FIITJEE

ALL INDIA TEST SERIES

JEE (Advanced)-2025

CONCEPT RECAPITULATION TEST – II

PAPER –1

TEST DATE: 24-04-2025

Time Allotted: 3 Hours **Maximum Marks: 180**

General Instructions:

- The test consists of total 51 questions.
- Each subject (PCM) has 17 questions.
- This question paper contains **Three Parts.**
- **Part-I** is Physics, **Part-II** is Chemistry and **Part-III** is Mathematics.
- Each **Part** is further divided into **Two Sections**: **Section-A & Section-B**.

Section – A (01 – 04, 18 – 21, 35 – 38): *This section contains* ***TWELVE (12)*** *questions. Each question has* ***FOUR*** *options.* ***ONLY ONE*** *of these four options is the correct answer.*

Section – A (05 –07, 22 – 24, 39 – 41): *This section contains* ***NINE (9)*** *questions. Each question has* ***FOUR*** *options.* ***ONE OR MORE THAN ONE*** *of these four option(s) is(are) correct answer(s).*

Section – A (08 – 11, 25 – 28, 42 – 45): *This section contains* ***TWELVE (12)*** *Matching List Type Questions. Each question has* ***FOUR*** *statements in* ***List-I*** *entries (P), (Q), (R) and (S) and* ***FIVE*** *statements in* ***List-II*** *entries (1), (2), (3), (4) and (5). The codes for lists have choices (A), (B), (C), (D) out of which,* ***ONLY ONE*** *of these four options is correct answer.*

Section – B (12 – 17, 29 – 34, 46 – 51): *This section contains* ***EIGHTEEN (18)*** *numerical based questions. The answer to each question is a* ***NON-NEGATIVE INTEGER VALUE****.*

MARKING SCHEME

Section – A (Single Correct): Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+3	If ONLY the correct option is chosen.
Zero Marks	:	0	If none of the options is chosen (i.e. the question is unanswered);
Negative Marks	:	–1	In all other cases.

Section – A (One or More than One Correct): Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+4	If only (all) the correct option(s) is (are) chosen;
Partial Marks	:	+3	If all the four options are correct but ONLY three options are chosen;
Partial marks	:	+2	If three or more options are correct but ONLY two options are chosen and both of which are correct;
Partial Marks	:	+1	If two or more options are correct but ONLY one option is chosen and it is a correct option;
Zero Marks	:	0	If none of the options is chosen (i.e. the question is unanswered);
Negative Marks	:	–2	In all other cases.

Section – B: Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+4	If ONLY the correct numerical value is entered at the designated place;
Zero Marks	:	0	In all other cases.

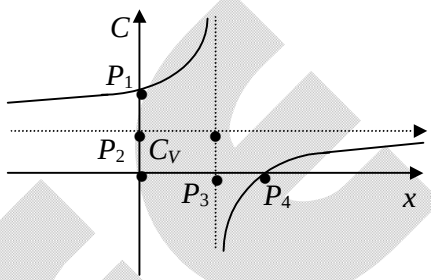
Physics

PART – I

SECTION – A
(One Options Correct Type)

*This section contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.*

1. The following graph gives the variation of molar heat capacity C a function of x where x is given by the expression PV^x = constant. If gas is monoatomic what are the coordinates of P_1 and P_4



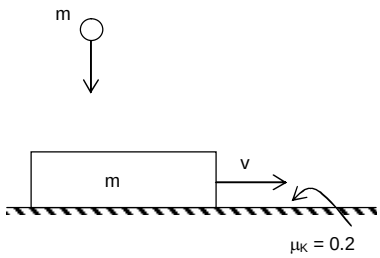
(A) $\left(0, \frac{5}{2}R\right)$ & $\left(\frac{5}{3}, 0\right)$

(B) $\left(0, \frac{3}{2}R\right)$ & $\left(\frac{7}{5}, 0\right)$

(C) $\left(0, \frac{5}{2}R\right)$ & $\left(\frac{7}{5}, 0\right)$

(D) $\left(0, \frac{7}{5}R\right)$ & $\left(\frac{5}{3}, 0\right)$

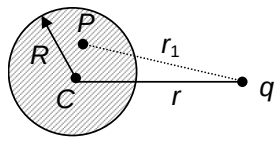
2. A ball of mass m falls vertically from a height h and collides with a block of equal mass m moving horizontally with a velocity v on a surface. The coefficient of kinetic friction between the block and the surface is $\mu_k = 0.2$, while the coefficient of restitution (e) between the ball and the block is 0.5. There is no friction acting between the ball and the block. The velocity of the block just after the collision decreases by (if it is still in motion)



