FIITJEE INTERNAL Phase Test

BATCHES – Two Year CRP – 2325

PHYSICS, CHEMISTRY & MATHEMATICS

QP CODE: 100740 **RIT – 4**

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.

Forthcoming Exam – FTRE on 15th Sept. 2024.

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.

*** In multiple choice questions the options are given as F,T,R & E which correspond to the options A,B,C & D respectively in the 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** (**01–03)** 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.

(ii) **Part-A (04-07) –** 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.

(iii) **Part-A (08-11) –** This section contains Four (04) 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 **+3 Marks** for correct answer and **-1 marks** for wrong answer.

(iii) **Part-B (01-06)** This section contains **SIX (06)** questions. The answer to each question is a **NON-NEGATIVE INTEGER**. For each question, enter the correct integer corresponding to the answer. Each question carries **+4 marks** for correct answer. **There is no negative marking.**

Name of the Candidate: _____

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

Enrolment Number: _____

*** In multiple choice questions the options are given as F,T,R & E which correspond to the options A,B,C & D respectively in the OMR sheet.**

SECTION – I : PHYSICS

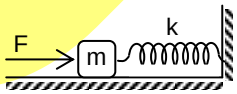
(PART – A)

(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.**

1. A composite rod consists of a steel rod of length 25 cm and crossectional area 2 A and copper rod of length 50 cm and crossectional area A. the composite rod is subjected to an axial load F. If the young's modulii of steel and copper are in the ratio 2 : 1 then choose the correct alternative(s).
(F) the extension produced in copper rod will more.
(T) the extension in copper and steel parts will be in the ratio 1 : 8.
(R) the stress in copper rod will be more.
(E) no extension will be produced in the steel rod.

2. A constant force F is applied on a spring block system as shown in figure. The mass of the block is m and spring constant is k. The block is placed over a smooth surface. Initially the spring was unstretched. Choose the correct alternative(s)



(F) the block will execute SHM
(T) amplitude of oscillation is F/2k
(R) time period of oscillation is $2\pi\sqrt{\frac{m}{k}}$
(E) the maximum speed of block is $\sqrt{\frac{2Fx - kx^2}{m}}$
(here x = F/k)

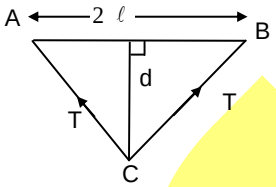
3. A satellite of mass M_s is orbiting the earth in a circular orbit of radius R. It starts losing energy slowly at a constant rate 'C' due to friction. If M_e and R_e denote the mass and radius of the earth respectively, then
(F) its kinetic energy continuously decreasing.
(T) its kinetic energy continuously increasing.
(R) the time taken by it to reach the surface of the earth is $\frac{GM_eM_s}{2C}\left(\frac{1}{R_e}-\frac{1}{R}\right)$.
(E) the time taken by it to reach the surface of the earth is $\frac{GM_eM_s}{C}\left(\frac{1}{R_e}-\frac{1}{R}\right)$.

Space For Rough Work

(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.**

4. A wire of radius r stretched without tension along a straight line is lightly fixed at A and B. What is the tension in the wire, when it is pulled into the shape A C B. Take Y = young's modulus and $d << \ell$

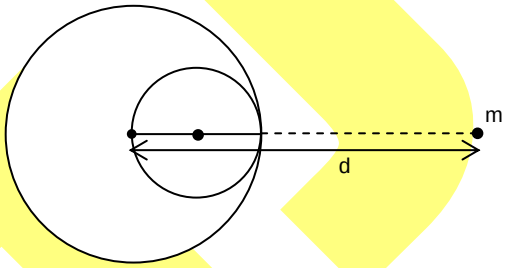


(F) $\frac{Y^2d^2}{2\pi r^2\ell^2}$ (T) $\frac{Y\pi r^2d^2}{2\ell^2}$ (R) $\frac{Y\pi r^2}{2\ell^2d^2}$ (E) $\frac{Y\pi r^2\ell^2}{2d^2}$

5. The density of water at the surface of the ocean is ρ. If the bulk modulus of water is B, what is the density of ocean water at a depth where the pressure is nP_0, where P_0 is the atmospheric pressure?

