FIITJEE INTERNAL Phase Test

PHYSICS, CHEMISTRY & MATHEMATICS

Pattern - CPT-2 | **QP CODE: 100040** | **PAPER - 2**

Time Allotted: 3 Hours **Maximum Marks: 186**

- 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.

Forthcoming Exam – BBE Test on 9th & 16th Oct. 2022

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 Parts**: **Part-A & B** in the 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 Part.

(i) **PART–A** (**01–08)** contains (8) Multiple Choice Questions which have **One or More 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 (09-12) –** This section contains Two (02) List-Match Sets, each List-Match set has Two (02) Multiple Choice Questions. Each List-Match set has two lists: List-I and List-II. 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 combination chosen and **-1 marks** for wrong options chosen.

(iii) **Part-B (01-06)** contains six (06) Numerical based questions, the answer of which maybe positive or negative numbers or decimals to **Two decimal places** (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) and each question carries **+3 marks** for correct answer. **There is no negative marking.**

Name of the Candidate :_____

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

Enrolment Number :_____

BATCH – NWCM2024O1S & O2S_PT-2

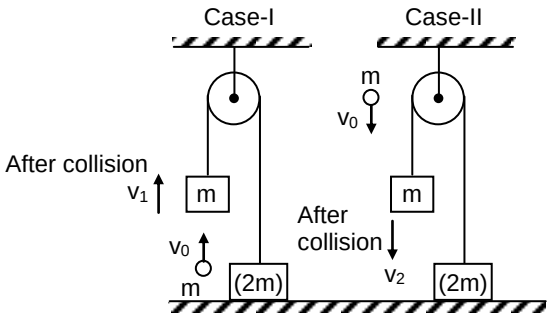
SECTION – I : PHYSICS

(PART – A)

(One or More Than One Options Correct Type)

This section contains **8 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D), out of which **ONE** or **MORE THAN ONE is correct.**

1. Two masses 2m and m are connected by an inextensible light string. The string is passing over a light frictionless pulley. The mass 2 m is resting on a surface and mass m is hanging in air as shown in figure. A particle of mass m strikes the mass m from below in case (I) with a velocity v_0 and in case (II) strikes mass m with a velocity v_0 from top and sticks to it in both case.



(A) The conservation of linear momentum can be applied in both the cases just before and just after collision, if we consider both bodies having mass m as system.

(B) The conservation of linear momentum can be applied in case I but cannot be applied in case II just before and just after collision, if we consider both bodies having mass m as system.

(C) The ratio of velocities of mass m just after collision in first and second cases i. e. $\frac{v_1}{v_2} = \frac{1}{2}$.

(D) The ratio of velocities of mass m just after collision in first and second case i.e. $\left(\frac{v_1}{v_2}\right) = 2$.

2. A particle of mass m can move in a force field. Potential energy U varies on location of the particle according to the following equation.

$$U = -k(x-a)^2(x-b)^2$$

Here k, a and b are positive constants. What can you conclude about small amplitude oscillations of the particle?

(A) It can oscillate about a three location with angular frequency $(b-a)\sqrt{2k/m}$.

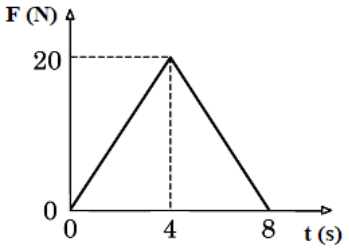
(B) It can oscillate about two different locations with angular frequency $(b-a)\sqrt{k/m}$.

(C) It can oscillate about a single location with angular frequency $(b-a)\sqrt{k/m}$.

(D) It can oscillate about two different locations with angular frequency $(b-a)\sqrt{2k/m}$.

Space For Rough Work

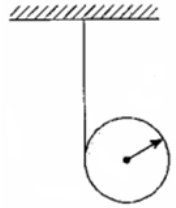
3. A box of mass 4 kg placed on a horizontal floor, is acted upon by a horizontal force F that varies with time t as shown in the given graph. If coefficients of static and kinetic frictions are 0.25, on which of the following conclusions can you arrive? (g = 10 m/sec^2)



(A) The box starts moving at the instant t = 2.0 s.
(B) The maximum velocity acquired by the box is 5.0 m/s.
(C) The box stops at the instant t = 9.0 s.
(D) Modulus of average power of the force F is more than that of the frictional force.

