

FIITJEE
ALL INDIA TEST SERIES
JEE (Advanced)-2025
FULL TEST – VIII
PAPER –1
TEST DATE: 27-04-2025

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

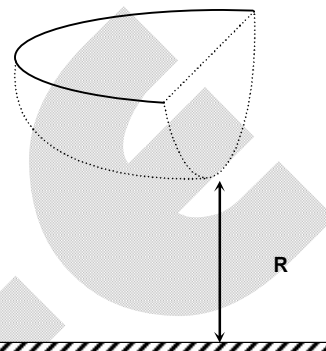
(One Options Correct Type)

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. A hollow body of mass M is in the shape of a quadrant sphere of radius R . It is released from rest in the situation shown. If the collision is elastic, find angular velocity of the body just after striking the ground.

(A) $\frac{12}{17}\sqrt{\frac{g}{R}}$
(C) $\frac{6}{17}\sqrt{\frac{g}{R}}$

(B) $\frac{12}{17}\sqrt{\frac{2g}{R}}$
(D) $\frac{6}{17}\sqrt{\frac{2g}{R}}$



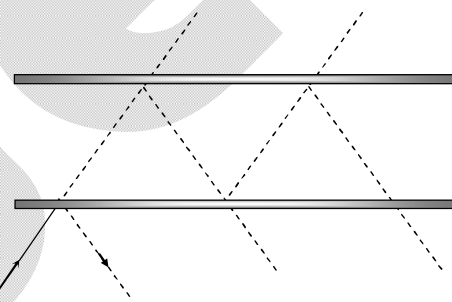
2. Consider a situation where two plane glass sheets are placed parallel to each other. It is known that sheet transmits only a fraction of incident light. The first sheet transmits $t_1 = \frac{3}{4}$ fraction of incident light

and second only $t_2 = \frac{1}{6}$ fraction of incident light.

What fraction of incident light passes through these parallel sheets provided no energy is lost in sheets.

(A) $\frac{5}{21}$
(C) $\frac{15}{23}$

(B) $\frac{3}{19}$
(D) Data insufficient



3. A satellite of mass m is orbiting the earth in a circular orbit of radius r . It starts losing its mechanical energy due to small air resistance at the rate of c J/s. The time taken by the satellite to hit the surface of the earth is

(A) $\frac{GMm}{c} \left(\frac{1}{R} - \frac{1}{r} \right)$
(C) $\frac{2GMm}{c} \left(\frac{1}{R} - \frac{1}{r} \right)$

(B) $\frac{GMm}{2c} \left(\frac{1}{R} - \frac{1}{r} \right)$
(D) $\frac{GMm}{c} \left(\frac{1}{R} + \frac{1}{r} \right)$

4. A parallel plate capacitor is filled with a dielectric whose dielectric constant varies with the applied voltage as $K = \alpha V$, where $\alpha = 1 \text{ volt}^{-1}$. Another identical capacitor (without dielectric) charged to a potential drop $V_0 = 30 \text{ volt}$ is connected in parallel to the first uncharged capacitor. The final potential drop across each capacitor is

(A) 5V
(C) 15V

(B) 10V
(D) 20V

SECTION – A

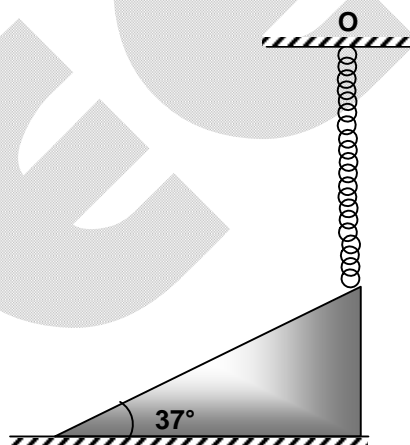
(One or More than one correct type)

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).

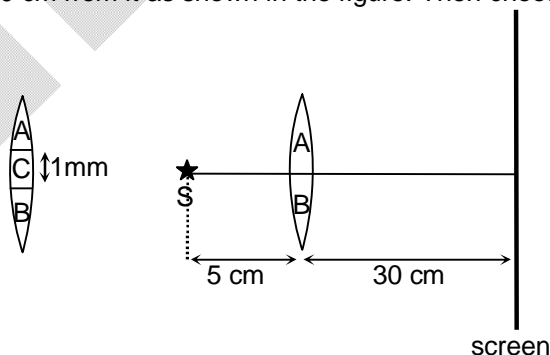
5. The pitch of a screw gauge is 1 mm and its cap is divided into 100 divisions. When nothing is placed between its studs, the zero of the circular scale is lying 6 divisions above the reference line. When a wire is placed between its studs, the main scale reading is 3 divisions and 58th division of circular scale coincides with the reference line. Then choose the correct option(s).
- (A) The least count of the screw gauge is 0.01 mm.
 (B) The zero error in the screw gauge is – 0.06 mm
 (C) The diameter of the wire is 3.52 mm
 (D) The diameter of the wire is 3.64 mm.