(F) $\rho\, e^{\left[\frac{P_0(n-1)}{B}\right]}$ (T) $\rho\, e^{\left[\frac{B}{P_0(n-1)}\right]}$ (R) $\rho\, e^{\left[\frac{nB}{P_0(n-1)}\right]}$ (E) none of these

6. A spherical hollow is made in a lead sphere of radius R such that its surface touches the outside surface of the lead sphere and passes through it centre. Mass of lead sphere before hollowing is M. A particle of mass 'm' is placed at a distance 'd' from the centre of the lead sphere and on the lien joining the centre of the sphere and the centre of the hollow as shown. Force of attraction between the hallowed sphere and the particle.

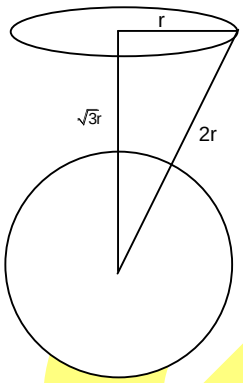


(F) $\frac{GMm}{4d^2}$ (T) $\frac{GMm}{d^2}\left[1+\frac{1}{6\left(1+\frac{R}{2d}\right)^2}\right]$

(R) $\frac{GMm}{d^2}\left[1-\frac{1}{8\left(1-\frac{R}{2d}\right)^2}\right]$ (E) $\frac{GMm}{d^2}\left[1+\frac{1}{8\left(1+\frac{R}{2d}\right)^2}\right]$

Space For Rough Work

7. A uniform ring of mass m and radius r is placed directly above a uniform sphere of mass M and of equal radius. The centre of the ring is directly above the centre of the sphere at a distance $r\sqrt{3}$ as shown in the figure. The gravitational force exerted by the sphere on the ring will be



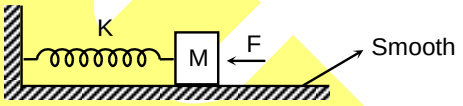
(F) $\frac{GMm}{8r^2}$ (T) $\frac{GMm}{4r^2}$

(R) $\sqrt{3}\frac{GMm}{8r^2}$ (E) $\frac{GMm}{8r^2\sqrt{3}}$

(Matching List Sets)

This section contains **FOUR (04)** 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 the given figure a block of mass M = 1 kg is attached to one end of massless spring of spring constant k = 100 N/m and other end of spring is fixed. Initially spring in its natural length. A horizontal force F = 10 N at t = 0 is applied on the block.



List-I		List-II	
(P)	Amplitude of SHM in cm is	(1)	$\pi/30$
(Q)	Maximum speed of block in cm/s is	(2)	100
(R)	The time in second after which compression in the spring is half of amplitude if block starts from extreme position	(3)	10
(S)	Maximum compression in the spring in cm is	(4)	20
		(5)	13

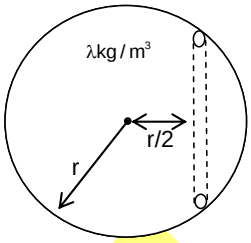
The correct option is:

(F) P $\rightarrow$ 3 ; Q $\rightarrow$ 2 ; R $\rightarrow$ 5 ; S $\rightarrow$ 1 (T) P $\rightarrow$ 4 ; Q $\rightarrow$ 3 ; R $\rightarrow$ 1 ; S $\rightarrow$ 5

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

Space For Rough Work

9. Consider a planet of radius r having density λ. A tunnel is dug inside it at a distance r/2 from its centre as shown. An object of mass m is left in the tunnel at the surface at t = 0 then



List-I		List-II	
(P)	Time taken by the object to reach the mid of the tunnel	(1)	Zero
(Q)	Magnitude of velocity of object at the centre of the tunnel	(2)	g
(R)	Normal reaction applied by wall of the tunnel on the object	(3)	$\sqrt{\frac{3\pi}{16G\lambda}}$
(S)	Acceleration of object when it reach the mid of the tunnel	(4)	$\frac{2}{3}\pi G\lambda r\, m$
		(5)	$\left(\sqrt{\pi G\lambda}\right) r$

The correct option is:

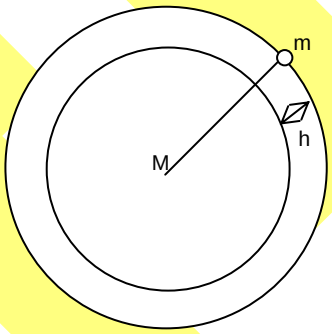
(F) P $\rightarrow$ 3 ; Q $\rightarrow$ 5 ; R $\rightarrow$ 2 ; S $\rightarrow$ 4

