FIITJEE INTERNAL Common Test

BATCHES – PANINI426-G1 & PANINI426XII-1

PHYSICS, CHEMISTRY & MATHEMATICS

QP CODE: 101090 | **Common Test-5**

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 options(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.**

1. An x-ray tube operating at 30 kV, will emit x-ray of minimum wavelength
(A) 2840 Å (B) 0.414 Å (C) 2.14 Å (D) 1.78 Å

2. Two beams of light having intensities I and $4I$ interfere to produce a fringe pattern on a screen. The phase difference between the beams is $\pi/2$ at point A and π at point B. Then the difference between resultant intensities at A and B is :
(A) $2I$ (B) $4I$ (C) $5I$ (D) $7I$

3. Light of wavelength 3500A° is incident on two metals A and B, A of work function 4.2 eV and B of work function 1.19 eV respectively. The photoelectrons will be emitted by
(A) metal A (B) metal B
(C) both A and B (D) neither metal A nor metal B

4. In a young's double-slit experiment λ = 500 nm, d = 1 mm and D = 1 m. The minimum distance from the central maximum for which the intensity is half of the maximum intensity is
(A) 2×10^{-4} m (B) 1.25×10^{-4} m (C) 4×10^{-4} m (D) 2.5×10^{-4} m

(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. Nucleus A decays to B with decay constant λ_1 and B decays to C with decay constant λ_2. Initially at t = 0, number of nuclei of A and B are $2N_0$ and N_0 respectively. At $t = t_0$, number of nuclei of B stop changing. If at this instant number of nuclei of B are $\frac{3N_0}{2}$.
(A) the value of t_0 is $\frac{1}{\lambda_1}\ln\frac{4}{3}\frac{\lambda_1}{\lambda_2}$ (B) the value of t_0 is $\frac{1}{\lambda_2}\ln\frac{4}{3}\frac{\lambda_1}{\lambda_2}$
(C) the value of N_A at $2t_0$ is $\frac{3N_0}{2}\frac{\lambda_2}{\lambda_1}$ (D) the value of N_A at t_0 is $\frac{2N_0}{3}\frac{\lambda_2}{\lambda_1}$

6 In Young's double-slit experiment, two wavelengths of light are used simultaneously where $\lambda_2 = 2\lambda_1$. In the fringe pattern observed on the screen,
(A) maxima of wavelength λ_2 can coincide with minima of wavelength λ_1.
(B) fringe width of λ_2 will be double that of fringe width of λ_1.
(C) nth order minima of λ_2 will coincide with (2n – 1)th order maxima of λ_1.
(D) none of the above

Space For Rough Work

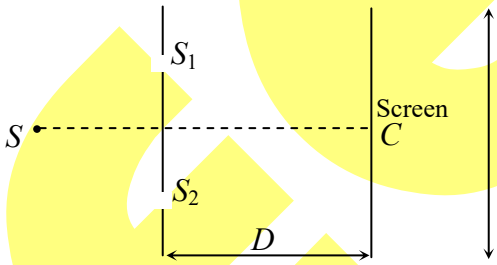
7. The electron in a hydrogen atom makes a transition $n_1 \to n_2$, where n_1 and n_2 are the principal quantum numbers of two states. Assume the Bohr model to be valid. If the time period of the electron in the initial state is eight times that in the final state then the possible values of n_1 and n_2 are

(A) $n_1 = 4, n_2 = 2$ (B) $n_1 = 8, n_2 = 2$ (C) $n_1 = 8, n_2 = 1$ (D) $n_1 = 6, n_2 = 3$

(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. In a YDSE setup, light of wavelength of light 4000Å is used. Distance of screen from the slits is 2m and distance between the slits is 1 mm. There are four slabs, slab 1 (thickness 2mm, refractive index 2), slab 2 (thickness 1mm, refractive index 3), slab 3 (thickness 4mm, refractive index 3/2) and slab 4 (thickness 3mm, refractive index 5/3).



