}{4}$

11. The electric field through an area of $2m^2$ varies with time as shown in the graph. The greatest displacement current through the area is at



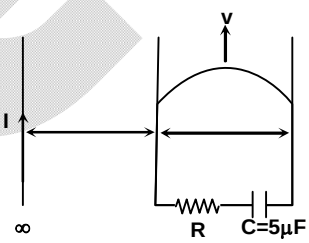

(A) t = 1 sec
(B) t = 4 sec
(C) t = 8 sec
(D) t = 12 sec

12. The velocity (in m/s) of image in a situation as shown in the figure is



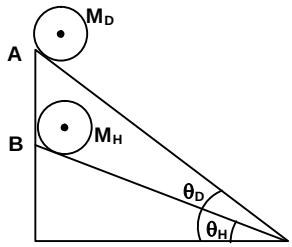

(A) $24\hat{i} - 46\hat{j}$
(B) $-46\hat{i} - 24\hat{j}$
(C) $46\hat{i} + 24\hat{j}$
(D) $46\hat{i} - 24\hat{j}$

13. Two ends of a semicircular rod one at a distance 1 cm and 2 cm from a fixed long straight wire carrying current I as shown in the figure. The rod is made to move with constant speed of v on a conducting frame. At t = 0 capacitor is uncharged. The maximum change on the capacitor C= 5μF is (Take $\frac{\mu_0}{4\pi} = 10^{-7}$ S.I. unit, $Iv = \frac{1}{\ell n 2}$ S.I. unit)




(A) $1\times10^{-12}$C
(B) $2\times10^{-12}$C
(C) $3\times10^{-12}$C
(D) $4\times10^{-12}$C

14. A uniform disc of mass $M_D$ and a uniform hollow sphere of mass $M_H$ are placed at points A and B of two inclines, respectively. If they roll on the incline without slipping such that their acceleration are the same, then the ratio $\frac{\sin\theta_D}{\sin\theta_H}$

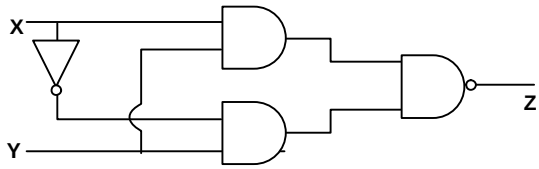



(A) $\frac{5}{9}$
(B) $\frac{9}{5}$
(C) $\frac{9}{10}$
(D) $\frac{8}{5}$

15. n moles of an ideal gas with constant volume heat capacity $C_V$ undergo an isobaric expansion by certain volume. The ratio of the work done in the process, to the heat supplied is

(A) $\frac{nR}{C_V - nR}$
(B) $\frac{nR}{C_V + nR}$
(C) $\frac{4nR}{C_V + nR}$
(D) $\frac{4nR}{C_V - nR}$

16. Truth table for the given circuit is




(A)

| X | Y | Z |
|---|---|---|
| 1 | 0 | 1 |
| 0 | 0 | 1 |
| 1 | 1 | 1 |
| 0 | 1 | 1 |

(B)

| X | Y | Z |
|---|---|---|
| 1 | 0 | 0 |
| 0 | 0 | 0 |
| 1 | 1 | 0 |
| 0 | 1 | 1 |

(C)

| X | Y | Z |
|---|---|---|
| 1 | 0 | 1 |
| 0 | 0 | 1 |
| 1 | 1 | 1 |
| 0 | 1 | 0 |

(D)

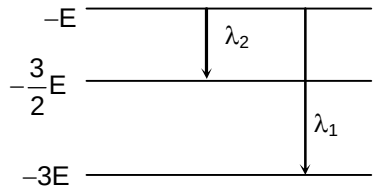
| X | Y | Z |
|---|---|---|
| 1 | 0 | 0 |
| 0 | 0 | 1 |
| 1 | 1 | 1 |
| 0 | 1 | 1 |

17. In a young's Double slit experiment, D equals the distance of screen from slit and d is the separation between the slit. The distance of the nearest point to the central maxima where intensity is twice as that due to single slit is equal to (D >> d)

