FIITJEE INTERNAL Phase Test

BATCHES – PANINI426-G1, A1, A2 & B1_PT-3

PHYSICS, CHEMISTRY & MATHEMATICS

QP CODE: 100895 | **Paper – 2**

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-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.**

(iv) **Part-B** (07-10) This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX**.** For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places. Each question carries **+3 marks** for the correct answer. **There is no negative marking.**

Name of the Candidate: _____

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

Enrolment Number: _____

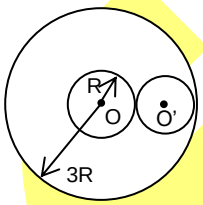
SECTION – I: PHYSICS

(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.**

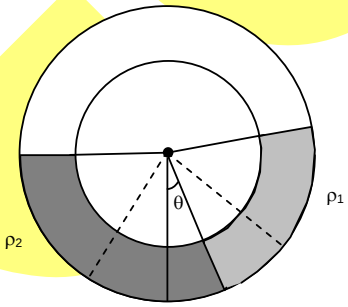
1. A thick hollow sphere with inner radius R and outer radius 3 R has a uniform volume mass density ρ. It has a spherical cavity of radius R as shown. The gravitational field at the centre O′ of the cavity is



(A) zero (B) $\frac{2}{3}\pi G\rho R$

(C) $\frac{5}{3}\pi G\rho R$ (D) $\frac{7}{3}\pi G\rho R$

2. A small uniform tube is bent into a circle of radius r whose plane is vertical. Equal volumes of two immiscible liquids whose densities are ρ_1 and $\rho_2\,(\rho_1 > \rho_2)$ fill half the circle. The angle between radius passing through interface and vertical axis is given by



(A) $\tan^{-1}\left(\frac{\rho_1}{\rho_2}\right)$ (B) $\tan^{-1}\left(\frac{\rho_2}{\rho_1}\right)$

(C) $\tan^{-1}\left(\frac{\rho_1-\rho_2}{\rho_1+\rho_2}\right)$ (D) $\tan^{-1}\left(\frac{\rho_1+\rho_2}{\rho_1-\rho_2}\right)$

3. Two spherical bodies of masses M and 5M and radii R and 2R respectively are released in free space with initial separation between their centres equal to 12R. If they attract each other due to gravitational force only, then the distance covered by smaller body just before collision is

(A) 1.5 R (B) 2.5 R (C) 4.5 R (D) 7.5 R

4. A hemispherical portion of radius R is removed from the bottom of a cylinder of radius R. The volume of the remaining cylinder is V and its mass is M. It is suspended by a string in a liquid of density ρ where it stays vertical. The upper surface of the cylinder is at a depth h below the liquid surface. The force on the bottom of the cylinder by the liquid is

(A) Mg (B) Mg - Vρg

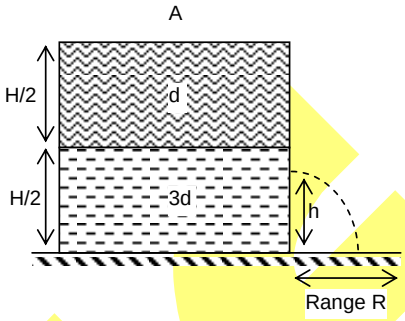
(C) $Mg+\pi R^2h\rho g$ (D) $\rho g(V+\pi R^2h)$

Space For Rough Work

(One or More Than One Options Correct Type)

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

5. A container of large uniform cross sectional area A resting on a horizontal surface holds two immiscible non viscous and incompressible liquids of density d and 3d, each of height H/2. The lower density liquid is open to the atmosphere having pressure P_0. A tiny hole of area a(a<<A) is punched to the vertical side of lower container at a height h (0<h<H/2) for which range is maximum.



