FIITJEE INTERNAL TEST

PHYSICS, CHEMISTRY & MATHEMATICS

QP CODE: 101005 | **Common Test-2**

Time Allotted: 3 Hours | **Maximum Marks: 180**

- Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.
- You are not allowed to leave the Examination Hall before the end of the test.

Batches – Two Year CRP(2426) Batches

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: _____

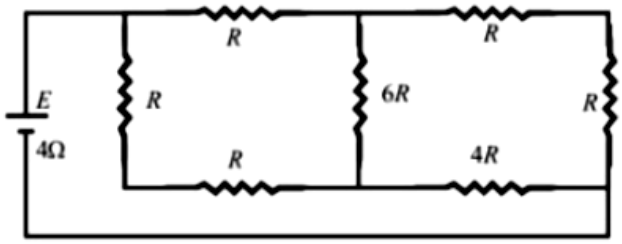
SECTION – I: PHYSICS

(PART – A)

(Single Correct Answer Type)

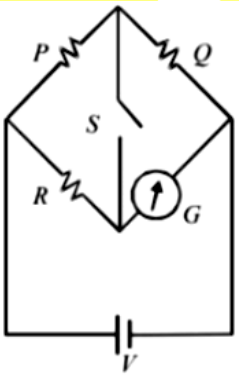
This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

1. A battery of internal resistance 4Ω is connected to the network of resistances as shown. In order that the maximum power can be delivered to the network, the value of R in Ω should be



(A) $\frac{4}{9}$ (B) 2 (C) $\frac{8}{3}$ (D) 18

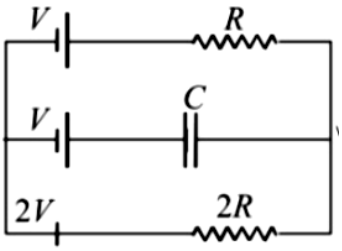
2. In the circuit P ≠ R, the reading of the galvanometer is same with switch S open or closed. Then
(A) $I_R = I_G$
(B) $I_P = I_G$
(C) $I_Q = I_G$
(D) $I_Q = I_R$



3. In the given circuit, with steady current, the potential drop across the capacitor must be

(A) V (B) $\frac{V}{2}$

(C) $\frac{V}{3}$ (D) $\frac{2V}{3}$



4. A wire of length L and 3 identical cells of negligible internal resistances are connected in series. Due to the current, the temperature of the wire is raised by ΔT in a time t. A number N of similar cells is now connected in series with a wire of the same material and cross-section but of length 2L. The temperature of the wire is raised by the same amount ΔT in the same time t. The value of 'N' is:
(A) 4 (B) 6 (C) 8 (D) 9

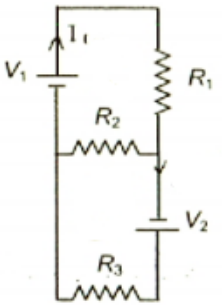
Space For Rough Work

(One or More Than One Options Correct Type)

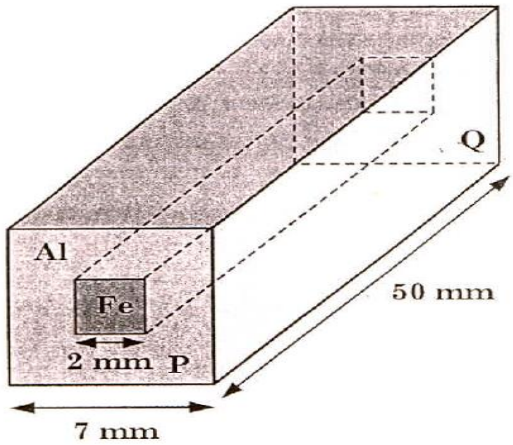
This section contains **4 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D), out of which **ONE** or **MORE THAN ONE is correct.**

5. Heater of an electric kettle is made of a wire of length L and diameter d. It takes 4 minutes to raise the temperature of 0.5 kg water by 40 K. This heater is replaced by a new heater having two wires of the same material, each of length L and diameter 2d. The way these wires are connected is given in the options. How much time in minutes will it take to raise the temperature of the same amount of water by 40 K?
(A) 4 if wires are in parallel (B) 2 if wires are in series
(C) 1 if wires are in series (D) 0.5 if wires are in parallel

