

FIITJEE INTERNAL TEST

PHYSICS, CHEMISTRY & MATHEMATICS

CPT-1

PHASE-IV

CODE:

PAPER - 1

Time Allotted: 3 Hours

Maximum Marks: 210

- 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 Parts.
3. **Part-I** is Physics, **Part-II** is Chemistry and **Part-III** is Mathematics.
4. Each part is further divided into two sections: **Section A & C**.
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 Three Parts.

- (i) **Section-A (01 – 10)** contains 10 multiple choice questions which have one or more than correct answer. Each question carries +4 marks for correct answer and – 1 mark for wrong answer.
- (ii) **Section-C (01 – 10)** contains 10 Numerical based questions with single digit integer as answer, ranging from 0 to 9 and each question carries +3 marks for correct answer. **No negative marking** for wrong answer.

Name of the Candidate : _____

Batch : _____ Date of Examination : _____

Enrolment Number : _____

BATCH – Two Yr CRP(1820)

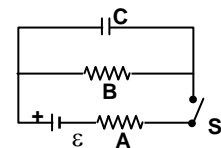
PART – I : PHYSICS

SECTION – A: (One or More than one correct type)

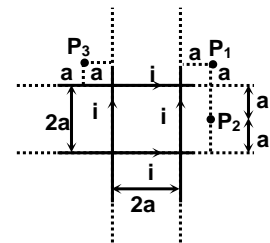
This section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

1. A proton moving with a constant velocity passes through a region of space without any change in its velocity. If E and B represent the electric and magnetic fields respectively, this region of space may have
- (A) $E = 0, B = 0$ (B) $E = 0, B \neq 0$
 (C) $E \neq 0, B = 0$ (D) $E \neq 0, B \neq 0$

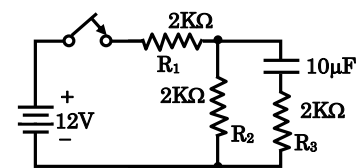
2. In the circuit shown, A and B are equal resistances. When S is closed the capacitor C charges from the cell of emf ε and reaches a steady state.
- (A) During charging, more heat is produced in A than in B .
 (B) In the steady state, heat is produced at the same rate in A and B .
 (C) In the steady state, energy stored in C is $\frac{1}{4}C\varepsilon^2$.
 (D) In the steady state, energy stored in C is $\frac{1}{8}C\varepsilon^2$.



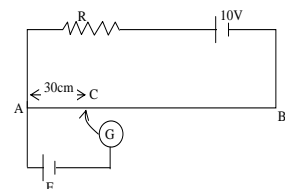
3. All wires are infinitely long and each wire is insulated with each other, then
- (A) The magnitude of magnetic field at point P_1 is zero
 (B) The direction of magnetic field at point P_2 is inward
 (C) The direction of magnetic field at point P_3 is outward
 (D) None of these



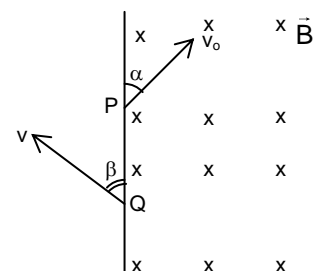
4. In the circuit shown, the switch is turned on at $t = 0$. Then,
- (A) at $t = 0$, current supplied by battery is 4 mA
 (B) at $t = 0$, current in R_3 is 2 mA
 (C) in the steady state current supplied by battery is 3 mA
 (D) in the steady state current in R_3 is zero



5. AB is a potentiometer wire of length 100 cm and its resistance is 10Ω . It is connected in series with a resistance $R = 90\Omega$ and a battery of emf 10V and negligible internal resistance. A source of unknown emf E is balanced by 30 cm length of the potentiometer wire, with jockey position at C .



