

PHYSICS, CHEMISTRY & MATHEMATICS**QP CODE: 101033****Common Test-3****Time Allotted: 3 Hours****Maximum Marks: 180**

- Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.
- You are not allowed to leave the Examination Hall before the end of the test.

INSTRUCTIONS

Caution: Question Paper CODE as given above MUST be correctly marked in the answer OMR sheet before attempting the paper. Wrong CODE or no CODE will give wrong results.

A. General Instructions

1. Attempt ALL the questions. Answers have to be marked on the OMR sheets.
2. This question paper contains **Three Sections**.
3. **Section-I** is Physics, **Section-II** is Chemistry and **Section-III** is Mathematics.
4. All the section can be filled in **PART-A & B** of OMR.
5. Rough spaces are provided for rough work inside the question paper. No additional sheets will be provided for rough work.
6. Blank Papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices, in any form, are not allowed.

B. Filling of OMR Sheet

1. Ensure matching of OMR sheet with the Question paper before you start marking your answers on OMR sheet.
2. On the OMR sheet, darken the appropriate bubble with **Blue/Black Ball Point Pen** for each character of your Enrolment No. and write in ink your Name, Test Centre and other details at the designated places.
3. OMR sheet contains alphabets, numerals & special characters for marking answers.

C. Marking Scheme For All Two Parts.

- (i) **Part-A (01-04)** – Contains Four (04) multiple choice questions which have ONLY ONE CORRECT answer Each question carries **+3 marks** for correct answer and **-1 marks** for wrong answer.
- (ii) **PART-A (05–07)** contains (3) Multiple Choice Questions which have One or More Than One Correct answer.
Full Marks: +4 If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.
Partial Marks: +1 For darkening a bubble corresponding to **each correct option**, provided NO incorrect option is darkened.
Zero Marks: 0 If none of the bubbles is darkened.
Negative Marks: -1 In all other cases.
For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will result in **+4 marks**; darkening only (A) and (D) will result in **+2 marks**; and darkening (A) and (B) will result in **-1 marks**, as a wrong option is also darkened.
- (iii) **Part-A (08-10)** – This section contains Three (03) Matching List Sets. Each set has **ONE** Multiple Choice Question. Each set has **TWO** lists: **List-I** and **List-II**. **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5). **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question. Each question carries **+4 Marks** for correct answer and **-1 marks** for wrong answer.
- (iii) **Part-B** – This section contains **SIX (06)** questions numerical based questions. The answer to each question is a **NUMERICAL VALUE**. If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places. Each question carries **+4 marks** for correct answer. **There is no negative marking.**

Name of the Candidate: _____

Batch: _____ Date of Examination: _____

Enrolment Number: _____

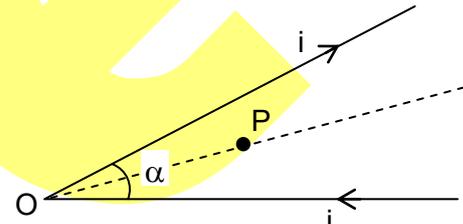
SECTION – I: PHYSICS

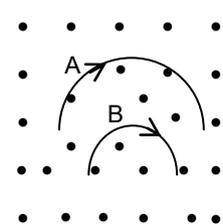
(PART – A)

(Single Correct Answer Type)

This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

- A cyclotron is operated at an oscillator frequency of 24 MHz and has a dee radius $R = 60$ cm. What is magnitude of the magnetic field B (in Tesla) to accelerate deuterons (mass = 3.34×10^{-27} kg)?
 (A) 9.5 (B) 7.2 (C) 5.0 (D) 3.2
- A thin rod is bent in the shape of a small circle of radius r . If the charge per unit length of the rod is σ , and if the circle is rotated about its axis at a rate of n rotations per second, the magnetic induction at a point on the axis at a large distance y from the centre
 (A) $\mu_0 \pi r^3 n \frac{\sigma}{y^3}$ (B) $2\mu_0 \pi r^3 n \frac{\sigma}{y^3}$ (C) $\left(\frac{\mu_0}{4\pi}\right) r^3 n \frac{\sigma}{y^3}$ (D) $\left(\frac{\mu_0}{2\pi}\right) r^3 n \frac{\sigma}{y^3}$
- An infinitely long conductor is bent at a point O at an angle α as shown. The magnetic field at a point P distant r along the angle bisector is
 (A) $(\mu_0/4\pi) \cdot (2i/r) [1+\cos(\alpha/2)]/\sin(\alpha/2)$
 (B) $(\mu_0/4\pi) \cdot (i/r) \cot(\alpha/2)$
 (C) $(\mu_0/2\pi) \cdot (i/r) \cot(\alpha/2)$
 (D) $(\mu_0/4\pi) \cdot (i/r) \sin(\alpha/2)$


