# FIITJEE INTERNAL Phase Test

BATCHES – PANINI426-G1 & PANINI426-A1-A2_PT-2

## PHYSICS, CHEMISTRY & MATHEMATICS

**QP CODE: 100815** | **Paper – 1**

**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 (08-11) –** 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:** _____

# SECTION – I: PHYSICS

## (PART – A)

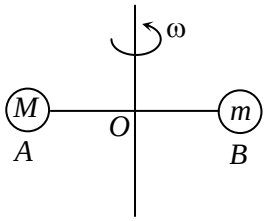
**(Single Correct Answer Type)**

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. Two bodies of mass 1 kg and 2 kg move towards each other in mutually perpendicular direction with the velocities 3 m/s and 2 m/s respectively. If the bodies stick together after collision the energy loss will be

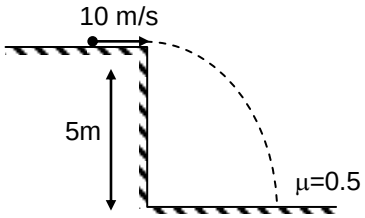
(A) 13 J (B) $\frac{13}{3}$ J (C) 8 J (D) 7 J

2. Two balls of mass *M* = 9 g and *m* = 3 g are attached by massless threads *AO* and *OB*. The length *AB* is 1 m. They are set in rotational motion in a horizontal plane about a vertical axis at *O* with constant angular velocity $\omega$. The ratio of length *AO* and *OB* $\left(\frac{AO}{OB}\right)$ for which the tension in threads are same will be



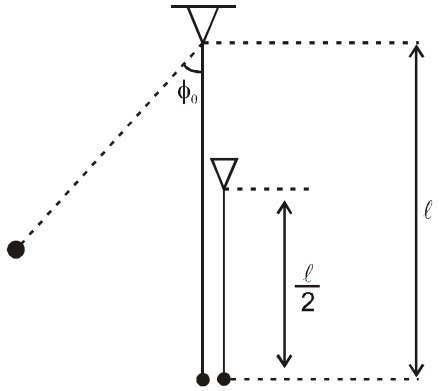

(A) $\frac{1}{3}$ (B) 3 (C) $\frac{2}{3}$ (D) $\frac{3}{2}$

3. A small ball moving with a velocity 10 m/s, horizontally (as shown in figure) strikes a rough horizontal surface having $\mu = 0.5$. If the coefficient of restitution is e = 0.4. Horizontal component of velocity of ball after first impact will be (g = 10 m/s$^2$)




(A) 10 m/s (B) 8 m/s
(C) 3 m/s (D) 4 m/s

4. There are two identical balls of mass m = 0.2 kg are suspended on two threads of lengths $\ell$ = 1m and $\frac{\ell}{2}$. The threads are made of the same material and in their vertical position the two balls touch each other. If the ball hanging on the longer thread is released from an initial angle $\phi$ = 60$^0$ with respect to the vertical, then the thread breaks just before the collision. What is the maximum initial angle from which this ball can be released to that none of the threads break after the totally elastic collision?




(A) $\cos^{-1}\left(\frac{3}{4}\right)$ (B) $\sin^{-1}\left(\frac{3}{4}\right)$ (C) $\tan^{-1}\left(\frac{3}{4}\right)$ (D) None of these

***Space For Rough Work***

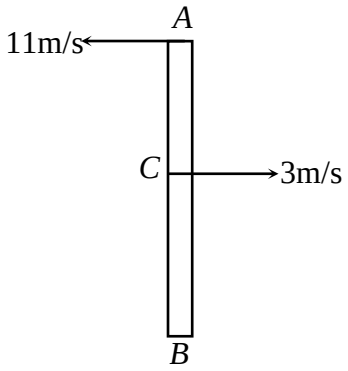
**(One or More Than One Options Correct Type)**

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. Two particles, *P* of mass 2*m* and *Q* of mass *m*, are subjected to mutual force of attraction and no other force acts on them. At *t* = 0, *P* is at rest at point *O* and *Q* is moving away from *O* with a speed 5*u*. At a later instant *t* = *T* (before any collision has taken place), *Q* is moving towards *O* with speed *u*. Then
(A) momentum of particle *P* at *t* = *T* is zero.
(B) momentum of particle *P* at *t* = *T* is 6 *mu.*
(C) work done by the force of attraction during $0 \le t \le T$ is 12 $mu^2$.
(D) work done by the force of attraction during $0 \le t \le T$ is –3 $mu^2$.

