FIITJEE
ALL INDIA TEST SERIES
JEE (Advanced)-2025
FULL TEST – X
PAPER –1
TEST DATE: 07-05-2025

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

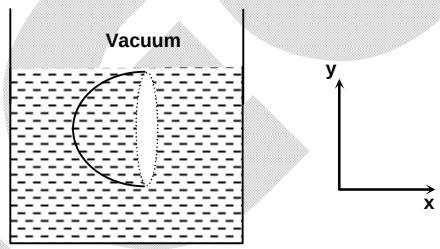
SECTION – A
(One Options Correct Type)

*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 nuclear fusion reaction $_1H^2 \rightarrow _2He^4 + \text{Energy}$, is proposed to be used for the production of industrial power. Assuming the efficiency of process for production of power is 20%, find approximately how much Deuterium is required to be consumed for an output power of 500 MW for a duration of 1 year. Given mass of $_1H^2$ nucleus = 2.0141 a.m.u. and mass of $_2He^4$ nuclei = 4.0026 a.m.u. and 1 a.m.u. = 931 MeV

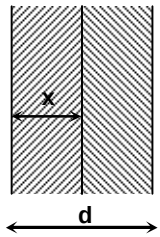
(A) 165 kg (B) 138 kg
(C) 180 kg (D) 60 kg

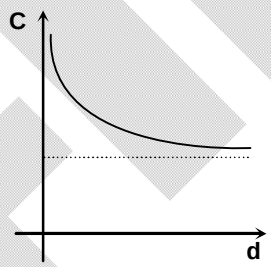
2. In a fluid of density ρ is immersed a solid hemisphere of density $\rho/2$ and radius R as shown. Find the force on the lower half of the hemisphere by the fluid.



(A) $\frac{5}{6}\pi R^3\rho g\hat{j}$ (B) $\frac{5}{6\sqrt{2}}\pi R^3\rho g(\hat{i}+\hat{j})$
(C) $\frac{2}{3}\pi R^3\rho g\hat{j}$ (D) $\frac{2}{3\sqrt{2}}\pi R^3\rho g(\hat{i}+\hat{j})$

3. A dielectric is completely filled between the space of a parallel plate capacitor. The separation between plates of capacitor is 'd' and dielectric constant is given by $k = k_0e^{\lambda x}$, where 'k_0' and 'λ' are positive constants and x is distance from one plate of capacitor. If distance between plate (d) increases slowly then graph between capacitance of capacitor and distance between plate is given by



(A)


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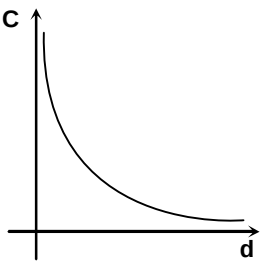
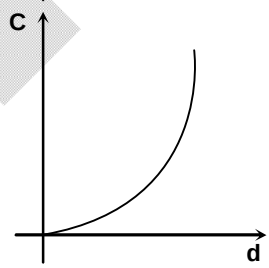
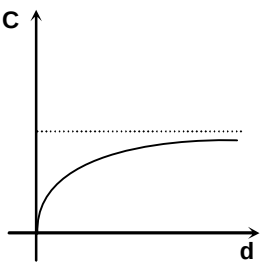


(C)


(D)


4. Suppose that one of the slits in YDSE is wider than the other, so the amplitude of the light reaching on the screen from one slit, acting alone, is five times that from the other slit, acting alone. The intensity for central bright fringe is I_0, then find the intensity I on the screen for (angular position) $\theta = 37°$. (Take $\frac{d}{\lambda} = \frac{5}{18}$, where d is separation between the slits and λ is wavelength of the source)

(A) $\left(\frac{124}{225}\right)I_0$ (B) $\left(\frac{93}{225}\right)I_0$

(C) $\left(\frac{62}{225}\right)I_0$ (D) $\left(\frac{31}{225}\right)I_0$

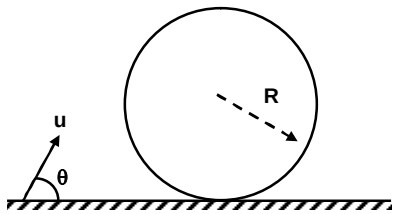
SECTION – A
(One or More than one correct type)

*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. Living wood takes radioactive carbon from the atmosphere during the process of photo synthesis. The proportion of C^{14} and C^{12} being 8×10^{-14}. When wood dies C^{14} decays with half life 2.1×10^9 s. 4g of carbon from a piece of dead wood gave a total count of 20 disintegrations per minute. Then, (Take $N_a = 6 \times 10^{23}$, $\ell n2 = 0.7$)

(A) Age of wood is 8.4×10^9 s.
(B) Age of wood is 6.3×10^9 s.
(C) Number of C^{14} at present in the wood piece is 10^9
(D) Number of C^{14} at present in the wood piece is 10^{10}

6. A particle is thrown from ground with speed u at an angle θ with horizontal as shown. If u_0 is the minimum value of u so that the particle will cross the horizontal cylinder just grazing at two points on it and θ_0 is the corresponding angle of projection. Then choose the correct option(s).