(A) h = H /3

(B) Range R = $\frac{2H}{3}$

(C) Range R = $\frac{3H}{2}$

(D) Velocity of efflux $v = \sqrt{\frac{2}{3}gH}$

6. Two bodies, each of mass M, are kept fixed with a separation 2L. A particle of mass m is projected from the midpoint of the line joining their centres, perpendicular to the line. The gravitational constant is G. The correct statement(s) is (are)

(A) The minimum initial velocity of the mass m to escape the gravitational field of the two bodies is $4\sqrt{\frac{GM}{L}}$.

(B) The minimum initial velocity of the mass m to escape the gravitational field of the two bodies is $2\sqrt{\frac{GM}{L}}$.

(C) The minimum initial velocity of the mass m to escape the gravitational field of the two bodies is $\sqrt{\frac{2GM}{L}}$.

(D) The energy of the mass m remains constant.

7. A metal wire of length L area of cross section A and young's modulus Y is stretched by a variable force F such that F is always slightly greater than the elastic forces of resistance in the wire when the elongation of the wire is l.

(A) the work done by F is $\frac{YAl^2}{2L}$

(B) the work done by F is $\frac{YAl^2}{L}$

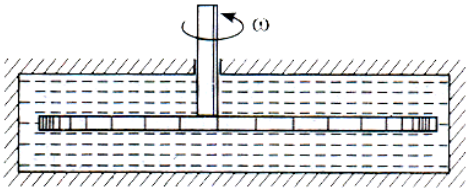
(C) the elastic potential energy stored in the wire is $\frac{YAl^2}{2L}$

(D) the elastic potential energy stored in the wire is $\frac{YAl^2}{L}$

Space For Rough Work

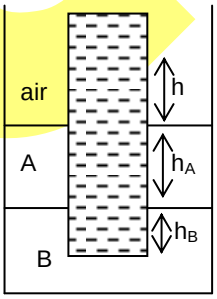
(PART – B)
(Non – Negative Integer)

1. A thin circular disc of radius R is made to rotate with a constant angular speed ω within a oil filled (coeff. of viscosity η) cylindrical box as shown in the figure. The clearance between the disc & the horizontal planes of the cylindrical box is very small & is equal to h. Considering that the vertical side of the cylindrical box is almost in contact with the disc, the power to be supplied to the system to maintain the constant angular speed is $\frac{\pi\eta\omega^x R^y}{h}$. Then x + y is



2. Three particles, each of mass m, are situated at the vertices of an equilateral triangle of side length a. The only forces acting on the particles are their mutual gravitational forces. It is desired that each particle moves in a circle while maintaining the original mutual separation a. Find the initial velocity that should be given to each particle. $\left(\text{take } a = \frac{GM}{16}\right)$

3. A uniform solid cylinder of density 0.8 g/cm^2 floats in equilibrium in a combination of two non mixing liquid A & B with its axis vertical. The height of liquid A is h_A = 1.2 cm. The length of the part of the cylinder immersed in liquid B is h_B = 0.8 cm. Find the total force exerted by liquid A on the cylinder

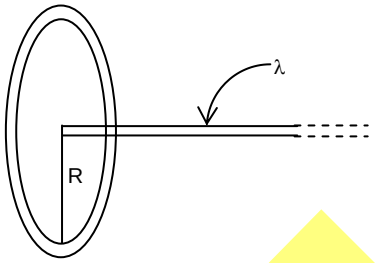


4. Two soap bubbles of equal radii (R = 40 mm) are stuck together with an intermediate film separating them. Surface tension of solution forming bubbles is 7 x 10^{-3} N/ m. What will be the distance (in mm) between centres of bubbles .

5. A cord of length 64 m is used to connect a 100 kg astronaut to a spaceship whose mass is much larger than that of the astronaut. If the value of the tension in the cord is n x 10^{-2} N. Assume the space ship is orbiting near the earth surface and also assume that the astronaut fall on a straight line from the earth's centre. The radius of the earth is 6400 km. Find the value of 'n'.

