FIITJEE

BATCH – AII 1820

PHYSICS, CHEMISTRY & MATHEMATICS

CPT2 | **CODE:** | **PAPER - 2**

Time Allotted: 3 Hours **Maximum Marks: 312**

- 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. Each section is further divided into two part: **Part A & B**
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 Three Parts.

(i) **PART-A (01 – 08)** contains 8 Multiple Choice Questions which have Only One Correct answer. Each question carries **+4 marks** for correct answer and **–1 marks** for wrong answer.

PART-A (09 – 16) contains 4 Paragraphs. Based upon each paragraph, 2 Multiple Choice Questions have to be answered. Each question has Only One Correct answer and carries **+3 marks** for the correct answer and **–1 mark** for a wrong answer.

(ii) **PART-B (01 – 04)** contains 4 Matrix Match Type Question which have statements given in 2 columns. Statements in the first column have to be matched with statements in the second column. There may be One or More Than One Correct choices. Each question carries **+12 marks** for all correct answer however for each correct row **+3 marks** will be awarded and **–1 mark** for each row matched incorrectly.

Name of the Candidate :_____

Batch :_____ **Date of Examination :**_____

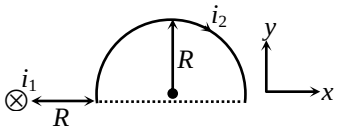
Enrolment Number :_____

SECTION-I: PHYSICS

Part-A: Only One Option Correct Type

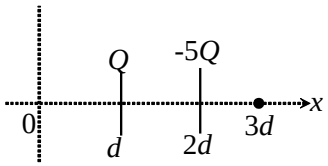
This section contains **8 Multiple Choice Questions.** Each question has 4 choices (A), (B), (C) and (D), out of which **Only One Option is correct.**

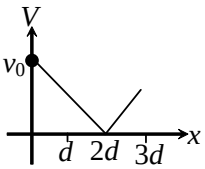
1. A very long current carrying wire is placed along *z*-axis having current of magnitude i_1 towards negative *z*-axis. A semicircular wire of radius *R* and having current i_2 is placed in *x*-*y* plane, such that line joining two end points of the semicircular wire passes through long wire as shown in figure. Nearest distance of semicircular wire from long wire is *R*. Net magnetic force on semicircular wire will be

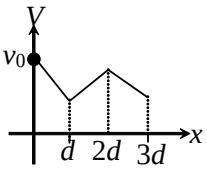


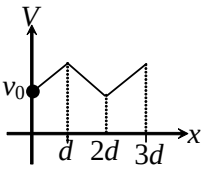
(A) $\frac{\mu_0 i_1 i_2}{2\pi}\ln 3$ (B) $\frac{\mu_0 i_1 i_2}{2\pi}\ln\frac{3}{2}$ (C) zero (D) $\frac{\mu_0 i_1 i_2}{2\pi}$

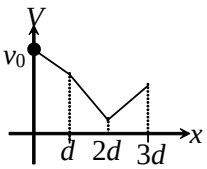
2. Two large identical plates are placed in front of each other at $x = d$ and $x = 2d$ as shown in figure. If charges on plates are Q and $-5Q$, the potential versus distance graph for region $x = 0$ to $x = 3d$ is (d is very small and potential at $x = 0$ is v_0)



(A) 

(B) 

(C) 

(D) 

3. Two longitudinal waves propagating in the X and Y directions superimpose. The wave equations are as below $\psi_1 = A\cos(\omega t - kx)$ and $\psi_2 = A\cos(\omega t - ky)$. Trajectory of the motion of a particle lying on the line $y = x + \frac{(2n+1)\lambda}{2}$ will be

(A) straight line (B) circle
(C) ellipse (D) none of these

4. Two longitudinal waves propagating in the *X* and *Y* directions superimpose. The wave equations are as below $\psi_1 = A\cos(\omega t - kx)$ and $\psi_2 = A\cos(\omega t - ky)$. Trajectory of the motion of a particle lying on the line $y = x + \frac{(2n+1)\lambda}{2}$ will be

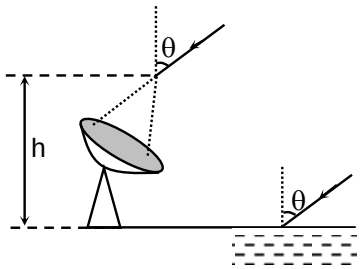
(A) straight line (B) circle (C) ellipse (D) none of these

5. The equation of a particle executing SHM is given by $x = 3\cos\left(\frac{\pi}{2}\right)t$ cm, where *t* is in second. The distance travelled by the particle in the first 8.5 s is