(A) $\frac{D\lambda}{2d}$ (B) $\frac{D\lambda}{4d}$

(C) $\frac{D\lambda}{3d}$ (D) $\frac{2D\lambda}{d}$

18. Figure shows energy levels of a molecule, the ratio of the wavelengths $\frac{\lambda_1}{\lambda_2}$ for transitions shown is




(A) $\frac{1}{2}$ (B) $\frac{1}{4}$

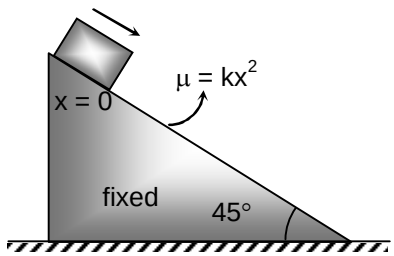
(C) 1 (D) 2

19. The external and internal diameters of a hollow cylinder are measured to be $(5.23 \pm 0.01)$ cm and $(4.89 \pm 0.01)$ cm . The thickness of the wall of the cylinder is

(A) $(0.17 \pm 0.02)$ cm (B) $(0.17 \pm 0.01)$ cm

(C) $(0.34 \pm 0.01)$ cm (D) $(0.34 \pm 0.02)$ cm

20. A block is released from rest on a rough inclined plane with coefficient of friction varying as $\mu = kx^2$ ; where k is constant. The maximum velocity of block for




(A) $x = \frac{1}{\sqrt{k}}$ (B) $x = \frac{2}{\sqrt{k}}$

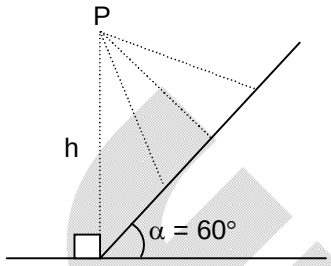
(C) $x = \frac{4}{\sqrt{k}}$ (D) $x = \frac{3}{\sqrt{k}}$

## SECTION – B

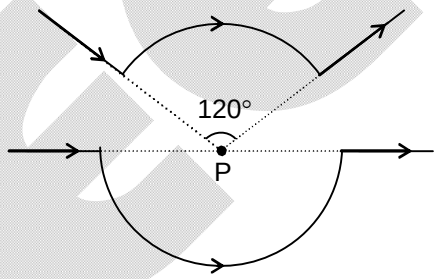
**(Numerical Answer Type)**

*This section contains **05** Numerical based questions. The answer to each question is rounded off to the nearest integer value.*

21. A point P lies vertically above the lowest point of an inclined plane of inclination $\alpha = 60°$ at a height h = 30 m. Point P is joined to the plane at number of points by smooth wires, running in all possible directions. Small bodies in the shape of beads are released from P along the wire simultaneously. Find the least time (in sec) taken by bead to reach the inclined plane. (Take g = 10 m/s$^2$)

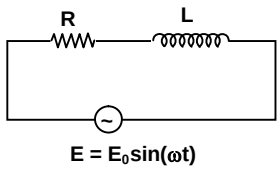



22. Figure shows two current segments. In the upper segment, an arc of radius 4 cm subtends an angle of 120° with centre P . The lower segment includes a large semicircle of radius 5 cm also with centre P. If I = 0.2 amp in both. If the net magnetic field at point P due to these current segments is $\frac{\pi x}{30}\mu T$ ,then find the value of x .




23. A charged particle of 1 $\mu$C and having mass 2 gm is projected with speed of 10 m/s from a point where electric potential is $4\times10^5$ V in the direction of decreasing electric potential. The electric potential at a point where its speed becomes $10\sqrt{2}$ m/s is $n\times10^5$ volts. Find the value of n?

24. Figure show a series LR circuit, when instantaneous voltage across source is maximum. The voltage across inductor is 3V and that across resistor is 4V. If resistance is 2$\Omega$, the reactance of inductor is $\sqrt{n}\ \Omega$, find the value of n.




