FIITJEE   INTERNAL TEST

PHYSICS, CHEMISTRY & MATHEMATICS

QP CODE: 101072   **Common Test-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.

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 (05–08)** contains **(4) 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 –** This section contains Eight **(08)** questions numerical based questions. The answer to each question is a **NUMERICAL VALUE.** If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places. 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. In the circuit shown, sliding contact is moving with uniform velocity towards right. Its value at some instance is 12 Ω. The current in the circuit at this instant of time will be
   (A) 0.5 A
   (B) More than 0.5 A
   (C) Less than 0.5 A
   (D) May be less or more than 0.5 A depending on the value of L
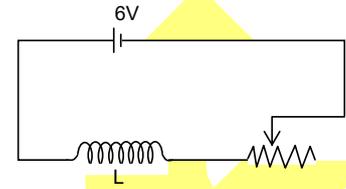
2. In the circuit shown, the key (K) is closed at t = 0, the current through the key at the instant t = 10^{-3} ln2 sec, is
   (A) 2 A   (B) 3.5 A
   (C) 2.5 A   (D) zero
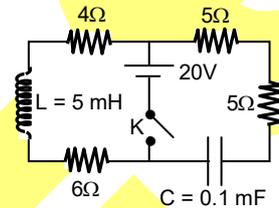
3. AB and CD are smooth, parallel, horizontal rails on which a conductor T can slide. A cell, E, drives current I through the rails and T.
   (A) T will experience a force towards right
   (B) T will experience a force toward left
   (C) T will experience a force upward
   (D) T will not experience any force
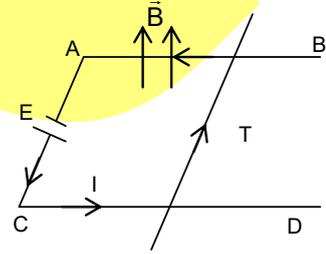
4. The uniform but time varying magnetic field B(t) exists in a circular region of radius a and is directed into one of the paper as shown in the figure. The magnitude of the induced electric field at point P at a distance r from the centre of the circular region.
   (A) is zero   (B) decreases as 1/r
   (C) increases as r   (D) decreases as $1/r^2$
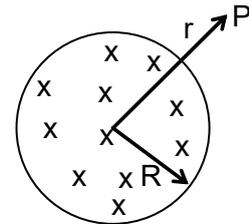
(One or More Than One Options Correct Type)

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

5. AB and CD are smooth parallel rails, separated by a distance ℓ, and inclined to the horizontal at an angle θ. A uniform magnetic field of magnitude B, directed vertically upwards, exists in the region. EF is a conductor of mass m, carrying a current i. For EF to be in equilibrium,
   (A) i must flow from E to F   (B) Biℓ = mgtanθ
   (C) Biℓ = mgsinθ (D) Biℓ = mg
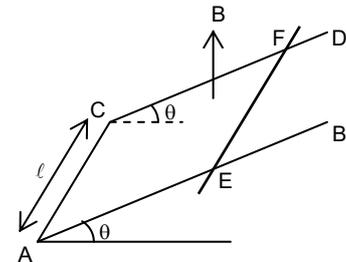
Space For Rough Work

6. A circular conducting loop is being rotated with a constant angular speed ω about an axis (which is the diameter) in a uniform magnetic field. Which of these following statements. are true [N is the no of turns, B is the magnitude of magnetic field & A is the area of the loop]
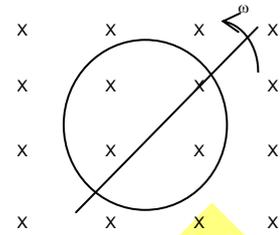
(A) Average induced emf in the loop is zero