(A) $u_0^2 = Rg\left[2 + 2\sqrt{2}\right]$ (B) $\tan^2\theta_0 = [3 + 2\sqrt{3}]$

(C) $u_0^2 = Rg\left[2 + 2\sqrt{3}\right]$ (D) $\tan^2\theta_0 = [3 + 2\sqrt{2}]$

7. Consider a great number of rings with radius 'a' each, made of a thin metallic wire with resistance R. The rings have been put in a uniform way on a very long glass cylinder, which is vacuum inside. The rings lie in planes perpendicular to the cylinder axis and are glued in their respective position. The number of rings per unit length on the cylinder is n. At a certain moment, the cylinder starts rotating around its symmetry axis with a constant angular acceleration α. Pick the correct option(s) for steady state. (e = charge of an electron, m = mass of an electron)

(A) Current induced in the rings, $I = \frac{2\pi ma^2\alpha}{eR}$

(B) Current induced in the rings, $I = \frac{2\pi ma^2\alpha}{3eR}$

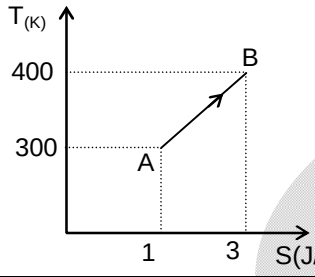
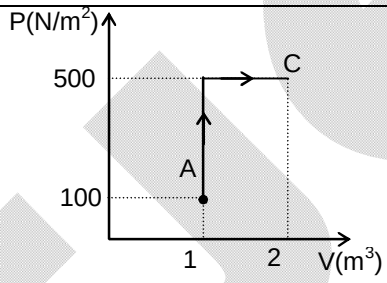
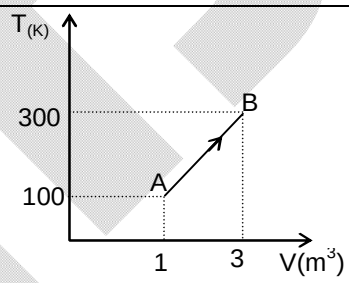
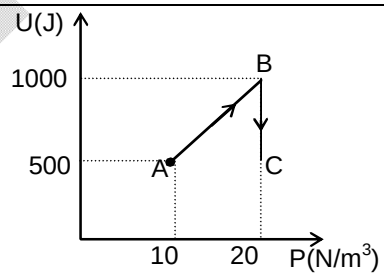
(C) Magnetic field at the cylinder's axis is $B = \frac{2\pi\mu_0 mna^2\alpha}{eR}$

(D) Magnetic field at the cylinder's axis is $B = \frac{2\pi\mu_0 mna^2\alpha}{3eR}$

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.*

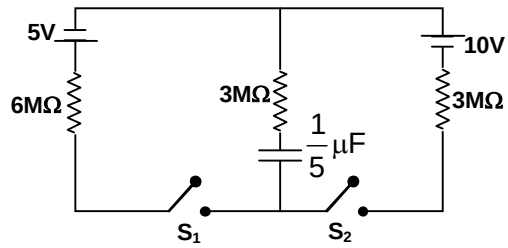
8. In List-I, difference thermodynamics process are given and in List-II magnitude of possible heat exchange between system and surrounding are given due the process.

List –I				List -II
(P)	2 mole monoatomic ideal gas is taken through process A → B which is shown in temperature (T) and entropy(s) diagram		(1)	1850J
(Q)	2 mole ideal monoatomic gas is taken through process A→ B→ C as shown in P-V diagram		(2)	8314J
(R)	Two mole monoatomic ideal gas is taken through the process A→B as shown in the T-V diagram		(3)	333J
(S)	One mole monoatomic ideal gas is taken through the process ABC as shown in the figure, with the help of internal energy U and pressure P of the gas		(4)	400J
			(5)	700J

The correct option is:

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

9. Three resistors of resistance 6MΩ, 3MΩ and 3MΩ, one capacitor of capacitance $\frac{1}{5}\mu F$, two cells of potential difference 5V and 10V and two switches are connected in the circuit as shown in the figure. Both switches is closed simultaneously at t = 0. (e^{-1} = 0.37)



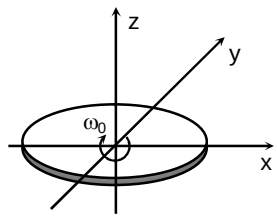
List-I describe the charges and currents in the circuit at a particular time and List-II gives possible values of charges and current.

