FIITJEE
ALL INDIA TEST SERIES
JEE (Advanced)-2024
FULL TEST – III
PAPER –1
TEST DATE: 08-02-2024

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 –03, 18 – 20, 35 – 37):* 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 *(04 – 07, 21 – 24, 38 – 41)*: This section contains **TWELVE (12)** questions. Each question has **FOUR** options. **ONLY ONE** of these four options is the correct answer.

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 (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 – 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 – 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 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).*

1. One end of thin aluminium rod (cross-sectional Area = 10^{-6} m^2) is butt welded to the end of copper rod with same diameter. Both rods are very long and under uniform tension of 900 N. Given that

$Y_{(Cu)} = 1.6 \times 10^{11}$ Nm^{-2} $\quad Y_{(Al)} = 0.9 \times 10^{11}$ $N\,m^{-2}$

$\rho_{(Cu)} = 8.1 \times 10^{3}$ $kg\,m^{-3}$ $\quad \rho_{(Al)} = 2.5 \times 10^{3}$ $Kg\,m^{-3}$

(A) The value of reflection factor $\frac{A_r}{A_i}$ for longitudinal pulse approaching the junction along copper rod is 0.15

(B) The value of reflection factor $\frac{A_r}{A_i}$ for longitudinal pulse approaching the junction along copper rod is approximately 0.3

(C) The value of reflection factor $\frac{A_r}{A_i}$ for transverse pulse approaching the junction along copper rod is 0.15

(D) The value of reflection factor $\frac{A_r}{A_i}$ for transverse pulse approaching the junction along copper rod is approximately 0.3

2. A metal wire of length *L*, area of cross-section A and Young's modulus *Y* is stretched by a variable force *F* such that *F* is always slightly greater than the elastic forces of resistance in the wire. When the elongation of the wire is *l*

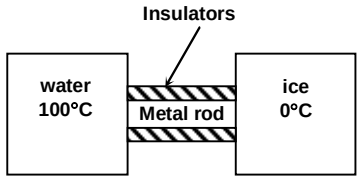
(A) the work done by *F* is $\frac{YAl^2}{2L}$

(B) the work done by *F* is $\frac{YAl^2}{L}$

(C) the elastic potential energy stored in the wire is $\frac{YAl^2}{2L}$

(D) no heat is produced during the elongation

3. An insulated container is filled with ice at 0°C, and another container is filled with water that is continuously boiling at 100°C. In series of experiments, the container connected by various, thick metal rods that pass through the walls of container as shown in the figure.



In the experiment I: a copper rod is used and all ice melts in 20 minutes.
In the experiment II: a steel rod of identical dimensions is used and all ice melts in 80 minutes.
In the experiment III: both the rods are used in series and all ice melts in t_{10} minutes.
In the experiment IV: both rods are used in parallel all ice melts in t_{20} minutes.

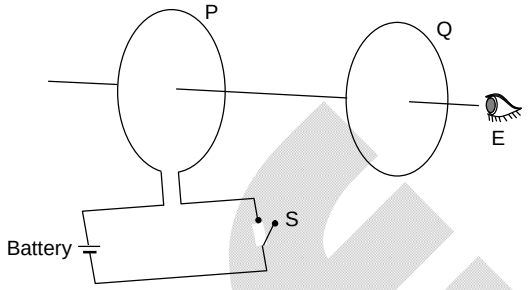
(A) The value of t_{10} is 100 minutes (B) The value of t_{10} is 50 minutes

(C) The value of t_{20} is 16 minutes (D) The value of t_{20} is 8 minutes

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.*

4. As shown in figure P and Q are two co-axial conducting loops separated by some distance. When the switch S is closed, a clockwise current I_p flows in P (as seen by E) and an induced current I_{Q_1} and I_{Q_2} flows in Q when the current is increasing and decreasing respectively in loop P then the directions of I_{Q_1} and I_{Q_2} (as seen by E) are:



(A) respectively clockwise and anticlockwise
(B) both clockwise
(C) both anticlockwise
(D) respectively anticlockwise and clockwise

5. Moment of inertia of the given isosceles triangular plate in figure-1, about an axis passing through 'O' and perpendicular to plate is I_0. Find the moment of inertia of the given plate (lamina) in figure-2, about an axis passing through 'C' and perpendicular to plane of the plate as shown in the figure. (Mass per unit area of both plate is same)

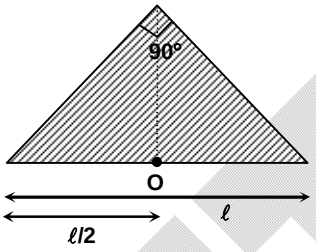


Figure -1

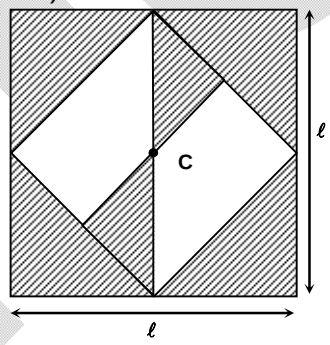
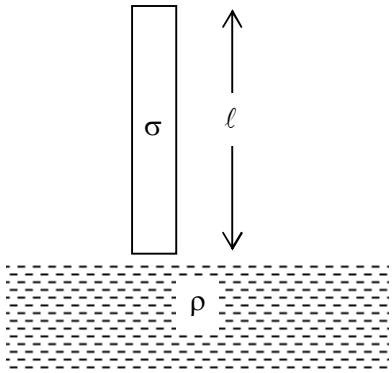


Figure -2

(A) 3.25 I_0
(B) 6.5 I_0
(C) 3.5 I_0
(D) 3.75 I_0

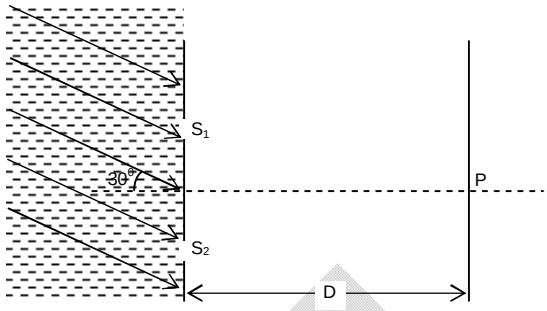
6. A uniform vertical cylinder is released from rest when its lower end just touches the liquid surface of a deep lake. The maximum displacement of cylinder is

Take, ℓ = 4 m and $\frac{\sigma}{\rho} = \frac{1}{2}$



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

7. The given figure shows a YDSE apparatus are incident on slits S_1 and S_2 ($S_1S_2 = \frac{2}{3}$mm) at an angle 30^o with the horizontal. The medium on left side of the slits in water $\left(\mu_w = 4/3\right)$. To obtain the central maxima at point P, a glass slab $\left(\mu_g = 3/2, \text{inside water}\right)$ is introduced in front of slit S_1. The thickness of the glass slab required for this purpose is

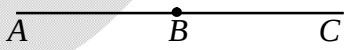


(A) 2 mm (B) 4/3 mm
(C) 4 mm (D) 8/3 mm

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. A long wire *ABC* is made by joining two wires *AB* and *BC* of equal area of cross section. *AB* has length 4.8 m and mass 0.12 kg while *BC* has length 2.56 m and mass 0.4 kg. The wire is under a tension of 160 N. A wave *Y* (in cm) = 3.5 sin (*kx* – *wt*) is sent along *ABC* from end *A*. No power is dissipated during propagation of wave.