- Two particles A and B of masses m_A and m_B respectively and having the same charge are moving in a plane. A uniform magnetic field exists perpendicular to this plane. The speeds of the particles are v_A and v_B respectively and the trajectories are as shown in figure. Then
 (A) $m_A v_A < m_B v_B$ (B) $m_A v_A > m_B v_B$
 (C) $m_A < m_B$ and $v_A < v_B$ (D) $m_A = m_B$ and $v_A = v_B$

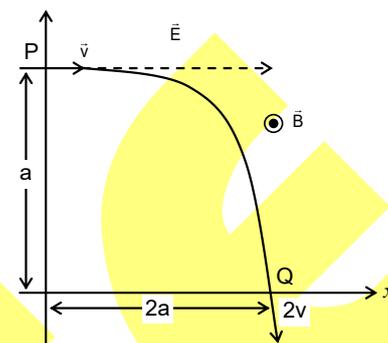


Space For Rough Work

(One or More Than One Options Correct Type)

This section contains **3 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

5. A particle with charge $+q$ and mass m moving under the influence of a uniform electric field $E\hat{i}$ and uniform magnetic field $B\hat{k}$ follows a trajectory from P to Q as shown in figure. The velocities at P and Q are $v\hat{i}$ and $-2v\hat{j}$ which of the following statements(s) is/are correct?



(A) $E = \frac{3}{4} \left[\frac{mv^2}{qa} \right]$.

(B) Rate of work done by the electric field at P is $\frac{3}{4} \left[\frac{mv^3}{a} \right]$.

(C) Rate of work done by the electric field at P is zero.

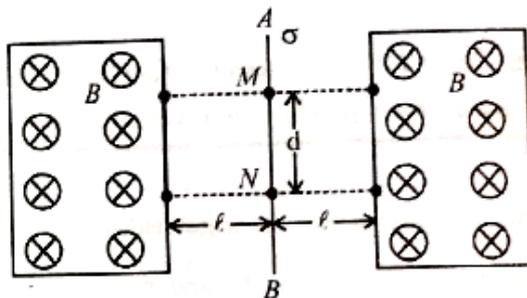
(D) Rate of work done by both the fields at Q is zero.

6. A charged particle with velocity $\vec{v} = x\hat{i} + y\hat{j}$ moves in a magnetic field $\vec{B} = y\hat{i} + x\hat{j}$. The magnitude of magnetic force acting on the particle is F . Which one of the following statements are correct?

(A) No force will act on particle if $x = y$ (B) $F \propto (x^2 - y^2)$ if $x > y$

(C) The force will act along z-axis if $x > y$ (D) The force will act along y-axis if $y > x$

7. A plane sheet AB having charge density σ has two holes at M and N at a separation of d and is placed normal to the plane of the paper. Two metallic boxes of very large size having magnetic field B are kept on both sides of the sheet at a distance ℓ as shown in figure. A charge particle q at N is given small velocity towards right. Holes on the plane sheet and holes on boxes are on the same level. The charge particle enters in right box, comes out through the holes and enters in the left box at the upper hole. Again comes out from the lower hole and continues to revolve. Neglect gravity. Choose the correct options.



(A) The magnetic field inside the boxes is $\frac{2m}{qd} \sqrt{\frac{q\sigma\ell}{\epsilon_0 m}}$

(B) The time period of revolution is $\sqrt{\frac{m\ell\epsilon_0}{q\sigma}} \left(8 + \frac{\pi d}{\ell} \right)$

(C) The magnetic field inside the boxes is $\frac{m}{qd} \sqrt{\frac{q\sigma\ell}{\epsilon_0 m}}$

(D) The time period of revolution is $\sqrt{\frac{m\ell\epsilon_0}{q\sigma}} \left(4 + \frac{\pi d}{\ell} \right)$

Space For Rough Work

(Matching List Sets)

This section contains **Three (03)** Matching List Sets. Each set has **ONE** Multiple Choice Question. Each set has **TWO** lists: **List-I** and **List-II**. **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5). **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.