6. A thin flexible uniform chain of mass 'm' and length ' ℓ ' is suspended from point 'O' so that its lower end just touches a smooth inelastic fixed plane of inclination 37°. Now the chain is released from point 'O'. Then choose the correct option(s).

- (A) The force exerted by the chain on the plane as a function of time 't' is $\frac{6}{5} \frac{mg^2 t^2}{\ell}$.
 (B) The force exerted by the chain on the plane, when the chain falls by a distance $\ell/2$ is $\frac{6}{5} mg$.
 (C) Total impulse on the plane while the complete chain falls is $\frac{3}{5} m\sqrt{2g\ell}$
 (D) Total impulse on the plane while the complete chain falls is $\frac{4}{5} m\sqrt{2g\ell}$



7. A convex lens of focal length 10 cm is cut along the diameter into two identical halves A and B and in the process a central layer C of the lens of thickness 1 mm is lost. Then the two halves A and B are put together to form a composite lens. A point source of light emitting wavelength $\lambda = 5000 \text{ \AA}$ is placed at a distance 5 cm in front of this composite lens and a screen is placed behind the lens at a distance 30 cm from it as shown in the figure. Then choose the correct option(s).




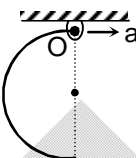
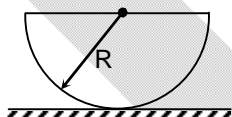
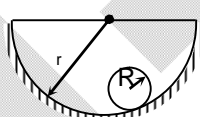
- (A) The fringe width of the interference pattern obtained on the screen is 0.2 mm.
 (B) The fringe width of the interference pattern obtained on the screen is 0.6 mm.
 (C) The number of interference bands observed on the screen is 15.
 (D) The number of interference bands observed on the screen is 12.

SECTION – A

(Matching List Type)

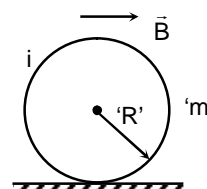
This section contains **FOUR (04)** Matching List Type Questions. Each question has **FOUR** statements in **List-I** entries (P), (Q), (R) and (S) and **FIVE** statements in **List-II** entries (1), (2), (3), (4) and (5). The codes for lists have choices (A), (B), (C), (D) out of which **ONLY ONE**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

8. In List-I a body is given which can oscillate if slightly disturbed from its equilibrium position. In List-II time period of oscillation is given.

List –I			List –II	
(P)	A thin hemispherical shell of radius R is supported on the end of thin fixed vertical rod		(1)	$2\pi\sqrt{\frac{26R}{15g}}$
(Q)	A thin semicircular ring of radius R is hanging from point O which is accelerating in horizontal direction with some acceleration so that the line joining two ends of the semicircular ring is vertical.		(2)	$2\pi\sqrt{\frac{R}{g\left(1+\frac{4}{\pi^2}\right)}}$
(R)	Solid hemisphere of radius R is placed on rough sufficiently rough horizontal surface to support rolling.		(3)	$2\pi\sqrt{\frac{2R}{g\left(1+\frac{4}{\pi^2}\right)}}$
(S)	A solid sphere of radius R is placed inside a fixed concave surface of radius r = 6R friction is large between sphere and concave surface to support rolling.		(4)	$2\pi\sqrt{\frac{4R}{3g}}$
			(5)	$2\pi\sqrt{\frac{7R}{g}}$

The correct option is:

- (A) (P) → (4) (Q) → (3) (R) → (1) (S) → (5)
 (B) (P) → (4) (Q) → (2) (R) → (5) (S) → (4)
 (C) (P) → (1) (Q) → (3) (R) → (4) (S) → (2)
 (D) (P) → (2) (Q) → (5) (R) → (1) (S) → (3)
9. A ring of mass $m = 10$ kg and radius $R = 5$ cm is kept at rest on a smooth horizontal surface in vertical plane as shown in the figure. The ring carries a current $i = 7$ ampere. A constant horizontal magnetic field $B = 100$ mT is switched on at $t = 0$.



List –I describes the statement regarding ring and List-II gives their respective values.