Space For Rough Work

6. If the force of interaction between the ring of mass M and radius R and a semi infinite rod of linear mass density λ kept axially is $\frac{aGM\lambda}{R}$, then a =



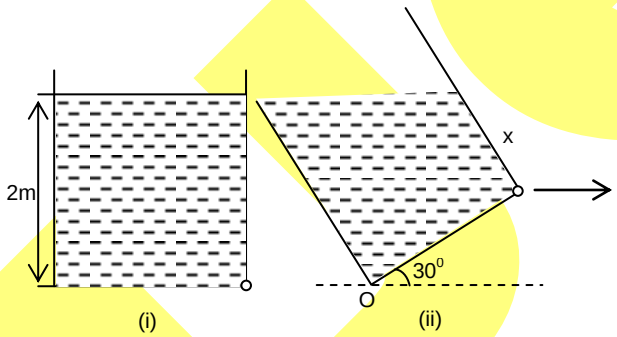
(PART – B)

This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Paragraph for Question no. 7 to 8

Velocity of efflux in Torricelli's theorem is given by $v = \sqrt{2gh}$ here h is the depth of hole from the top surface, After that, motion of liquid can be treated as projectile motion. Take g = 10 m/s^2.

Liquid is filled in a vessel of square base $(2m \times 2m)$ upto a height of 2m as shown in figure. In figure (ii) the vessel is tilted form horizontal at 30^0. Liquid does not spill out.



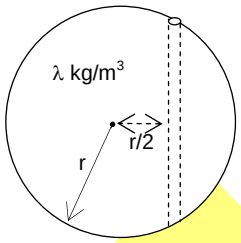
7. What is the velocity of efflux in m/ sec in the case?

8. At what distance from point O (in metre), will the liquid strike on the ground?

Space For Rough Work

Paragraph for Question no. 9 to 10

Consider a planet of radius r having density λ. A tunnel is dug inside it at a distance r/2 from it's centre as shown in figure. An object of mass m is left in the tunnel at the surface at t = 0 , then



9. Time taken by the object to reach the centre of the tunnel will be $k\sqrt{\frac{3\pi}{G\lambda}}$. Find the value of 'k'.

10. Normal reaction applied by wall of the tunnel on the object when object is at a distance x from the centre of tunnel is $\frac{x}{y}\pi G\lambda rm$. Find x + y.

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. Which produces the minimum number of products when reacts with water?
   (A) Li_2O_2 (B) Li_3N
   (C) Li_2O (D) LiH

2. The solubility product of silver acetate(CH_3COOAg) in pure water is 2×10^{-3}. What will be its solubility in a basic buffer?
   (A) more than $\sqrt{2\times10^{-3}}$ (B) less than $\sqrt{2\times10^{-3}}$
   (C) equal to $\sqrt{2\times10^{-3}}$ (D) unpredictable

3. Which sodium compound can readily form H_2 gas when it reacts with water?
   (A) Na_2O_2 (B) NaOH
   (C) NaH (D) Na_2O

4. $A(g) \rightleftharpoons B(g) + C(g)$
   One mole each of A, B and C gases are taken in a one litre container. At equilibrium the concentration of A is found to be 0.8 M. How many moles of A should be added at equilibrium so that the concentration of C becomes 1.4 M?
   (A) 0.72 (B) 0.48
   (C) 0.96 (D) 0.26

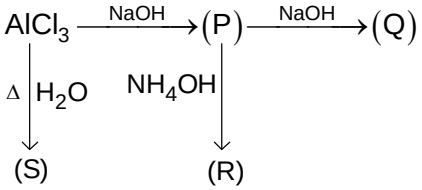
(One or More Than One Options Correct Type)

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. The pH of which of the following solution(s) do(es) not depend on concentration?
   (A) $NaNO_3$ (B) $NaHCO_3$
   (C) CH_3COONH_4 (D) Na_2SO_4

6. The correct statement(s) regarding B_2H_6 is/are
   (A) 12 electrons are involved in bonding
   (B) two types of sigma bonds are present
   (C) reacts with water forming O_2 and H_3BO_3
   (D) $H_4B_4O_7$ is formed when it is heated in presence of moisture

Space For Rough Work

7. 