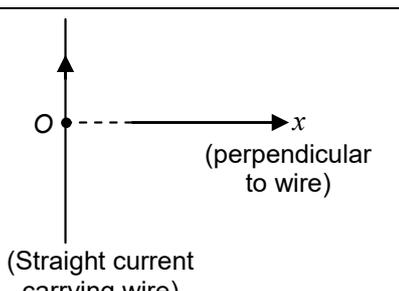
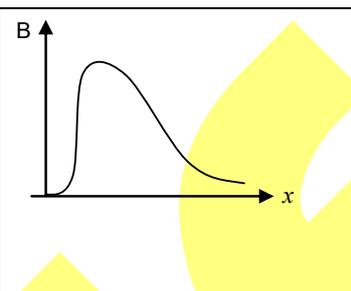
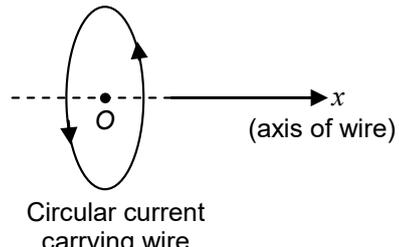
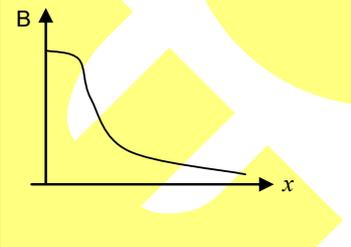
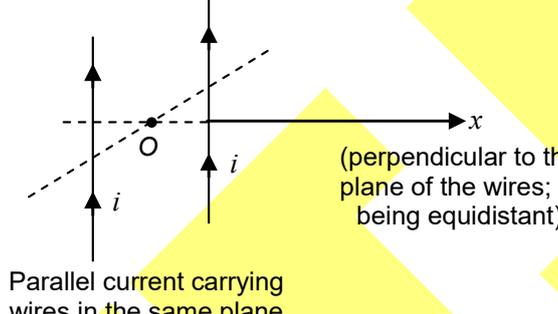
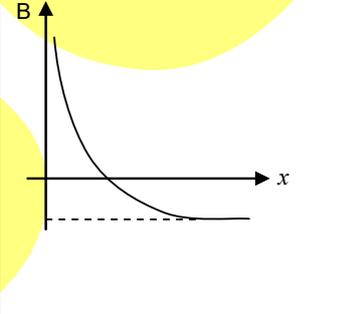
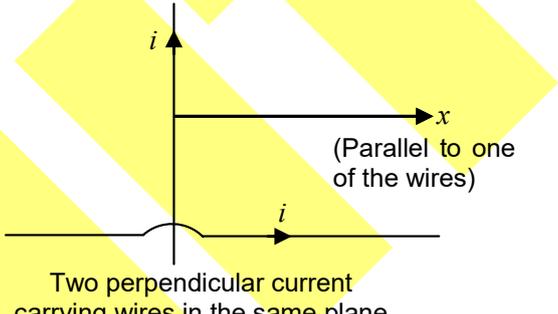
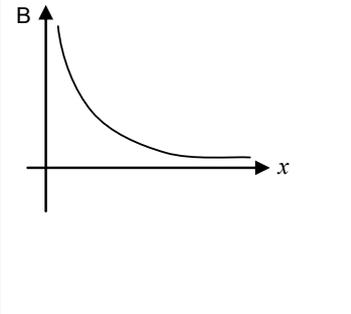
8. Consider no gravity. For a neutral metallic conductor MN, match the following. (The magnetic field exist in a circular region centered at M.)

	List-I		List-II
(P)		(1)	Constant (including zero) external work is required.
(Q)		(2)	Will generate a constant non-zero potential difference between M and N.
(R)		(3)	Will generate a time varying potential difference between M and N.
(S)		(4)	Time varying external work is required.

The correct option is:

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

9. The entries in List-I depict certain current distributions, while the entries in List-II depict the variation of the magnetic field (B) as one moves along the x -axis for each of these distributions, but in a different order. Match the entries in List-I with the proper entries in List-II.