- (A) the value of E is 0.15 V (B) the value of E is 0.30 V
 (C) $V_C - V_B = -0.7$ V (D) $V_C - V_B = 0.7$ V
6. A particle of charge $-q$ and mass m enters a uniform magnetic field \vec{B} (perpendicular to paper inwards) at P with a velocity v_0 at an angle α and leaves the field at Q with velocity v at angle β as shown in figure. Then
- (A) $\alpha = \beta$
 (B) $v = v_0$

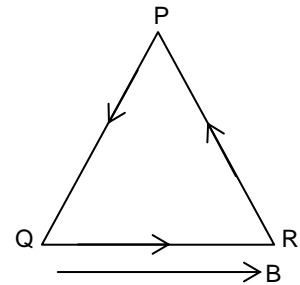


(C) $PQ = \frac{2mv_o \sin \alpha}{Bq}$

(D) particle remains in the field for time $t = \frac{2m(\pi - \alpha)}{Bq}$

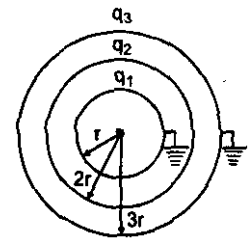
7. An equilateral triangular loop PQR of side l carries a currents I in the direction shown. The loop is kept in uniform magnetic field B , directed parallel to the base of triangle QR as shown. Net force F and torque τ acting on loop is

- (A) $F = 0$ (B) $F = \sqrt{3} IlB$
 (C) $\tau = 0$ (D) $\tau = \frac{\sqrt{3} I^2 l B}{4}$



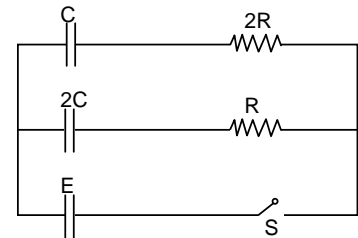
8. Three concentric conducting spherical shells have radii r , $2r$ and $3r$ and charges q_1 , q_2 and q_3 respectively. Innermost and outermost shells are earthed as shown in figure. Select the correct alternative(s)

- (A) $q_1 + q_3 = -q_2$ (B) $q_1 = -\frac{q_2}{4}$
 (C) $\frac{q_3}{q_1} = 3$ (D) $\frac{q_3}{q_2} = \frac{-1}{3}$



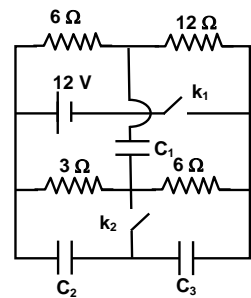
9. In the circuit shown in figure, switch S is closed at time $t = 0$, Select the correct statement(s)

- (A) Rate of increase of charge is same in both the capacitors
 (B) Ratio of charge stored in capacitors C and $2C$ at any time t would be $1 : 2$
 (C) Time constant of both the capacitors are equal
 (D) Steady state charge in capacitors C and $2C$ are in the ratio of $1 : 2$



10. Given $C_1 = 2\mu F$; $C_2 = 4\mu F$, $C_3 = 8\mu F$. C_1 , C_2 , C_3 are initially uncharged. Initially all the keys are open. Then

- (A) In steady state, after closing k_1 alone the charge in capacitor C_1 is zero.
 (B) In steady state, after closing k_1 alone the charge in capacitor C_2 and C_3 are $8\mu C$ and $4\mu C$.
 (C) In steady state, after closing k_1 alone the current drawn from the cell is $2A$.
 (D) In steady state, after closing k_1 and k_2 the current drawn from the cell is $1A$.

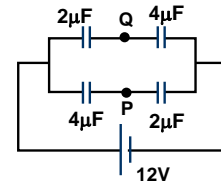


SECTION – C (Integer Answer Type)

This section contains **10 questions**. The answer to each question is a **single-digit integer**, ranging from 0 to 9. The correct digit below the question number in the ORS is to be bubbled.

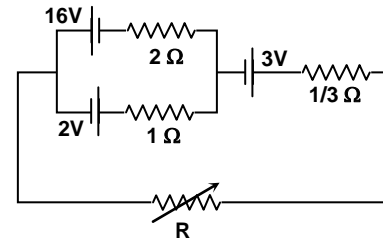
1. When two identical batteries of internal resistance 1Ω each are connected in series across a resistor R , the rate of heat produced in R is J_1 . When the same batteries are connected in parallel across R , the rate is J_2 . If $J_1 = 2.25 J_2$ then the value of R in Ω is

2. In the figure, the p.d. between P and Q is (in Volt)

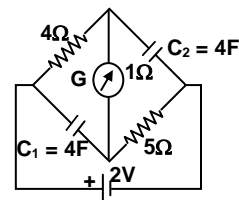


3. A hollow charged metal sphere has a radius r . If the potential difference between its surface and a point at distance $3r$ from its centre is V then the electric intensity at distance $3r$ from the centre is $\frac{V}{\lambda r}$. Find the value of λ .