25. Two travelling wave produces standing wave represented by equation

$$y = 2(\text{mm})\cos\left(\frac{\pi}{4}\text{cm}^{-1}\right)x\sin(78.5\,\text{s}^{-1})t$$

The node closet to the origin in the region x > 0 will be at x= ……cm

# Chemistry

## PART – B

### SECTION – A
### (One Options Correct Type)

*This section contains **20 multiple choice questions**. Each question has **four choices** (A), (B), (C) and (D), out of which **ONLY ONE** option is correct.*

26. Decomposition of $Cl_2O_7(g)$ proceeds by zero order kinetics as:
$Cl_2O_7(g) \longrightarrow 2ClO_2(g) + \frac{3}{2}O_2(g)$. If $P_o$ = 600 mm Hg and $-\frac{d[Cl_2O_7]}{dt} = 50$ mm Hg. Then rate of production of $O_2$ and half-life period of reaction are
(A) 50 mm Hg, 10 sec
(B) 60 mm Hg, 6 sec
(C) 75 mm Hg, 6 sec
(D) 75 mm Hg, 10 sec

27. $BrO_3^- \xrightarrow{0.54\ V} BrO^- \xrightarrow{0.17\ V} Br^-$
$E^o = x$
The value of x is
(A) – 0.417 V
(B) 0.717 V
(C) 0.37 V
(D) 0.417 V

28. The decreasing order of the rate of nitration of the following compounds is:
I. Benzene II. $C_6D_6$
III. Nitrobenzene IV. Chlorobenzene
(A) I > II > III > IV
(B) I > II > IV > III
(C) I = II > IV > III
(D) I = II > III > IV

29. Choose the incorrect statement
(A) $NF_3 < NCl_3 < NBr_3$ (Lewis base strength)
(B) In hydrolysis of $SbCl_3$ the addition of excess of HCl suppresses the hydrolysis by shifting the equilibrium to the left
(C) $NF_3$ does not undergo hydrolysis
(D) Thermal stability of $PCl_5 > PCl_3$

30. Equal volume each of two sols of AgI, one obtained by adding $AgNO_3$ to slight excess of KI and another obtained by adding KI to slight excess of $AgNO_3$ are mixed together. Then:
(A) The sols will coagulate each other mutually
(B) A true solution will be obtained
(C) The two sols will stabilize each other
(D) The sol will stabilize each other

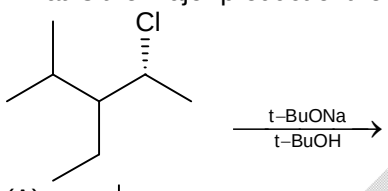
31. In H-like species, an electron jumps from an orbital having two radial and two angular nodes to the orbital having same sign of wave function in all direction, at any distance. If energy of the emitted photon is 326.4 eV, the species is:
(A) H
(B) $He^+$
(C) $Li^{+2}$
(D) $B^{+4}$

32. 2 moles of ideal gas undergoes following process:
(1) A reversible isobaric expansion from 1 atm, 20 litre to 1 atm 40 litres. (2) A reversible isochoric change to 0.5 atm. (3) A reversible isothermal compression from 0.5 atm to 1.0 atm at $27^{o}$C. The total work in the process is
[Given: 1 litre atm = 100 J]
(A) 19.89 J (B) 1415 J
(C) 20.11 J (D) 22.22 J

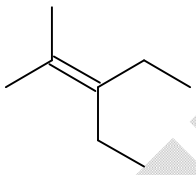
33. 10 ml of 0.2 M solution of $K_xH(C_2O_4)_y$ requires 8 mL of 0.2 M acidified $KMnO_4$ solution. Then the value of x is?
(A) 1 (B) 2
(C) 3 (D) 4

34. Which of the following statement is correct with respect to bond angle
(A) The $F-\widehat{Kr}-F$ angle in $KrF_4$ is $90^{o}$.
(B) The $F-\hat{S}-F$ angle in $SF_2$ is more than $109^{o}28'$.
(C) The $H-\hat{N}-N$ angle in $N_2H_2$ is approximately $180^{o}$.
(D) The $Cl-\hat{N}-O$ angle in NOCl is more than $120^{o}$.

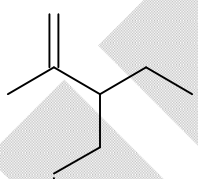
35. What is the major product of the reaction?