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

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

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

10. A satellite of mass m is orbiting the Earth at a height h from its surface. [M is mass of the earth and its radius is R]



List-I		List-II	
(P)	Kinetic energy of the satellite	(1)	$-\frac{GMm}{(R+h)}$
(Q)	Potential energy of the satellite	(2)	$\frac{1}{2}\frac{GMm}{(R+h)}$
(R)	Total energy of the satellite	(3)	$\frac{-GMm}{2(R+h)}$
(S)	The energy must be spent to pull the satellite out of the earth's gravitational field	(4)	$\frac{2GMm}{(R+h)}$
		(5)	$-\frac{2GMm}{(R+h)}$

The correct option is:

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

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

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

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

Space For Rough Work

11. Match List-I with List-II.

List-I		List-II	
(P)	A force that restores an elastic body of unit area to its original state.	(1)	Bulk modulus
(Q)	Two equal and opposite forces parallel to opposite faces.	(2)	Young's modulus
(R)	Forces perpendicular everywhere to the surface per unit area same everywhere	(3)	Stress
(S)	Two equal and opposite forces perpendicular to opposite faces.	(4)	Shear modulus
		(5)	Strain

Choose the correct answer from the options given below:

(F) P $\rightarrow$ 4 ; Q $\rightarrow$ 2 ; R $\rightarrow$ 3 ; S $\rightarrow$ 5 (T) P $\rightarrow$ 2 ; Q $\rightarrow$ 4 ; R $\rightarrow$ 5 ; S $\rightarrow$ 3

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

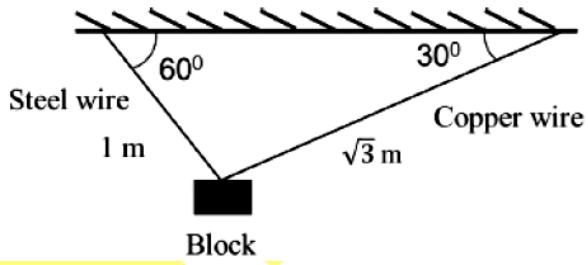
(PART – B)

(Non – Negative Integer)

1. A uniform rod of length L has a mass per unit length λ and area of cross section A. The elongation in the rod is l due to its own weight if it is suspended from the ceiling of a room. The Young's modulus of the rod $\frac{\lambda g L^2}{NAl}$, then find the value of 'N' is _____.

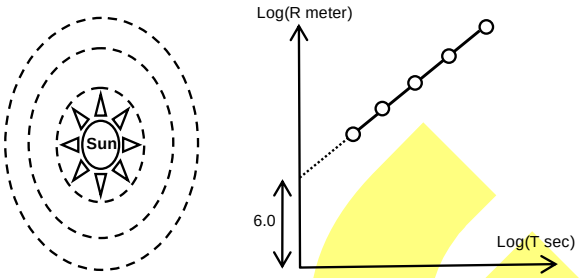
2. A block of weight 100 N is suspended by copper and steel wires of same cross sectional area 0.5 cm^2 and length $\sqrt{3}$ m and 1 m, respectively. Their other ends are fixed on a ceiling as shown in figure. The angles subtended to copper and steel wires with ceiling are 30^o and 60^o, respectively. If elongation in copper wire is (Δl_c) and elongation in steel wire is (Δl_s), then the ratio $\frac{\Delta l_c}{\Delta l_s}$ is_____.

[Young's modulus for copper and steel are 1×10^{11} N/m^2 and 2×10^{11} N/m^2 respectively]



Space For Rough Work

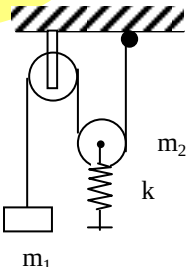
3. Many particles are revolving around a fixed sun, in circular orbits of different radius (R) and different time period (T). To estimate the mass of the sun, the orbital radius (R) and time period (T) of planets were noted. Then $\log_{10}T$ v/s $\log_{10}R$ curve was plotted.
The curve was found to be approximately straight line (as shown in figure) having y intercept = 6.0 (neglect the gravitational interaction among the planets



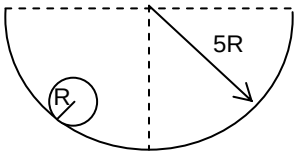
[Take $G = \frac{20}{3} \times 10^{-11}$ in MKS, $\pi^2 = 10$]
Find the value of 3 times of slope of the line