(A) $0.5\sqrt{2gh}$ (B) 0

(C) $0.1\sqrt{2gh}$ (D) $0.3\sqrt{2gh}$

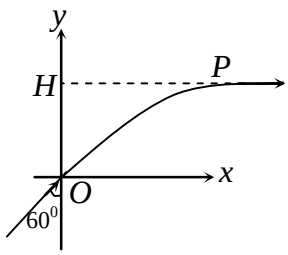
3. A point charge is placed at a distance r from center of a conducting neutral sphere of radius R (r > R). The potential at any point P inside the sphere at a distance r_1 from point charge due to induced charge of the sphere is given by [k = $\frac{1}{4\pi\varepsilon_0}$]



(A) kq/r_1 (B) kq/r

(C) $kq/r - kq/r_1$ (D) $-kq/R$

4. A system of coordinates is drawn in a medium whose refractive index varies as $\mu = \frac{2}{1+y^2}$, where $0 \le y \le 1$. A ray of light is incident at origin at an angle 60^0 with *y* –axis as shown in the figure. At point P ray becomes parallel to x-axis. The value of *H* is



(A) $\left\{\left(\frac{2}{\sqrt{3}}\right)-1\right\}^{1/2}$ (B) $\left\{\frac{2}{\sqrt{3}}\right\}^{1/2}$

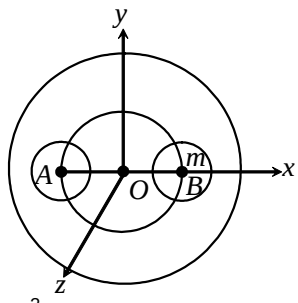
(C) $\left\{\left(\sqrt{3}\right)-1\right\}^{1/2}$ (D) $\left\{\left(\sqrt{3}+1\right)\right\}^{1/2}$

SECTION – A
(One or More than one correct type)

*This section contains **THREE (03)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).*

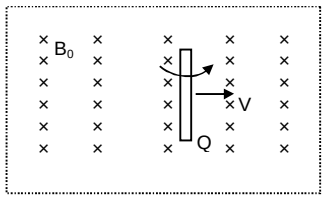
5. One mole of monoatomic gas expands with temperature according to the relation $V = KT^{2/3}$ where 'k' is constant. Then choose the correct alternative(s).
(A) Work done to change the temperature by 30°C is 20 R.
(B) Change in internal energy when temperature is changed by 20°C is 30 R.
(C) If volume of gas is changed by 2% the temperature will change by 3%.
(D) If temperature of gas is changed by 2% the pressure will change by 6%.

6. A solid sphere of uniform density and radius 4 units is located with its centre at the origin *O* of co-ordinates. Two spheres of equal radii 1 units, with their centres at *A*(–2,0,0) and *B* (2, 0 ,0) respectively, are taken out of the solid leaving behind spherical cavities as shown in figure. Then



(A) the gravitational field due to this object at the origin is zero.
(B) the gravitational field at the point *B*(2, 0, 0)is zero
(C) the gravitational potential is same at all points on the circle $y^2 + z^2 = 36$
(D) the gravitational potential is same at all points on the circle $y^2 + z^2 = 4$

7. A uniform thin rod PQ of length 'L' is moving in a uniform magnetic field B_0 such that velocity of its centre of mass is v and angular velocity is $\omega = \frac{4v}{L}$. Then



(A) e.m.f. between end P and end Q of the rod is $B_0 l v$
(B) end P of the rod is at higher potential than end Q of the rod
(C) end Q of the rod is at higher potential than end P of the rod
(D) the electrostatic field induced in the rod has same direction at all points along the length of rod.

SECTION – A
(Matching List Type)

*This section contains **FOUR (04)** Matching List Type Questions. Each question has FOUR statements in **List-I** entries (P), (Q), (R) and (S) and FIVE statements in **List-II** entries (1), (2), (3), (4) and (5). The codes for lists have choices (A), (B), (C), (D) out of which **ONLY ONE** of these four options is correct answer.*

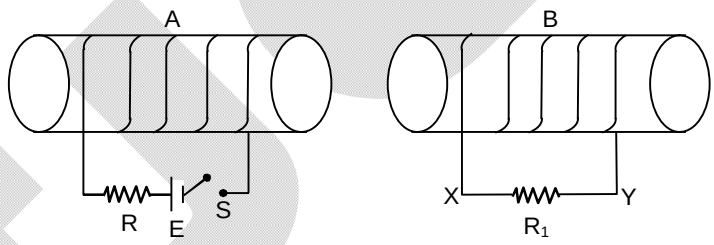
8. Average speed of a bus measured by six different students is given as follows:

Student number	1st	2nd	3rd	4th	5th	6th
Speed (m/s)	12.5 m/s	12.3 m/s	11.8 m/s	12.4 m/s	12.2 m/s	12.6 m/s