List –I		List -II	
(P)	The maximum charge on the capacitor in μC	(1)	0.63
(Q)	Charge on capacitor at t = 1 sec in μC	(2)	1.54
(R)	Current in the branch of capacitor at t = 1 sec in μA	(3)	2.06
(S)	Current passing through battery of 5V at t = 1 sec in μA	(4)	1.00
		(5)	0.37

The correct option is:

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

10. A disc of mass m is placed over a horizontal smooth surface (xy plane) such that the centre of the disc is at the origin of the xyz space, as shown in the figure. Radius of the disc is R = 1m and is rotating with an angular velocity $\vec{\omega}_0 = -6\hat{k}$ rad/s and having zero velocity of centre of mass. A particle of same mass m hits the disc with a speed $|\vec{v}|$ = 8 m/s in each case of list-I. List-I gives the trajectory and velocity direction of the particle before hitting the disc and the coefficient of restitutions (e) of the collision. List-II gives the angular velocity of the disc just after the collision (in rad/s)

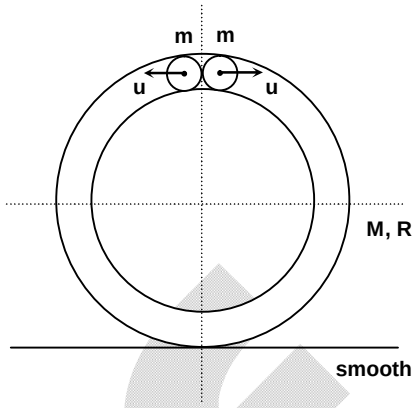


List –I		List -II	
(P)	x = 0, y = R and $\hat{v} = -\hat{k}$, e = 0	(1)	3
(Q)	$y = \frac{x}{\sqrt{3}}$, z = 0 and $\hat{v} = \frac{\sqrt{3}}{2}\hat{i} + \frac{1}{2}\hat{j}$, e = 1	(2)	5
(R)	y = R, z = 0 and $\hat{v} = \hat{i}$, e = 0	(3)	6
(S)	$y = \frac{R}{2}$, z = 0 and $\hat{v} = \hat{i}$, e = 0	(4)	7
		(5)	8

The correct option is:

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

11. A circular tube of mass 'M' and radius 'R' is placed vertically on a smooth horizontal surface as shown. Two small balls each of mass 'm' just fit inside the tube are placed at the top of the tube and imparted initial velocity 'u' to each ball in opposite directions. If angle made by the radius vector of either ball with the vertical is 'θ' at which the tube looses contact with the horizontal surface. List – I contains the different values of 'θ' and 'u' and List – II contains the corresponding mass ratio (M/m) of the tube and each ball. Then match the options of List – I correctly with the options of List – II.



List – I		List - II	
(P)	When $\theta = 37°$ and $u = \sqrt{gR}$	(1)	$\frac{M}{m} = \frac{64}{25}$
(Q)	When $\theta = 37°$ and $u = \sqrt{2gR}$	(2)	$\frac{M}{m} = \frac{66}{25}$
(R)	When $\theta = 53°$ and $u = \sqrt{gR}$	(3)	$\frac{M}{m} = \frac{24}{25}$
(S)	When $\theta = 53°$ and $u = \sqrt{2gR}$	(4)	$\frac{M}{m} = \frac{36}{25}$
		(5)	$\frac{M}{m} = \frac{21}{25}$

The correct option is:

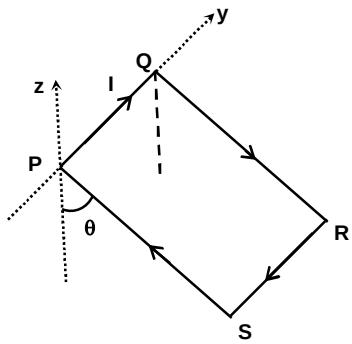
(A) (P) $\rightarrow$ (3) (Q) $\rightarrow$ (2) (R) $\rightarrow$ (5) (S) $\rightarrow$ (4)
(B) (P) $\rightarrow$ (3) (Q) $\rightarrow$ (1) (R) $\rightarrow$ (4) (S) $\rightarrow$ (2)
(C) (P) $\rightarrow$ (1) (Q) $\rightarrow$ (3) (R) $\rightarrow$ (4) (S) $\rightarrow$ (2)
(D) (P) $\rightarrow$ (2)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