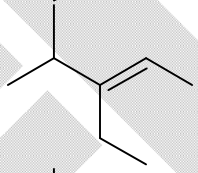

(A)



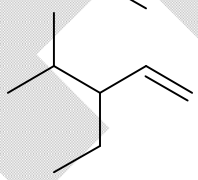
(B)



(C)



(D)



36. In the reaction,

$3Br_2 + 6CO_3^{--} + 3H_2O \longrightarrow 5Br^- + BrO_3^- + 6HCO_3^-$

(A) Bromine undergoes disproportionation

(B) Equivalent weight of $CO_3^{--}$ is $\frac{10M}{5}$

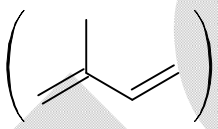
(C) Equivalent weight of $Br_2$ is $\frac{3M}{5}$

(D) $CO_3^{--}$ is reducing agent

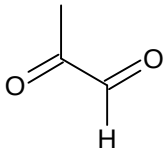
37. A gaseous equailibrium $A(g) + B(g) \rightleftharpoons 2C(g)$, rate constant forward and backward reactions are $6.4 \times 10^{-4}$ and $1.6 \times 10^{-4}$ respectively, starting with initially 2 moles each of A and B in a two litres contains equilibrium concentration of C is,

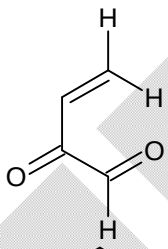
(A) 1.2 (B) 1.66

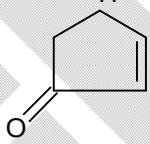
(C) 1.00 (D) 1.42

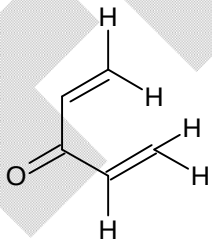
38. Natural rubber is the polymer of isoprene 

Natural rubber $\xrightarrow[2.\ Zn+H_2O]{1.\ O_3}$ [x] $\xrightarrow[2.\ H^+, \Delta]{1.\ OH^-(aq)}$ [Y]. The compound [Y] is

(A) 

(B) 

(C) 

(D) 

39. Non-volatile solute 'A' dimerises in a solvent as $2A \rightleftharpoons A_2$. If m is the molarity. Then equilibrium constant for reaction is

(A) $\frac{2K_b\left(K_bm+\Delta T_b\right)}{\left(2\Delta T_b-K_bm\right)^2}$ (B) $\frac{K_b\left(K_bm-\Delta T_b\right)}{\left(2\Delta T_b-K_bm\right)^2}$

(C) $\frac{K_b\left(K_bm-\Delta T_b\right)}{\left(2\Delta T_b-K_bm\right)^2}$ (D) $\frac{K_b\left(K_bm-\Delta T_b\right)}{\left(2\Delta T_b+K_bm\right)^2}$

40. The basic ionisation constant for hydrazine, $N_2H_4$ is $9.6\times 10^{-7}$. What would be the percent hydrolysis of 0.1 $N_2H_5Cl$?

(A) 0.016% (B) 3.2%

(C) 1.6% (D) 0.032%

41. The number of chiral carbons in the product formed when glucose reacts with HCN is

(A) 5 (B) 4

(C) 6 (D) 3

42. On reaction of cis-2-phenyl-1-bromocyclopentane with alc. KOH produces a compound (X). (X) on reaction with dil. $H_2SO_4$ produces (Y). Which of the following statement is incorrect for (X) and (Y)?

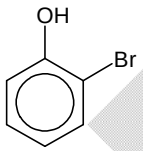
(A) Product (Y) is a $3^o$ ROH, with a chiral carbon.

(B) IUPAC name of (X) is 1-phenylcyclopentene.

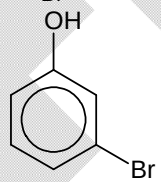
(C) No rearrangement occurs when product (X) is made to react with dil. $H_2SO_4$.

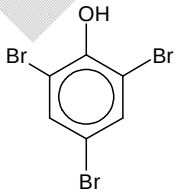
(D) (X) and (Y) both are optically inactive.