List-I		List-II	
(P)	 <p>(Straight current carrying wire)</p>	(1)	
(Q)	 <p>Circular current carrying wire</p>	(2)	
(R)	 <p>Parallel current carrying wires in the same plane</p>	(3)	
(S)	 <p>Two perpendicular current carrying wires in the same plane</p>	(4)	

The correct option is:

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

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

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

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

Space For Rough Work

10. Find correct match for the figure in List-I as shown with the items given in List-II.

List-I		List-II	
(P)		(1)	$F \neq 0$
(Q)		(2)	$F = 0, \bar{\tau} \neq 0$
(R)		(3)	$F = 0, \bar{\tau} = 0$
(S)		(4)	$F \neq 0, \bar{\tau} = 0$

The correct option is:

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

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

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

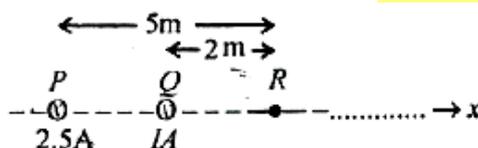
(D) $P \rightarrow 2; Q \rightarrow 3; R \rightarrow 1; S \rightarrow 4$

Space For Rough Work

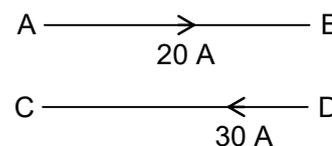
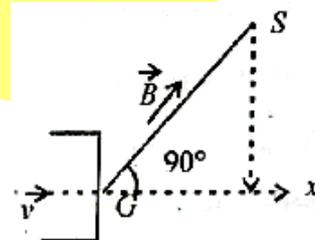
(PART – B)

This section contains **SIX (06)** numerical based questions. The answer to each question is a NUMERICAL VALUE. If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.

1. A beam of protons with a velocity 4×10^5 m/sec enters a uniform magnetic field of 0.3 tesla at an angle of 60° to the magnetic field. Find the radius (in m) of the helical path taken by the proton beam.
2. Two long parallel wires carrying current 2.5 amperes and 1 ampere in the same direction (directed into the plane of the paper) are held at P and Q respectively such that they are perpendicular to the plane of paper. The points P and Q are located at a distance of 5 metres and 2 metres respectively from a collinear point R (see figure). An electron moving with a velocity of 4×10^5 m/s along the positive x-direction experiences a force of magnitude 3.2×10^{-20} N at the point R. Find the value of ℓ (in ampere).

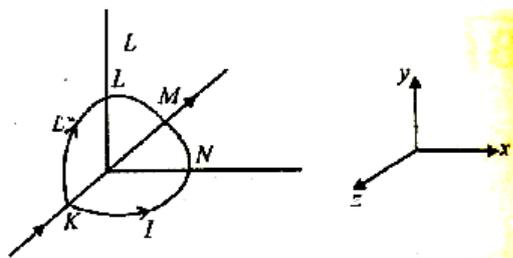


3. An electron gun G emits electron of energy 2 keV travelling in the positive x-direction. The electrons are required to hit the spot S where $GS = 0.1$ m, and the line GS makes an angle of 60° with the x-axis as shown in the figure. A uniform magnetic field \vec{B} exists parallel to GS in the region outside the electron gun. Find the minimum value of B (in mT) needed to make the electrons hit S.
4. A long horizontal wire AB, which is free to move in a vertical plane and carries a steady current of 20 A, is in equilibrium at a height of 0.01 m over another parallel long wire CD which is fixed in a horizontal plane and carries a steady current of 30 A, as shown in figure. When AB is lightly depressed, then find the period of oscillations (in second).



Space For Rough Work

5. A circular loop of radius R is bent along a diameter and given a shape as shown in the figure. One of the semicircles (KNM) lies in the x - z plane and the other one (KLM) in the y - z plane with the centres at the origin. Current I is flowing through each of the semi circles as shown in figure.



A particle of charge q is released at a origin with a velocity $\vec{v} = -v_0 \hat{i}$. Find the magnitude of instantaneous force \vec{F} on the particle if $\mu_0 q v_0 I = 8R$. Assume that space is gravity free.

6. A proton and an α -particle are accelerated with same potential difference and they enter in the region of constant magnetic field B perpendicular to the velocity of particle. Find the ratio of radius of curvature of proton to the radius of curvature of α -particle.

SECTION - II : CHEMISTRY

(PART - A)

(Single Correct Answer Type)

This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

- Anisotropic solids
 - have direction independent physical properties
 - melt at a single temperature (sharp melting point)
 - have random distribution of particles (atoms, molecules or ions)
 - contain cubic unit cells of different edge lengths
- The vapour pressure of which liquid decreases by maximum extent by adding NaCl to it?
 - Benzene
 - Water
 - Chloroform
 - Ether
- The amount of an ideal gas (helium) dissolve in a solvent is directly proportional to the
 - temperature
 - vapour pressure of solvent
 - partial pressure of the gas above the solution
 - interparticle attractive force of the solvent

Space For Rough Work

4. In NaCl unit cell, Na^+ ions are found at the
 (A) face centres and corners of the unit cell
 (B) corners and edge-centres of the unit cell
 (C) body centre and edge-centres of the unit cell
 (D) face centres and body centre of the unit cell

(One or More Than One Options Correct Type)

This section contains 3 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE** or **MORE THAN ONE** is correct.