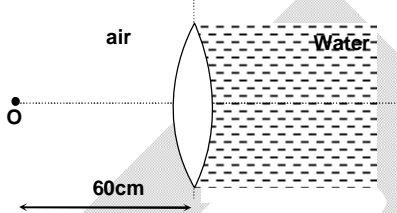
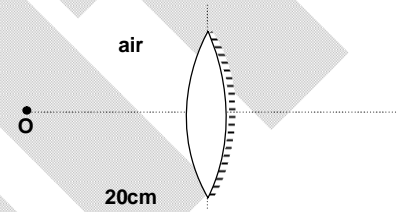
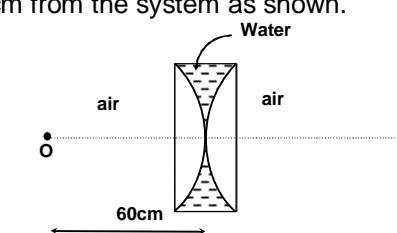
List –I		List –II	
(P)	The magnetic moment of loop in S.I. units	(1)	0.0880
(Q)	Torque acting on loop due to magnetic field in S.I. units at $t = 0$	(2)	0.0044

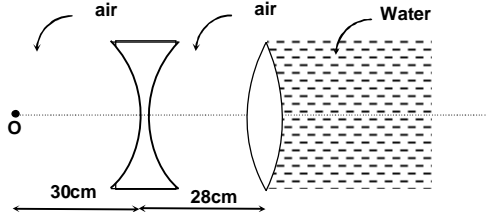
(R)	Angular acceleration of loop in S.I. units at $t = 0$	(3)	0.0055
(S)	Kinetic energy of ring when it has rotated through 90°	(4)	0.4400
		(5)	0.0550

The correct option is:

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

10. List-I contains the situation of one or more than one thin lenses (refractive index of the material of each lens is 1.5). The refractive index of surrounding media are also given in each case. In List-II contains the information of magnitude of final image distance (in cm) in each case. Refractive index of the material of lens in each case is 1.5.

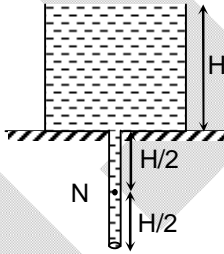
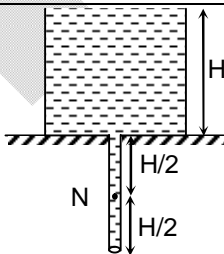
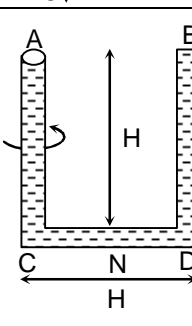
List –I		List –II	
(P)	<p>A thin equiconvex lens of focal length 20 cm (in air) is placed so that medium to the left of it is air ($\mu_{\text{air}} = 1$) and medium to the right of it is water ($\mu_{\text{water}} = \frac{4}{3}$). A point object is placed in air on the principal axis of the lens at a distance 60 cm from it.</p> 	(1)	240
(Q)	<p>One of the curved surfaces of a thin equiconvex lens of focal length 60 cm (in air), is silvered. A point object is placed to the left of the lens at a distance 20 cm from the lens.</p> 	(2)	160
(R)	<p>Two thin plano-convex lens each of focal length 30 cm (in air) is placed in contact so that their curved surfaces are in contact. Water ($\mu_{\text{water}} = \frac{4}{3}$) is filled in the space between the lenses. The media to the left and right side of the system of the lenses is air ($\mu_{\text{air}} = 1$). A point object is placed in air at a distance 60 cm from the system as shown.</p> 	(3)	180

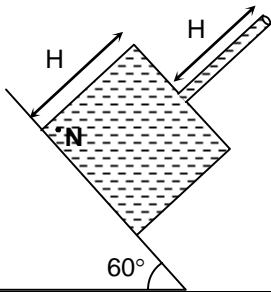
(S)	<p>A concave lens of focal length $f_1 = -20$ cm and an equiconvex thin lens of focal length 40 cm are placed at a distance 28 cm so that their principle axes are coinciding. The surroundings media are shown in the diagram. A point object is placed on the principle axis at a distance 30 cm to the left of concave lens</p> 	(4)	80
		(5)	60

The correct option is:

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

11. In List-I liquid of uniform density is filled in container and in the List-II gauge pressure at point N is given

	List -I			List -II
(P)	Wide container of height H and a pipe of length H is shown in the figure. The end of the pipe is closed		(1)	$\rho g H$
(Q)	Wide container of height H is connected with a pipe of small area of cross section. Liquid is allowed to flow out from pipe. Assume Bernoulli's theorem is valid		(2)	$\frac{5}{4} \rho g H$
(R)	ABCD is U shape tube in which liquid is filled fully and end B is closed with help of cap, while end A is open. It is rotated about AC with angular speed $\omega = \sqrt{\frac{2g}{H}}$. Point N is at mid point of horizontal part of the tube.		(3)	$\frac{-\rho g H}{2}$