6. Velocity of a particle of mass 2 kg. changes from $V_1 = -2\hat{i} - 2\hat{j}\ m/s$ to $\vec{V}_2 = (\hat{i} - \hat{j})$ m/s after colliding with a plane surface.
(A) The angle made by the plane surface with positive x axis is $90^0 + \tan^{-1}\left(\frac{1}{3}\right)$
(B) The angle made by the plane surface with the positive x axis is $\tan^{-1}\left(\frac{1}{3}\right)$
(C) The direction of change in momentum makes an angle $\tan^{-1}\left(\frac{1}{3}\right)$ with the positive x-axis
(D) The direction of change in momentum makes an angle $90^0 + \tan^{-1}\left(\frac{1}{3}\right)$ with the plane surface.

7. A uniform rod *AB* of length 7 m is undergoing combined rotational and translational motion such that, at some instant of time, velocities of its end point *A* and centre *C* are both perpendicular to the rod and opposite in direction, having magnitude 11 m/s and 3 m/s respectively as shown in the figure. Velocity of centre *C* and angular velocity of the rod remains constant
(A) acceleration of point *A* is 56 m/s$^2$
(B) acceleration of point *B* is 56 m/s$^2$
(C) at the instant shown in the figure acceleration of point *B* is more than that of point *A*.
(D) angular velocity of the rod is 4 rad/sec

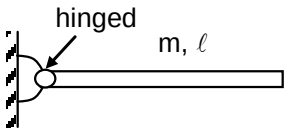



***Space For Rough Work***

**(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. A uniform rod of mass m & length $\ell$ is released from rest in the position shown in figure. Rod is hinged at one end. It is free to rotate in vertical plane about hinge. Take length of rod $\ell$ = 1. Find the values in List-I when rod becomes vertical.



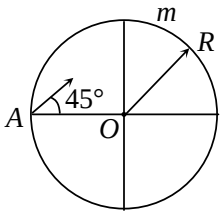

| List-I | | List-II | |
|---|---|---|---|
| (P) | Angular velocity of rod is | (1) | $\frac{3g}{2}$ |
| (Q) | Angular acceleration of rod is | (2) | 0 |
| (R) | Acceleration of centre of mass of rod is | (3) | $\frac{3g}{4}$ |
| (S) | Net force acting on rod is | (4) | $\sqrt{3g}$ |
| | | (5) | $\frac{3Mg}{4}$ |
| | | (6) | $\frac{3Mg}{2}$ |

When rod is vertical

(A) P $\rightarrow$ 4, Q $\rightarrow$ 2, R $\rightarrow$ 6, S $\rightarrow$ 3 (B) P $\rightarrow$ 4, Q $\rightarrow$ 2, R $\rightarrow$ 1, S $\rightarrow$ 6

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

9. 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 (particle is projected along the surface). Take: R = 1 m, *m* = 1 kg, v = 1 m/s, coefficient of restitution e = 1



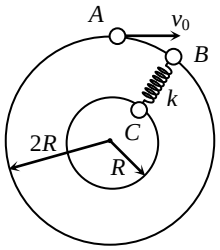

| List-I | | List-II | |
|---|---|---|---|
| (P) | $\frac{1}{\sqrt{2}}$ | (1) | The particle reaches the same point "A" on the ring after time t = |
| (Q) | $\sqrt{2}$ | (2) | Magnitude of impulse transferred during first collision. |
| (R) | $2\sqrt{2}$ | (3) | Magnitude of impulse transferred during second collision. |
| (S) | $4\sqrt{2}$ | (4) | Time taken by particle to reach a point diametrically opposite to A on the ring. |
| | | (5) | Time taken by particle to hit the ring for the first time. |

The correct option is:

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

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

10. Three particles each of mass *m*, can slide on fixed frictionless circular tracks in the same horizontal plane as shown. Particle *A* moves with velocity $v_0$ and hits particle *B* elastically. Assuming that *B* and *C* are initially at rest and lie along a radial line and the spring is initially relaxed before impact, then

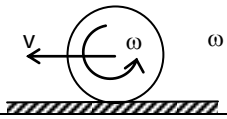
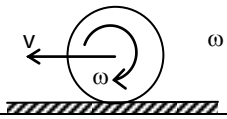
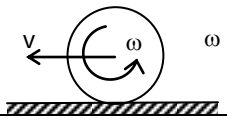
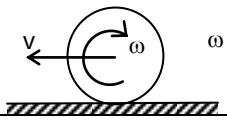