The correct statement(s) is/are

(A) S in Al_2O_3 (B) P is $Al(OH)_3$

(C) Q is $NaAlO_2$ (D) R is not a product

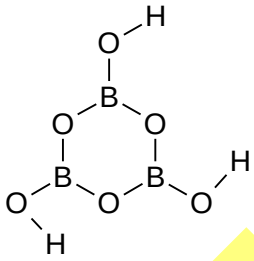
(PART – B)

(Non – Negative Integer)

1. (43×10^{-7}) gram of $Be(OH)_2$ is required to form a saturated solution in water of volume one litre. If the solubility product(K_{sp}) of $Be(OH)_2$ is expressed as $y \times 10^{-21}$, what is the value of y?

2. What is the pH of 10^{-4} M NaOH solution in water at 298 K?

3. An oxy-acid of boron has the following structure in aqueous solution.



What is the molar mass(in g mol^{-1}) of the monomer of the cyclic trimer. The monomer are obtained by heating the trimer?

4. How many maximum number of Na^+ ions are formed by heating sodium pyrosilicate?

5. $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

The partial pressure of O_2 at equilibrium is 0.5 atm and the partial pressures of SO_2 and SO_3 are same at equilibrium. Then, the equilibrium constant K_P is

6. How many total number of electrons do not participate in bonding according to valence bond theory?

Space For Rough Work

(PART – B)

This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Paragraph for Question no. 7 to 8

The process of preferential precipitation of one ion in presence of another by adding another ion of opposite charge is called selective precipitation. A solution contains 0.01 M of Cl^- and Br^- ions. The ions are precipitated as AgCl and AgI by adding $AgNO_3$ solution.

K_{sp} of AgCl = 1×10^{-10}

K_{sp} of AgBr = 1×10^{-13}

7. The percentage of $[Br^-]$ left unprecipitated when the Cl^- ions start precipitation is:

8. The percentage of Br^- ions precipitated when Cl^- starts to precipitate as AgCl is:

Paragraph for Question no. 9 to 10

The decomposition reactions involving solid reactants and gaseous products take place in a closed container for achieving equilibrium. One example of such reaction is

$$4A(s) \rightleftharpoons 2B(g) + 3C(g)$$

The equilibrium constant K_P of the reaction is 1.08×10^{-3} atm^5 at 298 K.

9. What is the partial pressure of B(g) at equilibrium in atm unit?

10. What is the equilibrium pressure in atm unit?

Space For Rough Work

SECTION – III: MATHEMATICS

(PART – A)

(Single Correct Answer Type)

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

1. Ellipses are described with line segment AB as the fixed major axis. The locus of an end of a latus rectum is:
   (A) straight line (B) parabola
   (C) circle (D) ellipse

2. The eccentricity of the conic represented by $x^2 - y^2 - 4x + 4y + 16 = 0$ is
   (A) 1 (B) $\frac{1}{2}$
   (C) –1 (D) $\sqrt{2}$

3. If the arithmetic mean of the roots of a quadratic equation is 7 and the arithmetic mean of their reciprocal is $\frac{7}{2}$, then the quadratic equation is
   (A) $x^2 - 7x + 2 = 0$ (B) $x^2 - 14x + 2 = 0$
   (C) $x^2 - 14x + 4 = 0$ (D) $x^2 - 7x + 4 = 0$

4. If a, b, c are positive real numbers such that $a + b + c = 3$, then the minimum value of $\frac{a}{6-a} + \frac{b}{6-b} + \frac{c}{6-c}$ is
   (A) $\frac{1}{5}$ (B) $\frac{1}{3}$ (C) $\frac{3}{5}$ (D) $\frac{4}{5}$

(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. If the tangent at the point $\left(4\cos\theta, \frac{16\sin\theta}{\sqrt{11}}\right)$ to ellipse $16x^2 + 11y^2 = 256$ is also tangent to circle $x^2 + y^2 - 2x = 15$, then θ equals:
   (A) $\frac{\pi}{3}$ (B) $\frac{2\pi}{3}$ (C) $\frac{5\pi}{6}$ (D) $\frac{5\pi}{3}$