43. When phenol is heated with an aqueous solution of mixture of KBr and $KBrO_3$; the major product obtained is:

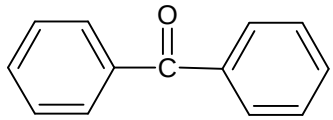
(A) 

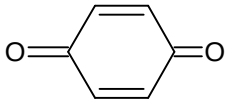

(B) 

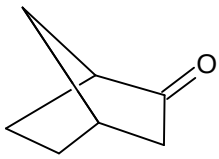

(C) 

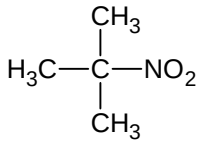

(D) 

44. Which of the following compound exhibits tautomerism?

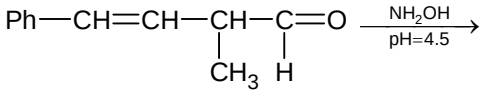
(A) 

(B) 

(C) 

(D) 

45. The possible number of stereoisomers of the product of following reaction would be:



(A) 2 (B) 4
(C) 6 (D) 8

## SECTION – B

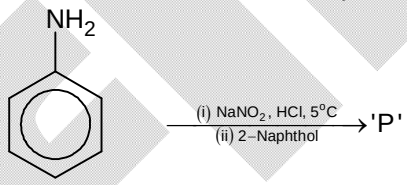
**(Numerical Answer Type)**

*This section contains **05** Numerical based questions. The answer to each question is rounded off to the nearest integer value.*

46. The number of ions having same value of spin only moment $(\mu_s)$ in $Fe^{++}$, $Mn^{++}$, $Cr^{++}$ and $Ni^{++}$ is....

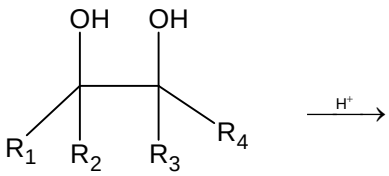
47. The number of species having higher $IE_1$ than Ca from the following is.....
Ga, Ge, Br, Se, Kr, As, K

48. Number of $\pi-$bonds in the product 'P' in the following reaction is____



49. An optically pure organic compound has specific rotation of +40°C. The optical purity of the sample that exhibits specific rotation of +32° is_____%

50. If total number of possible product in the following molecule are 'x' when $R_1 \neq R_2 \neq R_3 \neq R_4$ and 'y' when $R_2 = R_4 \neq R_1 \neq R_3$ then the value of 'x + y' is ($R_1$, $R_2$, $R_3$ and $R_4$ are alkyl group).



# Mathematics

## PART – C

### SECTION – A
### (One Options Correct Type)

*This section contains **20 multiple choice questions**. Each question has **four choices** (A), (B), (C) and (D), out of which **ONLY ONE** option is correct.*

51. Let M and N are square matrices of same order satisfying MN = M and NM = N, then $(M^{2024} + N^{2024})^{2025}$ is equal to
(A) M + N (B) 2025 (M + N)
(C) $2^{2024}$(M + N) (D) $2^{2025}$(M + N)

52. If $\left(x-2+\frac{1}{x}\right)^{30} = a_0x^{30} + a_1x^{29} + .....a_{29}x + a_{30}x^{-1} + ..... + a_{60}x^{-30}$ and $k = a_0 + a_1 + a_2 + ..... + a_{60}$ if $k - a_{30} = -{}^nC_r$, then n + r is equal to
(A) 50 (B) 80
(C) 90 (D) 110

53. Four digit numbers are formed using the digits from the set {0, 1, 2, 3, 4, 5} repetition of digits is allowed then :
Statement ($S_1$) : The number of such numbers formed that are odd is 480.
Statement ($S_2$) : The number of such numbers formed such that it contains exactly three different digits is 360.
(A) $S_1$, $S_2$ are true (B) $S_1$, $S_2$ are false
(C) $S_1$ is true and $S_2$ is false (D) $S_1$ is false and $S_2$ is true