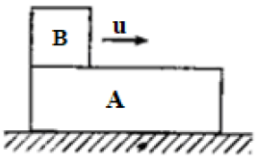
4. Consider that a ball falls from some height H on flat horizontal surface with coefficient of restitution e between ball and the surface. Ball rebounds again and again till it finally stops.
(A) Height attained after n^{th} strike $e^{2n-1}H$
(B) Height attained after n^{th} strike $e^{2n}H$
(C) Total distance covered by the particle is $H\left(\frac{1+e^2}{1-e^2}\right)$
(D) Total distance covered by the particle is $\frac{H}{2}\left(\frac{1+e^2}{1-e^2}\right)$

5. A sting is wrapped over a uniform cylinder, as shown in diagram (side view). When cylinder is released, string unwraps without any slipping and cylinder comes down. Which of the following is true?



(A) Work done by Tension force on the cylinder is zero.
(B) Work done by the Tension is negative.
(C) Ratio of rotational kinetic energy and translational kinetic energy is $\frac{1}{2}$.
(D) Ratio of rotational kinetic energy to translational kinetic energy is 2.

6. A long block A is at rest on a smooth horizontal surface. A small block B, whose mass is half of A, is placed on A at one end and projected along A with some velocity u. The coefficient of friction between the blocks is μ:



(A) The blocks will reach the final common velocity $\frac{u}{3}$.
(B) The work done against friction is two-thirds of the initial kinetic energy of B.
(C) Before the block reach a common velocity, the acceleration of A relative to B is $\frac{2}{3}\mu g$.
(D) Before the blocks reach a common velocity the acceleration of A relative B is $\frac{3}{2}\mu g$.

Space For Rough Work

7. Velocity of a particle of mass 2 kg changes from $\vec{v}_1 = (2\hat{i} + 2\hat{j})$ 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 the positive x-axis is $90^o + \tan^{-1}\left(\frac{1}{3}\right)$

(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 90° with the plane surface.

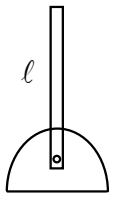
(D) the direction of change in momentum makes an angle $90^o + \tan^{-1}\left(\frac{1}{3}\right)$ with the plane surface.

8. A particle is oscillating with frequency f. (Assume no dapping effects)
(A) Its potential energy varies periodically with frequency 2f.
(B) Its kinetic energy varies periodically with frequency 2f.
(C) Its total mechanical energy (potential energy + kinetic energy) varies periodically with period 4f.
(D) Its total mechanical energy is constant.

This section contains **2 List-Match Sets**, each List-Match set has **2 Multiple Choice Questions**. Each List-Match set has two lists: List-I and List-II. 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.

List Match Set (09-10)

A uniform rod of mass m and length ℓ released from the position shown in figure and it start rotating in vertical plane about hinge. (g = 10 m/sec^2)



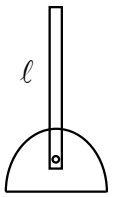
List-I		List-II	
(I)	Angular velocity of rod.	(P)	15
(II)	Normal reaction in vertical direction.	(Q)	3
(III)	Velocity of point P at distance r from hinge.	(R)	4
(IV)	Centripetal force on centre of mass	(S)	2.5

9. Mass of rod 1 kg, length $\ell = \frac{10}{3}$ meter, angular displacement θ = 90°, $r = \frac{4}{3}$ meter

(A) I $\rightarrow$ Q ; II $\rightarrow$ S ; III $\rightarrow$ R ; IV $\rightarrow$ P (B) I $\rightarrow$ S ; II $\rightarrow$ R ; III $\rightarrow$ P ; IV $\rightarrow$ Q
(C) I $\rightarrow$ S ; II $\rightarrow$ R ; III $\rightarrow$ Q ; IV $\rightarrow$ P (D) I $\rightarrow$ Q ; II $\rightarrow$ S ; III $\rightarrow$ P ; IV $\rightarrow$ R

Space For Rough Work

A uniform rod of mass m and length ℓ released from the position shown in figure and it start rotating in vertical plane about hinge. (g = 10 m/sec^2)

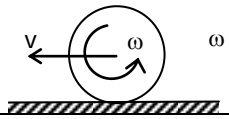
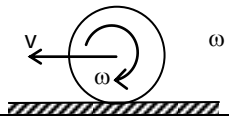
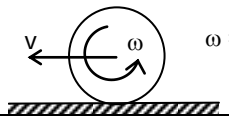
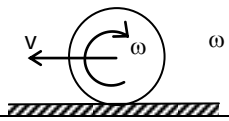


List-I		List-II	
(I)	Angular velocity of rod.	(P)	15
(II)	Normal reaction in vertical direction.	(Q)	3
(III)	Velocity of point P at distance r from hinge.	(R)	4
(IV)	Centripetal force on centre of mass	(S)	2.5

10. Mass of rod = $\frac{1}{10}$kg, length of rod $\ell = \frac{4}{15}$ meter, angular displacement θ = 180°, r = $\frac{1}{6}$ meter.