(A) $\left(24 + \frac{3}{\sqrt{2}}\right)$ cm (B) $\left(27 - \frac{3}{\sqrt{2}}\right)$ cm (C) $\left(24 - \frac{3}{\sqrt{2}}\right)$ cm (D) $\left(27 + \frac{3}{\sqrt{2}}\right)$ cm

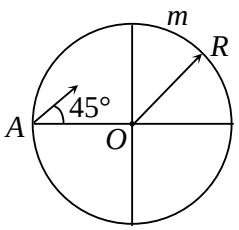
space for rough work

6. Radio waves of wavelength λ at an angle θ to vertical are received by a radar after reflecting from a nearby water surface and directly. If the radar records a maximum intensity, the height of antenna *h* from water surface can be



(A) $\frac{\lambda}{2\cos\theta}$ (B) $\frac{\lambda}{2\sin\theta}$ (C) $\frac{\lambda}{4\sin\theta}$ (D) $\frac{\lambda}{4\cos\theta}$

7. A ring of mass *m* and radius *R* is placed on a frictionless horizontal surface. A particle of mass *m* is projected from point *A* with velocity *v* at an angle of 45° with *AO* as shown. The incorrect statements are



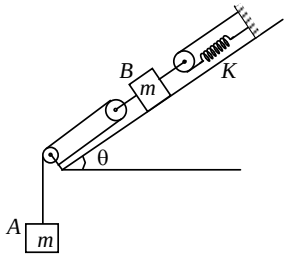
(A) The particle reaches the same point *A* on the ring after time $\frac{4R\sqrt{2}}{v}$.

(B) Magnitude of impulse transformed during first collision is $\frac{mv}{\sqrt{2}}$.

(C) Magnitude of impulse transformed during second collision is $\frac{mv}{\sqrt{2}}$.

(D) Particle reaches diametrically opposite point on the ring in time $\frac{2R}{v}$.

8. Two blocks *A* and *B*, each of mass *m* are connected by means of a pulley-spring system on a smooth inclined plane of inclination θ as shown in the figure. All the pulleys and spring are ideal. Now, *B* is slightly displaced from its equilibrium position. It starts to oscillate. Time period of oscillation of *B* will be (Take *m* = 4 kg, *K* = 5 N/m, π = 3.14)



(A) 3.14 s (B) 6.28 s (C) 4.28 s (D) 5.14 s

Paragraph Type Questions

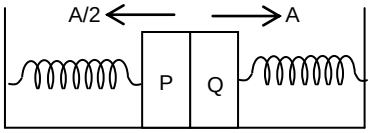
This section contains **4 paragraphs.** Based upon each paragraph, 2 Multiple Choice Questions have to be answered. Each question has **Only One Correct** answer.

Paragraph for Question Nos. 9 to 10

In perfectly inelastic collision between two bodies momentum remains constant and the bodies stick together. Angular frequency of a spring block system is $\omega = \sqrt{\frac{K}{m}}$ and maximum speed of particle is SHM is ωA, where A is the amplitude.

space for rough work

Question: Two identical blocks P and Q have mass m each. They are attached to two identical springs initially unstretched. Now the left spring (along with P) is compressed by $\frac{A}{2}$ and the right spring (along with Q) is compressed by A. Both the blocks are released simultaneously. The collide perfectly inelastically. Initially time period of both the block was T.



9. The amplitude of combined mass is

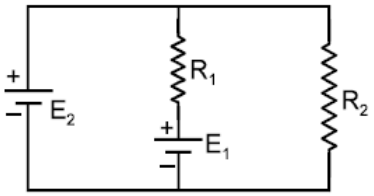
(A) $\frac{A}{4}$ (B) $\frac{A}{2}$ (C) $\frac{2A}{3}$ (D) $\frac{3A}{4}$

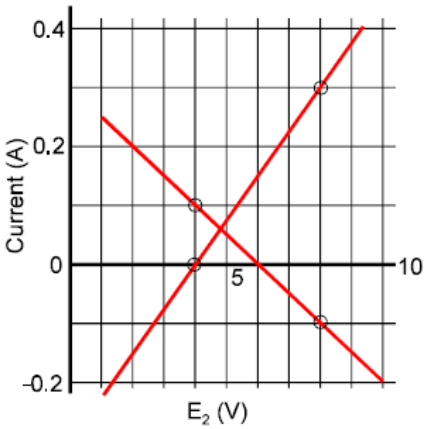
10. What is energy of oscillation of the combined mass?