Given: $v_0$ = 1 m/s, m = 5 kg, K = 16 N/m

| List-I | | List-II | |
|---|---|---|---|
| (P) | 1.0 | (1) | Maximum stretch in the spring |
| (Q) | 0.4 | (2) | Velocity of B when the stretch in the spring is maximum |
| (R) | 0.8 | (3) | Velocity of "B" immediately after impact. |
| (S) | 0.25 | (4) | Velocity of "C" when stretch in the spring is maximum |
| | | (5) | Half of maximum potential energy stored in the spring |

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

11. Matching the list-I to the correct option of list-II.

| List-I | | List-II (When rolling without slipping begins) | |
|---|---|---|---|
| (P) |   $\omega = \frac{2v}{R}$ | (1) | $v_{cm}$ is towards left in case of uniform ring. |
| (Q) |   $\omega = \frac{2v}{R}$ | (2) | $v_{cm}$ is towards left in case of solid uniform sphere |
| (R) |   $\omega = \frac{v}{2R}$ | (3) | $v_{cm}$ is towards right in case of uniform ring. |
| (S) |   $\omega = \frac{v}{2R}$ | (4) | $v_{cm}$ is towards right in case of solid uniform sphere. |

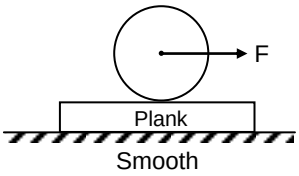
The correct option is:
(A) P → 1,2 ; Q → 2,3 ; R → 1,2 ; S → 1,2 (B) P → 1,3 ; Q → 2,3 ; R → 1,4 ; S → 2,4
(C) P → 1,2 ; Q → 3,4 ; R → 3,4 ; S → 1,2 (D) P → 1,4 ; Q → 3,4 ; R → 1,2 ; S → 2,4

***Space For Rough Work***

## (PART – B)

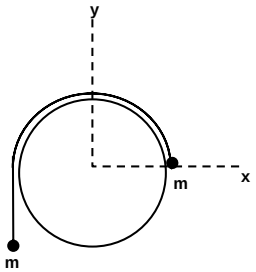
**(Non – Negative Integer)**

1. A solid cylinder of mass m is placed over a plank of same mass as shown in figure. The plank is placed on smooth horizontal surface. There is sufficient friction between cylinder and plank to prevent slipping. If a force is applied at the centre of the cylinder then find the ratio of magnitude of acceleration of cylinder to magnitude of the acceleration of the plank.

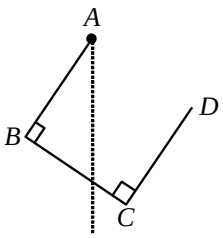



2. A monkey of mass m is sitting on a platform of mass M. Monkey can jump with a velocity of 5 m/s making an angle $37^0$ with the horizontal with respect to platform. If value of m/M is 'x' for the monkey to jump 1 meter with respect to the ground, the value of 'x' is $\left(\frac{n}{10}\right)$, then value of 'n' is _____.

3. Figure shows a smooth cylindrical pulley of radius R with centre at origin of co-ordinates. An ideal thread is thrown over it on the two parts of ideal thread two identical masses are tied initially at rest with co-ordinates (R, 0) and (-R, -R) respectively. If mass at x-axis is given a slight upward jerk, it leaves contact with pulley at (R cos$\phi$, R sin$\phi$). Then find $\phi$/sin$\phi$.

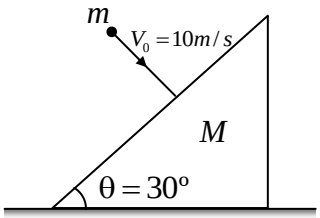



4. Three identical rods are joined and hinged at A as shown. If the angle made by the rod AB with the vertical in equilibrium is $\tan^{-1}\left(\frac{k}{4}\right)$, find 'k'.




5. A ball moving with velocity $\hat{i}$ collides with a stationary wall and returns with a velocity $\hat{j}/2$ then the coefficient of restitution for this collision will be 2/n. Then the value of 'n' is _____.