SECTION – B

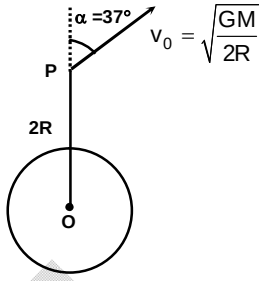
(Numerical Answer Type)

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

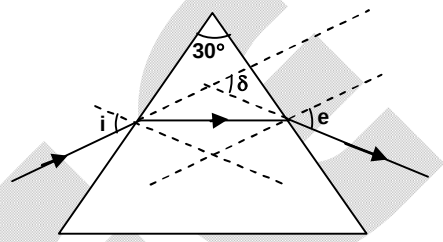
12. A square current carrying loop of side length ℓ and carrying a current I is hinged about its horizontal side PQ (Parallel to y axis). There is a uniform magnetic field $\vec{B} = B_0\left(\hat{i} - \hat{k}\right)$ in the region. The linear mass density of loop is λ and acceleration due to gravity is g. The loop remains in equilibrium when it's plane makes an angle $\theta = 37°$ with the vertical (z-axis). If the value of B_0 is $\frac{n\lambda g}{7\,I}$, find the value of n. (given sin 37°= 3/5)



13. A satellite is projected into space from a point P at a distance 2R from the centre of the earth at an angle α = 37° with the vertical as shown in the figure. The velocity of projection is $v_0 = \sqrt{\frac{GM}{2R}}$. It is found that the satellite is propelled into an elliptical orbit. If the eccentricity of the elliptical orbit is $e = \left(\frac{n}{10}\right)$. Find the value of 'n'. (Where M = mass of the earth, R = Radius of the earth)



14. A ray of light is incident at an angle of incidence 60° on one face of a prism as shown in the figure. The angle of prism is 30°. The ray emerging out of the prism makes an angle of 30° with the incident ray. If refractive index of the prism is $\mu = \sqrt{a}$. Find the value of a.



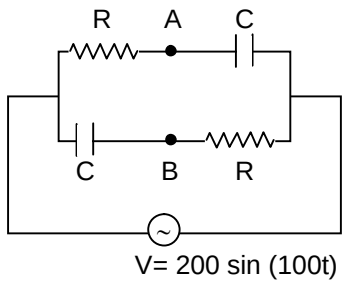
15. A particle of mass 'm' moving with a velocity 'v_0' strikes an identical particle at rest and sticks to it. The energy lost in this collision is the same as that required by a hydrogen like ion of atomic number 'z' for its electron to jump from the ground state to the first excited state. If m = 2.6×10^{-17} kg and v_0 = 2 m/s, find z.

16. A particle travels in a straight line such that for a time interval $2 \le t \le 6$ sec its motion is described by $v = \frac{4}{a}$ m/s, where a is in m/s^2. If v = 6 m/s at t = 2 sec, then the particle's acceleration at t = 5 sec is $\sqrt{\frac{k}{15}}$ m/s^2. Find the value of k.

17. An AC circuit contains two identical resistances and two identical capacitors, connected as shown in the figure.

$\left[R = \frac{1000}{\sqrt{3}}\Omega, \text{ and } C = 10\mu F\right]$

If $n\phi = \pi$, where ϕ is the phase angle between the source voltage and potential difference between point A and point B. Find the value of n.



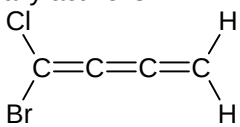
Chemistry

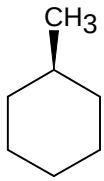
PART – II

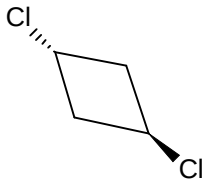
SECTION – A
(One Options Correct Type)

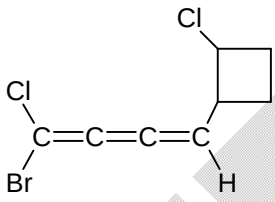
*This section contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.*

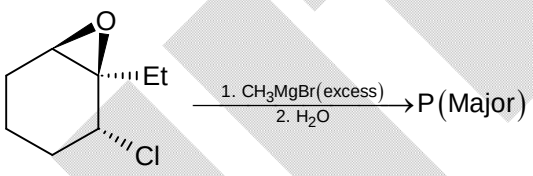
18. Optically active is

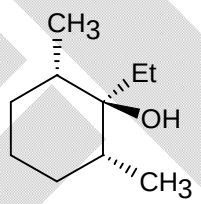
(A) 

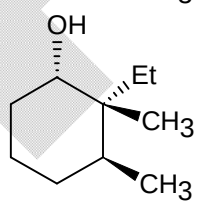
(B) 

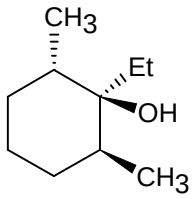
(C) 

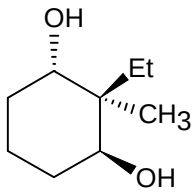
(D) 

19. 