5. An ideal solution was prepared by mixing of two liquids A and B. p_A and p_B represent their partial pressures above the solution, X_A and X_B represent their mole fraction in the solution, y_A and y_B represent their mole fraction in the vapours above the solution and p_A^0 and p_B^0 represent their vapour pressures in pure state. Choose the correct relation(s) [P_T is the total pressure above the solution]
 (A) $\frac{y_A}{y_B} = \frac{p_A}{p_B}$ (B) $\frac{X_A}{X_B} = \frac{p_A^0}{p_B^0}$ (C) $p_B = p_B^0(1 - X_A)$ (D) $P_T = p_A^0 X_A + p_B^0 X_B$
6. In the face centred cubic(FCC) unit cell of ZnS, the S^{2-} ions forms the FCC lattice in which the Zn^{2+} ions occupy half of the tetrahedral voids. The edge-length of the unit cell is 'a' unit. Choose correct statement(s) from the following
 (A) The radius of S^{2-} ion is $\frac{\sqrt{2}a}{4}$ unit
 (B) The radius of Zn^{2+} ions is $\left[\frac{a}{4}(\sqrt{3} - \sqrt{2})\right]$ unit
 (C) the coordination number of cation (Zn^{2+}) and anion(S^{2-}) are same and equal to four
 (D) the Zn^{2+} ions occupy half of the face centre positions of the unit cell
7. 0.4 mole of $\text{Al}_2(\text{SO}_4)_3$ was added to one Kg water at 1 bar pressure. $\text{Al}_2(\text{SO}_4)_3$ undergoes 92% dissociation into Al^{3+} and SO_4^{2-} ions under the experimental condition. Which observation(s) is/are correct for the solution? [K_b of $\text{H}_2\text{O} = 0.52 \text{ K Kg mol}^{-1}$]
 (A) Molality of the solution is 0.4
 (B) The van't Hoff factor of the solute is 4.68
 (C) The elevation of boiling point of the solvent is 0.973 unit
 (D) Boiling point of water under the reaction condition is 100°C

Space For Rough Work

(Matching List Sets)

This section contains **Three (03)** Matching List Sets. Each set has **ONE** Multiple Choice Question. Each set has **TWO** lists: **List-I** and **List-II**. **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5). **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.

8. Match the lists.

List – I (Unit cells)		List– II (Properties)	
(P)	Simple cubic	(1)	Coordination number is 12
(Q)	Face centered cubic	(2)	Particles are present only at the corners of the unit cell
(R)	Body centered cubic	(3)	Number of atoms per unit cell of a metal crystal is four for this unit cell
(S)	Hexagonal close packing	(4)	CsCl crystallizes through this unit cell
		(5)	Packing fraction is around 68%

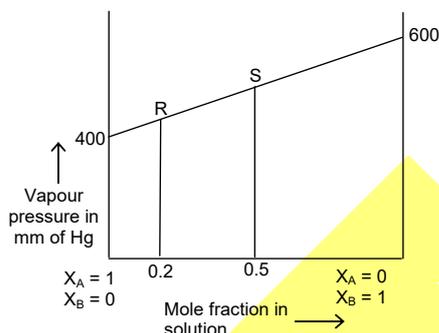
(A) P → 2; Q → 1, 4; R → 3, 5; S → 4

(B) P → 2; Q → 1, 3; R → 4, 5; S → 1

(C) P → 2; Q → 1, 3; R → 3, 4; S → 5

(D) P → 2; Q → 1, 5; R → 4, 5; S → 1

9.



The vapour pressure versus mole fraction graph of an ideal solution of liquids A and B are given above. Match the quantities mentioned in list-I with their values mentioned in list-II.