List–I	List-II
(P) Amplitude of reflected wave	1. 2.0
(Q) Amplitude of transmitted wave	2. 1.5
(R) Maximum displacement of antinodes in the wire *AB*	3. 5
(S) Percentage fraction of power transmitted in the wire *BC*	4. 82
	5. 92

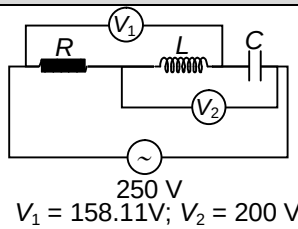
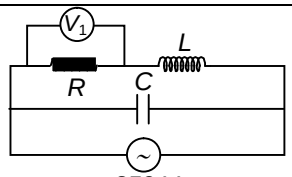
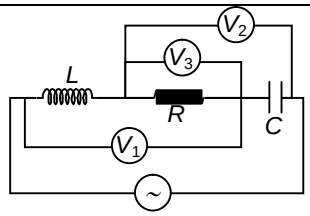
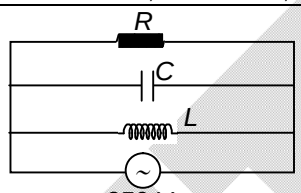
(A) (P) – 4, (Q) – 3, (R) – 2, (S) – 1 (B) (P) – 3, (Q) – 4, (R) – 1, (S) – 2
(C) (P) – 2, (Q) – 1, (R) – 3, (S) – 4 (D) (P) – 4, (Q) – 3, (R) – 1, (S) – 2

9. Two guns, situated on the top of a hill of height 10 m, fire one shot each with the same speed $5\sqrt{3}$ m/s at some interval of time. One gun fires horizontally and other fires upwards at an angle of 60° with the horizontal. The shots collide in air at a point *P*. Assume origin on the ground and below the muzzle and motion of the shots in *xy*-plane (*x*-axis along horizontal and *y*-axis vertically upward).

List–I	List–II
(P) The time interval between the firing of first shot to the instant of collision (in second)	1. 5
(Q) *x*-coordinate at the instant of collision (in m)	2. 2.5
(R) *y*-coordinate at the instant of collision (in m)	3. $5\sqrt{3}$
(S) Just before the collision, magnitude of *y*-component of relative velocity of one shots with respect to other shot (in m/s)	4. 2 5. 7

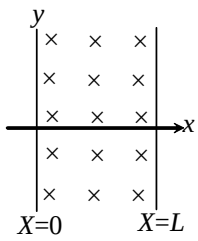
(A) P - 4, Q - 3, R - 1, S - 2 (B) P - 3, Q - 4, R - 1, S - 2
(C) P - 1, Q - 2, R - 3, S - 4 (D) P - 4, Q - 3, R - 2, S – 1

10. In list–I some AC circuits with meter readings are given and in list–II some circuit quantities are given. Match the entries of list–I with the entries of list–II.

List–I	List–II
(P)  250 V V_1 = 158.11V; V_2 = 200 V	(1) V_R = 150 V
(Q)  250 V V_1 = 150 V	(2) V_L = 50 V
(R)  250 V V_1 = 158.11 V; V_2 = 291.6 V; V_3 = 150 V	(3) V_C = 250 V
(S)  250 V	(4) Power factor of the circuit is $\frac{3}{5}$

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

11. Magnetic field B_0 is present in the region $X = 0$ to $X = L$ along –ve z-axis. A charge particle having charge q and mass m enters in magnetic along x-axis with speed v_0. If $L = \frac{mv_0}{2qB_0}$, angle of deviation is ϕ_1 and time spent in magnetic field is t_1 and if $L = \frac{\sqrt{3}}{2}\frac{mv_0}{qB_0}$ angle of deviation is ϕ_2 and time spent in magnetic field is t_2, then



List-I	List-II
(P) ϕ_1 is	1. $\frac{\pi m}{6qB}$
(Q) ϕ_2 is	2. $\frac{\pi m}{3qB}$
(R) t_1 is	3. $\pi/3$
(S) t_2 is	4. $\pi/6$
	5. $\pi/2$