4. Two spherical stars A and B have densities ρ_A and ρ_B, respectively. A and B have the same radius, and their masses M_A and M_B are related by $M_B = 2M_A$. Due to an interaction process, star A loses some of its mass, so that its radius is halved, while its spherical shape is retained, and its density remains ρ_A. The entire mass lost by A is deposited as a thick spherical shell on B with the density of the shell being ρ_A. If v_A and v_B are the escape velocities from A and B after the interaction process, the ratio $\frac{v_B}{v_A} = \sqrt{\frac{23}{(n \times 5)^{1/3}}}$. The value of 'n' is _____.

5. If the period of free oscillation of the system shown here if the mass m_1 is pulled down a little and the force constant of the spring is k and the mass of the fixed pulley is negligible but mass of the other pulley is m_2 is $2\pi\sqrt{\frac{m_2 + nm_1}{k}}$, then find the value of 'n'.
[Pulleys are frictionless]



6. A solid sphere of radius R rolls without slipping in a cylindrical trough of radius 5 R. If the time period of small oscillations is $2\pi\sqrt{\frac{28R}{ng}}$, then find the value of 'n'.



Space For Rough Work

*** In multiple choice questions the options are given as F,T,R & E which correspond to the options A,B,C & D respectively in the OMR sheet.**

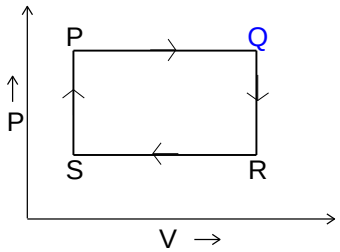
SECTION – II : CHEMISTRY

(PART – A)

(One or More Than One Options Correct Type)

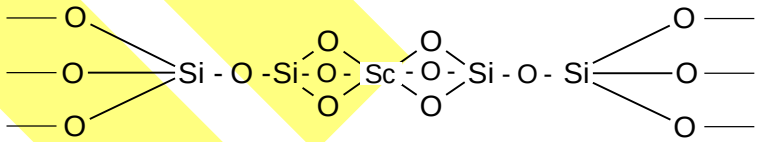
This section contains **3 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D), out of which **ONE** or **MORE THAN ONE is correct.**

1. Which of the following is/are true statement(s)?
(F) BH_3 is not a stable compound
(T) Boron hydrides are formed when dilute HCl reacts with Mg_3B_2
(R) All the B – H bond lengths in B_2H_6 are equal
(E) The boron hydrides are readily hydrolysed

2. 

A thermodynamic system containing four processes is given above. Choose correct statement(s).
(F) No PV-work is done along paths S → P and Q → R.
(T) Heat is evolved along path R → S
(R) Along path P → Q work is done by the system on the surrounding.
(E) R → S is an isothermal process

3. In the pyrosilicate $\left(Si_2O_7^{6-}\right)$ ion
(F) one oxygen atom is shared between two tetrahedral units
(T) it contains Si – Si bond
(R) there is no Si = O bond
(E) The structure of scandium pyrosilicate is



Space For Rough Work

(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.**

4. If it is assumed that heat of hydrogenation of ethene is 5 KJ/mol and experimental heat of hydrogenation of buta-1, 3-diene is 8 KJ/mol. The resonance energy of buta-1, 3-diene in KJ/mol is
(F) 2 (T) 1
(R) 3 (E) 17

5. Which carbide reacts with water to give the largest hydrocarbon?
(F) Be_2C (T) Mg_2C_3
(R) Al_4C_3 (E) CaC_2

6. Calculate the work done in a reversible and isothermal process at 1000K, in which the volume of a container containing one mole of an ideal gas is expanded to 10 times of its initial volume? [R = 8.314 JK^{-1} mol^{-1}]
(F) -12.69 KJ mol^{-1} (T) -19.15 KJ mol^{-1}
(R) -20.84 KJ mol^{-1} (E) 12.69 KJ mol^{-1}

7. $Mg_3B_2 + H_3PO_4 \longrightarrow$ Mixture of boranes
The major product is B_4H_{10}. Which borane needs the highest temperature for formation?
(F) B_2H_6 (T) B_5H_{11}
(R) $B_{10}H_{14}$ (E) B_4H_{20}