(A) I $\rightarrow$ Q ; II $\rightarrow$ S ; III $\rightarrow$ P ; IV $\rightarrow$ R
(B) I $\rightarrow$ Q ; II $\rightarrow$ P ; III $\rightarrow$ R ; IV $\rightarrow$ Q
(C) I $\rightarrow$ P ; II $\rightarrow$ R ; III $\rightarrow$ Q ; IV $\rightarrow$ S
(D) I $\rightarrow$ P ; II $\rightarrow$ R ; III $\rightarrow$ S ; IV $\rightarrow$ Q

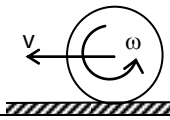
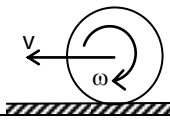
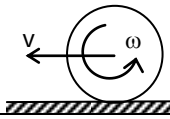
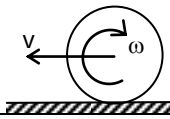
List Match Set (11-12)

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

11. Identify the correct option.

(A) C – QR; D – RS
(B) A – PQ; B – QR
(C) A – PR; B – PR
(D) A – RS; B – QS

Space For Rough Work

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

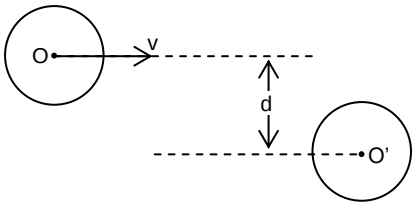
12. Identify the correct option.
(A) C – QR; D – PR (B) A – QR; B – PQ
(C) C – PQ; D – PQ (D) A – QR; B – PS

(PART – B)

(Integer Type)

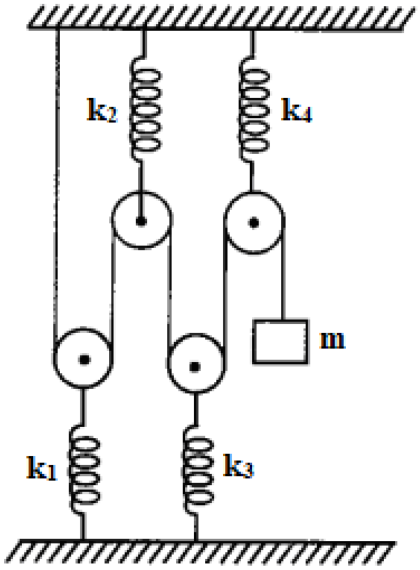
Part-C (01-06) contains six (06) Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) and each question carries **+4 marks** for correct answer and **there will be no negative marking.**

1. A disc of radius r and mass m moving on perfectly smooth surface at a speed v= $\frac{15}{\sqrt{17}}$ m/s undergoes an elastic collision with an identical stationary disc of mass 2m. The magnitude of velocity (in m/s) of the first disc after the collision will be(given d= $\frac{8r}{5}$)



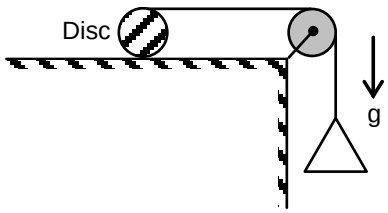
Space For Rough Work

2. In the arrangement shown in given below figure, pulleys are small and light and springs are ideal and $K_1 = 25\ \pi^2$ N/m, $K_2 = 2K_1$, $K_3 = 3K_1$ and $K_4 = 4K_1$ are the force constants of the springs. Calculate the period of small vertical oscillations of block of mass m = 3 kg.



3. A particle of mass m is subjected to an attractive central force of magnitude k/r^2, k being a constant. If at the instant when the particle is at an extreme position in its closed orbit, at a maximum distance a from the centre of central force, its speed is $\sqrt{(k/2ma)}$, if the distance of other extreme position is 'b'. Find a/b.