54. The number of points in the complex plane that satisfy the condition |z – 2| = 2, z(1 – i) + $\bar{z}(1+i) = 4$ where $i = \sqrt{-1}$, is
(A) 0 (B) 1
(C) 2 (D) more than 2

55. Let $T(\theta) = \cos^2(30°-\theta°) - \cos(30° - \theta°)\cos(30° + \theta°) + \cos^2(30° + \theta°)$, then value of $4\sum_{\theta=1}^{30}\theta T(\theta) =$
(A) 1395 (B) 1295
(C) 995 (D) 895

56. The number of three term increasing geometrical progressions comprising distinct natural numbers less than or equal to 100, with common ratio as a natural number is
(A) 106 (B) 53
(C) 47 (D) 104

57. If a and b are chosen randomly by throwing a pair of fair cubical dice, then the probability that $\lim_{x\to0}\left(\frac{a^x+b^x}{2}\right)^{2/x} = 6$ equals
(A) $\frac{1}{9}$ (B) $\frac{2}{9}$
(C) $\frac{3}{9}$ (D) $\frac{4}{9}$

58. Let f(x) be a cubic polynomial on R which increases in interval $(-\infty, 0)$ and in $(1, \infty)$ and decreases in interval (0, 1). If f′(2) = 6 and f(2) = 2, then the value of

$$\tan^{-1}(f(1)) + \tan^{-1}\left(f\left(\frac{3}{2}\right)\right) + \tan^{-1}(f(0))$$

is equal to

(A) $\tan^{-1}2$ (B) $\cot^{-1}2$
(C) $-\tan^{-1}2$ (D) $-\cot^{-1}2$

59. If the logarithms of two distinct positive numbers are equal to the corresponding numbers then base of logarithms belongs to in interval

(A) (0, 1) (B) (1, e)
(C) $(e, e^e)$ (D) $(1, e^{1/e})$

60. Let y = y(x) satisfy the differential equation $\left(2xy + x^2y + \frac{y^3}{3}\right)dx + \left(x^2 + y^2\right)dy = 0$. If y(1) = 1 and $(y(0))^3 = ke$, $k \in N$ then k is

(A) 3 (B) 4
(C) 1 (D) 2

61. A strictly increasing continuous function f(x) intersects with its inverse $f^{-1}(x)$ at $x = \alpha$ and $x = \beta$, $\int_{\alpha}^{\beta}\left(f(x) + f^{-1}(x)\right)dx = 13$, where $\alpha, \beta \in N$ then the value of $|\alpha\beta|$ equals

(A) 25 (B) 36
(C) 42 (D) 56

62. Given lines $\frac{x}{a} + \frac{y}{b} = 1$ and ax + by = 1 are two variable lines, 'a' and 'b' being the parameters connected by the relation $a^2 + b^2 = ab$. The locus of the point of intersection has the equation

(A) $x^2 + y^2 + xy - 1 = 0$ (B) $x^2 + y^2 - xy + 1 = 0$
(C) $x^2 + y^2 + xy + 1 = 0$ (D) $x^2 + y^2 - xy - 1 = 0$

63. Let $H_n : \frac{x^2}{1+n} - \frac{y^2}{3+n} = 1$, $n \in N$. Let k be the smallest even value of n such that the eccentricity of $H_K$ is rational number. If '$\ell$' is length of the latus rectum of $H_K$, then $21\ell$ is equal to

(A) 101 (B) 204
(C) 102 (D) 306

64. In a parabola $y^2 = 4ax$, two points P and Q are taken such that the tangents drawn to parabola at these points meet at directrix in R. Focus of locus of circumcentre of triangle PQR will be

(A) $\left(\frac{a}{2}, 0\right)$ (B) (a, 0)
(C) $\left(\frac{3a}{2}, 0\right)$ (D) $\left(\frac{5a}{2}, 0\right)$

65. If circle is inscribed in ellipse $x^2 + 4y^2 = 4$, then range of radius of circle is

(A) [0, 1) (B) (0, 1]
(C) $\left[\frac{1}{2}, 1\right]$ (D) $\left(\frac{1}{2}, 1\right]$