6. A ball of mass 1 kg moving with velocity 10 m/s collides perpendicularly on a smooth stationary wedge of mass 2kg. If the coefficient of restitution is e = 7/20 then find the velocity of ball after the collision. [in $ms^{-1}$]



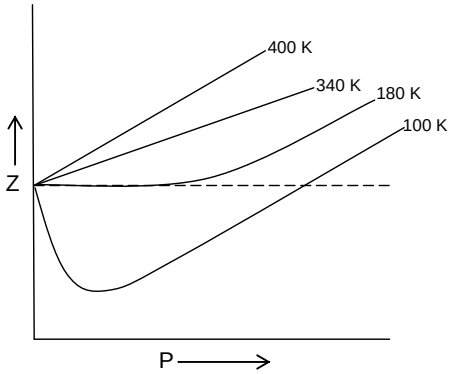

***Space For Rough Work***

# 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. 


In the above graph, the behaviour of an ideal gas at different temperature is given. The Boyle temperature of the graph is

(A) 100 K (B) 180 K
(C) 340 K (D) 400 K

2. In which of the following substance(s) ion-dipole interaction is observed?

(A) HCl and $H_2O$ (B) Benzene and toluene
(C) NaCl and acetone (D) NaCl

3. Which of the following molecule has the highest dipole moment?

(A) $BF_3$ (B) $PCl_3$
(C) $CH_4$ (D) $CO_2$

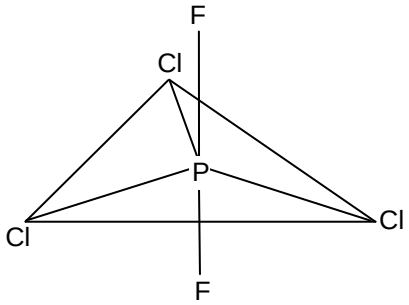
4. According to Maxwell's velocity distribution curve, which of the following characteristic is observed if the temperature is decreased?

(A) Number of molecules having higher velocity increases
(B) Fraction of molecules having lower velocity increases
(C) Area under the distribution curve decreases
(D) The most probable velocity increases

***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. 


Choose correct statement(s) for the molecule $PF_2Cl_3$.

(A) P – F bonds are formed by hybrid orbitals having less% of s-orbital character than P – Cl bonds.

(B) The bond angles like $90^o$, $120^o$ and $180^o$ are observed in it.

(C) Phosphorus undergoes $sp^3d$ hybridization by using the $3d_{z^2}$ orbital, if the P – Cl bonds are present in the XY-plane

(D) It's dipole moment is greater than zero

6. $A_2(g) + 2B(g) \longrightarrow 2AB(g)$

The rate equation of the reaction is

Rate = $k[A_2]^2[B]$

Choose correct statement(s)

(A) The overall order of the reaction is three

(B) It is an elementary reaction

(C) The rate of reaction will increase by eight times if the volume of reaction container is reduced to half of it's initial volume

(D) The concentration of 'B' will increase by four times if the volume of reaction container is reduced to $\frac{1}{4}$ of its initial volume

7. $Br_2$ and $Cl_2$ exist respectively as liquid and gas at room temperature and 1 bar pressure, so the standard enthalpy of formation ($\Delta_f H^o$) of which species is/are zero?

(A) $Br_2$ liquid (B) $Cl_2$ gas

(C) Br liquid (D) Cl gas

***Space For Rough Work***

**(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 (Chemical species)** | | **List– II (Bond order according to VBT)** | |
|---|---|---|---|
| (P) | $SO_4^{2-}$ | (1) | 2 |
| (Q) | $PO_4^{3-}$ | (2) | 1.33 |
| (R) | $CO_3^{2-}$ | (3) | 1.5 |
| (S) | $SO_3$ | (4) | 1.25 |
| | | (5) | 1.4 |

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

9. Match the lists.

| **List – I (Compressibility factor of gases)** | | **List– II (Behaviour of gases)** | |
|---|---|---|---|
| (P) | Z > 1 | (1) | Gas shows ideal behaviour |
| (Q) | Z < 1 | (2) | Gas is under critical condition, i.e. $T_C$, $V_C$ and $P_C$ |
| (R) | Z = 1 | (3) | $\frac{a}{V^2}$ is neglected from van der Waal's equation |
| (S) | Z = 0.375 | (4) | 'b' is neglected from van der Waal's equation |
| | | (5) | Gas occupy 22.4 L volume at NPT |