(B) Average induced emf in the loop is $\dfrac{BA\omega N}{2}$

(C) A sinusoidal current flows in the loop

(D) Amplitude of induced emf is $\dfrac{BA\omega N}{2}$

7. Magnetic field is present in a circular region of radius 'R'. assume the field depends on time is given by $B = \alpha_o t$ (α_o is a positive constant). Charge Q_o is moved in this region from A to B through different paths as shown below. If W_I, W_{II} and W_{III} are work done by the induced electric field in path I, II, III in moving a positive charge
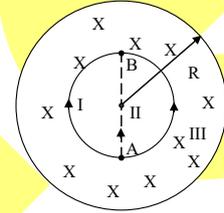
(A) $\dfrac{W_I}{W_{III}} = -1$

(B) $\dfrac{W_{II}}{W_I} = 0$

(C) W_{II} is positive

(D) W_{III} is positive

8. For an LCR circuit, the power transferred from the deriving source to the driven oscillator is $P = I^2 Z \cos\phi$:

(A) Here, the power factor as $\phi \geq 0, P \geq 0$

(B) The driving force can give no energy to the oscillator (P = 0) in some cases

(C) The driving force cannot siphon out (P < 0) the energy out of oscillator

(D) The driving force can take away energy out of the oscillator

(PART – B)

This section contains **Eight (08)** numerical based questions. The answer to each question is a NUMERICAL VALUE. If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.

1. A uniform but time varying magnetic field is present in a circular region of radius R = 4 m. The magnetic field is perpendicular and into the plane of the paper and the magnitude of the field is increasing at a constant rate $\alpha = \dfrac{1}{\pi}$ T sec^{-1}. There is a straight conducing rod of length 2R placed as shown in the figure. Find the magnitude of induced emf (in volt) across the rod.
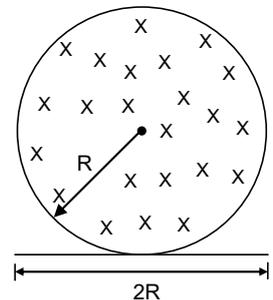
Space For Rough Work

2.   Average power in purely inductive circuit is:

3.   A wire forming one cycle of sine curve is moved in $x - y$ plane with velocity $\vec{V} = 3\hat{i} + 2\hat{j}$. There exit a magnetic field $\vec{B} = -3\hat{k}$. Find the motional emf develop across the ends PQ of wire
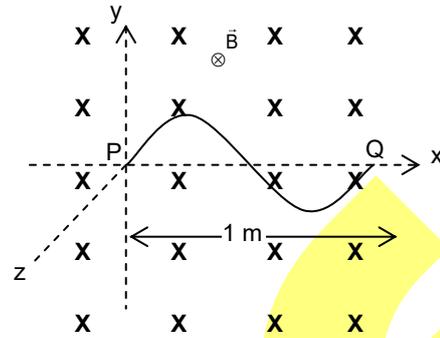

4.   The resistance of a coil when used in the ac power supply (220 V – 50 Hz) is 100 Ω (power factor of circuit is half). Find the self-inductance (in Henry) of the coil.

5.   A plane loop, shaped as two squares of sides a = 1m and b = 0.4 m is introduced into a uniform magnetic field perpendicular to the plane of loop. The magnetic field varies as B = 10^{-3} sin 100 t. Find the amplitude of current induced(In A) in the loop if resistance per unit length is r = 5 mΩ m^{-1}. The inductance is negligible.
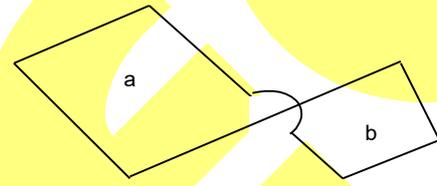


6.   In an AC circuit the phase difference between emf and current is $\pi/3$ then the power factor of the circuit is (1/n). Where 'n' is