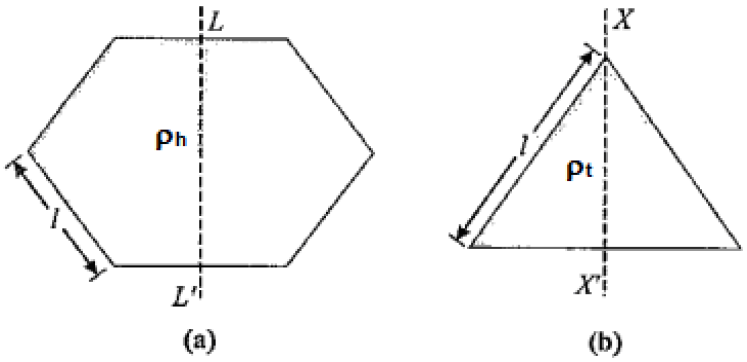
4. In the adjacent figure a light and thin string is wound in a uniform disc of mass m and radius r very tightly. The disc is kept at rest in vertical position on a rough horizontal surface and string passes over a fixed pulley. A light pan is attached to the free end of the string. The maximum mass that can be placed on the pan so that disc will not slip is equal to = mK/2. Find value of 'K'. coefficient of friction between the surface and the disc is 0.1 and there is no friction between string and pulley.



Space For Rough Work

5. A satellite is describing a circular orbit around a massive planet of radius R. The altitude of the satellite above surface of planet is 3R and its speed is v_0. To place the satellite in an elliptical orbit which will bring it closer to the planet, its velocity is reduced from v_0 to βv_0, when $\beta < 1$. The smallest permissible vale of β if satellite is not to crash on the surface of planet is $\sqrt{\frac{2}{K}}$, find K.

6. Moment of inertia of a uniform hexagonal plate about an axis LL′ is 'I' as shown in the given below figure. The moment of inertia (about axis XX′) of an equilateral uniform triangular plate of thickness double that of the hexagonal plate is I_1 (Ratio of specific gravity $\frac{\rho_t}{\rho_h} = 3$): Find $\left(\frac{I_1}{I}\right)$



Space For Rough Work

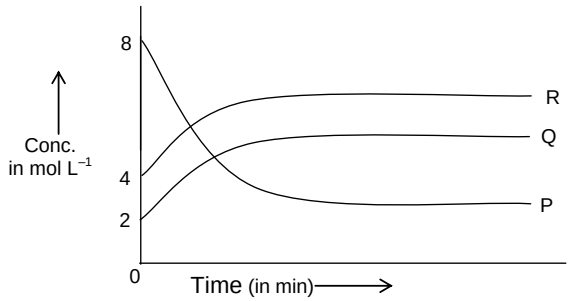
SECTION - II : CHEMISTRY

(PART – A)

(One or More Than One Options Correct Type)

This section contains **8 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D), out of which **ONE** or **MORE THAN ONE is correct.**

1. $HCN(K_a = 10^{-10})$, $NH_4OH(K_b = 10^{-5})$
Choose correct statement(s) related with the above acid and base.
(A) the degree of dissociation of 0.1 M solution of NH_4OH is greater than that of 0.1 M solution of HCN.
(B) HCN is less acidic than $NH_4^{\oplus}$
(C) Reaction between HCN and NH_4OH forms a salt. The pH of the aqueous solution of that salt is independent of concentration
(D) 200 mL of 0.2 M HCN can completely react with 200 mL of 0.2 M NH_4OH forming 0.04 mole of NH_4CN

2. 

In reaction $P(g) \rightleftharpoons Q(g) + R(g)$ which is represented in above figure, the reactant undergoes 50% reaction at equilibrium.
Choose correct statement(s)
(A) the equilibrium constant K_c is 12
(B) if in a container 0.1 mole of each of P, Q and R are taken, then the forward reaction will be favoured
(C) at equilibrium the concentration of P, Q and R are same
(D) it is a homogeneous equilibrium

3. Under which condition(s), the rate constant is independent of temperature?
(A) Activation energy(E_a) = zero
(B) No bond breaking is required
(C) Heterogeneous reactions containing solid phases
(D) Zero order reactions

Space For Rough Work

4. $H_2O(\ell) \rightleftharpoons H^+(aq) + OH^-(aq)$

K_w at 25°C = 1×10^{-14}

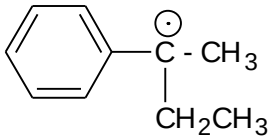
Choose correct statement(s) for above reaction at 25°C

(A) $[H_2O] = [H^+] + [OH^-]$

(B) K_{eq}(ionization) = 1.8×10^{-16}

(C) H^+ and OH^- undergo extensive hydrolysis in water

(D) H^+ and OH^- undergo extensive hydration in water

5. 