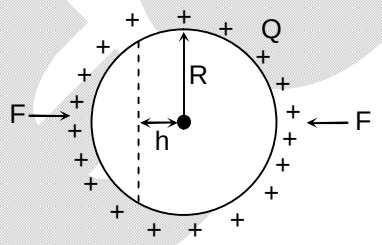
(A) (P) – 4, (Q) – 3, (R) – 2, (S) – 1 (B) (P) – 3, (Q) – 4, (R) – 1, (S) – 2
(C) (P) – 1, (Q) – 2, (R) – 3, (S) – 4 (D) (P) – 4, (Q) – 3, (R) – 1, (S) – 2

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. A metallic rod of length 1m is rigidly clamped at one of its end. The other end of the rod is free. Longitudinal stationary waves are set up in the rod in such a way that there are total six antinodes observed along the rod. Young's modulus and density of the rod are $6.4\times10^{10}\text{N/m}^2$ and $4\times10^{3}\text{kg/m}^3$ respectively. If the frequency of the constituent wave is $\frac{22000}{n}$Hz. Then find the value of n.

13. Consider a spherical shell of radius R and total charge Q distributed uniformly over its surface. Now this spherical shell is cut into two parts by a plane at a distance h from the centre as shown in the figure. The force required to keep the two parts together is given by $F=\frac{Q^2(R^2-h^2)}{n(4\pi\in_0)R^4}$.

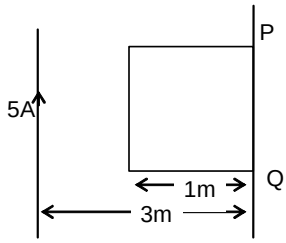


Find the value of n.

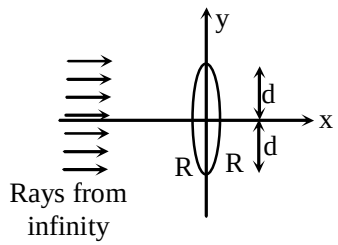
14. At a depth $h_1=\frac{R}{2}$ from the surface of a planet (radius R = 3000 km), acceleration due to gravity is g_1. It's value changes by Δg_1, when one moves down further by 1 km. At a height h_2 above the surface of the earth acceleration due to gravity is g_2. It's value changes by Δg_2 when moves up further by 1 km. If $\Delta g_1 = \Delta g_2$ and $h_2 = d\times10^2$ km. Find d. (Assume the planet to be a uniform sphere of radius R) (Take $2^{1/3}=1.3$)

15. An electric charge distribution produces an electric field $\vec{E}=C\left(1-e^{-\alpha r}\right)\frac{\hat{r}}{r^2}$ where $C=\frac{1}{4\pi\varepsilon_0}$ & α are constant. If the net charge within the radius $r=\frac{1}{\alpha}$ is $\left(1-e^{-N}\right)$, then find the value of 'N' ?

16. A square loop of side 1m and a long straight conductor carrying a current of 5A are located in the same plane. Resistance of the loop is 1 Ω. The loop is turned through an angle of 180^0 about an axis PQ. Axis PQ is at a distance of 3m from the current carrying conductor. The electric charge having flown through the loop is about 10^{-7} x Coloumb, Find x. (closest integer value)



17. A biconvex thin lens of radius of curvature R = 3 is made-up of variable refractive index $\mu=\frac{3}{2}\left\{1+\frac{|y|}{d}\right\}$. Assume very small aperture 2d<<R. The parallel rays are incident as shown. Due to the variable refractive index of lens there are infinite number of images on the principal axis. These image are separated over the length l. Find the value of l (in m).