7.   A 50 Hz ac source of 20 volts is connected across R and C as shown in figure. The voltage across R is 12 volt. Find the voltage across C (in Volt)
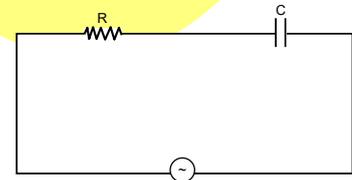
8.   A rod of length 1 m rotates about one of its end point with an angular velocity 2 rad/ sec in a plane perpendicular to the magnetic field B = 2T as shown in the figure. Then find magnitude of electric field(In SI unit) at the mid point of the rod
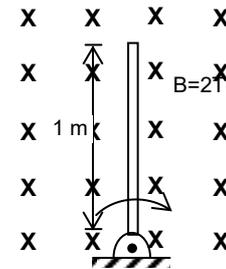
Space For Rough Work

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 of the following disproportionation reaction is not practically observed?

   (A) $Br_2 + 2OH^- \xrightarrow{\ 0°C\ } Br^- + BrO^- + H_2O$ (B) $I_2 + 2OH^- \xrightarrow{\ 0°C\ } I^- + IO^- + H_2O$

   (C) $3Br_2 + 6OH^- \xrightarrow{\ 50°C\ } Br^- + BrO_3^- + 3H_2O$ (D) $3I_2 + 6OH^- \xrightarrow{\ 50°C\ } 5I^- + IO_3^- + 3H_2O$

2. Micelles formation from soap($C_{17}H_{35}COONa$) decreases

   (A) electrical conductivity of the colloidal solution

   (B) the number of Na^+ ions in the colloidal solution

   (C) the cleaning action of soap

   (D) dispersion of oils and fats during washing of fabrics

3. Which of the following ores are not roasted in order to remove volatile impurities and to convert the ore to metal oxide?

   (A) Sulphide ores   (B) Sulphate ores   (C) Selenide ores   (D) A and B are correct

4. Which of the following statement is correct?

   (A) $Cl_2O > F_2O > H_2O$ (bond angles)

   (B) $NH_3 > PH_3 > AsH_3$ (basic character)

   (C) $AsH_3 > PH_3 > NH_3$ (tendency to form complex with metal ion)

   (D) $NH_3 > PH_3 > AsH_3$ (reducing character)

(One or More Than One Options Correct Type)

This section contains **4 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 formula of chalcopyrite is $CuFeS_2$. In order to extract copper from it, the concentrated ore is heated strongly with SiO_2 and O_2. The product(s) formed in this process is/are

   (A) $FeSiO_3$ (B) Cu_2S (C) CuS (D) $Fe_2(SiO_3)_3$

6. Some following statements about hydrophilic sols. The correct statement is/are

   (A) they do not require electrolytes for stability

   (B) their coagulation is reversible

   (C) their viscosity is in the order of that of water

   (D) their surface tension is usually lower that of dispersion medium

7. Identify the true statements regarding adsorption

   (A) species like CO, NH_3 and C_2H_4 that have unshared electron pairs or multiple bonds can be chemisorbed without dissociation. In contrast, species like H_2, CH_2 and C_2H_6 usually dissociate when chemisorbed.

   (B) metal that chemisorb hydrogen will usually catalyze the exchange reaction $H_2 + D_2 \longrightarrow 2HD$

   (C) the reaction of water vapour with anhydrous $CaCl_2$ to form a hydrated compound is an example of absorption.

   (D) in physical adsorption of gas on a solid the enthalpy change for the formation of the second, third and subsequent layers is about the same as the enthalpy change of condensation of gas to a liquid.

Space For Rough Work

8.   Which inter-halogen compound(s) exist(s)?
      (A) ICl_3 (B) ClF_3 (C) FCl_3 (D) IBr_9

(PART – B)

This section contains **Eight (08)** numerical based questions. The answer to each question is a NUMERICAL VALUE. If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.