List-I		**List-II**	
(P)	Mean absolute error	(1)	$\pm$ 0.2
(Q)	Mean value	(2)	12.3 m/s
(R)	Relative error	(3)	$\pm$ 0.0163
(S)	Percentage error	(4)	$\pm$ 1.63 %

The correct option is:
(A) P–3 ; Q–1 ; R–2 ; S–4
(B) P–1 ; Q–2 ; R–3 ; S–4
(C) P–1 ; Q–3 ; R–4 ; S–2
(D) P–1 ; Q–4 ; R–3 ; S–2

9. In the circuit shown in figure two coils are arranged as shown. In List-I, some operation which is carried out in circuit I is mentioned and in List-II about its effect.

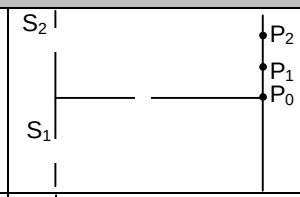
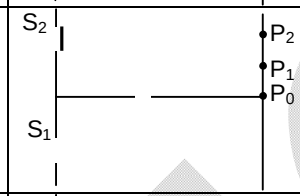
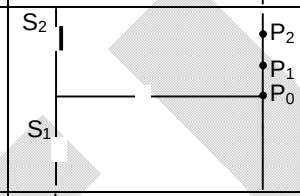
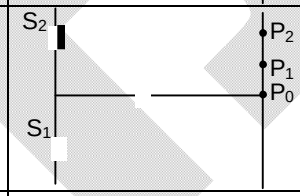


Match the entries of List-I with the entries of List-II.

List-I		**List-II**	
(P)	Switch S is closed (exclude small switching time)	(1)	Current in R_1 is form X to Y.
(Q)	Switch S is closed for long time then it opened for this transition time.	(2)	Current in R_1 is form Y to X
(R)	If coil A is move, perpendicular to B, switch S is closed.	(3)	No current is flowing through R_1.
(S)	The battery of constant emf is replaced by a varying emf and switch S is closed.	(4)	Current in R_1 can be from X to Y or form Y to X.
		(5)	Coil B will attract coil A

The correct option is:
(A) P–2 ; Q–1, 3 ; R–5 ; S–4
(B) P–3 ; Q–2 ; R–2, 5 ; S–3,4
(C) P–3 ; Q–4 ; R–1, 2 ; S–4
(D) P–1 ; Q–2, 5 ; R–2, 5 ; S–4

10. List-I shows four situations of standard young's double slit arrangement with screen placed far away from the slits S_1 and S_2. In each of these cases $S_1P_0 = S_2P_0$, $S_1P_1 - S_2P_1 = \lambda/4$ and $S_1P_2 - S_2P_2 = \lambda/3$, where λ is the wavelength of the light used. In the cases B, C and D, a transparent sheet of refractive index μ and thickness t is pasted on slit S_2. The thickness of the sheets are different in different cases. The phase difference between the light waves reaching a point P on the screen from the two slits is denoted by $\delta(p)$ and the intensity by I(p). Match each situation given in List-I with the statement(s) in List-II.

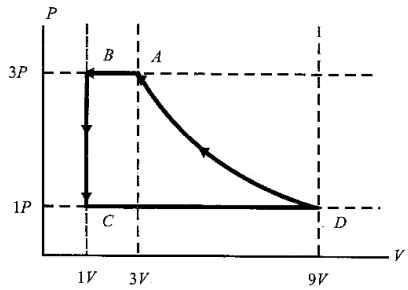
List-I			List-II	
(P)	No slit is covered by a plate		(1)	$\delta(P_0) = 0$
(Q)	$(\mu - 1)t = \lambda/4$		(2)	$\delta(P_1) = 0$
(R)	$(\mu - 1)t = \lambda/2$		(3)	$I(P_1) = 0$
(S)	$(\mu - 1)t = 3\lambda/4$		(4)	$I(P_0) > I(P_1)$
			(5)	$I(P_2) > I(P_1)$

The correct option is:

(A) P–1,4 ; Q–3 ; R–5 ; S–3,5 (B) P–1,3 ; Q–4 ; R–5 ; S–3,4,5

(C) P–1,4 ; Q–2 ; R–3 ; S–3,4,5 (D) P–1,2 ; Q–5 ; R–4 ; S–1,5

11. One mole of a monatomic ideal gas is taken through a cycle ABCDA as shown in the P-V diagram. List-II gives the characteristics involved in the cycle. Match them with each of the processes given in List-I.