List-I		List-II	
(P)	If slab 1 is placed in front of slit S_1.	(1)	Central maxima is at C.
(Q)	If slab 2 is placed in front of slit S_2 along with condition (A).	(2)	Central maxima is above C.
(R)	If slab 3 is placed behind slit S_1 along with condition (B).	(3)	Fringe width = 0.8 mm
(S)	If slab 4 is placed behind slit S_2 along with condition (C).	(4)	No. of fringes crossing the central maxima as a result of slab placing is 5000.
		(5)	Fringe width = 8 mm

The correct option is:

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

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

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

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

Space For Rough Work

9. In a photoelectric effect experiment. If f is the frequency of radiations on the metal surface and I is the intensity of the incident radiations, then match the following:

List-I		List-II	
(P)	If f is increased keeping I and work function constant	(1)	Stopping potential increases
(Q)	If distance between cathode and anode is increased	(2)	Saturation current increases
(R)	If I is increased keeping f and work function constant	(3)	Maximum kinetic energy of photoelectron increases
(S)	Work function is decreased keeping f and I constant	(4)	Stopping potential remains same

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

10. List-I shows four situations of standard young's double slit arrangement with screen placed far away from the slits S_1 and S_2. Match each situation given in List-I with the statement(s) in List-II.

List-I		List-II	
(P)	If sodium light is replaced by red light of same intensity.	(1)	All fringes are coloured except central fringe.
(Q)	Monochromatic light is replaced by white light.	(2)	Fringe width will become quadrupled.
(R)	Distance between slits and screen is doubled and the distance between slits is halved.	(3)	The bright fringe will become less bright.
(S)	If one of the slits is covered by cellophane paper.	(4)	The fringe width will increases.
		(5)	The fringe width will decreases.

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

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. The wavelength of K_α line from an element of atomic number 51 is λ. For another element the wavelength of K_α line is 4λ. If the atomic number of the second element is y then $\frac{y+4}{10}$ is

2. Monochromatic light of wavelength of 600 nm is used in a YDSE. One of the slits is covered by a transparent sheet of thickness 0.9 x 10^{-5} m made of a material of refractive index 1.6. How many bright fringes will shift due to the introduction of the sheet?

3. Two radioactive elements R and S disintegrate as

   $R \longrightarrow P + \alpha$; $\lambda_R = 4.5 \times 10^{-3}$ years $^{-1}$

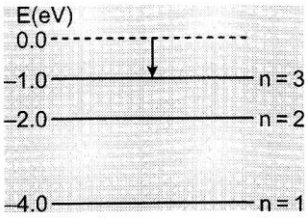
   $S \longrightarrow Q + \beta$; $\lambda_S = 3 \times 10^{-3}$ years $^{-1}$

   Starting with number of atoms of R and S in the ratio of 2 : 1, this ratio after the lapse of three half lives of R will be

4. A thin sheet of glass (μ=1.5) of thickness 6 microns introduced in the path of one of interfering beams of a double slit experiment shifts the central fringes to a position previously occupied by fifth bright fringe. If the wavelength of the light used is $\frac{k}{5}\mu m$ then find the value of 'k'.

5. Shows the energy-level diagram of hydrogen like imaginary element X. (*hc* = 1242 eV-nm)

   The ionization energy of element X , in the ground state is ……. eV.



6. In a Young's double-slit experiment, the slits are 2 mm apart and are illuminated with a mixture of two wavelengths λ = 750 nm and λ' = 900 nm. At what minimum distance (in mm) from the common central bright fringe on a screen 4m from the slits will a bright fringe from one interference pattern coincide with a bright fringe from the other?

Space For Rough Work

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.**

1. The $p^{K_{a1}}$ and $p^{K_{a2}}$ values of an alpha amino acid are 8 and 10 respectively. What is the pH of its aqueous solution?
(A) 7 (B) 9 (C) 6 (D) 2

2. How many element(s) is/are present in the monomer of teflon?
(A) 2 (B) 3 (C) 4 (D) 1

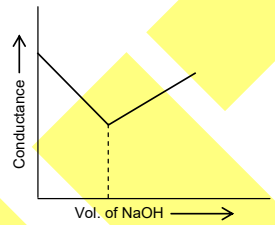
3. At pH = 4, glycine exists as(pI of glycine = 6.42)
(A) $H_3\overset{\oplus}{N}-CH_2-COO^{\ominus}$ (B) $H_3\overset{\oplus}{N}-CH_2-COOH$
(C) $H_2N-CH_2-COO^{\ominus}$ (D) NH_2-CH_2-COOH