(Matching List Sets)

This section contains **FOUR (04)** 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 (Silicates)		**List– II (Structure)**	
(P)	$Ca_3Fe_2(SiO_4)_3$	(1)	Sheet structure
(Q)	$Na_2ZrSi_4O_{10}$	(2)	Pair of tetrahedra
(R)	$Ca_2ZnSi_2O_7$	(3)	Tetrahedral structure
(S)	$Ca_2Mg_5(Si_4O_{11})_2(OH)_2$	(4)	Double chain structure
		(5)	Closed ring

(F) P $\rightarrow$ 3; Q $\rightarrow$ 1; R $\rightarrow$ 4; S $\rightarrow$ 5 (T) P $\rightarrow$ 2; Q $\rightarrow$ 5; R $\rightarrow$ 3; S $\rightarrow$ 4
(R) P $\rightarrow$ 3; Q $\rightarrow$ 1; R $\rightarrow$ 2; S $\rightarrow$ 4 (E) P $\rightarrow$ 2; Q $\rightarrow$ 3; R $\rightarrow$ 5; S $\rightarrow$ 4

Space For Rough Work

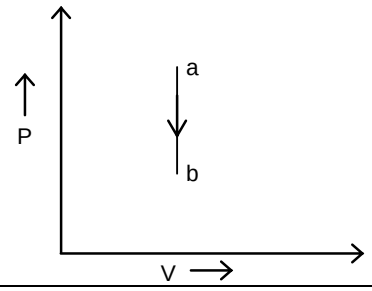
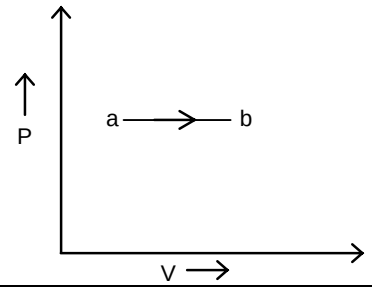
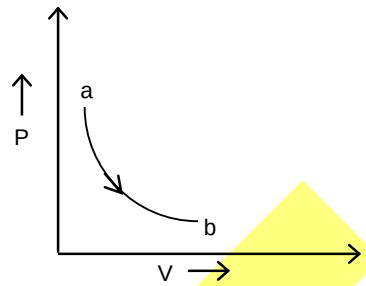
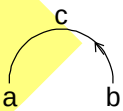
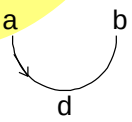
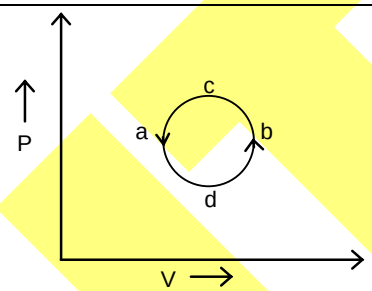
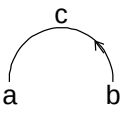
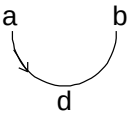
9. Match the lists.

List – I (Reversible processes)		List– II (Characteristics)	
(P)	Isothermal process	(1)	Work done is accompanied with change in temperature
(Q)	Adiabatic process	(2)	Internal energy of the system does not change during expansion or compression
(R)	Isobaric process	(3)	Entropy change of the system depends on C_P and temperature
(S)	Isochoric process	(4)	No expansion or compression of the system takes place
		(5)	Total work done is zero

(F) P $\rightarrow$ 3; Q $\rightarrow$ 2; R $\rightarrow$ 5; S $\rightarrow$ 4
(T) P $\rightarrow$ 2; Q $\rightarrow$ 1; R $\rightarrow$ 3; S $\rightarrow$ 4
(R) P $\rightarrow$ 2; Q $\rightarrow$ 3; R $\rightarrow$ 4; S $\rightarrow$ 1
(E) P $\rightarrow$ 2; Q $\rightarrow$ 3; R $\rightarrow$ 4; S $\rightarrow$ 5

Space For Rough Work

10. Match the lists.

List – I (Thermodynamic reversible process)		**List– II (Characteristics)**	
(P)		(1)	a → b is an isothermal process
(Q)		(2)	Along a → b entropy change of system decreases and that of surrounding increases
(R)		(3)	Work done along path  is greater than that along 
(S)		(4)	Along a → b entropy change of system increases and that surrounding decreases
		(5)	Work done along path  is less than that along 