(S)	A thin pipe of height H , connected with a wide vessel of height H filled with liquid is released from rest on smooth inclined plane. Point N is at the edge point of bottom of vessel.		(4)	$\frac{\rho g H}{2}$
			(5)	$\frac{3}{2} \rho g H$

The correct option is:

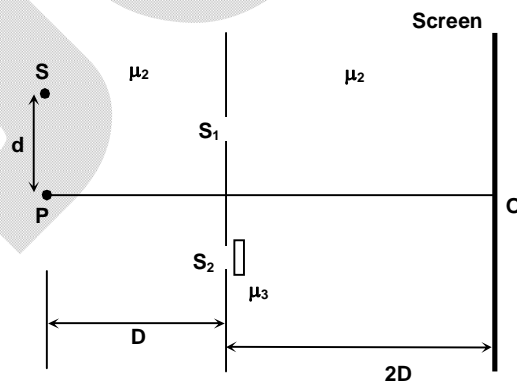
- (A) (P) \rightarrow (3) (Q) \rightarrow (2) (R) \rightarrow (2) (S) \rightarrow (4)
 (B) (P) \rightarrow (5) (Q) \rightarrow (3) (R) \rightarrow (2) (S) \rightarrow (1)
 (C) (P) \rightarrow (1) (Q) \rightarrow (3) (R) \rightarrow (4) (S) \rightarrow (2)
 (D) (P) \rightarrow (2) (Q) \rightarrow (5)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

SECTION – B

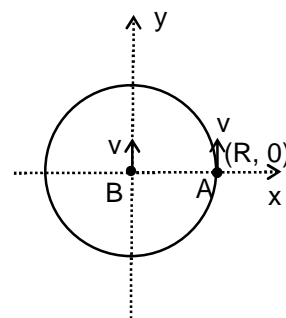
(Numerical Answer Type)

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

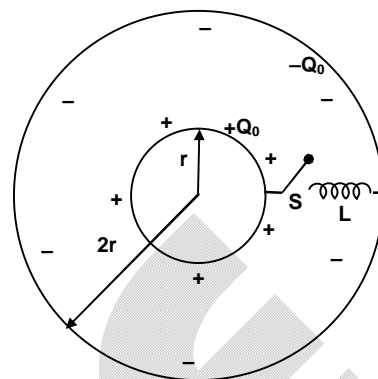
12. Consider the Young's double slit apparatus as shown in figure. The slits S_1 and S_2 are placed symmetrically about the line OP which is perpendicular to the screen. The entire space is filled with a liquid of refractive index μ_2 . A thin transparent sheet of thickness t and refractive index μ_3 is placed in front of the slit S_2 . A monochromatic source S is placed at a distance d above the line OP. The separation between the slits S_1 and S_2 is d . Given $D = 1\text{m}$, $d = 2\text{mm}$, $t = 6\mu\text{m}$, $\mu_2 = 1.2$ and $\mu_3 = 1.8$. Find the distance of central maximum (in mm) from the origin O.



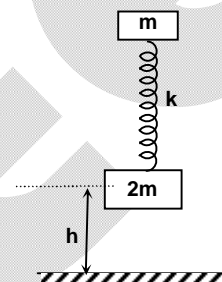
13. Two particles move with same speed v in x - y plane. Particle A moves on the circle of radius R centered at origin while particle B moves along the positive y -axis. At $t = 0$ particle A is at $(R, 0)$ and B is at the origin. Average angular velocity of B as seen by A in the time interval $\frac{\pi R}{2v}$ is $\frac{\alpha v}{R}$. Find the value of α .



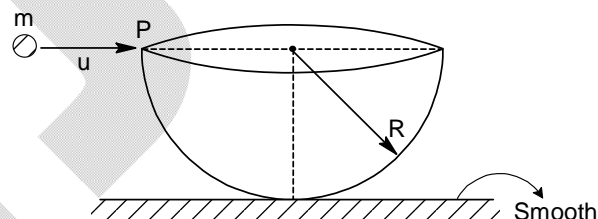
14. Two concentric conducting spherical shells of radius r and $2r$ are having initial charges $+Q_0$ and $-Q_0$ respectively as shown in the figure. Switch S is closed at time $t = 0$. If current through the inductor L at time $t = \frac{\pi}{4} \sqrt{8\pi L \epsilon_0 r}$ is $\frac{Q_0}{n\sqrt{\pi \epsilon_0 L r}}$. Find the value of n .