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

10. Match the lists.

| **List – I (Order of reactions)** | | **List– II ($t_{½}$ = 12 minute time needed for 75% completion of reaction)** | |
|---|---|---|---|
| (P) | Zero order | (1) | 36 minutes |
| (Q) | First order | (2) | 18 minutes |
| (R) | Second order | (3) | 48 minutes |
| (S) | Third order | (4) | 24 minutes |
| | | (5) | 144 minutes |

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

***Space For Rough Work***

11. Match the lists.

| List – I (Reversible thermodynamic processes) | | List– II (Characteristics) | |
|---|---|---|---|
| (P) | Isothermal process | (1) | Expansion work decreases temperature of the system |
| (Q) | Adiabatic process | (2) | No PV work is done |
| (R) | Isobaric process | (3) | Temperature remains constant during work done by the system |
| (S) | Isochoric process | (4) | Work is done at constant pressure |
| | | (5) | Total work done is zero |

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

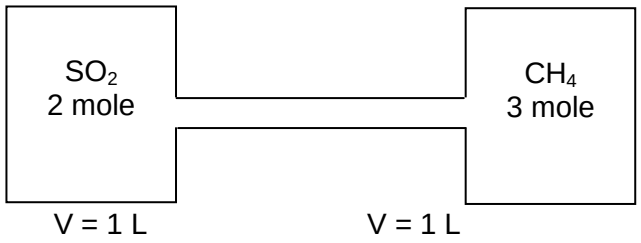
## (PART – B)

**(Non – Negative Integer)**

1. According to molecular orbital theory, the electronic configuration of $O_2$ is
$\sigma_{1s}^2\sigma_{1s}^{*2}\sigma_{2s}^2\sigma_{2s}^{*2}\sigma_{2p_z}^2\pi_{2p_x}^2 = \pi_{2p_y}^2\pi_{2p_x}^{*1} = \pi_{2p_y}^{*1}\sigma_{2p_z}^{*}$
If x is the number of electrons present in the orbital(s) which has(ve) two nodal planes, and y is the bond order of $O_2$, what is the value of (x + y)

2. What is the most probable velocity of an ideal gas (At. Wt = 40 g $mol^{-1}$) at 100 K in $ms^{-1}$ unit?
[R = 8 J $K^{-1}$ $mol^{-1}$]

3.




During effusion at constant temperature $SO_2$ gas meets $CH_4$ at a distance of 2.5 cm from $SO_2$ end. What is the length of the tube in cm unit?

***Space For Rough Work***

4. The rate constant(k) and frequency factor (A) of a reaction are respectively $6 \times 10^{-4}$ time$^{-1}$ and $7.2 \times 10^{-3}$ time$^{-1}$. If the fraction of reactant molecules crossing the energy barrier is $\frac{1}{2x}$ what is the value of x?

5. The entropy of $\frac{1}{2.303}$ moles of an ideal gas in a container is 2 J $K^{-1}$ mol$^{-1}$. What will be its entropy (in J $K^{-1}$ mol$^{-1}$ unit) if the container volume is increased to 10 times at constant temperature in a reversible manner?
[Assume R = 8 J $K^{-1}$ mol$^{-1}$]

6. Bond energy of A – A = 100 kJ mol$^{-1}$
Bond energy of B – B = 120 kJ mol$^{-1}$
Bond energy of A – B = 200 kJ mol$^{-1}$
If the enthalpy change of the reaction
$A_2(g) + 2B_2(g) \longrightarrow 2AB_2(g)$ is expressed as –x kJ, what is x?

***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. Lines $(1+\lambda)x+(4-\lambda)y+(2+\lambda)=0$ and $(4-\lambda)x-(1+\lambda)y+(6-3\lambda)=0$ are concurrent at points A and B respectively and intersect at C, then locus of centroid of $\Delta ABC$ is

(A) $\left(x+\frac{3}{2}\right)^2+\left(y+\frac{7}{10}\right)^2=\frac{17}{50}$ (B) $\left(x-\frac{3}{2}\right)^2+\left(y-\frac{7}{10}\right)^2=\frac{17}{50}$

(C) $\left(x-\frac{3}{2}\right)^2+\left(y+\frac{7}{10}\right)^2=\frac{17}{50}$ (D) $\left(x+\frac{3}{2}\right)^2+\left(y+\frac{7}{10}\right)^2=\frac{17}{450}$