4. Three cells of emf 16V, 2V and 3V and internal resistance 2Ω , 1Ω and $\frac{1}{2}\Omega$ respectively are connected with an unknown resistance R as shown in the figure. What is the value of R such that power developed through R is maximum in steady state condition?

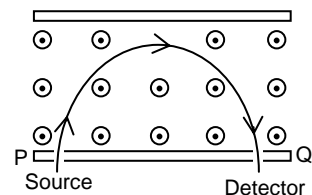


5. In the circuit shown below the cell is ideal, with emf = 2 V. The resistance of the coil of the galvanometer G is 1Ω . Then, find the potential difference across C_1 (in volts), in steady state.

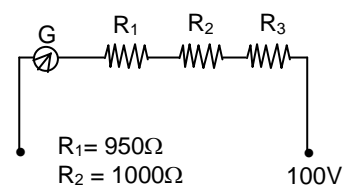


6. Two copper wires, one double the diameter of the other, have the same current through them. If the electrons in the thinner wire have drift speed v_1 and the electrons in the thicker wire have a drift speed v_2 , what is the value of v_1/v_2 .

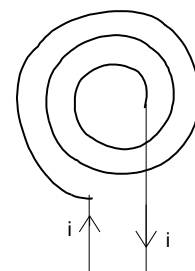
7. A uniform magnetic field with a slit system as shown in the figure is to be used as a momentum filter for high energy charged particles (enter and exit perpendicular to PQ). With a field of B tesla it is found that the filter transmits α particle each of energy 2.2 MeV. The magnetic field is increased to $2.13B$ tesla and deuteron ions are passed into the filter. What is the approximate energy (In MeV) of each deuteron ions transmitted by the filter?



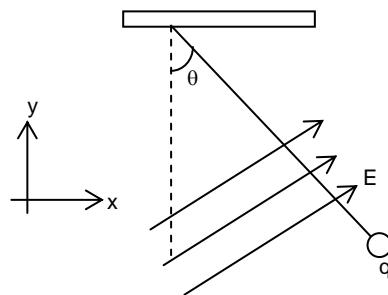
8. A galvanometer has an internal resistance of 50Ω and current required for full scale deflection is 1 mA. The series resistance R_3 required (as shown in figure) to use it as a voltmeter with given range, as indicated in figure is $1.4n \times 10^4\Omega$, then $n =$



9. A thin insulate wire forms a plane spiral of $N = 100$ turns carrying a current $I = 2.3$ A. The inner and outer radii are equal to $a = 5$ cm and $b = 10$ cm. Find the magnetic field (In 10^{-3} T)at the centre of spiral [In 2 = 0.69]



10. A charged cork ball of mass $m = 16 \text{ g}$ is suspended from a light string in the presence of a uniform electric field \vec{E} as shown in the figure. Where $\vec{E} = \left(\frac{1}{2}\hat{i} + 2\hat{j}\right) \text{ N/C}$, the ball is in equilibrium at the angle of $\theta = 37^\circ$. If the tension in the string is $W \times 10^{-2} \text{ N}$, then $W =$



Space for rough work

PART – II : CHEMISTRY

SECTION – A: (One or More than one correct type)

This section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

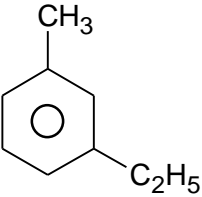
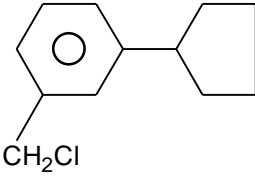
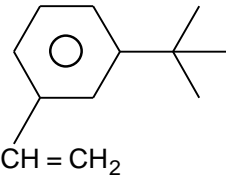
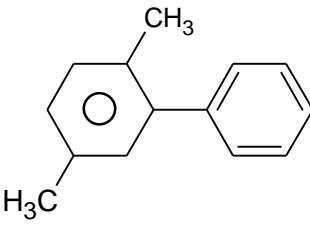
- Which of the following alkyl bromide(s) can form 1, 3-butadiene upon reaction with alcoholic KOH through E₂ path?

(A) $\text{BrCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$	(B) $\text{CH}_3\underset{\text{Br}}{\text{CH}}\underset{\text{Br}}{\text{CH}}\text{CH}_3$
(C) $\text{BrCH}_2\text{CH}_2\underset{\text{Br}}{\text{CH}}\text{CH}_3$	(D) $\text{CH}_3\text{CH}_2\underset{\text{Br}}{\text{CH}}\text{CH}_2\text{Br}$
- Which of the following compound(s) can form oxime with NH₂OH?