1.   Number of valence e^- in the metal present in argentite ore is x, then what is value of $\dfrac{x}{2}$?

2.   In the following reactions,
      $Na_2SO_3 + S \xrightarrow{\text{boiling water}}$ [X] (Colorless Solid)
      $AgBr \xrightarrow{\text{excess[X]}}$ [Y] (soluble Complex)
      $X + Cl_2 + H_2O \longrightarrow$ [Z] + HCl
      Sum of sulphur atoms in compound [X], [Y] and [Z]

3. $Au + NaCN + O_2 + H_2O \longrightarrow Na\left[Au(CN)_2\right]$

      $Na\left[Au(CN)_2\right] + Zn \longrightarrow Na_x\left[Zn(CN)_y\right] + Au$
      The value of (x + y) is

4. XeF_4 disproportionates in water giving reduced and oxidized products. If the ratio of oxidation states of Xe in the oxidized and reduced product is x : y, what is the value of (x + y).

5.   Electrolysis of pure Al_2O_3 is carried out with graphite anode. During electrolysis gas A is liberated at anode and two more gases B and C are formed by the reaction between A and Anode. If molar mass of gases are M_A, M_B and M_C, what is the value of $\dfrac{M_A + M_B + M_C}{50}$?

6.   How many oxygen atom(s) is/are present in the compound which is derived from ZnS and is electrolyzed for the production of zinc?

7.   For Freundlich's adsorption isotherm, $\dfrac{x}{m} = Kp^{1/n}$, how many values of 'n' from the given list ensure(s) efficient adsorption?
      (1.2, 0, 0.2, 0.4, 2, 1.4, 2.24, -0.8)

8.   How many hybridized orbitals are required by xenon to form XeO_4?

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. Area bound by the curves $y = |x| - 2$ and $y = 1 - |x - 1|$, is equal to :

   (A) 4 sq. units   (B) 6 sq. units   (C) 2 sq. units   (D) 8 sq. units

2. The area of the portion enclosed by the curve $\sqrt{x} + \sqrt{y} = \sqrt{a}$ and the axes of reference is:

   (A) $\dfrac{a^2}{6}$ (B) a^2 (C) $\dfrac{a^2}{2}$ (D) $\dfrac{a^2}{4}$

3. The value of $\displaystyle\lim_{n\to\infty}\sum_{r=1}^{r=4n}\dfrac{\sqrt{n}}{\sqrt{r}\left(3\sqrt{r}+4\sqrt{n}\right)^2}$ is equal to:

   (A) $\dfrac{1}{35}$ (B) $\dfrac{1}{14}$ (C) $\dfrac{1}{10}$ (D) $\dfrac{1}{5}$

4. $\displaystyle\lim_{n\to\infty}\dfrac{n}{(n!)^{1/n}}$ is equal to

   (A) e   (B) $\dfrac{1}{e}$ (C) 1   (D) $\displaystyle\int_0^1 \ln x\, dx$

(One or More Than One Options Correct Type)

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

5. Consider the functions $f(x)$ and $g(x)$, both defined from $R \to R$ and are defined as $f(x) = 2x - x^2$ and $g(x) = x^n$ where $n \in N$. If the area between $f(x)$ and $g(x)$ in first quadrant is $\dfrac{1}{2}$ then n is a divisor of

   (A) 12   (B) 15   (C) 20   (D) 30

6. The figure shows a horizontal line $y = c$ passing through (b, c) intersecting the curve $y = 8x - 27x^3$. If the shaded areas are equal, then

   (A) $b = \dfrac{1}{9}$ (B) $b = \dfrac{4}{9}$

   (C) $c = \dfrac{32}{27}$ (D) $c = \dfrac{23}{27}$
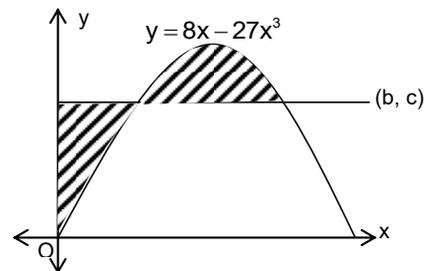
Space For Rough Work