15. A spring mass system is held at rest with the spring relaxed at a height 'h' above the ground. The minimum value of $h = \frac{\lambda mg}{k}$ for which the system has a tendency to rebound after hitting the ground, then find the value of λ . (assume zero coefficient of restitution for lower block and ground)



16. A hollow hemispherical bowl of mass m , radius R is placed on a smooth horizontal surface. A particle (also of mass m) strikes the hemi spherical bowl at point P and sticks to it. The velocity of particle just after the collision in vertically upwards direction is $\frac{ku}{25}$; where k is an integer. Find k .



17. A lamp post of length ℓ and cross sectional area $S = 10 \text{ cm}^2$ is made of material with linear expansion coefficient $\alpha = 1.1 \times 10^{-5} \text{ K}^{-1}$ and Young's modulus $Y = 2.0 \times 10^{11} \text{ N/m}^2$. If temperature of lamp post is raised by $\Delta T = 10\text{K}$, what mass (in kg) should be put on the lamp post, so that there is no change in the length of lamp post ($g = 10 \text{ m/s}^2$)

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.

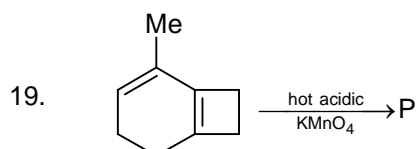
18. 5 mol PCl_5 (g) and 1 mol N_2 gas is placed in a closed vessel. At equilibrium 20% of PCl_5 (g) decomposes and total pressure in the container is found to be 1 atm. The K_p for the reaction PCl_5 (g) \rightleftharpoons PCl_3 (g) + Cl_2 (g) is

(A) $\frac{1}{24}$ atm

(B) $\frac{1}{4}$ atm

(C) $\frac{1}{16}$ atm

(D) $\frac{1}{28}$ atm



IUPAC name of 'P' would be

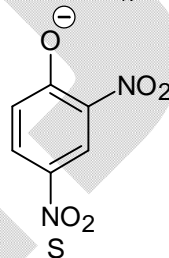
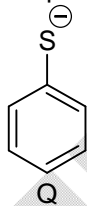
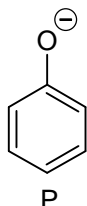
(A) 3, 6, 7-trioxo octanoic acid

(B) 3,6,7-trioxo octanal

(C) 4,7,8-trioxo nonanoic acid

(D) 2,3,6-trioxo nonanoic acid

20. The order of nucleophilicity of the following anions in a $\text{S}_{\text{N}}2$ reaction in a protic solvent is



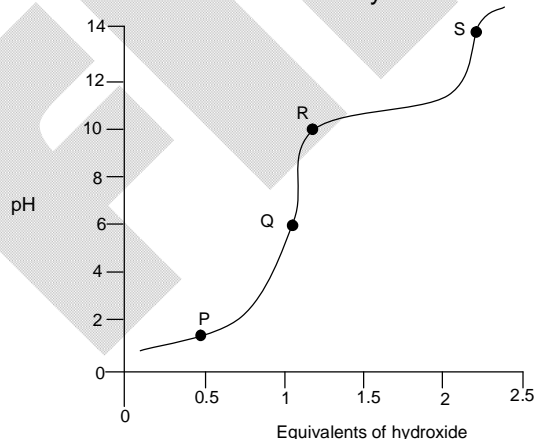
(A) $Q > R > S > P$

(B) $Q > P > R > S$

(C) $Q > R > P > S$

(D) $P > S > R > Q$

21. The titration curve of alanine hydrochloride is given below



The position in the graph that corresponds to the isoelectric point of alanine is

(A) P

(B) Q

(C) R

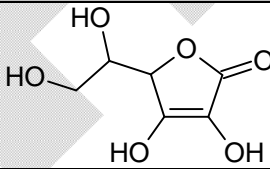
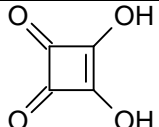
(D) S