2. Let $C_1 : x^2 + y^2 = 1$; $C_2$: $(x - 10)^2 + y^2 = 1$ and $C_3$: $x^2 + y^2 - 10x - 42y + 457 = 0$ be three circles. A circle $C$ has been drawn to touch circles $C_1$ and $C_2$ externally and $C_3$ internally. Now circles $C_1$, $C_2$ and $C_3$ start rolling on the circumference of circle $C$ in anticlockwise direction with constant speed. The centroid of the triangle formed by joining the centres of rolling circles $C_1$, $C_2$ and $C_3$ lies on

(A) $x^2 + y^2 - 12x - 22y + 144 = 0$ (B) $x^2 + y^2 - 10x - 24y + 144 = 0$

(C) $x^2 + y^2 - 8x - 20y + 64 = 0$ (D) $x^2 + y^2 - 4x - 2y - 4 = 0$

3. The locus of the vertex of the family of parabolas $y=\frac{a^3x^2}{3}+\frac{a^2x}{2}-2a$ (a is parameter) is

(A) $xy=\frac{105}{64}$ (B) $xy=\frac{3}{4}$

(C) $xy=\frac{35}{16}$ (D) $xy=\frac{64}{105}$

4. Let $f(x) = 2x^3 + ax^2 + bx$, $(a, b \in N)$, if graph of f(x) cuts the x–axis at 3 distinct points, then minimum value of $a^2 + b^2$ is

(A) 10 (B) 2

(C) 9 (D) 8

***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. Sides of a rhombus are parallel to the lines x + y – 1 = 0 and 7x – y – 5 = 0. It is given that diagonals of the rhombus intersect at (1, 3) and one vertex 'A' of the rhombus lies on the line y = 2x. Then the coordinates of the vertex A are

(A) $\left(\frac{8}{5}, \frac{16}{5}\right)$ (B) $\left(\frac{7}{15}, \frac{14}{15}\right)$

(C) $\left(\frac{6}{5}, \frac{12}{5}\right)$ (D) $\left(\frac{4}{15}, \frac{8}{15}\right)$

6. A (4, –2), B(–2, 4) and C(5, 5) are the vertices of a $\Delta ABC$. If the perpendicular bisector of BC meets the circumcircle at D. A and D are on the opposite side of BC. Then

(A) equation of AD is 3x – y = 14

(B) equation of AD is 3x + y = 10

(C) distance of AD from origin is $\sqrt{10}$

(D) area enclosed by AD with coordinate axes = $\frac{98}{3}$

7. 'P' is a point which moves in the xy plane such that the point 'P' is nearer to the centre of a square than any of the sides. The four vertices of the square are ($\pm$ a, $\pm$a). The region in which 'P' will move is bounded by parts of parabola of which one has the equation

(A) $y^2 = a^2 - 2ax$ (B) $y^2 = a^2 + 2ax$

(C) $x^2 = a^2 - 2ay$ (D) $x^2 = a^2 + 2ay$

**(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. Consider the family of lines $ax+by+c=0$ where $4a^2+9b^2-c^2+12ab=0$. Let 'p' denote distance of R (6, 8) from the line $ax+by+c=0$

Match the following:

| | List I (value of p) | | List II (No. of lines) |
|---|---|---|---|
| (P) | $p=\sqrt{41}$ | (1) | 1 |
| (Q) | $p=2/\sqrt{13}$ | (2) | 2 |
| (R) | $p=\sqrt{185}$ | (3) | 3 |
| (S) | $p=\sqrt{80}$ | (4) | 4 |
| | | (5) | 5 |

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

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

***Space For Rough Work***

9. Match the following:

| | List – I | | List – II |
|---|---|---|---|
| (P) | Length of side of an equilateral triangle with one vertex at origin and inscribed in the parabola $y^2 = 12x$ is | (1) | $18\sqrt{3}$ |
| (Q) | Length of chord through origin of parabola $y^2 = 12x$ and having slope 1 unit is | (2) | $24\sqrt{3}$ |
| (R) | Length of normal chord of the parabola $y^2 = 12x$ subtending a right angle at focus is | (3) | $7\sqrt{5}$ |
| (S) | Length of normal chord of the parabola $y^2 = 12x$ subtending a right angle at the vertex is | (4) | $12\sqrt{2}$ |
| | | (5) | $15\sqrt{5}$ |