66. Let $\bar{a},\bar{b},\bar{c}$ are three vectors having magnitudes 1, 2, 3 respectively satisfy the relation $|(\bar{a}\times\bar{b})\cdot\bar{c}| = 6$. If $\bar{d}$ is a unit vector coplanar with $\bar{b}$ and $\bar{c}$ such that that $\bar{b}\cdot\bar{d} = 1$ then the value of $|(\bar{a}\times\bar{c})\cdot\bar{d}|^2 + |(\bar{a}\times\bar{c})\times\bar{d}|^2$ is

(A) 9 (B) 3

(C) 27 (D) $\frac{9}{2}$

67. Let $\bar{a},\bar{b},\bar{c}$ be three non-zero vectors satisfying $\bar{a} = \bar{b}\times\bar{c} + 2\bar{b}$ where $|\bar{b}| = |\bar{c}| = 2$ and $|\bar{a}| \le 4$. The sum of possible value(s) of $|2\bar{a} + \bar{b} + \bar{c}|$ is

(A) 8 (B) 12

(C) 20 (D) 32

68. If the equation of the plane passing through the point (–1, 2, 0) and parallel to the lines $\frac{x}{3} = \frac{y+1}{0} = \frac{z-2}{-1}$ and $\frac{x-1}{1} = \frac{y+1}{2} = \frac{z+1}{-1}$ is ax + by + cz = 1, then the value of a + b + c is

(A) 3 (B) 4

(C) 5 (D) 10

69. Let A = {1, $a_1$, $a_2$, …… $a_{18}$, 77} be set of integers with $1 < a_1 < a_2 \ldots < a_{18} < 77$. Let the set A + A = {x + y : y ∈ A} contain exactly 39 elements. Then the value of $a_1 + a_2 + \ldots + a_{18}$ is equal to

(A) 600 (B) 702

(C) 800 (D) 200

70. Consider the data on X taking the values 0, 2, 4, 8, ….. $2^n$ with frequencies ${}^nC_0$, ${}^nC_1$, …. ${}^nC_n$ respectively. If the mean of this data is $\frac{728}{2^n}$, then n is equal to

(A) 15 (B) 8

(C) 4 (D) 6

## SECTION – B

### (Numerical Answer Type)

*This section contains **05** Numerical based questions. The answer to each question is rounded off to the nearest integer value.*

71. The number of integral values of k for which line 3x + 4y – k = 0, lies between the circles $x^2 + y^2 - 2x - 2y + 1 = 0$ and $x^2 + y^2 - 18x - 12y + 113 = 0$, without cutting a chord on either of circle is equal to

72. Let $E_1$, $E_2$, $E_3$ be three independent events associated with a random experiment such that $3P(E_1 \cap \overline{E_2} \cap \overline{E_3}) = P(\overline{E_1} \cap E_2 \cap \overline{E_3}) = 9P(\overline{E_1} \cap \overline{E_2} \cap E_3) = 3 - 3P(E_1 \cup E_2 \cup E_3)$, where $P(E_1)$, $P(E_2)$, $P(E_3) \neq 1$ and P(A) denotes probability of event A. If absolute value of $\begin{vmatrix} P(E_1) & P(E_2) & P(E_3) \\ P(E_2) & P(E_3) & P(E_1) \\ P(E_3) & P(E_1) & P(E_2) \end{vmatrix} = \frac{a}{b}$ where a, b ∈ N, then least value of a + b is

73. If the length of the perpendicular drawn from the point P(a, 4, 2), a > 0 on the line $\frac{x+1}{2}=\frac{y-3}{3}=\frac{z-1}{-1}$ is $2\sqrt{6}$ units and Q($\alpha_1$, $\alpha_2$, $\alpha_3$) is the image of point P on this line then $a+\sum_{i=1}^{3}\alpha_i$ is equal to

74. Let 'f' be a function defined on the interval (0, $2\pi$] such that $\int_0^x (f'(t)-\sin 2t)dt=\int_x^0 f(t)\tan t\,dt$ and f(0) = 1, if the maximum value of f(x) is m then 8m is equal to

75. The eccentricity of ellipse $3x^2 + 4y^2 = 12$ is changed at the rate 0.1/sec. The time in sec. such that ellipse becomes auxiliary circle is