26. Match the following

List – I		List – II	
(P)	$ \begin{array}{c} \text{CHO} \\ \\ \text{HO} - \text{C} - \text{H} \\ \\ \text{HO} - \text{C} - \text{H} \\ \\ \text{H} - \text{C} - \text{OH} \\ \\ \text{H} - \text{C} - \text{OH} \\ \\ \text{CH}_2\text{OH} \end{array} $	(1)	Functional isomer of D-glucose
(Q)	$ \begin{array}{c} \text{CHO} \\ \\ \text{H} - \text{C} - \text{OH} \\ \\ \text{HO} - \text{C} - \text{H} \\ \\ \text{HO} - \text{C} - \text{H} \\ \\ \text{H} - \text{C} - \text{OH} \\ \\ \text{CH}_2\text{OH} \end{array} $	(2)	Epimer of D-glucose
(R)	$ \begin{array}{c} \text{CHO} \\ \\ \text{HO} - \text{C} - \text{H} \\ \\ \text{H} - \text{C} - \text{OH} \\ \\ \text{HO} - \text{C} - \text{H} \\ \\ \text{HO} - \text{C} - \text{H} \\ \\ \text{CH}_2\text{OH} \end{array} $	(3)	Reducing sugar
(S)	$ \begin{array}{c} \text{CH}_2\text{OH} \\ \\ \text{C} = \text{O} \\ \\ \text{HO} - \text{C} - \text{H} \\ \\ \text{H} - \text{C} - \text{OH} \\ \\ \text{H} - \text{C} - \text{OH} \\ \\ \text{CH}_2\text{OH} \end{array} $	(4)	Forms same osazone on treatment $\text{Ph}-\text{NH}-\text{NH}_2$ as D-glucose forms
		(5)	Enantiomer of D-glucose

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

27. Match the following:

List – I		List – II	
(P)		(1)	All the C – O bonds are equal in its dianion form.
(Q)	H_2CO_3	(2)	Diprotic acid
(R)		(3)	Decolourises purple colour of the MnO_4^- ion

(S)	$\begin{array}{c} \text{CO}_2\text{H} \\ \\ \text{CO}_2\text{H} \end{array}$	(4)	Produces effervescence on addition of NaHCO_3
		(5)	Stronger acid than phenol

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

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

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

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

28. Match the following:

List – I		List – II	
(P)	CrO_4^{2-}	(1)	Contains peroxo linkage
(Q)	$\text{Cr}_2\text{O}_7^{2-}$	(2)	Unstable compound
(R)	CrO_5	(3)	Cr in +VI state
(S)	CrO_8^{3-}	(4)	Oxidizes 1° alcohol to carboxylic acid
		(5)	All Cr – O bonds are equivalent

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

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

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

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

SECTION – B

(Numerical Answer Type)

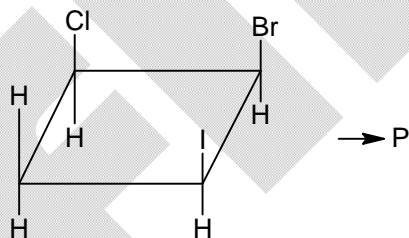
This section contains **SIX (06)** Numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.

 29. 100 ml 0.1 M HCl is added to 200 ml 0.1 M Na_2CO_3 solution. What would be the pH of the final solution.

[For H_2CO_3 , $K_{a1} = 10^{-7}$, $K_{a2} = 10^{-11}$]

 30. If the number of five membered rings in fullerene ($\text{C} - 60$), cis-1,2 diol-boric acid complex and in $\text{Ca(II)} - \text{EDTA}$ chelate are x, y and z respectively then value of $\frac{x \times y \times z}{10}$ is

31.

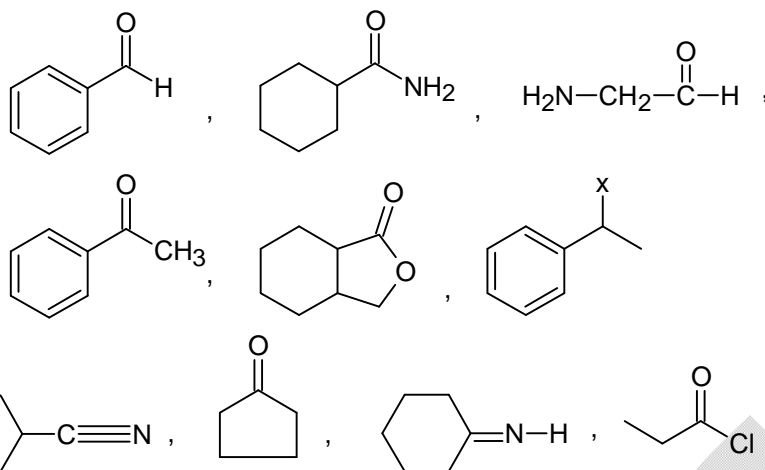


If 'P' has x pairs of diastereomers and y pairs of enantiomers then value of $\frac{x}{y}$ would be

 32. Total number of species among the following in which at least one atom has same hybridisation as the N-atom in azide (N_3^-) ion.