(A) $\frac{1}{2}kA^2$ (B) $\frac{1}{4}kA^2$ (C) $\frac{1}{8}kA^2$ (D) $\frac{1}{16}kA^2$

Paragraph for Question Nos. 11 to 12

In the circuit given below, both batteries are ideal. EMF E_1 of battery 1 has a fixed value, but emf E_2 of battery 2 can be varied between 1.0 V and 10.0 V. The graph gives the currents through the two batteries as a function of E_2, but are not marked as which plot corresponds to which battery. But for both plots current is assumed to be negative when the direction of the current through the battery is opposite the direction of that battery's emf. (direction of emf is from negative to positive)





11. The value of emf E_1 is

(A) 8 V (B) 6 V (C) 4 V (D) 2 V

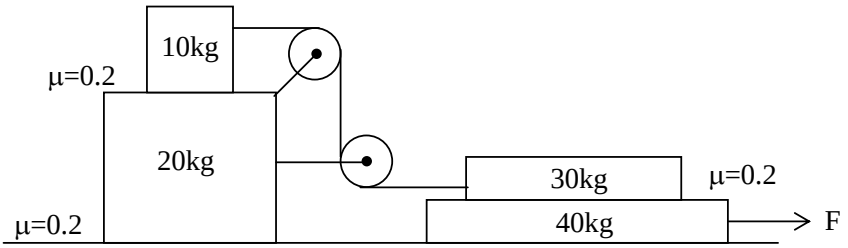
12. The resistance R_1 has value

(A) 10 Ω (B) 20 Ω (C) 30 Ω (D) 40 Ω

space for rough work

Paragraph for question 13 to 14

The coefficient of friction between 20 kg and ground, between 10 kg and 20 kg and between 30 kg and 40 kg is 0.2. No friction is present between 40 kg block and ground. A constant force F has been applied on 40 kg mass. The friction force between 10 kg and 20 kg is f_{R1} and friction force between 30 kg and 40 kg mass is f_{R2}. It is given that $2f_{R1}=f_{R2}$.



13. Magnitude of force F
(A) 50 N (B) 60 N (C) 70 N (D) 70.5 N

14. Acceleration of 10kg block
(A) Zero (B) 0.25 m/s^2 (C) 1.25 m/s^2 (D) 0.50 m/s^2

Paragraph for question 15 to 16

A cutting tool under microprocessor control has several forces acting on it. One force is $\vec{F} = -\alpha x y^2 \hat{j}$, a force in the negative *y*-direction whose magnitude depend on the position of the tool. The constant α is 2.50 N. Consider the displacement of the tool from the origin to the point *x* = 3.00 m, *y* = 3.00 m.

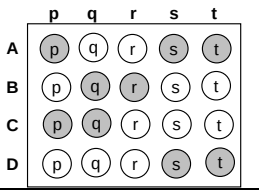
15. Calculate the magnitude of work done on the tool by $\vec{F}$. If this displacement is along the straight line *y* = *x* that connects these two points.
(A) 2.50 J (B) 500 J (C) 50.6 J (D) 2 J

16. Calculate the work done on the tool by $\vec{F}$ of the tool is first moved out along the *x*-axis to the point *x* = 3.00m, *y* = 0 and then moved parallel to the *y*-axis to *x* = 3.00 m, *y* = 3.00 m
(A) 67.5 J (B) 85 J (C) 102 J (D) 7.5 J

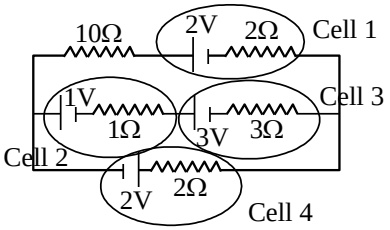
space for rough work

Part-B : Matrix-Match Type Questions

This Section contains **4 Matrix Match Type Questions.** Each question has **four statements** (A, B, C and D) given in **Column I** and **five statements** (p, q, r, s and t) in **Column II.** Any given statement in Column I can have correct matching with **ONE** or **MORE** statement(s) given in Column II. For example, if for a given question, statement B matches with the statements given in q and r, then for the particular question, against statement B, darken the bubbles corresponding to q and r in the ORS.

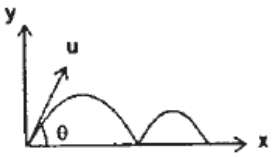


1. Match the column I and column II.



Column-I		Column-II	
(A)	Cell 1	(P)	Chemical energy of cell is decreasing
(B)	Cell 2	(Q)	Chemical energy of cell is increasing
(C)	Cell 3	(R)	Work done by cell is positive
(D)	Cell 4	(S)	Thermal energy developed n cell is positive

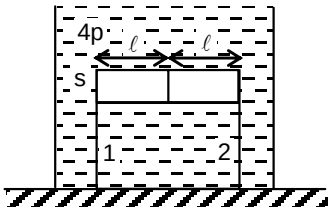
2. A projectile is fired from a horizontal frictionless ground. Coefficient of restitution between the projectile and he ground is e. If T_1, H_1, R_1 v_1 ; T_2, H_2 R_2, v_2; are time flight, maximum height, range, horizontal velocities in first two collisions, then match the following.