Chemistry

PART – II

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).*

18. Which of the following sequences is/are incorrect with respect to the property indicated?
(A) oxidizing power: $F_2 > Cl_2 > Br_2$ (B) bond energy: $F_2 > Cl_2 > Br_2$
(C) Electronegativity: F > Cl > Br (D) Electron affinity: F > Cl > Br

19. Which of the following does not use hybridized orbitals in its bonding?
(A) NF_3 (B) CS_2
(C) HClO (D) HCl

20. Amongst the following which are not true?
(A) EAN of iron if $Fe(C_5H_5)_2$ is 36
(B) $[Fe(H_2O)_6]^{2+}$ has paramagnetism due to 4 unpaired electrons
(C) $[Cr(NH_3)_6]^{3+}$ is diamagnetic
(D) $[CoI_4]^{2-}$ has square planar geometry

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.*

21. The weight of acetic anhydride that must be added to 75 g of 92 % acetic acid aqueous solution to make the concentration of acetic acid 100 % would be
(A) 22 g (B) 34 g
(C) 48 g (D) 56 g

22. The thermal decomposition of azoisopropane to hexane and nitrogen follows first order kinetics.

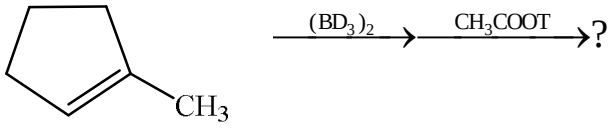
$(CH_3)_2CH - N = N - CH(CH_3)_2(g) \longrightarrow N_2(g) + C_6H_{14}(g)$

If P_i is the initial pressure of the reactant and P is the total pressure after time (t). The correct expression for the rate constant in terms of P_i and P is

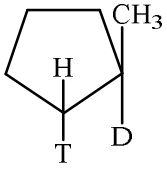
(A) $k = \frac{2.303}{t}\log\frac{P_i}{(2P_i - P)}$ (B) $k = \frac{2.303}{t}\log\frac{2P_i}{(2P_i - P)}$

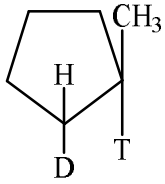
(C) $k = \frac{2.303}{t}\log\frac{2P_i}{(P_i - P)}$ (D) $k = \frac{2.303}{t}\log\frac{3P_i}{(3P_i - P)}$

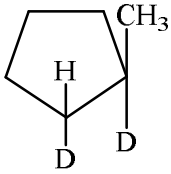
23. Which of the following is incorrect?
(A) The smaller the gold number of a lyophilic colloid, the larger will be its protecting power
(B) Lyophilic sols in contrast to lyophobic sols are easily coagulated on addition of small amount of electrolytes.
(C) Ferric chloride solution is used to stop bleeding from fresh cut because it coagulates blood.
(D) At critical micelle concentration, several properties of solution of surfactant undergo a dramatic change

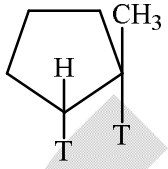
24. 

The product of the above reaction is

(A) 

(B) 

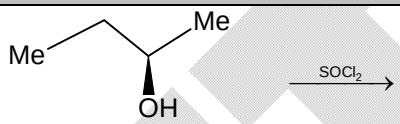
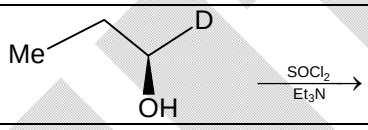
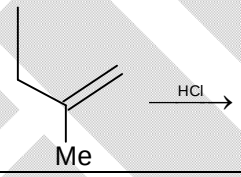
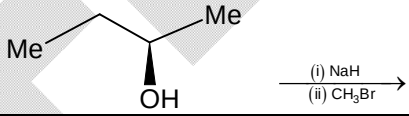
(C) 

(D) 

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 following

List-I (reaction)		List-II(Comment on major product and intermediate)	
(P)		(1)	Optically active compound
(Q)		(2)	Inversion of configuration
(R)		(3)	Retention of configuration
(S)		(4)	Optically inactive compound
		(5)	Carbocation intermediate

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

26. Match the List I with II and choose the correct option from the codes given below:

List-I (reaction)		List-II (intermediate)	
(P)	Wurtz reaction	(1)	Carbocation
(Q)	Dehydration of alcohol with Conc. H_3PO_4	(2)	Electrophile (excluding free radicals)
(R)	Kolbe's electrolysis	(3)	Free radical
(S)	Aldol condensation	(4)	Carbanion
		(5)	N_2 gas liberated in intermediate step