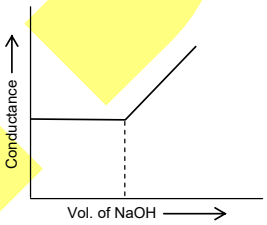
4. The presence of phenolic group is confirmed by treating the phenolic compound with a solution of
(A) NaOH (B) $FeCl_3$ (C) $Zn(NO_3)_2$ (D) NaSCN

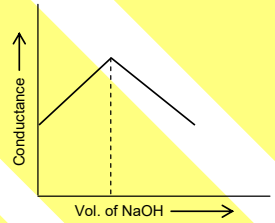
(One or More Than One Options Correct Type)

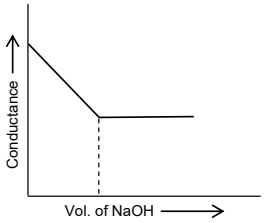
This section contains **3 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D), out of which **ONE** or **MORE THAN ONE is correct.**

5. Which of the following plot(s) will not be obtained for a conductometric titration of HCl and NaOH?

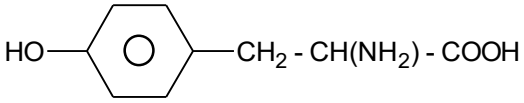
(A) 

(B) 

(C) 

(D) 

Space For Rough Work

6. 

The correct statement(s) regarding Tyrosine(given above) is/are:

(A) it responds to Xanthoproteic test
(B) it produces H_2 gas when reacts with NaOH
(C) it forms CO_2 with $NaHCO_3$
(D) it contains an symmetric carbon atom

7. $Zn(s)\left|Zn^{2+}(C_1)\right|\left|Cu^{2+}(C_2)\right|Cu(s)$

The values of $E_{cell} = E^0_{Cell}$, if

(A) $C_1 > C_2$
(B) $C_1 = C_2$
(C) $C_1 = 1M$ and $C_2 = 1M$
(D) $C_1 < C_2$

(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.

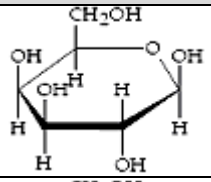
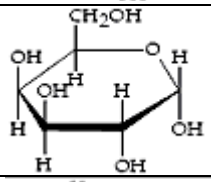
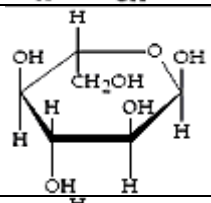
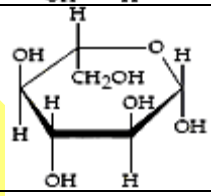
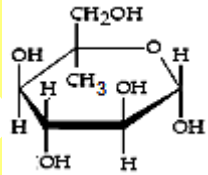
8. Match the lists. (do not consider '0' as even number to answer the following)

List – I (Polymer)		**List– II (Observations)**	
(P)	Nylon-6	(1)	Degree of unsaturation of monomer is even number
(Q)	PAN	(2)	Degree of unsaturation of monomer is odd number
(R)	Dacron	(3)	Number of delocalizing lone pairs in its monomer is even number
(S)	PVC	(4)	Number of delocalizing lone pairs in its monomer is odd number
		(5)	monomer contains dative bond

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

Space For Rough Work

9. Celluose on complete hydrolysis in the presence of H^+ gives A and B. Both A and B are isomers M.pt of A is less than that of B.

List – I		List– II	
(P)	Enantiomer of 'A'	(1)	
(Q)	Diastereomer of 'A'	(2)	
(R)	Enantiomer of 'B'	(3)	
(S)	Diastereomer of 'B'	(4)	
		(5)	

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

10. Match the lists.

List – I (Quantities)		List– II (Factors on which dependency exist)	
(P)	Molar conductance	(1)	Temperature
(Q)	Emf of a cell in operation	(2)	Concentration of species involved
(R)	Electrode potential	(3)	Nature of substance involved
(S)	Standard reduction potential	(4)	Dilution
		(5)	Ionization energy

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

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. What is the ratio of molar conductance to equivalent conductance $\left(\frac{\Lambda_m}{\Lambda_e}\right)$ of Mohr's salt, $FeSO_4.(NH_4)_2SO_4.6H_2O$?