Column I		Column II	
(A)	T_1/T_2	(P)	$1/e^2$
(B)	H_1/H_2	(Q)	$1/e$
(C)	R_1/R_2	(R)	$1/e\cos\theta$
(D)	v_1/v_2	(S)	1

space for rough work

3. A rod is formed by joining two cylinder each having a length ℓ and cross sectional area S. The densities of cylinder are ρ and 2ρ respectively. The rod is now horizontally suspended in a liquid of density 4ρ with help of two string as shown in the figure. The entire setup is kept inside a lift



Column-I		Column-II	
(A)	Tension in string 1 if the lift is moving upwards with constant velocity.	(P)	$5/2\rho s\ell g$
(B)	Tension in string 2 if the lift is moving upward with constant velocity	(Q)	Zero
(C)	Tension is string 1 if the lift is moving downwards with acceleration 2g/11.	(R)	$11/4\rho s\ell g$
(D)	Tension in string 2 if the lift is moving upward with an acceleration 2g/9	(S)	$9/4\rho s\ell g$
		(T)	Lying between $2\rho s\ell g$ and $2.6\rho s\ell g$

4. In column-I we depict situations. Match with column-II depicting the effect.

Column I		Column II	
(A)	A rod of length L hinged at the end and is rotating about it in horizontal smooth plane with angular velocity ω. E is the kinetic energy of the rod.	(P)	If L suddenly increases (by heating) ω may increases.
(B)	Standard YDSE apparatus with fringe width ω and distance between the slits = L.E is intensity in front of one of the slits.	(Q)	If L suddenly increases (by heating) ω may decrease.
(C)	A rod of length L at whose end 2 equal and opposite charges are fixed. The rod is placed in a uniform electric field perpendicular to the rod. The angular velocity of the rod after a small angular displacement is ω. E is the potential energy of charges with the electric field in the initial position.	(R)	E may increase if L decreases (by cooling).
(D)	In X-ray experiment, L is filament temperature, E is intensity of X-ray and ω is cut-off wavelength.	(S)	E may decrease if L decreases (by cooling).
		(T)	ω is independent of L.

space for rough work

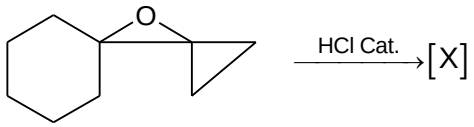
SECTION-II: CHEMISTRY

Part-A: Only One Option Correct Type

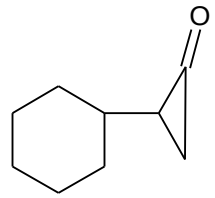
This section contains **8 Multiple Choice Questions.** Each question has 4 choices (A), (B), (C) and (D), out of which **Only One Option is correct.**

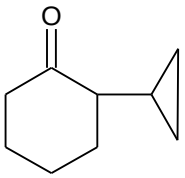
1. Kekule benzene and Dewar benzene are
   (A) Canonical forms (B) Structural isomers
   (C) Tautomers (D) Conformational isomers

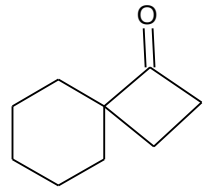
2. Which one of the following reagent can be used for differentiating the Cu^{2+} and Bi^{3+}?
   (A) H_2S gas in presence of dil HCl (B) NH_4OH(excess)
   (C) $K_4[Fe(CN)_6]$ (D) (B) and (C) both

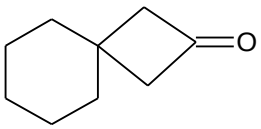
3. 

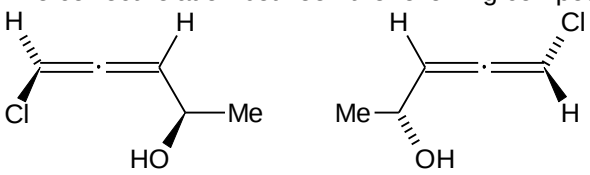
   The compound[X] is

   (A) 

   (B) 

   (C) 

   (D) 