Space For Rough Work

6. The equation $\frac{x^2}{10-\lambda}+\frac{y^2}{6-\lambda}=1$ represents

(A) a hyperbola if $\lambda<6$ (B) an ellipse if $\lambda>6$

(C) a hyperbola if $6<\lambda<10$ (D) an ellipse if $0<\lambda<6$

7. Let $f(x)=\left(e^x+2x\right)^{\frac{3}{x}}$, then

(A) $\lim\limits_{x\to0} f(x)=9$ (B) $\lim\limits_{x\to+\infty} f(x)=e^3$

(C) $\lim\limits_{x\to0} f(x)=e^9$ (D) $\lim\limits_{x\to+\infty} f(x)=3$

(PART – B)
(Non – Negative Integer)

1. A tangent to the ellipse $x^2+4y^2=4$ meets the ellipse $x^2+2y^2=6$ at P and Q. Let angle between tangents at P and Q of the ellipse $x^2+2y^2=6$ is $\frac{\pi}{k}$, then k =

2. If $y=(1+x)(1+x^2)(1+x^4).....(1+x^{2^n})$, then $\frac{dy}{dx}$ at y = 0 is:

3. Number of real values of x in $[-2\pi, 2\pi]$ for which value of the expression $y=\sqrt{2\sin x}-\sin x$ is maximum, is:

4. Find the number of solutions satisfying the equation $\cos\frac{x}{2}-\sin\frac{x}{2}=\sin x-1$, where $|x-\pi|\le\frac{3\pi}{9}$.

5. Let $S=\frac{3}{2}+\frac{3}{6}+\frac{3}{12}+\frac{3}{20}+....\infty$ then S is equal to

6. The value of $\lim\limits_{x\to0}\frac{(1-\cos2x)(3+\cos x)}{x\tan4x}$ is equal to

Space For Rough Work

(PART – B)

This section contains Two paragraphs. Each paragraph having TWO questions Numerical answer type with answer XXXX.XX. For each question, enter the correct numerical value. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Paragraph for Question no. 7 to 8

Let the quantities 1, $\log_y x, \log_z y$ and $-15\log_x z$ be the first four terms of an arithmetical progression with common difference d. All terms of the A.P. being real.

7. The value of $\left(xz^{-3} + xy + yz^3\right)$ is equal to

8. Magnitude of the sum of the first 25 terms of the A.P. is equal to

Paragraph for Question no. 9 to 10

If the normals at $(x_i, y_i), i = 1,2,3,4$ on the rectangular hyperbola $xy = c^2$, meet at the point (α, β).

9. The value of $\sum x_i$ is equals to $\alpha^k\beta^p$ where $k + p =$

10. The value of $\sum y_i$ is equals to $\alpha^k\beta^p$ where $k + p =$

Space For Rough Work

FIITJEE INTERNAL TEST

BATCHES: PANINI426-G1, A1, A2 & B1_PT-3

Paper – 2

Code: 100895

JEE ADVANCED LEVEL

ANSWER KEY

ANSWER KEYS

Physics

PART – A

1.	D	2.	C	3.	D	4.	C
5.	ABD	6.	BD	7.	AC		

PART – B

1.	6	2.	4	3.	0	4.	40
5.	3	6.	1	7.	4.96 (range: 4.94 to 4.98)		
8.	3.95 (range: 3.93 to 3.97)			9.	0.25	10.	5

Chemistry

PART – A

1.	C	2.	B	3.	C	4.	B
5.	ABCD	6.	AB	7.	ABCD		

PART – B

1.	4	2.	10	3.	44	4.	3
5.	2	6.	18	7.	0.1	8.	99.9
9.	0.2	10.	0.5				

Mathematics

PART – A

1.	B	2.	D	3.	B	4.	C
5.	AD	6.	CD	7.	BC		

PART – B

1.	2	2.	1	3.	4	4.	4
5.	3	6.	2	7.	3	8.	575
9.	1	10.	1				