List-I		List-II	
(P)	Process A $\rightarrow$ B	(1)	Internal energy decreases
(Q)	Process B $\rightarrow$ C	(2)	Internal energy increases
(R)	Process C $\rightarrow$ D	(3)	Heat is lost
(S)	Process D $\rightarrow$ A	(4)	Heat is gained
		(5)	Work is done on the gas

The correct option is:

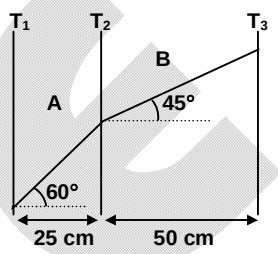
(A) P–1,3,5 ; Q–1,3 ; R–2,4 ; S–3,5 (B) P–1,2,5 ; Q–1,2 ; R–4 ; S–3,5

(C) P–1,5 ; Q–1,3 ; R–2,4 ; S–4,5 (D) P–3,5 ; Q–1,4 ; R–2,3 ; S–2,4

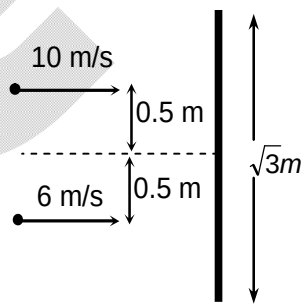
SECTION – B
(Numerical Answer Type)

*This section contains **SIX (06)** Numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.*

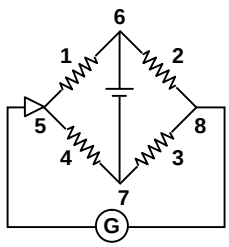
12. Two conductors A and B each of cross section area 5 cm^2 are connected in series. Variation of temperature (in °C) along the length (in cm) is as shown in the figure. If thermal conductivity of A is $2\sqrt{3}$ J/m-sec-°C and the heat current in the conductors is 0.173 J/s. Find thermal conductivity of B (in J/m-sec-°C upto one decimal place.)



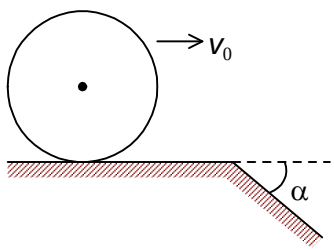
13. A thin uniform bar lies on a frictionless surface and is free to move in any way on the surface. Its mass is 0.16 kg and length $\sqrt{3}$ metres. Two particles each of mass 0.08 kg are moving on the same surface and towards the bar in a direction perpendicular to the bar, one with a velocity 10 m/s and the other with 6 m/s as shown in Figure. The first particle strikes the bar at *A* and the other at the point B. The points A and B are at distances 0.5 m from centre of the bar. The particles strike the bar at the same instant of time and stick to the bar on collision. The loss of kinetic energy of the system on the above collision process is $\frac{x}{100}$ J, then find the value of 'x'.



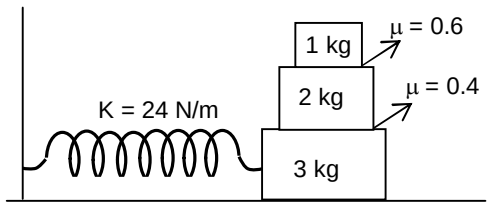
14. Four wires of equal length 8 m are arranged as shown in the figure. Wires, 2, 3 and 4 are of equal cross sectional area and wire 1 is of half the cross section of these wires. By how much distance pointer at point 5 must be moved to get null point?



15. A uniform solid cylinder of radius, *R* = 15 cm rolls over a horizontal plane passing into an inclined plane forming an angle α = 30° with the horizontal as in Figure. Find the maximum integral value of the velocity v_0 (in m/s) which still permits the cylinder to roll on to the inclined plane section without a jump. The sliding is assumed to be absent.



16. What can be the maximum amplitude (in m) of the system so that there is no slipping between any of the blocks



17. An organ pipe P_1 closed at one end vibrating in its first overtone and another pipe P_2 open at the both ends vibrating in its third overtone are in resonance with a given tuning fork. The ratio of the length of P_1 to that of P_2 is $\frac{3}{n}$ then n = ?

Chemistry

PART – II

SECTION – A
(One Options Correct Type)

*This section contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.*

18. $NH_4Cl_{(s)} \rightleftharpoons NH_{3(g)} + HCl_{(g)}$

The value of K_p of above system at 304.55 K is 6.25 atm^2 and one mole of HCl is present at equilibrium. Find the volume of the reaction vessel assuming the gases as ideal and the undissociated NH_4Cl occupies no volume.

(A) 12.5 L (B) 20 L
(C) 10 L (D) 15 L

19. Which of the following compound is formed as the major product when a solution of Ph_3CCOOH in conc.H_2SO_4 is mixed with CH_3OH?