4. The correct relation between the following compounds is:–
   

   (A) enantiomers (B) diastereomers
   (C) Identical (D) Constitutional isomers

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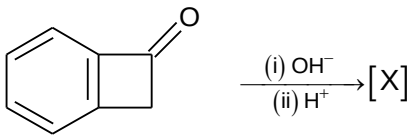
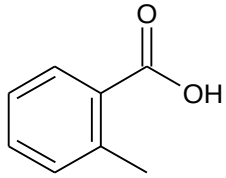
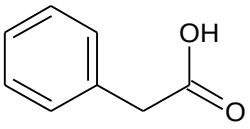
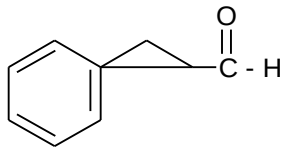
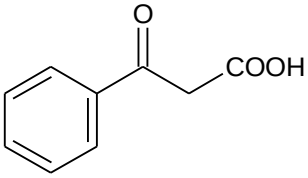
5. 

The major compound[X] is

(A) 

(B) 

(C) 

(D) 

6. The compound formed by dissolving gold and platinum in aqua-regia is
(A) $[AuCl_4]^{3-}$ and $[PtCl_6]^{2-}$ (B) $[AuCl_4]^{-}$ and $[PtCl_6]^{4-}$
(C) $[AuCl_4]^{-}$ and $[PtCl_6]^{2-}$ (D) $[AuCl_4]^{-}$ and $[PtCl_6]^{2-}$

7. Which of the following will have three stereoisomeric forms?
i. $[Cr(NO_3)_3(NH_3)_3]$ ii. $K_3[Co(C_2O_4)_3]$
iii. $K_3[Co(C_2O_4)_2Cl_2]$ iv. $[Co(en)_2ClBr]$
(A) iii and iv (B) i and iv (C) ii and iii (D) i and ii

8. The pair of compounds having the same hybridization for the central atom is
(A) $[Cu(NH_3)_4]^{2+}$ and $[Ni(NH_3)_4]^{2+}$ (B) $[NiCl_4]^{2-}$ and $[PtCl_4]^{2-}$
(C) $[Cu(NH_3)_4]^{2+}$ and $[Zn(NH_3)_4]^{2+}$ (D) $[Co(NH_3)_6]^{3+}$ and $[Co(H_2O)_6]^{3+}$

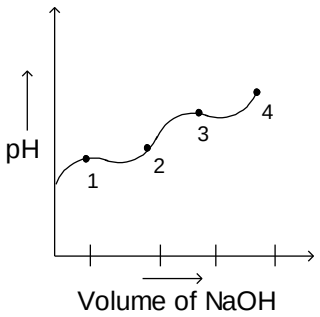
Paragraph Type Questions

This section contains **4 paragraphs.** Based upon each paragraph, 2 Multiple Choice Questions have to be answered. Each question has **Only One Correct** answer.

Paragraph for Question Nos. 9 to 10

A solution of alanine hydrochloride, $[H_3N - CH(CH_3) - COOH]^+Cl^-$ is titrated with a solution of sodium hydroxide to produce a curve as follows:

K_1 and K_2 of alanine hydrochloride are 4.6×10^{-3} and 2.0×10^{-10} respectively



9. The pH at point 3 is
(A) 2.34 (B) 6.02 (C) 9.07 (D) 11.02

space for rough work

10. Which of the following is correct ratio of $\frac{H_3N^+ - CH(CH_3)COO^-}{H_2N - CH(CH_3)COO^-}$ at pH 10?

(A) 2: 1 (B) 5: 8 (C) 1 : 2 (D) 8: 5

Paragraph for Question Nos. 11 to 12

The vapour pressure of two pure liquids A and B which form an ideal solution are 300 and 800 Torr, respectively, at temperature T. A liquid solution of A and B for which the amount fraction of A is 0.60 is contained in a cylinder closed by a piston on which the pressure can be varied. The solution is slowly vaporized at temperature T by decreasing the applied pressure, starting with a pressure of about 1 atm.

11. Calculate the mole fraction of the vapour of B in first bubble of vapour formed.
(A) 0.36 (B) 0.50 (C) 0.54 (D) None of these

12. The pressure when only this last droplet of liquid remains will be:
(A) 420 Torr (B) 400 Torr (C) 350 Torr (D) None of these

Paragraph for question 13 to 14

Gas (X) is colourless diamagnetic with fishy smell. When X is cooled at -112°C, it condenses to a deep blue liquid which is dangerously explosive. X is one of the most powerful oxidizing reagent. It is second to F_2 in oxidizing power:

13. X is
(A) H_2O_2 (B) PH_3 (C) O_3 (D) Cl_2

14. When mercury is shaken with X, the metal adheres to the glass as a mirror. It is because of formation:
(A) HgO (B) Hg_2O (C) Hg_3P_2 (D) $HgCl_2$