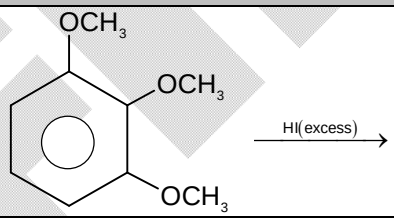
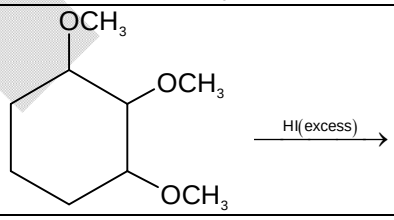
(A) P→1, 2 3; Q→1, 2; R→3; S→3, 4;
(B) P→3, 4; Q→1, 2; R→3; S→4;
(C) P→1, 3; Q→1, 2; R→1, 3, 5; S→3;
(D) P→3; Q→1, 2; R→1, 3; S→1, 2, 5;

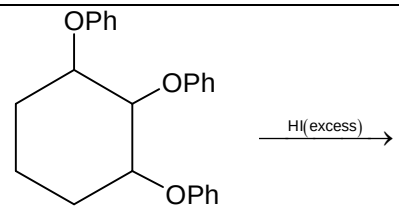
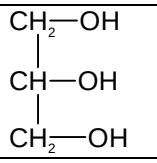
27. Match List –I with List –II

List-I		List-II	
(P)	$CH_3-\overset{\overset{O}{\|\|}}{C}-Cl\,/\,NaN_3$	(1)	Lossen rearrangement
(Q)	$CH_3-\overset{\overset{O}{\|\|}}{C}-NH_2\,/\,NaOBr$	(2)	Schmidt rearrangement
(R)	$CH_3COOH\,/\,N_3H$	(3)	Hofmann rearrangement
(S)	$C_6H_5-\overset{\overset{O}{\|\|}}{C}-NH-O-\overset{\overset{O}{\|\|}}{C}-CH_3\,/\,Base$	(4)	Curtius rearrangemenrt
		(5)	Carbylamine reaction

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

28. Match the following:

List-I		List-II	
(P)		(1)	More than 4 moles of HI will be consumed
(Q)		(2)	Product will react with Na

(R)		(3)	Product formed contain 2º halide
(S)		(4)	CH_3I is one of the product

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

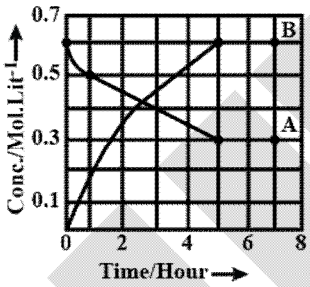
SECTION – B

(Numerical Answer Type)

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

29. 0.3 g of a sample of an oxalate salt is dissolved in 100 cc of water. It required 90 cc of N/20 $KMnO_4$ solution for complete oxidation. The percentage of oxalate $(C_2O_4^{2-})$ in the given sample is

30. The progress of the reaction $A \rightleftharpoons nB$ with time is represented in the figure. The value of n is



31. When 100 ml sample of methane and ethane along with excess of O_2 is subjected to electric spark, the contraction in volume was observed to be 212 ml. When the resulting gases were passed through KOH solution, further contraction in volume (in mL) will be?

32. Hydrogen atom in states of high quantum number have been created in the laboratory and observed in space. The quantum number of the Bohr orbit in a hydrogen atom whose radius is 10^5 Å will be (rounded off to nearest integer)?

33. 0.15 mole of pyridinium chloride has been added to 500 cm^3 of 0.2 M pyridine solution What is the pH of the resulting solution assuming no change in volume? (K_b for pyridine = 1.5×10^{-9} M)

34. The normal boiling point of an ether is 307 K. Ether is to be stored in aluminium drums that can withstand a pressure of 10 atm. If $\Delta H_{vapouristion}$ of ether is 27 kJ mol^{-1} at its boiling point, the maximum temperature (in Kelvin) to which the drums of ether could be safely exposed will be (rounded off to nearest integer)?