(A) CH ₃ CHO	(B) CH ₃ CH ₂ OH
(C) CH ₃ COCH ₃	(D) CH ₃ COOH
- Which reaction(s) produce CH₃CHO?

(A) $\text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\text{PCC}}$	(B) $\text{CH}_3\text{CHCl}_2 \xrightarrow{\text{H}_2\text{O}/\text{OH}^-}$
(C) $\text{CH}_3\text{COCl} \xrightarrow[\text{Pd/BaSO}_4 \text{ (Rosenmund reaction)}]{\text{H}_2}$	(D) $\text{CH}_3\text{COOH} \xrightarrow{\text{LiAlH}_4}$
- Which of the following can react with 2, 4-dinitrophenyl hydrazine?

(A) CH ₃ CH ₂ CH ₂ OH	(B) $\text{CH}_3\overset{\text{O}}{\parallel}\text{CCH}_2\text{CH}_3$
(C) CH ₃ CH ₂ CH ₂ COOH	(D) $\text{CH}_3\text{CH}_2\overset{\text{O}}{\parallel}\text{CCH}_2\text{CH}_3$
- Which of the following compound(s) form dicarboxylic acid(s) on alkaline permanganate oxidation?


(A) 	(B) 
(C) 	(D) 
- Which of the following can form acetic acid on acidic hydrolysis?

(A) CH ₃ COCl	(B) (CH ₃ CO) ₂ O
(C) $\text{Ph} - \text{O} - \overset{\text{O}}{\parallel} \text{C} - \text{CH}_3$	(D) CH ₃ CH ₂ OH

7. In which of the following option the left side species is a better nucleophile than the right side species in aqueous solution?
- (A) CH_3^\ominus , NH_2^\ominus (B) I^\ominus , Cl^\ominus
 (C) SH^\ominus , OH^\ominus (D) NO_2^\ominus , NO_3^\ominus
8. In which of the following alkyl halides the halogen atom(s) has/have been bonded to sp^3 hybridized carbon atoms?
- (A) $\text{CH}_3\text{CH}_2\text{Cl}$ (B) $\text{CH}_2 = \text{CH} - \text{Cl}$
 (C) $\text{CH}_2 = \text{CH} - \text{CH}_2 - \text{Br}$ (D) $\text{CH}_3 - \text{CH} = \text{CH} - \text{CHCl}_2$
9. Which of the following compounds can form intermolecular hydrogen bond?
- (A) CH_3OH (B) CH_3OCH_3
 (C) CH_3NH_2 (D) $\text{CH}_3\text{COOCH}_3$
10. Which of the following are primary amines?
- (A) $\text{CH}_3\text{CH}_2\text{NH}_2$ (B) CH_3CONH_2
 (C) CH_3NH_2 (D) CH_3NHCH_3

SECTION – C (Integer Answer Type)

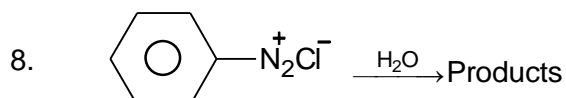
This section contains **10 questions**. The answer to each question is a **single-digit integer**, ranging from 0 to 9. The correct digit below the question number in the ORS is to be bubbled.

1. CH_3Cl , $\text{C}_2\text{H}_5\text{Br}$, $\text{C}_2\text{H}_5\text{F}$, CH_3I , $\text{C}_2\text{H}_5\text{I}$, $\text{CH}_3\underset{\text{Cl}}{\text{C}}\text{HCH}_3$ and CH_3Br
 How many of the above molecule(s) is/are more reactive than $\text{C}_2\text{H}_5\text{Cl}$ towards $\text{S}_{\text{N}}2$ reaction?
2. $\begin{array}{c} \text{CH}_3 \\ | \\ \text{H}-\text{C}-\text{OH} \\ | \\ \text{H}-\text{C}-\text{OH} \\ | \\ \text{H}-\text{C}-\text{OH} \\ | \\ \text{CH}_3 \end{array} \xrightarrow{\text{HIO}_4} \text{Products}$
 How many moles of carboxylic acid(s) is/are formed in the above reaction?
3. How many optical isomer(s) is/are possible for fructose?
4. How many of the following compounds on catalytic hydrolysis forms aldehyde or ketone?
 2-butene, ethyne, propyne, 2-chlorobutane, 2-pentyne
5.  $\xrightarrow[\text{Heat}]{\text{Conc. H}_2\text{SO}_4} \text{Product(s)}$
 How many product(s) containing five-membered ring(s) is/are formed in the above reaction? (consider stereoisomers)
6. $\text{CH}_3\text{CH}_2\text{CH}_3 \xrightarrow[\text{Heat}]{\text{Cl}_2} \text{Dichloro product(s)}$
 How many dichloro product(s) is/are formed in the above reaction? [Do not consider stereoisomers]