(A) 

(B) 

(C) 

(D) 

20. 4 mole of a mixture O_2 and O_3 is reacted with excess of acidified solution of KI. The liberated iodine require 1 L of 2 M hypo solution for complete reaction. The mole percent of O_3 in the initial sample is

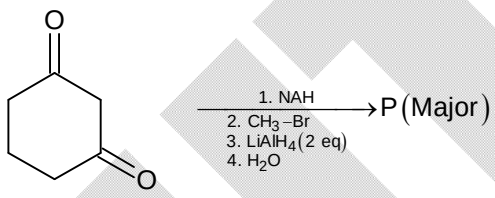
(A) 25 (B) 30
(C) 75 (D) 50

21. Square pyramidal shape is

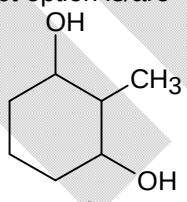
(A) XeF_2 (B) ICl_4^-
(C) XeF_5^+ (D) XeF_5^-

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).*

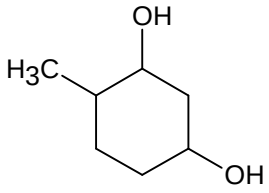
22. 

Choose correct option is/are

(A) P is 

(B) Number stereo isomers in P is 4

(C) Number of stereo isomer in P is 3

(D) P is 

23. The correct statement for $2p_z$ orbital is/are

(A) $\psi_{n,\ell,m} \propto \left(\frac{Z}{a}\right)^{3/2}\left(\frac{Zr}{a}\right)e^{-2r/2a}\cos(\theta)$

(B) $\psi_{n,\ell,m} \propto \left(\frac{Z}{a}\right)^{3/2}\left(2-\frac{Zr}{a}\right)e^{-2r/2a}$

(C) xy plane is nodal plane

(D) $2p_z$ ungerade orbital

24. Which of the following complexes is/are shows the co-ordination isomerism?

(A) $\left[Pt(NH_3)_4\right][PtCl_4]$

(B) $\left[CO(en)_3\right]\left[Cr(CN)_6\right]$

(C) $\left[Ag(NH_3)_2\right][AgCl_2]$

(D) $\left[CO(NH_3)_6\right]\left[CO(NO_2)_6\right]$

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		List – II
(P)	$2Ag^+ + Cu \longrightarrow 2Ag + Cu^{+2}$ $E^o_{Cu^{2+}/Cu} = 0.34$ $E^o_{Ag^+/Ag} = 0.80$ $\left[Ag^+\right] = 10^{-2}$ M, $\left[Cu^{+2}\right] = 10^{-4}$	(1)	$E_{Cell} = 0.5605$
(Q)	$Ni \mid Ni^{+2}(1\,M) \mid\mid Cu^{+2}(0.1\,M) \mid Cu$ $E^o_{Ni^{+2}\mid Ni} = -0.25$ V, $E^o_{Cu^{2+}/Cu} = 0.34$ V	(2)	$E_{Cell} = 0.0295$
(R)	$Pt \mid H_2(P_1\ atm) \mid H^+(1\,M) \mid\mid H^+(1\,M) \mid H_2(P_2\ atm)$	(3)	$E_{Cell} = E^o_{cell}$
(S)	$Zn - Hg(C_1\ M) \mid Zn^{2+}(aq) \mid Hg - Zn(C_2\ M)$ $C_1 = 1$ gm $\mid 100$ gm of Hg, $C_2 = 10$ gm $/ 100$ gm of Hg	(4)	$E_{Cell} = 0.59$ V
		(5)	$E^o_{cell} = 0$

(A) P→4; Q→5; R→1; S→2

(B) P→3; Q→1; R→5; S→2

(C) P→4; Q→2; R→3; S→5

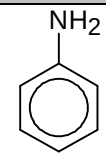
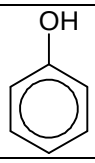
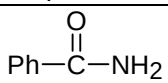
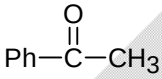
(D) P→3; Q→1; R→2; S→5