(F) P → 4; Q → 2; R → 1; S → 5
(R) P → 2; Q → 4; R → 1; S → 3
(T) P → 1; Q → 4; R → 2; S → 5
(E) P → 4; Q → 1; R → 2; S → 3

Space For Rough Work

11. Match the lists.

List – I (Compounds of boron)		List– II (Properties)	
(P)	$(BN)_x$	(1)	Symmetrical addition of NH_3 takes place
(Q)	B_2H_6	(2)	Forms more than one products during heating
(R)	$B_3N_3H_6$	(3)	Is used as a lubricant only at high temperature
(S)	H_3BO_3	(4)	Undergoes hydrolysis readily to produce H_3BO_3, NH_3 and H_2
		(5)	Exists in cubic and hexagonal form

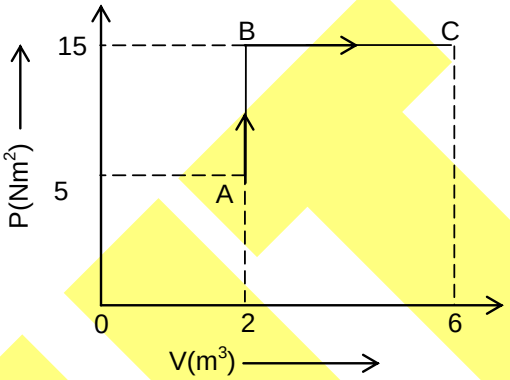
(F) P → 5; Q → 3; R → 2; S → 4
(T) P → 3; Q → 1; R → 3; S → 4
(R) P → 5; Q → 3; R → 4; S → 1
(E) P → 3; Q → 1; R → 4; S → 2

(PART – B)

(Non – Negative Integer)

1. In borax($Na_2B_4O_7.10H_2O$)
If x = the number of B – O – H bonds present in it
y = the number of sp^2-hybrdidized boron atoms in it
& z = the number of sp^3-hybridized boron present in it, then
The value of (x + y + z) is

2. The magnitude of work done, on changing the state from A to C via B is



Space For Rough Work

3. The standard enthalpy change for the reaction

$$CO(g)+\frac{1}{2}O_2(g)\longrightarrow CO_2(g)$$

At 300 K is -285.4 KJ/mol. The standard entropy change for the reaction is -9.4×10^{-x} KJ/mol. Given that standard Gibbs energies of formation for CO_2 and CO are -394.4 and -137.2 KJ/mol respectively. What is the value of x?

4. How many of the following molecules have their standard heat of formation zero at 298 K?
$O_2(\ell)$, C(graphite), C(diamond), S(monoclinic), Br_2(solid), I_2(solid)

5. One mole of an ideal gas at 1 atm and TK temperature is expanded adiabatically and reversibly until the pressure is 0.1 atm and temperature becomes 40 K. What is the initial temperature (T) of the process in Kelvin unit?
$\left(C_V=\frac{3R}{2}\right)$[log 40 = 1.6]

6. The formula of an alkyl silicon chloride is $Si(R)_x(Cl)_y$. What will be the value of 'y' if it forms cross-linked silicone upon hydrolysis?

Space For Rough Work

*** In multiple choice questions the options are given as F,T,R & E which correspond to the options A,B,C & D respectively in the OMR sheet.**

SECTION – III : MATHEMATICS

(PART – A)

(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.**

1. Let line L be a normal to the parabola $y^2 = 4x$. If L passes through the point (9, 6), then L can be

(F) $y - x + 3 = 0$ (T) $y + 3x - 33 = 0$

(R) $y + x - 15 = 0$ (E) $y - 2x + 12 = 0$

2. If $T(3,2)$ is the foot of perpendicular drawn from focus $S(2,-1)$ on a tangent to the parabola, and the directrix of parabola passes through $P(0,9)$, then

(F) Length of latus rectum of parabola is $8\sqrt{2}$

(T) Equation of tangent at vertex is $x + y - 5 = 0$

(R) Equation of axis of the parabola is $x - y - 3 = 0$

(E) Directrix is at a distance from focus

3. Let $\alpha = 3\cos^{-1}\left(\frac{5}{\sqrt{28}}\right) + 3\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$ and $\beta = 4\sin^{-1}\left(\frac{7\sqrt{2}}{10}\right) - 4\tan^{-1}\left(\frac{3}{4}\right)$ then which of the following does not hold(s) good?