(A) $Ph_3CCOOCH_3$ (B) Ph_3COCH_3
(C) Ph_3CCOCH_3 (D) Ph_3CCHO

20. A tetrapeptide of glycine contains

(A) four peptide linkages
(B) five oxygen atoms
(C) five nitrogen atoms
(D) four nitrogen atoms which lone pairs participate in resonance

21. 2g of benzoic acid (C_6H_5COOH) was dissolved in 25g of benzene. The solution shows a depression in freezing point equal to 1.62 K. Molar depression constant for benzene is 4.9 K Kg mol^{-1}. What is the percentage association or dissociation of the acid in solution?

(A) 98.2% (B) 8.92%
(C) 8.64% (D) 86.4%

SECTION – A
(One or More than one correct type)

*This section contains **THREE (03)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).*

22. Which of the following represent(s) the correct order of reactivity of the oxides of iron with HCl?

(A) FeO > Fe_3O_4 (B) Fe_2O_3 > Fe_3O_4
(C) Fe_3O_4 > Fe_2O_3 (D) Fe_2O_3 > FeO

23. $X_{(g)} + 2Y_{(g)} \longrightarrow 3Z_{(g)}$

Choose correct statement(s) regarding the above elementary reaction.

(A) The half- life of X does not vary with its initial concentration.
(B) The rate of reaction is twice the rate of disappearance of Y.
(C) The rate of reaction decreases by eight times by reducing the volume of the reaction vessel to half of its original value.
(D) The half-life of Y is inversely proportional to its initial concentration.

24. Which of the following element(s) do not produce any gas when treated with NaOH?
(A) Sulphur (B) Phosphorus
(C) Silicon (D) Chlorine

SECTION – A
(Matching List Type)

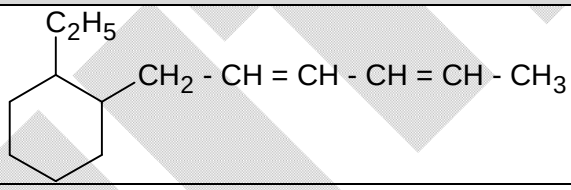
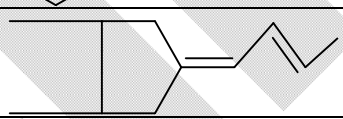
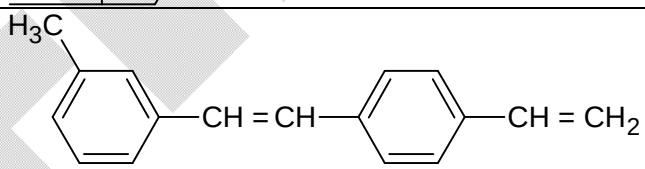
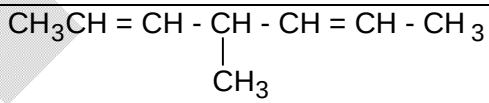
*This section contains **FOUR (04)** Matching List Type Questions. Each question has FOUR statements in **List-I** entries (P), (Q), (R) and (S) and FIVE statements in **List-II** entries (1), (2), (3), (4) and (5). The codes for lists have choices (A), (B), (C), (D) out of which **ONLY ONE** of these four options is correct answer.*

25. Match the lists.

	List-I (Electrons of atoms)		List-II (Set of quantum numbers)
(P)	The outermost electron of calcium(Z = 20)	(1)	(n = 3, ℓ = 2, m = -1, s = +½)
(Q)	The valence electron of iron(Z = 26)	(2)	(n = 4, ℓ = 0, m = 0, s = - ½)
(R)	The unpaired electron of aluminium(Z = 13)	(3)	(n = 3, ℓ = 1, m = -1, s = -½)
(S)	The unpaired electron of arsenic(Z = 33)	(4)	(n = 4, ℓ = 1, m = +1, s = +½)
		(5)	(n = 3, ℓ = 0, m = 0, s = +½)

(A) P → 1; Q → 4; R → 3; S → 2 (B) P → 3; Q → 2; R → 5; S → 4
(C) P → 2; Q → 4; R → 5; S → 3 (D) P → 2; Q → 1; R → 3; S → 4

26. Match the lists.

	List-I (Organic compounds)		List-II (Number of stereoisomers)
(P)		(1)	16
(Q)		(2)	8
(R)		(3)	4
(S)		(4)	2
		(5)	6

(A) P → 2; Q → 4; R → 5; S → 3 (B) P → 2; Q → 3; R → 1; S → 4
(C) P → 1; Q → 3; R → 4; S → 3 (D) P → 1; Q → 2; R → 4; S → 3