List – I		List– II	
(P)	Vapour pressure difference between pure B and A liquids	(1)	$\frac{3}{11}$
(Q)	Vapour pressure of the solution at point 'R'	(2)	$\frac{2}{15}$
(R)	Vapour pressure of the solution at point 'S'	(3)	200 mm of Hg
(S)	Mole fraction (y_B) of liquid B in the vapour above the liquid at point 'R'	(4)	500 mm of Hg
		(5)	440 mm of Hg

(A) P → 3; Q → 5; R → 4; S → 2

(B) P → 5; Q → 3; R → 4; S → 2

(C) P → 5; Q → 4; R → 3; S → 1

(D) P → 3; Q → 5; R → 4; S → 1

Space For Rough Work

10. Match the lists.

List – I (Solids)		List– II (Observed defects)	
(P)	Crystal containing NaCl and SrCl ₂	(1)	Schottky defect
(Q)	NaCl crystal	(2)	Metal deficiency defect
(R)	Crystal containing NaCl and Na	(3)	Frenkel defects
(S)	Crystal of Fe _{0.95} O	(4)	Metal excess defect
		(5)	Impurity defect

(A) P → 4; Q → 3; R → 2; S → 5

(B) P → 5; Q → 1; R → 4; S → 2

(C) P → 5; Q → 1; R → 2; S → 4

(D) P → 4; Q → 3; R → 5; S → 2

(PART – B)

This section contains **SIX (06)** numerical based questions. The answer to each question is a NUMERICAL VALUE. If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.

- If each corner atom of a simple cubic unit cell of a metal contributes $\frac{1}{x}$ part to the unit cell, what is the value of $\frac{x}{5}$?
- The vapour pressure of a pure solvent is 24 mm of Hg. A liquid solution is made by mixing 2 moles of a non-volatile solute with 8 moles of the solvent. What is the vapour pressure of the solution in mm of Hg unit?
- The crystal of a metal contains face centred cubic (FCC) unit cell. The atomic mass of the metal is 60.22 g mol⁻¹ and the volume of the unit cell is 10⁻²² cm³. What is the density of the solid in g/cm³ unit?
[N_A = 6.022 × 10²³]
- How many tetrahedral voids are present in a hexagonal close packing (HCP) unit cell?
- The degree of dissociation of CH₃COOH in H₂O is 0.8 and the degree of association of CH₃COOH in benzene (C₆H₆) is also 0.8. Two solutions of equal molality are prepared by mixing CH₃COOH with water and benzene in two different containers. If the K_f of H₂O is 1.8 K Kg mol⁻¹ and that of benzene is 5 K Kg mol⁻¹, the simplest ratio of depression in freezing point (ΔT_f) in the two solvents are found to be x : y, what is the value of (x + y)?
- The molarity of an ideal solution of water and an amino acid is 0.4 M. What is the osmotic pressure of the solution at 400 K in atm unit?
[Assume R = 0.08 L atm K⁻¹ mol⁻¹]

Space For Rough Work

SECTION – III : MATHEMATICS

(PART – A)

(Single Correct Answer Type)

This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

1. The radius of a circle having minimum area which touches the curve $y = 4 - x^2$ and the lines $y = |x|$ is
 (A) $4(\sqrt{2} + 1)$ (B) $4(\sqrt{2} - 1)$ (C) $\frac{\sqrt{17} - \sqrt{2}}{2}$ (D) $\frac{\sqrt{17} + \sqrt{2}}{2}$

2. $\int (x+1)(2x+1)(3x+1)\dots(2025x+1) \left(\frac{1}{x+1} + \frac{2}{2x+1} + \frac{3}{3x+1} + \dots + \frac{2025}{2025x+1} \right) dx =$
 (A) $x(2025)! + c$
 (B) $(x+1)(2x+1)(3x+1)\dots(2023x+1) + c$
 (C) $\frac{2025!}{(x+1)(2x+1)(3x+1)\dots(2023x+1)} + c$
 (D) $\frac{1}{x(2025)!} + c$

3. On the open interval $(-c, c)$, where 'c' is a positive real number, $y(x)$ is an infinitely differentiable solution of the differential equation

$$\frac{dy}{dx} = y^2 - 1 + \cos x$$
 with the initial condition that $y(0) = 0$, then which of the following is correct
 (A) $y(x)$ has a local maximum at origin.
 (B) $y(x)$ has a local minimum at origin.
 (C) $y(x)$ is strictly increasing on the open interval $(-\delta, \delta)$ for some positive real number δ .
 (D) $y(x)$ is strictly decreasing on the open interval $(-\delta, \delta)$ for some positive real number δ .