(F) $\alpha < \pi$ but $\beta > \pi$ (T) $\alpha > \pi$ but $\beta < \pi$

(R) Both α and β are equal (E) $\cos(\alpha + \beta) = 0$

(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.**

4. Consider parabola $y^2 = 40x$, A circle $S = 0$ is drawn taking one of its focal chord as diameter. The extremeties of the focal chord being P_1 and P_2.

(F) A point 'P' is taken on the circumference of S = 0, Then $\angle P_1PP_2 = \frac{\pi}{4}$

(T) x = 10 is a tangent to S = 0

(R) Combined equation of the tangents at P_1 and P_2 has $(\text{coeff. } x^2) + (\text{coeff. } y^2) = -2$

(E) Orthocenter of ΔP_1PP_2 lies on it

Space For Rough Work

5. If $2p^2-3q^2+4pq-p=0$ and a variable line $px+qy=1$ always touches a parabola whose axis is parallel to x-axis, then the equation of the parabola is

(F) $(y-4)^2=24(x-2)$ (T) $(y-3)^2=12(x-1)$

(R) $(y-4)^2=12(x-2)$ (E) $(y-3)^2=24(x-1)$

6. From the top of a cliff of height h = 2a the angle of depression of the foot of a certain tower is found to be double the angle of elevation of the top of the tower of height h. If θ is the angle of elevation, then its value is

(F) $\cos^{-1}\sqrt{\frac{2h}{a}}$ (T) $\sin^{-1}\sqrt{\frac{2h}{a}}$

(R) $\sin^{-1}\sqrt{\frac{a}{2-h}}$ (E) $\tan^{-1}\sqrt{3-\frac{2h}{a}}$

7. The mean deviation from the mean of the A.P. $a+a+d, a+2d, \ldots\ldots, a+2nd$ is:

(F) $n(n+1)d$ (T) $\frac{n(n+1)d}{2n+1}$

(R) $\frac{n(n+1)d}{2n}$ (E) $\frac{n(n-1)d}{2n+1}$

(Matching List Sets)

This section contains **FOUR (04)** 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 following

Normals are drawn at point P, Q and R lying on the parabola $y^2=4x$ which intersect at (3, 0). Then

	List - I		List – II
(P)	Area of ΔPQR	(1)	2
(Q)	Radius of circumcircle of ΔPQR	(2)	$\frac{5}{2}$
(R)	Centroid of ΔPQR	(3)	$\left(\frac{5}{2},0\right)$
(S)	Circumcentre of ΔPQR	(4)	$\left(\frac{2}{3},0\right)$
		(5)	(1, 0)

(F) P→ (1); Q → (1) ; R→(4); S→(3) (T) P→ (3); Q → (2) ; R→(5); S→(4)

(R) P→ (2); Q → (1) ; R→(4); S→(5) (E) P→ (2); Q → (3) ; R→(5); S→(1)

Space For Rough Work

9. $\frac{\sin 3\alpha}{\cos 2\alpha}$ is

List – I		List – II	
(P)	Positive	(1)	$\alpha \in \left(\frac{13\pi}{48}, \frac{14\pi}{48}\right)$
(Q)	Negative	(2)	$\alpha \in \left(\frac{14\pi}{48}, \frac{18\pi}{48}\right)$
(R)	Positive or negative or zero	(3)	$\alpha \in \left(\frac{18\pi}{48}, \frac{23\pi}{48}\right)$
(S)	Not defined	(4)	$\alpha = \frac{23\pi}{4}$
		(5)	$\alpha = 23\pi$

(F) P $\to$ 3, Q $\to$4, R $\to$1, S $\to$5 (T) P $\to$ 2, Q $\to$3, R $\to$4, S $\to$ 1
(R) P $\to$ 3, Q $\to$1, R $\to$2, S $\to$4 (E) P $\to$ 1, Q $\to$2, R $\to$3, S $\to$ 4

10. List – I contains 2 identical functions in each row. Match List I with corresponding intervals of x in List – 2

List – I		List – II	
(P)	$\sin^{-1}\left(\frac{2x}{1+x^2}\right)$, $2\tan^{-1}x$	(1)	$[-1, 1]$
(Q)	$\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)$, $2\tan^{-1}x$	(2)	$[0, \infty)$
(R)	$\sin^{-1}(3x-4x^3), \pi - 3\sin^{-1}x$	(3)	$\left[\frac{1}{2}, 1\right]$
(S)	$\cos^{-1}(4x^3-3x), 3\cos^{-1}x$	(4)	$(-\infty, 0]$
		(5)	$\left[-1, \frac{-1}{2}\right]$