26. Match the following:

List – I		List – II	
(P)	$\left(\Delta G_{system}\right)_{T,P} = 0$	(1)	Irreversible isothermal expansion
(Q)	$\left\|\Delta S_{system}\right\| = \left\|\Delta S_{surrounding}\right\|$	(2)	Isothermal compression
(R)	$\left\|W_{irrev}\right\| > \left\|W_{rev}\right\|$	(3)	$\Delta S = \frac{\Delta H}{T}$
(S)	$\left\|\Delta S_{system}\right\| > \left\|\Delta S_{surrounding}\right\|$	(4)	Isothermal expansion
		(5)	Reversible isothermal expansion

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

27. Match the following:

List – I		List – II	
(P)		(1)	Gives 2,4 DNP test
(Q)		(2)	Gives isocyanide test
(R)		(3)	Tri substitution product with Cl_2/H_2O
(S)		(4)	Gives Hoffmann bromamide test
		(5)	Gives Azo-coupling reaction with diazonium salt in basic medium

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

28. Match the following

List – I		List – II	
(P)	Gives coloured ppt. with $K_4[Fe(CN)_6]$	(1)	Ni^{2+}
(Q)	Gives red ppt. with DMG in alkaline medium	(2)	Cu^{2+}
(R)	Gives coloured ppt. with KI which dissolves in excess of KI to give colouless complex	(3)	Pb^{2+}
(S)	Gives coloured ppt. with KCN and ppt. changes its colour immediately which further gives complex with excess of KCN	(4)	Co^{2+}
		(5)	Fe^{3+}

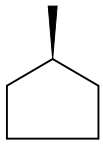
(A) P→2; Q→4; R→ 3; S→1
(B) P→1; Q→3; R→5; S→2
(C) P→5; Q→1; R→3; S→2
(D) P→5; Q→2; R→4; S→1

SECTION – B

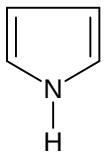
(Numerical Answer Type)

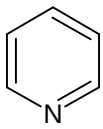
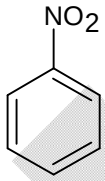
*This section contains **SIX (06)** Numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.*

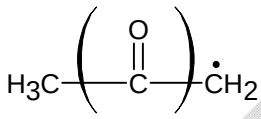
29. Number of monohalogen derivative including stereo isomers for the following is



30. Total number of correct statement among the following is

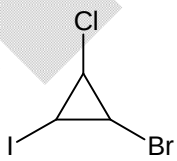
(A)  is aromatic

(B)  is more reactive than  for EAS reaction

(C) In  the presence of  group stabilise the radical

(D) Adiabatic irreversible expansion for ideal gas, $[\Delta S]_{system} = 0$

(E) In  the state of hybridization of radical is sp^3

31. Total number of diastereomeric pair for  is x then value of $\frac{x}{6}$ is

32. One mole of an ideal monoatomic gas initially at 800 K and 64 atm is expanded to a final state at 200 K and 1 atm. To achieve the above charge a reversible path is contracted that involve an adiabatic expansion in the beginning followed by an isothermal expansion to the final state. The magnitude of net work done by the gas (in cal) is

$(\ell n2 = 0.7), (R = 2 \text{ cal mol}^{-1} \text{ k}^{-1})$

33. The half-life period of a first order chemical reaction is 15 minutes. Time required for the completion of 99% of the chemical reaction will be (log2 = 0.30)

34. How many of the following ores contains CO_3^{2-} ion.

Cerrusite, Azurite, Calamine, Zincite, Siderite, Magnetite, Magnesite, Dolomite, Bauxite.

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. Consider two parabolas $y = x^2 - x + 1$ and $y = -x^2 + x + \frac{1}{2}$. The parabola $y = -x^2 + x + \frac{1}{2}$ is fixed and parabola $y = x^2 - x + 1$ rolls without slipping around the fixed parabola, then the locus of the focus of the moving parabola is
(A) $y = 1$ (B) $y = x$
(C) $y = x^2$ (D) $y = -x^2$

36. Point 'O' is the centre of ellipse with major axis AB and minor axis CD. Point F is one focus of ellipse. If OF = 6 and the diameter of the inscribed circle of ΔOCF is 2, then the product AB.CD equals
(A) 65 (B) 72
(C) 78 (D) 92

37. Three circles C_1, C_2, C_3 with radii r_1, r_2, r_3 ($r_1 < r_2 < r_3$) respectively are given as $r_1 = 2$, and $r_3 = 8$ they are placed such that C_2 lies to the right of C_1 and touches it externally, C_3 lies to the right of C_2 and touches it externally. There exist two straight lines each of which is a direct common tangent simultaneously to all the three circles then r_2 is equal to
(A) $r_2 = 4$ (B) $r_2 = 5$
(C) $r_2 = 10$ (D) $r_2 = 16$