2. An alcoholic solution of dimethylglyoxime is added to an aqueous solution of nickel chloride. Slow addition of ammonium hydroxide lead to the precipitation of a Rosy-red coloured metal complex. If the oxidation number of the metal in the complex is +x, the value of x is

3. The sodium extract of an organic compound produces red solution with Fe^{3+} ion. The presence of how many element(s) except carbon and hydrocarbon are confirmed by this test?

4. A hydrogen electrode is placed in a solution containing CH_3COOK and CH_3COOH in the ratio of a : b and b : a has electrode potential values of -1.59 and +1.0 V, respectively. Calculate pK_a of CH_3COOH.

5. What is the molar mass of the molecule in g mol^{-1} unit which is lost during formation of Nylon 6, 6 from hexamethylene diamine and adipic acid?

6. The specific conductance of an electrolyte solution is 4.8 ohm^{-1} cm^{-1}. What will be the specific conductance in $ohm^{-1}cm^{-1}$ if the electrolyte solution is diluted to twice of it's initial volume?

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. Let $\begin{vmatrix} x^6+4x & 3x-1 & x+2 \\ 2x-1 & -2x^2 & x-4 \\ x+3 & x+4 & 3x^2 \end{vmatrix} = \sum_{r=0}^{10} a_r x^r$, then the value of $\frac{\sum_{r=0}^{10} a_r}{a_9+a_0}$ is

(A) 54 (B) 27 (C) $\frac{27}{2}$ (D) 9

Space For Rough Work

2. Let $f(x)$ be a non – constant function such that $\int_0^x (f(t))^3\,dt = \frac{1}{x^2}\left(\int_0^x f(t)\,dt\right)^3 \ \forall\, x \in R \sim \{0\}$. If $f(1)=1$, then $f\left(\frac{1}{2}\right) =$

(A) 2 (B) 4 (C) 8 (D) 16

3. If A is a non – singular matrix of order 2 such that $A + \text{adj}\,A = A^{-1}$ then $\left|2A^{-1}\right|$

(A) $\frac{1}{2}$ (B) 1 (C) 4 (D) 8

4. The number of differentiable functions $y:(-\infty, \infty) \to [0, \infty)$ satisfying $y' = 2\sqrt{y};\ y(0)=0$ is

(A) 1
(B) 2
(C) finite but more than 2
(D) infinite in number

(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 real valued function $f(x)$ is such that $f:\left(0, \frac{\pi}{2}\right) \to R^+$ satisfies the differential equation: $xf'(x) = 1 + f(x)\{x^2 f(x) - 1\}$ and $f\left(\frac{\pi}{4}\right) = \frac{4}{\pi}$, then

(A) $f(x) = \frac{\sin x}{x}$ (B) $f(x) = \frac{\tan x}{x}$ (C) $\lim_{x\to 0} f(x) = 1$ (D) $f(x) = \frac{\tan^{-1} x}{x}$

6. Let $A = \{1,2,3,.....,36\}$. Let P, Q, R be set of all $1\times 1, 2\times 2, 3\times 3$ matrices respectively that can be formed using elements of A. If $|M|$ represents determinant of matrix M, then

(A) $\sum_{M\subset P} |M| = 666$ (B) $\sum_{M\subset Q} |M| = 666^2$ (C) $\sum_{M\subset R} |M| = 666^3$ (D) $\sum_{M\subset Q} |M| = \sum_{M\subset R} |M|$

7. Which of the following statements is/are correct.

(A) If A is a $(n\times n)$ matrix such that $a_{ij} = (i^2 + j^2 - 5ij)(j-i), \forall\, i$ and j, then $\text{tr}(A) = 0$

(B) If A is a $(n\times n)$ matrix such that $a_{ij} = (i^2 + j^2 - 5ij), \forall\, i$ and j, then $\text{tr}(A) \neq 0$