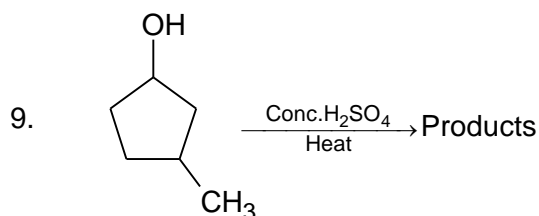


How many different type of product(s) is/are formed in the above aldol condensation reaction.

[Do not consider stereoisomers]

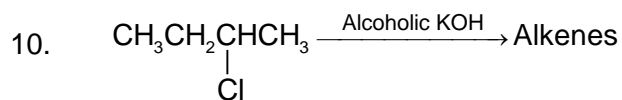


How many oxygen atom(s) is/are present in the aromatic product of above reaction?



How many cycloalkenes is/are formed in the above reaction?

[Do not consider stereoisomers]



How many alkene(s) is/are formed in the above reaction?

[Consider geometrical isomers]

Space for rough work

PART – III : MATHEMATICS

SECTION – A: (One or More than one correct type)

This section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

1. Suppose $f'(x)$ exists for each x and $h(x) = f(x) - (f(x))^2 + (f(x))^3$ for every real number x . Then
 - (A) h is increasing whenever f is increasing
 - (B) h is increasing whenever f is Decreasing
 - (C) h is decreasing whenever f is decreasing
 - (D) Nothing can be said in general

2. Let f be differentiable for all x . If $f(1) = -2$ and $f'(x) \geq 2$ for $x \in [1,6]$, then
 - (A) $f(6) < 8$
 - (B) $f(6) \geq 8$
 - (C) $f(6) > 5$
 - (D) $f(6) \leq 5$

3. If $f(x - y)$, $f(x)f(y)$ and $f(x + y)$ are in A.P. for all $x, y \in \mathbb{R}$ and $f(0) \neq 0$ then
 - (A) $f'(x)$ is an even function
 - (B) $f'(1) + f'(-1) = 0$
 - (C) $f'(2) - nf'(-2) = 0$
 - (D) $f'(3) + f'(-3) = 0$

4. If $f(x) = \min.(1, \cos x, 1 - \sin x)$, $-\pi \leq x \leq \pi$, then:
 - (A) $f(x)$ is not differentiable at $x = 0$
 - (B) $f(x)$ has local maximum at $x = 0$
 - (C) $f(x)$ is differentiable at $x = \frac{\pi}{4}$
 - (D) $f(x)$ is continuous and bounded in $x \in [-\pi, \pi]$

5. The function $f(x) = \begin{cases} 5x - 4, & \text{for } 0 < x \leq 1 \\ 4x^2 - 3x, & \text{for } 1 < x < 2 \\ 3x + 4, & \text{for } x \geq 2 \end{cases}$ is
 - (A) continuous at $x = 1$ and $x = 2$
 - (B) continuous at $x = 1$ but not derivable at $x = 2$
 - (C) continuous at $x = 2$ but not derivable at $x = 1$
 - (D) continuous at $x = 1$ and 2 but not derivable at $x = 1$ and $x = 2$

6. If $\lim_{n \rightarrow \infty} \left(an - \frac{1+n^2}{1+n} \right) = b$, where a is a finite number, then
 - (A) $a = 1$
 - (B) $a = 0$
 - (C) $b = 1$
 - (D) $b = -1$

7. If $\tan^{-1} x - \sin^{-1} x = k$ has real solutions then k can be
 - (A) -1
 - (B) $\frac{-1}{2}$
 - (C) 0
 - (D) $\frac{3}{4}$