I_3^- , CO_2 , XeF_2 , CH_3CN , NO_2^+ , N_2O , SO_2 , C_3O_2

33. How many of the following compounds can be reduced by NaBH_4 ?



34. The total number of optically active isomers of dichloridobis(glycinato) cobaltate (III) ion is

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 a pair of variable straight lines $x^2 + 4y^2 + \alpha xy = 0$ (where α is a real parameter) cut the ellipse $x^2 + 4y^2 = 4$ at two points A and B, then the locus of the point of intersection of tangents at A and B is
 (A) $x^2 - 4y^2 + 8xy = 0$ (B) $(2x - y)(2x + y) = 0$
 (C) $x^2 - 4y^2 + 4xy = 0$ (D) $(x - 2y)(x + 2y) = 0$
36. If $|z - 1| = 1$ and $\arg(z) = \theta$, where $z \neq 0$ and θ is acute, then $1 - \frac{2}{z}$ is equal to
 (A) $\tan \theta$ (B) $i \tan \theta$
 (C) $\tan \frac{\theta}{2}$ (D) $\tan \frac{\theta}{2}$
37. Let $f : X \rightarrow Y$ $f(x) = \sin x + \cos x + 2\sqrt{2}$ is invertible, then $X \rightarrow Y$ is/ are
 (A) $\left[\frac{\pi}{4}, \frac{5\pi}{4}\right] \rightarrow [\sqrt{2}, 3\sqrt{2}]$ (B) $\left[-\frac{\pi}{4}, \frac{3\pi}{4}\right] \rightarrow [\sqrt{2}, 3\sqrt{2}]$
 (C) $\left[-\frac{3\pi}{4}, \frac{3\pi}{4}\right] \rightarrow [\sqrt{2}, 3\sqrt{2}]$ (D) $\left[-\frac{3\pi}{4}, -\frac{\pi}{4}\right] \rightarrow [\sqrt{2}, 3\sqrt{2}]$
38. Suppose $g(x)$ satisfies $g(x) = x + \int_0^1 (xy^2 + yx^2)g(y) dy$, then $g(x)$ is
 (A) $x + \frac{61}{119}x + \frac{80}{119}x^2$ (B) $x + \frac{7}{11}x^2$
 (C) $\frac{180}{61}x + \frac{80}{119}x^2$ (D) none of these

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. If $y(\sin 2x + y \cos x) + \sin x \cdot \frac{dy}{dx}(\sin x + 2y) = \sin x(1 + 2\cos x)$ and $\left(\frac{\pi}{2}, 0\right)$ is a point on the curve then which of the following is a point on the curve also
 (A) $\left(\frac{3\pi}{2}, -1\right)$ (B) $\left(\frac{3\pi}{2}, 0\right)$
 (C) $\left(\frac{\pi}{2}, -1\right)$ (D) $(2\pi, 0)$

40. ABCD is a rectangle with A(-1, 2), B(3, 7) and AB : BC = 4 : 3. If d is the distance of the origin from the centre of the rectangle then [d] is equal to (where [.] denotes the greatest integer function).
 (A) 4 (B) 5
 (C) 6 (D) 7
41. If $\int e^{x^{1/3}} \cdot dx = me^{x^{1/3}} (x^{2/3} - 2x^{1/3} + 2) + c$ then m is
 (A) greater than 1 (B) greater than 2
 (C) greater than 3 (D) greater than 4

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. Let \vec{a} and \vec{b} be two unit vectors which are orthogonal. Two lines $L_1 : \vec{r} = 6\vec{a} - \vec{b} + \lambda(2\vec{b} - \vec{a})$ and $\vec{r} = \vec{a} - \vec{b} + \mu(\vec{a} + 3\vec{b})$ where $\lambda, \mu \in \mathbb{R}$ are coplanar, then choose the correct option from the following List(s) (where [.] represents greatest integer function)

List – I		List - II	
(P)	$\lambda + \mu$ is equal to	(1)	1
(Q)	$ \lambda - \mu $ is equal to	(2)	5
(R)	If θ is angle between L_1 and L_2 , then $[\tan \theta] + 3$	(3)	6
(S)	Distance of point of intersection of L_1 and L_2 from origin is 'd', then [d] is	(4)	4
		(5)	0

The correct option is:

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

43. Match the following List-I with List-II

List – I		List - II	
(P)	If $f_1(n)$ be the number of divisors of n and $f_k(n) = f_1(f_{k-1}(n))$, then the least integer k for which $f_k(2024^{2024}) = 3$ is	(1)	2
(Q)	Let A be a non-singular matrix such that $A^{-1} = \begin{bmatrix} 1 & 1 & 1 \\ 4 & 6 & 8 \\ 100 & 100 & 99 \end{bmatrix}$, then the value of $\frac{1}{3}\{\det(\text{adj}(2A)) + \det(2A)\}$	(2)	1
(R)	Tangents AB and AC are drawn from A to $x^2 + y^2 - 2x + 4y + 1 = 0$ meeting it at B and C. If equation of circumcircle of $\triangle ABC$ is $x^2 + y^2 - x + y - 2 = 0$. Such that A is (a, b), then a + b is	(3)	4