6. Two ideal batteries of emf V_1 and V_2 and three resistances R_1, R_2 and R_3 are connected as shown in the figure. The current in resistance R_2 would be zero if
(A) $V_1 = V_2$ and $R_1 = R_2 = R_3$
(B) $V_1 = V_2$ and $R_1 = 2R_2 = R_3$
(C) $V_1 = 2V_2$ and $2R_1 = 2R_2 = R_3$
(D) $2V_1 = V_2$ and $2R_1 = R_2 = R_3$



7. In an aluminium (Al) bar of square cross section, a square hole is drilled and is filled with iron (Fe) as shown in the figure. The electrical resistivities of Al and Fe are $2.7 \times 10^{-8}\ \Omega$ m and $1.0 \times 10^{-7}\ \Omega$ m, respectively. The electrical resistance between the two faces P and Q of the composite bar is



(A) $\frac{2475}{64}\mu\Omega$ (B) $\frac{1875}{64}\mu\Omega$ (C) $\frac{1875}{49}\mu\Omega$ (D) $\frac{2475}{132}\mu\Omega$

Space For Rough Work

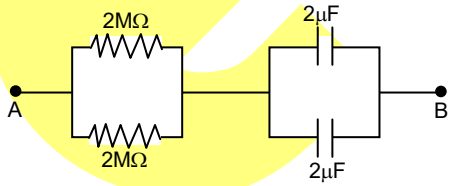
8. An incandescent bulb has a thin filament of tungsten that is heated to high temperature by passing an electric current. The hot filament emits black-body radiation. The filament is observed to break up at random locations after a sufficiently long time of operation due to non-uniform evaporation of tungsten from the filament. If the bulb is powered at constant voltage, which of the following statement(s) is(are) true?
(A) The temperature distribution over the filament is uniform.
(B) The resistance over small section of the filament decreases with time.
(C) The filament emits more light at higher band of frequencies before it breaks up.
(D) The filament consumes less electrical power towards the end of the life of the bulb.

(PART – B)

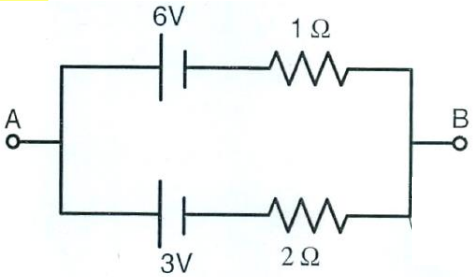
This section contains **Eight (08)** numerical based questions. The answer to each question is a NUMERICAL VALUE. If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.

1. 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. At time t = 0, a battery of 10 V Is connected across points A and B In the given circuit. If the capacitors have no charge Initially, at what time (in seconds) does the voltage across them become 4 V?



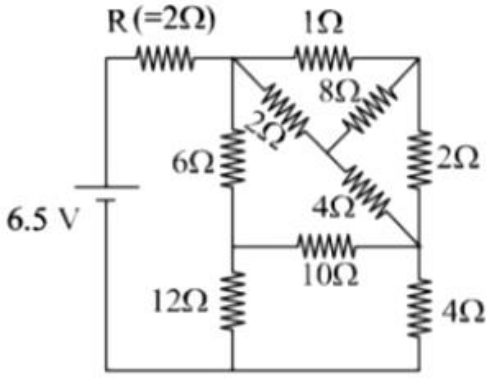
3. Two batteries of different emfs and different internal resistances are connected as shown. The voltage across AB in volts is



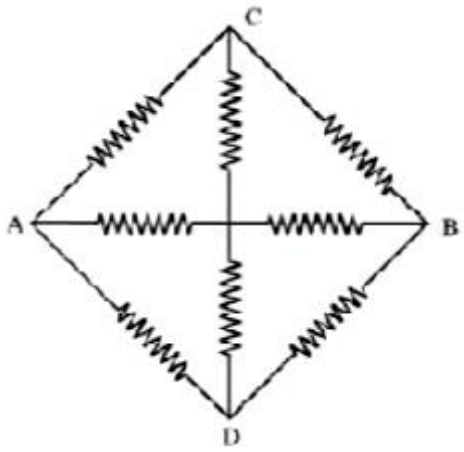
4. A galvanometer gives full scale deflection with 0.006 A current. By connecting it to a 4990 Ω resistance, it can be converted into a voltmeter of range 0 – 30 V. If connected to $\frac{2n}{249}\Omega$ resistance, it becomes an ammeter of range 0 – 1.5 A. The value of 'n' is:

Space For Rough Work

5. In the following circuit, the current through the resistor R (= 2Ω) is I Amperes. The value of I is:

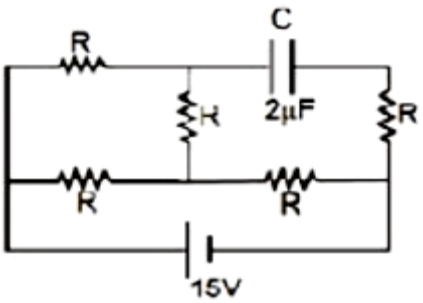


6. In the network shown, each resistance is equivalent to R. The equivalent resistance between points A and B is $\frac{2R}{y}$. Find the value of y.



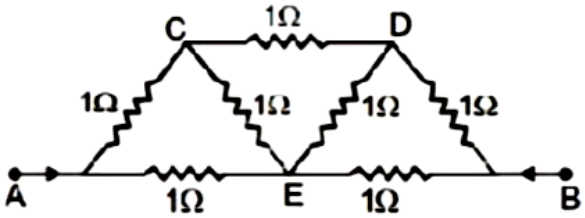
Space For Rough Work

7. The circuit is as shown in the figure, the cell is ideal with e.m.f – 15 V, each resistance is of 2Ω. The potential difference across the capacitor is 6 K volt. Find the value of 'K'.



8. In the diagram below each resistance is of 1Ω. The total resistance between A and B is $\frac{8}{p}\Omega$.

Find the value of 'p'.



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 isomer of 2-pentanone($C_5H_{10}O$) contains maximum number of sp^2-carbon atoms?
   (A) Position isomer (B) Chain isomer
   (C) Tautomer (D) Functional isomer(aldehyde)

2. The product of which reaction reacts with sodium metal to form a salt and H_2 gas?
   (A) $CH_3-\overset{\overset{O}{\|}}{C}-CH_3 \xrightarrow[\text{Clemmensen's reduction}]{Zn-Hg/Conc.HCl/\Delta}$
   (B) $CH_3CHO \xrightarrow{LiAlH_4}$
   (C) $CH_3CH_2\overset{\overset{O}{\|}}{C}CH_3 \xrightarrow{NH_2NH_2/H^+}$
   (D) $CH_3CH_2CHO \xrightarrow{NH_3}$

3. Reaction of CH_3CHO with Fehling's solution (mixture of $CuSO_4$, NaOH and Sodium potassium tartrate) forms a red precipitate due to formation of compound(X). In(X)
   (A) the oxidation number of copper is +1
   (B) three different elements are present including sodium
   (C) sulphur is present as SO_3^{2-} ion
   (D) the red colour producing species is hydrogen

4. Reaction of formaldehyde(HCHO) with which reagent forms a product which has the largest molar mass?
   (A) $NaBH_4$ (B) CH_3MgBr/H_3O^+
   (C) $KMnO_4/H^+$ (D) NH_3

(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. Which reagent(s) will you use as a set to convert CH_3CHO to $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$?
   (A) Conc.H_2SO_4 (B) CH_3MgBr/H_3O^+
   (C) Cu/300°C (D) $Ca(CH_3COO)_2$

Space For Rough Work

6. The product(s) of which reaction show(s) geometrical isomerism?

(A) $CH_3CH_2\overset{\overset{O}{\|}}{C}CH_3 + NH_2OH \xrightarrow{H^+}$

(B) $2CH_3CHO \xrightarrow[\text{Heating}]{\text{Dil.NaOH}}$

(C) $CH_3CHO \xrightarrow[\text{Heating}]{I_2/NaOH}$

(D) $CH_3\overset{\overset{O}{\|}}{C}CH_3 \xrightarrow{C_6H_5NHNH_2/H^+}$

7. $CH_3CHO \xrightarrow{HCN} CH_3CH\begin{matrix}OH\\CN\end{matrix}$

The correct statement(s) regarding above reaction is/are

(A) the reaction can be catalysed by using NaOH which removes protons from HCN and increases the concentration of CN^- ions.

(B) if NaCN/HCN is used instated of only HCN, the reaction becomes faster.

(C) if NaCN/NaOH is used instead of HCN, the rate of reaction becomes very slow.

(D) the product contains an asymmetric carbon atom.