Paragraph for question 15 to 16

Consider the following reaction(s)

$$\underset{\text{(Pale green)}}{A(s)} \xrightarrow{\Delta} \underset{\text{(Brown)}}{B(s)} + C(g) + D(g) + E(v)$$

$$E \xrightarrow{\text{Anhydrous } CuSO_4} \underset{\text{(Blue solid)}}{F}$$

$$A \xrightarrow{KMnO_4/H^+} MnO_4^- \text{ is decolourised}$$

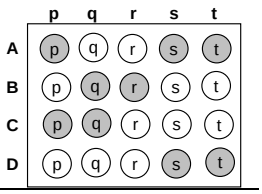
15. Sum of oxidation state of the central atom in C(g) and D(g) is
(A) 6 (B) 10 (C) 8 (D) 4

16. Select incorrect statement about compound F:
(A) it adsorb orange-red light for d-d transition
(B) 4 water molecule are directly bonded with each Cu^{2+}
(C) it is paramagnetic
(D) it's $\mu = \sqrt{8}$ B.M

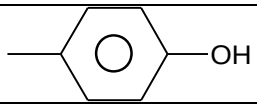
space for rough work

Part-B : Matrix-Match Type Questions

This Section contains **4 Matrix Match Type Questions.** Each question has **four statements** (A, B, C and D) given in **Column I** and **five statements** (p, q, r, s and t) in **Column II.** Any given statement in Column I can have correct matching with **ONE** or **MORE** statement(s) given in Column II. For example, if for a given question, statement B matches with the statements given in q and r, then for the particular question, against statement B, darken the bubbles corresponding to q and r in the ORS.



1. Match the following:

List – I (Group)		List – II (Compound)	
(A)	$-NH_2$ group	(P)	Glycine
(B)	$-NO_2$ group	(Q)	Piciric acid
(C)	$-CH_2OH$ group	(R)	Tyrosine
(D)		(S)	Serine

2. Match the following:

List – I		List – II	
(A)	Lobry de Bruyn van Eikenstein rearrangement	(P)	Sucrose
(B)	Ninhydrin test	(Q)	Glucose
(C)	Inversion of sugar	(R)	Acetaldehyde
(D)	Decolouration of bromine water	(S)	Alanine

space for rough work

3. Match the binary liquid solutions given in Column-I with their properties in Column-II.

Column – I		Column – II	
(A)	Ethyl ether and acetone	(P)	$\Delta_{mix}H = 0$
(B)	Ethylene dibromide and propylene dibromide	(Q)	$\Delta_{mix}H < 0$
(C)	Chloroform and propanone	(R)	$\Delta_{mix}S > 0$
(D)	Phenol and aniline	(S)	shows positive deviation from Raoult's law.
		(T)	The partial molar volume of a constituent is equal to the molar volume of the constituent when in pure form.

4. Match the columns:

Column – I		Column – II	
(A)	$XeF_6 + SiO_2 \rightarrow$	(P)	One of the product has pyramidal shape
(B)	P_4(white) + $SO_2Cl_2 \rightarrow$	(Q)	One of the product has sp^3 hybridization
(C)	$H_2SO_4 + P_4O_{10} \rightarrow$	(R)	One of the product has $p\pi$-$d\pi$ overlapping
(D)	$XeF_6 + H_2O \rightarrow$	(S)	One of the product has zero dipole moment

space for rough work

SECTION-III: MATHEMATICS

Part-A: Only One Option Correct Type

This section contains **8 Multiple Choice Questions.** Each question has 4 choices (A), (B), (C) and (D), out of which **Only One Option is correct.**

1. Club Truncator is in a soccer league with six other teams, each of which it plays once. In any of its 6 matches, the probabilities that Club Truncator will win, lose, or tie is each $\frac{1}{3}$. Now consider the events

   W: Club Truncator will finish the season with more wins than losses
   L: Club Truncator will finish the season with more losses than wins
   E: Club Truncator will finish the season with equal number of wins and losses

   (A) P(**W**)= $\frac{294}{729}$ (B) $P\left(\bar{\mathbf{L}}\right) = \frac{98}{243}$

   (C) $P\left(\bar{\mathbf{E}}\right) = \frac{141}{729}$ (D) P(**W**)= P(**L**)= $\frac{1}{2}$P(**E**)

2. If $c \in R$ and the negative for one of the solutions of $x^2 - 3x + c = 0$ is a solution of $x^2 + 3x - c = 0$, then one of the solution of $x^2 - 3x + c = 0$ is
   (A) -1 (B) 1
   (C) 3 (D) None of these

3. The value of $\int_0^1 \left(\prod_{m=1}^{99}(x+m)\right)\left(\sum_{n=1}^{99}\frac{1}{x+n}\right)dx$ is

   (A) 99 (B) 99 (99)!