27. Match the lists.

	List-I (Complexes)		List-II (Characteristics)
(P)	$[Cr(H_2O)_6]^{2+}$	(1)	Same crystal field electronic configuration for strong as well as weak field ligands
(Q)	$[Ni(NH_3)_6]^{2+}$	(2)	Has half filled electronic configuration according to valence bond theory as well as crystal field theory
(R)	$[Mn(H_2O)_6]^{2+}$	(3)	The electronic configuration is $t_{2g}^6 e_g^1$
(S)	$[Co(NH_3)_6]^{2+}$	(4)	Shows Jahn Teller distortion
		(5)	Has $t_{2g}^3 e_g^0$ configuration

(A) P $\rightarrow$ 5; Q $\rightarrow$ 2; R $\rightarrow$ 1; S $\rightarrow$ 3
(B) P $\rightarrow$ 2; Q $\rightarrow$ 1; R $\rightarrow$ 4; S $\rightarrow$ 3
(C) P $\rightarrow$ 4; Q $\rightarrow$ 1; R $\rightarrow$ 2; S $\rightarrow$ 3
(D) P $\rightarrow$ 5; Q $\rightarrow$ 2; R $\rightarrow$ 1; S $\rightarrow$ 3

28. Match the lists.

	List-I (Type of liquid solutions)		List-II (Characteristics)
(P)	Ideal solution	(1)	Enthalpy of mixing is greater than zero
(Q)	Solution showing positive deviation from ideal behaviour	(2)	Enthalpy of mixing is less than zero
(R)	Solutions showing negative deviation from ideal behaviour	(3)	Enthalpy of mixing is zero
(S)	Azeotropic mixture	(4)	Components can't be separated by distillation due to same composition of components in liquid and vapour phase
		(5)	Components can't be separated by distillation due to identical interparticle forces of the components

(A) P $\rightarrow$ 3; Q $\rightarrow$ 2; R $\rightarrow$ 4; S $\rightarrow$ 1
(B) P $\rightarrow$ 3; Q $\rightarrow$ 1; R $\rightarrow$ 2; S $\rightarrow$ 4
(C) P $\rightarrow$ 5; Q $\rightarrow$ 1; R $\rightarrow$ 3; S $\rightarrow$ 2
(D) P $\rightarrow$ 5; Q $\rightarrow$ 2; R $\rightarrow$ 1; S $\rightarrow$ 4

SECTION – B
(Numerical Answer Type)

*This section contains **SIX (06)** Numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.*

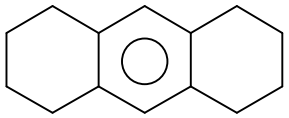
29. 0.7 g of $Na_2CO_3.xH_2O$ is dissolved in 100 ml of water, 20 ml of which required 19.8 ml of 0.1N HCl for complete reaction. Therefore, the value of x is

30. The solubility product of $Mg(OH)_2$ is 5×10^{-10} at 25°C. What is the p^{OH} value of its saturated solution in water?

31. $$CH_3Br + CH_3 - \overset{O}{\overset{\|}{C}} - CH_2 - \overset{O}{\overset{\|}{C}} - C_2H_5 \xrightarrow{C_2H_5ONa} \text{Products}$$

How many organic product(s) containing seven carbon atoms is/are formed in the above reaction (Do not consider isomers).

32. The molecular formula of an octahedral complex of cobalt is $Co(Br)(Cl)(NO_2)4H_2O$. How many structural isomers are possible for the complex?

33.  $+ CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2Cl \xrightarrow{AlCl_3}$ Major Product

How many monochloro product(s) will be formed if the major product of above reaction reacts with Cl_2 in presence of sunlight? [Do not consider stereoisomers]

34. A vessel contains a mixture of nitrogen and fluorine in the molar ratio of 1:3. The mixture reached equilibrium to form NF_3 when 25% of the reactants had reacted. If the total pressure of the system is 28 atm at equilibrium. What will be the equilibrium partial pressure of NF_3 in atm unit?

Mathematics

PART – III

SECTION – A
(One Options Correct Type)

*This section contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.*

35. If $(\cos\theta+i\sin\theta)(\cos 2\theta+i\sin 2\theta).....(\cos n\theta+i\sin n\theta)=1$, where $i=\sqrt{-1}$ then the value of θ is, where m, $n\in I$:

(A) $4m\pi$ (B) $\frac{2m\pi}{n(n+1)}$

(C) $\frac{4m\pi}{n(n+1)}$ (D) $\frac{m\pi}{n(n+1)}$

36. Let $f(x)$ be a differentiable function satisfying $f'(x)=f(x)$ with $f(0)=1$ and $g(x)$ satisfies $f(x)+g(x)=e^x(x+1)^2$. If $\int_0^1 f(x)g(x)dx=ae^2+b$, then the value of $(a+b)$ is