8. $2HCHO \xrightarrow{\text{Conc.NaOH}} (A) + (B)$

$(B) \xrightarrow{HCl} HCOOH + NaCl$

The correct statement(s) regarding the product(A) is/are

(A) it forms CH_3CHO upon mild oxidation with PCC(pyridinium chlorochromate).

(B) it is reduced to HCHO with $NaBH_4$.

(C) it is obtained when HCHO is reduced with $LiAlH_4$

(D) it does not dehydrate to any alkene when it is treated with conc.H_2SO_4

(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. 

$\xrightarrow[\text{Wolf–Kishner reduction}]{N_2H_4, KOH, \Delta}$ Product (P)

The sum of the number of carbon and hydrogen atoms present in product(P) is

2. How many aldehydes including stereoisomer(s) is/are possible with formula $C_6H_{12}O$?

Space For Rough Work

3. When aldol condensation is carried out in presence of strong alkali, repeated condensation and dehydration results in the formation of resins. One example of the resin is

$CH_3-(CH=CH)_n-CHO$

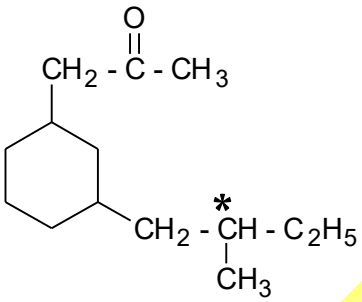
If the molar mass of the aldehyde which forms the resin is M, what is the value of $\frac{M}{10}$?

4. $CH_3CH_2\overset{*}{C}H(CH_3)-CHO \xrightarrow{NH_2OH/H^+} Product(P)$

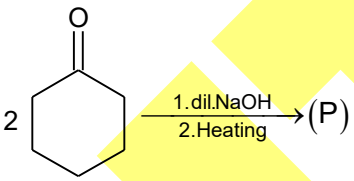
How many stereoisomers is/are formed as products in above reaction?

5. $OHC-CH_2-\underset{OH}{CH}-CH_2-CHO \xrightarrow[2.Heating]{1.\ KMnO_4/H^+(excess)} (P)+2CO_2$

(P) is an organic product. If the molar mass of (P) is X g mol^{-1}, what is the value of $\left(\frac{X}{4}\right)$?

6. 

How many maximum number of enol(s) is/are possible by above ketone considering stereoisomers?

7. 

How many sp^2-carbon atoms are present in (P)?

8. HCHO, CH_3CHO, $CH_3(CH_2)_3COCH_3$, CH_3CH_2CHO, $CH_3CH_2COCH_3$, $CH_3CH(CH_3)CH_2CH_2CHO$

How many of the above compound(s) is/are more reactive than CH_3COCH_3 towards nucleophilic addition reaction?

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. The function $f(x)=\int_0^{x^2}\frac{t^2-1}{e^t+1}dt$ has

(A) $x=0$ as its point of inflection (B) one maxima and one minima
(C) one maximum and two minimum (D) two maximum and one minimum

2. ℓ_1 and ℓ_2 are the side lengths of two variable squares S_1 and S_2 respectively. If $\ell_1=\ell_2+\ell_2^3+6$ then rate of change of the area of S_2 with respect to rate of change of the area of S_1 when $\ell_2=1$ is equal to

(A) $\frac{3}{4}$ (B) $\frac{4}{3}$ (C) $\frac{3}{2}$ (D) $\frac{1}{32}$

3. The equation of the tangent to the curve f (x) = $1 + e^{-2x}$ where it cuts the line y = 2 is

(A) x + 2y = 2 (B) 2x + y = 2 (C) x – 2y = 1 (D)x–2y+2 = 0

4. Number of critical points of the function $f(x)=(x-2)^{\frac{2}{3}}(2x+1)$ is equal to

(A) 0 (B) 1 (C) 2 (D) 3

(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. Let $f(x)=\begin{cases}(1-x)^{\alpha}.x.(1-\cos(2\pi x)), & 0<x\le 1\\ 0, & x=0\end{cases}$. If Rolle's theorem is applicable to $f(x)$ for $x\in(0,1)$, then α can be:

(A) –2 (B) –1 (C) $\frac{1}{2}$ (D) 1

Space For Rough Work

6. Let $f(x)=\int_0^x e^{-t^2}(t-5)(t^2-7t+12)dt$ for all $x\in(0,\infty)$, then:

(A) f has a local maximum at x = 4 and a local minimum at x = 3

(B) f is decreasing on $(3,4)\cup(5,\infty)$ and increasing on $(0,3)\cup(4,5)$

(C) There exists at least two $c_1,c_2\in(0,\infty)$ such that $f''(c_1)=0$ and $f''(c_2)=0$

(D) There exists some $c\in(0,\infty)$ such that $f'''(c)=0$

7. Which of the following is (are) correct?

(A) $3^{\pi}>\pi^3$ (B) $\sin x>x-\frac{x^3}{6}\forall x>0$

(C) $2>\left(\frac{5}{2}\right)^{\frac{4}{5}}$ (D) $10^{11}>11^{10}$

8. Let $f(x)=\begin{cases}x^3+x^2-10x; & -1\le x<0\\ \sin x; & 0\le x<\frac{\pi}{2}\\ 1+\cos x; & \frac{\pi}{2}\le x\le\pi\end{cases}$ then f(x) has

(A) local maximum at $x=\frac{\pi}{2}$ (B) local minimum at $x=\frac{\pi}{2}$

(C) absolute maximum at x = 0 (D) absolute maximum at x = –1

(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 polynomial function P(x) of degree 5 with leading coefficient one, increases in the interval (– ∞, 1) and (3, ∞) and decreases in the interval (1, 3). Given that P(0) = 4 and P′(2) = 0. Then value of $\frac{P'(6)}{100}$ is

2. A telephone company has 500 subscribers on its list and collect fixed charges Rs 300 per subscriber per year. The company proposes to increases the annual subscription and it is believed that for every increases of Rs. 1 in the charge one subscriber will discontinue. Find the charge per subscriber that will maximize the income of the company.

Space For Rough Work

3. Let $f(x)=\begin{cases}(x+2)^3, & -3<x\le -1\\ x^{\frac{2}{3}}, & -1<x<2\end{cases}$ and $g(x)=\int_{-3}^{x} f(t)dt, -3<x<2$. Find the number of extremum points of g′(x).

4. Let $f(x) = 2x^3 + 3(1 - 3a)x^2 + 6(a^2 - a)x + b$ where $a, b \in R$. Find the smallest integral value of 'a' for which f(x) has positive point of local maximum.

5. Let $f:R\to R$ be defined as $f(x)=|x|+|x^2-1|$. The total number of points at which f attains either a local maximum or a local minimum is

6. Let be a function defined on R (the set of all real numbers) such that $f'(x)=2010(x-2009)(x-2010)^2(x-2011)^3(x-2012)^4$, for all $x\in R$. If g is a function defined on R with values in the interval $(0,\infty)$ such that $f(x)=\ell n(g(x))$, for $x\in R$, then the number of points in R at which g has a local maximum is

7. If the exhaustive set of all possible values of c such that $f(x)=e^{2x}-(c+1)e^x+2x+\cos 2+\sin 1$, is monotonically increasing for all $x\in R$, is $(-\infty,\lambda]$, then find the value of λ.

8. Let P(x) be a polynomial of degree 5 having extremum at x = –1, 1 and $\lim_{x\to 0}\left(\frac{P(x)}{x^3}-2\right)=4$. If M and m are the maximum and minimum value of the function $y=P'(x)$ on the set $A=\{x\,|\,x^2+6\le 5x\}$ then find $\frac{m}{M}$.

Space For Rough Work

FIITJEE INTERNAL TEST

BATCHES – Two Year CRP(2426) Batches

Common Test – 2

Code: 101005

JEE ADVANCED

ANSWER KEY

ANSWER KEYS

Physics

PART – A

1.	B	2.	A	3.	C	4.	B
5.	BD	6.	ABD	7.	B	8.	CD

PART – B

1.	4.00	2.	2.00	3.	5.00	4.	5.00
5.	1.00	6.	3.00	7.	2.00	8.	7.00

Chemistry

PART – A

1.	C	2.	B	3.	A	4.	D
5.	BC	6.	AB	7.	ABCD	8.	CD

PART – B

1.	15	2.	10	3.	4.4	4.	4
5.	14.5	6.	24	7.	3	8.	4

Mathematics

PART – A

1.	C	2.	D	3.	B	4.	C
5.	CD	6.	ACD	7.	ABD	8.	AD

PART – B

1.	12	2.	400	3.	2	4.	2
5.	5	6.	1	7.	3	8.	6