(F) P $\to$ 1, Q $\to$2, R $\to$3, S $\to$3 (T) P $\to$ 2, Q$\to$3, R $\to$4, S $\to$1
(R) P $\to$ 1, Q $\to$2, R $\to$3, S $\to$5 (E) P $\to$1, Q $\to$3, R $\to$1, S $\to$4

Space For Rough Work

11. Consider the following lists:

List-I		List-II	
(P)	$\left\{x \in \left[-\frac{2\pi}{3}, \frac{2\pi}{3}\right] : \cos x + \sin x = 1\right\}$	(1)	has two elements
(Q)	$\left\{x \in \left[-\frac{5\pi}{15}, \frac{5\pi}{18}\right] : \sqrt{3}\tan 3x = 1\right\}$	(2)	has three elements
(R)	$\left\{x \in \left[-\frac{6\pi}{5}, \frac{6\pi}{5}\right] : 2\cos(2x) = \sqrt{3}\right\}$	(3)	Has four elements
(S)	$\left\{x \in \left[-\frac{7\pi}{4}, \frac{7\pi}{4}\right] : \sin x - \cos x = 1\right\}$	(4)	Has five elements
		(5)	has six elements

(F) P $\to$ 3, Q $\to$4, R $\to$1, S $\to$5
(T) P $\to$ 1, Q $\to$1, R $\to$5, S $\to$3
(R) P $\to$ 3, Q $\to$1, R $\to$2, S $\to$4
(E) P $\to$ 1, Q $\to$2, R $\to$3, S $\to$4

(PART – B)

(Non – Negative Integer)

1. If the normal to a parabola $y^2 = 4ax$ at P meets the curve again in Q and if PQ and the normal at Q makes angles α and β respectively with the x – axis then $\left|\tan\alpha(\tan\alpha + \tan\beta)\right|$ has the value equal to:

2. If sum of all the solutions of the equation $\cot x + \text{cosec}\, x + \sec x = \tan x$ in $[0, 2\pi]$ is $\frac{k\pi}{2}$, then find the value of k.

3. Number of value(s) of $x \in [0, 2\pi]$ which satisfies the equation $\sin^2 x + \text{cosec}^2 x = \cos^2 x + \sec^2 x$ is

4. The value of sum $\sum_{n=1}^{\infty} \cot^{-1}\left(\frac{(n^2+2n)(n^2+2n+1)+1}{2n+2}\right) = \sec^{-1}\left(\frac{\sqrt{5}}{\lambda}\right)$ then λ is equal to

5. If $\sum_{n=1}^{\infty} \tan^{-1}\left(\frac{\sqrt{2n+2} - \sqrt{2n-2}}{2 + \sqrt{n^2-1}}\right) = \frac{\pi}{2} + \tan^{-1} k$ then find the value of k^2.

6. Considering only the principal values of the inverse trigonometric functions, the value of $\left[\frac{3}{2}\cos^{-1}\sqrt{\frac{2}{2+\pi^2}} + \frac{1}{4}\sin^{-1}\frac{2\sqrt{2}\pi}{2+\pi^2} + \tan^{-1}\frac{\sqrt{2}}{\pi}\right]$ is ([.] denotes greatest integer function)

Space For Rough Work

FIITJEE INTERNAL TEST

BATCHES: Two Year CRP325

RIT – 4

Code: 100740

JEE ADVANCED LEVEL

ANSWER KEY

ANSWER KEYS

Physics

PART – A

1.	FR	2.	FRE	3.	TR	4.	T
5.	F	6.	R	7.	R	8.	E
9.	T	10.	F	11.	R		

PART – B

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

Chemistry

PART – A

1.	FTE	2.	FTR	3.	FRE	4.	F
5.	T	6.	T	7.	F	8.	R
9.	T	10.	R	11.	E		

PART – B

1.	8	2.	60	3.	2	4.	2
5.	100	6.	3				

Mathematics

PART – A

1.	FTE	2.	FTR	3.	FTE	4.	E
5.	R	6.	E	7.	T	8.	F
9.	R	10.	F	11.	T		

PART – B

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