Mathematics

PART – III

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).*

35. Which of the following is /are true ?

(A) $\int_0^1 \sin\left(x^2+2x+1\right)dx - \int_1^2 \sin x^2 dx = 0$

(B) $\int_{-1}^{1} e^{\sin x}dx - \int_0^1 e^{\sin(2x+1)}dx = 0$

(C) $\int_{-5}^{-4} \sin\left(x^2-3\right)dx + \int_{-2}^{-1} \sin\left(x^2+12x+33\right)dx = 0$

(D) $\int_{-4}^{4} \cos x^2\, dx - 8\int_0^1 \cos 16(2x-1)^2 dx = 0$

36. Consider all pairs (x, y) of integers such that $1 + 2^x + 2^{2x+1} = y^2$. Then
(A) both (y – 1) and (y + 1) are even
(B) if $x \geq 3$, one of these factors y -1 and y + 1 is divisible by 2^{x-1}
(C) if $x \geq 3$, one of these factors y - 1 and y + 1 is divisible by 2^x
(D) if $x \geq 3$, exactly one of the factors y – 1 and y + 1 is divisible by 4

37. Let, $\ell(z) = Az + B$, $A, B \in$ complex number. It is given that maximum value of $|\ell(z)|$ on the segment, $-1 \leq x \leq 1$, y = 0 of the real line in the complex plane (z = x + iy) is M. Then, for every z $|\ell(z)| < \lambda KM$ [K is the sum of the distance from point P(z) to the points $Q_1(1, 0)$ and $Q_2(-1, 0)$ where λ can be

(A) $\frac{1}{4}$ (B) 1
(C) 2 (D) 3

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.*

38. If $A = \lim_{x\to 0} \frac{\sin^{-1}(\sin x)}{\cos^{-1}(\cos x)}$ and $B = \lim_{x\to 0} \frac{[\{x\}]}{x}$, then

(A) A = 1 (B) A = 2
(C) B = 0 (D) B = 1

39. a, b, c are determined by throw of a dice thrice, then which of the following is **NOT** correct

(A) the probability that origin (0, 0) lies inside the circle $(x – a)^2 + (y – b)^2 = c^2$ is $\frac{47}{216}$

(B) the probability that origin (0, 0) lies inside the circle $(x – a)^2 + (y – b)^2 = c^2$ is $\frac{48}{216}$

(C) the probability that origin (0, 0) lies on the circle $(x-a)^2+(y-b)^2=c^2$ is $\frac{2}{216}$

(D) the probability that origin (0, 0) lies outside the circle $(x-a)^2+(y-b)^2=c^2$ is $\frac{166}{216}$

40. The value of $\sum_{r=2}^{100}\frac{3^r(2-2r)}{r(r+1)(r+2)}$ is equal to

(A) $\frac{1}{2}-\frac{3^{100}}{100(101)}$ (B) $\frac{3}{2}-\frac{3^{101}}{101(102)}$

(C) $\frac{3}{2}-\frac{3^{100}}{100(101)}$ (D) None of these

41. Tangent drawn at any point P on a curve meets x-axis at Q such that circumcentre of ΔPOQ has abscissa half that ordinate. The differential equation to such a curve is

(A) $\frac{dy}{dx}=\frac{x+2y}{2x-y}$ (B) $\frac{dy}{dx}=\frac{2y-x}{2x+y}$

(C) $\frac{dy}{dx}=\frac{2y+y}{2x-y}$ (D) None of these

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. Indian and Australia play series of 'n' one day matches and probability that India wins a match against Australia is $\frac{1}{2}$.