   (C) 99 (100) ! (D) none of these

4. If ${}^{100}C_6 + 4\,{}^{100}C_7 + 6\,{}^{100}C_8 + 4\,{}^{100}C_9 + {}^{100}C_{10}$ has the value equal to ${}^{x}C_y$, then the value of (x + y) can be
   (A) 104 (B) 115
   (C) 198 (D) 1994.

5. Line segments drawn from the vertex opposite to the hypotenuse of a right angle triangle to the points trisecting the hypotenuse, have lengths sinx and cosx , where $0 < x < \frac{\pi}{2}$. Then

   (A)Maximum area of the triangle is $\frac{7}{20}$ (B) The length of hypotenuse is $\frac{1}{\sqrt{5}}$

   (C)The length of hypotenuse is $\frac{3}{\sqrt{5}}$ (D) Maximum area of the triangle is $\frac{9}{10}$

space for rough work

6. If $f(x)+f(y)=\frac{1}{x}+\frac{1}{y}\forall x,\ y\in R-\{0\}$ and $\int_2^3 \frac{3(f(x))^5-f(x)}{1-(f(x))^4}dx=\frac{1}{2}\log\frac{2^\alpha}{3^\beta}$, then

(A) $\alpha > 2\beta$ (B) α is prime
(C) $\alpha < \beta$ (D) $(\alpha+\beta)$ is prime

7. Let A be a 2015 x 2015 matrix where $a_{ij}=\frac{1}{\min(i,j)}$ for $1\le i,j\le 2015$. Then $\det(A)$ equals

(A) $\frac{1}{2014!2015!}$ (B) $\frac{1}{2014!2016!}$
(C) $-\frac{1}{2014!2015!}$ (D) None of these

8. If A is a diagonal matrix of order 3 x 3 commutative with every square matrix of order 3 x 3 under multiplication and trace (A) = 12, then $\sqrt{|A|}$ equals

(A) 4 (B) 5
(C) 8 (D) 9

Paragraph Type Questions

This section contains **4 paragraphs.** Based upon each paragraph, 2 Multiple Choice Questions have to be answered. Each question has **Only One Correct** answer.

Paragraph for Question Nos. 9 to 10

Let α,β,γ be three real numbers such that $\alpha^2+\beta^2+\gamma^2-\gamma=0$ and $z=\frac{\alpha+i\beta}{1-\gamma}$.

9. $|z|^2$ equals

(A) γ (B) $1-\gamma$
(C) $\frac{\gamma}{1-\gamma}$ (D) $\frac{1-\gamma}{\gamma}$

10. α equals

(A) $\frac{z+\bar{z}}{2(1+|z|^2)}$ (B) $\frac{(\bar{z}-z)i}{2(1+|z|^2)}$
(C) $\frac{(z-\bar{z})i}{2(1+|z|^2)}$ (D) none of these

space for rough work

Paragraph for Question Nos. 11 to 12

Let equations of two

Lines $l_1 \equiv 4y - 4x + 12a^2 + 20a + 11 = 0$ and $l_2 = 4y + 4x + 12a^2 + 4a - 21 = 0$ and

S be a circle with centre at $\left(2a+1, -\frac{3}{4}(2a+1)^2 - 1\right)$ and radius 'r' units

11. The area enclosed by the angle bisector of the lines $l_1=0$ and $l_2=0$ and the lines passing through the centre of the circle S=0 and equally inclined to $l_1=0$ and $l_2=0$
(A) 4 sq.units (B) 6 sq.units
(C) 9 sq. units (D) 10 sq.units

12. If $l_3=0$ and $l_4=0$ are the lines, passing through origin and perpendicular to $l_1=0$ and $l_2=0$ respectively, let the line 3x-4y=2008 cuts lines $l_3 = 0$ and $l_4 = 0$ at A and B and the curve $x^2 - y^2 = 2008$ at C and D respectively then
(A) AB+CD=AD (B) AC=BD
(C) AB=CD (D) none of these

Paragraph for question 13 to 14

Let $\vec{a}, \vec{b}, \vec{c}$ and $\vec{d}$ be unit vectors such that $\vec{a}.\vec{b} = \vec{b}.\vec{c} = \vec{c}.\vec{a} = \cos\theta$ and $\vec{d}.\vec{a} = \vec{d}.\vec{b} = \vec{d}.\vec{c} = \cos\alpha$.