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

10. Normals are drawn at points P, Q, R on the parabola $y^2 = 4x$, which intersect at $(3,0)$ then

| List – I | | List – II | |
|---|---|---|---|
| (P) | Area of $\Delta PQR$ is | (1) | 2 |
| (Q) | Radius of circumcircle of $\Delta PQR$ is | (2) | $\frac{5}{2}$ |
| (R) | Distance of the vertex of parabola from the centroid of $\Delta PQR$ is | (3) | $\frac{11}{6}$ |
| (S) | Distance of the centroid from the circumcenter of $\Delta PQR$ is | (4) | $\frac{2}{3}$ |
| | | (5) | 1 |

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

***Space For Rough Work***

11. Match the following

| | List – I | | List – II |
|---|---|---|---|
| (P) | The least positive integral values of $\lambda$ for which $(\lambda-2)x^2+8x+(\lambda+4)>0$, for all real x is | (1) | 3 |
| (Q) | The equation $x^2+2(a^2+1)x+(a^2-14a+48)=0$ possesses roots of opposite signs then x value of '$a$' can be | (2) | 5 |
| (R) | If the equation $ax^2+2bx+4c=16$ has no real roots and $a+c>b+4$, then integral value of *c* cannot be equal to | (3) | 7 |
| (S) | If N be the number of solution of the equation $\lvert x^2-x-6\rvert = x+2$ then the value of *N* is | (4) | 12 |
| | | (5) | 20 |

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

## (PART – B)

**(Non – Negative Integer)**

1. Let $M(-1,2)$ and $N(1,4)$ be two points in a plane rectangular coordinate system XOY. P is a moving point on the x-axis. When $\angle$MPN takes its maximum value, the x-coordinate of point P is

2. In triangle ABC, equation of side BC is $x-y=0$. Orthocentre and centroid of the triangle are (5,8) and $\left(3,\frac{14}{3}\right)$ respectively. If the diameter of circumcircle of the triangle is $\sqrt{10}\lambda$ then $\lambda$ equals

***Space For Rough Work***

3. Let $L_1 : x+y=0$ and $L_2 : x-y=0$ are tangents drawn to a parabola whose focus is at $S(1,2)$. If the length of latus rectum of the parabola can be expressed as $\frac{m}{\sqrt{n}}$ (m, n are coprime) then value of $m+n-2=$ _____

4. If the locus of the middle points of the chords of the parabola $y^2=2x$ which touches the circle $x^2+y^2-2x-4=0$ is given by $\left(y^2+1-x\right)^2=\lambda\left(1+y^2\right)$, then the value of "$\lambda$" = _____

5. The equation $2\left(\log_3 x\right)^2-\left|\log_3 x\right|+a=0$ has exactly four real solutions if $a\in\left(0,\frac{1}{K}\right)$, then the value of K is __

6. The set of real parameter '$a$' for which the equation $x^4-2ax^2+x+a^2-a=0$ has all real solutions, is given by $\left[\frac{m}{n},\infty\right)$ where *m* and *n* are relatively prime positive integers, then the value of $(m+n)$ is

***Space For Rough Work***

# FIITJEE INTERNAL TEST

## BATCHES – PANINI426-G1 & PANINI426-A1-A2_PT-2

## Paper – 1

## Code: 100815

## JEE ADVANCED LEVEL

## ANSWER KEY

### ANSWER KEYS

### Physics

**PART – A**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. | B | 2. | A | 3. | C | 4. | A |
| 5. | BD | 6. | AC | 7. | ABD | 8. | B |
| 9. | B | 10. | C | 11. | A | | |

**PART – B**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. | 3 | 2. | 14 | 3. | 2 | 4. | 3 |
| 5. | 8 | 6. | 2 | | | | |

### Chemistry

**PART – A**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. | B | 2. | C | 3. | B | 4. | B |
| 5. | ABC | 6. | ACD | 7. | AB | 8. | C |
| 9. | B | 10. | A | 11. | D | | |

**PART – B**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. | 4 | 2. | 200 | 3. | 10 | 4. | 6 |
| 5. | 10 | 6. | 460 | | | | |

### Mathematics

**PART – A**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. | A | 2. | B | 3. | A | 4. | A |
| 5. | AC | 6. | BC | 7. | ABCD | 8. | D |
| 9. | C | 10. | A | 11. | B | | |

**PART – B**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. | 1 | 2. | 4 | 3. | 9 | 4. | 5 |
| 5. | 8 | 6. | 7 | | | | |