8. Let $f(x) = \begin{cases} 1+x & 0 \leq x \leq 2 \\ 3-x & 2 < x \leq 3 \end{cases}$ then for $g(x) = f(f(x))$ discontinuity lies at $x =$
 (A) 0.5 (B) 1
 (C) 2 (D) 3
9. If f is an odd continuous function in $[-1, 1]$ and differentiable in $(-1, 1)$ then which of the following statement(s) is (are) correct?
 (A) $f'(a) = f(1)$ for some $a \in (-1, 0)$
 (B) $f'(b) = f(1)$ for some $b \in (0, 1)$
 (C) $n(f(\alpha))^{n-1} f'(\alpha) = (f(1))^n$ for some $\alpha \in (-1, 0)$ and $\forall n \in \mathbb{N}$
 (D) $n(f(\beta))^{n-1} f'(\beta) = (f(1))^n$ for some $\beta \in (0, 1)$ and $n \in \mathbb{N}$
10. $\int \frac{1}{\sin^2 x \cdot \cos^2 x} dx =$
 (A) $\tan x - \cot x + c$ (B) $\cot x - \tan x + c$
 (C) $2 \cot 2x + c$ (D) $-2 \cot 2x + c$

SECTION – C (Integer Answer Type)

This section contains **10 questions**. The answer to each question is a **single-digit integer**, ranging from 0 to 9. The correct digit below the question number in the ORS is to be bubbled.

1. Evaluate $\lim_{x \rightarrow 0} (\cos x)^{\cot x}$
2. The absolute maximum of $y = x^3 - 3x + 2$ in $0 \leq x \leq 2$ is
3. The value of 'a' for which $f(x) = \begin{cases} a + \sin^{-1}(x+b); & x \geq 1 \\ x & ; & x < 1 \end{cases}$ is differentiable at $x = 1$ is
4. If $f(x)$ satisfies the relation $f(x) + f(x+4) = f(x+2) + f(x+6)$ for all x , then find the period of $f(x)$
5. Let $f(x)$ be a twice differentiable function for all real values of x and satisfies $f(1) = 1$, $f(2) = 4$ and $f(3) = 9$ then for some $x \in (1, 3)$, $f''(x) =$ _____
6. A tangent drawn at a point (α, β) on the curve $y = x^3$ meets it again at (γ, δ) then $\left| \frac{\gamma}{\alpha} \right| =$ _____
7. The number of integral values 'a' can take so that $f(x) = x^3 + (a+2)x^2 + 3ax + 5$ is invertible in $\mathbb{R} \rightarrow \mathbb{R}$
8. If the graph of $y = f(x)$ is symmetrical about the point $(5, 0)$ and $f'(7) = 3$, then the value of $f'(3) =$ _____

9. If $g(x) = x^2 + \frac{1}{x^2}$ and $f(g(x)) = x^6 + \frac{1}{x^6}$ then $f'(2) =$ _____

10. If $\int \frac{(\sqrt{x})^5}{(\sqrt{x})^7 + x^6} dx = a \log\left(\frac{x^k}{1+x^k}\right) + c$ then $k + \frac{1}{a} =$ _____

Space for rough work

FIITJEE INTERNAL TEST

BATCH: Two Yr CRP(1820)

QP Code:

PAPER I (PHASE – IV)

ANSWERS

PHYSICS (PART-I)

1. **ABD**
5. **BD**
9. **BCD**

2. **ABD**
6. **ABCD**
10. **AC**

Part A

3. **ABC**
7. **AD**

4. **ABCD**
8. **ABC**

1. **4**
5. **1**
9. **2**

2. **4**
6. **4**
10. **5**

Part C

3. **6**
7. **5**

4. **1**
8. **7**

CHEMISTRY (PART-II)

1. **ABC**
5. **ABD**
9. **AC**

2. **AC**
6. **ABC**
10. **AC**

Part A

3. **ABC**
7. **BCD**

4. **BD**
8. **ACD**

1. **5**
5. **1**
9. **2**

2. **1**
6. **4**
10. **3**

Part C

3. **8**
7. **4**

4. **3**
8. **1**

MATHEMATICS (PART-III)

1. **AC**
5. **AB**
9. **ABD**

2. **BC**
6. **AC**
10. **AD**

Part A

3. **BD**
7. **BCD**

4. **ABCD**
8. **BC**

1. **1**
5. **2**
9. **9**

2. **4**
6. **2**
10. **5**

Part C

3. **1**
7. **4**

4. **8**
8. **3**