(S)	The value of $\left[\tan \frac{\pi}{7} \tan \frac{2\pi}{7} \tan \frac{3\pi}{7} \right]$ is (where $[.]$ represents greatest integer function)	(4)	6
		(5)	0

The correct option is:

(A) (P) \rightarrow (1); (Q) \rightarrow (3); (R) \rightarrow (2); (S) \rightarrow (5)

(B) (P) \rightarrow (4); (Q) \rightarrow (5); (R) \rightarrow (3); (S) \rightarrow (1)

(C) (P) \rightarrow (4); (Q) \rightarrow (3); (R) \rightarrow (2); (S) \rightarrow (1)

(D) (P) \rightarrow (1); (Q) \rightarrow (3); (R) \rightarrow (4); (S) \rightarrow (5)

44. Match the following List-I with List-II

List - I		List - II	
(P)	If α, β, γ are roots of the equation $x^3 - x^2 - 2x - 3 = 0$ and $\Delta = \begin{vmatrix} \beta^2 & 2\beta\gamma - \alpha^2 & \gamma^2 \\ \alpha^2 & \gamma^2 & 2\alpha\gamma - \beta^2 \\ 2\alpha\beta - \gamma^2 & \beta^2 & \alpha^2 \end{vmatrix}$, then $\sqrt{\Delta}$ is	(1)	1
(Q)	Let $f(k) = \int_0^4 x(4-x) - k dx$ be minimum, then the value of k is	(2)	3
(R)	A chord AB of an ellipse $\frac{x^2}{9} + \frac{y^2}{\lambda^2} = 1$ subtends 90° at centre of this ellipse 'O'. If $\frac{1}{OA^2} + \frac{1}{OB^2} = \frac{14}{45}$, then λ^2 is equal to	(3)	5
(S)	Let $L = \lim_{n \rightarrow \infty} \sum_{r=1}^n \frac{1}{2025\sqrt{n^{2025}} + r \cdot 2025}$, then the value of L is	(4)	7
		(5)	0

The correct option is:

(A) (P) \rightarrow (4); (Q) \rightarrow (3); (R) \rightarrow (5); (S) \rightarrow (2)

(B) (P) \rightarrow (5); (Q) \rightarrow (3); (R) \rightarrow (2); (S) \rightarrow (1)

(C) (P) \rightarrow (5); (Q) \rightarrow (3); (R) \rightarrow (1); (S) \rightarrow (2)

(D) (P) \rightarrow (4); (Q) \rightarrow (3); (R) \rightarrow (2); (S) \rightarrow (1)

45. If $g(x)$ is inverse of $f(x)$, then match the following List-I with List-II

List - I		List - II	
(P)	$f(x) = 2x + \cos x$, then $\frac{1}{4g''(1)}$ is	(1)	-1
(Q)	$f(x) = x^x$, then $\frac{1}{2}g''(1)$ is	(2)	0
(R)	$f(x) = \tan^{-1} x$, then $g''(0)$ is	(3)	1
(S)	$f(x) = e^{x^3+x}$, then $ g''(1) $	(4)	2
		(5)	8

The correct option is:

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

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 $0 \leq x < 4$, $-2 \leq y < 3$ and $-1 \leq z < 5$. If $[a]$ denotes greatest integer $\leq a$, and $\Delta = \begin{vmatrix} [x+2] & [y] & [z] \\ [x] & [y+1] & [z] \\ [x] & [y] & [z+1] \end{vmatrix}$ then the maximum value $(\Delta - 10)$ equals of _____
47. The number of solutions of the pair of equations $2 \sin^2 \theta - \cos 2\theta = 0$ and $2 \cos^2 \theta - 3 |\sin \theta| = 0$ in the interval $[0, 2\pi]$ is _____
48. Let S_n be a series of integers in the increasing order which divides n . The number of terms common in S_{6174} , S_{57624} , S_{6048} _____
49. Let V be the volume of the tetrahedron formed by the planes $x + y = 0$; $y + z = 0$; $z + x = 0$ and $x + y + z = 1$ then $6V$ is equal to _____
50. If $\lim_{n \rightarrow \infty} \frac{1}{n^4} \prod_{r=1}^{2n} (n^2 + r^2)^{1/n} = e^{\left(\int_a^b f(x) dx \right)}$ then the value of $e^{f(a+b)}$ is _____
51. $\alpha^3 - 3\alpha^2 + 5\alpha = 1$ and $\beta^3 - 3\beta^2 + 5\beta = 5$ then $(\alpha + \beta)$ is equal to _____