List- I		List- II	
(P)	If 'n' is not fixed and series ends when any one of the team completes its 4^{th} win then probability that India wins the series is	(1)	$\frac{4}{2^7}$
(Q)	If n = 7, then probability that India wins atleast three consecutive matches is	(2)	$\frac{47}{2^7}$
(R)	For n = 7, probability that India wins series through consecutive wins is	(3)	$\frac{1}{2}$
(S)	For n = 7, probability that India doesn't win two consecutive matches is	(4)	$\frac{17}{2^6}$
		(5)	$\frac{3}{2^7}$

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

43. If $I(m)=\int_0^{\pi}\ln(1-2m\cos x+m^2)dx$, then match the following

List– I		List– II	
(P)	I(1) =	(1)	I(–1)
(Q)	$\frac{I(9)}{I(3)}=$	(2)	2
(R)	I(81) =	(3)	0
(S)	$\frac{I(25)}{I(5)}=$	(4)	I(3)
		(5)	1

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

44. The function y = f(x) is defined by relations
$x = a(\theta + \sin\theta)$
$y = a(1 - \cos\theta)$ where θ is parameter, f(x) is differentiable for all x except $x = \pm k, \pm 3k, \pm 5k$ .....

Match the following List – I with List – II.

List – I		List – II	
(P)	Value of k is _____(where a = 1)	1.	π
(Q)	Area bounded by y = f(x) and y =f(k) for $x \in [-k, k]$ is ..... (where a = 1)	2	2π
(R)	Fundamental period of f(x) is _____(where a = 2)	3.	3π
(S)	Fundamental period of f'(x) is _____(where a = 1)	4.	4π
		5.	0

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

45. Let $f(x)=|1+e^{|x|}-e^{-x}|$ and $g(x)=|e^{|x|}-2|$

List– I		List– II	
(P)	Area bounded by f(x) and g(x) is	(1)	$e+\frac{1}{e}$
(Q)	Area bounded by y = f(x), x = –1, x = + 1 and x– axis is	(2)	$\ln\frac{2^4}{e^2}$
(R)	Area bounded by y = g(x) and x-axis	(3)	$\ln\frac{27}{16}$
(S)	Area bounded by max {f(x), g(x)}, x-axis, x = – 2 and y-axis	(4)	$\ln 27+e^2-7$
		(5)	4 ln 2 – 2

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

46. Let S be the set of points whose coordinates x, y, z are integers that satisfy $0 \le x \le 2, 0 \le y \le 3$ and $0 \le z \le 4$. Two distinct points are randomly chosen form S. If, the probability that the mid-point of the segment they determine also belongs to S is $\frac{p}{q}$ (p and q are co-prime) then $\frac{p+q}{100}$ is_____

47. If $b\cos x + \frac{b\cos 3x}{2} \le 3$ for all x, then the number of integral values of b is _____.

48. Let f be a continuous and differentiable function in (x_1, x_2). If f(x) : $f(x) \ge x\sqrt{1-f((x))^4}$ and $\lim_{x\to x_1}(f(x))^2 = 1$ and $\lim_{x\to x_2^-}(f(x))^2 = \frac{1}{2}$. Then minimum value of $\left[x_1^2 - x_2^2\right]$ is .....(where [.] denotes the greatest integer function).

49. If p, q, r, s are the probabilities of raining at four different places at some fixed moment, then the maximum value of $3(p^2 + q^2 + r^2 + s^2) - 2(p + q + r + s) + 4$ is _____

50. Five different digits from the set of numbers (1, 2, 3, 4, 5, 6, 7} are written in random order. If the probability that 5 digit number thus formed is divisible by 9 is $\frac{x}{y}$ (x and y are co-prime numbers), then the value of y-10x is _____

51. If $\cot^{-1}\left(2^2 + \frac{1}{2}\right) + \cot^{-1}\left(2^3 + \frac{1}{2^2}\right) + \cot^{-1}\left(2^4 + \frac{1}{2^3}\right) + ... + \infty = \cot^{-1} x$, then the value of x is _____