(C) If P is a matrix such that $PP^T = P^TP = I$ and if $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$, and

$$A = \begin{bmatrix} \sin^2\alpha & \sin\alpha\sin\beta & \sin\alpha\sin\gamma \\ \sin\alpha\sin\beta & \sin^2\beta & \sin\beta\sin\gamma \\ \sin\alpha\sin\gamma & \sin\beta\sin\gamma & \sin^2\gamma \end{bmatrix}$$ and $Q = P^TAP$, then $PQ^6P^T = 32A$

(D) If matrix $A = [a_{ij}]_{3\times 3}$ and matrix $B = [b_{ij}]_{3\times 3}$ where $a_{ij} + a_{ji} = 0$ and $b_{ij} - b_{ji} = 0\ \forall\, i$ and j then $A^{14}B^7$ is a singular matrix.

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. Let α and β be the distinct roots of the equation $x^2 + x - 1 = 0$. Consider the set $T = \{1, \alpha, \beta\}$. For a 3×3 matrix $M = (a_{ij})_{3\times3}$, define $R_i = a_{i1} + a_{i2} + a_{i3}$ and $C_j = a_{1j} + a_{2j} + a_{3j}$ for $i = 1,2,3$ and $j = 1,2,3$

Match each entry in List I to the correct entry in List II.

	List – I		List – II
(P)	The number of matrices $M = (a_{ij})_{3\times3}$ with all entries in T such that $R_i = C_j = 0$ for all i, j is	(1)	1
(Q)	The number of symmetric matrices $M = (a_{ij})_{3\times3}$ with all entries in T such that $C_j = 0$ for all j, is	(2)	12
(R)	Let $M = (a_{ij})_{3\times3}$ be a skew – symmetric matrix such that $a_{ij} \in T$ for $i > j$. Then the number of elements in the set $\left\{\begin{pmatrix} x \\ y \\ z \end{pmatrix} : x,y,z \in R, M\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} a_{12} \\ 0 \\ -a_{23} \end{pmatrix}\right\}$ is	(3)	infinite
(S)	Let $M = (a_{ij})_{3\times3}$ be a matrix with all entries in T such that $R_i = 0$ for all i. Then, the absolute value of the determinant of M is	(4)	6
		(5)	0

The correct option is

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

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

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

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

Space For Rough Work

9. The solution of the differential equation

	List – I		List – II
(P)	$\left(1+x\sqrt{x^2+y^2}\right)dx+\left(-1+\sqrt{x^2+y^2}\right)y\,dy=0$	(1)	$xe^{\sin\frac{y}{x}}=C$
(Q)	$(x-1)dy+y\,dx=x(x-1)y^{1/3}dx$	(2)	$x-\frac{y^2}{2}+\frac{1}{3}\left(x^2+y^2\right)^{3/2}=C$
(R)	$\left(y\left(1+x^{-1}\right)+\sin y\right)dx+(x+\log x+x\cos y)dy=0$	(3)	$y^{2/3}(x-1)^{2/3}=\frac{(x-1)^2}{9}+\left(\frac{2}{9}\right)(x-1)+C$
(S)	$x\cos\frac{y}{x}dy=\left(y\cos\frac{y}{x}-x\right)dx$	(4)	$xy+y\log x+x\sin y=C$
		(5)	$y^{2/3}(x-1)^{2/3}=\frac{(x+1)^2}{9}+\left(\frac{2}{9}\right)(x-1)+C$

The correct option is

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

10. Match each entry in List I to the correct entry in List II.

List – I		List – II	
(P)	If $\begin{bmatrix}1&2&a\\0&1&4\\0&0&1\end{bmatrix}^n=\begin{bmatrix}1&18&2007\\0&1&36\\0&0&1\end{bmatrix}$, then $(n+a)=$	(1)	225
(Q)	If A is a square matrix of order 3 such that $\lvert A\rvert=a, B=\text{adj}(A)$ and $\lvert B\rvert=b$, then $\left(ab^2+a^2b+1\right)\lambda=$ _____ (where $\frac{1}{2}\lambda=\frac{a}{b}+\frac{a^2}{b^3}+\frac{a^3}{b^5}+\ldots$ upto ∞ and $a=3$)	(2)	200
(R)	Let $A=\begin{bmatrix}a&b&c\\p&q&r\\1&1&1\end{bmatrix}$ and $B=A^2$. If $(a-b)^2+(p-q)^2=25, (b-c)^2+(q-r)^2=36$ and $(c-a)^2+(r-p)^2=49$, then $\det\left(\frac{B}{2}\right)$ equals	(3)	16
(S)	If A and B are square matrices of odd order and $(A+B)^2=A^2+B^2$, if $\det(A)=2$, then $\det(B)$ equals	(4)	108
		(5)	0