38. If $f(x) = k^3x + k^3 - 2$ cuts the curve $g(x) = \frac{1}{2}\ln x^2$ at exactly one point then 'k' may lie in the interval
(A) $\left(\frac{1}{\sqrt{e}}, e\right)$ (B) $\left(\frac{1}{e}, \frac{1}{\sqrt{e}}\right)$
(C) $\left(\frac{1}{e^2}, \frac{1}{e}\right)$ (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. $\vec{p}, \vec{q}, \vec{r}$ be vectors such that $\vec{q}\cdot\vec{r} = 0$ and $\vec{p}\cdot\vec{q} \neq 0$. Let α is real constant such that $\vec{x}\cdot\vec{p} = \alpha$; $\vec{x}\times\vec{q} = \vec{r}$, then $\vec{x} = \lambda_1\vec{q} + \lambda_2(\vec{p}\times\vec{r})$ where
(A) $\lambda_1 = \frac{\alpha}{\vec{p}\cdot\vec{q}}$ (B) $\lambda_2 = \frac{1}{\vec{p}\cdot\vec{q}}$
(C) $\lambda_2 = \frac{1}{\vec{r}\cdot\vec{q}}$ (D) $\lambda_1 = \frac{\alpha}{\vec{r}\cdot\vec{q}}$

40. Let cos A + cos B = x; cos 2A + cos 2B = y; cos 3A + cos 3B = z, then which of the following is true
(A) $\cos^2 A + \cos^2 B = 1 + \frac{y}{2}$ (B) $\frac{1}{4}(2x^2 - y - 2) = \cos A \cos B$
(C) $2x^3 + z = 3x(1 + y)$ (D) $xyz = 0\ \forall\ A, B \in R$

41. Consider P, Q, R to be vertices of ΔPQR with integral coordinates and integral sides, and $(|PR| + |RQ|)^2 < 8$. Area $(\Delta PQR) + 1$, then
(A) $\angle R$ can be a right angle
(B) ΔPQR can be isosceles
(C) P, Q, R can lie on a square
(D) P, Q, R can lie on circle centred on midpoint of line segment PQ

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 an equilateral triangle ABC with vertices at z_1, z_2 and z_3 be inscribed in the circle $|z| = 2$ and again a circle is inscribed in the triangle ABC touching the sides AB, BC and CA at $D(z_4)$, $E(z_5)$ and $F(z_6)$ respectively

List – I		List – II	
(P)	Then value of $\text{Re}(z_1\bar{z}_2 + z_2\bar{z}_3 + z_3\bar{z}_1)$ is equal to	(1)	2
(Q)	If $\frac{4z_1}{z_3}$ is equal to $a(-1+i\sqrt{3})$, then a is	(2)	–6
(R)	The value of $\|z_1 + z_2\|^2 + \|z_2 + z_3\|^2 + \|z_3 + z_1\|^2$ is	(3)	12
(S)	\If P is any point on incircle the value of $DP^2 + EP^2 + FP^2$ is	(4)	6
		(5)	25

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

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

List – I		List - II	
(P)	If $\int_0^1 (f^6(x) - 8x f^3(x))dx + \frac{16}{3} = 0$, then $f^3(1)$ is	(1)	0
(Q)	If $g(x) = \int_0^x \left(t^4 \int_1^x f(u)du \right) dt$, then $g'(1) + g''(1)$ is $k_1 + \frac{f'(1)}{k_2}$, then $k_1 - k_2$ (given f(1) = 5)	(2)	1
(R)	The value of $\int_0^1 \frac{t^3 - 1}{\ln t} dt$ is ln k, then k – 4 is	(3)	3
(S)	Let $I_1 = \int_0^1 \frac{e^t}{1+t} dt$ and $I_2 = \int_0^1 \frac{t^2}{e^{t^3}(2-t^3)} dt$, then $\frac{I_1}{eI_2}$ is	(4)	4
		(5)	6