The correct statement(s) for above free radical is/are

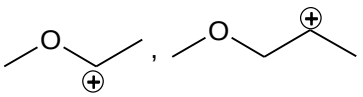
(A) it gains stability due to hyperconjugation and resonance effects.

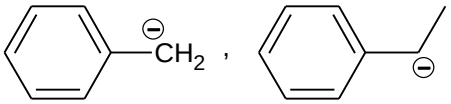
(B) it is an electron deficient intermediate.

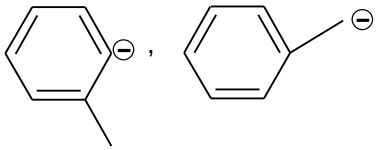
(C) the intermediate can form sigma as well as pi-bonds with another free radical.

(D) the activation energy for the reaction between two such free radicals is zero.

6. In which option(s), the left hand side reaction intermediate is more stable than the right hand side intermediate?

(A) 

(B) 

(C) 

(D) $F - CH_2^{\oplus}$, $Cl - \overset{\oplus}{C}H_2$

7. $Mg(OH)_2(s) \rightleftharpoons Mg^{2+}(aq) + 2OH^-(aq)$

K_{sp} of $Mg(OH)_2$ = 5×10^{-7} at 25°C

Choose correct statement(s) from the following

(A) the pH of the saturated solution of $Mg(OH)_2$ is 12.

(B) maximum solubility is observed above the pH mentioned in (A).

(C) molarity of OH^- ions in the saturated solution is 0.01 M.

(D) the solubility increases by adding NH_4Cl.

8. Which of the following substance(s) is/are more basic than NH_3?

(A) CH_3NH_2 (B) CH_3NO_2

(C) CH_3CN (D) CH_3NHCH_3

Space For Rough Work

This section contains **2 List-Match Sets**, each List-Match set has **2 Multiple Choice Questions**. Each List-Match set has two lists: List-I and List-II. 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.

Match the following & answer accordingly:

List – I		List– II	
(I)	Hyperconjugation	(P)	Only sigma electrons are involved
(II)	Inductive effect	(Q)	Only pi-electrons are involved
(III)	Resonance	(R)	Both sigma and pi-electrons are involved in some cases
(IV)	Electromeric effect	(S)	An external reagent is involved
		(T)	Depends on the number of alpha(α) C – H bonds
		(U)	Propagates through C – C σ-bonds

9. The correct matching between list-I and list-II is
(A) I $\rightarrow$ P (B) II $\rightarrow$ S
(C) III $\rightarrow$ T (D) IV $\rightarrow$ R

10. The correct matching between list-I and list-II is
(A) I $\rightarrow$ U (B) II $\rightarrow$ R
(C) III $\rightarrow$ Q (D) IV $\rightarrow$ T

Match the following & answer accordingly:

List – I		List– II	
(I)	$N_2(g)+O_2(g)\rightleftharpoons 2NO(g)$	(P)	Pressure has no effect on the equilibrium sate
(II)	$2NO_2(g)\rightleftharpoons 2NO(g)+O_2(g)$	(Q)	$K_P = K_C$
(III)	$NO(g)+NO_2(g)\rightleftharpoons N_2O_3(\ell)$	(R)	Removal of O_2 favours the forward reaction
(IV)	$N_2O_4(s)\rightleftharpoons 2NO_2(g)$	(S)	Addition of inert gas at constant volume favours forward reaction
		(T)	$K_P = (P_{equm})^2$
		(U)	Activity of one compound is one

11. The correct matching between list-I and list-II is
(A) I $\rightarrow$ R (B) II $\rightarrow$ Q
(C) III $\rightarrow$ U (D) IV $\rightarrow$ S

12. The correct matching between list-I and list-II is
(A) I $\rightarrow$ S (B) II $\rightarrow$ U
(C) III $\rightarrow$ Q (D) IV $\rightarrow$ T

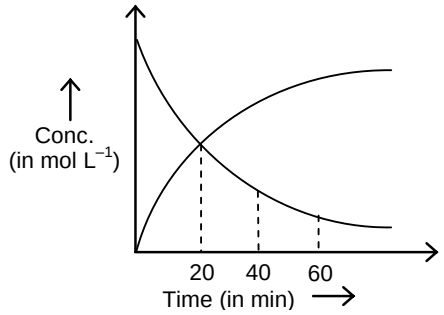
Space For Rough Work

(PART – B)

(Integer Type)

Part-C (01-06) contains six (06) Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) and each question carries **+4 marks** for correct answer and **there will be no negative marking.**

1. For the first order reaction, $A(g) \longrightarrow B(g)$, the following graph is given.



If x% of reaction is finished in 40 min, the value of x is

2. Phenolphthalein is used as an indicator in the titration of NaOH with HCl. 100 mL of 0.1 M NaOH solution required 100 mL of 0.09 M HCl for the reaction.