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

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. The number of straight lines which satisfy the differential equation $\frac{dy}{dx}+x\left(\frac{dy}{dx}\right)^2-y=0$ is __

2. Let $f(x)$ be a non – constant function such that $\int_0^x (f(t))^3\,dt=\frac{1}{x^2}\left(\int_0^x f(t)\,dt\right)^3 \quad \forall x\in R\sim\{0\}$

   If $f(1)=1$, then $f\left(\frac{1}{2}\right)=$ _____

3. If $A=\begin{bmatrix}\frac{1}{2} & 0\\ \frac{1}{3} & -\frac{1}{3}\end{bmatrix}$, then let $\lim\limits_{n\to\infty}\sum\limits_{r=1}^{n} r.A^{r-1}=\begin{bmatrix}a & 0\\ b & c\end{bmatrix}$ (where $A^0=I$). Further if $B=\begin{bmatrix}\frac{a}{2} & 8b\\ 2 & 16c\end{bmatrix}$, then absolute value of $\frac{\left|\text{adj}\left(\text{adj}\,3\left(\text{adj}\left(2B^{-1}\right)^T\right)\right)\right|}{9}$ is _____.

4. Given $\alpha,\beta\in\{0,1,2,3,4,5,6,7\}$. Consider the system of equation
   $2x+y+3z=6$
   $x+2y+\alpha z=\beta$
   $x+y+z=4$
   Let A = number of ordered pairs (α,β) so that system has unique solution
   B = number of ordered pairs (α,β) so that system has no solution
   C = number of ordered pairs (α,β) so that system has infinite number of solutions. The value of $A+2B-3C$ is

5. A 3×3 determinant has entries 1 or –1. Let S be the set of all determinants such that the product of elements of any row or column is (–1). For example, $\begin{vmatrix}1 & -1 & 1\\ 1 & 1 & -1\\ -1 & 1 & 1\end{vmatrix}$ is an element of S and number of elements in S is m. Let $P=\begin{bmatrix}3 & -2 & 3\\ 2 & -2 & 3\\ 0 & -1 & 1\end{bmatrix}$ and trace of the matrix $\text{adj}(\text{adj}P)$ is n, then the value of $\frac{m}{n}=$ _____.

6. If $y=f(x)$ is twice differentiable function satisfying $2y^5\frac{dy}{dx}+2\left(\frac{dy}{dx}\right)^3.y^5=\frac{d^2y}{dx^2}$ and $f(0)=f'(0)=0$ then $\frac{(f(x))^{\lambda}}{\mu}=\tan^{-1}(f'(x))$ then $\lambda+\mu=$ _____

Space For Rough Work

FIITJEE INTERNAL TEST

BATCHES – PANINI426-G1 & PANINI426XII-1

Common Test – 5

Code: 101090

JEE ADVANCED LEVEL

ANSWER KEY

ANSWER KEYS

Physics

PART – A

1.	B	2.	B	3.	B	4.	B
5.	A	6.	BC	7.	AD	8.	A
9.	B	10.	B				

PART – B

1.	3	2.	9	3.	1	4.	3
5.	4	6.	9				

Chemistry

PART – A

1.	B	2.	A	3.	B	4.	B
5.	BCD	6.	ACD	7.	BC	8.	B
9.	C	10.	B				

PART – B

1.	4	2.	2	3.	2	4.	5
5.	18	6.	2.4				

Mathematics

PART – A

1.	C	2.	C	3.	D	4.	D
5.	BC	6.	AD	7.	ACD	8.	C
9.	B	10.	B				

PART – B

1.	2	2.	8	3.	1	4.	67
5.	8	6.	9				