4. $\int \frac{x^4 \ln x + 2}{x^3 \ln x + x} dx =$
 (A) $\frac{x^2}{2} - \ln \left| \ln x + \frac{1}{x^2} \right| + c$ (B) $\frac{x^2}{2} - \ln \left| \ln x - \frac{1}{x^2} \right| + c$
 (C) $\ln \left| \ln x + \frac{1}{x^2} \right| - \frac{x^2}{2} + c$ (D) $\ln \left| \ln x - \frac{1}{x^2} \right| - \frac{x^2}{2} + c$

Space For Rough Work

(One or More Than One Options Correct Type)

This section contains **3 multiple choice questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE or MORE THAN ONE is correct**.

5. Let $f(x)$ be a continuous function in $[0, 3]$ and differentiable in $(0, 3)$ such that $f(3) = 0$ then there exists some $\alpha \in (0, 3)$ such that
- (A) $\alpha f'(\alpha) + f(\alpha) = 0$ (B) $\alpha f'(\alpha) + 3f(\alpha) = 0$
 (C) $\alpha f'(\alpha) + 2f(\alpha) = 0$ (D) $\alpha f'(\alpha) + 4f(\alpha) = 0$
6. $\int \frac{x^2 + 20}{(x \sin x + 5 \cos x)^2} dx =$
- (A) $\tan\left(x - \tan^{-1} \frac{x}{5}\right) + c$ (B) $-\cot\left(x + \tan^{-1} \frac{5}{x}\right) + c$
 (C) $\frac{5 \sin x - x \cos x}{x \sin x + 5 \cos x} + c$ (D) $\frac{5 \sin x + x \cos x}{x \sin x + 5 \cos x} + c$
7. Let $F(x) = (f(x))^2 + (f'(x))^2$, $F(0) = 6$, where $f(x)$ is thrice differentiable function such that $|f(x)| \leq 1$ for all $x \in [-1, 1]$, then choose the correct statement(s)
- (A) there is at least one point in each of the intervals $(-1, 0)$ and $(0, 1)$ where $|f'(x)| \leq 2$
 (B) there is at least one point in each of the intervals $(-1, 0)$ and $(0, 1)$ where $F(x) \leq 5$
 (C) there is no point of local maxima of $F(x)$ in $(-1, 1)$
 (D) for some $c \in (-1, 1)$, $F(c) \geq 6$, $F'(c) = 0$ and $F''(c) \leq 0$

(Matching List Sets)

This section contains **Three (03) Matching List Sets**. Each set has **ONE** Multiple Choice Question. Each set has **TWO** lists: **List-I** and **List-II**. **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5). **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.

8. Match each entry in **List - I** to the correct entry in **List - II**.

	List - I		List - II
(P)	Let $f(x) = \begin{cases} x^{3/5} & \text{if } x \leq 1 \\ -(x-2)^3 & \text{if } x > 1 \end{cases}$ then the number of critical points on the graph of the function is	(1)	5
(Q)	Number of real solution of the equation $\log_2^2 x + (x-1)\log_2 x = 6 - 2x$, is	(2)	4
(R)	The number of values of c such that the straight line $3x + 4y = c$ touches the curve $\frac{x^4}{2} = x + y$ is	(3)	3
(S)	$f(x) = x^2 + xg'(1) + g''(2)$ and $g(x) = f(1)x^2 + xf'(x) + f''(x)$ Then value of $f(3) + 4 =$ _____	(4)	2
		(5)	1

The correct option is

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

9. Consider $f(x) = |\ln|x|| - kx^2, x \neq 0$. Match the column I with the value of k in column II

	List - I		List - II
(P)	$f(x) = 0$ has two distinct solutions	(1)	$k = 0 \cup \left(\frac{1}{2e}, \infty\right)$
(Q)	$f(x) = 0$ has four distinct solutions	(2)	$k = \frac{1}{2e}$
(R)	$f(x) = 0$ has six distinct solutions	(3)	$k \in (-\infty, 0)$
(S)	$f(x) = 0$ has no solutions	(4)	$k \in \left(0, \frac{1}{2e}\right)$
		(5)	$k \in \left(\frac{1}{2e}, \frac{1}{e}\right)$

The correct option is

- (A) P→(4) Q → (2) R→(5) S→(1) (B) P→(1) Q → (2) R→(4) S→(3)
 (C) P→(3) Q → (3) R→(4) S→(4) (D) P→(1) Q → (5) R→(3) S→(4)
10. Match each entry in **List - I** to the correct entry in **List - II**.