13. If $\theta = \frac{\pi}{3}$ then α is equal to
(A) $\frac{\pi}{4}$ (B) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$
(C) $\cos^{-1}\left(\sqrt{\frac{2}{3}}\right)$ (D) $\frac{\pi}{2}$

14. If $\theta = \cos^{-1}\left(\frac{1}{4}\right)$ then α is equal to
(A) $\frac{\pi}{4}$ (B) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$
(C) $\cos^{-1}\left(\sqrt{\frac{2}{3}}\right)$ (D) $\frac{\pi}{2}$

space for rough work

Paragraph for question 15 to 16

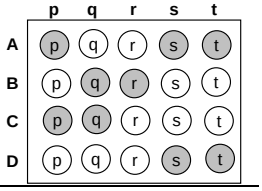
Let the total number of different positive integral solutions for the equation $x_1x_2x_3x_4 = a$ be 1024, where x_1, x_2, x_3, x_4 are four variables and a is the product of prime numbers with their power one

15. The total integral solution of the equation is
(A) 5120 (B) 6144 (C) 7168 (D) 8192

16. The total number of positive integral solution of the equation if 1 is excluded in the solution
(A) 256 (B) 1024 (C) 120 (D) 240

Part-B : Matrix-Match Type Questions

This Section contains **4 Matrix Match Type Questions.** Each question has **four statements** (A, B, C and D) given in **Column I** and **five statements** (p, q, r, s and t) in **Column II.** Any given statement in Column I can have correct matching with **ONE** or **MORE** statement(s) given in Column II. For example, if for a given question, statement B matches with the statements given in q and r, then for the particular question, against statement B, darken the bubbles corresponding to q and r in the ORS.



1. Let $f:R^+ \to R$ be a strictly increasing function such that $f(x) > -\frac{1}{x} \forall x > 0$ and $f(x)f\left(f(x)+\frac{1}{x}\right) = 1 \quad \forall x > 0$. Now match the following

Column A		Column B	
(A)	f(1)=	(P)	$\frac{1+\sqrt{5}}{2}$
(B)	Maximum value of f(x) in [1,2]	(Q)	$\frac{1-\sqrt{5}}{2}$
(C)	Minimum value of f(x) in [1,2]	(R)	$\frac{1-\sqrt{5}}{4}$
(D)	$\int_e^{e^2} f(x)dx$	(S)	$\frac{1+\sqrt{5}}{4}$

2. Match the following

Column – I		Column – II	
(A)	The number of points $P\left(3\hat{i}+\lambda\hat{j}+\mu\hat{j}\right)$ which lie on the line $\vec{r}.\left(2\hat{i}+\hat{j}+k\right) = 3 = \vec{r}\left(\hat{i}+2\hat{j}+k\right)-1$ and $\overrightarrow{OP}\left(\hat{i}+2\hat{j}+k\right) = 0$ is	(P)	2
(B)	$\vec{a},\vec{b},\vec{c}$ are any three vectors then $\vec{a}\left(\left(\vec{b}+\vec{c}\right)\times\left(\vec{a}+\vec{b}+\vec{c}\right)\right)$ is equal to	(Q)	1
(C)	If $\vec{a} = \hat{i}+\hat{j}+k, \vec{b}\ 4\hat{i}+3\hat{j}+4k, \vec{c} = \hat{i}+\alpha\hat{j}+\beta k$ are linearly dependent and $\left\|\vec{c}\right\| = \sqrt{3}$ then $\alpha + \beta$ is equal to	(R)	-1
(D)	If $\vec{a} = \hat{i}+\hat{j}+k, \vec{a}\times\vec{b} = \hat{j}-k$ and $\vec{b} = \alpha\hat{i}+\beta\hat{j}+\gamma k$ then α - β is equal to	(S)	0

space for rough work

3. Let $f:R\to R$ and g:R$\to$R be functions such that f(g(x)) is one-one function

Column A		Column B	
(A)	Then g(x)	(P)	Must be one-one
(B)	Then f(x)	(Q)	May not be one-one
(C)	If g(x) is onto then f(x)	(R)	May be many one
(D)	If g(x) is into then f(x)	(S)	Must be many-one

4. Match the principal values of $\cos^{-1}\left(8x^4-8x^2+1\right)$ given in column-I with the corresponding intervals of x given in column-II, for which it holds

Column A		Column B	
(A)	$4\cos^{-1}x$	(P)	$0\le x\le\frac{1}{\sqrt{2}}$
(B)	$4\cos^{-1}x-2\pi$	(Q)	$\frac{1}{\sqrt{2}}\le x\le 1$
(C)	$2\pi-4\cos^{-1}x$	(R)	$-1\le x\le-\frac{1}{\sqrt{2}}$
(D)	$4\pi-4\cos^{-1}x$	(S)	$-\frac{1}{\sqrt{2}}\le x\le 0$

space for rough work