The indicator ionizes as $HPh(aq) \rightleftharpoons H^+(aq) + Ph^-(aq)$

The ionization constant of the indicator, K_{in} is (1×10^{-11}). If the simple ratio of $\frac{[Ph^-]}{[HPh]}$ at the end point is expressed as x : y, what is the value of (x + y)?

3. The pH of an aqueous solution of NaCN is 11. How many times will the solution be diluted to change it's pH to 10? [K_a of HCN = 10^{-10}]

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

One mole each of A, B and C gases are taken in a one litre container. Total moles of the reacting species at equilibrium is 4.2. If the mole fraction of B at equilibrium is expressed as a simple ratio x/y, the value of (y - x) is

5. The value of ℓnK_p(K_p = Equilibrium constant) of a reaction is -5. Calculate the temperature in kelvin unit at which the standard free energy change ΔG^o of the reaction will be 41.57 kJ mol^{-1}.
[R = 8.314 j K^{-1} mol^{-1}]

6. What is the pH of 0.01 M aqueous solution of CH_3COONH_4?
[K_a of CH_3COOH = K_b of NH_4OH]

Space of Rough Work

SECTION - III : MATHEMATICS

(PART – A)

(One or More Than One Options Correct Type)

This section contains **8 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D), out of which **ONE** or **MORE THAN ONE is correct.**

1. If range of expression $\frac{x^2-2x+d}{x^2+3x+d}$ be $[a,6]$, then

(A) $a=\frac{1}{7}$ (B) $d=4$

(C) $a=\frac{2}{7}$ (D) $d=2$

2. x_1,x_2 are the roots of the equation $x^2-3x+A=0$; x_3,x_4 are roots of the equation $x^2-12x+B=0$, such that x_1,x_2,x_3,x_4 form an increasing G.P. then

(A) A = 2 (B) B = 32

(C) $x_1+x_3=5$ (D) $x_2+x_4=10$

3. Let tangents at $A(z_1)$ and $B(z_2)$ are drawn to the circle $|z|=2$. Then which of the following is/are CORRECT?

(A) The equation of tangent at A is given by $\frac{z}{z_1}+\frac{\bar{z}}{\bar{z}_1}=2$.

(B) If tangent at $A(z_1)$ and $B(z_2)$ intersect at $P(z_p)$, then $z_p=\frac{2z_1z_2}{z_1+z_2}$

(C) Slope of tangent at $A(z_1)$ is $\frac{1}{i}\left(\frac{z_1+\bar{z}_1}{z_1-\bar{z}_1}\right)$.

(D) If points $A(z_1)$ and $B(z_2)$ on the circle $|z|=2$ are such that $z_1+z_2=0$, then tangents intersect at $\frac{\pi}{2}$.

Space For Rough Work

4. For non-negative integers n, let

$$f(n)=\frac{\sum_{k=0}^{n}\sin\left(\frac{k+1}{n+2}\pi\right)\sin\left(\frac{k+2}{n+2}\pi\right)}{\sum_{k=0}^{n}\sin^2\left(\frac{k+1}{n+2}\pi\right)}$$

$\cos^{-1}x$ is an angle on the interval $[0,\pi]$ whose cosine is x, which of the following is/are correct?

(A) $f(4)=\frac{\sqrt{3}}{2}$

(B) $\lim_{n\to\infty} f(n)=\frac{1}{2}$

(C) If $\alpha=\tan\left(\cos^{-1}f(6)\right)$, then $\alpha^2+2\alpha-1=0$

(D) $\sin\left(7\cos^{-1}f(5)\right)=0$

5. If two distinct chords of parabola $y^2=4ax\,(a>0)$ passing through (a, 2a) are bisected by the line $x+y=1$, then the length of the latus rectum can be:

(A) 1 (B) 4
(C) 3 (D) 2

6. If $y=\alpha x^2+\alpha x+\frac{1}{24}$ and $x=\alpha y^2+\alpha y+\frac{1}{24}$ are tangent to each other (or touch each other), then

(A) $\alpha=\frac{2}{3}$ (B) $\alpha=\frac{3}{2}$

(C) $\alpha=\frac{13-\sqrt{601}}{12}$ (D) $\alpha=\frac{13+\sqrt{601}}{12}$

7. Let $x_1,x_2.....,x_n$ be n observation such that $\sum x_i^2=400$ and $\sum x_i=80$. Then possible value(s) of n among the following is/are:

(A) 20 (B) 15
(C) 18 (D) 23

Space For Rough Work

8. A ten-sided regular polygon is inscribed in the circle $|z|=1$ and whose vertices are $A_1,A_2,....,A_{10}$. G_1 is centroid of $\Delta A_1A_2A_3$, G_2 is centroid of $\Delta A_2A_6A_9$ and G_3 is centroid of $\Delta A_3A_5A_7$. P is centroid of $\Delta G_1G_2G_3$ then

(A) $\angle POA_1=\frac{2\pi}{5}$ (B) $OP=\frac{1}{10}$

(C) $\angle POA_1=\frac{4\pi}{5}$ (D) $OP=\frac{1}{9}$

This section contains **2 List-Match Sets**, each List-Match set has **2 Multiple Choice Questions**. Each List-Match set has two lists: List-I and List-II. 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.

9. If $y=x+1$ is axis of a parabola, $y+x=4$ be tangent of the same parabola at its vertex and $y=2x+3$ be one of its tangents, then

Column-I		Column-II	
(A)	If equation of directrix of parabola is $ax+by-29=0$, then $a+b=$	(P)	9
(B)	If length of latus rectum of parabola is $\frac{a\sqrt{2}}{b}$ where a and b are relatively prime natural numbers, then $a+b=$	(Q)	18
(C)	Let extremities of latus rectum are (a_1,b_1) and (a_2,b_2), then $[a_1+b_1+a_2+b_2]=$ (where [.] denote greatest integer function)	(R)	23
(D)	If equation of parabola is $a(x-y+1)^2=b(x+y-4)$ where a and b are relatively prime natural numbers then $a+b=$	(S)	37

(A) a $\rightarrow$**Q** b $\rightarrow$**R** c $\rightarrow$**P** d $\rightarrow$**S** (B) a $\rightarrow$**S** b $\rightarrow$**R** c $\rightarrow$**P** d $\rightarrow$**Q**

(C) a $\rightarrow$**Q** b $\rightarrow$**P** c $\rightarrow$**R** d $\rightarrow$**S** (D) a $\rightarrow$**Q** b $\rightarrow$**S** c $\rightarrow$**P** d $\rightarrow$**R**

10. Consider a sequence $\{b_n\}$ of integers such that b_1,b_2,b_3 are in G.P. b_2,b_3,b_4 are in A.P., b_3,b_4,b_5 are in G.P., b_4,b_5,b_6 are in A.P., b_5,b_6,b_7 are in G.P. and so on. Also given that $b_1=1$ and $b_5+b_6=198$. Then

Column-I		Column-II	
(A)	$\sqrt{b_7}$ is equal to	(P)	5
(B)	Sum of digits of b_8 is equal to	(Q)	15
(C)	$\sqrt{b_9}$ is equal to	(R)	9
(D)	Sum of digits of b_{10} is equal to	(S)	17
		(T)	13

(A) a $\rightarrow$**S** b $\rightarrow$**P** c $\rightarrow$**Q** d $\rightarrow$**T** (B) a $\rightarrow$**T** b $\rightarrow$**P** c $\rightarrow$**S** d $\rightarrow$**Q**

(C) a $\rightarrow$**T** b $\rightarrow$**P** c $\rightarrow$**Q** d $\rightarrow$**S** (D) a $\rightarrow$**P** b $\rightarrow$**T** c $\rightarrow$**S** d $\rightarrow$**Q**

Space For Rough Work

11.

Column-I		Column-II	
(A)	If a, b, c are length of sides of a triangle, then the roots of the equation $a^2x^2+\left(b^2+a^2-c^2\right)x+b^2=0$ are	(P)	of opposite signs
(B)	If a, b, c are unequal positive numbers and b is A.M. of a and c, then the roots of the equation $ax^2+2bx+c=0$ are	(Q)	both positive
(C)	If $a\in R$, then the roots of the equation $x^2-(a+1)x-a^2-4=0$ are	(R)	both negative
(D)	If a, b, c are unequal positive numbers and b is H.M. of a and c, then the roots of the equation $ax^2+2bx+c=0$ are	(S)	real and distinct
		(T)	Imaginary

(A) a $\rightarrow$**S** b $\rightarrow$**P** c $\rightarrow$**Q** d $\rightarrow$**T**
(B) a $\rightarrow$**T** b $\rightarrow$**R** c $\rightarrow$**PS** d $\rightarrow$**T**
(C) a $\rightarrow$**T** b $\rightarrow$**PS** c $\rightarrow$**Q** d $\rightarrow$**S**
(D) a $\rightarrow$**P** b $\rightarrow$**T** c $\rightarrow$**S** d $\rightarrow$**Q**

12.