	List - I		List - II
(P)	$\int \frac{x^4 - 1}{x^2 \sqrt{x^4 + x^2 + 1}} dx$	(1)	$\ln \left(\frac{(x^2 + 1) + \sqrt{x^4 + 1}}{x} \right) + C$
(Q)	$\int \frac{x^2 - 1}{x \sqrt{1 + x^4}} dx$	(2)	$C - \frac{1}{2} \ln \left(\frac{\sqrt{x^4 + 1} - \sqrt{2}x}{(x^2 - 1)} \right)$
(R)	$\int \frac{1 + x^2}{(1 - x^2) \sqrt{1 + x^4}} dx$	(3)	$C - \tan^{-1} \left(\sqrt{\sqrt{1 + \frac{1}{x^4}} - 1} \right)$
(S)	$\int \frac{1}{(1 + x^4) \sqrt{\sqrt{1 + x^4} - x^2}} dx$	(4)	$\frac{\sqrt{x^4 + x^2 + 1}}{x} + C$
		(5)	$\frac{\sqrt{x^2 + x + 1}}{x} + C$

The correct option is

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

Space For Rough Work

(PART – B)

This section contains **SIX (06)** numerical based questions. The answer to each question is a NUMERICAL VALUE. If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.

- Let $\int \frac{3e^x + 5 \sin x + 10 \cos x}{e^x + 4 \sin x + 3 \cos x} dx = mx + n \ln(e^x + 4 \sin x + 3 \cos x) + C$, where C is constant of integration. Find the value of $(m^2 + n^2)$.
- If the primitive of the function $f(x) = \frac{\sin^4 x}{\cos^2 x}$ with respect to x is $\tan x + g(x) + C$, where $g(0) = 0$ and C is a constant of integration, then find the value of $8 \left(\frac{\pi}{8} + g \left(\frac{\pi}{12} \right) \right)$.
- Let $\int \frac{f'(x)g(x) - g'(x)f(x)}{(f(x) + g(x))\sqrt{f(x)g(x) - g^2(x)}} dx = \sqrt{m} \tan^{-1} \left(\sqrt{\frac{f(x) - g(x)}{ng(x)}} \right) + C$, where $m, n \in \mathbb{N}$ and ' C ' is constant of integration ($g(x) > 0$). Find the value of $(m^2 + n^2)$.
- The number of integral value(s) of ' a ' for which the inequality $|x - a| < 3 - x^2$ holds true for at least one negative ' x ' is
- Let $f: \mathbb{R} \rightarrow \mathbb{R}$ have at least five real distinct zeros. Then find the minimum number of zeros of $f(x) + 6f'(x) + 12f''(x) + 8f'''(x)$.
- Let $P(x)$ be a polynomial of least degree which has a local maximum at $x = 1$ and a local minimum at $x = 3$. If $P(1) = 6$ and $P(3) = 2$, then $P'(0) =$

Space For Rough Work

FIITJEE INTERNAL TEST

BATCHES – PANINI426-G1 & PANINI426XII-1

Common Test – 3

Code: 101033

JEE ADVANCED LEVEL

ANSWER KEY

ANSWER KEYS

Physics

PART – A

- | | | | |
|--------|--------|-------|--------------|
| 1. D | 2. A | 3. A | 4. B |
| 5. ABD | 6. ABC | 7. AB | 8. B (bonus) |
| 9. A | 10. D | | |

PART – B

- | | | | |
|-----------------|---------|---------|---------|
| 1. 0.12 (bonus) | 2. 4.00 | 3. 4.74 | 4. 0.20 |
| 5. 2.00 | 6. 0.70 | | |

Chemistry

PART – A

- | | | | |
|--------|--------|---------|------|
| 1. B | 2. B | 3. C | 4. C |
| 5. ACD | 6. ABC | 7. ABCD | 8. B |
| 9. D | 10. B | | |

PART – B

- | | | | |
|--------|---------|------|-------|
| 1. 1.6 | 2. 19.2 | 3. 4 | 4. 12 |
| 5. 52 | 6. 12.8 | | |

Mathematics

PART – A

- | | | | |
|---------|--------|---------|------|
| 1. C | 2. B | 3. D | 4. A |
| 5. ABCD | 6. ABC | 7. ABCD | 8. A |
| 9. B | 10. C | | |

PART – B

- | | | | |
|------|------|------|------|
| 1. 5 | 2. 1 | 3. 8 | 4. 6 |
| 5. 2 | 6. 9 | | |