7. Which of the following definite integral(s) vanishes?

   (A) $\displaystyle\int_0^{\pi/2} \ln(\cot x)\,dx$
   (B) $\displaystyle\int_0^{2\pi} \sin^3 x\,dx$
   (C) $\displaystyle\int_{1/e}^{e} \frac{dx}{x(\ln x)^{1/3}}$
   (D) $\displaystyle\int_0^{\pi} \sqrt{\frac{1+\cos 2x}{2}}\,dx$

8. Suppose $I_1 = \displaystyle\int_0^{\pi/2} \cos(\pi \sin^2 x)\,dx$; $I_2 = \displaystyle\int_0^{\pi/2} \cos(2\pi \sin^2 x)\,dx$ and $I_3 = \displaystyle\int_0^{\pi/2} \cos(\pi \sin x)\,dx$, then

   (A) $I_1 = 0$
   (B) $I_2 + I_3 = 0$
   (C) $I_1 + I_2 + I_3 = 0$
   (D) $I_2 = I_3$

(PART – B)

This section contains **Eight (08)** numerical based questions. The answer to each question is a NUMERICAL VALUE. If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.

1. The area bounded by curves $y = \sin\dfrac{\pi x}{2}$ and $y = x^3$ is $\dfrac{a-\pi}{b\pi}$ sq. units, then the value of $(a-b)$ is _____.

2. The interval such that the value of $\displaystyle\int_a^b (2+x-x^2)\,dx$ is maximum is [a, b], then the value of $(b-a)$ is _____

3. The area bounded by the curve $y = \sin x$, tangent drawn to it at $x = 0$ and the line $x = \dfrac{\pi}{2}$ is $\dfrac{\pi^m - n}{n}$ then the value of $\dfrac{n}{m}$ is _____.

4. Find the area bounded by the curves $4y = |x^2 - 4|$ and $y + |x| = 7$.

5. $\displaystyle\int_1^2 \frac{(x^2-1)\,dx}{x^3 \cdot \sqrt{2x^4 - 2x^2 + 1}} = \dfrac{u}{v}$ where u and v are in their lowest form. Find the value of $\dfrac{(1000)\mu}{\upsilon}$.

6. Given a function g continuous on R such that $\displaystyle\int_0^1 g(t)\,dt = 2$ and $g(1) = 5$. If
   $f(x) = \dfrac{1}{2}\displaystyle\int_0^x (x-t)^2 g(t)\,dt$, then the value of $(f'''(1) - f''(1))$ is equal to:

7. If $\displaystyle\int_0^{\pi/3} \frac{\cos x}{3 + 4\sin x}\,dx = K\log\left(\dfrac{3 + 2\sqrt{3}}{3}\right)$, then K is:

8. If $f(0) = 1$, $f(2) = 3$ and $f'(2) = 3$, then the value of $\displaystyle\int_0^1 x f''(2x)\,dx$ is _____

Space For Rough Work

FIITJEE INTERNAL TEST

BATCHES – PANINI426-G1 & PANINI426XII-1

Common Test – 4
Code: 101072
JEE ADVANCED
ANSWER KEY

ANSWER KEYS

Physics
PART – A

1.	B	2.	C	3.	A	4.	B
5.	AB	6.	AC	7.	ABD	8.	ABC

PART – B

1.	4	2.	0	3.	6	4.	0.55
5.	3	6.	2	7.	16	8.	2

Chemistry
PART – A

1.	B	2.	A	3.	B	4.	B
5.	AB	6.	ABD	7.	ABCD	8.	AB

PART – B

1.	0.5	2.	7	3.	6	4.	7
5.	2.08	6.	4	7.	3	8.	4

Mathematics
PART – A

1.	A	2.	A	3.	C	4.	A
5.	BCD	6.	BC	7.	ABC	8.	ABC

PART – B

1.	6	2.	3	3.	4	4.	32
5.	125	6.	3	7.	0.25	8.	2