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

37. If the equations $a(y+z)=x, b(z+x)=y, c(x+y)=z$ have non – trivial solution, then $\frac{1}{1+a}+\frac{1}{1+b}+\frac{1}{1+c}$ is equal to

(A) 1 (B) 2
(C) –1 (D) –2

38. If $\vec{u}=\vec{a}-\vec{b}; \vec{v}=\vec{a}+\vec{b}$ and $|\vec{a}|=|\vec{b}|=2$ then $|\vec{u}\times\vec{v}|$ is equal to

(A) $\sqrt{2\left(16-(\vec{a}.\vec{b})^2\right)}$ (B) $2\sqrt{\left(16-(\vec{a}.\vec{b})^2\right)}$

(C) $2\sqrt{\left(4-(\vec{a}.\vec{b})^2\right)}$ (D) $\sqrt{2\left(4-(\vec{a}.\vec{b})^2\right)}$

SECTION – A
(One or More than one correct type)

*This section contains **THREE (03)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).*

39. The number of 4 digit natural numbers formed by using

(A) exactly two distinct digits is 567 (B) exactly two distinct digit is 558
(C) at least three identical digits is 333 (D) at least three identical digits is 315

40. In a school, students can play three games A, B, C. For any given game, the probability that a selected student plays only this game but none of the other game is 0.1. For any two given games, the probability that a selected student plays exactly these two games is 0.14. The probability that a student plays all the three games given that he plays games A and B is $\frac{1}{3}$.

Then which of the following option is/are **CORRECT**?

(A) The probability that a student does not play any game given that he does not play game A is $\frac{21}{55}$

(B) The probability that a student does not play any game is $\frac{22}{100}$

(C) The probability that a student plays all the three games given that he plays at least two games is $\frac{1}{7}$

(D) The probability that a student plays game A given that he plays either B or C is $\frac{15}{23}$

41. Which of the following statement(s) is/are **CORRECT**?

(A) $f(x)=\begin{cases} x^2\sin\frac{1}{x}; & x\neq 0 \\ 0; & x=0 \end{cases}; g(x)=\begin{cases} \cos x; & x\neq 0 \\ 0; & x=0 \end{cases}$ then $\lim\limits_{x\to 0} g(f(x))$ exists

(B) Let $y=f(x)$ be continuous at $x=a$, $y=g(x)$ be continuous at $x=f(a)$ and $y=h(x)$ be discontinuous at $x=g(f(a))$ then $y=h(g(f(x)))$ may be continuous at $x=a$

(C) Let f and g be two functions defined from $R\to R$ and let g be discontinuous function at $x=a$ and f be continuous at $x=g(a)$, further f is strictly increasing on R then fog must be discontinuous at $x=a$.

(D) Let $y=f(x)$ be continuous at $x=a$ and $f(a)=0$, $y=g(x)$ be another function defined in neighborhood of $x=a$, then $f(x).g(x)$ must be continuous at $x=a$.

SECTION – A
(Matching List Type)

*This section contains **FOUR (04)** Matching List Type Questions. Each question has FOUR statements in **List-I** entries (P), (Q), (R) and (S) and FIVE statements in **List-II** entries (1), (2), (3), (4) and (5). The codes for lists have choices (A), (B), (C), (D) out of which **ONLY ONE** of these four options is correct answer.*

42. If a variable line $L: 3x-2y-4+\lambda(x-2y+4)=0$ where λ is a parameter is passing through a fixed point P (a, b) and $S: x^2+y^2=8$ is a circle, then:

List – I		List – II	
(P)	$(a+b)$ is equal to	(1)	$2\sqrt{2}$
(Q)	Length of the tangent from 'P' to the circle 'S' is	(2)	$4\sqrt{2}$
(R)	Least distance of 'P' to the circle 'S' is	(3)	$6\sqrt{2}$
(S)	Least radius of the circle whose centre is 'P' and it contains the circle 'S', is	(4)	$2\sqrt{6}$
		(5)	8

(A) P $\to$5; Q$\to$2; R$\to$2; S$\to$4 (B) P $\to$5; Q$\to$4; R$\to$1; S$\to$3
(C) P $\to$5; Q$\to$4; R$\to$3; S$\to$3 (D) P $\to$5; Q$\to$2; R$\to$2; S$\to$4

43. Consider a system of linear equation $3x + y - z = 0$, $x - \frac{py}{4} + z = 2$ and $2x - y + 2z = 4$ where $p, q \in I$ and $p, q \in [1, 10]$ then identify the correct statement(s).