Column-I		Column-II	
(A)	If z_1 and z_2 are two non zero complex numbers such that $\left\|z_1z_2\right\|=2$ and $\arg z_1-\arg z_2=\frac{\pi}{2}$, then $3i\bar{z}_1z_2=$	(P)	1
(B)	If z_1 satisfies the equation $\left\|z-3\right\|=4$ and z_2 satisfies the equation $\left\|z+1\right\|+\left\|z-1\right\|=3$. If m, M be the minimum maximum values of $\left\|z_1-z_2\right\|$ respectively. Then $m+2M=$	(Q)	2
(C)	If $z=(3-i)+\lambda(4-3i)$, then the minimum value of $\left\|z\right\|$ is equal to $(\lambda\in R)$	(R)	3
(D)	If z lies on the curve $\arg(z-1)=\frac{\pi}{4}$. Then the maximum value of $\left\|\left\|z+2-5i\right\|-\left\|z-5i\right\|\right\|$ is equal to	(S)	6
		(T)	17

(A) a $\rightarrow$**S** b $\rightarrow$**P** c $\rightarrow$**T** d $\rightarrow$**Q**
(B) a $\rightarrow$**T** b $\rightarrow$**R** c $\rightarrow$**PS** d $\rightarrow$**T**
(C) a $\rightarrow$**T** b $\rightarrow$**P** c $\rightarrow$**Q** d $\rightarrow$**S**
(D) a $\rightarrow$**S** b $\rightarrow$**T** c $\rightarrow$**P** d $\rightarrow$**Q**

Space For Rough Work

(PART – B)

(Integer Type)

Part-C (01-06) contains six (06) Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) and each question carries **+4 marks** for correct answer and **there will be no negative marking.**

1. If the range of the function $f(x)=\frac{x^2+ax+b}{x^2+2x+3}$ is $[-5,4]$, where $a,b\in N$, then the value of (a^2+b^2) = _____

2. Let $P(x)$ be a quadratic polynomial with complex coefficients whose leading coefficient is 1. Suppose the equation $P(P(x))=0$ has 4 distinct solutions $3,4,\alpha,\beta$ then sum of all possible values of $(\alpha+\beta)^2$ equals.

3. If $S=\sum_{k=1}^{80}\frac{1}{\sqrt{k}}$ then [S], (where [x] denotes the greatest integer less than or equal to x)

4. Let z be a non real complex number satisfying $z^{23}=1$ then $\sum_{k=0}^{22}\frac{1}{1+z^k+z^{2k}}$

5. Let $f(x)=ax^2+bx+c,$ where a, b, c are integers. Suppose $f(1)=0,\ 40<f(6)<50,\ 60<f(7)<70,$ and $1000t<f(50)<1000(t+1)$ for some integer t. Then the value of t is

6. The parabola $y=x^2+ax+b$ cuts the coordinate axes in three points. If the circle through them passes through the fixed point (λ,μ) then $\lambda+\mu$ equals

Space For Rough Work

FIITJEE INTERNAL TEST

BATCHES: NWCM2024O1S & O2S_PT-2

PHASE TEST–2: PAPER-2

Code: 100040

JEE ADVANCED LEVEL

ANSWER KEY

ANSWER KEYS

PHYSICS

PART – A

1.	BD	2.	C	3.	ABCD	4.	BC
5.	AC	6.	ABD	7.	AC	8.	ABD
9.	A	10.	D	11.	B	12.	C

PART – B

1.	3.00	2.	2	3.	3	4.	3
5.	5	6.	0.20				

CHEMISTRY

PART – A

1.	ABC	2.	ABD	3.	AB	4.	BD
5.	ABD	6.	ABD	7.	ACD	8.	AD
9.	A	10.	C	11.	C	12.	D

PART – B

1.	75	2.	6	3.	100	4.	8
5.	1000	6.	7				

MATHEMATICS

PART – A

1.	BC	2.	ABCD	3.	ABC	4.	ACD
5.	ACD	6.	ABCD	7.	ACD	8.	CD
9.	A	10.	B	11.	B	12.	D

PART – B

1.	277	2.	85	3.	16	4.	15.33
5.	4	6.	1				