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

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

List – I		List - II	
(P)	Let $P=(1,7,\sqrt{2})$ be a point and the line L is $2\sqrt{2}(x-1)=y-2$, z = 0. If PQ is the distance from plane $\sqrt{2}x+y-z=1$ from point P measured along a line inclined at angle 45° with the line L and is minimum, then the value of PQ is	(1)	0
(Q)	If $\vec{a}=\hat{i}+\hat{j}+2\hat{k}$, $\vec{b}=\hat{i}+2\hat{j}+2\hat{k}$ and $\lvert\vec{c}\rvert=1$ such that $[\vec{a}\times\vec{b}\quad\vec{b}\times\vec{c}\quad\vec{c}\times\vec{a}]$ has a maximum value, then the value of $\lvert(\vec{a}\times\vec{b})\times\vec{c}\rvert^2$ is	(2)	3
(R)	If $[\vec{a}+2\vec{b}+3\vec{c}\quad\vec{b}+2\vec{c}+3\vec{a}\quad\vec{c}+2\vec{a}+3\vec{b}]=36$ where $\vec{a},\vec{b}$ and $\vec{c}$ are three vectors, then the value of $\begin{vmatrix}\vec{a}\cdot\vec{a} & \vec{a}\cdot\vec{b} & \vec{a}\cdot\vec{c}\\ \vec{b}\cdot\vec{a} & \vec{b}\cdot\vec{b} & \vec{b}\cdot\vec{c}\\ \vec{c}\cdot\vec{a} & \vec{c}\cdot\vec{b} & \vec{c}\cdot\vec{c}\end{vmatrix}$ is equal to	(3)	5
(S)	The planes $(a\hat{i}-\hat{j}+7\hat{k})\cdot\vec{r}=1$, $(a\hat{i}+\hat{j}-2\hat{k})\cdot\vec{r}=-1$ and $(2\hat{i}-\hat{j}+2\hat{k})\cdot\vec{r}=5$ intersect the plane $\hat{k}\cdot\vec{r}=0$ along the lines DC, EC and ED respectively. If CD subtends right angle at the origin, then value of 10a – 3 is equal to	(4)	4
		(5)	1

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

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

List – I		List - II	
(P)	Let S be the sample space of all 3 × 3 matrices with entries from the set {0, 1}. Let the event E_1 and E_2 be given by E_1 = {A ∈ S : Det A = 0} and E_2 = {A ∈ S : Sum of entries of A is 7}. If a matrix is chosen at random from S and $P\left(\frac{E_1}{E_2}\right)=\frac{p}{q}$ where HCF (p, q) = 1, then value of p + q is	(1)	1
(Q)	The value of $\begin{vmatrix}1 & a & a^2-bc\\ 1 & b & b^2-ca\\ 1 & c & c^2-ab\end{vmatrix}$ is equal to	(2)	2
(R)	If P, Q, R are the angles of triangle PQR, then the value of $\begin{vmatrix}-1 & \cos R & \cos Q\\ \cos R & -1 & \cos P\\ \cos Q & \cos P & -1\end{vmatrix}$ + 1 is equal to	(3)	3

(S)	A is the n × n matrix whose elements are all 1 and B is the n × n matrix whose diagonal elements are all n and the other elements are (n – r), then 4 + |(B – rI)(B – (n^2r – nr + r)I)| is	(4)	4
		(5)	0

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

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. The range of real constant 't' for which $(1 - \tan^2 t)\sin\theta^2 + \tan^2 t \cdot \tan\theta^2 \geq \theta^2$; always holds $\forall\ \theta \in \left(0, \frac{\pi}{2}\right)$ is $[\alpha, \beta)$ then $\frac{\beta}{\alpha}$ is equal to _____

47. The complete set of non-zero values of 'k' such that the equation $|x^2 - 7x + 6| = kx$ is satisfied by at least one and at most three real value(s) of x is $(-\infty, \ell_1] \cup [\ell_2, \infty)$ then $\frac{|\ell_1 - \ell_2|}{2}$ is equal to_____

48. If a, b, c are three positive real numbers then the minimum value of $\frac{a+3c}{a+2b+c} + \frac{4b}{a+b+2c} - \frac{8c}{a+b+3c}$ is $\alpha + \beta\sqrt{2}$ (where $\alpha, \beta \in Z$), then $|\alpha + \beta|$ is equal to _____

49. A chess match between two players A and B is won by whoever first wins a total of two games. Probability of A's winning, drawing and losing any particular game are $\frac{1}{6}$, $\frac{1}{3}$ and $\frac{1}{2}$ respectively. (The games are independent). If the probability that B wins the match in the 4^{th} game is p, then 6p is equal to _____

50. Let $f(x) = ax^2 + bx + c$, where $a \neq 0$, a, b, c are integers and $f(1) = 1$, $6 < f(3) < 8$ and $18 < f(5) < 22$. Then the number of solutions of equation $f(x) = e^x$ is _____

51. Consider A and B as 2 × 2 matrices with determinant equal to 1, then $|tr(AB) - tr(A)\cdot tr(B) + tr(AB^{-1})| + 2$ is _____