List – I		List – II	
(P)	Number of ordered pairs (p, q) for which system of equation has unique solution is	(1)	1
(Q)	Number of ordered pairs (p, q) for which system of equation has no solution is	(2)	9
(R)	Number of ordered pairs (p, q) for which system of equation has infinite solutions is	(3)	10
(S)	Number of ordered pairs (p, q) for which system of equation has atleast one solution is	(4)	90
		(5)	91

(A) P $\to$4; Q$\to$2; R$\to$1; S$\to$5 (B) P $\to$4; Q$\to$3; R$\to$1; S$\to$4
(C) P $\to$4; Q$\to$3; R$\to$2; S$\to$5 (D) P $\to$4; Q$\to$2; R$\to$2; S$\to$4

44. Match the value 'a' from List – II.

List – I		List– II	
(P)	$4(\cos^3 10° + \sin^3 20°) = a(\cos 10° + \sin 20°)$	(1)	2
(Q)	$\frac{1}{\tan 3\theta + \tan\theta} - \frac{1}{\cot 3\theta + \cot\theta} = \cot(a\theta)$	(2)	1
(R)	$\frac{1 - \cos 2\theta + \sin 2\theta}{1 + \cos 2\theta + \sin 2\theta} = \tan a\theta$	(3)	4
(S)	$\frac{\cot\theta - 1}{\cot\theta + 1} = \frac{1 - \sin a\theta}{\cos a\theta}$	(4)	3
		(5)	-1

(A) P $\to$4; Q$\to$2; R$\to$1; S$\to$5 (B) P $\to$4; Q$\to$3; R$\to$1; S$\to$4
(C) P $\to$5; Q$\to$4; R$\to$2; S$\to$1 (D) P $\to$4; Q$\to$2; R$\to$2; S$\to$4

45. Match the List – I and List – II

	List – I		List– II
(P)	If a, b, c are distinct integers and ω and ω^2 are cube roots of unity and if minimum value of $\lvert a + b\omega + c\omega^2\rvert + \lvert a + b\omega^2 + c\omega\rvert$ is $n^{1/4}$, then the value of $\frac{n}{12} - 5$ must be	(1)	4
(Q)	If z is any complex number satisfying $\lvert z - 3 - 2i\rvert \le 2$, then the minimum value of $\lvert 2z - 6 + 5i\rvert$ is	(2)	1
(R)	If the roots of $z^3 + iz^2 + 2i = 0$ represent vertices of ΔABC in argand plane than area of triangle is	(3)	2

(S)	If $(1+i)(z+\bar{z})+(a+i)(z-\bar{z})+2(a-1)i=0$ and $z\bar{z}=18$ where $a\in R$ then the value of $\lvert a\rvert$ can be	(4)	5
		(5)	7

The correct option is

(A) P→(4) Q → (2) R→(5) S→(1)
(B) P→(5) Q → (4) R→(3) S→(2)
(C) P→(3) Q → (3) R→(4) S→(4)
(D) P→(1) Q → (5) R→(3) S→(4)

SECTION – B
(Numerical Answer Type)

*This section contains **SIX (06)** Numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.*

46. Number of ordered pairs (x, y) where $x,y\in[0,2\pi]$ and $(3\sin x+4\cos x)\cos y=5$ is

47. Let z_1,z_2 satisfy $z^2-z+ai=0$ for $a\in R$ and $\lvert z_1-z_2\rvert=1$, then $a=$

48. Consider the curve $C_1:y^2=4ax;(a>0)$ and $C_2:(x+b)^2+y^2=b^2;(b>0)$
$L_1:y=m_1x+\lambda_1;(m_1>0)$, $L_2:y=m_2x+\lambda_2;(m_2<0)$
Represents tangents to C_1 drawn from centre of C_2 and $L_3:y=m_3x+\lambda_3;(m_3<0)$
$L_4:y=m_4x+\lambda_4;(m_4>0)$ represents tangents to C_2 drawn from focus of C_1. Number of ordered pairs (a, b) such that L_1,L_3 intersect on y – axis is m. Then m is equal to_____

49. If $I_n=\int_0^{2\pi}\frac{\cos n\theta}{\cos\theta}d\theta:n\in N$ then value of $\left[I_{2021}+\lvert I_{2023}\rvert\right]$ is _____(where $[.]$ represents greatest integral function)

50. Sum of the terms of an arithmetic sequence which contains odd number of terms is 714. The first term is increased by 1, third term is increased by 3, fifth term is increased by 5 and so on. Now the sum of the terms of the sequence is 835. Then the middle term of the original sequence is _____.

51. If $\vec{d}=\lambda(\vec{a}\times\vec{b})+\mu(\vec{b}\times\vec{c})+\nu(\vec{c}\times\vec{a}),[\vec{a}\ \ \vec{b}\ \ \vec{c}]=\frac{1}{8}$ and $\vec{d}.(\vec{a}+\vec{b}+\vec{c})=8$ then $\frac{\lambda+\mu+\nu}{16}$ is equal to